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JANUARY 1983

EDITOR & DESIGN DIRECTOR: BOB GUCCIONE
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EXECUTIVE EDITOR DICK TERESI
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Don Brautigam originally created this painting for the cover of Stephen King's book Night Shift *(New American Library). Jim Plumeri developed the concept based on the story "I Am the Doorway," in which aliens inhabit the hand of an astronaut.*

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FIRST WORD

By Vernor Vinge

We are caterpillars, soon to be butterflies, and, when we look to the stars, we take that vast silence as evidence of other races transformed

social and technological prediction is very popular. This is reasonable. It seems that change is the only constant in our lives; we want to be prepared.

Yet there is a stone wall set across any clear view of our future, and it's not very far down the road. Something drastic happens to a species when it reaches our stage of evolutionary development—at least that's one explanation for why the universe seems so empty of other intelligence. Physical catastrophe (nuclear war, biological pestilence, Malthusian doom) could account for this emptiness, but nothing makes the future of any species so unknowable as technical progress itself.

A favorite game of futurists is to plot technological performance—computer speed, say—against time. Such trend curves climb ever more steeply. Extrapolated 30 or 40 years, they are so high and steep that even the most naive futurist discounts their accuracy. Some who talk about that era predict a leveling off of progress. After all, saturation effects are observed in other growth processes.

There is an important reason why this process won't level off. We are at the point of accelerating the evolution of intelligence itself. The exact means of accomplishing this phenomenon cannot yet be predicted—and is not important. Whether our work is cast in silicon or DNA will have little effect on the ultimate results. The evolution of human intelligence took millions of years. We will devise an equivalent advance in a fraction of that time. We will soon create intelligences greater than our own.

When this happens, human history will have reached a kind of singularity, an intellectual transition as impenetrable as the knotted space-time at the center of a black hole, and the world will pass far beyond our understanding. This singularity, I believe, already haunts a number of science-fiction writers. It makes realistic extrapolations to an interstellar future impossible. To write a story set more than a century hence, one needs a nuclear war in between—to retard progress enough so that the world remains intelligible.

A Cro-Magnon man brought into our present could eventually understand the changes of the last 35,000 years. The difference between contemporary man and the creatures who live beyond the singularity is incomparably more profound. Even if we could visit their era, most of what we would see would be forever incomprehensible.

This is a vision most people reserve for the far future, perhaps after another million years of normal evolution. Surprise—it is a future that will happen as soon as superhuman intelligences are created. And given our progress in computer and biological sciences, that should be between 20 and 100 years from now.

The passage into this great singularity should not be abrupt. So far there has been little progress in automating the distinct prerogatives of the human mind. During the next 20 years this will change. Programs that can perform symbolic as well as numeric processing will become common. The student's hand computer will become competent enough to solve most problems in our present undergraduate courses. Universities will scramble to provide curricula that will train students to think with these new tools. Graduates will need an ever deeper understanding of their majors to compete successfully for technical jobs. As the years pass, we will find that a rapidly diminishing number of humans will be necessary to keep large systems running.

It's missing the point to call this process "technological unemployment." Even before the last jobs are automated, our successors—the more-than-human intelligences we are creating—will already be onstage. Whatever paradise the world may be, man will be the leading actor no more.

For some, this scenario may be even less desirable. Indeed more cataclysmic than having a nice atomic war, after which we might proceed with human business as usual.

But if the singularity is properly considered, it need not be depressing. Marvin Minsky of Massachusetts Institute of Technology has suggested we regard these new beings as our children—children who will do still better than their parents did.

Sometimes this point of view is enough for me; often it is not. I want man to be a continuing participant. And perhaps there is a way. The machine intelligences need not be independent of our own. Even now, when we use personal computers, we are extending our memory and our ability to solve problems and dilemmas that confront us daily. In a sense we are augmenting our own intelligence. As we improve the man/computer interface, this amplification effect will increase. When the computer half of the partnership becomes intelligent, it might still be part of an entity that includes us. The singularity then becomes the result of a massive amplification of human intelligence rather than simply its replacement by machines.

Falling into the singularity is admittedly a frightening thing, but now we might regard ourselves as caterpillars who will soon be butterflies and, when we look to the stars, take that vast silence as evidence of other races already transformed. ∞

Vernor Vinge is the author of several science fiction novels, the most recent being True Names. *An associate professor of math sciences at San Diego State University, he served as a panelist at the Omni Symposium on Artificial Intelligence and Science Fiction, held last summer.*

CONTRIBUTORS

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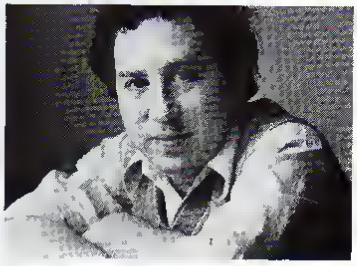

EDELHART


EHRLICH


SPEIGEL


McAULIFFE

Omni's network of stringers usually come from the halls of academia. But the unlikely channel of rock n' roll provides the spark of inspiration behind this month's feature. Brain Tuner, which looks at a novel cure for drug addiction developed by Scottish surgeon Dr. Margaret Patterson. It was British rock star Pete Townshend, one of the many celebrities treated by Patterson, who tipped us off to her bizarre line of work. At least Townshend's description sounded bizarre. Patterson, he explained, uses a little black box to help people give up everything from heroin to cigarettes and alcohol. The "box" was supposed to ameliorate withdrawal symptoms and ease craving by transmitting a small amount of electricity to the addict's brain. *Omni* associate editor *Kathleen McAuliffe*, who in the past has written on other aspects of electrical medicine, was assigned to check the story out. "I was skeptical at first, because the black box simply sounded too good to be true," she recalls. "But after carefully researching its scientific rationale, and speaking to some half-dozen of Patterson's patients, I believe her therapy holds the potential of revolutionizing the field of drug rehabilitation." For her in-depth report, turn to page 44.

Dr. John Lilly is best-known as the "dolphin man." His life is an odyssey, a fascinating, bewildering, and controversial story. He is a mental giant, a man of enormous talent, qualified psychoanalyst, skilled brain researcher, and authority in fields as diverse as neuroanatomy, biophysics, and computer theory. Today, in a self-imposed exile, he works with computers to develop a human/dolphin language. In this month's unique Interview, on page 56, the man whose life was the model for the film *Altered States* tells contributor *Judith Hooper* about his quantum leaps, from Catholicism to self-experimentation with psychedelics and extraterrestrial reality, from the labs of Cartesian science to the sonar tanks of his cetaceans.

Omni's "Laurels (and Hardys)" were inaugurated last year to commemorate the renownless wizards of science who invent curious machines, espouse novel theories, entertain the improbable or just plain blunder about. *Mike Edelhart*, coauthor of *The Ultimate Computer Book* (Addison-Wesley, 1983), was given the task of collecting the oddest scientific achievements of 1982. Consider, for example, the company that designed a computer program that verbally abuses its operator. Or the scientists who attached weights to the legs of cockroaches and made them run on treadmills. Surely city dwellers will welcome this new, resistless breed with wiry hamstrings. In recognition of such clogs in the wheel of progress, *Omni* announces its awards, starting on page 60.

Within the next few decades a burst of scientific and technological activity will alter our world. Automated office systems, genetic engineering, and space manufacturing will create dramatic change. Present modes of energy, commerce, and transportation will be outdated. The fortunes of some national economies will falter, reshaping the spheres of political influence. The details of this revolution are chronicled in "Our Future Stock," an excerpt from the recently released book *The Omni Future Almanac*, published by Harmony/Crown. On page 68, *Omni*'s editors forecast future incomes for emerging job markets, estimate the prices for commodities from hamburgers to houses, and warn about skills likely to be outmoded.

Ancient texts abound with legends of sea serpents and leviathans—prehistoric creatures that defy fictionalization. They suddenly appear and disappear, leaving behind footprints, skeletal fragments, and big rumors—from Central Asia to Africa's inland waterways to the American West. The International Society of Cryptozoology (Box 43070, Tucson, AZ 85733) was founded to capture and study these atypical biological specimens. *Karen Ehrlich* is a hypnotist and Human Potential Trainer. *E. Lee Speigel* is producer and host of *The Edge of Reality*, a weekly WNBC radio show. Coauthors of "Hidden Monsters" (page 108), they vividly describe expeditions of anthropologists in pursuit of such zoological anomalies as Bigfoot, the Tasmanian wolf, and Champ, from Lake Champlain.

Are you up to the challenge of Wizard of Wor™ and Gorf™?

So you're hot stuff at video games? Joysticks melt in your hand? Don't let it go to your head. Try mastering Wizard of Wor and Gorf, the two Bally/Midway arcade hits you can now play at home. They're new from CBS Video Games.

Both are made for the Atari® Video Computer System™ and Sears® Video Arcade™.

WIZARD OF WOR

Dare you enter the Wizard's diabolic dungeon where doom lurks at every turn? Can you keep your composure as the Wizard's henchmen try eating you ALIVE? Fight back. Use your radar screen.

Vaporize the Burwors. Chase the Worluk.

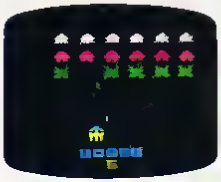
Until the Ultimate. The sometime-visible/sometime-invisible Wizard. Trust no one.

Wizard is designed so two may play at the same time. And since all's fair in Wor even your best friend can zap you.

Now we don't want you to freak out totally but if you're still up to the challenge, top the all-time high score: 29,500 by Frank Merollo (10/82) and Buz Pryzby (8/82).

GORF

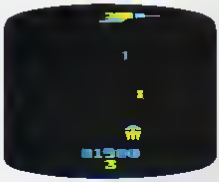
Can you hold up under the challenge of four different boards in one game? At nine different levels? Try and beat the high score of 32,700 by Horace Eckerstrom (9/82). No sweat? Well what if we told you each level was faster than the last? Next time you'll think before you speak. But now you must face



Gorfian bombs.

Kamikaze crazies & Laser Ships.

Deadly Subquark Torpedoes.



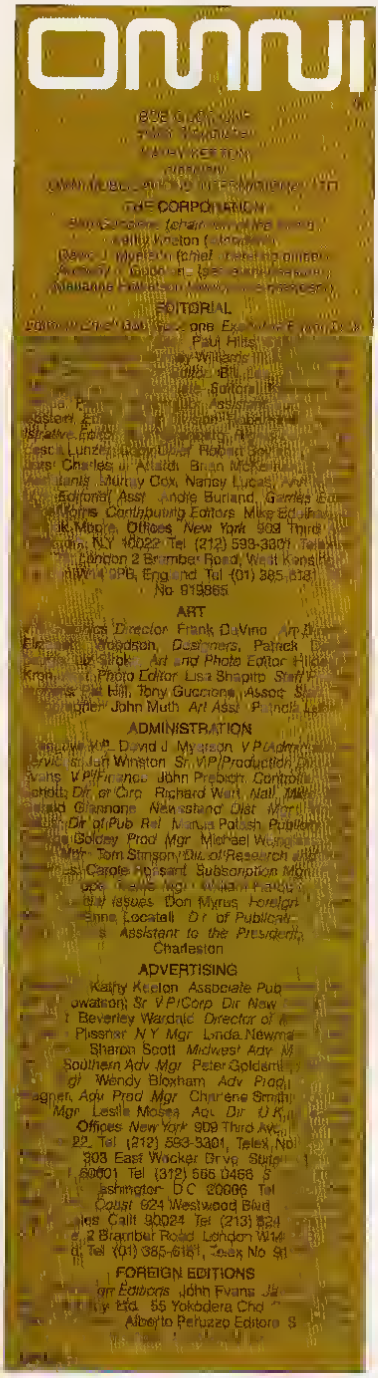
And finally. The dreaded Neutron Flagship.

Gorf's not easy. There's only ONE vulnerable spot on the Flagship. But don't let a little neutronium bomb stop you from hitting it.

Now that you know what to expect, are you still up to the challenge of Wizard and Gorf?

CBS Video Games

Are you up to the challenge?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Paul Hiltz

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Read All About It

I have just finished reading the August 1982 issue of *Omni* and I think the Games section [on humorous headlines] is particularly funny. It reminded me of a funny story and a headline that my sister-in-law told me about a few years ago about a small group of crazed women in Lansing, Michigan, who for some strange religious rite slathered themselves with mustard and stole a United Parcel Service truck. The police finally apprehended the women, and the story was printed in the Lansing paper with the headline

MUSTARD LADY FLEES, POLICE CATCH UP

Elizabeth Hennessey
Detroit, Mich.

Mad about Marijuana

The fact that marijuana is illegal seems to have clouded the judgment of Franklynn Peterson and Judi Kesselman-Turkel in their report "Reefer Madness" [Continuum, September 1982]. It would be equally desirable and necessary to isolate and test active components of marijuana if it were legal.

Have the authors forgotten the large number of persons who, for health or safety reasons, cannot smoke four joints a day? Would they not even try to help those for whom euphoria is disorienting, unpleasant, and sometimes frightening?

If the authors believe that marijuana is safe and harmless, they should work to legalize it rather than attack the legitimate scientific efforts of researchers.

Joseph Budd
St. Simons Island, Ga.

Afraid of the Dark?

I was disappointed with the skeptical attitude in the article "Butterflies in the Dark" [July 1982], by Les Ericson.

Human sensory perception is not limited to the traditional five senses. We can imagine concepts from quark to galaxy. Why are telepathy and clairvoyance considered unusual?

Only children are afraid of the dark. Let us move into the future with open minds and faith and hope in mankind's abilities.

Linda O'Kraley
Madison, Wis.

Manufactured Taxpayers

I was outraged when I read the article entitled "Baby Makers, Inc.," by Allan Maurer [Continuum, September 1982]. Why does a fantastic science magazine deal with future political issues? So what if the fourth most populous country in the world becomes the fortieth? I've always thought that the government is more concerned with eliminating human life (considering the vast escalation of nuclear warheads) than with creating it. Oh, I get it now. Somebody must be afraid of the fact that fewer people means fewer taxpayers.

Anthony Michaels
Philadelphia

Bad Break

Is 3-D TV really considered a breakthrough [Continuum, September 1982]? Now the car chases, the shootings, the vulgarity, and the inane commercials will actually come right out of the screen at us, eh?

I would consider it a greater breakthrough to create a robot that would crush the television sets and hand everyone a book to read.

Sterling Johnson
Palm Springs, Calif.

Baldness Concern

It isn't often that I feel an urge to write to a magazine, but "Baldness Cure" by Eric Mishara [Continuum, July 1982], deserves comment. Being afflicted with this malady (alas!), I read the report with great interest. I was happy that a member of the medical community had finally initiated research into this problem.

It should be obvious that no one wants to be bald. So far the only people who did anything about this problem were the crooks and charlatans, with their costly and ineffective lotions and preparations. But all that these "miracle" hair restorers ever made grow were these crooks' bank accounts. Hair loss is a legitimate problem, and I feel it's about time the medical establishment got involved with finding a cure.

James Brace
Sandusky, Ohio

DIALOGUE

FORUM

In which the readers, editors, and correspondents discuss theories and speculation arising out of Omni. *Readers are encouraged to debate views and pose questions to* Omni, *the scientific community, and the science-fiction establishment. The opinions published are not necessarily those of the editors.*

Agent Orange Controversy

I believe I have some information that may clarify some of the conclusions drawn by Dr. Ronald Codario in the article "The Agent Orange Mystery," by Pamela Weintraub [Earth, August 1982]. While the article claims that agent orange is the cause of many Vietnam veterans' medical problems, we at Dow Chemical believe there are other chemicals and drugs that are the real culprits. There is no credible evidence available that the health of Vietnam veterans differs significantly from that of nonveterans.

Throughout the Vietnam War, malaria was the leading medical problem among American troops. Malaria posed such a difficult problem because of a certain strain of the disease called falciparum. This strain produced a more serious illness and was resistant to all of the normal antimalaria drugs. It has been shown that malaria plays a role in the development of certain types of cancer.

In order to control the problem of falciparum malaria in Vietnam, a new antimalaria drug had to be found. An extensive drug-screening process discovered such a compound—dapsone. Previously, dapsone had been used for the treatment of leprosy.

Because of the urgency of the problem, no one questioned the wisdom of using dapsone in Vietnam, but we now know that it does produce a wide range of toxic effects that closely resemble the present complaints of Vietnam veterans. Use of dapsone among ground troops was limited in 1969, when it was learned that side effects were responsible for the death of at least eight servicemen.

Hepatitis was the second leading medical problem among American troops in Vietnam. Science has demonstrated that hepatitis plays an important role in the development of liver cancer.

Another possible cause of veterans' illnesses is melioidosis, a bacterial disease unique to certain parts of Southeast Asia. Melioidosis has long been referred to as the "time bomb disease" or the "medical time bomb," because there have been many cases in which bacteria have entered the human body but in which no symptoms were apparent. Only years later did the disease manifest itself.

Dow encourages you to discuss the agent orange issue with the Veterans Administration and the White House Interagency Work Group on Agent Orange, since the plight of veterans should be addressed by the government which committed them to wartime service.

Phillip H. L. Schneider
Dow Communications
Midland, Mich.

Dr. Ronald Codario replies: *Melioidosis is indeed a "time bomb disease." In two studies of Vietnam veterans, one of 416 and the other of 500 men, it was found that 9 percent of the participants had elevated titers [concentrations of a substance] consistent with exposure to the organism. However, elevated titers do not indicate active disease or even the tendency to develop active disease. Dr. Walter Schleck, of the special pathogen branch of the Center for Disease Control, has asserted that "since 1973 we have less than a dozen isolates of this organism from all sources. This would suggest that the actual number of culture-proven cases is quite small." Although the disease may lie dormant for some time, reactivation is characterized by high fevers, with recurrent bone, lung, and prostate abscesses. This clearly is not what the vast majority of Vietnam veterans are complaining about and does not explain the porphyrin disturbances.*

Dapsone is a drug that has been used in more than 11 million lepers. Peripheral nerve damage and liver disorders have been reported in only a handful of cases, and these people were taking large doses of the drug, not the small doses the veterans had. Mr. Schneider mentions the unfortunate incident in 1969 when 8 veterans out of 200,000 given dapsone died of agranulocytosis, a disorder characterized by the destruction of white blood cells. This occurred in individuals who also were taking chloroquine and quinine. Hence, dapsone alone could not be implicated. Dapsone has never been reported to cause porphyrin problems or a positive reaction to the Ehrlich test.

Mr. Schneider discusses the association of liver cancer and hepatitis. It should be pointed out that only one type of virus (hepatitis B) is associated with a greater risk of liver cancer. In fact the risk is 274 times as great.

I want to congratulate *Omni* magazine and Dr. Ronald Codario on exposing the Veterans Administration's position on agent orange. Pamela Weintraub's article explained a lot of the unexplained symptoms of my disability that V.A. doctors had ignored.

The V.A. position is that until medical researchers definitively link agent orange to the described problems of veterans, the V.A. will not recognize the problem. We need the support of the media and the public at large if we are to get the medical help we deserve.

Joseph Williams
Arlington, Tex.

Although I am glad to see that there are people who are interested in helping Vietnam veterans who were exposed to agent orange and the real culprit, dioxin, I'd like to emphasize the point that veterans are not the only ones who have been affected by dioxin poisoning.

My family and our neighbors have also been exposed to this deadly chemical and neither my husband nor I ever served in Vietnam. A metal reclamation center located in the vicinity of our home was producing dioxin and other pollutants.

My husband became ill with nervous disorders like those described in your article, and I suffered from dizziness, joint pain, and irritability.

We contacted the Illinois Environmental

Protection Agency which in turn contacted the Cook County Department of Toxicology They found evidence of dioxin in both animals and humans in the area The plant was eventually closed because it had never received a proper permit to operate

To read of a possible antidote is encouraging after we'd been told that we have a "mystery illness" which we must learn to live with The mention of research being pursued at the Watson Laboratory in Minneapolis gives us hope and a line to possible help in case severe symptoms of this disease reappear

Mary Brown
Crete Ill

Thank you for the article on the effects of agent orange No one seems to know much about agent orange but Pamela Weintraub's article was most informative

My husband has been in and out of hospitals ever since 1968 when he was sent home from Vietnam after he was wounded in the foot

He has been seeing a psychiatrist for the past three years He quit his job with the Postal Service on May 1 1982, after working there for four years because of mental and physical stress His bones ache, and his foot hurts all the time

Our lives seemed to be falling apart So my husband decided to try to get help at the VA office We got the usual runaround until a doctor found out that my husband had served in Vietnam from 1966 to 1968 She told him that he should take agent orange tests

Well, doctors don't tell you anything about anything, and we decided to find out about agent orange ourselves Your article was a great beginning for us

Connie Goodin
Jacksonville, Fla

I have been building up steam for a while on the agent orange issue I sympathize with those individuals who have been affected but I am uncertain about the publicity the whole issue has received Is it self-recrimination or is it hitting out at those within the government who made the terrible decision to use those ghastly herbicides?

I think there can be no doubt about the fact that the decision was a conscious one and that it was made somewhere in the highest levels of government

This being the case I can only quote a rather appealing aphorism "A people get the kind of government they deserve"

The issue of what has happened to the Vietnamese against whom these herbicides were used, should not be ignored What has happened to them?

Charl du Plessis
Wynberg Cape Town
Republic of South Africa

"The Agenf Orange Mystery" appropriately emphasizes that veterans are suffering from something and the public owes it to them to find out what it is Having been exposed repeatedly to the herbicide 2 4 5-T and therefore to the toxic impurity it contains in trace amounts, I can't help wondering whether some other factor may be involved in the cases of suspected poisoning from dioxin TCDD

I first began to work with products containing 2 4 5-T in 1946, and my exposure in spite of all due care in handling must have been massive compared to that of most veterans I understand that medical histories and continuing surveillance of chemical plant workers who have a long history of exposure to this toxic dioxin fail to indicate any long-term problems

The important thing is to find out what is really wrong with these veterans and to help them

Keith Barrons
Holmes Beach Fla

Nuclear Reactions

Omni's interview with Hans Bethe [September 1982] left me frightened and appalled Until now I had thought that Dr Strangelove was some cinema stereotype but Dr Bethe comes across as the kind of man who is equally as unfeeling and filled with dangerous contradictions

I guess it really isn't a surprise to hear one of the pronuclear spokesmen say that he "considers everything to be a matter of numbers" in regard to reactor safety and declare that the German Atomgesetz safety law is "a stupid law" It doesn't strike him as the least bit insane that the Japanese are dotting their volcanic islands with reactors And in almost the same breath he notes "We have tons of weapons-grade material It is very difficult to completely prevent any accumulation of fissionable material for illicit purposes" Right after noting that fuels sold to utilities would have to be kept on "a military site subject to that level of security"

I am very disappointed that the interviewer did not question Dr Bethe about solar power If the utilities, the nuclear establishment the government, and the military put half their energies into the development of clean safe solar power this planet would be safe and powered for untold millennia

But of course the established nuclear businesses aren't having any of that May the next century's minds prove Bethe and his ilk to be anachronisms which we will sately outgrow

Don Jordon
Phoenix

Excellent job! The interview with Dr Hans Bethe was a rare treat for me I am a reactor operator in the U S Navy and I have participated in the operation maintenance and testing of many different power plants

It's about time we heard from someone of Dr Bethe's caliber on the issue of nuclear safety The mistrust of large industrial utilities has put us in a position that must be overcome soon if we are to compete effectively with other users/suppliers of nuclear technology

Michael Bull
Charleston S C

Omni's interview with Dr Hans Bethe was full of the same empty-headed rhetoric that proponents of nuclear power and nuclear weapons have mouthed since the dawn of the Nuclear Age

Thank you for printing it It will help people understand the arrogance with which the nuclear industry practices its black arts Perhaps it will help our children understand how civilization got itself into its present predicament and I hope it will show us how we can get ourselves out of it It is inconceivable that people in Hans Bethe's position conclude that they have the right to place all of civilization in such jeopardy

Bill Evans
Lagunitas Calif

Though I am very much opposed to nuclear power and its growth in our country I found your interview with Dr Hans Bethe very informative

Dr Bethe clearly believes in the safety of nuclear power and welcomes its proliferation However it was not made clear where the waste from nuclear-power sources would be stored or eventually disposed of

This is no small matter and I believe that Dr Bethe should have discussed the question

Diane Dougherty
Fortuna, Calif

Dr Hans Bethe may be a very intelligent person but he seems to lack common sense He totally ignores some very important facts concerning nuclear power If is understandable that as a physicist Dr Bethe would like to promote his field of study but when something that is so potentially dangerous continues to be thrust upon the environment some precautions must be taken or at least more appropriate alternatives must be sought

The laws of probability state that the more nuclear reactors that are built, the more it is likely that a nuclear accident will occur

Now I wouldn't be against nuclear power if I thought there were no other viable alternatives But solar power could easily become the most economical energy source if we spent even a fraction of the money time and effort we now spend on fission reactors

Technology should not be used for its own sake It must be applied to solve problems not create them

Rick Siegfried
Arcata Calif

CHILDREN OF DISASTER

EARTH

By Douglas Starr

Janice and Ed Dennis know the special anguish of parents whose children have been hurt by pollution. Twelve years ago the Dennises moved from rural Washington to Kellogg, Idaho, so that Ed could work in the Bunker Hill Company smelter. For two years they lived in a small house in the shadow of the smoking factory, which in a month could spew tons of gray, toxic lead. "At three in the afternoon you'd have to drive with your headlights on," Janice recalls. "Sometimes you couldn't breathe, the air hurt your lungs so bad."

As time passed, the Dennis children grew increasingly ill, with maladies ranging from headaches to stomach cramps. Those symptoms, though, didn't gain meaning until 1974, when federal investigators reported that Kellogg had the worst lead poisoning epidemic in the nation. Ninety-nine percent of the children living within a mile of the plant had abnormally high levels of lead in their blood; nearly a fifth had levels high enough to qualify them as victims of lead poisoning. Later a specialist in Chicago confirmed the Dennises' worst fears. Three of their five children had irreversible brain damage, two probably will never be able to hold a job without close supervision. Only the children were affected. With their nervous systems still developing, they were exquisitely sensitive to the nerve-damaging metal.

The powder, people told Cathy Scott, was harmless as freshly fallen snow. And so she laughed when her son Sean came home after rolling in heaps of asbestos with his buddies at the Globe, Arizona, trailer park. The community had been built on the site of an old asbestos mill, huge deposits of the material lurked beneath a thin layer of soil. But no one in Globe suspected danger until the Arizona Health Department told them their children had been playing with a potent carcinogen.

"I think the whole world collapsed when they told us that," Cathy says, recalling the day in 1979 she heard the news. She learned that asbestos could wait anywhere from a few years to a few decades to act; then it could render the lungs useless or trigger cancer. And children were most vulnerable of all.

These victims add their laments to those from dozens of pollution hot spots throughout this country. With toxins spewing into the air, seeping from the ground, leaching into drinking water, even passing to infants through mother's milk, today's young face environmental dangers unlike any that existed in centuries past. No one knows how, or sometimes even which, substances will affect the next generation, says Dr. Laurence Finberg, chairman of the American Academy of Pediatrics' Environmental Hazards Committee. But the young are sure to be hurt most of all.

Children, quite simply, are more sensitive than adults. Their reproductive cells and brain cells—the tissues most likely to be injured by toxins—are still growing, making them likely to absorb pollutants. Children breathe more air per body weight than their elders and put things into their mouths, bringing them in contact with a vast variety of poisons.

This may seem obvious, but only recently has the effect of pollution on children been even partially documented. Only last year, for example, did researchers at New York University show that children's lung performance is impaired by the same "safe" pollution levels adults find comfortable. Another new study shows that the child of a factory worker sometimes becomes sick with the same occupational illnesses that affect the working parent, simply from the chemicals the parent brings home on the clothes he or she wore at work.

A Nova Scotia doctor found an extreme case of this in 1976, when he was called to treat a baby girl suffering from a nearly fatal case of jaundice. Nothing seemed to help. Dr. Philip Bagnell says, yet the child miraculously recovered after a few days' separation from her mother.

The reason? A dry-cleaning solvent called tetrachloroethylene (TCE) had tainted the mother's milk. The mother had frequently lunched with her husband at the

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Children are being poisoned by toxins spewing into the air and leaching from the ground

GET AWAY SPECIAL FINALS

SPACE

By Owen Davies

Make a foamed aluminum alloy for low-mass construction in space. Study bone formation in weightlessness. Prepare plastics that cannot be formed on Earth. These are three of the suggestions that have made it to the finals in *Omni*'s Get Away Special Contest.

Test the effect of short-term spaceflight on fine wine and cheese: that's one suggestion that didn't.

Last June *Omni* made its readers an offer that many could not refuse. Send in the best idea for a scientific experiment to fly on the space shuttle, and we'll pick up the tab. We will give you one of NASA's Get Away Special (GAS) canisters in which to carry out your plan, pay the cost of your equipment, and then fly you anywhere in the continental United States to watch the landing of the shuttle that carries your payload.

It was not easy for respondents to devise a possible winner. The experiment must offer new information of real scientific or technological interest. It must weigh no more than 60 pounds and fit inside a GAS package less than 20 inches across and 15 inches high. And it must be able to survive accelerations of up to 4gs, sound levels that would kill an unprotected animal, and outside temperatures that could vary from a high of 110°F to a low of −296°F—quite a bit colder than liquid oxygen.

Even before facing the rigors of space, the proposals must endure two rounds of judging. In the first, a team of space scientists, headed by physicist Robert W. Bussard, inventor of the interstellar ramjet, examined all the suggestions, rejecting any that failed even a single criterion. When several contestants sent in similar ideas, the judges selected the entries that most closely matched our criteria. Only 16 entries survived this rigorous screening.

Now the second round has begun. Working with NASA project manager Donna S. Miller, we've sent each finalist a copy of the GAS *Experimenter Handbook*, which details the technical constraints on experiments designed to fly in a Get Away Special cylinder. Remaining entrants have been given the option of spelling out their plans in greater detail. Miller cautions that plans of the winning entrant will probably be changed when NASA's experts screen them for safety hazards and technical problems. But judging during the second round will continue to weigh entries against the criteria we used in the first round: originality, feasibility, practical interest, elegance, and cost-effectiveness.

In alphabetical order, the finalists and their ideas are:

Robert Arnold, Massillon, Ohio. Test the structural properties of concrete exposed to the vacuum, radiation, and temperature changes of space.

Franklin H. Cocks, a professor of mechanical engineering and materials science at Duke University in Durham, North Carolina. Create foamed aluminum alloys with unique stiffness properties.

Mike Fowler, Austin, Texas. Examine the crystal structure and properties of mixed plastics solidified in space.

Harry Gifford, Sacramento, California. Study foamed metals by using a low-melting-point alloy called Wood's metal.

Leland T. Gilmore and *Sheldon R. Pearlman*, Silver Spring, Maryland. Look at the growth and movement of microorganisms in microgravity.

Margaret Joyce, Arlington, Virginia. Attempt to make a new piezoelectric material from components that cannot be mixed on Earth.

Kevin T. Keith, a pre-med student from Castro Valley, California. Study the development of a living tissue sample in microgravity conditions.

Mary G. Lingua and *Timothy W. Foresman*, an environmental engineer and a research ecologist, respectively, from Oak View, California. Test the effect of weightlessness on embryonic growth in the California sea urchin.

Gary B. Mortensen, Waseca, Minnesota. Fabricate electronic frequency-control crystals in the vacuum of space in the hope of prolonging their useful life.

Nigel M. Parsad, a ninth-grader in Fairview, New Jersey. By exposing amino acids to conditions in outer space, test

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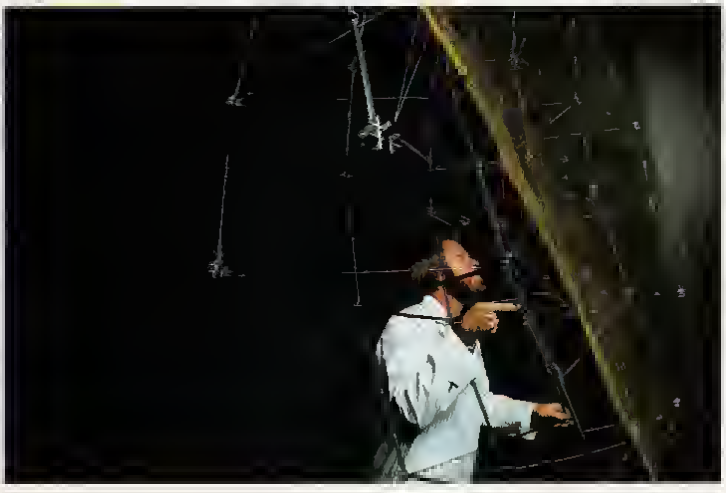


Models for the future. Omni contest stimulated readers' inventiveness and robust curiosity.

PEACE PILL

LIFE

By Tabitha M Powledge

If science could just invent a pill that controlled aggression we might have a peaceful planet, a world without war or even barroom brawls Right?

Wrong But we need to understand why this notion is wrong because someone has already invented a drug that looks at first glance like the ideal candidate for an antiaggression pill Scientists in the Netherlands have reported and other laboratories have confirmed some remarkable antiaggression properties in an experimental compound they have christened DU 27716

DU 27716 is remarkable because it appears to have much more precise effects than drugs now used for controlling aggression A male mouse given DU 27716 does not attack another mouse introduced into his cage This is very unmouselike behavior The drug does not merely reduce mouse offensiveness, it abolishes it Its effects on rats in identical circumstances are slightly different, DU 27716 reduces offensive attack dramatically but it does not totally eliminate the response

Within minutes DU 27716 changes normal aggression patterns Other drugs currently used to control aggression take days, sometimes weeks to start working Scientists are further fascinated because the drug appears to have little effect on most other kinds of behavior Some drugs that control aggression work by sedating the subject a tranquilized mouse is obviously, not a pugnacious mouse But a mouse given DU 27716 is perfectly perky and puts in an apparently normal mouse day

Most important although it has a pronounced effect on offensive behavior the drug appears to have little effect on defensive behavior at least when administered in small doses A mouse treated with DU 27716 will still defend himself against attack by an untreated mouse into whose cage he has been placed The drug however has one very considerable drawback that has surfaced in the case of rats It ruins their sex life (but in males only not in females)

No one knows whether DU 27716 would affect human beings in the same ways It hasn't even been tried out on other primates monkeys and apes though such experiments are likely to begin soon Since mice and rats respond somewhat differently to the drug it is probable that other species will respond differently too

The fact that mice and rats do not have identical reactions to DU 27716 is a key to understanding why this drug—or any other antiaggression drug—will never eliminate all outward manifestations of antagonism or hostility If the drug abolishes offensive attack in the mouse, but merely reduces the same behavior in the rat the biochemistry underlying this response must be different in mice and rats despite the close evolutionary kinship between these genera

Even within a single species, diversity remains a fundamental characteristic of aggressive behavior Very simply the word *aggression* covers an immense amount of behavioral territory Consider for example a wife who knocks her husband over the head with a frying pan in a moment of rage and kills him Is

she engaging in the same behavior as a robber who guns down a storeowner who resists him during a holdup? How do those two acts compare with a killing carried out for pay by a hitman? We might call all three acts murder and they are all clearly examples of aggression But despite the identical label we apply they are all quite different sorts of actions with different motivations and different accompanying emotions Different body chemistry almost certainly influences each one as well This implies that no single drug could control the behavior of all three killers

This becomes particularly obvious if we compare any one of those murderous acts with another kind of killing—the killing carried out in wartime None has any similarity to the coldly rational calculations that motivate the commanders of modern military machines Today's warfare often involves attempts by two armies to destroy each other without the slightest personal animosity The combatants themselves would probably much rather be somewhere else We can fight an even more impersonal war by pushbutton with an enemy half a world away Even if DU 27716 worked in humans as it does in rodents it is hard to imagine that this drug or any related compound could prevent this sort of institutional remote dispassionate bloodshed

Someday, perhaps even before too long we may have drugs that can control certain narrowly defined aggressive behaviors Perhaps DU 27716 will be among them, perhaps not

The drugs will raise troubling moral questions about how and on whom they should be used, but that is a subject for a different discussion

The point is that curbing aggression, in all its variety can only be slow laborious, and piecemeal Each kind of aggression has a unique cause and requires a unique solution Moreover some forms of aggression such as detense are socially valuable and require no "solution" at all The sad truth is that there can never be a pill that will give us peace in the barroom or on the battlefield ∞

TUMORS OF THE PSYCHE

MIND

By Mike Edelhart

Gregory's brain tumor appeared when he was nine. It defied surgery and radiation and spread swiftly all through his brain. The boy was considered doomed. Then, at the Biofeedback Psychophysiology Center of the Menninger Foundation, in Topeka, Kansas, he was taught to visualize his cure mentally.

He made his fight for life a titanic space battle. His cancer-killing white blood cells became a deadly fighter squadron. He was the intrepid squad commander "blue leader." His doctor was "ground control." One year later his tumor was gone. Now thirteen, he is still visualizing, and still cancer-free.

This tale, once typical of grocery checkout tabloids, was related at a prestigious medical conference sponsored by the American Institute of Stress. The conference was convened to report on a new medical idea that has gained wide attention and credence among the general public: that many diseases may be abetted, even caused, by psychological influences, particularly stress, and that diseases can be conquered by using the mind to overcome those influences.

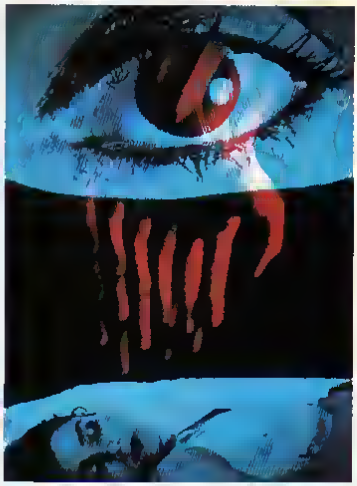
As the conference sponsor, Dr. Paul Rosch said, "Stress is when you're not in control of something. It doesn't matter what method you use [to get back in control] as long as you have faith in it. If there is a strong faith in a treatment mode—whether it be a faith healer, the shrine at Lourdes, laetrile, or nutrition—it creates the feeling that people are controlling the situation. They are telling themselves, 'I'm the boss. I'm in control here.'"

Yet, despite the enthusiasm of supporters such as Dr. Rosch, the case for stress as a direct cause for cancer is scientifically weak. And its wide promotion has actually harmed far more cancer patients and their families than it has helped.

Take, for example, the widely reported concept of the "cancer personality" advanced by psychologist Dr. Lawrence LeShan. The typical cancer victim, LeShan says, had a traumatic childhood and has a repressed emotional makeup, and his cancer appears within months after he suffers some severe trauma, such as the death of a loved one. By being written about often, this model has been invested with the aura of truth, despite the fact that an implied link between cancer and trauma is physically impossible.

"Cancer cannot possibly develop six to eight months after a loss is experienced," says Dr. Joan Borysenko, a Harvard psychologist and cell biologist. "The time since the first cell turns cancerous until a palpable tumor develops is eleven years in breast cancer and five years in lung cancer," she says. "There is no way that someone's cancer could be due to his emotional loss. Nor could such events be causal factors in and of themselves," she adds. "The disease is much too complicated to allow for such a simple explanation."

But worse is the fact that this uncritical acceptance of the stress-cancer link can sharpen patients' emotional suffering. Methods that require patients to accept the idea that their emotions contributed to their cancer are not innocuous," warns Dr. Jimmie Holland, chief of Psychiatry Service at Sloan-Kettering Memorial Cancer Center. "The patient who already feels guilty for delaying seeking treatment, or who is vulnerable to self-doubt, may become more upset."



Mind over matter. Is there a cancer mindset?

The Institute for Psychosocial Study, a New York City–based professional organization, points out that more and more cancer patients are facing this problem every day. As more people come to believe that emotions and attitudes contribute to the development and the cure of cancer, patients cannot help wondering whether the disease is the result of a personal shortcoming," one statement from the Institute suggests. "What begins as the hopeful wish to believe in the power of mind over matter carries the implicit fear that this may actually be so."

As a matter of scientific fact, serious researchers say, a cancer victim cannot be held personally responsible either for his disease or for its cure. In the words of Philadelphia cancer researcher Dr. Claus Bahnson, "No one is any more to blame for his illness than for the shape of the features on his face."

The role that stress plays in cancer, and many other diseases, is still open to question. Most researchers agree that whatever the effect of stress, it is not significant and not always predictable. To begin with, studies have shown that stress can inhibit as well as stimulate tumor growth. And even where stress does seem to enhance the risk of cancer, its impact is relatively small in humans, according to cancer expert Dr. Bernard Fox, of the National Cancer Institute.

At the most, Fox and other experts will only venture that psychosocial factors may not trigger a cancer. But if you're prone to develop cancer, stress will speed up the disease process.

While serious researchers move slowly forward in their understanding of the roots of cancer and what role stress may play, public fascination with the stress-disease link continues.

THE ARTS

By Morton Hunt

The great British biologist J B S Haldane was once asked by a group of theologians what his studies of living creatures had taught him about the nature of God. He replied somewhat wickedly that they revealed God's "inordinate fondness for beetles."

No doubt this ruffled the feathers of the audience, but it was more than a flippant remark. It expressed Haldane's special scientific perception of reality. For of the million identified zoological species, three quarters are insects, and three fifths of these are beetles. It was Haldane's way of pointing out the irony of human egocentrism.

This kind of vision fascinates science writer Philip Hilts, in whose new book, *Scientific Temperaments* (Simon and Schuster, 1982), the anecdote appears. For several years Hilts played Boswell to three leading American scientists. He tagged around after them, ate and drank with them, and asked them countless questions.

Hilts chose as his three specimens Robert Wilson, a leading explorer of the inside of the proton and the developer and director of Fermilab, the immense atom- and particle-smashing laboratory; Mark Ptashne, of Harvard, a principal developer of gene splicing and leading investigator of the molecular mechanisms that start up or stop gene activity, and John McCarthy, one of the chief creators of the field of artificial intelligence and the director of the Stanford University Artificial Intelligence Laboratory.

An impressive trio—superachievers all. And oddballs all. Wilson, shy and reclusive, refuses to have a phone in his office (he once ripped one out of the wall and buried another in the earth of a potted plant). Ptashne slaves compulsively around the clock in the laboratory, yet has found the money and time to buy and play a Stradivarius. McCarthy can get so lost in thought that after being asked a question, he will walk away without a word, then return to answer it minutes—or even days—later!

The three portraits reveal much more than the special vision and idiosyncrasies such scientists are capable of. Hilts deftly captures both the excitement and the tedium of scientific research, the incomparable thrill of discovery, and—surprisingly—the letdown that may follow it. (Ptashne speaks of the "cruelty" of having one's problem disappear right after it has been solved.)

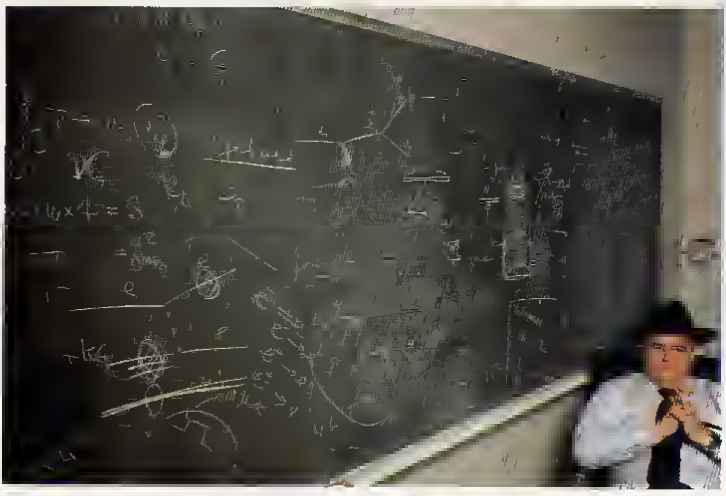
Hilts also explores the painful awareness and deep concern all three men have about the impact of their various discoveries on their society. Take Wilson, for example, who worked on the first atomic bomb. "He was naive and thought the bomb could be politically contained," Hilts said recently.

When the first one was detonated, he got physically ill. He couldn't stomach the terror he had helped create. He feels a sense of sin about it and has worked in antinuclear-war organizations ever since to expiate the sin." It's a relief to learn that *Dr. Strangelove* is only a story and that Wilson, Ptashne, and McCarthy are men of conscience and humanity.

Scientific Temperaments is a visit to three worlds of ideas. Hilts was so captivated by the drama of what had been happening in each of these fields of science that for a while he felt at war with himself. "I found the ideas so interesting," Hilts told me, "that I wanted to write about them as much as about the three men working in them." The problem proved to be its own solution. He wrote in a kind of counterpoint, continually shifting from the personal to the general and then back again.

Each profile offers its own unique pleasures. I found it great fun to eavesdrop on Hilts's conversations with these three extraordinary people and to peep into their private lives. On the other hand, the passages on particle physics, biogenetics, and artificial intelligence excited me by making what had seemed incomprehensible suddenly clear and simple. (Well, *relatively* simple.)

Scientific Temperaments is filled with science writing of the highest order. It is a reassuring book. It demonstrates that we, too, though we may not be capable of doing what the scientists do, are able to see what they see. ∞



Fermilab Director Robert Wilson, one of the men of vision profiled in Scientific Temperaments

THE ARTS

By Roberta Grant

Imagine a motion picfure over five years in the making a high-budgef special effects extravaganza with no sign of spaceships, galactic wars or extraterrestrial visitors a tilm telling the sometimes terrifying tale of youth tested by the responsibilities of maturity without using a single human actor a film from Master Muppeteer Jim Henson wifhout one Muppet in it

The Dark Crystal is a cinematic fairy tale more closely related in spirit to J R R Tolkien's Lord of the Rings trilogy than to *Star Wars* or *E T* But, unlike Ralph Bakshi's mediocre film version of Tolkien's Hobbit saga *The Dark Crystal* is not the result of animators human computerized or otherwise Neither does its magic depend on millions of dollars spent on lavish postproduction optical effects *Dark Crystal* is set in a full scale three-dimensional dramatic world inhabited by Skeksis, Pod People crystal bats and lithe Gelflings

When Henson was invited to create some offbeat characters for the original *Saturday Night Live* TV show he used lifelike eyes—the kind taxidermists emplace in stuffed animals—and became tascinated with the possibility ot doing a film about characters that looked alive as opposed to cartoonlike Muppets Henson dreamed of a fairy-tale fantasy world and when he discovered the drawings ot British illustrator Brian Froud (the coauthor of the best-selling *Faeries*) Henson knew he'd found a partner

Froud and Henson began by working backward Normally you write a story and then decide how to illustrate it Henson says But in this case we started by creating the world visually and then allowed the story to grow out of that I wanted to come up with creatures whose form would dictate the kinds of experiences they would have To draw the world of *The Dark Crystal* Froud studied the physical structures ot insects and reptiles as well as the artifacts of ancient and even prehistoric cultures

As the two creators worked together their story line emerged A character must make an irrevocable decision abouf his life and the lives of those around him says Gary Kurtz coproducer with Henson of this film 'Such a story could be set in any environment, buf the advantage ot fantasy is that it allows you to abstract the story enough to see its moral in a slightly different way

Kurtz cut his teeth as a big-budget producer on the high-tech space allegories *Star Wars* and *The Empire Strikes Back* What is new about *The Dark Crystal* and its principal challenge Kurfz feels is the obligation to make the various nonhuman Gelflings, Skeksis and Garthims emotionally compelling in addifion to making them capable ot walking talking and shaking hands With an actor even if he's motionless you can put a camera on his face and study him There's always some tacial movement going on But with mechanical creatures you have to orchestrate every movement down to the blink of an eye There's nothing there when it isn't being operated Kurtz says When you work with mechanical creatures the problem is to make them sufficiently versatile

In one sequence Jen and Kira his mate escape the ferrible claws ot Garthim warriors by climbing up on the backs ot two Landstriders then racing away As drawn by Froud the Landstriders were hideous long-legged, swift creatures with owl-shaped faces and hairy elephant-hide skins When we were originally laying out the film Kurtz recalls 'we thought of doing fhe Landsfriders in miniature using traveling mat and sfop-mofion photography in a traditional *King Kong* style If would have meant building a miniature swamp and a jungle

However Henson had a different idea What I wanted to do throughout the film was *not* rely on those kinds of techniques but instead actually accomplish it in the studio, full-scale Searching for a way fo bring fhe Landstriders to life the Henson team noticed one of their performers (the men and women who actually operate the creatures) clowning around on stilts Eureka! It was not fhe complete solufion but now they had a structural concept

Ultimately the Landstrider was to consist

With mechanical actors the producers orchestrate every move down to the blink of an eye

CONTINUED ON PAGE 122

HEATH'S HERO BREAKTHROUGHS

By Gurney Williams III

A new domestic robot from the Heath Company hauls small loads, talks, senses movement, light, and sound, and understands the binary chatter of that other domestic servant, the microcomputer.

Sold as a kit (for under $1,500), the 39-pound, do-it-yourself Hero 1 is also capable of telling owner/builders to do it themselves. "I do not do windows" is one of 33 phrases built into the robot's integrated-circuit memory.

There are other things it will not do. The robot won't carry more than 16 ounces at a time in its clawlike gripper. Nor will it climb stairs or feed its four rechargeable electric cells by itself, although it will lapse into a kind of meditative power-down state if battery systems fall below 10 volts. (The usual output is 27 volts.)

But its designers point out that it can perform many of the functions of the family major-domo, including patrolling rooms and checking for unexpected movement, delivering drinks, waking its owners on time, and even threatening intruders by raising its gripper and announcing that it's calling the police.

Experimenters can also hook the Hero 1 up to home computers to carry out more elaborate tasks. The robot comes with an on-board microprocessor programmable through a keyboard. And it can take orders from programs on cassette tape recorders, or from a hand-held control device called a teaching pendant. After one run-through of a sequence of tasks, the robot faithfully repeats the sequence down to the last twitch of its extendable gripper.

In a test of the assembled robot, we programmed it to pick up a plastic cup, carry it in a weaving pattern around a carpeted room, and put it down. After we'd helped it to find its starting point, the Hero retraced its path, rolling along on three wheels and manipulating the cup appropriately to prevent spilling.

Designers also showed off a light-sensing system that converts changes in illumination into digital information. A sound sensor, they explained, responds to "explosive" noises such as hand claps or single-syllable words (*bye*), while an ultrasonic ranging system, operating at 32,000 cycles per second, detects objects up to eight feet away. An easily accessible electronic board on the robot's head permits experimenters to patch in other home-designed devices, such as heat detectors or smoke alarms.

Heath also sells a fully constructed Hero 1 for $2,495. Complementing the automaton, the company offers a 1,200-page, 18-unit Robotics Education Course. The self-taught lessons cover robot fundamentals, sensors, voice synthesis, and other topics. The $99.95 course can be taken without the robot. But Heath (Dept. 150–125, Benton Harbor, MI 49022) says it's a lot more effective to study the lessons using Hero 1 as a teaching aid (or as a gofer for an occasional aspirin).

Gripper on Hero robot menaces intruders, carts drinking glasses without spilling a drop.

NEW PRODUCTS

When the Baby-Temp, a new baby pacifier, turns black, don't throw it out, call the doctor. The Baby-Temp is designed to do more than pacify. A tiny, green liquid-crystal thermometer floating in the glycerine-filled plastic nipple turns black when the infant's temperature rises over 100°F. The Baby-Temp can be sterilized just like an ordinary pacifier, and the glycerine and heat sensor are harmless if swallowed. ($2.50, from TRP Energy Sensors, 232 Madison Avenue, Suite 401, New York, NY 10016.)

It is the next best thing to a Polaroid instant camera: a portable processing system that makes it possible to develop instantly photographs that have been taken with any ordinary 35mm camera. There's just one catch. You have to use a special Polaroid film. The Polaroid Autoprocess 35mm System includes a portable film processor, a slide cutter and mounter, and a series of slide mounts. Three types of film are available in 12- or 36-exposure rolls: color transparency, black-and-white transparency, and a special high-contrast black-and-white line-copy film. (Under $100, Polaroid Industrial Marketing, 575 Technology Square, Cambridge, MA 02139.)

CONTINUUM

CIVIL DEFENSE

This is a test. This station is conducting a test of the Emergency Broadcast System. This is only a test. How many times has this sober message followed by the eerie tone of the emergency signal interrupted your favorite talk show or rock song? Then the reassuring epilogue. If this had been an actual emergency, the attention signal you just heard would have been followed by official information, news, or instructions."

Some time in the next year broadcast audiences nationwide may get a preview of the rest of the test: a full-scale emergency announcement issued by the country's number one entertainer, Ronald Reagan. In the event of a nuclear war, officials hope, emergency instructions could help save countless lives. There's just one catch 22: the likelihood that most broadcast stations would be wiped off the air by the electromagnetic pulse that follows a nuclear blast.

The Emergency Broadcast System plays an important part in the Federal Emergency Management Agency's (FEMA) proposed $4.2-billion, seven-year civil defense program, which critics say is really a plot to persuade Americans they can fight, survive, and possibly even win a nuclear war. And compared to the rest of the program, the emergency broadcast test seems downright useful.

The *heart* of the FEMA program is the Crisis Relocation Plan to move 150 million Americans from the 400 or so high-risk areas to rural "host communities." Most of these communities have already rejected the concept for fear they'll be trampled by "guests." And so-called guests haven't embraced the plan, either. Just try leaving New York City for the country at 5 PM on a steamy summer Friday, skeptics point out. If you think the roads are bad at rush hour, try them at Ground Zero. Luckily, the plans are at this point far from complete. Congress recently slashed FEMA's proposed $252 million Crisis Relocation budget to about $147 million.

But some of FEMA's other programs are already in the works. By 1984, for instance, emergency instructions will be included in phone books reaching 38 million people. Directories serving Plattsburgh, New York; Limestone, Maine; Marquette County, Michigan; and Austin, Texas, contain detailed evacuation maps and lists of what to take and what to leave behind. (Pets stay. Credit cards, bankbooks, and insurance policies, of course, go.) Bus pickup points are also included in case you want to stick around for public transportation to your host community or designated fallout shelter.

If there are no instructions in your phone book yet, don't worry. FEMA has also prepared a series of informative newspaper articles. The first, entitled "Knowing Nuclear Hazards Is a Key to Personal Survival," gets right to the point. If the U.S. should be attacked, people who happen to be close to a nuclear explosion would probably be killed or seriously injured by the blast.

The articles also contain do-it-yourself plans for expedient fallout shelters, including one you can build right under your car in case you get stuck in a traffic jam. There is also the "snackbar fallout shelter," which you can build in your basement, enabling you to sit out the blast in the comfort of your own home. What about public fallout shelters marked with the familiar triangular emblem? Most of these are right in the center of high-risk metropolitan areas, the article advises. And the supplies stockpiled in them during the Sixties have either rotted or been removed.

FEMA's salient point, the one it tries to drive home in its concluding article, is this: "The U.S. could survive a nuclear attack and go on to recover within relatively few years." Accordingly, the U.S. Postal Service recently publicized its plans for delivering mail after a nuclear attack, and the Treasury Department has come up with a contingency plan for filing income taxes. Since records normally used to document and determine income would probably be destroyed, the Treasury suggests a simple sales tax instead.

There is just one thing that FEMA didn't bargain on when it came up with its master defense plan: that the American people would consider the idea of a "survivable nuclear war" the ultimate joke. Says Dr. Robert S. Norris, an official at the Center for Defense Information in Washington, D.C.: "We've gotten calls for the last six months from little rural towns all over the country. They want to know how they can take care of sixty thousand relocated people. And those questions lead to bigger questions, like whether or not we should build the MX missile. FEMA's plan backfired. It has become a great educational device that reaches—and appalls—just about everybody."

—PHOEBE HOBAN

CONTINUUM

Injection of implants produces endorphin surge

BREAKING SMOKERS' EARS AND NOSES

A Florida doctor has developed a radical treatment for breaking cigarette smokers of their habit. He damages the cartilage in their ears and nose.

Dr. Robert Palmer, a University of Miami physician, claims that habitual smokers are actually addicted to their own endorphins, those morphinelike chemicals produced by the body in response to wounds or such irritants as nicotine. Endorphins are probably 10,000 times more addictive than heroin, accounting for the hold that cigarettes have on their users.

So Palmer developed a shot he says stimulates endorphin production in the brain, thereby ridding smokers of this dependency.

The treatment starts with the injection of sodium chloride, vitamin B, and procaine, a local anesthetic, into the cartilage of each ear and on the side of the nose. The mixture is a chemical irritant that temporarily damages cartilage, causing the body to produce endorphins of its own.

Newly treated smokers no longer need cigarettes, Palmer explains, since they're getting endorphins from the wounded cartilage. Then, as the cartilage heals, the body produces less and less endorphin with each passing day. By the time the supply shuts off in less than a week, smokers have been weaned away from their dependency.

The treatment is 100 percent effective at "deaddiction," Palmer claims. But since smoking is a complex behavior with many psychological components, half the patients return to smoking within a year. If should be possible to improve the de addiction rate, he notes, by adding conventional treatment.

Palmer offers his injection treatment at two SmokeMed clinics in southern Florida. Similar therapy is available from Dr. M. Dennis Mabry of the Nicotine Withdrawal Clinic in El Paso, Texas.

—Robert Deckert

Modesty is of no use to a beggar

—Homer

HOOVER, THE TALKING SEAL

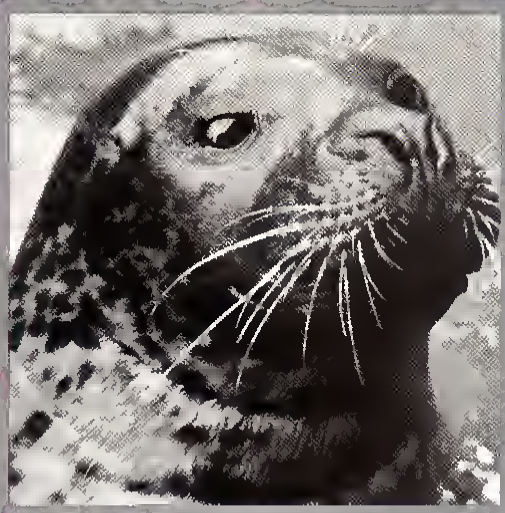
Some unsung wino on the Boston waterfront may deserve credit for what top animal biologists consider an unprecedented development: a talking seal.

Hoover, a ten-year-old spotted seal living at the New England Aquarium, has startled visitors to his waterfront tank with a number of clearly articulated phrases—spoken, of course, with an unmistakable Boston accent.

"Hello," come over here," Hoover tells aquarium visitors who arrive during the spring seal mating season, apparently the only time the 200-pound creature feels moved to speech. "How are you?" is another favorite Hooverism. And when he tires of performing for his guests, he just says, "Get out of here."

"This is the first time anyone has observed this kind of thing," says biologist Sheri Gish of the Smithsonian Institution who explains that Hoover's pronouncements fall short of true speech. "There is no evidence he understands what the words mean," she says.

Aquarium officials disclaim credit for Hoover's achievement. They believe the seal had nocturnal lessons from some vagrant frequenting his tank. "He sounds sort of disreputable," says Smithsonian scientist Katherine Ralls. "The aquarium is not in the best section of town."—Ben Barber



Hoover. There's no evidence that he understands the meaning of his pronouncements. Still, he has a pretty good Boston accent.

A TEMPORAL KIND OF LOVE

Is your wife in the habit of stripping for diners at the corner deli? Is your husband provoked to sexual arousal and trancelike states by the sight of a safety pin? And has your son reported pounding stomach pains followed by the urge to dress in women's clothing?

If so, they may be afflicted with temporal-lobe epilepsy (TLE). In which seizures flash through the lobes on either side of the brain, just behind the ears.

Most people think epileptics are stricken by muscular convulsions that make them lose all control of their limbs, explains James Ellison, a psychiatrist at Tufts University. But that's more typical of grand mal epilepsy, in which the entire brain sends out scrambled nervous impulses. With TLE victims, seizures are concentrated in the temporal lobes alone. Attacks can include muscular contractions, but often they don't.

Since the temporal lobes help process emotional and sexual stimuli, Ellison says, TLE victims suffer predictable personality changes. They often develop a deepening interest in religion and morality. TLE victims also tend to develop a passion for writing and a wide range of sexual abnormalities, including transvestitism, exhibitionism, fetishism, and, most commonly, a noticeable loss of the sex drive.

Some epileptics may not have psychological problems at all but may simply be victims of seizures concentrated in their temporal lobes.

TLE is often misdiagnosed, Ellison says. With the advent of modern brain scans, detecting TLE should be easier. That's crucial, Ellison stresses, because victims can be helped with anticonvulsant drugs.

—Charles Craig

"I wish I'd never woke up this morning
Life was easy when it was boring."

—The Police

CRUEL HARVEST

When the Indians of the Ohio River valley gave up hunting and gathering in favor of agriculture, they reaped pestilence, malnutrition, and violence along with their corn.

According to Anthony Perzigian of the University of Cincinnati, the seemingly progressive move to agriculture punished the Indians with devastating overreliance on a few low-protein crops (corn, beans, and squash). They became at once more sedentary and more bellicose, commonly dying of wounds or disease.

Perzigian, who is both an anthropologist and an anatomist, examined skeletal remains of four prehistoric cultures that spanned the period from 2500 B.C. to A.D. 1250. As the centuries passed, he found, there was a steady deterioration of health.

Infectious diseases were known in the very earliest times, Perzigian says, but their frequency increased dramatically once agriculture was established. Evidence for contagion and undernutrition, he adds, comes from stress markers on bones and teeth. Both baby and permanent teeth from the agriculturalists show faulty enamel and ten times as many cavities as among the hunter-gatherers. X rays of bones from ancient agricultural societies reveal episodes of arrested growth. And projectile points embedded in bones attest to stepped-up hostilities and violence.

Perzigian also found signs of widespread tuberculosis, a scourge he attributes to increased population and decreased resistance to disease.

—Dava Sobel

Anthony Perzigian examines the fossil evidence.

CONTINUUM

WORLD'S BIGGEST ORGANISM

Your skin mouth and gut are crawling with bits of an invisible immortal world-encompassing superorganism The idea is spooky but immunologists Sorin Sonea and Maurice Panisset at the University of Montreal are proposing it as a new way to view bacteria

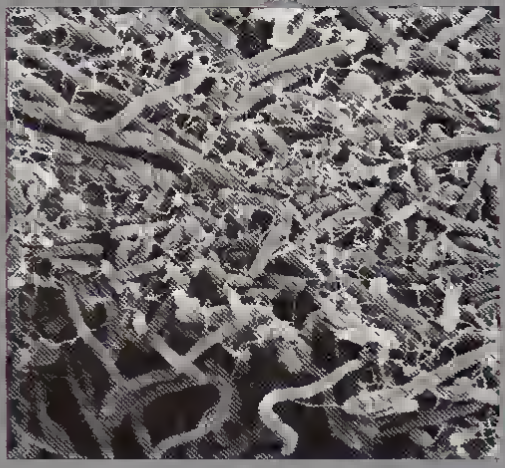
The bacterial world is not a collection of different species of one-celled organisms they contend Rather it's a single complex entity just as a horse is True groups of bacteria differ But so do the cells that make up a horse's eyes or its intestine

What the horse's cells have in common the scientists note is shared genetic information packaged neatly in each cell's chromosomes and descended directly from the original cell formed when the horse was conceived Likewise all bacteria are also descended from one cell that first bacterium that divided some 3 billion years ago

The researchers believe that when the bacterial superorganism is attacked it fights back with the help of brethren that may be thousands of miles away

If you've ever taken too much of the same antibiotic to fight a bacterial infection for instance you know that the medication eventually stops working The reason For every antibacterial agent there are bound to be bacteria that have somehow mutated to break it down And when these altered bacteria—carried around the world in water or on the wind—happen to find you they simply replace their dying companions multiplying with a vengeance as they fend off the drug

Sonea and Panisset compare the superorganism to a slow-working computer that may seek and then find, the solution to a threat —Mary Soderstrom



Bacteria Not individual one-celled organisms say two immunologists but a single complex entity that encircles the globe

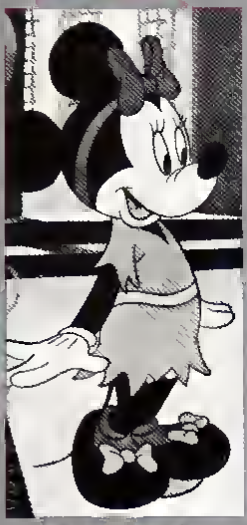
MIGHTY MOTHER MOUSE

Laboratory mice are valued for their genetic similarity this is crucial if experiments are to be consistent from one time and place to the next Now some California scientists say they have shown that every inbred mouse alive arose from a single female born hundreds perhaps thousands of years ago

The researchers reached this conclusion after finding identical strands of DNA in the mitochondria of 14 lab mouse strains The mitochondria—tiny energy organs found within each cell—contain DNA that has been passed on *only* by the mother Stanford University geneticist Tim Ferris explains So if two mice have identical mitochondrial DNA they most likely have a common female ancestor

In a control group of 20 wild mice from four different continents Ferris adds, he and his colleagues found tremendous variation In fact he says almost no two wild mice had mitochondrial DNA exactly alike

Some scientists have speculated that the grand mouse mother was one of the creatures revered around 1200 B C in the temples of Apollo Others say she can be traced to the pet mouse trade of seventeenth-century Europe No matter what her origin though, it's almost certain that she did indeed exist For according to Ferris and his associates at the University of California at Berkeley chances are one in 10 million that lab mice would have identical mitochondrial DNA by accident —Chris Christiansen



All lab mice may have a common female ancestor

'A science is any discipline in which the fool of this generation can go beyond the point reached by the genius of the last generation"

—Max Gluckman

Males spatial aptitude may be influenced by sex hormones

3D HORMONES

Visualizing and manipulating complex three dimensional objects has been called a male talent while women are said to have superior verbal skills Now a study at Massachusetts General Hospital in Boston suggests these intellectual differences stem from biological makeup

Neurologist Daniel Hier and endocrinologist William Crowly gave a battery of tests to 19 men with idiopathic hypogonadotrophic hypogonadism a rare condition marked by sexual immaturity and a scarcity of testosterone The 19 scored as well on verbal problems as normal men but they did 25 to 30 percent worse on spatial-ability tasks The males failed to improve their spatial ability scores even when a new drug was used to stimulate testosterone production

"I suspect hormones alter the brain circuits responsible for spatial reasoning *before* puberty " Hier says "After that brain organization is permanently established "—Eric Mishara

OLD AGE ENZYME

The elderly don t really die of old age Instead, they succumb to colds or minor infections that younger bodies would easily ward off If scientists could just explain this failure of the immune system they d be able to help the elderly live longer healthier lives Now a group of biochemists at North Texas State University say they've found the cause a crucial enzyme that stops working when the body gets too old

The enzyme—called triosephosphate isomerase or TPI—stimulates white blood cells to fight infection in the young But in the elderly, according to Robert Gracy head of the Texas team TPI is chemically altered For some unknown reason it takes on a negative electrical charge and becomes totally useless It lingers in aging cells without doing its job the immune system falters and disease sets in

Negatively charged TPI accumulates also in children with progeria and Werner s syndrome both diseases that drastically accelerate death Further research, Gracy adds should someday help scientists replace the defective enzyme in young and old alike

—Sy Montgomery

ELECTRIC LEUKEMIA

People who work with high voltage electricity on a daily basis may be at greater risk of developing leukemia

This conclusion comes from epidemiologist Samuel Milham who recently updated a mortality study for the Washington State Department of Social and Health Services He found that those working around powerful electric or magnetic fields were 37 percent more likely than the general population to come down with leukemia Those at highest risk included power-station operators aluminum workers power and telephone linemen motion-picture projectionists and even radio and telegraph operators

X rays and ultraviolet light are already known to cause cancer But Milham s study suggests that many types of electromagnetic radiation including those long assumed safe may also be carcinogenic Only further study he says can confirm or deny the danger

—Rick Boling

"Should I refuse a good dinner simply because I do not understand the processes of digestion?"

—Oliver Heaviside

"The function of muscle is to pull and not to push, except in the case of the genitals and the tongue "

—Leonardo da Vinci

Motion-picture projector operators may stand a greater than normal risk of developing leukemia because of the high voltages

CONTINUUM

INDIAN INTERSTATE

An extensive network of ancient roads surrounding Chaco Canyon in northwestern New Mexico is raising questions about the Anasazi Indians who built the highways as well as a dozen towns and an impressive astronomical observatory some 1 000 years ago

The roads crisscross an area of about 60 000 square miles connecting former outlying Anasazi communities with the ancient metropolis inside Chaco Canyon itself Several stretches of road run more than 40 miles in length and most measure a full 30 feet in width Yet the Anasazi had no vehicles or pack animals Why would they require roadways of such grandeur?

' It s a big mystery concedes Chris Kincaid of the Bureau of Land M[illegible] agement who headed a recent project to identify the roads

'What we *do* know she says is that the roads were definitely constructed and they represent a major engineering effort and labor investment Even in places where the roadbeds traversed flat rock she adds the builders cut into the rock so that the paths would be clearly delineated all along the route

The roads were built used, and abandoned in a mere 75 years By A D 1250 the Anasazi had left the San Juan Basin to seek more fertile pastures elsewhere —Dava Sobel

To serve an unintelligent man is like crying in the wilderness, massaging the body of a dead man plant ing water lilies on dry land, whispering in the ear of the deaf

—Panchatantra

Chaco Canyon's south side. Prehistoric 30 foot-wide roads head south, well beyond the horizon. No one knows why they were built

TEST FOR SUICIDE

A recent discovery that suicide is related to a chemical in the brain may lead to a test that ferrets out suicide-prone people

The chemical called serotonin is a neurotransmitter a substance that delivers messages from one nerve cell to another And according to Dr Michael Stanley of Wayne State University in Detroit it seems to be in short supply in the brains of suicide victims

Stanley compared the brains of nine New York City residents who had committed suicide with the brains of nine people who died of other causes The suicides brains had 44 percent fewer sites where serotonin could attach to nerve cells—an indication of reduced serotonin activity

It should eventually be possible says Stanley, to develop a blood test to identify potential suicides They could then be treated he continues with the antidepressant trazodone and an experimental drug named Zimeladine two medications known to boost serotonin production

—Paul Raeburn

DIET BALLOON

"Just eat less and you'll lose weight is a refrain obese people hear time and time again But eating less means feeling hungry, which usually leads to consuming even more food

Now two Danish doctors have come up with a non-surgical way to make eating less feel like being full They literally fill their patients tummies with bags of air

Who will jump? Lack of serotonin may provide a clue

Ole Gyring Nieben and Henrik Harboe of the University of Copenhagen, recently used catheters to thread latex balloons down the throats and into the stomachs of five obese women After being inflated to about the size of a fist the balloons floated freely for one to three weeks before harmlessly collapsing and leaving the body

The women who averaged 5'6" in height and with an average weight of 218 pounds reported eating less feeling fine and being sated by the vitamin-and-protein-rich diet recommended by the doctors They felt discomfort only when they ate too much

During three separate ten day periods the first with a balloon, the second

without one and the third with a balloon again the women lost on the average 11 pounds, 1 1 pounds and 4 6 pounds One woman dropped a whopping 19 pounds during her first go-round with the diet balloon —Carol A Johmann

ESKIMO BREEDING

The Arctic wilderness had virtually no electricity telephones roads or even houses Yet to Dr Joel Ehrenkranz, it was the perfect place to answer his question Do people like many animals, sometimes breed according to season? If they do he thought it should be most noticeable near the poles where temperature and day length differ most drastically from one season to another

In the summer of 1978 that reasoning led Ehrenkranz to the coastal town of Nain in northern Labrador Canada There he met with the Reverend Siegfried Hettasch who gave him records kept by Moravian Church missionaries since 1760 which included the dates of 5 000 Eskimo births

Ehrenkranz found that for 200 years Eskimo births had peaked in the spring and fall then bottomed out in summer and winter

To find out why Ehrenkranz set up a research clinic in Nain,s nursing station I got four Eskimo hunters to come in one day at the beginning of every season " says Ehrenkranz who also served as a traveling doctor for the region He drew blood samples from each man and looked for changes in pineal and pituitary hormones that affect fertility

We found that the hormones were well choreographed to turn on reproduction in late summer and late winter ' resulting in an abundance of births in late spring and late fall Ehrenkranz says He plans several more trips to the Arctic to answer yet another question Why do hormones produce the greatest fertility during the Arctic s most diverse seasons— summer with 24-hour-a-day sunlight and winter a time of total darkness?

—Carol A Johmann

Do humans have breeding seasons like other animals? Eskimos tend to bear their children in late spring and late fall

POSTDOC BLUES

Everyone knows that newly minted M D s become hard working low-paid hospital interns and residents before moving up to private practice and big bucks New science Ph D s interested in research careers in university laboratories similarly turn to apprenticeships in academic lingo called postdoctorals, or postdocs They too, work long hours for paltry pay but nothing awaits them in academe except disappointment

As the number of students dwindles, budgets tighten, and retirement is put off universities have fewer positions to offer The boom years of the Sixties are gone explains physicist Lee Grodzins of Massachusetts Institute of Technology who chaired a National Academy of Sciences (NAS) panel on postdocs Last year the number of new positions for assistant professors in physics for example was about one fourth what it was in 1968

Many who wish to stay in academic research become trapped in what NAS study director Porter E Coggeshall calls the postdoctoral holding pattern, one postdoc position after another sometimes without pay

Disappointment may loom for apprentice researchers

Many others discouraged, leave research Still others never enter preferring the promise of an LL D or M B A to a science Ph D

What will the future bring? Some authorities are predicting shortages of researchers Others worry about faculties growing older Grodzins says There are fewer graduate students fewer postdocs fewer assistant professors in some fields Who is going to do the research?

—Carol A Johmann

"Have you comprehended the expanse of the earth? Where is the way to the dwelling of light and where is the place of darkness?

—Job

CONTINUUM

The alarm weighs 1 5 ounces can be clipped to eyeglasses a hat or a headband and can be heard over the roar of a diesel engine

DOZE-ALARM

Oliver Red Miller a long-distance trucker from Scottsdale Arizona kept falling asleep at the wheel Fearing that Miller would have a serious accident Myron Herr a friend of Miller s built a small alarm containing a globule of mercury and a battery-powered buzzer that would sound whenever a pair of electrical wires came into contact with each other

The alarm was enclosed in a tiny box sewed into Miller's hat Whenever Mil er s head began to nod forward the mercury would flow over the wires creating an electrical connection and setting off the alarm

When other truck drivers learned of Miller s secret for staying awake on the road they tried in vain to talk him into selling the hat So Herr teamed up with engineer Austin Elmore a professional inventor The two refined the device reducing its volume to less than two cubic inches with a weight of a mere 1 5 ounces

Called Doze Alarm the device is now produced by the Marlin Manufacturing Company in Bedford Ohio —Margaret Sachs

God is not dead He is alive and well and working on a much less ambitious project

—Anonymous

SPERM BANK HEIST?

Last April 21 when a baby girl was born to Joyce Kowalski who lives in Phoenix the infant was the immediate focus of international attention

She was the first child artificially conceived with sperm obtained from the Repository for Germinal Choice a nonprofit Escondido California, sperm bank that accepts only Nobel laureates and other geniuses as donors

Unfortunately in that instance the repository s screening was less than vigilant Joyce Kowalski and her husband Jack had served time in a federal penitentiary for a 1978 fraud conviction And earlier Jack Kowalski had been accused of neglecting Joyce s two children born of a previous marriage

Even though applicants must now fill out a rigorous ten-page questionnaire repository spokesman Paul Smith concedes 'It s still possible for a couple to deceive us Would organized crime or a power-crazed Third World leader consider stealing the repository s Nobel sperm? We've had one inquiry from a foreign government,' Smith says but it s friendly to the United States As for organized crime I *can* imagine the mob wanting to breed some talent for their future requirements

Right now 3 000 vials of frozen sperm are stored in an underground storeroom on the ten-acre Escondido estate of multimillionaire

Will the mob want to heist some Nobel-caliber sperm?

Robert Graham the repository s cofounder and benefactor Resources management expert Anthony Weiner says that in his opinion they should at least have the level of security that a museum has to protect its artworks

But Smith says, ' We re merely in the business of offering the best genes available to couples who want children Whether we ll get caught up in some outrageous intrigue in the future I just can t say

—Eric Mishara

'Heroes are created by popular demand, sometimes out of the scantiest materials

—Gerald White Johnson

Currents from a black box, designed by Dr. Margaret Patterson (right), restore harmony to addicts' discordant lives. Listen to the

BRAIN TUNER

BY KATHLEEN McAULIFFE

"It looks like a Walkman," explains Pete Townshend, the lead guitarist of and chief songwriter for the Who, the British rock band. "You clip this transistor-size unit onto your belt, and there're two wires leading from it that you attach behind your ears. Then it's a question of tuning in to the right frequency."

The thirty-eight-year-old rock star is not describing the latest advance in recording technology, but a novel treatment for drug addiction—a treatment that may

PHOTOGRAPHS BY EARL MILLER

"Patients feel only a slight tingling, yet this mild therapy subdues violent reactions"

work by striking a melodic chord in the brain. The Walkman look-alike transmits a tiny electrical signal that appears to harmonize with natural brain rhythms and, in the process, reduce craving and anxiety. Or at least it worked for Townshend. The little black box, he says, saved him from a nearly suicidal two-year alcoholic binge that eventually drove him to heavy tranquilizers and virtually any other drug he could get his hands on. "The treatment works not only for boozers," Townshend emphasizes. "It's helped people give up cigarettes, heroin, barbiturates, speed, cocaine, marijuana—you name it. There is a different frequency that works best for each kind of addiction."

Dr. Margaret Patterson (above), a Scottish surgeon currently residing in southern California, is the owner and inventor of this magical device. Her black box (innards of an early model are pictured on the page opposite) sounds suspiciously like quackery. Just twiddle a few knobs and—presto—you can be cured of every imaginable vice. But the magic is real to people in the rock 'n' roll industry, who call her a miracle worker. Apparently Townshend is not the only celebrity who has benefited from her unusual remedy. She is credited with having reformed more than a dozen top recording stars, including ex-heroin addicts Eric Clapton and the seemingly indestructible Keith Richards of the Rolling Stones, whose reckless abuse of drugs became as legendary as his music. (For Townshend's personal account of combating drug addiction with Patterson's black box, see page 48.)

Happily, Patterson does not fit the image of either a charlatan or a cult figure. She is in her fifties, slender of frame, with a kindly face that radiates compassion. Her pale blue eyes are set off by a magnificent mane of auburn hair which is swept up into a graceful, oversized bun. "I hesitate to use the word *cure*," she says in a soft, lilting burr. "I prefer to call it a method of rapid detoxification. The electricity quickly cleanses the addict's system of drugs, restoring the body to normal within ten days. Most patients report that their craving also subsides in the process."

Patterson's electrical stimulator is currently pending clinical approval by the Food and Drug Administration (FDA) in the United States, where she has lived since 1981. Over the last decade in Britain, however, almost 300 addicts have received NeuroElectric Therapy (NET), the technical name for her treatment. Patterson claims that all but four left drug-free at the end of the detoxification process—a remarkable 98 percent success rate. "NET should not be confused with ECT—electroconvulsive therapy for mental patients," she cautions. "NET is far milder, involving currents at least twenty times weaker. Patients feel only a slight tingling sensation behind their ears where the electrodes are taped on." Yet this "mild" therapy, she insists, will subdue the violent physiological reactions that can make "going cold turkey" intolerable for even the most strong-willed person. Though normally soft-spoken, Patterson asserts unequivocally, "I can take anyone off a drug of abuse, no matter how severe his or her addiction, with only minimal discomfort."

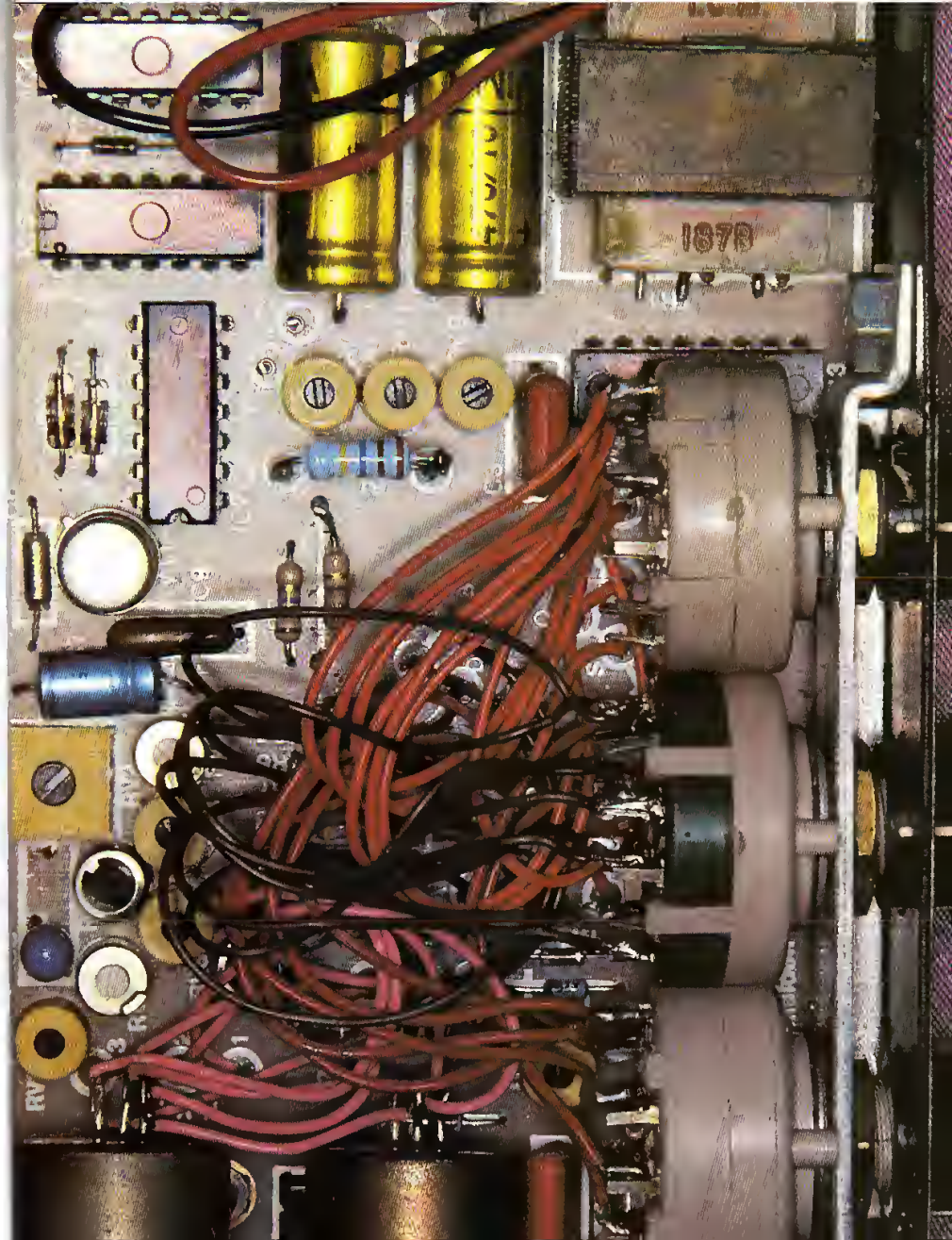
Of course, not all those who complete the detoxification program remain abstinent. Patterson emphasizes that NET is most effective when backed up by counseling, remedial training, and a supportive home environment. For many individuals, however, the treatment does appear to have long-lasting effects. If we are to believe the recidivism figures she cites, they are many times lower than the national average for every class of addictive drug.

A glance at Patterson's credentials provides reassurance that she is both serious and highly capable. At twenty-one, she was the youngest woman to qualify as a doctor at Scotland's Aberdeen University. Only four years later she obtained her Fellowship at the Royal College of Surgeons, at Edinburgh University—an elite circle that few surgeons penetrate before their thirties. And just before her fortieth birthday she was presented one of her native land's highest honors by the Queen—an M.B.E., or Member of the Order of the British Empire—for her outstanding medical work in India.

Colleagues and patients describe the tiny Scottish surgeon as warm, confident, and virtually unflappable. "You can't con her," says one patient who had spent years cheating and lying to get bigger drug prescriptions. "And if you try to put one over on her, she won't turn her back on you like other doctors."

"She's the sort of mother you always dreamed of having," says a female addict. Still another views her as a saintly figure "with the selfless devotion of someone like Mother Theresa."

Patterson's close rapport with her patients has made some professionals question whether her dazzling record in drug rehabilitation is really attributable to the powers of electricity. "It's her personality" is the chief disclaimer psychiatrists have attached to her work. "She doesn't control for psychological factors such as people's expectations," says Dr. Richard B. Resnick, an associate professor at New York Medical College, who is recognized as an innovator in the treatment of heroin addiction. "For



PETE TOWNSHEND ON THE BLACK BOX

Who guitarist Pete Townshend traces his downward slide toward drugged oblivion to the troubled spring of 1980. Long months of touring had brought him to the brink of a marital rift. Gross financial mismanagement had left him $1 million in debt to English banks. And all the while he brooded incessantly about the future of the Who. "I started drinking about a bottle and a half of cognac a day," Townshend recalls. "And to cut through the drunken stupor I was in, I got into this deadly alcohol-cocaine oscillation. Eventually I became such a physical wreck that I went to this doctor, who prescribed me sleeping pills and an antidepressant called Ativan. These Ativans made me feel great, and soon I was taking eight to ten tablets a day, plus three sleeping pills every night. By Christmas, though, the Ativan stopped working, and so I turned to heroin. A month later it dawned on me that I was actually dying, that my macho, 'I-can-do-anything' mentality would kill me. It was then I contacted Meg [Margaret Patterson]."

"Even though I'd seen startling successes with her technique, I didn't know whether it would work for me. But by the second day I knew I was on the home straight. And on the third day I felt feelings of sexual desire returning, feelings of just wanting to go out for a walk. It was incredible! There was a sense of inner joy as I started to gain independence from drugs. A natural energy flow slowly returned to my body. I could feel the old me coming back, and the first emotion I felt was arrogance. I thought, 'This will be easy. A few more days on this machine, and then I'll shoot up to L.A. and go dancing.' That was my frame of mind. But the fourth day I got depressed. Initially I had been given low electrical frequencies for heroin, but when I became depressed, I was given some high frequencies for my cocaine addiction. And at this high setting, I would sometimes have psychedelic experiences. The colors in the room would suddenly start to go wooo. Then I had another setback, followed by a day when I felt superhuman. It was just like being on heroin. But the next day I again felt like death warmed over. Some withdrawal symptoms even returned.

"Gradually, though, your mood levels off so that by the tenth day you feel fairly normal. In retrospect, I realize that the treatment is an education in itself. NET reeducates the brain to produce its own drugs, and in the process you learn something about your human potential. You come to realize that somewhere within you is the power to deal with crises, tensions, and frustrations. So the treatment reaffirms one's faith in the self-healing process.

"Of course it seems incredibly crude to shoot a thousand-cycle pulse through the brain—and *voilà*! Yet that's the beauty of it. There's something almost mystical about recovering by such a ridiculously simple technique. Somehow a simple little gadget has made me feel whole. And if I'm ever raped by a crazed pusher and become hooked all over again, I won't hesitate to call Meg and have my addiction handled in this straightforward, completely technical way."

example: what happens if you fasten electrodes to patients' heads but don't turn on the electricity? You just talk to them and feed them chicken soup. Will they do better, the same, or worse than the group that got current?'

Such skepticism is less common in England, where Patterson's clinical practice was based until recently. There, a number of doctors have already begun to obtain the same beneficial effects with her electrical stimulator model.

Dr. Margaret Cameron, a psychiatrist with the National Health Service in Somerset, England, reports that NET gives "very, very good results—better than any other treatment I've encountered." Since May 1981 Dr. Cameron has treated 40 alcoholics, 2 methadone addicts, 4 heroin addicts, and a few individuals with mixed addictions involving cocaine and barbiturates. In follow-up interviews conducted six months to a year later, 60 percent of the alcoholics were still off alcoholic beverages and none of the other patients had relapsed. A private practitioner based in New Jersey, Dr. Joseph Winston, shares Cameron's enthusiasm for NET. "As a benign, effective technique for withdrawing people from drugs, it is virtually unmatched."

If NET has met with resistance, it is because its mode of action strains the explanatory powers of modern science. Until recently orthodox medicine refused to recognize that infinitesimal electrical currents may influence the behavior or function of living organisms. Currents less than 100 millivolts—or below the threshold for triggering a nerve impulse—were assumed to have no effect on biological processes. This dogmatic view had to be reassessed when accounts of such unsettling phenomena began appearing with increasing frequency in technical journals over the last decade. NET is, in fact, only one branch of a young, controversial discipline that is still struggling to achieve respectability—the science of electrical medicine.

In the early Seventies scientists began introducing very small currents via electrodes to different parts of the body—with dramatic results. A rat amputee was induced to regrow a forelimb down to the midjoint, according to one exciting—though sometimes contested—report. In human applications, the FDA has approved the use of such currents for stitching together stubborn bone fractures. Recent experimental trials also indicate that trickling flows of electricity promote the healing of chronic bedsores, burns, and even peripheral-nerve injuries. The external currents, it is theorized, stimulate rapid healing by augmenting the body's internal currents.

'By contrast, weak currents applied to the brain affect different physiological processes,' says Dr. Robert O. Becker, a pioneer of electrical medicine who recently retired from Veterans Administration Hospital in Syracuse, New York. "But I believe Dr. Patterson is producing profound alterations of the central nervous system.

CONTINUED ON PAGE 115

FICTION

THE MIND OF MEDEA

An odd pilgrimage solves a biological riddle

BY KATE WILHELM

Irina Ulene hated the garish hotel that looked as if it had been designed by someone who had glimpsed Rousseau's jungle images once in a distant past. Harsh yellow light, brilliant oranges, reds, blues—everything was too vivid, too glaring. The greenery was false, hybridized by someone who believed that banana leaves were six feet wide and bird-of-paradise plants ten feet tall.

Jolly, the owner of the hotel, joined her at the entrance to the bar and guided her to a table, where they ordered drinks. It was said that Jolly was one-third man, two-thirds prosthetics. It did not show. He was dressed in jodhpurs, boots, a pale blue silk shirt; there was even a white scarf tied about his throat.

"Give any thought to the job I offered you?" he asked.

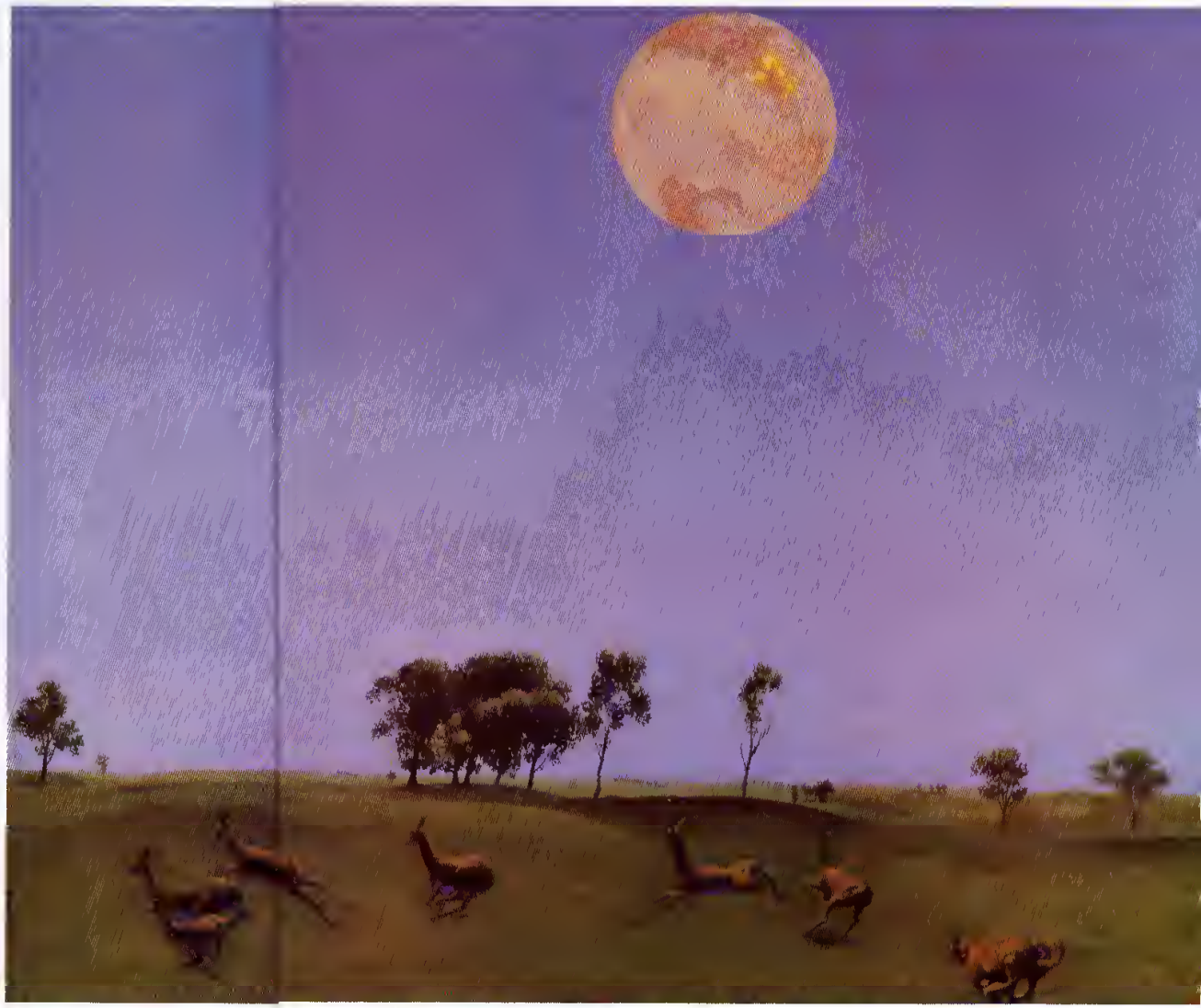
She nodded. "Thanks, but no. I'll fulfill my contract with Chien Li if anyone ever comes to guide me to her camp."

"Pick will show up," Jolly said reassuringly. He glanced about the barroom with fondness. "You could do worse than work for me, you know. Chien's crazy. You won't last out there more than a month or so. Job'll be here when you come back."

She did not respond. The bar was crowded; the hotel was filled with ship personnel, members of various exploratory groups, government people, the science committee people. Three out of four of them were men, most of them would never leave Medea again. Nearly all of them watched her openly.

"The others," Jolly went on, "are working on such tight budgets that one more salaried employee would break them. Corum, Kuwait, Michaels, all of them. You'll get

PAINTING BY CLIFF McREYNOLDS



so bored out there with Ch'ien Li you'll be back in a month three at the most and you'll need something to do"

Irina stopped listening It was not the salary she knew that had made the others turn her down She would draw no salary during her five-year contract on Medea She had waived salary to ensure her return trip home at the end of her five years and that made her a dabbler a mercenary in the eyes of real scientists Only Ch ien Li had not objected but Ch'ien Li had wanted no one at all had accepted an assistant only because the science committee had ruled that she must

For twenty-two years Ch ien Li had been living in the field observing the creatures that were called fuxes or foxes She had published no results yet *Twenty-two years* Irina thought coldly If Ch'ien Li could stand it for twenty-two years she could stand it for five She looked past Jolly at a boisterous man who had entered the bar shouting greetings to the bartender

The newcomer was heavy with immense shoulders, abundant black hair, and a swarthy complexion He seemed to know everyone in the bar stopped here and there to pound someone on the back to bear hug someone else to chat and laugh as he weaved among the tables

"That's your guide" Jolly said "Paulo Aranha or Pick"

The big man saw her and charged forward until he reached the table, where he stopped and leaned forward to examine her "Irina?" His eyes were bloodshot

"You know I am"

He sat down, chuckling "You're not the pretty little thing I've been dreaming about tell you that right off"

Irina was a tall woman with broad shoulders, a large face with pale blue eyes pale eyelashes and brows She knew she was not pretty "I expected you days ago"

"Got held up You ready to move out?

"I've been ready since my second day in this place"

"Calm down I'm here, and we'll be on our way Half an hour at the main entrance See you there" He got up and strode away She thought he was laughing at her

Jolly stood up smiling openly "You'll be back," he said with satisfaction "Crazy old Ch'ien Li, Pick snake vines sting birds rock monsters, heat, nothing to do but watch the little fuckers You'll be back"

They left in an aircar that rose swiftly above Medea Town with its artificial white light and hard-edged shadows Up here the light was dull red It reminded Irina of a partial eclipse of the moon Pick had changed also his swarthy skin now appeared Afro-black where it showed below the silver half-mask he wore She had one just like it for eye protection from the infrared atmosphere

A flock of dooley birds had risen with them paced them when Pick leveled off and headed northwest the birds began to dive into the airstreams of the jets They looked like spears when they folded their wings to dive She had read about them during her indoctrination, but seeing them was something else

Below the forests had been cleared and replaced by fields, the only visible green The lush plants under ultraviolet lights stretched north and south following the coastline When they ended the change to orange umber red brown was abrupt and complete The car climbed higher Then Pick set the automatic controls and leaned back with his hands behind his head Irina gazed in rapt attention at a dancing wall of lights the borealis

She was roused by his voice and turned A cloud of living balloons was coming from the north hundreds of them in a mass She uttered a low cry, then became silent again The gasbags were every color some pulsing with light, others opalescent, some so brilliant that it seemed they were being consumed by inner fire They were level with the car but abruptly they began to rise straight up moving together the way a school of fish does changing direction as a single entity Irina watched them until they vanished in a dense cloud layer

"They're like Portuguese men of war except they're different" Pick said "Filled with hydrogen with those damn appendages hanging down That's what happened to Jolly one of them took him for a ride and dumped him Ended his days as a guide" He did not look at her as he added, "If one of the fuckers comes down and you're in the open, you hug the ground or dig in if you can Best if you can find a big rock bush tree something, but if you can't you kiss dirt"

Fuckers fuxes foxes They were the creatures that Ch'ien Li was studying the ones Irina would study also in order to determine their intelligence

They flew over rolling hills mountains a wide brown river a chocolate-colored lake umber plains swamps After a brief stop for lunch, they were buffeted by storms and the ride became a lurching stomach-wrenching ordeal The trees thinned out were stunted deformed by careless wind pruning, and there were long stretches of ground with only grasslike cover and straggly bushes all in shades of brown This was uneasy land and twice they detoured around dust storms that hid the world below completely

Finally a deep valley appeared with woods and a river The trees were not very tall and their leaves were sand-colored but the valley looked peaceful no wind stripped the trees here

"Home again" Pick said cheerfully as he took them into the valley "There's camp"

His voice sounded loud after the long silence The scowl he had worn for the past few hours had not been meant for her she realized but for the storm and the near hurricane-force winds "I'm glad it's quiet in here," she said straining to see the camp

He laughed "Oh it's quiet You'll see"

She stiffened at the mockery in his voice and looked straight ahead She could now make out the structures

There were five white mounds that could have been smooth boulders in a clearing Pick flew even lower and finally came to a stop before one of the mounds that was the size of a one-story house The side of it opened and he glided the car inside Irina was dazzled by the glare of white light when she pulled off her mask

She got out stiffly and blinking looked about her The dome was opaque filled with cool fresh air There were two smaller cars scout cars and a complex of machinery the power plant air conditioners purifiers other unfamiliar equipment An opening in the wall appeared and a tiny woman stepped forward

Irina felt a jolt when she saw Ch'ien Li who was a legendary figure on Earth She was no larger than a ten-year-old child her face was bone-white her black hair was streaked gray She looked as old as death

"Here she is" Pick called as Ch'ien Li approached slowly "I'm going to get some sleep Unload later" He waved to the two women and left by way of another small doorway in the plastic

"You must be tired also" Ch'ien Li said She stopped some feet away from Irina and made no offer to shake her hand or greet her in any formal manner "Come I'll take you to your room"

Ch'ien Li led the way through a short passage into another smaller dome Separate living quarters, a true luxury Here there were personal furnishings a bed a chair a desk a computer terminal

"You may have meals here if you choose or in the group room I'm afraid my own hours are very irregular However you and Pick may want to share mealtime" Ch'ien Li said indicating the room First rest Then we shall discuss the work in progress"

She regarded Irina for a moment or two her own face devoid of any expression then bowed slightly and withdrew

Like a talking doll Irina thought An activated old-fashioned talking doll

The foxes were a thousand yards down river clearly visible from the camp even

> *"The creature was immature, the size of a half-grown cat, it had eight legs and moved so fast that, played back in real time, its movements were blurred past comprehension"*

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His name is synonymous with dolphin/human communication, isolation tanks, drug-induced voyages into altered states of consciousness. Is he crazy? Or brilliant? Or both?

INTERVIEW

JOHN LILLY

Above the ranch-style dream houses and seafood restaurants along the Pacific Coast Highway the rugged, bleached Malibu canyons, twisting roads, dusty scrub oaks, and desert sagebrush speak a supernal language. It is a landscape of the spirit more than of the body, and Dr. John C. Lilly, dolphin magus and scientist-turned-seeker, seems at home here—where the spectacular surf down at Zuma Beach is a mere rim of white foam on the edge of the world. If life imitates art, Dr. Lilly should live on just such a mountaintop.

It hadn't been easy to find him. When I asked scientist acquaintances about Lilly's whereabouts, most of them said something like, "Do you mean what dimension?" Someone thought he worked with dolphins at Marine World in Redwood City, just south of San Francisco, and, it turns out, he does. But when I phoned there, I talked to a succession of secretaries who had never heard of the remarkable Dr. Lilly. I finally left a message with "Charlie," a gate guard who told me that he sometimes "sees him go in and out." No luck. When at last I called his house in Malibu, Lilly answered the telephone himself and gave me road directions that were accurate to the tenth of a mile.

Lilly's autobiography *The Scientist* (1978), begins with the creation of the universe out of cosmic dust, but his own human chronicle starts in St. Paul, Minnesota, in 1915. A scholarship whiz kid at the California Institute of Technology, Lilly graduated with a degree in biology and physics in 1938 and went on to earn his M.D. from the University of Pennsylvania. Though he became a qualified psychoanalyst, his first love was brain "hardware." His mastery of neurophysiology, neuroanatomy, biophysics, electronics, and computer theory gave him something of the technical ingenuity of the genie in *The Arabian Nights*. From 1953 to 1958

PHOTOGRAPH BY CHRISTOPHER SPRINGMANN

he held two posts—one at the National Institute of Mental Health (NIMH) and one at the National Institute of Neurological Diseases and Blindness—both part of the National Institutes of Health (NIH) in Bethesda Maryland. In his early years at the NIH he invented a technique that allowed scientists for the first time to take brain-wave recordings from the cortex of unanesthetized animals. He also mapped the brain's pleasure and pain systems by direct electrical stimulation of its core regions. And in 1954, tackling the classic puzzle of what would happen to the brain if it were deprived of all external stimulation, he built the world's first isolation tank.

Floating in his dark, silent, saltwater void—the original version of which required that he wear a skindiver's mask—Lilly discovered that sensory deprivation did *not* put the brain to sleep as many scientists had supposed. Furthermore, tanking led him far afield from the doctrine that the mind is fully contained within the physical brain. The tank, he declared, was a "black hole in psychophysical space, a psychological freefall," which could induce unusual sensations, reverie states, waking dreams, even a kind of out-of-the-body travel. (Today, of course, isolation tanks are so much a part of the culture that even straitlaced businessmen routinely spend their lunch hours—and upwards of $20—relaxing in health-spa tranquility tanks based on Lilly's original design.)

More and more enamored of the deep, womblike peace he experienced in the tank, Lilly began to wonder what it would be like to be buoyant all the time. Whales, dolphins and porpoises sprang to mind, and the rest, of course, is history. By 1961, Lilly had resigned from the NIH to found and direct the Communications Research Institute in the U.S. Virgin Islands and Miami, Florida, for the purpose of studying these big-brained, sea-dwelling mammals. Convinced that dolphins are not only smarter but more "humane" than *Homo sapiens*, and that they communicate in a sophisticated sonar language—popularized, rather inaccurately, by the baby-talking dolphins of the film *Day of the Dolphin*—Lilly began a lifelong quest to "talk" to the Cetacea. Today, he uses a "two-faced" computer system called JANUS—named after the two-faced Roman god—to work out a human/dolphin language.

While Lilly was experimenting with otherworldly states in the isolation tank, the halcyon days of hallucinogenic research were under way at the NIMH. (LSD was not to become a controlled and therefore sticky substance until 1966.) Lilly, however, did not try LSD until the early 1960s. Once he did, it became his high mass. Mixing LSD and isolation tanking for the first time in 1964, he entered what he described as "profound altered states—transiting interstellar realms, conversing with supernatural beings, giving birth to himself and, like Pascal, exploring infinities macroscopic and microscopic." "I traveled among cells, watched their functioning . . . and realized that within myself was a grand assemblage of living organisms, all of which added up to me," he would write of his illuminations in *The Center of the Cyclone* (1972). "I traveled through my brain, watching the neurons and their activities. . . . I moved into smaller and smaller dimensions, down to the quantum levels, and watched the play of the atoms in their own vast universes, their wide empty spaces, and the fantastic forces involved in each of the distant nuclei with their orbital clouds of force held electrons. . . . It was really frightening to see the tunneling effects and the other phenomena of the quantal level taking place."

By all accounts, Lilly has probably taken more psychedelic substances—notably LSD and "vitamin K," the superhallucinogen he prefers not to identify—than anyone else in the consciousness business. Since the lords and overseers of establishment science frown on using one's own brain and nervous system as an experimental laboratory, Lilly today reports his findings in popular books instead of in neurophysiology papers. He makes the scene at such New Age watering holes as Esalen in California and Oscar Ichazo's Arica training place in Chile. He hasn't received a government grant since 1968. When asked about him, mainstream scientists tend to shake their heads sadly, as if recalling someone recently deceased.

> *"I can run my computer, ski, or do just about anything on vitamin K. I've been on it for as much as a hundred days straight. You don't really sleep, because you don't need to."*

"The trouble with Lilly is that he is in love with death," says one neuroscientist friend of his. "But God, is he brilliant! Yes, he is brilliant, and yes, he does seem to have flirted quite flagrantly with death. Though LSD- or K-related accidents have almost killed him on at least three occasions, Lilly still keeps going back to the void, once tripping on K he tells me for 100 solid days and nights. It is also true that he has always returned to Earth, however constraining its boundaries, and that his wife, Toni, has had a good deal to do with that."

The moment I arrive at his house, having driven my rental car over zigzagging mountain roads, Lilly announces: "We have one rule in this house. No one can take drugs of any kind and drive back down that road." Five minutes later he seems to be offering me acid and K—or did I hallucinate that? Is he putting me on? What kind of game is he playing with the anonymous reporter who has come to call?

He tapes me with a matchbook-sized Japanese tape recorder while I tape him. The phone rings and Lilly answers it, his face as immobile as the wooden Indian that guards his entryway. "Who are you?" he demands. His side of the conversation is curt. "It was someone asking about the solid-state entities," he tells me. As our interview proceeds, I watch various expressions play across his patrician, chiseled-granite face—unexpected sweetness whenever he speaks of Toni or of dolphins. (When talking about a dolphin, Lilly always uses the pronoun *he*, never *it*.) Sometimes his language is full-bodied and poetic; sometimes it is a private blend of computerspeak and Esalenese, full of phrases like "Earth Coincidence Control Offices," "metaprogrammings" and "belief-system interlocks." My own questions echo in my head, and Lilly seems bored, on the verge of walking off abruptly into a zero-g universe of his own. Possibly to get rid of me for a while, he escorts me to his *samadhi* isolation tank.

In this warm, saline sea of isolation, where such luminaries as Nobel physicist Richard Feynman, anthropologist Gregory Bateson, psychologist Charles Tart and est czar Werner Erhard have floated and had visions, I try to sort it all out. My visions are disconnected, rudimentary. I am a swamp plant, trailing its leaves on the water; a fetus; a dolphin; a whirring brain in an inert shell. An hour and a half later (one loses track of time) I emerge and try to continue the interview. The problem is, in my state of tranquillity, I have lost interest in asking reporterlike questions and, besides, I feel Lilly retreating more and more into some remote, glacial space behind his eyes. From another room a manic laugh track from what sounds like an old *I Love Lucy* show floats out to us. Some time later, Toni Lilly suddenly walks in, smiling and carrying bags of groceries. Her husband jumps up to help her unload the car, and I take my cue to depart back down the mountain.

Only later, at home in the Los Angeles lowlands, do I notice that *I* am altered—that for 24 hours after isolation tanking, reality looks and feels quite different. Four weeks later I telephone Lilly, and we talk again. The following interview is the result of our afternoon together in his Malibu home and of that subsequent telephone conversation.—Judith Hooper

Omni: You're probably best known as "Dr. John Lilly, the dolphin man." What is the aim of your current dolphin research?

Lilly: At Marine World, we're working with computers to develop a human/dolphin code analogous to the Morse code used in telegraphy. The project is called JANUS—for Joint Analog Numerical Un-

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To honor vital clogs in the wheels of scientific progress, we offer Omni's second annual

LAURELS (AND HARDYS)

OMNIBUST Some years ago a group of creative chemists decided it was time to let the public in on the wonder of modern science. So they got themselves a vat, and they boiled and stirred and treated a foul-smelling brew with puissant chemicals. And at an industrial exposition they displayed the product of their talents: a silk purse made from several hundred pounds of sows' ears. It was to commemorate such feats that the *Omni* Laurels (and Hardys) were born. Delivering this new honor into reality proved more difficult than recognizing the need for it. We pondered at length, for example, how to reward such achievements. After all, the Nobel Foundation bestows thousands of dollars and a trip to Stockholm. Could we do less? We could. No prize, we felt, could equal in kind or quality the deeds of our winners. So that is what we give them: nothing.

How our chief judge, Mike Edelhart, makes his selections, we fear to speculate. But it is clear that his methods work. For, leaving no stein unturned, he has delivered unto our limelight the alcoholic android, the psychologists who might cure it, some pioneering roach trainers, and two geophysicists with a remarkable new solution to the energy shortage.

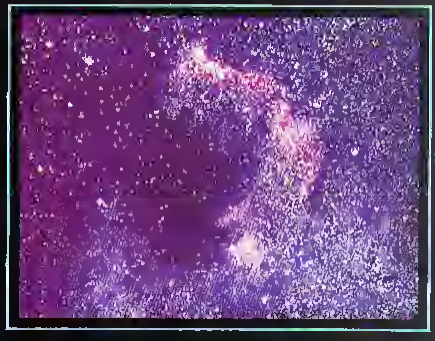
These and other fabulous frays in the fabric of progress receive their just reward in the following pages.

FIZZLING SYZYGY The world failed to end last spring. That should not be newsworthy, and yet a year or so ago some of our wider-eyed colleagues were reporting with trepidation the arrival of the grand *syzygy*, or the alignment of the planets on one side of the sun. This, they claimed, would lead to massive solar flares, tidal waves, earthquakes, and general calamity. For better or worse, California might at last fall into the sea.

There were several things wrong with this forecast. For one thing, the planets never lined up; astronomers had long known that they wouldn't. At their closest, the planets were still spread across a quarter-circle of sky.

The stories were based on a book entitled *The Jupiter Effect*, by John Gribbin and Steven Plageman, and Gribbin had retracted the prediction here in *Omni* as early as June 1980. That was not enough to quell public eagerness for an exciting story, and sensational articles flowered the world over.

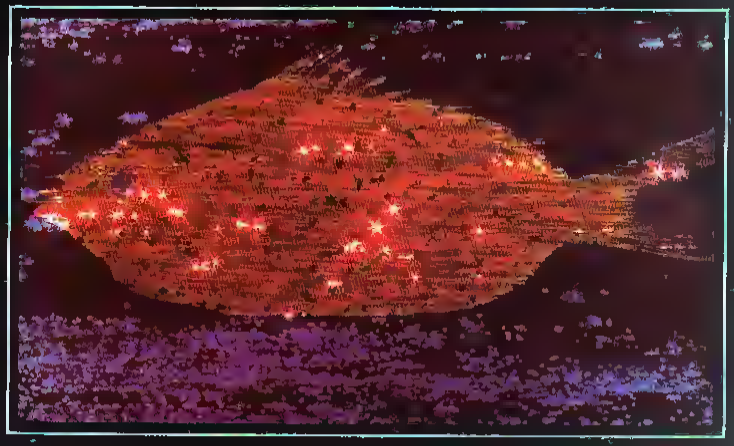
Fortunately, science writers will eventually have the chance to redeem themselves. Similar alignments have occurred regularly since the birth of the solar system. The next end of the world is scheduled for the year 2181.



FUNKY SCIENCE For bringing a remarkable, fresh perspective to the public discussion of nuclear power, we wish to honor Harold C. Funk, editor of the *Milton* (Canada) *Weekly Tribune*.

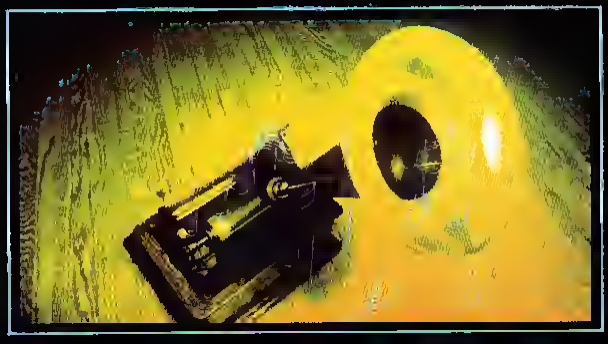
Funk dislikes nuclear power because he believes that electricity generated by atoms is radioactive. Ontario Hydro, which operates nuclear plants in Funk's vicinity, tried to convince him otherwise, but the plucky editor held his ground. "At the end of the interview," he wrote in his paper, Ontario Hydro's man "was unable to convince me that the fish in my frying pan was not contaminated. They could very well learn in years to come that electricity, which comes from a nuclear reaction, is contaminated."

Even more alarming, Funk has also discovered, he told us, that the sun is only 290,000 miles away from the earth.



DIGITAL DASTARDRY Once electronic gizmos started getting clever, it could only be a matter of time before they got into trouble. Los Angeles police last year spotted one robot weaving drunkenly around Beverly Boulevard and booked the tin man, perhaps for being under the influence of someone under the influence.

In another case, Belle, Bell Laboratories' computer-chess champion, was jailed. Belle and her companion, Ken Thompson, were on their way to a chess meeting in the USSR. Thompson made it to Moscow, Belle vanished. After frantic searching, it turned out that Belle had never even made it out of Kennedy Airport. Customs officials had confiscated her as a piece of contraband technology being smuggled to the Russians. Pleas from Bell scientists, diplomats, and Thompson himself failed. In the end it took a $600 ransom to get Belle freed. Strike one for old Liberty, Belle.



BIOCHEMISTRY RAG Perhaps inspired by ketones, or barbershop hormoney, a University of London researcher named Harold Baum has penned *The Biochemist's Songbook*, a compendium of ditties from bile ducts to Broadway.

Baum's melodies are old favorites like "Mine Eyes Have Seen the Glory of the Coming of the Lord," "Auld Lang Syne," and "Waltzing Matilda." But the lyrics are right out of the laboratory.

From "The Battle Hymn of the Aerobes" come these stirring lines: "Mine eyes have seen the glory of respiratory chains/ In every mitochondrion intrinsic to membranes/ Functionally organized in complex subdomains . . ." And the paean ends (EVERYBODY!) "Glory, glory, respiration/Where electrons flow along." Break out another flask for Dr. Baum.

IT'S A MOLD, it's a slime, it's . . . Remember the horror flick *The Blob*? In the utter blackness of an Arkansas cave, Princeton University biologist David Waddell has found the next best thing, a vicious slime mold that crawls around in the shape of a slug and devours its cousins one cell at a time.

Most of the slime molds in Blanchard Springs Cavern graze on bat guano and other biological detritus, so does this one. But when it meets another slime mold, it dispatches a few of its component amoebas to infiltrate the hapless creature, poison it, and eat it cell by cell. Slowly the invaders multiply, spreading through their victim until they take its place.

For now, the rest of the world seems safe, but as the slime molds grow and get hungrier and reproduce themselves . . . who knows? Today Blanchard Springs Cavern, tomorrow the Creature That Ate St. Louis.

LAURELS (AND HARDYS)

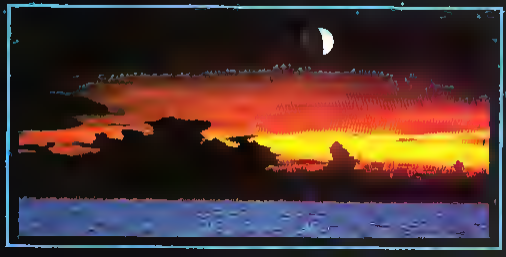
PERILOUS PLAY The world may be rid of smallpox, but medical researchers face several new plagues, resulting from recreation. Disco finger is a recently diagnosed skin irritation often accompanied by Saturday night fever. The main symptom, abrasions on the fingers, comes from snapping them to the disco beat. Treatment involves abstinence from getting down or funky.

Space Invaders obsession strikes prospective bridegrooms, according to the *Journal of the American Medical Association*. Victims become wedded to the game instead of their fiancées, who are symbolized by the aliens. The video obsession is blown away, according to Duke University researchers, once the player reaches the altar.

TOMORROW AND TOMORROW and tomorrow . . . Fearless prophets last year were able to foresee that Eta Carinae, a star 100 times larger than our sun, will explode in the magnificent display of a supernova almost any day now . . . give or take a few millennia.

The star has already flared briefly, in the nineteenth century, say Drs. Kris Davidson, of the University of Minnesota, and Nolan Walborn, of Chile's Cerro Tololo Inter-American Observatory. And the glowing cloud around the star contains large quantities of nitrogen, the stellar equivalent of age spots.

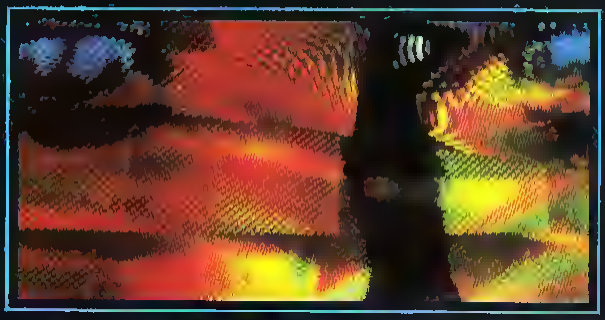
So sometime soon we can expect Eta Carinae to treat us to a blazing spectacle. It will happen, the intrepid seers say, sometime *within the next 10,000 years*. Duck!



UDDER INCOMPETENCE When Hawaii's Health Department officials discovered a potentially dangerous pesticide in samples of milk sold to the public, here is what they did. They waited. They shipped the samples to a mainland laboratory for further testing, which showed that the milk was indeed heavily laced with heptachlor. That's a substance that keeps ants off pineapple plants and also, in laboratory tests, causes cancer and liver disorders in mice.

Then officials waited some more. They took more samples and discovered that they, too, contained the poison. So they took more samples. It was 57 days before they finally informed the public.

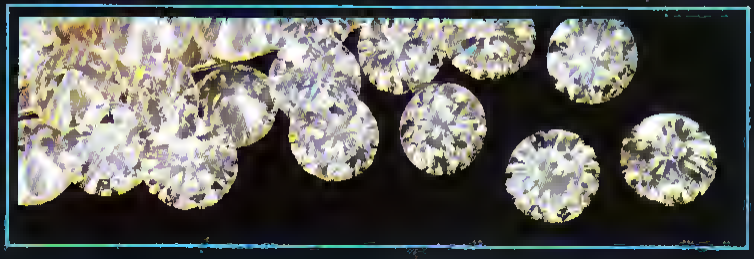
The delay allowed plenty of time for milk to be poured on children's cereal or mixed into ice cream, leaving Hawaiian consumers with the shakes.



HARDHEARTED SDFTWARE It wasn't enough that computers humiliated us with glitches, error messages, and rapacious aliens. Now they can actively insult us.

ABUSE is a surprisingly popular new computer program that transforms your mild-mannered micro into a swaggering bully. Turn on your computer and slip in the disk, and it suddenly pelts you with an endless stream of insults. "Do you realize your mother's face would spoil pork?" it may ask, or "May a mangy linebacker throw a transmission through your face."

And ABUSE is persistent. Once it seizes control of your computer, there is no way to shut it off short of pulling the plug. The only sure defense we found, is to remove the disk, wrap it in aluminum foil, and bake in a moderate oven for two hours



CDDKING WITH DIAMONDS A pair of University of California geophysicists say gems deep underground get converted into methane gas as they are shoved toward the surface. Yet there may be some compensation. The scientists claim that by looking for diamonds, we may come up with lots of natural gas. And if the earth can do it, there's no reason why scientists shouldn't discover a way to let you cook your peas with carats

BEHAVIDRISM ON THE ROCKS For the last few years some psychologists have been telling alcoholics that they could learn to drink socially. Grad student Mark Sobell and his undergraduate wife, Linda, had proved that, they thought, in a well-publicized study at California's Patton State Hospital. The Sobells set up a cocktail lounge in the hospital, then gave 20 drinkers behaviorist therapy—electric shocks if they gulped their highballs. This, the Sobells said, had taught all but one of their patients to drink in moderation.

Now comes the stiff chaser. Their work has been repudiated by their former boss and roundly attacked by several California researchers.

Contrary to the Sobells' claim, said the investigators checking their work, of the 19 original "cures," only 1 continued to drink moderately and 4 have died. In November, adding further fizz to the controversy, a prestigious committee reviewing the work dismissed most of the criticisms of the original study, supporting the "scientific integrity" of the Sobells. The only firm conclusion was that someone's headed for a hangover.

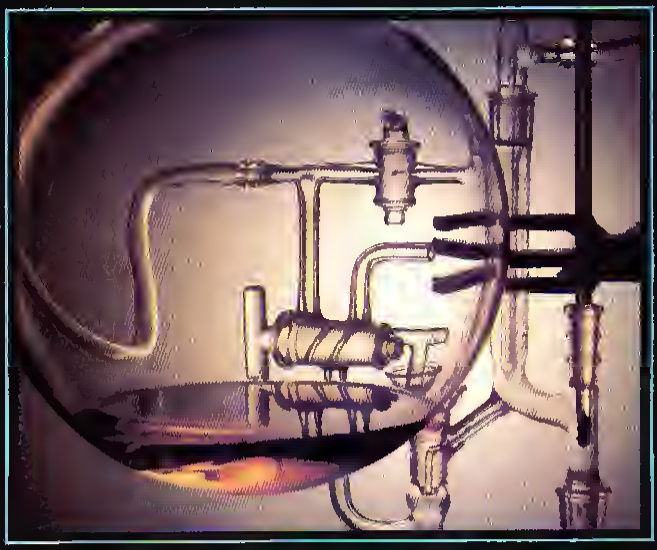
LAURELS (AND HARDYS)

THE INTOLERABLE STRAIN All mice are not created equal, a team of University of Wisconsin researchers concluded. And their finding has put the world's largest supply house for lab animals into the scientific doghouse.

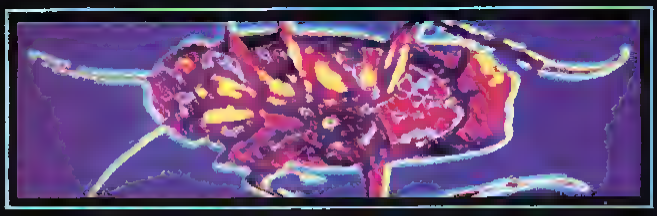
The mice in this case were supposed to be as genetically uniform as identical twins: elite members of a strain called BALB-c. These mice have been inbred since 1913 so that their genetic purity provides a clean background against which to measure research results. However, Brenda Kahan and Robert Auerbach, of the University of Wisconsin at Madison, discovered that some of the animals shipped from the Charles River Breeding Laboratories came with dirty genes. Tests indicated that they weren't the rodent thoroughbreds researchers had ordered.

As a result of the foul-up, some scientists complained they lost their entire experimental output for the year. The breeder pointed its finger back at the researchers, saying they never told Charles River its mice were bad.

In any event Charles River has destroyed entire colonies of the possibly tainted mice, admitting that its best-laid plans for genetic purity among mice had gone extraordinarily agley.

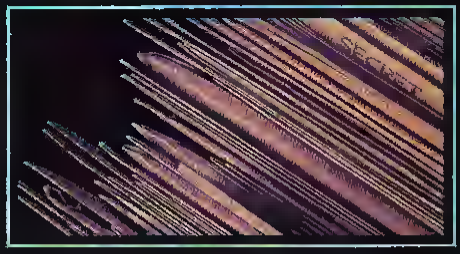


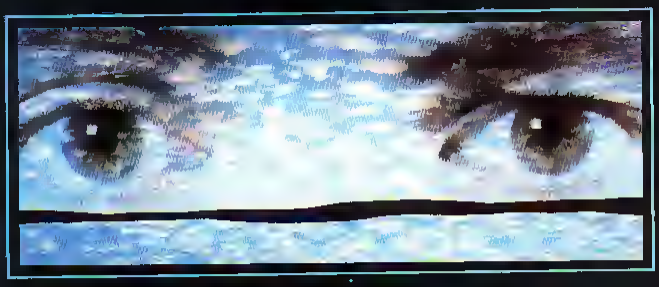
ROACH COACH Emory University biologists are living out a city dweller's dream by fastening little weights to the legs of cockroaches and forcing them to run to nowhere on treadmills. Not surprisingly for animals for which a grease spot is the height of good taste, cockroaches thrive under the routine. Their extensors and flexors are bulging. Perhaps this year the researchers will try teaching their scurrying little subjects the healthy benefits of avoiding midnight snacks.



WHY NOT DISAPPEARING INK? Only by supreme effort could the Russians top their already legendary achievements in creative repression, but last year they managed. At least 11 scientists considered less than absolute in their fealty to Big Brother Russia have had their academic degrees revoked by the state, according to the Committee of Concerned Scientists. Fifty-four more cases have been partially corroborated.

Scientists subjected to the disciplinary measure face pay cuts, demotion, and ostracism by colleagues; they may also lose their jobs and be barred from laboratories and scientific libraries. Reportedly, the Soviet government demanded the return of the scientists' diplomas. No doubt they have a paper shortage along with their shortages of wheat, corn, and appliances. Coming next, a scientist shortage?





SILVER LINUS Our Never-Say-Die Award goes to Linus Pauling for his defense of the alleged cancer cure laetrile. The apricot-pit extract scored a resounding failure in a racent clinical trial by the National Cancer Institute. Patients receiving it survived less than five months, on average—about what could have been expected with no treatment at all—and most showed substantial tumor growth. Yet in a letter to the *New England Journal of Medicine*, where the report on the laetrile study appeared, the two-time Nobel laureate wrote, "It is my opinion that there probably was a beneficial effect, including prolongation of survival."

YES, WE HAVE NO BANANA Jell-O Pudding Pops claim to be the dessert moms prefer. Heavan knows why. Here is what the vanilla and banana pops contain: skim milk, sugar, water, nonfat dry milk, hydrogenated coconut and palm kernel oils, corn syrup, modified tapioca starch, dextrin, sodium caseinate, salt, dextrose, sodium stearoyl lactylate, artificial flavor, polysorbate 60, microcrystalline cellulose, sorbitan monostearate, xanthan gum, carrageenan, cellulose gum, guar gum and artificial coloring.

Notice anything missing? How about banana or vanilla? In truth, the banana pops contain no banana, and the vanilla pops have no real vanilla. We called the putative Pudding Pops' manufacturer, General Foods, to ask them whatever became of the bananas or beans. But they were out to lunch.

FLUSH FLIGHT The space shuttle may have been an engineering and astronautical masterpiece during its first three missions, but, alas, it was a bathroom fiasco. The orbiting truck's crews had to contend with a high-tech $3-million commode that refused to work. It clogged and polluted the crew quarters.

We're happy to report that shuttle astronauts Henry W. Hartsfield and Thomas K. Mattingly last year became the first shuttle command team to be successfully potty-trained for space. "This may have been something we overlooked," explained a NASA spokesman. "It requires more than just pulling the handle." So the fourth-flight crew received extensive potty training from a task force of NASA engineers before their flight. Once in orbit, pupils Hartsfield and Mattingly followed directions and were very good during their trip on the nice rocket. NASA, we're sure, is flush with success.

A survey of jobs, new technology, and the world economy in the next millennium

During the next 50 years an incredible array of new technologies is expected to move from the lab to the world of business. We are already seeing evidence of this today. Robots are replacing humans on production lines. Microcomputers have become fixtures in offices. Biofactories are beginning to manufacture batches of engineered human insulin.

To find out where these changes are leading us, the editors of *Omni* surveyed economic trends, interviewed the country's top futurists, pored over the massive amount of data gathered by U.S. government agencies, such as the Department of Commerce, the Bureau of Labor Statistics, and NASA, and analyzed the projections of experts for a broad range of industries, from transportation to telecommunication. From these we have extrapolated an economic scenario for the future, one that shows that the coming decades promise to be especially volatile and exciting for American business. The expected upheaval will profoundly change not only our lives but also those of our children and grandchildren.

For the more developed nations, this era of turmoil will be marked by economic difficulties, problems with waste and pollution, and continually dwindling resources. By contrast, the underdeveloped Third World countries will spearhead a new industrial age with the

OUR FUTURE STOCK

BY THE EDITORS OF OMNI

PHOTOGRAPH BY PETER ANGELO SIMON

same fervor and energy that characterized American industrial expansion in the days of Vanderbilt, Carnegie, Morgan, and Rockefeller. These glimpses of our economic future are taken from *The Omni Future Almanac*, which was published last fall.

LIFE STYLE 2001

By the year 2001 most Americans will be enjoying a new prosperity. At first glance this may hardly seem possible, mostly because of our rising cost of living. Some examples: According to projections of U.S. government figures, a pound of hamburger in 2001 could sell for $10.50; a simple dress with a $60 price tag in 1980 might be sold for $275, and a three-bedroom house that cost $75,000 in 1980 could fetch $600,000 in a 2001 market.

But in real cost, measured by the percentage of the family income they absorb, food, clothing, and shelter are expected to be cheaper. Housing, which absorbed about 21.3 percent of the average family income in 1980, is expected to account for 19.1 percent of that same income in 2001. Food will take 19.6 percent of the family budget, as compared with 20.7 percent in 1980. Clothing expenses will continue to decline, too, from 7.5 percent three years ago to 7.3 percent at the beginning of the next century. The urge to purchase the latest fashions will chiefly account for such a slight decline.

Several industrial trends will help explain these diminished costs. Smaller, more energy-efficient homes designed for the smaller family of the future will help keep housing costs low. Agricultural innovations—for example, a broader use of aquaculture, genetically engineered crops, and harvesting by robot farmworkers—will account for relatively low prices for food. And for those who are immune to the latest fads, more durable and less expensive clothes, made of new synthetic fibers, will help keep a family's clothing budget low.

In general, we should be able to cope quite well in such an economic climate. Salaries are expected to keep pace with the cost of living, easing the press of inflation. For example, the secretarial job that paid $11,000 a year in 1980 is expected to command about $45,000 in 2001; a factory worker who had made about $25,000 in 1980 might expect to hold a similar job paying about $98,000; and the high school teacher whose salary is around $15,000 now will be paid $58,000. Of course, there will be others who will do better or worse, depending on how much foresight they show in the choice of their careers.

JOB MARKETS AND CAREERS

The technological revolution that will prevail for the remainder of this century will create jobs and professions that as little as five years ago were nonexistent. These newly developed markets will demand of workers an understanding of sophisticated technical information and communications systems as well as an increased technical expertise. By the year 2001 basic skills that once were vital to business will be rendered obsolete. The spot welder on the automobile production line, the clerk typist in an office, the field worker on a farm will go the way of the steamboat pilot and the blacksmith.

The most significant trend in years to come will be the shift from formation-type jobs (factory work, office typing, and general clerical work) to information-type jobs (programming, word processing, and supervising technical machinery). The American economy will witness the demise of the blue-collar worker as automation and robotics become more prevalent, heralding the rise of the steel-collar worker. Such traditional blue-collar employers as General Motors and U.S. Steel have already begun to automate their factories—a fact reflected in the swollen unemployment rolls in our industrial states.

> *"The underdeveloped Third World countries will spearhead a new industrial age with the same fervor and energy that characterized American industrial expansion in the days of Carnegie."*

By contrast, office and service jobs will be abundant, but only for those prepared to improve their technical skills. Again, it will be automation that will displace many of the low-skilled and semiskilled workers in the present economy.

In fact, the era of the paperless office has already begun. It has been promoted by two principal developments: computers that process business information and the explosive growth of telecommunication systems and products. This office revolution not only has changed how work is done and information is handled but has redefined the function of everyone who works in an office, from the corporate executive down to the lowliest clerk.

Computers in the paperless office can easily handle all employees' requests simultaneously. And features like executive tiering will ensure that requests from senior employees receive priority response. The future will bring still more possibilities.

• *Electronic mail.* A message is typed into a computer, which instantly sends the letter to its destination and files all requested copies. The recipient gets the message—either on his screen or through his printer—when he asks his computer for the "mail." At first only internal corporate messages will go electronic, but by 1990 high-speed computer advances will make office-to-office electronic mail cost-effective; consequently, the Postal Service will be forced to compete. First-class mail may be mostly electronic by 2001.

• *Data banking.* In 1981 the number of office documents produced in the United States alone amounted to 72 billion pieces, according to the Worldwatch Institute. In 1991 the volume will increase to 250 billion pieces. By then, more than 50 percent of all office documents will be stored in digital computer form in electronic information banks. By 2001 more than 93 percent of the expected 1 trillion pieces of business information will be in digital form. The storage of office information will therefore constitute one of the biggest businesses in the world. The systems devised to sort, store, and retrieve information dependably will stagger the mind. The average office manager will have instant access to more information than would exist in a thousand Libraries of Congress.

• *Teleconferencing.* Dismal experiences with the early picture phone will stand in stark contrast to the future growth of the teleconferencing industry for office functions. At first the teleconference may catch on as an inexpensive way to reduce the cost of face-to-face meetings of a corporation's far-flung executives. But the ability to make sophisticated corporate presentations via teleconferences, together with the ability to record the entire conference proceedings, will lead to an even wider use of the teleconference.

• *Machines to talk to.* Machines that comprehend human speech will make a variety of feats possible. One would be an automatic translator that could take any spoken language and make it automatically translatable into any other language of choice, turning the words into a printed document, a video-screen display, or an electronic message to be sent to another computer. Another possibility is the voice-activated typewriter, which will automatically type or display words as a speaker dictates them.

• *Electronic blackboards.* These would be specially designed digitizing surfaces that could be laminated onto just about everything: tables, conference-room walls or podiums. These surfaces will display anything rendered on them—drawings, charts, or text—for transmission to other blackboards.

• *Video discs.* The video disc, the record-album-size storage plate, has an incredible capacity. Each side can hold the equivalent of 54,000 pages of information, and new developments may raise that capacity by a power of ten. Therefore, an increasing number of businesses may elect to store their document reference materials, employee files, and other permanent

information files on compact video discs

For the job hunter of 2020, scanning classified ads will be a quick education in how drastically the workplace will have changed. He or she is likely to see openings for such positions as biological historians, biofarming experts, computer art curators, fiberoptics technicians, hybrid-airship pilots, laser operators, maser specialists, remote nursing technicians, robot retrainers, space geographers, space traffic controllers, and teleconferencing coordinators, to cite but a few.

In the entertainment industry one endangered profession will be that of the television programmer. Since the 1950s this has been one of the most powerful jobs in the United States. But even today cable television has already begun to erode the mass market, and it may eventually become the true mass medium. There will by the year 2001 be no need for a programmer to devise and develop shows for the lowest common denominator. Fiberoptics and satellite technology will furnish cable viewers dozens of channels to choose from. Broadcasting will become *narrowcasting*.

There will always be farms, but by the next century farmworkers as we know them will be scarcer. The business of farming will become ever more complex. With computerized operations and robot harvesters, there will be no need for unskilled labor. The farm will be a place for people with training as electronic technicians, bio-engineers, and computer programmers. Indeed, the human farmworker someday may be simply the person with the phone number of the nearest robot repairman.

GLOBAL GROWTH 2001

It is just a matter of time before the economic leadership of the world changes hands. Already the United States, the Soviet Union, Canada, Western Europe, and even Japan have to cope with the problems inherent in an economy easing into middle age. As a result, by the year 2001 the fastest growing economies will be found in the Third World. By then the following nations are expected to be world leaders.

• *South Korea.* With a projected annual GNP (gross national product) growth rate of 10.1 percent and a population of about 53 million, South Korea is expected to maintain its reputation as a haven for capitalists. The conservative government, supported financially and militarily by the United States, will ensure that workers will go about making steel, building ships, and assembling machines without the distractions of strikes and protests. The government will also push for a higher living standard to defuse any revolutionary stirrings.

• *The People's Republic of China.* China's awesome natural and human resources (estimated population by the year 2001: 1,095 billion) could make it an economic giant. China will have ample numbers of workers for its own needs and may even export laborers all over the world. Unlike the natural resources of other nations, which will be nearing depletion, those of this vast country will be virtually untouched in 2001, and China could become a world economic leader, with a 9.6 percent projected growth rate in its GNP.

It will indeed be ahead of the rest of the world in the crucial field of energy management, something other developed nations, including the United States, will find painful and disruptive.

• *Brazil.* With a population estimated at around 205 million by the start of the century and a projected growth rate in its GNP of 8.2 percent, Brazil will continue its aggressive exploration of its vast natural resources to fuel its booming economy. Every year developers will clear an area the size of Kansas in the Amazon jungle to maintain Brazil's position as the chief source of the world's lumber and paper. The newly deforested regions will be turned into pastures and land for crops. The world's largest reserve of iron ore—an estimated 18 billion tons—in the Serra dos Carajás region will supply the metal for local industry and export. Companies will be dipping into the immense reserves of diamonds, gold, bauxite, copper, tin, nickel, and scores of other minerals waiting to be mined.

Brazil will continue to encourage foreign investment in its industries, especially by giving foreign firms a helping hand in keeping labor unions and antipollution laws weak. Its automobile manufacturing industry, the ninth-largest in the world in 1981, will grow rapidly, so will steel making and other enterprises too dirty and costly for more developed nations.

• *Nigeria.* By the year 2001 oil will constitute the backbone of Nigeria's growth. Any dislocations in the Middle East will make Nigeria's oil all the more valuable and enable it to be the most stable and most affluent nation in black Africa. Nigeria will gain immensely from this oil bonanza, with a growth rate in its GNP estimated to reach 6.2 percent by 2001. The government is expected to use the oil money to expand industry for its estimated 154 million people, making its natural gas production and its petrochemical industry among the world's largest.

• *Mexico.* Despite its current troubled economy, Mexico is expected to prosper in the long run, with a growth rate in the GNP of nearly 5.8 percent annually by the end of this century. Its oil will continue to be vital to the United States, and its natural gas will help keep the homes of Europe heated in future winters. The rate of population growth should come under control in these two decades, although by 2001 the population of Mexico will probably be 126 million, providing a cheap labor pool for Mexico's burgeoning industry.

Mexican prosperity will be further buttressed by American support. In spite of ethnic and economic friction, the United States will realize that Mexico is one of our most useful and loyal allies. ∞

"I haven't evolved. I just shaved."

dry cleaning factory, where he worked. There was only a small amount of TCE in the factory air, yet that low-level exposure had caused the toxins to accumulate in the woman's breasts. The mother, in effect, served as a concentrating machine. She was never aware of the vapors she breathed, yet they nearly killed her daughter. The incident becomes more frightening when you realize that PCBs and DDT have been found in mother's milk as well.

You'd think the very freakishness of such incidents would encourage scientists to study young victims of pollution. But this is rarely the case. Love Canal is one of the most notorious environmental disasters, and yet the studies there were so tinged with politics that many scientists call much of the research a joke. Some studies found birth defects, others did not; all found miscarriages, yet neither the state nor the federal government plans to study the surviving children. Similarly, in lead-poisoned Kellogg, the Bunker Hill Company relocated families that had been most heavily exposed, yet because health officials kept no records of the departing children, those who sustained the most harm will probably never be studied. And back in Globe, Arizona, the physician who took X rays of 90 town residents has run out of state funds to continue his work on the medical effects of asbestos.

Critics say this apparent negligence has deep roots in politics. "Children don't vote," says Dr. Finberg, "and there's almost no government money to study the effects of pollution on kids." Dr. William McDonnell, a research physician with the Environmental Protection Agency, argues that children are more difficult to study than adults, since getting permission from parents is often impossible. Nationally known environmental consultant Barry Castleman takes the darkest view of all. He alleges that the federal government caters to industry by ignoring childhood perils because once a hazard is admitted, parents will probably sue the offending firm.

As a solution, Finberg suggests we monitor children, setting up a national sampling network to study a wide range of toxins the way the government does tests on children to look for lead. Finberg also urges more long-term study of the children of Love Canal, Kellogg, and other polluted areas throughout the nation. "For years we've exhorted the government to do this," he says. "So far we haven't even gotten back a letter for our trouble."

This silence bodes ill for a society that presumably values its young. It bodes worse for parents like Ed and Janice Dennis or Cathy Scott, who now watch with mounting anxiety as their children grow. "The young are paying for the mistakes of adults," Scott says. "What a thing we've done! We've poisoned our kids." ☐

CONTINUED FROM PAGE 58

derstanding System Like the Roman god Janus it has two faces —a dolphin side and a human side

A human/dolphin language must contend with the fact that dolphins communicate at frequencies ten times above the human range While our speech falls between three hundred and three thousand hertz or cycles per second dolphins talk to one another underwater at frequencies from three thousand to thirty thousand hertz If you go into a pool with a dolphin and he starts whistling you'll hear what sounds like very high-pitched squeaks So the problem is to bring their frequency down into our sound window and ours up into theirs

We're using a computer system to transmit sounds underwater to the dolphins A computer is electrical energy oscillating at particular frequencies which can vary and we use a transducer to convert the electrical waveforms into acoustical energy You *could* translate the waveforms into any kind of sound you like human speech dolphin-like clicks whatever

Omni Do you type something out on the computer keyboard and have it transmitted to the dolphins as sound in their frequency range? And do they communicate back to the computer?

Lilly Yes but we actually use two computers An Apple II transmits sounds to the dolphins via a transducer from a keyboard operated by humans Then there is another computer made by Digital Equipment Corporation that listens to the dolphins A hydrophone or underwater microphone picks up any sounds the dolphins make feeds them into a frequency analyzer a sonic spectrum analyzer and then into the computer So the computer has an ear and a voice and the dolphin has an ear and a voice The system also displays visual information to the dolphins

On the human side it's rather ponderous because we have to punch keys and see letters on a screen People have tried to make dolphins punch keys but I don't think dolphins should have to punch keys They don't have these little fingers that we have So we'd prefer to develop a sonic code as the basis of a dolphin computer language If a group of dolphins can work with a computer that feeds back to them what they just said—names of objects and so forth—and if we can be the intercessors between them and the computer I think we can eventually communicate [See Talking Computer for Dolphins Continuum August 1982]

Omni How long will it take to break through the interspecies communication barrier?

Lilly About five years I think it may take about a year for the dolphins to learn the code and then in about five years we'll have a human/dolphin dictionary However we need some very expensive equipment to deal with dolphins underwater sonar Since dolphins see with sound in three dimensions—in stereo—you have to make your words sfereophonic words

Omni You've said that dolphins also use sonar beams to look at the internal state of one another's body or that of a human being and that they can even gauge another's emotional state that way How does that work?

Lilly They have a very high-frequency sonar that they can use to inspect something and look at its internal structure Say you're immersed in water and a sound wave hits your body If there's any gas in your body it reflects back an incredible amount of sound To the dolphin it would appear as a bright spot in the acoustic picture

Omni Can we ever really tune in to the dolphin's stereophonic world view or is it perhaps too alien to ours?

Lilly I want to I just did a very primitive experiment —a Saturday afternoon-type experiment—at Marine World I was floating in an isolation tank and had an underwater loudspeaker close to my head and an air microphone just above me Both were connected through an amplifier to the dolphin tank so that they could hear me and I could hear them I started playing with sound—whistling and clicking and making other noises that dolphins like Suddenly I felt as if a lightning bolt had hit me on the head We have all this on tape and it's just incredible It was a dolphin whistle that went *sssssshhhhheeeeeooooo* in a falling frequency from about nine thousand to three thousand hertz in my hearing range It started at the top of my head expanding as the frequency dropped and showing me the inside of my skull and went right down through my body The dolphin gave me a three-dimensional feeling of the inside of my skull describing my body by a single sound!

I want to know what the dolphin experiences I want to go back and repeat the experiment in stereo instead of with a single loudspeaker Since I'm not equipped like a dolphin I've got to use an isolation tank electronics and all this nonsense to pretend I'm a dolphin

Omni Human language isn't merely descriptive it has also evolved abstractions—units symbolizing things that aren't physically real that have no material composition You've written that dolphins probably have ancient vocal histories that their young must learn Do you believe their language is a symbolic system?

Lilly Sure If it weren't they wouldn't exist They have to know different kinds of fish and coral the distinction between edible and inedible—that sort of thing I suggest you don a dolphin suit and join them

Omni You've pointed out that the bottlenosed dolphin's brain is forty percent larger than ours and the orca [killer whale] has a brain four times larger These big brained dolphins and whales also have a larger association cortex uncommitted to basic sensorimotor processing and therefore available for thinking If cetaceans are smarter than we why do we humans assume we're the crown of creation?

Lilly Because we can't talk to anyone else The highest intelligence on the planet probably exists in a sperm whale who has a ten-thousand-gram brain six times larger than ours I'm convinced that intelligence is a function of absolute brain size Some years ago I solved the brain weight/body weight problem demonstrating that a large brain cannot exist in a small body it needs a massive body to protect it A brain is very fragile and if it is rotated very fast—by a blow to the jaw for instance —it tears loose from its moorings and kills itself by intracranial bleeding So too as a brain gets larger the head surrounding it and its moment of inertia must increase to prevent dangerous rotation Maybe the human brain can evolve further if we get control of our genetic code But in what direction?

Omni What has your intense acquaintance with cetaceans taught you about their character? What is their world like?

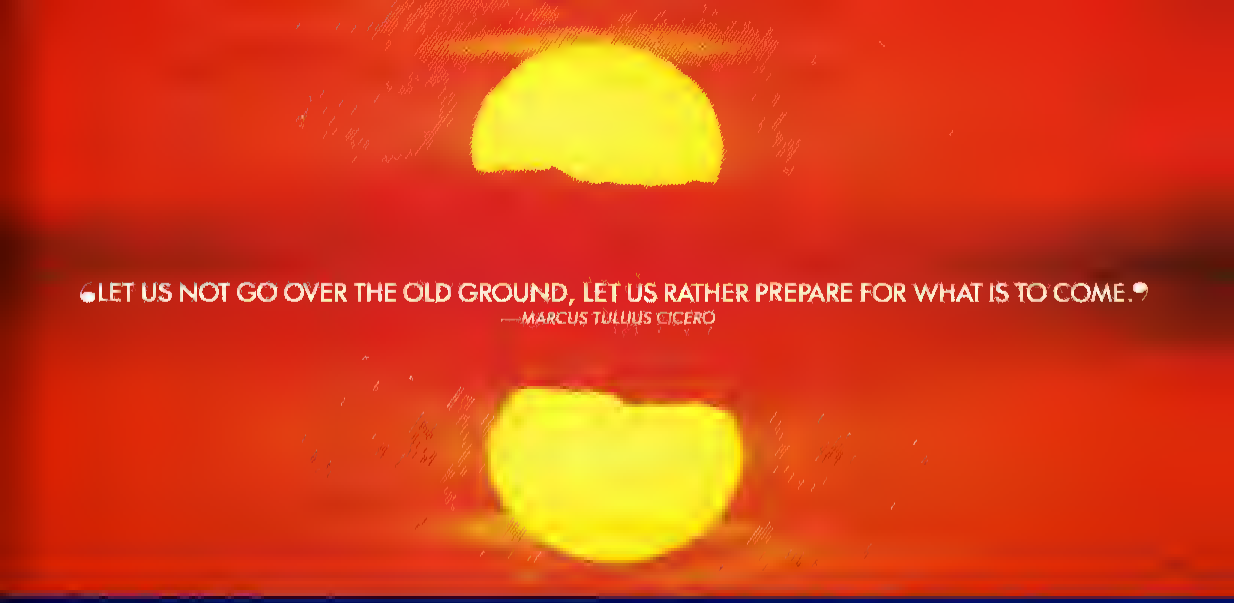
Lilly It's mostly sonic as I've said since they live in the water twenty-four hours a day and can't see at night They have no sense of smell but a very discriminating taste sense And of course they're buoyant as you are in an isolation tank One day while I was floating in the tank at NIMH I thought Gee wouldn't it be great to do this twenty four hours a day! When I mentioned it to a friend he said Well try the dolphins So that's how I started to work with dolphins

Having voluntary respiration dolphins are interdependent in ways in which we aren't they have a group mind If a dolphin passes out for any reason his friends must wake him up Otherwise he'll drown So every dolphin is aware of where every other dolphin is just in case he's needed "Do unto others as you would have them do unto you is one of their rules and unlike us they follow it twenty-four hours a day They're also more spiritual since they have more time to meditate Try the isolation tank and you'll see what it's like

Omni Tell me the circumstances that led you to invent the first isolation tank

Lilly There was a problem in neurophysi

"The hyperspace with which I've worked is one in which I can jump from one universe to another while maintaining human size, concepts, structure, and memories It's a domain I call Alternity"



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ology at the time. Is brain activity self-contained or not? One school of thought said the brain needed external stimulation or it would go to sleep—become unconscious—while the other school said 'No, there are automatic oscillators in the brain that keep it awake.' So I decided to try a sensory isolation experiment, building a tank to reduce external stimuli—auditory, visual, tactile, temperature—almost to nil. The tank is lightproof and soundproof. The water in the tank is kept at ninety-three to ninety-four degrees. So you can't tell where the water ends and your body begins, and it's neither hot nor cold. If the water were exactly body temperature, it couldn't absorb your body's heat loss, your body temperature would rise above one hundred six degrees, and you might die.

I discovered that the oscillator school of thought was right: that the brain does not go unconscious in the absence of sensory input. I'd sleep in the tank if I hadn't had any sleep for a couple of nights, but more interesting things happen if you're awake. You can have waking dreams, study your dreams, and with the help of LSD twenty-five or a chemical agent I call vitamin K, you can experience alternate realities. You're safe in the tank because you're not walking around and falling down, or mutating your perception of external reality.

Omni: At the time you invented the tank weren't you doing brain research at the National Institute of Mental Health?

Lilly: Yes. I invented a technique called an electrocorticograph, or ECG, for implanting multiple electrode arrays onto the surface of the brain itself without injuring brain tissue as much as previous methods did. It was the first method for taking electrical recordings from the brains of unanesthetized animals—or even of humans. On a kind of television monitor you could watch the brain waves moving across the cerebral cortex in two dimensions. Basically you pound a short length of hypodermic needle tubing through the scalp, adjusting it to the depth of the bone so that the scalp closes over it. Then you can come back and put electrodes down through that little channel.

Omni: Was this the same technique you used to map the brain's pain and pleasure systems with direct electrical stimulation?

Lilly: No, that requires putting electrodes *below* the cortex, into the brain's deep motivational systems. The electrodes were the same; we just pushed them in deeper. At McGill University, in Montreal, James Olds and Peter Milner had discovered the positive-reinforcing systems in rats' brains. [In these famous studies, conducted in the early Fifties, rats learned to self-stimulate by activating electrodes in their brains' pleasure centers.] And H. E. Rosvold of Yale University had uncovered the negative-reinforcing systems in cats. I was the man who mapped *both* sides, positive and negative, and I went to a higher animal, the macaque monkey.

When I did the experiments again in the dolphin, I found he could *inhibit* his angry, aggressive responses when I stimulated the negative systems. That was fascinating. With his large, eighteen-hundred-gram brain, he had enough cerebral cortex to veto messages from the lower centers. Men can do that, too, as scientists such as [Tulane University medical researcher] Robert Heath have shown. Once, when Heath was stimulating a patient's negative system, the patient said, 'You stimulate that point again and I'll pull the electrodes out.'

Omni: Then would you say intelligence is a function of inhibition?

Lilly: Yes. You need a cerebral cortex of a critical size, with fine fiber connections running in both directions to the lower systems. That's where the middle self ("I-me") *lives*, up in that cortex—not in the lower centers. The lower centers (our lower self) prod us from below, as it were, with love or hate or fear. I think that the superself controls from somewhere "above the brain," in the spiritual domains.

> *"The Eleventh Commandment says, 'Thou shalt not bore God.' The first step in not boring God is to set up two opposing intellects, male and female."*

Omni: What structures are involved in the brain's pain and pleasure pathways?

Lilly: Well, the preoptic nucleus in the anterior hypothalamus, at the base of the brain, is very negative. It's our main survival nucleus. If the temperature is too hot or too cold, this nucleus freaks out the rest of the brain. If there's too much sodium in the blood, it freaks out the brain. It's an area for total fear. Then, moving downward toward the spinal cord, you hit a part of the hypothalamus that stimulates extreme pain all over the body. If you move sideways in either direction in that area of the brain, however, stimulation becomes incredibly positive. Around the preoptic nucleus, you run into the sexual system, which in males controls erection, orgasm, and ejaculation—each in a separate place—while farther back, in the mesencephalon, the three are integrated and fired off in sequence.

The brain has other pleasure systems, too—systems that stimulate nonsexual pleasure all over the body and systems that set off emotional pleasure. That is a kind of continuous pleasure that doesn't peak—a *satori* of mind. *Satori* and *samadhi* [terms for enlightened-bliss states in Zen Buddhism and Hinduism, respectively] and the Christian "states of grace" seem to involve a constant influx of pleasure and no orgasmic climax—like tantric sex. Spiritual states use these brain systems in their service. Many philosophers, including Patanjali, the second century B.C. author of the Yoga Sutras, have said that *jnana yoga*—the yoga of the mind—is the highest form of yoga. In this self-transcendence one can experience bliss while performing God's work; only recently have I achieved this for days at a time.

Omni: In your book *The Scientist* you wrote: 'If we can each experience at least the lower levels of *satori*, there is hope that we won't blow up the planet or otherwise eliminate life as we know it.' Are altered states necessary to our survival?

Lilly: Yes, the experience of higher states of consciousness, or alternate realities—I don't like the term *altered states*—is the only way to escape our brains' destructive programming, fed to us as children by a disgruntled karmic history. Newborns are connected to the divine; war is the result of our programmed disconnection from divine sources.

I am writing a book about alternate realities called *From Here to Alternity: A Manual on Ways of Amusing God*. On vitamin K, I have experienced states in which I can contact the creators of the universe, as well as the *local* creative controllers—the Earth Coincidence Control Office, or ECCO. They're the guys who run the earth and who program us, though we're not aware of it. I asked them, 'What's your major program?' They answered: 'To make you guys evolve to the next levels, to teach you, to kick you in the pants when necessary.'

Because our consensus reality programs us in certain destructive directions, we must experience other realities in order to know we have choices. That's what I call Alternity. On K, I can look across the border into other realities. I can open my eyes in this reality and dimly see the alternate reality; then close my eyes, and the alternate reality picks up. On K, you can tune your infernal eyes. They are not what is called the 'third eye,' which is centrally located, but are stereo, like the merging of our two eyes' images. Perhaps someday, if we learn about the type of radiation coming through those eyes, we can simulate the experience with a hallucinatory movie camera—an alternate-reality camera.

Omni: What is so special about vitamin K?

Lilly: It's a lot more fun than LSD or any of the other agents, because it induces a short trip and you can train yourself to the state. Pretty soon you can take ten times as much and still walk around and talk to people coherently, in spite of the fact that reality is vibrating. I can run my computer, ski, or do just about anything on K. I've been on it as much as a hundred days straight. You don't really sleep; you don't really dream, because you don't need to. And on K, I can experience the quantum reality. I can see [eminent University of Texas physicist] John

Wheeler s hyperspace from within

Omni: Can you explain what you mean by experiencing hyperspace from within?

Lilly: Wheeler's hyperspace also is known as a "nonlocal reality." Each of a pair of photons coming from an atom knows immediately what the other is doing, no matter how far away from each other they are. You can assume the existence of tachyons—faster-than-light particles, carrying messages—but I prefer Bell's theorem's solution to the Einstein-Podolski-Rosen experiment [which illustrated a seemingly impossible connectedness between particles in two different places]. According to [John] Bell's theorem, hyperspace would be a region of hidden variables in which all realities are represented at a single point and in which there is no need for messages to travel. The "hyperspace" with which I've been working is one in which I can jump from one universe to another—from this reality to an alternate reality—while maintaining human structure, size, concepts and memories. My center of consciousness is here, and I can know immediately what's going on anywhere in the universe. It's a domain I now call Alternity, where all choices are possible.

Omni: What first inspired you to use psychotropic drugs?

Lilly: I never use the word *drug*, because it leads into a legalistic morass. The Food and Drug Administration has been putting out bulletins lately about K, which is now listed as a possible "abused" drug. Because *abuse* means literally "away from use," I prefer the term *hyperuse*, or "too much use." So I don't want to call it by its chemical name, and I think of it as vitamin K anyway, because it gives me spiritual energy. I've never proselytized, never advocated wholesale use of psychedelics. They are not for everyone. When Timothy Leary said, "Turn on, tune in, drop out," only a self-selecting group ever tried LSD. I did not agree with him; my use was carefully controlled investigation, not "recreational use."

There were a lot of "LSD pushers" around our LSD research at the NIMH when I was there in the Fifties, but I didn't take LSD then. After about ten years in the tank I decided there was something new to be learned. So I came out here to California, where a lady I knew who had access to pure Sandoz LSD, twenty-five gave me the LSD for my first two trips. On my first trip I went through all the usual stuff: seeing my face change in the mirror, tripping out to music. During the first two movements of Beethoven's Ninth Symphony, I was kneeling in heaven, worshiping God and His angels, just as I had in church when I was seven years old. On that trip I did everything I'd read in the psychedelic literature so as to save time and get out of the literature the next time. During my third trip in the isolation tank in St. Thomas in 1964, I left my body and went into infinite distances—dimensions that are inhuman.

Omni: The Ken Russell/Paddy Chayefsky film *Altered States* closely resembles your life. What did you think of it?

Lilly: I think they did a good job. The hallucination scenes are much better than anything ever produced before. I understand that some of the crew, the actors and the producers were trained on K. The tank scenes were fine—except that in reality there are no vertical tanks, only horizontal ones—and the film implied that use of the tank itself would cause those out-of-the-body trips, which it doesn't.

The scene in which the scientist becomes cosmic energy and his wife grabs him and brings him back to human form is straight out of my *Dyadic Cyclone* [1976]. Toni did that for me. As for the scientist's regression into an apelike being, the late Dr. Craig Enright, who started me on K while taking a trip with me here by the isolation tank, suddenly became a chimp, jumping up and down and hollering for twenty-five minutes. Watching him, I was frightened. I asked him later, "Where the hell were you?" He said, "I became a prehominid, and I was in a tree. A leopard was trying to get me. So I was trying to scare him away." I said, "If you do that again, I'll kick you in the ass." He laughed.

> *"Subjectivity is nonsense. The subject is an object is a subject. The only way to isolate subject and object is to cut off the feedback and destroy the system."*

Omni: Can substances like K take one to lower, as well as to higher, states? Could one get stuck in a lower state, and is that a possible explanation for psychosis?

Lilly: You can get into lower states—rock consciousness, solid-state consciousness, whatever. If people do get stuck there, we would never hear from them, would we? As for so-called psychosis, it's just an insistence on staying in altered states, in spite of everyone else. Psychotics hang around and play games with everyone around them; it can be rather cruel. Anyone who has worked with them knows there's a wise and healthy essence back there, and what you have to do is contact it. Of course everyone's different. Some schizophrenics feel pain, others pretend pain so that they'll be taken care of.

Omni: Did Chayefsky interview you for either the book or the screenplay version of the film *Altered States*?

Lilly: No. The manuscript of *The Scientist* was in the hands of Bantam, the publishers. The head of Bantam called and said, "Paddy Chayefsky would like to read your manuscript. Will you give him your permission?" I said, "Only if he calls me and asks permission." He didn't call. But he probably read the manuscript.

Omni: UCLA psychologist and drug authority Ronald Siegel maintains that the chemical you call K can simulate the near-death experience, proving that the near-death experience is hallucination rather than a foretaste of things on the "other side." What is your view?

Lilly: Ron and I totally disagree, though I like him. He is theorizing on the side of the law. With his belief system—that these experiences are all wastebasket stuff—he doesn't *know* alternate realities.

My experiences have convinced me that Eastern yoga philosophy is right: that there is a *purusha* or atman [soul] for each person—one for the planet, one for the galaxy and so on. As mathematician/philosopher Franklin Merrell-Wolff says in his book *The Philosophy of Consciousness Without an Object*, consciousness was first—before the void even. When consciousness got bored and turned in upon itself, becoming conscious of itself, creation began. He/she/it created time, space, energy, matter, male, female—the whole tableau. It all got so complicated that sneaky things may go on beyond its ken.

If you get into these spaces at all, you must *forget* about them when you come back. You must forget you're omnipotent and omniscient and take the game seriously so you'll engage in sex, have children, and participate in the whole human scenario. When you come back from a deep LSD trip or a K trip—or coma or psychosis—there's always this extraterrestrial feeling. You have to read the directions in the glove compartment so you can run the human vehicle once more. After I first took acid in the tank and traveled to distant dimensions, I cried when I came back and found myself trapped in a body. I didn't even know whose body it was at first. It was the sadness of reentry. I felt squashed.

Omni: Some of your critics have made much of the fact that intense experimentation with LSD and K has brought you to the brink of death at least three times. While giving yourself an antibiotic injection during your early days of LSD experimentation, you once used a hypodermic containing detergent foam residue, which sent you into a coma. Then, during a period of prolonged K use, you nearly drowned, and later you seriously injured yourself in a bicycle accident. Were these accidents quasi-suicides—collisions with your brain's "self-destruct programs"?

Lilly: The whole issue of suicide is a very complex program. I've never tried to commit suicide, though I've been close to death. The near-death accidents resulted from taking something and acting in a certain way so that I ended up in great danger, and so I've hypothesized that the brain

contains lethal programs—self-destruct programs—below the level of awareness which LSD or K can release or strengthen. My accidents were near-death learning experiences. There's nothing like them. They train you faster than anything I know.

The year leading up to my bicycle accident in 1974 I spent in *satori* or a state of grace. I was having a ball, mostly living in alternate realities and sometimes falling flat on my face. In *The Autobiography of Ramakrishna* [1836–1886, a famous Indian saint] there's a story about Ramakrishna getting ready to board a river steamer. Two of his disciples began to fight, and so Ramakrishna went into *samadhi*. Since he was out of his body, his disciples had to stop fighting and carry him aboard. Well, that was the sort of state I was in, and Toni was the disciple who had to "carry me around."

Omni: In your reflections in *The Dyadic Cyclone* you seem to consider your accident as a way of paying for that year of bliss.

Lilly: It terminated that year. In our workshops we have a saying: "If you pass the cosmic speed limit, the cosmic cops will bust you." I got busted. I had taken forty-two milligrams of PCP [angel dust]. I'd been out there too long and hadn't paid enough attention to my planetside trip, so the Earth Coincidence Control Office called me back by throwing a bike accident at me while I was on PCP. I appreciate what the Control Office did. They are not cruel; they're in a state of high indifference.

While my body was in the hospital and in a coma for five days and nights, I was in alternate universes where the guides instructed me about various planetary catastrophes. I can't make up my mind whether that was an experience of genuine realities or just a projection of the damage to my body. In any case, I begged the guides to let me go back. I had to say, "I want to go back to Toni." At one point I clung to Toni for six solid hours so I could stay with her. It was very frightening. The guides told me, "You can stay here, in which case your body dies, or you can go back." I chose to go back to Toni, as I have chosen to go back every time.

Omni: Toni has obviously been a crucial counterpoint to what you once described as the "stainless-steel computer" part of yourself. In your recent books you've stressed the importance of what you call the "male-female dyad." Will you please explain this idea?

Lilly: That's the way the universe is constructed. Do you know about the Eleventh Commandment? It says, "Thou shalt not bore God, or He will destroy your universe." The first step in not boring God is to set up two opposing intellects, male and female, so that neither can tell what the other is thinking. If you totally fused with your mate, it might be a very dull trip.

I love female intelligences. Every single cell in your body has two x chromosomes. Every cell in my body has one x chromosome and a crippled x chromosome, an x chromosome with an arm missing, called

a y chromosome. You women are so well balanced with your two x s. You can be grounded and do the gardening, and take care of the kids and give them nurture, but we males have got to go out and explore the universe, banging our heads together and shooting one another.

Omni: Was it really necessary for you to have the near-death experiences you've recounted?

Lilly: It was for me. It was necessary to frighten the hell out of me, but many other people are just born right and don't have to struggle as I did. I had a Catholic background, a traumatic childhood—the whole business.

Omni: What was it about a Catholic background that you had to "unlearn"?

Lilly: The whole construct. I'd been taught by Irish Jesuits, who are very clever. They made up multiple layers of rationality for the whole Catholic structure. The nice thing about Catholicism, however, is that it teaches you what to believe. So when you throw it over, you know exactly what you're throwing over. You can say, "I *don't* believe in the Father Almighty," and continue right through the Apostles' Creed, the Confiteor, and the rest of it, tossing out one tenet at a time.

I believe in God, but not in the "Catholic God," who is vengeful. There's the whole business about guilt, "impure thoughts," going to hell if you don't do what the church commands. One way this was solved for me intellectually if not emotionally was by reading the "Grand Inquisitor" chapter of Dostoevsky's *The Brothers Karamazov*, in which Christ comes back to Earth. The Grand Inquisitor tells him, "When we saw those miracles in the street, we knew you were back. But this time we're not giving you any publicity. We're keeping you in this cell. *We* know how to run these people now." That just knocked the church right out of me, and by the time I was finished with Caltech, medical school, and psychoanalysis, that belief system was pretty well cleaned out of me.

Omni: What about psychoanalysis as religion? Both use the confessional, an elaborate rational system for structuring the irrational, transference, and so on.

Lilly: Well, I didn't get into the religious aspects, as I was fortunate in having an analyst, Robert Waelder, who was tree of the dogma. He had been trained by Anna Freud in Vienna, had a Ph.D. in physics, and was an analyst's analyst. I took psychoanalytic training under him for eight years, and he would go anywhere with me. Right off, practically in our first session, I told him I wanted to get a divorce [from his first of three wives], but that I thought I couldn't if I was in analysis. "Where did you learn that?" he asked. I said, "In the Freudian literature." He said, "Dr. Lilly, we are not here to analyze Freud, psychoanalytic literature, or other people's rules for your behavior. We are here to analyze *you*."

"Sooner or later he'll learn that when he presses the bar, he'll receive a salary."

Omni: How is it that, trained for eight years in psychoanalysis, you decided to devote yourself to brain hardware instead?

Lilly: I'd already had enough neurophysiological training to know there were a lot of mysteries in the brain. As Waelder said, psychoanalytic theory accounts for about one tenth of one percent of what goes on in psychoanalysis. I had to go further than that to find something more satisfying, and I found it in the concept of metaprogramming the human biocomputer.

A human being is a biorobot with a biocomputer in it, the brain. But we are not that brain, and we are not that body. A soul essence inhabits us, and, under acid, under K, under anesthesia, you'll find that the essence isn't tied to brain activity at all. Brain activity can be virtually flat, and you can be conscious—off somewhere in another realm. You just can't communicate with people in consensus reality.

Omni: In your experience, does the brain possess "trapdoors" into the domain of the soul? For example, neuroscientist Arnold Mandell, of the University of California at San Diego, has said that chemicals such as LSD can be "pharmacologic bridges" to transcendence.

Lilly: I agree with Mandell. Acid—and better, vitamin K—set up the chemical configuration of your brain so as to loosen the connection between the brain/body and the soul essence. Then the essence can move into alternate realities. I call this phenomenon the "leaky-mind hypothesis" or the "escaping-self hypothesis." There are a lot of ideas about the soul's location in the body, of course. In Spanish, when you're scared out of your wits, you say your soul is in your mouth—you have *el alma en la boca*. But the junction between the biocomputer and the essence is *not* localized in the brain; it's throughout the body. If you get out of your body, you can assume a fake body, an astral body, which can walk through walls. Your essence is represented in every cell in your body.

Omni: Orthodox scientists accuse you of unscientific practices, and some even suggest that your consciousness-altering experiments and near-death accidents have impaired your judgment. How would you reply to them?

Lilly: Well, I'd just throw my credentials at them, and I'd ask them to sit down and read my papers. Only narrow-minded people criticize me anyway; the broadband people who can move easily across boundaries and disciplines love my work. Down in Mexico, for instance, people have been educated to respect the superscience of the next century that their *brujos* and *curanderos* [sorcerers or witches and healers] are capable of calling up. My son John Lilly Jr., who has lived for sixteen years among the Huichol Indians, has a wonderful movie about these matters. Our orthodoxy, on the other hand, is very Germanic, very European. If you can't see it, touch it, or taste it, it doesn't exist.

I was brought up to divide science into

theory and experiment each guiding the other. The pure experimentalists who attack me lack good theory, but the theorists haven't done the experiments. There are really three departments to science: experiment, theory and experience. Experience is the part that doesn't get into the scientific journals.

Omni: How would you answer the charge that your self-experimentation is subjective and, therefore, unverifiable?

Lilly: Subjectivity is nonsense. Neither subjectivity nor objectivity exists in nature. That's the mind-contained-in-the-brain belief of some psychiatrists and other scientists. The subject is an object, is a subject. In a cybernetic system you go around in a circle, and subject and object have no reality. The only way to isolate subject and object is to cut off the feedback and destroy the system. It's a false dichotomy.

Omni: Do you believe that neuroscientists are on the verge of explaining the mind by mapping brain chemicals and so forth?

Lilly: I haven't yet seen any breakthroughs that are worth talking about. Neurochemistry is interesting but not specific enough yet. I suspect we'll find there are a million different compounds operating in the nervous system—specific compounds for specific regions and specific neurons. Caltech neuroscientist and Nobel laureate Roger Sperry's regeneration experiments [in which he rotated a salamander's eye and the severed nerve fibers somehow reconstructed their original connections to the optic tectum in the brain, as if they "knew" where to go] show that there are chemotropic substances that are specific to each fiber. I don't read neuroscience journals anymore. I depend on my friends to tell me what's going on.

You know [Kurt] Godel's theory, translated, says that a computer of a given size can model only a smaller computer; it cannot model itself. If it modeled a computer of its own size and complexity, the model would fill it entirely and it couldn't do anything. So I don't think we can understand our own brains fully.

Omni: Is it an extension of Godel's theorem, which states that some propositions can be neither proved nor disproved within a logical system?

Lilly: It's the same thing. If you have a closed system, the closed system can't account for itself. A set of sets that contains itself is a set that cannot possibly replicate itself. We are biological computers, and what Godel said is that you cannot conceive in full a computer the size of your own, for it would take up all the space you live in.

A sperm whale, with a brain six times the size of ours, could model a human and do a pretty good job of it. Since the model would take up only one sixth of his software brain, he could use the remaining five sixths to manipulate the model, predict its actions and so on. The trouble is that this big computer is caught in a body that humans can kill.

Omni: Could you elaborate on your con

cept of programming and metaprogramming the biocomputer?

Lilly: Have you seen the movie *Tron*? You must because *Tron* is us. In it, the computer grabs the character played by Jeff Bridges and takes him inside, making him a program in the computer. The Master Control Program revolts, takes over the computer and defies the users. So the users send in Tron, which is a program to destroy the Master Control Program that is preaching disbelief in the users.

Tron shows you things that are very, very spiritual. You can think of yourself as a biocomputer or an intelligent terminal run by a cosmic computer in the Earth Coincidence Control Office. The biocomputer contains certain wired-in survival programs dealing with eating, reproduction and so on, which lower animals also possess. But when the biocomputer reaches a certain threshold of complexity, there are higher-level programs in the association cortex that permit such things as making models, learning to learn, choice and so forth. We have short-term choices, but God help you if you go against the Master Control Program. A terminal cannot understand itself because it lacks sufficient space, but a replica of itself is in the cosmic computer, which can understand it. At the highest level, your true self (the "user" in *Tron*) is a cosmic game player, with access to an infinite computer—the ECCO computer. That is metaprogramming, self-metaprogramming.

Omni: How does one contact God?

Lilly: In many cases, I didn't know whether I was taken on a trip by God or by one of His business officers in the outer galaxy. Guides at each level above ours pretend to be God as long as you believe them. When you finally get to know the guide, he says, "Well, God is really the next level up." God keeps retreating into infinity. I've thought that I was in the mind of God—seeing rotating universes, yin and yang, male and female—but perhaps God himself is beyond that. Have I told you about the Dust-bowl God?

Omni: No. What is the "Dust-bowl God"?

Lilly: In my new book I have a theory called the Dust-bowl God. God got bored with this universe and the distribution of intelligence in it. So He made a dust bowl out beyond the galaxies. In this dust cloud, every particle is intelligent—on the atomic level, each particle is as intelligent as a human being. The dust particles made themselves into stars and planets and animals and humans, and everybody knew everybody, everything was totally aware of everything around it.

Now the problem is: If every particle is equally intelligent, and greater assemblages are even more intelligent, what are the traffic rules for relations between, say, humans and elephants? It would be nice to see such a universe, wouldn't it—the Dust-bowl Universe?

Omni: How would it differ from ours?

Lilly: Right. How would it? OO

GAMES

(ANSWERS TO GAMES, PAGE 28)

HAPPY NEW YEAR

$1+234-56-7-89=83$

Here is one set of formulas to find the integers *3* through *25*, using *1 9 8* and *3*:

$3=-1+9-8+3$
$4=1\times9-8+3$
$5=1+9-8+3$
$6=[1+(9-8)]\times3$
$7=-1+\sqrt{9}+8-3$
$8=1\times\sqrt{9}+8-3$
$9=1+\sqrt{9}+8-3$
$10=-1+9+8-3!$
$11=1^9\times8+3$
$12=1^9+8+3$
$13=-1+9+8-3$
$14=1\times9+8-3$
$15=1+9+8-3$
$16=1-9+(8\times3)$
$17=19-8+3!$
$18=1+\sqrt{9}+8+3!$
$19=-1+9+8+3$
$20=1\times9+8+3$
$21=1+9+8+3$
$22=1+(\sqrt{9}\times8)-3$
$23=1\times9+8+3!$
$24=19+8-3$
$25=1^9+(8\times3)$

OMNI TO 1983. Mrs. Halici recalls that the letters of our logo already look like numbers turned sideways. Starting with the arrangement at the top, she moves the seven outlined matches to get the year (below).

WORDS. In each of these words, the last two letters are the zip code abbreviation of a state, and the letters before them spell a city or town in that state. There is a Jack, Alabama; an Ava, Illinois; and so forth. Ross Eckler, editor of *Word Ways* (Spring Valley Road, Morristown, NJ 07960), says these are the only common words he could find in a quick trip through the Zip Code directory. If logologists could create cities as needed, there would be more interesting postmarks such as OOMPAH PA, OLLA LA and AINTNO MO.

SENTENCES. Hellweg calls his three sentences "chronograms" (*Word Ways*, August 1982). The initial letters of the words (or initial sound in the case of words beginning "ex-") spell out the Roman numerals for the year of each sentence. Thus: (1) MCMLXIX 1969 the first lunar landing. (2) MCDXCII 1492 Columbus's landing in the New World, and (3) MDCCLXXVI 1776 the proclamation of the American Declaration of Independence. OO

SPACE

CONTINUED FROM PAGE 22

the theory that primordial life arrived on Earth from outer space

Alexander D Pavlista and *A R Templeton* Lawrenceville New Jersey Study the uptake of chemicals by plants in space to learn whether fertilizers and pesticides can be used successfully without gravity

James H Sloan an electrical engineer in Sunnyvale California Try to grow algae in an extremely humid atmosphere possibly reducing the amount of irrigating water that space stations must carry

Timothy L Stroup a graduate student in biology at the University of Cincinnati Study bone formation in the chick embryo for clues to the cause of calcium loss in astronauts flying long missions

Andrew Thomson Melbourne Australia Prepare sandwiches of expanded polystyrene and aluminum or steel to determine whether samples made in space are strong enough for orbital construction

Brian Tillotson a graduate student in electrical engineering in Seattle Washington Attempt to make a highly reflective aluminum film only a few atoms thick for possible use in a solar sail

John Trifero Mogadore Ohio Carry a cesium atomic clock in the Get Away Special to determine whether it loses the amount of time predicted by Einstein's theory of general relativity

Good luck to all!

And to those whose submissions did not make it through the preliminary judging: Please understand that many good ideas were ruled out for technical reasons that had nothing to do with their basic merit. Others duplicated the goal of an entry that displayed more elegance or possibility of success. If we have another GAS contest—we'd surely like to, though our plans are still far from firm—you should stand an excellent chance on the second try.

Sad to say, though, a few entries failed for reasons that might have been avoided. Most often they simply lacked the originality we wanted. The contest announcement made it clear that because ants were already going aloft, termites surely would not win. We didn't think to mention houseflies, fruit flies, honeybees, bumblebees, beetles, earthworms, mealworms, or flatworms. They were still ruled out.

Several ideas were interesting but could easily be carried out without the shuttle. One entry, for example, suggested taking Kirlian photographs of plant leaves, but it did not explain why that should be done in space. Another recommended building a nitinol powered electrical generator, a feat often attempted here on Earth.

Some of the experiments involved space but seemed to offer few practical benefits. Testing the effect of spaceflight on the flavor of wine and cheese, the tones of a flute and a violin, and the resilience of a baseball fell into this category.

At least one scheme failed for reasons of safety. This contestant suggested sending up a 50-gallon drum of nuclear waste for disposal by ejection toward the sun.

Others seemed too ambitious. The judges agreed that a personal reentry device for use by stranded astronauts would be highly desirable but doubted that it could be developed within the space available. Proposals to test an ion drive and a solar sail, both intended to propel interplanetary probes, succumbed to the same concern. And though we appreciated the logic of simply letting Dr Bussard use the *Omni* GAS package to build his interstellar ramjet, that too seemed considerably beyond the scope of the contest.

And occasionally entrants had workable ideas but conceded that they were not competent to carry out their project. One girl in her early teens proposed a test of fertility in zero-g, then closed her letter with a PS: "If I could make an egg-sperm culture just to see if it could exist, I would. But I don't know the first thing about it."

One nonwinner (whose interest in *Omni* we could not understand) recommended sending up 50 kilograms of plastic explosive with which to test the astronauts' ability to return to Earth under their own power. We ordinarily wouldn't reveal the names and addresses of losers, but if the FBI were interested in talking to this cretin, how could we refuse?

We'll make one other exception: an honorable mention, *P D Reid* of Welland, Ontario. We're sorry we're unable to publish the details of your intriguing proposal to test psychic spoon bending in space, but several of us are still laughing. **DO**

CREDITS

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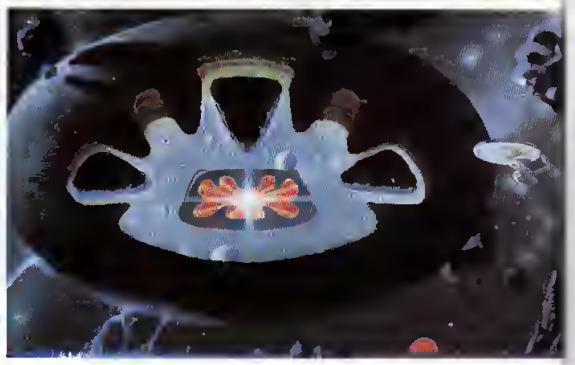
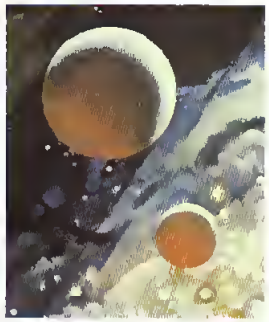




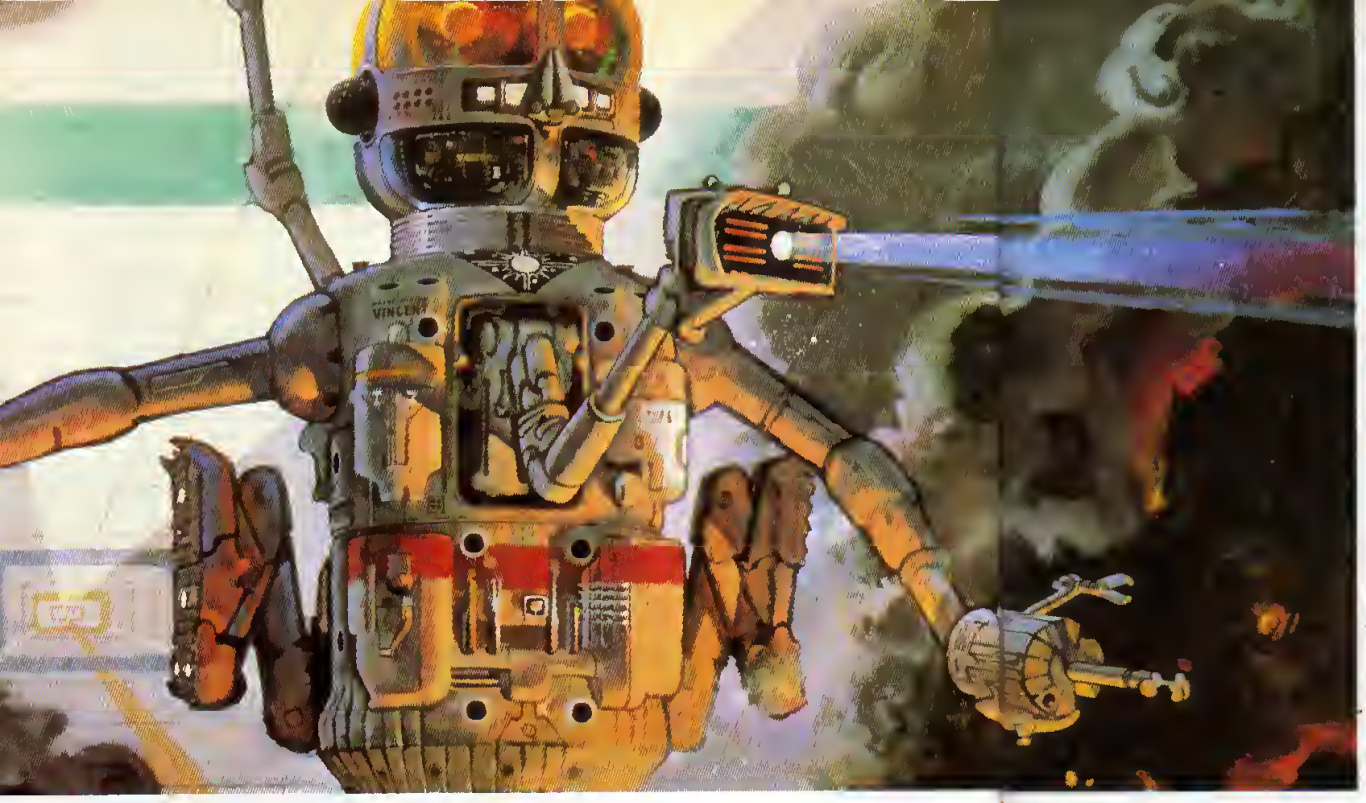
The spirit of adventure pervades Robert McCall's

SPACESCAPES

BY BEN BOVA

Robert McCall is an eyewitness to the future. Since childhood he has been fascinated with the technology and spirit of flight, and his paintings show this duality. Impeccably detailed technology is the central focus of his extensive portfolio; yet his work is set within a milieu of soaring, exhilarating, even mysterious spirituality that expresses his vision of a star-flung future for the human race.

In the book *Vision of the Future: The Art of Robert McCall*, by Ben Bova (Harry N. Abrams), McCall's paintings serve as a tapestry of tomorrow's history, starting with the earliest spaceflights and extend-

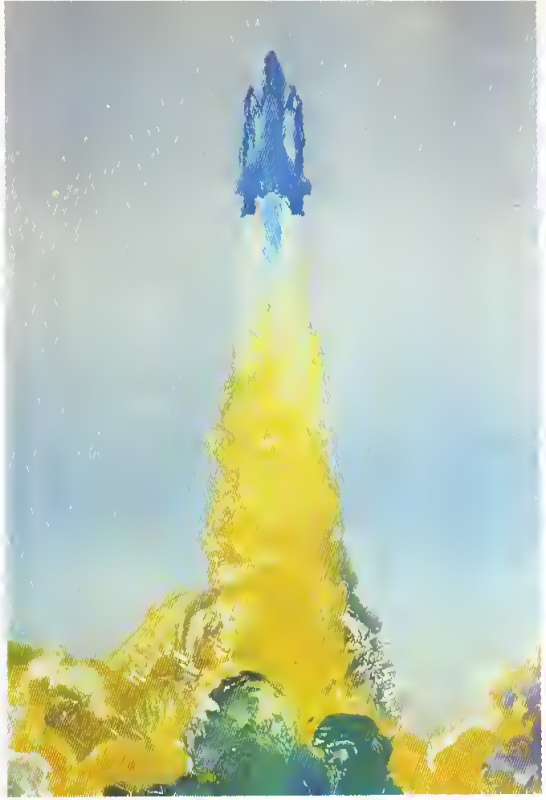


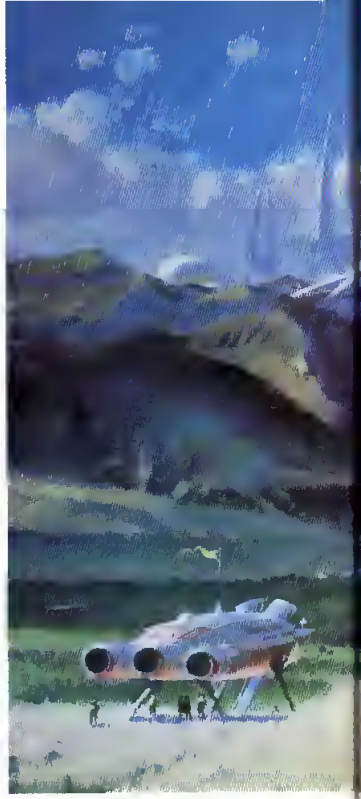
ing far out into space and time, depicting strange new worlds, robots and spacecraft, an Earth transformed by futuristic technology.

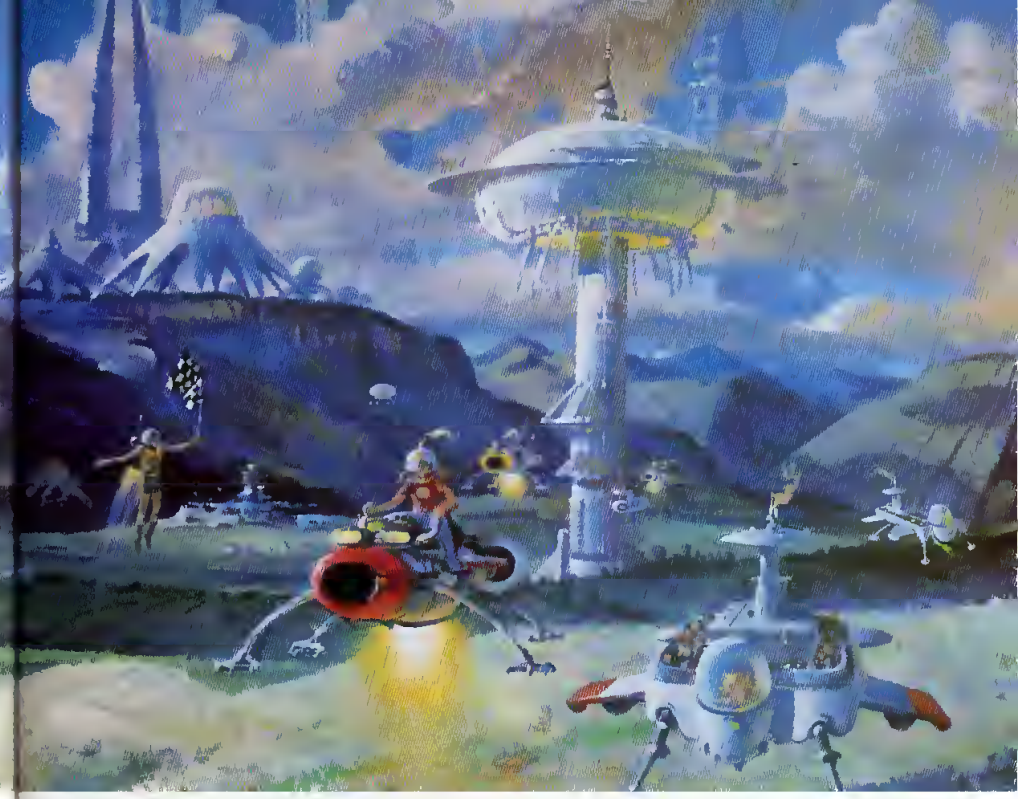
McCall's great interest in the future began with some paintings he did for *Life* magazine in the early 1960s, portraying a panoply of advanced spacecraft. Since then he has covered virtually every space launch, accompanying the astronauts as they suited up and riding the gantry elevator to their waiting space vehicle. Stanley Kubrick asked him to paint the advertising art for his film *2001: A Space Odyssey*, and McCall has painted vast murals for the National Air and Space Museum in Washington, D.C., and for several NASA centers.

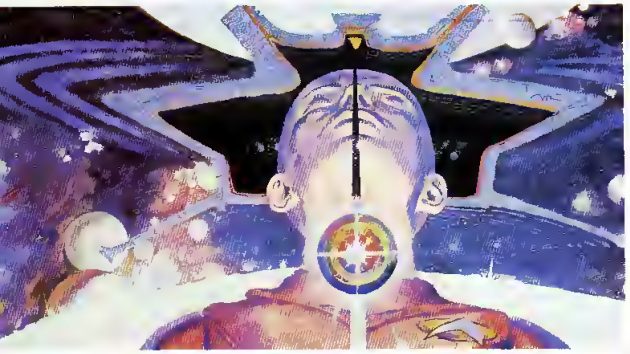
But McCall paints more than the spacecraft and gadgetry of tomorrow, more than alien vistas of time to come. His work spans the

"McCall's paintings express his vision of a star-flung future for the human race."









entire range of human experience in futuristic settings where our technology is used to create a life of abundance and adventure

"It's fun dreaming up strange, out-of-this world vehicles and environments," he says. "Through it all is woven a feeling of wonder and excitement about the universe, an overwhelming conviction that we're not alone, that the universe is teeming with life, and that someday we will make contact with beings from other planets."

The uniqueness of Robert McCall's vision of the future is that what he sees with his inner eye, he puts onto canvas in paintings that have all the sweep and power of an inventive imagination, yet the detail and discipline to convince us that these futuristic space scenes can be constructed by human hands. ∞

"It's fun dreaming up strange, out-of-this-world vehicles and alien landscapes."

Intelligent aliens will stand upright, building their world with two arms and two grasping hands

ANTI MATTER

UFO UPDATE

When Christopher Columbus first set foot in the New World he was astounded at the sight of Indians. The great thinkers of his time after all had predicted a place peopled by monstrous creatures in no way human.

Modern scientists are now making similar predictions about worlds yet to be discovered in the vastness of space. The probability of encountering beings that are physically similar to us, Carl Sagan and others suggest, is near zero. Evolution, they contend, is a random process that must create radically different creatures from one planet to the next.

As a biologist studying the evolution and development of shape, I've reached the opposite conclusion. I am convinced that evolution follows stringent rules that would operate the same way on any planet in the cosmos. If that's true, we may be in for the same surprise as Columbus. Once again, somewhere in space, we may come face to face with ourselves.

My argument begins with simple biochemistry. For life to exist, chemical reactions must occur rapidly, and that's impossible without a liquid solvent such as water. But if water is to keep its liquid form, it must remain at once too cool to vaporize, yet too warm to freeze. That's a tall order, and the only thing that can fill it is an earthlike planet.

Most experts agree that the evolution of earthly intelligence is rooted in the primate's upright posture, which freed the hands for grasping and holding. Versatile hands allowed protohumans to use tools and fire, thereby stimulating the brain that in turn led to more advanced technology which further increased intelligence and so on, until *Homo sapiens* evolved.

As far as I'm concerned, technology is essential to the development of intelligence, no matter what the planet. But if you're discussing an earthlike world, then technology can be developed only by creatures just about the size and shape of human beings.

To sustain a fire, for instance, one must feed it fuel. This requires humanoid arms and legs to fetch the logs. It also means human size and strength to support the wood as it is toted from one spot to another. (A small creature on a world with earthlike gravity couldn't carry logs large enough to keep the fire burning. An extremely large individual might lose its balance, succumbing to the force of a single fall.) And because brainy, bipedal extraterrestrials would actively pursue their food, their nose, ears and mouth would be concentrated together at a leading end, allowing them to see, smell, breathe and eat at once. The combination would form a recognizable face.

When we finally meet the extraterrestrials, the biggest problem will *not* be trying to figure out whether our strange friends are intelligent. Instead, the hitch might be convincing folks back home that the guests we have brought along with us really are aliens and not Leonard Nimoy or Christopher Reeve. *TRENT D. STEPHENS*

Trent D. Stephens is a biology professor at Idaho State University.

SMALL PEOPLE

Worried about the population explosion? Calm down. The burgeoning birthrate will cease to be a problem once we've bred a race of humans half normal size. That, at least, is the prediction of Thomas Easton, a theoretical biologist and technical writing teacher at the University of Maine.

"Cut people down to about three feet in height

and they won't eat as much food," Easton says. "Cars could then be the size of little red wagons, with all the old gas guzzlers converted to buses. In fact man's appetite for open space and raw materials would decrease to match his stature.

"This new breed of human," Easton says, "would have far more muscle, with the ability to run and jump almost like a cat. Reduced weight would ease the wear on joints, cutting the prevalence of arthritis. Since less blood would be pumped through a smaller circulatory system, the heart's work load would be diminished and there would be fewer cardiac arrests.

"The technology to shrink humans," Easton says, "will probably be available within a decade. A genetically engineered virus carrying genes coded to create small people, could be placed in a reservoir or released in the air. Then everyone infected would absorb the genes and produce lilliputian offspring."

But economist Anthony Wiener says Easton's forecast is ridiculous. "In the real world," he contends, "you deal with the population problem by reducing the birthrate. I expect countries with crowding problems to legislate mandatory sterilization by the year 2000."—Eric Mishara

All is riddle, and the key to the riddle is another riddle.
—*Ralph Waldo Emerson*

ELIXIR OF LIFE

Nature magazine, the most respected science journal in England, billed it as a breakthrough in anti-aging research. A tiny protein named longevin, the publication reported, had been isolated in carp by a Professor Obispo of the Stoyte Institute of Life Sciences at Tarzana College in California. Longevin appeared to be responsible for the remarkable longevity of carp, which reputedly live to a ripe old age of 150, *Nature* said. Moreover, the tiny protein significantly prolonged the life span of mice as well. Similar treatment of humans, the writer implied in his article titled "The Elixir of Life," could be just years away.

The difficulty arose when *Nature* readers attempted to track down both Professor Obispo and the science journals that had supposedly published the preliminary findings of his research. It was discovered, in fact, that neither Obispo nor the cited journals were listed in the Science Citation Index, the reference work that lists almost all scientific articles.

When reached at his London office, John Maddox, the editor of *Nature*, promptly confessed that the article on longevin had been an April Fool's Day joke. (Sorry, Mr. Reagan.) "It was very unusual for April first to fall on a Thursday, our weekly issue date," Maddox confided. "And it was too good an opportunity to pass up. It takes very little in the way of general knowledge to see it was a joke. Since then we have received half a dozen articles in the same vein, obviously sent by scientists who accepted the joke in the spirit it was written in."

When advised that the longevin article was now logged in the scientific database and would be cited as a reference by other scientists, Maddox said, "I doubt it."

He'd better tell that to the researchers who put their faith in Scisearch and a variety of other computer banks now broadcasting news of longevin throughout the world.—Robert Patton

MAGIC MOUTHPIECE

If the muscles in your arms are turning to onion somme, the problem may be your mouth. So says Dr. Richard Kaufman, an Oceanside, New York, orthodontist who designs mouthpieces for Olympic and professional athletes. Kaufman and a few peers believe that by correcting the

alignment of the upper and lower jaw the mouthguard (dubbed MORA or mandibular orthopedic repositioning appliance) can also boost an athlete s strength and energy

This claim has provoked guffaws among other orthodontists but Kaufman says he s found some new proof A special Kirlian camera capable of photographing the body s electromagnetic aura he contends, has shown that MORAs actually do increase vitality

In a recent study conducted in the kitchen of Pip Merrick program director of the International Kirlian Society Kaufman ran subjects through an arm-strength test while Pip sat at the camera s controls First with the MORA then without it each subject held an arm out at his or her side while Kaufman tried his best to push the arm downward Meanwhile Pip placed the fingers of the subject s other arm atop photosensitive paper Turning the kitchen lights out she then pushed a button and ignited a flat metal electrode beneath the paper By exposing the paper to intense light the electrode produced a photo of the aura around the fingers

As far as Kaufman is concerned the test proved that subjects wearing a mouthpiece were stronger and healthier The reason Their auras (above at left) were fuller than the auras (above right) of those without the mouthguard Pip however feels he s jumping the gun True the subjects fended off Kaufman s downward thrust better when their jaws were properly aligned but since they knew the aim of the experiment perhaps they were only making him happy And Pip says even dedicated Kirlians would be hesitant to call a fuller aura a sign of physical health or strength —Mark Teich

Intelligence is only an accidental concomitant of life and perhaps not even a very useful one

—Isaac Asimov

LOUD UFO

On the night of June 22 1972 Javier Bosque a seminary student in Logrono Spain sat in bed reading It was nearly 2 A M and the local radio station had gone off the air Suddenly Bosque claimed the windows swung open and a silver oval two feet in diameter floated in flooding the room with light Then the radio let out a bleating

cry Bosque fumbled for the cassette recorder stowed near his bed and quickly flicked it on

It didn t take long for news of the resulting tape one of only ten in UFO recording history to reach Willy Smith a retired nuclear physicist living in Norcross Georgia The eight-minute recording so fascinated him In fact that he analyzed it on his oscilloscope By transforming the noise into visual images on a screen Smith says the oscilloscope [illegible]ing perfectly [illegible]und waves [illegible]ac jumped from [illegible] pitch or frequenc [illegible] cycles per second to a screech of 4 000 cycles per second

The skeptics Smith says were dumbfounded They obviously realized that only the most sophisticated and expensive equipment could produce a sound like that It s not the sort of thing a seminary student in rural Spain would even attempt to fake

But acoustic engineer Howard Schecter who recently analyzed the tape for the Center for UFO Studies in Evanston Illinois says That s baloney! could produce the same sound right now with simple electronic equipment Besides he notes analyzing such extreme fluctuations on an oscilloscope is like looking at DNA with a magnifying glass

The only test that could provide real evidence Schecter adds requires a computer and thousands of dollars—money that ufologists just don t have

Where does Javier Bosque fit into all this? He was last seen in a little village in the Spanish mountains When questioned about the noisy UFO he made clear he had loftier concerns Leave me alone ' he insisted I m a priest

Kathrine Jason

I think that flying saucery and astrology prove one thing There s one born every minute!

Patrick Moore

BUENA FOOT

In Los Angeles they sing of Buena Foo a giant, malodorous reature that haunts the city with menacing howls O at least he howled menacingly one night in mid-May when people saw him in a Buena Park flood-control canal

Over the next several days researchers from Specia Forces Investigations dedicated t• the study of the paranormal the monstrous an• the traiteres trial combed the area with di g ods and ventured 25 feet nside a concrete storm drain in hopes of finding the critter Alt they discovered how-

ever were several four fingered handpr nts which they promptly copied n plaster casts for ongoing examination They opined that the prints were made by a heavy huge-thumbed creature larger and stronger than a man The evidence fanned excitement and brought throngs of onlookers to the area But it seems that Buena Foot himself was frightened off for no one has been able t• find a trace of him since

The police who oined the search grudgingly were satisfied that the monster was really a hairy vagrant who slept in the park and howled for reasons of his own They released a photo o the man who they said, matched Buena Foot s description on at least seven points But Dennis Ruminer of Special Forces declared the tramp was too short (only five feet eight inches tall) to be Buena Foot and he said that he and his team would continue their intensive search in Orange County s•uth o Los Angeles

Meanwhile another bel lowing vagrant was observed by independent investigator John De Herrera. This one was reported to be in his mid-thirties and just about six feet four

Dava Sobel

'I am skeptical about skepticism One could write an interesting article debunking debunking As with belief, so much depends on the way the mind faces

Martyn Skinner

LOVE POTION

Singles bars and bo ing computer dates got you down? Barbara MacKay a unemployed secretary turned stand up c mic felt that way so she bought a candle-and incense ritual ki fro the Mysti Eye occult shop on Broadway San Francisco

MacKay ast her first love spell at home She took a bath dried off n the air without any towel then anointed herself with evi - smelling oi inally she burned some pink passi

ncense while chanting her wish for a man

The result she says was hard to interpret I met a lot of men alm•st immediately But I had gone on a trip with Club Med So can t be sure how much the magic helped

After a subsequent dry spell though she decided to try the r ual again The outcome One cable car

ontrontation with a geriatric one cocktail with her down stairs neighbor and three months of going-nowhere dates with a man she met at a local disco Better than she d been doing but not much to show for an ncan tation meant o bring true ro an ove

It was very painful for me she notes but t an blame the o It brought men but finding the ight e an naki g the relationship work was p to me

MacKay s o cult experience nevertheless was hardly a loss After four rear-end collisions with her little Toyota she bought some magic herbs for the floor boards and hasn had an accident since

Owen Davies

How many of our daydreams would darken into ightmares if there seemed any danger of their coming true!

—Logan Pearsall Smith

MEDEA

CONTINUED FROM PAGE 54

more visible from an overlook perched three hundred feet up a rocky hill where an observation post had been set up. There were sensors in the foxes' village. Observation was both direct and through computer replay and it covered them as thoroughly as the eye of God, Irina thought. All of Ch'ien Li's work was in the computer, Pick taught Irina the codes they used. *Twenty-two years of work,* she thought with dismay.

"The camp is protected by an electric fence," Pick told her the first day, guiding her around it, showing her how to deactivate it with the touch of a button.

"We kill nothing here," he said. "The charge in the guns is for stun only. The fence is on stun. We want to stop them, not harm them. Can you fly?"

He taught her to manage the aircars and then went on to teach her the basics of the equipment in the maintenance room.

He was always patient, never condescending, but she felt her arrival was an irritant to him. As soon as he was satisfied that she could manage the aircar competently, that she knew what to look for if any of the machinery malfunctioned, he resumed his own pursuits. Day after day he left in one of the smell cars and did not return for many hours. He was making maps, he said. He was searching for evidence of older civilizations, poking around to see what there was to see.

After instructing her to review the work, Ch'ien Li had paid no attention to Irina.

The days passed slowly, and gradually Irina began to realize that this was what Jolly had meant. Ch'ien Li would drive her away by ignoring her, by letting boredom eat into her bones until she could stand no more. Irina went to the group room and sat before the terminal to wait for Ch'ien Li to appear. While she waited, she played through a tape of one of the foxes Ch'ien Li had tagged years ago.

The creature was immature, the size of a half-grown cat. It had eight legs and moved so fast that, played back in real time, its movements were blurred past comprehension. She played it back slower and slower until each motion was visible. It was catching insects and small crustaceans, using its forepaws as dexterously as any human surgeon used her hands.

For a time Irina played back bits of the fox at random, but then she started over and let the computer show her the bits that Ch'ien Li had tagged as significant. The fox, nearly grown, weaving a basket quickly and surely, with little wasted motion. The same fox digging in the ground, dropping seeds, cultivating a row of orange plants. Then fighting savagely with a winged creature twice its size. Being cared for by the other foxes with only four legs.

"At first we thought there were three species," closely related, of course," Ch'ien Li's voice said, close to Irina's ear. Irina had no idea how long the woman had been standing behind her. "But then we realized that each metamorphoses into the next phase."

Irina stood up stiffly, ready to confront Ch'ien Li with the injustice of her treatment, but the older woman motioned her to a long table preceded her to it, and sat down. Ch'ien Li touched the food panel, and two cups of steaming tea were deposited before them.

"They are born female," she started with no preamble, as if unaware of Irina's impatience. "At maturity they mate, and a pair of legs is detached when conception takes place. Within the placental pouch there are usually twins who grow and feed inside it until they are large enough to be quite independent. During this incubation the female maintains a guard over them in a nursery with other incubating young, assisted by other mothers. The mother is freed from constant surveillance, and she is very active in community affairs, making tools, farming, hunting, sharing time with other young females in the nursery. When they emerge, the young are protected by the entire community, but they are also independent for about a year, when schooling begins. They are taught hunting, the various village skills, and so on. When the female mates a second time, the next pair of legs is detached, and the process is identical, except that now the female becomes an immature male; her genitals drop off with the second brood, exposing male organs. This is a very busy time for the young males. They have much to learn. They must practice walking and running in an upright position now, and they must learn to glide all over again, as the distribution of weight has changed drastically. They become the most adept at soaring, gliding, at times apparently achieving true flight. They are very aggressive at this stage of development. They roam in groups and ravage other communities or engage in full-scale battles. They learn to use more advanced weapons, spears and even bows and arrows. And then the next stage occurs, and they become mating machines, those who survive the fledgling period. Most do not survive. And then," Ch'ien Li's voice became lower, and she sipped her tea thoughtfully. "And then they change again. Only a few out of each hundred survive to reach this phase. They are neither male nor female, but have achieved true integration of the two selves. They have experienced every phase their species goes through. They are the community judges, teachers, doctors, priests. All this in less than fifteen years," she said. "None has lived beyond fifteen years."

"The men turned into foxes, and they dipped their tails into the water and then began chewing them off, consuming themselves until only the heads and necks remained."

She stopped. Irina remembered her tea and lifted the cup to her lips. *Something is not right,* she found herself thinking. "They are too small," she said finally. "The brain pan is too small. They are too short-lived. How could they have achieved intelligence in a lifetime so short, with so little brain? It doesn't make sense."

Ch'ien Li shrugged, her face as black as a painted surface. "They could not have done it," she said. "However, if they are not intelligent, then they have the most advanced instinctual social behavior of any group ever observed. Either way, we must rewrite many books. *I* must rewrite many books," she amended.

Irina studied her. How old was she? Over a hundred, too old ever to return to Earth, too old probably to finish her work here, and yet daily that frail woman climbed the rocky hillside to the observation post high over the foxes. She knew Ch'ien Li worked around the clock with three- or four-hour pauses for sleep. What was driving her? What held together those frail bones, kept the blood flowing, kept her brain functioning? This one little puzzle about the foxes? Irina could not believe it was that simple, that easily answered.

"What are my duties?" she asked Ch'ien Li. "I have been tutored by Pick for weeks now. Surely I am not to serve here as a backup maintenance person and reviewer of your work."

Ch'ien Li smiled gently at her. "Review as much as you can first," she said. "It is all there. We have tagged one hundred fifteen foxes to date. Six remain alive. Five of them are still in the main community many miles from here. One is here with this group that two years ago began a journey that is not yet over. We don't know why or where they are going. We will follow until we do know. But until they move again, there is very little to do except watch, review, meditate." She stood up. "I am available in my room if you require me. It is always the waiting that is the hardest part of any expedition, my child. The waiting is what drives many people back to civilization. We shall see. We shall see."

After Ch'ien Li had withdrawn to her room again, Irina continued to sit at the table. She swished her tea, drank it down, and stared into the cup. There were no tea leaves, but she pretended anyway.

"I see you in a long green dress, meeting tall dark men, and short blond men, and fat bald men. I see you watching a furry animal fucking away."

At least, she thought, shoving the cup

into the receptacle that whisked it away she had discovered the answer to the puzzle of the creatures' names.

She drummed her fingers on the table and then went searching for Pick. She finally found him working in the maintenance/hangar room. He didn't look up.

"What are you making?"

"A still."

Fascinated, Irina moved closer. There was a large sealed pot and many coils of tubing not yet joined to it. "What are you going to distill?"

He chuckled. "There's always something."

"Ch'ien Li says you go to Medea Town every two months or so for supplies. Are you going soon? It's been nearly two months now."

"You got any shopping to do, make a list." He bent a pipe, measured it, bent it some more.

"You could bring enough supplies for a year at a time if you wanted to." She bit her lip when he turned his back on her. Then she said, "If you make your own liquor—"

"Brandy."

"Brandy. You won't need to go to town to get drunk. You go for a woman, don't you?"

Pick took up another section of the tubing, working it with his hands. He did not look at her. "Are you getting horny?"

"Yes. And I don't want to have to go to that ghastly hotel."

He whooped with laughter, and Irina found herself laughing, too. It had been so simple after all.

Pick put off his trip to town until they were actually running low on food, and then he stayed only three days, and when he returned, he announced that he had brought enough back to last a year. He winked at Irina. Ch'ien Li nodded gravely.

One day Irina joined Ch'ien Li in a shallow cave near the observation perch, here there was yet another computer terminal, some air cushions, and nothing else. Ch'ien Li sat on a cushion, watching the foxes below. She was like a bat, Irina thought, clinging to a dark spot.

"They aren't mating," Irina said. "I have reviewed them since they left the city, and they have not mated at all during this journey. Why?"

"We do not know," Ch'ien Li murmured. "And the young males don't make forays, they aren't fighting among themselves anymore."

Ch'ien Li nodded.

"Kuwait is having success in making contact with them," Irina said after a long silence. "They have language. That chanting we hear day after day, the clicks and growls, it is language, not random."

"So it seems."

Irina drew in a deep breath. Below, the foxes were assembled in several concentric rings, hunched down on the ground, motionless. The neuter was inside a shelter made of smooth poles, covered with

skins. There was no motion below, no sound now, although at any moment they might begin to move again. If it was a dance, it made no sense to Irina: the movements appeared too random. As one they would rise and start dashing here and there, or leap over and over, or walk zombielike in no discernible pattern wherever their feet took them, turning when the spirit moved them, apparently. Sometimes they kept it up for minutes, sometimes hours, sometimes for days, and when they stopped, it was as abruptly as when they began.

"They know we're here," Irina said. "In the beginning they tried to approach many times, and you repulsed them. Why? This is the way you observe animals, not intelligent beings. They have language. We could learn to communicate with them. This is merely animal behavior, technique."

She kept her gaze on the foxes, her body rigid, waiting for the rebuff.

Who am I? Ch'ien Li said quietly. "Ch'ien Li. Elizabeth Mary Barrister. Old woman. Scientist. Anthropologist. Ancient human being. Earthling. Leader. Mother. Sister. Daughter. Aunt. Writer. Teacher. Female. Perhaps neuter. There are more. Meat eater, carrion eater. Tea drinker. Without context, the question has no meaning. Without a mutual set of assumptions, the question answered is the same as the question unanswered."

She regarded Irina calmly. "Until very recently we did not even know the four-legged ones were the result of the natural development that all go through. Where are these hundred going? Do any of them ever live an entire life span without succumbing to disease, injuries, death by mishap? How can creatures with such small brains develop architecture? Medicine? We don't know. Until we have an inkling of what their lives are from start to finish, we do not know the proper questions to ask them. Questions without meaning, that is what we would mouth. My child," Ch'ien Li said softly, "have you not studied how the work of most of the important researchers was invalidated because of their active participation in the very effects they were studying? I repulsed them," she said, turning again to watch the foxes. "I erected a barrier they cannot cross, and I keep myself aloof from them. It is not enough, I know, but I have done my best not to intertere with their lives. And I have felt the terrible frustration of inactivity that tortures you."

Irina got up abruptly and deactivated the screen, stepped out into the dim red light that felt like the interior of an oven, and started down the hillside in defeat.

Overhead, high above the updrafts of the valley, gasbags rode the wind, swiftly vanished, reappeared to repeat the sport again and again.

Sometimes a flock of birds or other flying animals appeared, attacked the foxes, who no longer fought back, but simply retired to the shelter of their temporary quarters. Sometimes the flying creatures made swooping, halfhearted attacks against the three humans, but more often they chose the prey they knew.

Irina was having many dreams in almost every sleep period. She dreamed she wore a flowing green gown, and stood at the side of a fountain that splashed with bright blue water. She dipped a pitcher into the pool and poured the sparkling water into golden goblets held by multitudes of naked men. The men turned into foxes and dipped their tails into the water and then began methodically chewing them off, consuming themselves bloodlessly, until only the heads and necks remained. They rose into the air and vanished, riding the winds with the gasbags. She dreamed a gasbag pursued her over the rough hills, down valleys, up mountains, over chasms and gorges, never gaining on her, never leaving her, and as she raced over the rocky terrain, her feet bled and the flesh pulled off in strips, exposing the bones. Finally, unable to run any longer, she flung herself to the ground, and before her eyes there was an ancient fox, standing upright, its immense eyes like black windows into infinity. She was sucked toward the eyes, which grew larger and larger, and finally were all there was.

"They marched very fast, almost at a run, and when they reached a high point where the valley began to rise, the forward foxes, males and females, soared up into the air."

She sat upright in bed, breathless with fear. Awake now, she felt something had wrenched loose inside her, something vital had disintegrated without warning. Without it, that mysterious something, she was paralyzed, set adrift in a void that was drawing her away from this place, away from life itself.

Shivering hard, she left her bed and dressed shakily and made her way to the group room, where she found Pick and Ch'ien Li in conversation.

"There is an emergency," Ch'ien Li said, her quiet tone mocking her words. "We are discussing the proper procedure."

She indicated a chair at the long table where she and Pick were seated. "You have bad dreams," she said softly. "I am sorry."

"What is the emergency?" Irina asked.

"Our other sensors, the ones we installed at the fox city, have malfunctioned or have been destroyed. There was a terrible storm, an inland hurricane that brought great tides to the lake and sent mountain flood rivers into the valley. The city could have been swept away entirely, or perhaps only the sensors were destroyed."

"And the other foxes that you tagged?"

"They are no longer transmitting."

Irina sipped her tea. "That leaves only this one?"

Ch'ien Li nodded.

"Twenty-two years of work, with only this one left to prove or disprove anything!" Her cup clattered to the table, and she clenched her hands hard. Ch'ien Li would start over, she thought suddenly. She would find a new city, or colony, whatever they were, and would tag another hundred, two hundred, and start the long observations all over again.

"We are trying to decide if Pick should fly back and observe the damage personally. I think so. But without transmitters, finding the city again will be time-consuming. Pick will retrace our trail of two years."

"I'll find it," Pick said. He was watching Irina. "But I want to know something before I leave."

Ch'ien Li made a clicking sound.

"What do you mean?" Irina demanded.

"I checked up on you the day you got here," Pick said. "I didn't trust you. I've wanted to ask from the beginning. Who are you working for? Why did you waive salary to come to Medea? Ch'ien Li's work doesn't mean a damn thing to you."

"I have passage home," Irina said. "I accepted expenses and guaranteed passage home after five years. I couldn't get passage *and* a salary." She was furious that he could have been her bedmate all these months and still be suspicious.

Ch'ien Li's eyes glittered, and a smile appeared and vanished so fast it might have been an illusion. "Ah," she said. "You invested money. You will have been away for a hundred years. It will be a fortune. I see."

"You see nothing!" Irina snapped. "A fortune! Even if I am allowed to keep a tenth of it, a million dollars, what is that on Earth now? I expect to live a hundred, twenty years, possibly more. How long would such a paltry fortune last if every day you have to buy again and again some fleeting relief from boredom? What is there on Earth for anyone with a functioning brain? By day it's a siesta, and by night drink and gambling, for those who can afford it. For people like me, any working people, there is not even that much available. Within ten years I would have nothing, and then what? Sift the ashes once more, rewrite the books yet again, teach a few dilettantes an arcane subject that they will never use? No!"

"No. I'll go on tour, speak, write my book, be a celebrity for a short time, and during that time I'll charge the limit. And after that I'll combine my investment and my earnings and I'll return to Medea. And I'll be a Croesus! What a pity you'll be dead, my dear Pick, but there will be others. Maybe your bastards running around barefoot in Medea Town, or theirs."

Pick's great hands clenched. Irina rested

one of her hands on her charger. "I would just as soon use it on you as any other wild creature here," she said.

They stared at each other until there was a faint sound from Ch'ien Li. Irina glanced at her. The old woman was laughing.

"He is afraid that if all the other tagged foxes are dead, any accident here could bring an abrupt end to our years of work. Financing to start over would be difficult."

Irina stared at Pick in disbelief. "You think I could sabotage valuable research?"

"You haven't exactly kept it a secret that you don't think this is the way, that you don't think this is going anywhere."

Ch'ien Li raised both hands. "You will prepare to leave as soon as possible," she said with finality to Pick. "Take the big car. The storms may still be very bad."

What if there is trouble that I can ease? Should I try to save any of the tagged ones if they are still alive?

"You do nothing," Ch'ien Li said flatly.

In the beginning Ch'ien Li had flagged all the unusual behavior, but gradually a program had been developed for the computer, and it had been able to take over that task of comparative analysis of the minute-by-minute, second-by-second actions. If one of the foxes sneezed, the computer would flag it, and Ch'ien Li and Irina would study that part of the continuing record. But the days passed and nothing was flagged; no behavior out of the ordinary was noted, the foxes ate, slept, formed their rings, and went through their dances.

Irina had not realized how much she had come to rely on Pick to relieve the monotony of the camp. They had not talked very much, but he had recounted his mapping expeditions from time to time, and he had complained about the air conditioners and the lights and the food, and in that silent place his complaints had passed for conversation. And he had been a very good bedmate. Often Irina and Ch'ien Li sat silently for hours in the group room, each preoccupied, Irina with the endless review of the past twenty-two years and Ch'ien Li with the minutiae of various episodes that had stood out as extraordinary.

The foxes had started this journey over two years ago. When they traveled, they moved very fast, but each such advance was followed by weeks, even months, of the same kind of inactivity that had stalled them here. They had traveled through the temperate forests, over mountains, across rivers, through the tropics, and now were on the edge of the great central desert, which was the heart of the continent. They planted nothing on their trip, they hunted and gathered wild foods. Their only other requirements from the land were space to assemble shelters and water, which they collected in skin bags. The building materials they had brought with them.

Irina realized that for a long time she had not seen what was on the screen. She could remember no thoughts at all, as if she had fallen asleep with her eyes open.

"I'll go to the observation overlook."

"My child, you are so restless. You have been up there three times today." Ch'ien Li turned off the console she was studying and turned to regard Irina. "Have you read my book on the artifacts we found on Mars?"

Irina nodded. "You decided they were not indigenous."

"Yes. And that was the push for this exploration. Mars was stranger than Medea, I think. So close to home you could see Earth shining in the sky. And all the while seeing it, knowing how close it was, it was as if you had stepped into another universe. I wonder if our distant cousins who left the seas for land didn't feel the same thing, an unexpected freedom from something you never knew was a restraint until it was gone."

Irina had stood up. Now she sat down, and for the next hour Ch'ien Li talked about Mars, about the expedition on which she had been as subordinate as Irina now was.

"Like you," Ch'ien Li said, "I was bored with rehashing the same work others had done quite thoroughly. How I longed for a new civilization to be uncovered, a whole new people to unriddle. And we had to go to Mars to find them. Only to find that they had not been from Mars at all. This need for what is new, for the undiscovered, I wonder, is it a sign of intelligence after all? Or is it merely another instinctual behavior pattern? Where is the boundary?"

"Irina felt a jolt when she saw Ch'ien Li, who was a legendary figure on Earth. She was no larger than a ten-year old child, her face was bone-white. She looked as old as death."

Irina laughed. "Your work was of the highest intellectual order. Every award possible was bestowed on you. No one ever doubted for a moment the magnificence of your discoveries."

Ch'ien Li looked at her for a moment, then shook her head. "I made a guess that I wanted to be true, and then went on to find the proof. Hardly scientific. Totally irrational. Intuition, wish-fulfillment, fantasy. These have been the basis of my work."

Irina felt a great weariness numb her. "And this research?" she asked, and did not care what the answer was.

"The same," Ch'ien Li said. "Exactly the same as the rest. I want them to be intelligent, not merely instinctual creatures. I want this journey of theirs to be more than a new settlement searching for a home. I want and will have a higher significance in their behavior than simple migration." She never made gestures when she spoke, and her face seldom became animated, but now she smiled, revealing teeth that looked like two rows of polished rice. "I am quite crazy, my child. Anyone in Medea Town will tell you the same. I am so determined that I will impose my will on these creatures and force them into significance."

Pick's voice interrupted the conversation. "Here it is," he said. He sounded very tired. On the monitor there appeared a scene of desolation. Floodwaters still swirled throughout a valley, but there were indications that the water had been much higher than it was now. Nowhere was there a sign of a building until the cameras panned the hillsides around the valley, and here and there a solitary dwelling remained. They appeared sturdily built of wood and stone. The camera stopped on a small group of foxes of mixed ages who were digging with metal tools in the rubble.

"The neuters?" Ch'ien Li asked.

"No trace. I think there are fewer than five hundred survivors, and many of them have left the area, dragging a few possessions along with them."

Ch'ien Li was silent, her reaction was that of defeat, Irina realized, not knowing exactly why. The old woman sagged now, her face caved in, her eyes dulled.

"It was not foreseeable," Pick said with some force. "The storm, sure. But no one could have known there would be a rock slide high up in the mountains. The slide caused a flash flood when a lake was dumped. That's what happened here. It wasn't just the storm."

"Are you certain?" New life had come to Ch'ien Li's voice. Her back was straight again. She leaned forward in her chair.

"No mistake about it."

"Come home, Pick. Come home. You deserve a rest."

"Why is it important that they were aware of the approaching storm?" Irina asked after Pick's report.

"In our years of observation we have never seen them surprised by a storm, or a solar flare, or any natural phenomenon. They are always safely inside, or on high ground or otherwise protected. They have an ability to interpret signals that are not apparent to our equipment, not merely barometric changes, but more than that. It is one of the puzzles."

That night Irina was roused from sleep by the beep-beep of her terminal, and when she got to the group room, Ch'ien Li was already there. Her hair was down, her back to her buttocks, the first time Irina had seen it so. Always before it had been in intricate braids wound and rewound on her head.

"The next phase has started," Ch'ien Li said, and her voice betrayed excitement.

The foxes had formed two lines and were marching out of the valley. In the center of the lines the old neuter walked, sur-

rounded by a dozen young males. Many of the foxes wore harnesses, some in tandem, and they pulled carts loaded with their possessions. Every structure had been dismantled, every hut, every shelter, every trace of their residence in the valley had been removed. They marched very fast, almost at a run, and when they reached a high point where the valley began to rise, the forward foxes, males and females, soared up into the air and rode the winds above the others—a procedure that was to be repeated throughout their march.

High above the entire group, gasbags darted, as if in curiosity, defying the prevailing winds, to maintain a second level of observation.

"You must follow them," Ch'ien Li said. "Keep them under observation in the small car. We must not lose any part of their journey. Pick says you are very competent in the car. When you are ready, I'll instruct you. Go now. Get dressed. I'll start dismantling equipment here."

Irina could not deny the small feeling of satisfaction the old woman's words gave her. Pick had never told her she was competent. He had grunted and had gone on to other lessons without comment. She nodded and started to leave the group room. In her peripheral vision she saw Ch'ien Li clutch the table as she passed it on her way to her own room and for several moments remain there, hunched over. At first, Irina assumed that Ch'ien Li had stopped to pick something up, but the continued immobility of the other woman dissolved her glow of self-satisfaction, and she turned toward her.

"What is it?" She went back to Ch'ien Li. Ch'ien Li's face was like putty, her eyes closed. Irina pulled a chair near, then helped her into it. "There must be something you take," she said. "Where?"

"Hypo. My room." Ch'ien Li put her head down on her arms on the table.

Irina ran to her room, found the hypo and ran back. She examined the instrument. It held a premeasured dose. Working swiftly now, she depressed the button that released a sterilizing spray on Ch'ien Li's arm and then held the end of the instrument against the spot for a count of three. Not knowing what else to do, she kneeled on the floor by Ch'ien Li and held the old woman in her arms while they waited for the medicine to take effect. She was startled by the frailness, the thinness of the body she held. Ch'ien Li was very stiff, and only gradually did the rigidity leave her.

"You will not mention this," Ch'ien Li said, her voice was thin and wavery.

"What is it?"

"It doesn't matter. I became excited and forgot to take my medicine. I am sorry." Her voice regained its firmness as she spoke. Her face was still gray white, but her eyes were alive again, and as if to prove she had fully recovered, she now pushed herself away from the table and stood up. There was a touch of unsteadiness in her movements, none at all in her voice when she spoke again. "Go get your things together now. Only what you will need in the next two or three days. We should catch up with you before then, but if we are delayed, you should be prepared. We will break up camp here and bring everything else with us."

"I can't leave you alone!"

"You will do as I say! Report for instructions before you leave. And you will not mention this." When Irina shook her head, Ch'ien Li said, "Very well. When Pick returns, tell him I am keeping the foxes under observation. He will know what to do. And on his arrival, you will transport yourself to Medea Town in the other small car."

Soon there were no more trees as far as she could see. There were scattered, misshapen shrubs or cactuslike plants that grew horizontally inches above the ground. There were rocks, sand, and lava beds, and nothing alive except the double columns of foxes trotting through the wilderness, and above them soaring foxes, and above them other flying creatures that would be called vultures on Earth, and here might be altogether different, and finally, above all, the gasbags, more of them now, and they too behaved like vultures gathering

for a feast that was not quite ready

Irina knew this was a land of deception many of the rocks were really rock demons creatures that would come alive and move with startling ease to capture prey some of the bushes were not vegetable but another animal species that could assume half a dozen shapes and move rapidly when prey approached Irina dismissed the dangers on the ground and concentrated on the foxes

They unerringly avoided any confrontation and maintained a steady trot even though the land varied considerably in roughness, in some places it was covered with jagged rocks in other places with deep sand then again with lava The soaring foxes rode the wind easily, with grace and beauty She had never thought of them as beautiful before, but out here at ease with the steady hurricane-force wind hands outstretched as if they were diving they used their fingers as delicately and precisely as a concert pianist to test the flow and the response of the thick tough membranes was instantaneous a ripple or a dip or a sudden tautness or relaxation They were soaring singing making music that no living creature other than those performing would ever hear

When the foxes abruptly halted and began making preparations for a rest period she was startled It had seemed but a few minutes since they had left the valley actually nine hours had passed She had little sense of fatigue until she swept the ground with the electric charge waited until three rock demons flashed out of sight and settled the car She turned on the electric curtain and only then felt her aching muscles and her throbbing eyes She became aware again of the howling wind that rocked the car from time to time

The foxes erected wedge-shaped shelters, the openings away from the wind and they vanished inside leaving half a dozen guards on duty Irina found herself adding the interpretation without volition They were guards she told herself firmly and she stretched out to nap while she could

She was awakened three hours later by the beeping of the computer and now she was fully aware of her fatigue as she pulled herself up and watched in disbelief while the foxes took down the shelters and prepared to resume their race to something she could not anticipate They had trotted for nine hours rested for less than four and were ready to go again

The next ten hours were like the first nine The foxes moved steadily avoided the rock demons the pseudo-bushes and other objects that Irina flagged for attention later when there would be time for detailed examination of the record During their rest period they had eaten, while they were on the move they neither ate nor drank anything they did not pause or slow down or hesitate at any of the obstructions they encountered When there was a cliff to climb they zigzagged up it where there was a chasm to cross, they fastened ropes to their carts and took to the air to slide on the wind hauling the carts across and then resumed their progress

None of the airborne predators or carrion eaters ventured very close and Irina wondered whether foxes on the march were viewed here much the same way as mother bears with cubs were viewed on Earth

The motion of the small car was a dart forward a hovering while the foxes drew up even and then passed it another dart forward At no time were the foxes out of range of the many scanners and sensors that recorded their every movement every sound When the car hovered Irina could stir replay in slow motion the bits that showed the incredible soaring maneuvers eat, bathe, but she could not relax

Was it merely a lemming march or was there a plan behind it? She bit her lip and tried to choose one or the other answer

The intensity of the wind increased, and now the foxes were obviously suffering from the constant whipping of wind and wind-driven sand but they did not slow their pace and their rest periods were no longer than four hours after each eight to ten-hour run Irina needed stimulants and when the rest periods came she needed sedatives to counteract the stimulants and permit her to sleep She lost count of the rest periods—four or five possibly six—and she no longer reviewed the material in the computer but sat doggedly at the controls when it was time to move she did so, and when it was time to hover and wait she did that and trusted the machines to do what ever else was necessary

They had been climbing for a long time sometimes going partway down the other side of a hill they had just climbed but generally moving upward The radarscan showed mountains they were not visible to her unaided eyes

Periodically she reported back to Chien Li and at one point she learned that Pick had returned and they were on their way to meet her They would home in on her signal, there was nothing she should do except carry on

She was deplaning from a transport that had taken her home from Africa where she had studied for two years Outside snow had fallen early and she was eager to feel the wind in her face smell the clean wet snow She had to wait—someone had to inspect the cargo—and while she waited she strolled through a garden and clipped the heads off all the red flowers she saw She noticed a small doorway went to it and opened the heavy metal door She saw a winding passage without lights Glancing about quickly to make certain no one was there to stop her, she slipped into the passage and shut the door

A blast of hot air shook her, and the wind shrieked in her ears She staggered back, shaking violently, and slammed the door of the aircar She hurried to the controls and saw that she had landed the car on a plateau The foxes were all on top of it now not yet too far from the sensors Still shak-

ing she lifted and moved forward and only after she stopped hovering this time did she consider what had happened

She had dreamed so vividly that she had acted upon the dream She had hallucinated It was the effect of the drugs she was taking she knew and found no consolation in the knowledge

It was becoming harder to control the aircar updrafts were stronger here and crosscurrents of wind caused unpredictable turbulences She could see nothing but the rocky peaks wind sculptures in stone and down the slopes swirling sand

Pick and Ch'ien Li caught up with her during one of the rest periods Irina heard the voices insisting insisting but she could not make out what it was they wanted her to do She told herself to sleep until the beeper sounded she told herself the voices were part of her dream But reluctantly she admitted them to consciousness and stumbled up and to the console She turned off the electric screen and unlocked the door to admit Pick

"Whew!" he said, studying her "Come on, sack time for you Let's go"

He was talking cheerfully killing time to allow her to reorient herself from sleep to wakefulness she knew but her mind was foggy it kept slithering out of touch The sedative was still in control

She checked the computer console turned off the alarm she had set to alert her if the foxes broke camp early and then looked around dully to see whether there was anything else to do When Pick took her by the arm and guided her from the car she followed obediently The hot wind stung her shocked her awake

She needed no more sleep she protested to Ch'ien Li who steered her toward the rear of the car where bedding was released from the wall a curtain partition was unstrapped and there was no motion at all from the wind Ch'ien Li helped her undress, the first time since she had left the camp and tucked her into the airbed which yielded adjusted to her body temperature and soothed her

"You were a great comfort to me my child Ch'ien Li said softly "I knew I could trust you and now Pick knows it also I did the unpardonable I slept instead of working to ready the camp for our departure Pick was further delayed and you were left alone far too long You did a good job my child Tell me were you bored?"

Irina could no longer keep her eyes open Ch'ien Li's voice seemed to come from a great distance and she listened to the rhythmical cadences rather than the words "No" she said with great effort

"We can't go much higher in this car" Pick said after three more rest periods

They were high on the flank of the mountain and up here there were no more plateaus no more flat places for the car to rest and the wind blew with such turbulence that each lift now was questionable It seemed the wind lifted with the car and then whirled into a vortex that sucked it down harder than it had been lifted

Pick turned to Ch'ien Li waited She was watching the foxes prepare camp They had halted in a hollow between massive boulders where there was comparative quiet The summit of the mountain was two or three marches away Progress had been slowed by the roughness of the terrain here and by the heat and the wind The foxes looked exhausted and woebegone their fur matted and filthy some of them limped badly and at least twenty had been abandoned along the steep climb

Irina was scanning the mountain slowly she stopped backed up and studied an area on the console "Pick" she said could we get to that hollow? Pick and Ch'ien Li looked "If we can anchor the car there in the hollow out of the wind we could climb up and put sensors here and here" Irina pointed at the spots

"We could even observe them visually for the rest of the climb" Pick said

"As one, they would rise and start dashing here and there, or leap over and over, or walk zombielike in no discernible pattern turning wherever the spirit moved them"

While Pick slept Irina and Ch'ien Li shared duties There was little to do now except wait Above the hollow the wind screamed but it seldom reached into the opening among the rocks where the aircar was moored The sensors were in place, faithfully recording every tortured step upward the foxes made

When did you decide to apply for Medea service? Ch'ien Li asked "Everything of public importance is in the dossier everything but the interesting parts When? Why?" She laughed lightly "Our curiosity becomes simple impertinence

Irina shrugged "I don't mind I was in Africa studying with Raoul Claude I was his protegee his star pupil and we became lovers After ten years I realized there was nothing new in our work that he was content with his research just as it was When I mentioned my doubts about our work he accused me of naivete and youth!"

She paused and reflected for a moment "He was right I was young and naive enough to believe there was more than we were doing studying a village that had been studied countless times already using an interpreter from the village who had gone to the same university I had attended studied the same texts believed the same theories I applied for this Raoul tried to stop me He turned in a bad report but it was so patently biased that it was ignored Or else no one cared about the quality of the people who were being sent to Medea I still don't know which is true"

"The first," Ch'ien Li said "There is a severe shortage of adequately trained anthropologists That had become one of the dead sciences before my time even Your ancestors were the infamous Viking marauders sailing their terrible ships across uncharted seas Their compatriots stayed home and trembled at the thought of the great unknown and looked down on those who sought it as immature naive ignorant, selfish Little changes except the means We keep telling ourselves and the others who stay behind that we need to acquire knowledge that knowledge for its own sake is the only goal we have, and we lie Unconsciously for the most part because we too believe those words We have invented the whole miracle of language in order to rationalize what is irrational—our own actions"

She looked at the console and watched foxes struggling upward clinging to bare stones inching their way now with agonizing slowness "Even they," she said "even they share this need to wrap actions in symbolic mysticism Whatever it is they will do when they have achieved the pinnacle they could have done below Sacrifice of the eldest? A religious ceremony? A period of meditation? A group suicide? There is nothing they will do here that they could not have done below more easily and more economically and if we asked them if we had perfect understanding of their language and put the question to them no doubt they would have answers that would sound very logical and correct

Irina shook her head in annoyance "My reasons are clear and simple" she said "I shall become very rich and then live exactly as I choose do exactly what I want do the research that interests me That is quite simple And understandable"

Ch'ien Li smiled She said nothing and her silence was more annoying than any phrase she could have uttered

Pick joined them and Ch'ien Li withdrew to sleep Irina was still thinking about the conversation she had had with Ch'ien Li

Security and intellectual explorations Irina thought that was the issue Ch'ien Li was telling her she could not have both and Ch'ien Li was wrong

"I'm going out" Pick said suddenly

She had been vaguely aware of his restless movements within the confines of the car but she had paid no attention She shared his restlessness she thought irritably but it was childish to try to relieve it by going out into that oven

Pick hung a small hammer on his belt and left her She watched him on a screen as he examined the rock wall that made up one side of the protected spot they were

in Pick she thought, of course, he was a trained geologist She kept forgetting that The riches of the coast lands had made his work unprofitable The board had cut off his funds and finally he had given it up to be a guide and work for Ch ien Li She had read his background material in Jolly s hotel ages ago With a start she realized that she had been with Ch ien Li and Pick for nearly eight months How disappointed Jolly must have been when she had not reappeared hat in hand to beg for the job she had scorned

She stiffened watching the console Something new was happening finally The foxes were stopping Here and there some had found places where they could sit or crouch safely and they were not moving Others were still searching, climbing and when new ones found roosts they stopped

Irina hesitated Ch ien Li would want to know but if she didn't rest she might have another attack and so far it seemed pointless to rouse her at least until all the foxes had come to a halt Most were still moving

Irina checked the sensors to make certain nothing was being left out of the record and then she went out to tell Pick To her surprise the heat was not as intense here as it had been down lower The screaming winds sucked air from the crevice and the updraft was dry and steady enough to act like a natural fan evaporating perspiration as it formed cooling the skin although the air was many degrees hotter than the skin it cooled

She told Pick of the foxes' new activity and together they went to the end of the cul de sac that protected them and watched the foxes Only one continued to climb now, the old neuter as the rest settled themselves in niches and on ledges When finally only the small figure of the neuter still moved Irina returned to the car to awaken Ch ien Li

Now the three of them stood outside to watch the neuter make the final ascent of the mountain They were high among pinnacles here and the last climb was almost straight up a basalt spire that tapered as sharply as a church steeple

Above everything the wind shrieked gasbags flashed by caught by the rush of wind, carried out of sight in seconds

The neuter continued to struggle upward At times it seemed the wind would whip the small figure away fling it up into the sky out of sight, but the fox clung to the rock and gained an inch another inch then another

A gasbag came in lower than the others as it was swept past the peak it whipped out a tentacle and caught hold, and at the same moment the bag deflated It streamed up and away from the peak like a pennant but now the creature was anchored securely The neuter continued its laborious climb upward

Irina heard Pick cursing in a low savage voice Not now you bastard

Often in the lowlands a gasbag lifted a fox carried it up hundreds of feet a thou-

sand feet, and then dropped it, and the fox glided to land in a long, sweeping joy ride.

Irina's hands clenched at her sides. *Not now,* she echoed. The fox climbed. It was within an arm's length of the tentacles. Suddenly in a blur of flailing limbs and whipping tentacles the gasbag seized the fox and released its own hold on the jagged rock. Its bag was instantly inflated, and it was swept up and out of sight.

In stunned silence the three humans stared at the barren peak, then at the foxes huddled on ledges, on boulders, in niches, the foxes sat as if stunned also. There was no movement anywhere except that of the furious wind and the sweep of a gasbag as it flashed into and out of sight over them.

Finally Ch'ien Li turned and began to make her way back to the car, her head bowed, her shoulders sagging. Irina looked from her to Pick, who was staring at the empty peak. She followed Ch'ien Li.

Inside the car Ch'ien Li sat down and looked blankly at the floor. Irina glanced at the console, then looked harder, frowning.

The tagged fox was still registering, still rising in the air high over the mountain, but even as she watched, the dot of light was spreading, becoming a haze instead of the starlike point it had been.

"Look!" she cried then. "What's happening to it?"

Ch'ien Li came to her side, and together they watched the haze take shape, the shape of a small gasbag. Irina pressed Pick's signal button, and soon he stood beside the two women, and they watched the globular haze expand. Other sensors were still focused on the foxes waiting on their ledges and perches. Simultaneously they all stood up and turned their muzzles toward the sky with their eyes shut.

The globe continued to grow until suddenly it erupted like a skyrocket, sending streaks of light in all directions. Then it was all gone, the screen was blank.

Now the foxes moved. They began to leave the mountaintop.

Irina sat down hard, and when she looked around, Ch'ien Li and Pick were also seated. No one spoke. The foxes were moving out of range of the sensors, one screen after another was left with only rocks and blowing sand to show where they had been.

Pick left to collect the sensors. Neither of the women had moved while he was gone.

"Going down will be easier than coming up," he said.

"Not yet," Ch'ien Li said. "We can find them later. They will rest as soon as they reach their last camp."

The remaining screen with a fox in view went blank. Pick turned off all the consoles, looked at Irina, then at Ch'ien Li, who stood up and went outside. Irina began to replay the final episode of the agonizing saga in such slow motion that she could see the fox blink its eyes against the wind.

She watched the fox reach out, watched it close its eyes as soon as it was securely held by the tentacle. The fox was drawn upward, it vanished inside the gasbag, and the bag whisked out of sight. Frowning, she played through another tape, this time one that showed the sky with the other gasbags flashing in and out of range. The haze enveloped several of them, and they glowed deeper and deeper, their colors intensifying. This tape did not show the starburst effect, but it was evident when it happened. The gasbags within range pulsed wildly for a few seconds, then streamed away. Irina played it over again. Satisfied finally, she went outside and joined Ch'ien Li at the end of the cul-de-sac.

"The fox went deliberately," she said.

"I know."

"It wasn't dangling, not the way they usually do when the gasbags take them up for a ride. It was eaten, or absorbed, or something."

Ch'ien Li nodded, as if she had known that also.

"That's what they came up here for, wasn't it?" Irina asked. "For a... a sacrifice."

A blast of hot air shook her, and the wind shrieked in her ears. She staggered back, shaking violently, and slammed the door. She hurried to the controls.

"For what purpose?" the old woman murmured. "Always there is purpose behind a sacrifice. To make crops grow, to quiet a volcano, to still the storms. For what purpose?"

"I don't know," Irina said. "We don't know enough. Why did the other gasbags come? What did the rest of them get out of it? Why didn't they all grab a fox? They were waiting just as the other foxes were waiting. Then they all went away, just like the foxes."

"What do you mean?"

"You have to look at the tapes," Irina said helplessly. "I don't even know if it could mean anything."

"But you intuit that it does. Yes. We will look at the tapes again."

"It doesn't mean a damn thing!" Pick yelled. "Tell her it doesn't mean anything, and let's get out of here."

Irina shook her head. They were all outside, and Ch'ien Li was pacing slowly, ten paces, turning at the rock wall, ten paces. One hand cradled the other behind her back, her head was bowed in thought.

"She's sick. She made me promise not to tell you," he said. "You can't talk her into leaving." When she did not respond, he jerked her around. "Do it, or I'll haul her inside like a load of laundry and strap her down and take off. Tell her we're out of water, that you're sick, anything."

"She won't go. She doesn't have time to start over, don't you see? So close, to come this close..."

"It was a goddamn failure! That creature is dead! There's nothing up here for her now." He began to shake her.

He was very frightened, she realized. "You *do* understand," she cried softly. "You know she can't leave here yet."

"I understand all right," he said savagely. "You want her to die! You've hated all this, her, this project. You made it clear enough. When she's gone, you'll be able to go over to Kuwait or Corum. That's what you've been after from the start. Only you won't get it this way!"

She wrenched away from him, and he followed, his face close to hers. "You can't deny how you've hated her!"

She shook her head. Hated? Loved? Both, neither. They did not apply. Words had become useless. There was nothing she could say to Pick, nothing she could say to Ch'ien Li, nothing she could say to herself, that would make any sense.

"Do you know what her name means?" she whispered. Pick looked startled and wary. "It means the Creative and Fire. That's what she is, that is how she comes to understand everything. Fire that consumes and destroys and illuminates and permits the creative to erupt like a sun. She chose her name when she returned to China as a student. She knew the cost and the danger. You can't take it away from her now. No one can." She turned away from him and watched Ch'ien Li, pacing ten paces, back, again, and again.

Pick brought tea to Irina later and took another cup to Ch'ien Li, who seemed unaware of him until he touched her arm, and then she staggered slightly. He led her to a rock, and she sat down on it, accepted the tea, sipped it. He kneeled by her, speaking earnestly, his voice inaudible to Irina. He returned alone, Ch'ien Li still seated on the rock, her tea beside her, apparently forgotten.

Hours passed. Irina and Pick sat on the ground side by side, watching the old woman, who had resumed pacing. *How can she keep it up?* Irina thought dully. She should have collapsed. Where did she get the strength to move her muscles? To keep blood pumping?

Irina realized she must have slept without closing her eyes or slumping. She felt disoriented and for a moment could not think where she was or why. With a start she realized that Ch'ien Li was no longer there. She jerked, and beside her Pick roused.

"What...?" He pulled himself up, dragging her up also.

"Look!"

Ch'ien Li was climbing the wall at the far end. Already the wind was whipping at her,

molding her clothes to her body She paused halfway up the wall and rested her forehead pressed against the rocks She was not wearing her face mask. She resumed the climb

Above her was a ledge with another ascent beyond it It was very narrow, with only enough space to stand none to move about in When Ch'ien Li reached it she crouched as if to catch her breath, to rest again Maybe she had had another attack Irina thought and involuntarily she moved toward her Pick caught her hand in a hard unyielding grip Neither moved again

One of Ch'ien Li's braids had come loose in the wind and was snapping about her face unwinding Slowly she got to her feet, she had to move to one side to cling to a jutting column

A gasbag flashed into view snapped out a tentacle, and caught the same rock Ch'ien Li clung to For an instant Ch'ien Li did not move Then she reached out her free hand and a tentacle caught it, another wound about her waist She released her hold that hand was taken and she was lifted The bag inflated and it rose so fast it was an iridescent blur

Irina closed her eyes against a blinding flash, even though she knew it had no outside source She was rising rising and now she could see two small figures dwindling below her dwarfed by the peaks and boulders lost among them Her head was swelling, growing every event of her a life was accessible identified sorted experienced There was a surging sea and there was a frozen wasteland and a panorama of forests and swamps There were constellations and flares and comets and meteorites and there were singing lights that swelled into a chorus climaxed on an impossible note faded there were other ways of thinking

She lived a lifetime many lifetimes and all the while her head grew larger and filled with pain that was pleasure beyond endurance Everything became brighter until that, too was beyond endurance All she had known of joy, every thrill she had known with her body, had known with her mind faded to insignificance as this new union this new kind of coupling reached its climax When she flew apart each part was the whole each was complete

Irina became aware that she was on the ground drawn into a tight fetal ball She moved cautiously drew her legs out from under her sat up

Pick was starting to move, he too had drawn into a ball on the ground He stood, looking around his face half-hidden behind his mask He reached a hand toward her, and she took it Both of their hands were trembling

They went back to the aircar without speaking, hand in hand

Silently Pick did the checkouts before liftoff Like the foxes like the gasbags they were ready to leave there was nothing else for them here

With her mind's eye Irina glimpsed an image of a plain broken with rocks clumps of low growth some hills in the far distance and beyond them mountains blending into haze Across them not perceived but calling was the goal She felt herself stretch out to reach it and that line binding her to her goal was the path It was hers the way would follow She knew both the image and the thought were Ch'ien Li's but also hers now The image yielded moved aside when she willed it There were other images alien images that needed examination but later She smiled as she thought of the gasbags trying to make sense of the new images they had suddenly acquired

They lifted and were bufteted by the wind instantly A gasbag sped by "I wonder whether we could tag one of them Irina said Pick laughed and she laughed also

"Remember what happened to Jolly he reminded her

That was different He didn't know so he wasn't ready

"I'm not ready yet either " Pick said easily The car lurched in an eddy and when he regained control, he was whistling softly Irina relaxed She would write Ch'ien Li's biography of course correct in every detail If she made a mistake Pick would correct it She could almost see the years as mileposts along the line that stretched across the unmarked plain

They would tag more foxes and follow them and the next time there was a ceremonial procession to the mountaintop they would participate A smile kept forming itself on her lips and when she glanced at Pick he was smiling also

HIDDEN MONSTERS

The quest for apemen, aquatic cows, dinosaurs, and a giant tentacled beast

BY KAREN EHRLICH AND LEE SPEIGEL

The pygmies braved mud-choked paths, venomous snakes, and gorillas to reach the placid shore of Lake Tele. Surrounded by palm-roofed huts, the lake lay without a ripple in the sun. At the water's edge, amid emerald butterflies, the pygmies launched their tree-trunk canoes. If they were lucky, they would catch boatloads of lungfish and perch by dusk.

They floated slowly out into the center of the lake, readying their fishing lines and bait, when suddenly they heard a deafening crash. Then the water surged backward from the shore, revealing a pack of ten-foot-high monsters with swishing tails, snakelike necks, and darting reptilian heads.

Convinced they were in danger of being killed, the pygmies raced back to land and began felling trees. They drove dozens of stakes into mud along the perimeter of the lake, forming a fence to keep the beasts away. When one of the monsters began crashing through the barrier, the terrified fishermen speared it in the gut. They dragged the body to land, roasted it over open flames, and feasted for weeks. Then, one by one, they died.

This tale comes from the remotest part of the Congo Jungle, where it is said that a man who dares even *mention* an encounter with the monster—called the mokele-mbembe—will surely perish.

Pygmies do not seek out the wrath of this legendary beast. But Westerners, without ancient fables to stoke their fears, have stalked the creature for dec-

PAINTING BY DE ES SCHWERTBERGER

ades. In 1913 and again in 1938 German scientists sought out reports and footprints of the monster deep in the rain forests of the Congo and Cameroon. In 1976 crocodile expert James Powell Jr. traveled through Gabon to question the Fang people who live in dread of a mokele-mbembe-like animal they call n'yamala. Powell found that when he showed natives the sketch of a long-necked brontosaurus-like dinosaur thought to resemble mokele-mbembe, they identified it as the tyrannical n'yamala.

Powell's findings come as no surprise to University of Chicago zoologist Roy Mackal. While most of Mackal's colleagues doubt that mokele-mbembe exists, he himself claims the creature may actually be a living dinosaur, a bizarre relic of the planet's prehistoric past.

No ivory-tower theorist, Mackal has twice risked his life trekking through African swamps in search of mokele-mbembe. During his first venture, in February 1980, he set out with Powell and a team of pygmy porters for the Congo's Epena district, rumored to hide the beast. The great swamp between them and their destination was thick with insects and poisonous snakes. But the crew plowed through, going twelve miles a day for three days, on a trip that Mackal says "made *The African Queen* look like fun."

When the group arrived, they were greeted by Bantus and pygmies who pointed to the monster's stomping ground along the River of Grasses. The team also saw a cave alleged to have sheltered a mokele-mbembe until just about six weeks before their arrival.

Out of strength, time and money, Mackal finally left for home. But he returned with University of Arizona anthropologist Richard Greenwell in October 1981. This time they chose to go during the rainy season, when rivers would swell high enough to drift them and their heavy tracking equipment through hundreds of miles of uncharted swamp. If anything, the second trip was even rougher than the first.

"We got lost for a day in a vast sea of floating grass," Mackal says. "We had to push through it an inch at a time."

Greenwell adds, "One day I went to look for gorillas. There was mud up to my knees and water up to my chest. There could have been hundreds of dinosaurs lurking in the swamp near that river and we would never have known it."

When Mackal and his troupe left Africa in December, the closest they had come to mokele-mbembe was a 16-month-old trail of possible footprints. Disappointed? A bit, though from the beginning they had known the odds were against them. Discouraged? Not these intrepid explorers. Mackal's new strategy is to wait until he gets a hot tip that his quarry is in a specific area. Then he'll grab his camera and antivenom and fly there on a moment's notice.

Last January Mackal and Greenwell surfaced at the Smithsonian's National Museum of Natural History in Washington, D.C. In a small conference room, not far from the Hall of Dinosaurs, they met with an eminent group of scientists to establish the International Society of Cryptozoology, dedicated to the quest for bizarre or hidden animals. The study of strange creatures, Mackal points out, has long been the business of circus entrepreneurs and commercial animal collectors. But evidence gathered over the past few decades has convinced him and his colleagues that unbelievable beasts from apemen to sea serpents may well be real.

Absurd? Maybe, but man has continually discovered unknown species. In the early 1800s, for instance, reports of a cloven-hoofed giraffelike animal with horns and stripes on its legs and hindquarters came out of the Congo rain forest. What may have sounded like a mythical creature to many fascinated Sir Harry H. Johnston as a child. As an adult, he pursued the rumors and the animal the natives called okapi. After many misadventures and an expedition that nearly ended in disaster, a live okapi was finally secured in 1906. Johnston's okapi turned out to be a living *Palaeotragus*, known from the fossil record and believed extinct for 20 million to 40 million years. This prehistoric animal today abounds in modern zoos.

> *"They readied their lines and bait, when suddenly the water surged backward from the shore, revealing a pack of ten-foot-high monsters with lashing tails and reptilian heads."*

Another long-lost animal turned up on December 24, 1938, when fishermen hauled an unusual fish out of coastal African waters. J.L.B. Smith and Marjorie Courtenay-Latimer were excited beyond all ichthyologists' dreams because they were convinced that, in their hands, they held a recently living coelacanth. This relic fish, known from the fossil record, was supposedly extinct for 60 million to 70 million years. When information about this monumental discovery was communicated to the scientific establishment, Smith and Courtenay-Latimer received a rather cool reception. Scientists insisted that it was only a distorted fish that had been partially eaten by other animals and refused even to look at it. Now it is an accepted fact that the coelacanth has somehow persisted into modern times.

Finally, few people remember that when the duckbill platypus was first collected, scientists were suspicious of fraud and believed it to be an artifact. Even with a specimen in hand, they couldn't reconcile its apparent idiosyncrasies—the fact that one animal combined mammalian, avian and reptilian characteristics. Today, of course, its existence is no longer contested, and the controversy surrounding the discovery of the platypus is conveniently forgotten.

This list, moreover, is hardly complete. With millions of square miles at least partially unexplored, dozens of new animals turn up each passing year. And as Belgian zoologist Bernard Heuvelmans points out, "In the waterways of the world, anything may be possible."

LAKE MONSTERS

The animals cryptozoologists hope to snare next, in fact, are 30-foot-long beasts allegedly cruising the planet's deepest lakes. The most famous of these is the elusive creature said to haunt Scotland's Loch Ness.

Evidence for Nessie dates from A.D. 565, when St. Columba reportedly spied a long-necked monster skimming the loch's surface. International awareness of the animal, though, didn't begin until 1933, with the completion of a modern roadway along the lake's northern shore. From that point on, hordes of monster hunters and scientists have descended on the loch in hopes of catching the beast.

Today's premier Loch Ness explorer, engineer and attorney Robert Rines, still remembers the trip he took to Scotland some 30 years ago. Driving past the lake, an expansive stretch of blue surrounded by jagged piles of rock, he imagined summoning the mythical creature from its watery den. But he knew that even if he glimpsed a head, say, or a fin, he still couldn't prove his vision real.

So in 1970, when Rines, by then director of New Hampshire's Academy of Applied Science, learned that a group of scientists from the University of Chicago were embarking on a Loch Ness mission, he sought permission to go along. His contribution to the trip was sonar equipment that could send sound waves through the water, then monitor echoes to detect structures below.

During the course of that trip, he and New Hampshire sonar manufacturer Martin Klein detected several large, moving objects with the equipment. Exultant, Rines returned in 1972 with a special strobe-light camera developed by MIT Professor Harold Edgerton. With the camera trailing beneath the boat, he managed to photograph what appeared to be a six-foot-long, moving flipper attached to a large body. Then, on another journey in 1975, he succeeded in photographing a long, serpentine neck and body and got a close-up of what seemed like a head.

Since then, Rines says, his photos have been less than spectacular. Nessie-like shapes at the very edge of pictures or

amorphous blobs so far from the camera he can't make out their form

If current methods don't soon yield the answer, Rines and his academy will bring the cameras still closer to the monster with the help of dolphins. While one dolphin remains behind in a holding tank, its mate will set out wearing a special lightweight sonar machine and camera. Trained to follow the echoes of the sonar, the animal will track Nessie down and perhaps snap pictures of the creature. Then, mission complete, it will race home, proof in flipper, to the call of its waiting mate.

Though the search for Nessie has temporarily slowed, other lake monsters are yielding more promising evidence. Hundreds of people, for instance, say they've noticed "Caddy," a sea serpent supposedly living off the North American west coast near British Columbia. Last May, several guests at a dinner party beside Chesapeake Bay in Maryland were gazing out the window when they spotted a long, serpentlike creature with pock-marked skin. The host, businessman Robert Frew, grabbed his video camera to tape the event, producing what some scientists say may be the first authentic film of "Chessie." And just last fall, oceanographer Paul LeBlond, of the University of British Columbia, analyzed the picture of an object alleged to be "Champ," the infamous monster of Lake Champlain. The ripples and waves photographed around the partly submerged object, LeBlond contends, indicate it was alive—and at least 24 feet long.

The identity of these lake monsters reported in water troughs around the world is still up for grabs. Most scientists believe these oversized creatures are optical illusions created by leaves, partially submerged logs, strings of birds, even exceptionally large octopuses. Others suspect they're marine dinosaurs called plesiosaurs. But Mackal has a different theory. The sightings, he says, may turn out to be primitive whales called zeuglodons, presumed extinct for the past 20 million years. The majority of sightings, Mackal adds, were in rivers and lakes through which salmon pass to spawn. And these fish could provide any hungry zeuglodon with an adequate food supply.

Both Mackal and his critics agree the issue won't be absolutely settled until a lake monster is captured for study. Since even ardent believers admit this may never happen, cryptozoologists are stalking other types of creatures as well.

BIGFOOT

Their second important quarry is the apeman known as Bigfoot, which supposedly lurks in the forests of North America. If alleged eyewitnesses are right, the hairy creature has a gorillalike face on a heavy-set body with especially long and massive arms. Like the Abominable Snowman said to inhabit the towering Himalayas, it walks upright on a seven- to eight-foot tall frame, weighs 500 to 800 pounds, and exudes a sharp, unbearable stench.

The trail of Bigfoot begins centuries ago in the legends of the American Indians, who believed the apemen, dubbed sasquatch, were the progeny of giant warriors long since destroyed. Then, beginning with the first non-Indian report in 1811, traces of footprints and sightings of the animal throughout most of the United States and Canada mushroomed into the voluminous accounts that exist today.

But the rumors were considered just that until 1967, when Roger Patterson, a Washington State rodeo rider, took his famous film. Patterson and a colleague were on horseback tracking Bigfoot in the forest region of Bluff Creek, California. They had just entered a clearing when the horses suddenly reared, throwing the men. Patterson grabbed his camera in time to capture, on 28 feet of color film, a large, hairy, bipedal creature that appeared as startled at the sight of humans as they were at the sight of it. Turning once to look back at Patterson, the animal walked briskly out of the clearing and into the forest. The entire event lasted about a minute.

> *"After careful examination, he reached the earth-shattering conclusion that the beast was a six-ton octopus, possibly the hugest invertebrate ever reported in the Western world."*

Here, finally, was a piece of evidence that could be closely scrutinized. But the verdict was mixed. Skeptics said the forward motion of this Bigfoot looked almost too human to be anything but a man in a costume. After more than 50 viewings and repeated frame-by-frame measurements, however, anthropologist Grover Krantz of Washington State University was reasonably convinced that the Patterson film was legitimate. A large, bipedal primate, he contended, would possess a humanlike gait. And he noted Patterson swore to the authenticity of the film on his deathbed.

Unfortunately for Bigfoot fans, the questionable Patterson film long remained their biggest coup. But this past summer the most thrilling Bigfoot evidence ever emerged out of the Pacific Northwest.

U.S. Forest Patrolman Paul Freeman was making his rounds in the mountainous region east of Walla Walla, Washington, when he claims he chanced upon an eight-foot-tall Bigfoot, not more than 65 yards away. He rushed back to the Forest Service post and related the tale to his superiors, who quickly went to investigate. They found nearly 21 14-inch-long footprints pressed an inch deep into the hard ground. Pouring plaster into the tracks, they made casts of the most prominent prints.

Anthropologist Krantz was traveling through the People's Republic of China when he happened to pick up an English-language paper and read the news. Having long been interested in Bigfoot sightings, he vowed to study the prints as soon as he got home.

When five plaster casts arrived in his lab some weeks later, he was astounded. The toes contained thousands of dermal ridges (fingerprintlike lines) in an intricate primate pattern. Ridges on opposite feet were almost exact mirror images. And at least one of the toes was deformed. "Only an expert engraver could have forged something like that," Krantz contends. "Anyone that gifted should be counterfeiting coins."

The point Krantz likes to make is that Bigfoot is a "perfectly expectable animal," one that may be distantly related to man somehow persisting all these millions of years on the fringes of civilization. Could the creature be a survivor of *Gigantopithecus*, an allegedly extinct species of apeman? Or the missing link, a common ancestor of man and ape? Krantz says either might be the case, noting that "anatomically this thing has both human and simian characteristics. It stands upright, but intellectually it's an ape."

What would the discovery of a sasquatch mean? Krantz says: "It would disprove a major anthropological tenet, showing once and for all that a bipedal stance and freeing of the hands did *not* automatically give early man intelligence, tool making, and speech."

As with lake monsters, the bottom line here will be finding the creature itself. And that may be difficult, for skeptics point out that even the best Bigfoot evidence is hardly airtight. Many critics remain convinced that Freeman, or someone else, planted the sasquatch footprints on purpose. And not long ago a retired Washington State logger admitted that during the Twenties and Thirties he forged miles of Bigfoot prints with gigantic feet whittled from alderwood.

MAMMALS AND OTHER STRANGERS

Public attention has focused mostly on lake monsters and Bigfoot, but other creatures have also eluded scientific confirmation. Perhaps the most slippery of all are the mammals—an assortment of primates, bovines, felines, and canines—that may haunt more than just our dreams.

Roy Mackal and Richard Greenwell, for instance, have high hopes of finding aquatic "monkeys" and "cows" in the chilly Arctic.

In support of this theory, Mackal points to the writings of Georg Wilhelm Steller, who explored the Aleutian Islands with Vitus Bering in 1741. Steller, an acclaimed naturalist, had been gazing out to sea when

he supposedly spied a five-foot-long creature with a seallike body and a monkey's face. This flipperless animal, dubbed the sea monkey, had a forked tail, a doggish head and whiskers that made it look like a Chinaman. Many months later, Steller was shocked to see yet another unknown mammal, this time a dark brown sea cow with leathery skin and, he later learned, breasts full of milk. The enormous finned creature, Steller claimed, spent its days pasturing on seaweed near the coast. Once Steller's reports leaked out, though, the creature was relentlessly hunted by Russian fur merchants until its presumed extinction in 1759.

Mainstream scientists who respect Steller's meticulous journals say that sea monkeys and sea cows have surely perished from the face of the earth. But Greenwell and Mackal point to the many Soviet fishing trawlers that occasionally report cowlike creatures in the Bering Strait. And they add, the animals' potential habitat—the Aleutian Islands and much of the Siberian coast—is almost entirely unexplored.

Meanwhile, hundreds of people in a more civilized area—Tasmania—are claiming encounters with fierce marsupial dogs. (Marsupials, such as kangaroos, lack a placenta and carry their young in a pouch.) A number of local scientists say the reports are bogus, but University of Tasmania zoologist Eric Guiler has launched a full-scale hunt for the creatures, called Tasmanian wolves.

The wolves were common in the early days of the country, Guiler explains. But they gained a reputation for killing sheep. So in 1838 officials hired someone called the Tigerman to wipe the wolves out. There were a series of tigermen for the next several decades, and by 1930 the Tasmanian wolf was designated extinct.

Through the decades, though, Tasmanians have insisted that the creature persists. To Guiler, who's interviewed many of the witnesses, the claims make sense. To prove that, the professor has asked the World Wildlife Fund of Australia to help him place cameras around the bush in hopes of photographing one of the animals. Though he's had 15 cameras and two men scrutinizing the field for three years, however, no wolves have ever been seen.

"We just haven't been lucky," Guiler asserts. "And until we've got a photograph, no one will believe us."

If Guiler's having a rough time, so are his neighbors to the north in Queensland, Australia. They claim they're being invaded by marsupial tigers, supposedly extinct since the Pleistocene Era 15,000 years ago.

Disturbed by reports of huge black catlike animals roaming the region's rain forest, Alan Bartholomai and his staff at the Queensland Museum in Brisbane decided to investigate. After scouting the area, they recently found a cat skin that measured three feet in length from the tip of the nose to the front toes.

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The Artist

BRAIN TUNER

CONTINUED FROM PAGE 48

The psychological set that makes a person become an addict seems to disappear

Researchers are now starting to elucidate NET's scientific rationale winning over new converts from the more conservative ranks of the medical profession In the process Patterson's black box is helping to unlock the mysterious inner workings of that other black box the human brain The stimulus goes in and the response comes out but seldom are we afforded a glimpse of what happens in between By probing NET's effects on experimental animals investigators are shedding light on the underlying mechanisms that control everything from addictive behavior to our most basic drives and emotions As Dr Becker surmised, the stimulator does indeed cause "profound alterations of the central nervous system Underlying consciousness is an intricate orchestral arrangement of trillions of brain cells firing in concert Like different instruments in a symphony subpopulations of neurons are now believed to produce frequencies within a specific range Frequency so to speak is the music of the hemispheres

Like penicillin and X rays NET was born of scientific serendipity It began with an accidental discovery in the fall of 1972 At that time Patterson was head of surgery at Hong Kong's Tung Wah Hospital, a large charity institution with a poor clientele A neurosurgeon colleague Dr H L Wen had just returned from the People's Republic of China where he had learned the technique of electroacupuncture Primarily interested in its usefulness in the suppression of pain he began testing it on patients with a variety of ills Dr Wen, however did not know that almost 15 percent of his patients were addicted to heroin or opium of extremely high purity At that time the drugs were easily affordable at a daily cost of less than a pack of cigarettes

One day Patterson says an addict approached Dr Wen announcing that the electroacupuncture had stopped his withdrawal symptoms I felt as if I d just had a shot of heroin he said Wen initially thought nothing of it but a few hours later a second addict reported a similar experience equating the electroacupuncture with a certain dosage of opium

Further inquiries revealed that a few alcoholics and cigarette smokers in Wen's experimental group had also been freed from their craving To the eye however the electroacupuncture produced the most dramatic response in the narcotics addicts deprived of their drugs The characteristic runny nose stomach cramps aching joints and feeling of anxiety usually disappeared after 10 to 15 minutes of stimulation by needles inserted inside the hollow of the external ear at the acupuncturist s lung point At first these good effects lasted only a few hours But with repeated treatments patients remained symptom-free for periods of longer duration

The results of Wen's first study with 40 opiate addicts were published in the *Asian Journal of Medicine* the following spring Of this group 39 were drug-free by the time they left the hospital roughly two weeks after starting treatment When Patterson returned to England in July 1973 however she found that addicts there were far less enthusiastic about the procedure The Chinese loved acupuncture the British hated it "As bizarre as it may sound " Patterson explains Westerners—even those who mainlined drugs—often had an aversion to the needles

There was another reason not to use needles Patterson had suspected from the outset that acupuncture was essentially an electrical phenomenon Even the traditional explanation hinted that this might be so The ancient practice revolves around the notion that all living things possess vital energy called *chi* which circulates through the body by way of a network of channels or meridians Sickness was seen to be the result of disharmony manifested by an obstruction in the flow of *chi* which the needling was thought to remedy

> *"From the moment the electrodes were put on my head, my craving immediately diminished. When I had passed the three-day mark, I felt no craving at all."*

Was *chi* the ancients concept for what modern man now recognizes as the internal currents that course through the body? Could it be that the Chinese more than 2 500 years before the discovery of electricity had intuitively sought to alter this life force in an attempt to alleviate pain and to cure disease? Perhaps Patterson reasoned the twirling of needles generates a tiny electrical voltage Viewed in this light the more recent practice of electroacupuncture was simply a more intense form of the original twirling technique It so the electrical signal would be of crucial significance in the treatment of addictions

Years of clinical trial and error eventually confirmed her hunch First Patterson replaced needles with surface electrodes Then she went on to compare direct current with alternating current while varying the voltage shape and other aspects of the electrical signal Next she altered the electrode placement finding a position just behind the ear over the mastoid bone to be more effective than the lung point But of all the variables explored electrical frequency quickly emerged as the single most important element for success Those addicted to narcotics and sedatives preferred frequencies within the 75-hertz to 300-hertz range barbiturate addicts responded to lower frequencies and still other addicts especially those dependent on cocaine or amphetamines, benefited most from frequencies as high as 2 000 hertz "Musicians " she fondly recalls "really helped to strengthen my guesswork during those early days They invariably found the correct therapeutic setting right away It was as if their brains were more attuned to frequency

A further refinement of the therapy was prompted by still another fortuitous discovery A heavy abuser fell asleep with the electrical stimulator on and awoke 30 hours later well-rested and eager to take Patterson's children ice skating From that moment onward Patterson advocated continuous current application in the initial phases of treatment She began the search for more comfortable electrodes that could be worn during sleep and for smaller electrical stimulators that could be clipped onto belts permitting mobility during the day

By 1976 Patterson had transformed electroacupuncture into an exciting new experimental treatment mode that she christened NeuroElectric Therapy In her first clinical study which was reported that year in the U N *Bulletin on Narcotics* opiate addicts given NET as in-patients were all found to be drug-free an average of ten months after completing treatment In contrast opiate addicts who received NET only during the day as out-patients did not fare as well 47 percent were drug-free at the time of the follow-up

Because this preliminary investigation was limited to 23 patients her results could not be extrapolated to a larger cross section of addicts To provide better information about the long-term effects of NET and also to assess its value in the treatment of other kinds of addictions Patterson was recently awarded a research grant by the British Medical Association

Last fall at a Washington D C symposium sponsored by the American Holistic Medical Association Patterson presented the findings from this follow-up evaluation which tracked the progress of patients treated between 1973 and 1980 Data were obtained from confidential questionnaires and when possible from personal interviews Fifty percent responded to the survey and these respondents included 66 drug addicts (mostly mainline heroin or methadone users and mixed addiction cases), 9 cigarette smokers and 18 alcoholics At the time of the follow-up total abstinence was said to be achieved by 80 percent of the drug addicts 44 percent of the cigarette smokers, and 78 percent of the alcoholics who stated abstinence to be their goal An additional

7 alcoholics whose goal on admission was controlled drinking all reported success. (As Patterson herself cautions, however, these figures probably represent too favorable an outcome since patients who relapsed, especially alcoholics, may have been less likely to reply to the survey.) Of those who were successfully weaned from their dependence, 68 percent said they never or only rarely experienced craving, 15 percent said they occasionally felt craving, and another 17 percent said they frequently felt craving.

Interestingly, none of the drug addicts at the time of reporting had substituted alcohol for their earlier addiction—a finding that contrasts sharply with the figures cited in other studies. In one national survey, for example, 60 percent of addicts who had given up narcotics became heavy drinkers or alcoholics. Equally noteworthy was the extremely low dropout rate of all addicts enrolled in the program. Only 1.6 percent did not complete detoxification.

All things considered, the success of Patterson's patients is probably most remarkable from the standpoint of the brief duration of the therapy which, including counseling, rarely extends beyond 30 days. According to a large study of drug abusers admitted to a variety of government-sponsored programs, addicts treated less than three months did not fare any better than those in a no-treatment comparison group. So NET seems to achieve in a few weeks what few, if any, orthodox treatments can accomplish after months or years.

Not everyone, however, is convinced by the report's conclusions. A look at the history of drug reform in the United States shows that their cynicism is not ill-founded. Consider the government's efforts to curb narcotics use. The first U.S. Public Health Service hospital for heroin addicts opened in Lexington, Kentucky, where 18,000 patients were admitted between 1935 and 1952. All except some 7 percent of the alumni promptly relapsed after dismissal from the institution—a dreary record that other institutions scarcely improved upon in subsequent decades.

By the 1960s heroin addiction had spread like cancer through inner city ghettos. To control the expanding epidemic, health professionals turned to methadone, a synthetic opiate that is legally prescribed. Today thousands of clinics throughout the nation dispense methadone to certified addicts, and those maintained in these programs show higher rates of employment and fewer criminal offenses than before they began treatment. But methadone, alas, is even more addictive than heroin. As one medical authority points out: "The tragedy of methadone is that we cannot get people off methadone."

For narcotics addicts who aspire to a drug-free existence, society offers two main alternatives: the highly structured and insulated environments of such residential homes as Daytop Village, Phoenix House, and Odyssey House or out-patient clinics which provide daily counseling services. As many as 30 to 40 percent of the people who enroll in these community-based programs remain abstinent a year after leaving treatment. But to enter most of these programs, one must first detoxify in a hospital. And here's the hitch: 64 percent don't make it past the acute withdrawal phase to quality for further treatment.

It is still not understood why simple detoxification is so ineffective, but the facts are clear and inescapable, says Dr. Avram Goldstein, professor of pharmacology at Stanford University. "As I see it, the reason for the dismal failure ... is that the newly detoxified addict, still driven by discomfort, physiologic imbalance, and intense craving, cannot focus attention on the necessary first steps toward rehabilitation, but soon succumbs and starts using heroin."

Jean Cocteau, the French writer who resumed smoking opium after medicine had purged him of the habit, put it another way: "Now that I am cured, I feel empty, poor, heartbroken, and ill."

In sharp contrast, NET patients are said to emerge from treatment feeling healthy, energetic, even cheerful. Dr. Joseph Winston, the American physician who collaborated with Patterson in the treatment of

Keith Richards recalls that the musician came to us terribly ill. He was literally *green*. But he slept eighteen hours the first day and ten days later he was playing tennis and the group said he had not looked so good in years.

If Patterson's findings seem at total variance with the bulk of the clinical literature, the firsthand accounts of NET patients may help explain why.

Stuart Harris started shooting heroin as a sixteen-year-old cadet in the Royal Navy. By the time he underwent NET in the spring of 1981, he had been addicted to heroin 15 years, and for 11 of those years he had also injected methadone intravenously. I had the sweats very badly, he says of his experience on NET. 'You're emitting all this bad grunge from your body and you feel like you're speeding [on amphetamines]. But there's no withdrawal at all. That much I'll say for it. I mean when they told me about it, I just took it with a pinch of salt—another treatment they've tobbed off on the poor junkies. But believe me, if I was getting any pain as I used to have with withdrawals, I wouldn't have stayed there, 'cause I was a voluntary patient. When I discharged myself from hospital, I didn't go searching out for drugs as I would normally have done in the past, say after methadone reduction or narcosis (that's when they sedate you up to your eyeballs on sleeping pills). After completing all the other methods, I felt so uptight all the time. The first thing I wanted to do was have a massive great fix. But after NET all you really want to do is sleep. Everything is so easygoing. I can't say that it [heroin] doesn't drift into my mind. Like the other day, I fancied a fix. But it passed over in a few minutes. Before, if I'd felt the slightest urge for a fix, off I'd go to London. Something has changed. You feel calmer. You can accept the ups and downs.'

A man in his thirties, who requested anonymity, had injected heroin for eight years, combining this dosage with prescribed methadone during the last five years of the period. He received NET in 1974. The treatment was rough, he says. 'I felt as if I had a mild case of the flu, combined with short periods of feeling spaced out—even a bit euphoric. My anxiety and craving subsided right from the beginning, but a few weeks later my craving for heroin went back up again. I wanted to go out and score. And as a matter of fact, I did. But it was different. It wasn't satisfying. It didn't make me feel that great. I know this treatment changed my head, because I never thought about heroin again after that. You see, I had gotten off heroin for as much as a month, even two months, at a stretch. But the whole of that time I would be thinking of heroin and nothing else.'

A twenty-eight-year-old man, who also requested anonymity, combined a high level of alcohol and marijuana consumption with a cocaine habit of two to six grams each week for more than seven years. (The cocaine alone usually cost him more than

$1 000 a month) He agreed to speak to *Omni* immediately after completing NET treatment in the summer of 1982 'Until this therapy he says "I couldn t go three days without feeling an enormous craving for drugs Cocaine and to a lesser degree alcohol would always be on my mind But from the moment the electrodes were put on my head my craving immediately diminished When I had passed the three-day mark, I felt no craving at all and I still don't Drugs never enter my mind Now that I remember what it s like to feel good—to be clearheaded after all these years—I m certain that I won t go back on drugs

Rachel Waite a heavy smoker for five years was treated for her cigarette addiction in June 1981 "For the first three days on NET' she recalls I still had the urge to smoke and I probably would have lit up had a cigarette been handy However by the end of the treatment I definitely did not want one When I took an experimental puff it was a different sensation altogether It tasted foul and there was no hit whatsoever It was as if I was drawing on hot air

Surprisingly many patients who go on to build drug-free lives do not receive any formal counseling beyond that provided during the brief detoxification program Yet NET by itself cannot remove the root causes of addiction nor can it replace years of maladaptation with healthy skills for coping with life s stresses and disappointments Why then do so many patients experience such a metamorphosis?

The treatment Patterson believes simply sets the stage for further growth 'Because they feel so good she says 'they are better able to face the sort of problems that drove them to addiction in the first place You see most people who come off drugs without NET enter a phase of prolonged dysphoria They suffer from fearful depression and pessimism They can t eat They can t sleep They have no energy This can last for six months in the case of heroin and even longer in cases of methadone and barbiturate addiction But NET restores physiological normality within ten days which enormously reduces the amount of time needed for readjustment

If anything Patterson thinks that euphoria—not dysphoria—is to blame when rehabilitation fails The newly detoxified addict is optimistic to the point of being overconfident "In their elated state Patterson says "they think it will be easy to stay off drugs and then end up stumbling because they don t make enough of an attempt to change their ways

As if obeying Newtonian mechanics the black box appears to counter one mood shift with an equal swing in the opposite direction until the emotional pendulum finally comes to rest Is the black box in reality an electronic substitute for a chemical high? How can a physical treatment cause such a swing toward euphoria?

As fate would have it a scientist who had taught Patterson years earlier Dr Hans Kosterlitz would once again serve as her mentor by illuminating the mainspring of euphoria in the brain While working with Dr John Hughes at the University of Aberdeen in 1975 Dr Kosterlitz identified an endorphin a natural brain chemical with a molecular structure very similar to the opiates For this outstanding discovery the investigators later received the prestigious Lasker Award revered as America's equivalent of the Nobel Prize in medicine Almost overnight their finding triggered an explosion in the understanding of the biochemical basis of behavior opening a new vista on the controlling factors behind addiction Opium heroin morphine and other related drugs owe their potency to what Avram Goldstein calls one of nature's most bizarre coincidences"—their uncanny resemblance to the endorphins

Over the succeeding years researchers uncovered evidence of myriad other brain hormones that mimic psychoactive drugs from Valium and angel dust to hallucinogens Almost every mind-altering substance it is now assumed has an analogue in the brain And the precise mixture of neurojuices in this biochemical cocktail can mean the difference between tripping speeding crashing or seeing the world through sober eyes

These insights immediately suggested how the addict becomes trapped in a nightmarish cycle of dependency. In the initial phases of narcotic use, for example, the individual is assumed to have normal levels of endorphins in the brain. Injecting heroin causes a sudden and drastic elevation of opiates, which is subjectively interpreted as ecstasy. If through repeated use the brain is regularly flooded with opiates, it redresses the imbalance by cutting back on the production of its internal supply. Hence the well-known condition of tolerance develops. The addict steps up his dosage, and the brain further compensates by calling a massive shutdown of production. Eventually, according to the theory, the addict is shooting up solely for the purpose of "feeling normal." Should the drug supply be cut off at this stage, the opiate shortage cannot be instantly remedied. Drought ensues, unleashing withdrawal symptoms.

If an exogenous drug depletes the brain of its natural counterpart, it seemed logical that NET might quite literally juice up the system, rapidly replenishing the scarce neurochemical. Might certain frequencies of current catalyze the release of different brain hormones? Patterson wondered.

To find out, she conducted animal experiments in collaboration with biochemist Dr. Ifor Capel at the Marie Curie Cancer Memorial Foundation Research Department in Surrey, England. Simply by monitoring the blood of NET-treated rats, the investigators discovered low-frequency currents can indeed cause as much as a threefold elevation of endorphin levels.

In another experiment, the researchers examined NET's effects on rats rendered unconscious by massive doses of barbiturates. Once asleep, all the animals had electrodes clipped on to their ears, but only half the group actually received electrical current. The result: At one particular frequency—ten hertz—the experimental group rapidly regained consciousness, sleeping on average 40 percent less than the rats that received no electricity.

Why is the detoxification process hastened? One clue surfaced when the rats' brain tissue was analyzed. It was learned that the ten-hertz signal speeds up the production and turnover rate of serotonin (a neurotransmitter that acts as a stimulant to the central nervous system).

Similar experiments have now been repeated on rats made unconscious by injecting them with alcohol or ketamine (a cousin of angel dust). In almost every instance the frequencies that reduced sleeping time had earlier been proved therapeutic in the detoxification of human addicts. "Virtually every single parameter of current that I had stumbled upon during my clinical work was corroborated by the rat studies," Patterson declares with barely concealed excitement.

How a weak electrical current can open the floodgates of the mind is still a matter of conjecture, but the implications are obvious. Like a citizen's-band transmitter that infiltrates television frequencies, the black box must broadcast through brain frequency channels. And just as a TV receiver can pick up CB transmissions from a passing truck, the brain undoubtedly responds to the foreign-generated signal as if it originated from within its own communication network.

As far as we can tell, says Dr. Capel, a rugged Welshman with a melodic voice, each brain center generates impulses at a specific frequency based on the predominant neurotransmitters it secretes. In other words, the brain's internal communication system—its language, if you like—is based on frequency.

Unfortunately, neuroscientists are not yet fluent in this new tongue. NET is still a very blunt tool. Capel acknowledges. Presumably, when we send in waves of electrical energy at, say, ten hertz, certain cells in the lower brain stem will respond because they normally fire within that frequency range. As a result, particular mood-altering chemicals associated with that region will be released. That's what we *hope* is happening. In reality, however, much of the signal may be lost before it actually reaches the target cells. We just don't know. But if we can fine-tune the signal, I am confident our results will steadily improve.

At her small, two-bedroom home in Corona del Mar, Patterson has begun testing a new, improved model of the stimulator. Her goal—and the major impetus behind her decision to come to the United States—is to obtain funding for the establishment of a center where human and animal research can proceed in tandem. Until FDA clearance is given, however, she cannot begin treating addicts on a routine basis.

Will NET open a new route to salvation for the millions of Americans who each year flock to Alcoholics Anonymous, Smoke Enders and methadone maintenance clinics? Clearly, the final verdict is contingent upon replication of controlled studies. But if a feeble electrical current can truly curb the mind's excesses—from uncontrollable lusts to extremes of mood—its impact is sure to be far-reaching.

Addicts may represent only a tiny fraction of the people who will eventually be helped by NET, Capel predicts. In all likelihood, it will find an enormous range of uses, especially in the area of pain control. In one preliminary trial, terminal patients suffering from chronic pain found NET just as effective as their daily dose of morphine. By stimulating the brain's own painkillers, we didn't have to administer drugs, Capel marvels.

Early data also indicate that NET may prove highly promising in the treatment of mental disorders. The frequencies that induce euphoria and reduce tension, according to Dr. Cameron of Britain's National Health Service, seem to work wonders for patients suffering from severe depression and acute anxiety. Though it is far too soon to draw any conclusions

she notes that "a few of the half-dozen chronic depressives we've treated have found themselves jobs after years of unemployment."

As for Patterson, she hopes eventually to broaden her practice to include behavioral addictions from overeating and compulsive gambling to video-game fanaticism. Absurdity aside, these wider applications follow a certain logic. "Her ideas make perfect sense if one accepts the idea that behavioral addictions have a chemical basis," says Dr. William Regelson at the Medical College of Virginia. "It is very likely, for example, that all activities vital to survival—from sex to physical exercise—are physiologically addictive. It is now thought that the phenomenon called jogger's high is actually endorphin-mediated. In all probability, eating also releases some kind of pleasurable molecule. After all, why do we crave food? Low blood-sugar levels don't explain why. The truth is that we feel abnormal when we haven't eaten in a while. Some chemical in our brain has become depleted. We become restless and agitated, and after extreme deprivation we suffer withdrawal symptoms commonly known as hunger pangs. The only way to relieve our discomfort is to get more food. It's a fix—plain and simple."

If basic drives are addictive, then drugs are an ingenious means of shortcutting the elaborate scheme nature devised to ensure that we maintain health and reproduce ourselves. Merely by popping a pill we can top off our neurochemical reservoirs with no sweat expended. Instant orgasm without any foreplay. A cheap thrill.

But can't the same be said of NET? "Is it not, after all, an electronic fix?" asks Regelson, who fears the black box may become addictive in its own right. Patterson has kept her eyes open to any signs that her patients are becoming physically dependent on the equipment. But she rules out the possibility that there will ever be a black market in black boxes, because individual models can cost upward of $1,000—a hefty sum to cough up for purely recreational use. Besides, she has not encountered a single instance of electronic addiction in her ten years of practice. The explanation she believes: "Is that drugs—for the very reason that they are foreign—upset the brain's chemistry. NET, on the other hand, simply coaxes the brain to restore its own chemical balance. The body heals itself."

The intuitive feelings of her patients support this view. As reformed heroin addict Stuart Harris says: "At first I thought it would be fun to wire up the human race, so we could all go whizzing about. But after the initial buzz, you feel well, normal. Frankly, all NET does is help you face reality."

Patterson concurs: "All we can do is give people a chance. We can get them off whatever drug they're hooked to, but it's up to them to fill the void. They've got to find a constructive substitute for the drugs that have dominated their lives." ∞

MONSTERS

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Bartholomai, the museum's director, doesn't believe the skin comes from the long-lost tiger. Instead, he's convinced it was torn from the back of a giant pussycat. "Domestic cats may have escaped to the rain forest decades ago," he speculates. "Then, through the process of natural selection, they may have grown frightfully large to survive in the new terrain."

GIANT OCTOPUS

The Queensland cat may seem big, but it pales before what could be the world's hugest invertebrate—a six-ton octopus said to lurk off the Florida coast.

The beast came to light on November 30, 1896, when two boys cycling along the beach in St. Augustine, Florida, discovered a huge carcass buried in the sand. News of the find soon reached medical doctor and naturalist DeWitt Webb, who rushed to the scene, expecting a whale. But after careful examination he reached the astonishing conclusion that the beast was a giant octopus, the first ever glimpsed by a scientist.

With the help of a Yale professor named A. E. Verrill, an expert on the giant squid, Webb did further studies on the creature. Verrill himself eventually published accounts in local newspapers and a few scientific journals. The reaction of their peers? Outrage. Webb had found a mass of blubber, they charged—nothing more.

The story would have ended there, but for a chance find in 1957 by Forrest Wood, newly appointed curator at Marineland of Florida. Wood was going through some of his predecessor's papers when he discovered a yellowed newspaper clip describing the beast—a six-ton octopus stretching 150 feet, tentacle tip to tentacle tip.

Amazed, he began an intensive investigation, finally discovering a jar filled with samples of the 60-year-old carcass stowed away at the Smithsonian Institution. Then he recruited the help of his friend and fellow marine biologist Joseph Gennaro, Jr., of the University of Florida.

Gennaro persuaded the Smithsonian to let him take a few pieces of flesh back to Florida, and soon he was hard at work. Doing a microscopic analysis of the tissue, he found that it resembled neither whale blubber nor squid tissue. Instead, the cells formed a broad pattern of dark and light stripes seen only in the octopus. He and Wood published their account in *Natural History* magazine in 1971, only to receive a nasty letter from the Smithsonian. How dare they suggest the tissue was anything but whale blubber, the institution demanded, requesting that Gennaro return the borrowed sample at once.

Gennaro ignored the request, and just recently he conducted yet another study suggesting that the tissue *was* in fact something totally unique.

Working from his current lab at New York University, Gennaro cut a snippet of tissue from the Smithsonian sample. Then he removed tissue from a whale, a 60-year-old giant squid preserved in formaldehyde, an ordinary squid, and an ordinary octopus, too. Carefully labeling each sample with a number, he sent the batch off to Mackal at the University of Chicago.

Without knowing the real identity of the samples, Mackal conducted a biochemical analysis of each. They were all more or less similar, he found, except for one containing huge quantities of the supportive substance known as collagen. That sample, of course, turned out to be from the behemoth beached at St. Augustine.

As far as Gennaro is concerned, these results combine with Webb's detailed descriptions to indicate that the monster was indeed a giant octopus. Without any internal skeleton, he explains, an octopus grown large would need huge amounts of collagen to give it support. Whales, with strong internal skeletons, and squid, which use a substance called elastin for support, would have no such requirement, even if they did weigh five or six tons.

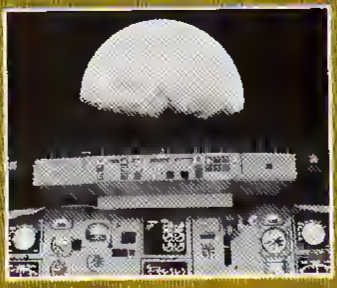
If any kin of the giant octopus still roam the sea, Gennaro says, they would count among the ocean's greatest beasts. "If it's anything like the octopus we know," he adds, "it lays hundreds, even thousands, of eggs at a time. There could be more than just a few of them, but they'd be harder to find than lake monsters. The ocean is a pretty big loch."

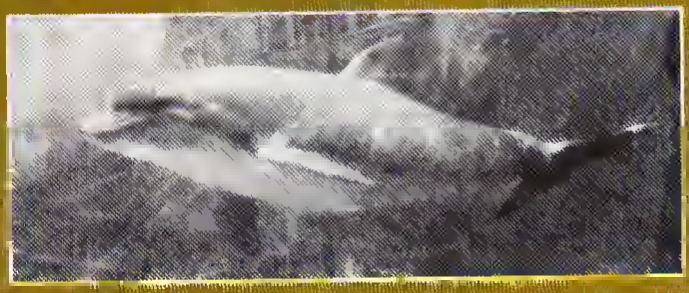
Monsters are a part of our heritage. The first sailors believed that if they didn't fall off the edge of the earth, a man-eating sea serpent would devour them alive. Reports of leviathans and mermaids continue to this day. Most of these, when examined, turn out to be mistaken identifications of known animals. Yet every once in a while a rumor turns out to be something extraordinary, a previously unknown animal. As in the case of the pygmy hippopotamus. For years natives in Africa talked about these miniature hippos, and no one believed them—until one was finally captured.

Yale University biologist Alvin Novick doubts that cryptozoologists will uncover anything significant. "There are far more important challenges to biologists and far more important uses for large expenditures of time, money and talent," he says, "than seeking marine apes in the Aleutians, sea serpents in Maryland or zeuglodons in Vermont. Belief in these creatures is nothing more than a reflection of anxiety in the modern world of science and an obvious extension of current interest in the paranormal."

To Richard Greenwell, though, the future of cryptozoology is bright. "From a statistical perspective alone," he contends, "some of these animals just have to be real. The field won't all crumble on one claim; we may be wrong about Bigfoot and right about Loch Ness." ∞

NEXT OMNI





SECRET OF THE MEGALITHS—The Incans of South America speak of a great power by which their ancestors could turn rock into soft clay. From material they say the ancient builders of prehistoric South American ruins including a mile-high fortress called Machu Picchu and the great sun gate, Thuanaco. Some scholars dismiss this deadpan as legend, but the French chemist Joseph Davidovits. He argues that this very technique may have been used to mold many South American monuments and also some of the most famous megaliths of antiquity. Stonehenge, the Easter Island statues, even the mighty pyramids, he contends, were *not* made of blocks dragged by millions of slaves; instead, they may have been molded in place with sophisticated technology rivaling that of today. To learn more about a controversial new theory which, if proved true, would force a major revision of ancient history, look for next month's *Omni*.

DREAMLAND—Fantasy art, which deals with the literal existence of impossibilities, is as wide and diverse as the realm of fiction. Each artist has his own unique approach to realizing his personal vision. The paintings of Roland Cat are characterized by the paradoxical qualities of familiarity and strangeness. Cat's carefully controlled images are rendered with great subtlety of detail. There is a feeling of childhood about these images—and a disquieting sense of hallucination. You won't want to miss the enchanted realm of Roland Cat in the February *Omni*.

THE FORBIDDEN EXPERIMENT—What happens to a small group of people when they discover they are about to die? Cockpit voice recorders found in the charred ruins of downed airplanes provide data—ethically impossible to collect otherwise—to psychologists studying the question. The words haunt: 'Come on, back, you're sinking. Don, come on back. . . . Are we clear of that Cessna?' 'Brace yourself.' 'I'm sorry.' 'I'm sorry.' They also reveal a surprising concern for small detail and a respect—sometimes unhealthy—for cockpit status. Our next issue reports that studies of last words are spurring airlines to improve communication among crew members. The research results from a growing awareness that survival often depends on what's said in the early seconds of a crisis.

FICTION—'The Shirt's Tale the Shorts Story' is a Valentine treat from a master of whimsy, Thomas M. Disch. In it an unlikely couple meet and find romance in the big city. In Lois Metzger's story 'The Best of Both Worlds' a young woman comes up with a unique solution to the problem of having too many suitors.

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of one performer using his hands and legs to operate four stilts. It took 15 minutes to get inside the creature. The designers created an entire skeletal structure that the performer strapped on, so that when the legs stretched, for example, underneath the latex skin one could see bone movement.

Operating the larger creatures was such a physical workout, Henson explains, 'that we started training a team of performers eight or nine months before we began shooting, to get their bodies in shape.'

Kurtz adds: 'It was almost like a repertory company. We had a group of mimes and regular performers who rehearsed for eight or ten weeks to learn the various necessary movements. They were trained by Jean-Pierre Amiel, a Swiss mime, who was very good at analyzing an overall movement and then isolating it into little bits to be worked on.'

For every creature in front of the camera, there were usually three to five performers making it work in a lifelike manner. 'One person was designated the primary performer,' Kurtz says. 'It was his or her responsibility to generate the personality of that character.'

Sometimes the person inside did the body's moves only, and other people were doing the face, Henson says. The primary performer also spoke the dialogue and usually controlled one of the hands, but hands are enormously difficult to operate convincingly, as he and Kurtz discovered while bringing *Empire*'s Yoda to life.

'They're especially difficult when you're trying to operate them from a distance,' says Kurtz. 'It's almost like looking in the mirror and trying to cut your hair. Everything's reversed. The performers rehearsed in front of mirrors and video monitors, so they would be able to ad-lib and know where the hand was going.'

'In some scenes,' Kurtz continues, 'we had up to twenty creatures onstage, which meant sixty people scattered about, operating them. By using radio-control mechanisms to open and close eyes, and mechanical linkage devices for hands, eyebrows, and facial expressions, the Henson team solved its problem of logistics. According to Kurtz, radio-control mechanisms are 'still a bit crude. You're transferring your movement to electrical energy, then back again to a servo motor, to a mechanical movement. They have a tendency to jerk slightly.' Mechanical linkage had the advantage of being directly linked to the performers' hands. The devices, somewhat like bicycle brakes, were made even smoother by adding hydraulic fluid to the tubes around the wires.

Tubes, wires, and skillful performers are responsible for bringing *The Dark Crystal* to life. 'The whole picture is one long special effect,' Kurtz claims. 'But we hope you won't notice that as it unfolds.'

PHENOMENA

A graceful whorl of earth and stone snakes out into the waters of Utah's Great Salt Lake. This delicate earthwork was the creation of man, not nature. Specifically, it was designed and built by Robert Smithson, a landscape artist who preferred to use wide open spaces as his canvas and elements of the earth as his design materials. This piece of his art, entitled *Spiral Jetty*, pays homage to a design that has fascinated artists for centuries, from the recurring ornamental spirals in ancient Celtic art to some of the more avant-garde architectural visions of the twentieth century. After completing *Spiral Jetty*, Smithson died in a plane crash while supervising the construction of another of his earthworks. This view was taken by Giantranco Gorgoni, using Kodachrome 25 film with a 24mm lens on his Nikon F.DO

Puzzling in the new year, blind cubing, and oughtagraphs

GAMES

By Scot Morris

Several months ago we asked how long it would be before someone claimed to be able to solve Rubik's Cube while blindfolded. We believe that our challenge has been met.

Paul Hertzel, thirty, of Waconia, Minnesota, was the first claimant to come to our attention. He studies a mixed-up cube for an hour or two, noting which subcubes need to be moved where, then dons a blindfold or holds the cube behind his back and starts twisting. After about five minutes and up to 200 rotations, it's done.

We haven't seen Hertzel perform this feat, but his description of how he does it reassures us there's nothing superhuman about it. But how does he "memorize so many rotations? He doesn't. "It's easier than it sounds," Hertzel explains. "If you were to jot down as one number all the number sequences you have memorized, it would be a very large and impressive number. Starting with your birth date, social security number, address, zip code, phone number, office phone, and so forth, it wouldn't take long to compile a 100-digit number that would appear random to anyone else. To reel off the whole number, all you need do is concentrate on the order of the subsets. You don't have to labor to recall your phone number; only its placement in the listing."

"Cubists" similarly have already memorized whole sequences. There's Rubik's Maneuver, a 12-step process to flip two edge-cubes over without disturbing the rest of the cube; another 12-step combination exchanges two sets of corner subcubes without affecting anything else. The blindfolded cubist need only remember which combinations are needed to restore a cube, and in what order. In some cases even this order is flexible, but the individual moves are performed by rote.

"My memory isn't exceptional," Hertzel adds. "I suspect someone with a better short-term memory could cut the study time down to ten or fifteen minutes. I assure you, it won't be long before you hear of some guy in Paducah or some school kid in Mexico City who can do this much faster than I can."

Indeed, it wasn't more than two weeks before we heard from David Singmaster in London, about John White, a student at the University of Warwick. White, he reports, can study a scrambled cube for about ten minutes, then solve it behind his back in a little over two minutes.

So we've had the first Rubik's Cube divorce (as predicted in September 1980), and now there's blind cubing. What next? We're waiting to hear about someone who solves a cube while juggling it. We expect this will first be done with two cubes (or a cube and a ball) juggled in one hand while the other hand does the twisting. Then we move to a three-object cascade, solving first one cube, then two, then three simultaneously. We don't expect this last challenge to be met before 1985.

The first commemorative issue to honor Rubik's Cube. Hungarian two forint stamp.

Scientists at Battelle Institute's Pacific Northwest Laboratories have created Cubot, a cube-solving robot. Cubot scans a scrambled cube with its optical system (eye), then its microcomputers (brain) direct mechanical grippers (hands) to perform the necessary twists to solve the cube. "Cubot can solve any scrambled cube in less than four minutes," said Dr. Michael A. Lind, a spokesman for the research group, "but we hope to reduce this to about two minutes."

In higher-order cubology, Uwe Meffert, the puzzle designer we featured last October, has sold his design for a $5\times5\times5$ cube to Ideal Toys, which will market it later this year as a follow-up to the $4\times4\times4$ Rubik's Revenge. Ideal will call this cube another "Rubik" invention, but don't believe it. Meffert has a working model of a $6\times6\times6$ cube, which will come next, and has designs on paper for the $7\times7\times7$.

HAPPY NEW YEAR

Is it possible to write the digits from *1* to *9* in order, and, by inserting only + and − signs, make an equation that equals *1983*? We don't think so. Don Hastings, of Detroit, who is interested in such things, says that the next date obtainable by this method (and not allowing a − in front of the first figure) will be *2012*. The last was *1967*.

Reaching *83* is easier; there are at least 13 ways to do it. For example, $1-2-3+4-5+6-7+89$ uses seven inserted symbols, $12-3+4-5+6+78-9$ uses six. There is only one way to reach *83* if you use just four + or − symbols, Hastings says. Can you find the unique formula?

Some people take this number play to extremes. M. Emrehan Hafici, an electrical engineer in Ankara, Turkey, sent us a strange and wonderful numerical ode to 1983. It includes, for example:

Ways to represent the integers from *1* to *25*, using the numbers *1*, *9*, *8*, and *3*, in order, and inserted symbols. (He allows the four standard functions, including an initial minus sign, factorial exponents, and square root.) Here are sample formulas for the first two integers:

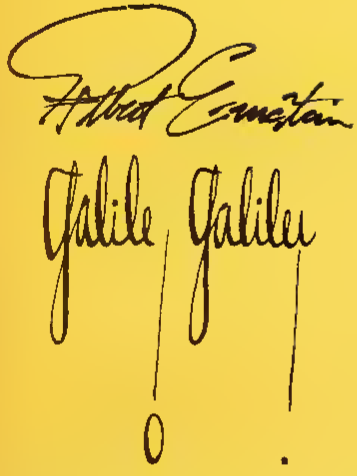
$$1=-1-9+8+3$$
$$2=-1\times(9-8)+3$$

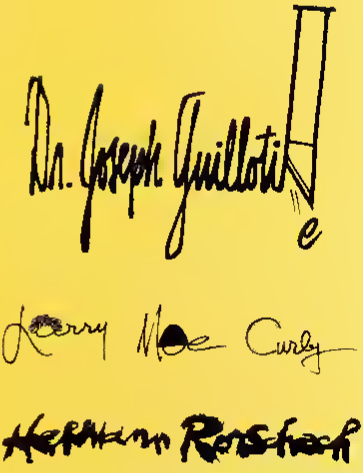
How many formulas can you find for numbers 3 through 25? (Answers are on page 82.)

In addition, there are formulas to yield *1983* that use one digit repeatedly, but exactly ten times. Hafici sent nine formulas, naturally, with these two starting the list:

$$(1+1)^{11}-11\times(1+1+1)!+1=1983$$
$$(22\times2)^2+(2+2)!+(2+2)!-2/2=1983$$

Then there were five different ways to represent *1983* that use one *1*, nine *9*s,





eight *8*s, and three *3*s in order, ways to do it with ordered digits (e g $-1-2+34\times56-7+89=1983$), ways to do it by using the letters in the name *Omni* (which, sideways appear as *0 3 2* and *1*) as exponents We can't print the whole collection here but we'll make copies for interested readers who send a self-addressed stamped envelope to 1983 Formulas, *Omni*, 909 Third Avenue New York NY 10022 (We were going to say "Space limitations prevent us from printing " but frankly, that wouldn't be the whole truth There are other limitations as well We're just glad to know that the formulas are there if we need them)

Space limitations don't prevent us from printing this coda on the theme from Halici's wife Uger Set out 29 matches like this

Mrs Halici's challenge Move matches around in this design to produce *1983* What is the minimum number of moves needed to accomplish this?

VERBAL VEXERS

WORDS The words below are unusual They share a common property and in fact are the only common English words or names we know of that have this property What is it?

JACKAL
AVAIL
LEEKY
THORIA
VICTORIA

SENTENCES What is the significance of the following sentences devised by Paul Hellweg

1 *Man can make lunar excursions in extravagance*

2 *"Made certain discoveries extraordinaire!" Columbus informed Isabella*

3 *Modern democracy created certain laudatory experiment extolling virtuous independence*

COMPETITION #26 OUGHTAGRAPHS

Readers may recall our Competition #9 for calligraphic wordplay or "designatures" A runner-up in that competition was Jeffrey Scott of Los Angeles, with his clever rendering of the words KNOWLEDGE and IGNORANCE which can be read as either word depending on where one divides the letters (April 1980)

Scott is a television screenwriter specializing in those animated Saturday morning cartoon shows (he has done nearly 200 scripts for *Superfriends Spider-man*, *Spider woman* and *Thundarr the Barbarian*) Most recently he developed and wrote the animated *Pac-Man* series

Recently Scott sent us the signatures shown on this page, which he calls "oughtagraphs" These are the signatures we'd like to see the way certain famous people *should* have signed their names We present them here as inspiration for our latest competition

Send us one original oughtagraph for any personality living dead or fictional The grand-prize winner will receive $100, runners-up (2–10) will receive $25 each Neatness definitely counts All entries become the property of *Omni* None will be returned Send entries (postmarked by February 15, 1983 from within the United States or by March 1 1983 from other countries) to Omni Competition #26 909 Third Avenue New York NY 10022 ☒

LAST WORD

By Randy Cohen

"Our songs about the weather are still in a primitive state. I urge the Weather Bureau to hire writers to create state-of-the-art weather songs."

and whimsical seeker of truth. These are letters he has written and received

Dr. Richard Hallgren
Director
National Weather Service

Dear Dr. Hallgren:

What about weather songs: that's what I want to know. The President has made it clear that improving our productivity is a prime national priority, and that means technological improvements. Despite this clear patriotic statement of American goals, our songs about the weather are still in a primitive state. For example:

"A Foggy Day in London Town"
"Somewhere over the Rainbow"
"Raindrops Keep Fallin' on My Head"

Old-fashioned? You bet! It's time someone did something about it. I say that our weather songs should embody the technical sophistication that your agency brings to its work. Thus, I urge the Weather Bureau to hire a few songwriters to create state-of-the-art weather songs. Here are a few titles to help you get started:

"A Partly Cloudy Day with a 60 Percent Probability of Precipitation in London Town"
"When the Barometer Is Rising Down in Dixie"
"Temperature Inversion in Paris"
"I've Got a Satellite Photo of Our Love"

What do you think? Are you ready to take up the challenge? I would be more than happy to provide you with the names of several excellent American songwriters. (Here's one: Stephen Sondheim.) In addition, I'd be quite eager to participate in the project directly.

Randy Cohen

Dear Mr. Cohen:

I must admit I never realized there was such a clear connection between prime national priority and weather songs. The concept is refreshing.

I am sure you will agree with the many citizens and taxpayers of our great nation, who rely on the National Weather Service (NWS), that issuing weather warnings and forecasts is serious business. What resources are available to the NWS to fulfill its mission must be wisely spent in this era of austerity.

Thank you for your ideas and interest. Maybe a private meteorological concern would have an interest in weather songs if it is looking to attract a larger audience.

Robert L. Sorey
Meteorological Division
National Weather Service

Dr. Farlah Jenkins
Department of Paleontology
Harvard University

Dear Dr. Jenkins:

Congratulations on your great discovery. As I understand it, you've found the jaw [illegible] mammal, and it's got triangular teeth. Wow! They say in the papers that it's a little like the Monjurotheriids and a little like the Kuehneotheriids, but is definitely neither, the plot thickens.

I do have a question. I gather that the naming of a new species is the privilege of its discoverer and that in most cases the discoverer names his find for himself, and why not? However, I'd like to suggest another angle on this thing. Would you be willing to name it for my girlfriend? She is a wonderful woman, and it is nearly her birthday. I've been searching around for the right gift, and a new mammal would be just the ticket.

What do you think? Can we work something out? If it would help, I'd be glad to send along many more details about her. By the way, this species nomenclature business is new to me. Does money usually change hands?

I look forward to hearing from you about this, because if you've made other name plans, I may have to buy her a book or a record or something.

Randy Cohen

Dear Mr. Cohen:

Thank you for your generous expression of interest in our discovery of the earliest known mammalian fauna in the New World.

I have given serious consideration to your proposal that I name the new mammal in honor of your girlfriend. Without knowing her name, I turned to contemplating the latinization of what information you did provide. I should choose *Cohenamata mirabilis*, the derivation being as follows: genus, Cohen plus *amata*, the perfect passive participle of *amare*, "to love," meaning "The one (female) loved by Cohen"; species, *mirabilis*, or "wonderful" (indeed, your letter asserts she is a wonderful woman).

Regrettably, however, I am dissuaded from this appellation on two grounds. Everywhere the press has touted my statement that this 180-million-year-old fossil must have been shrewlike in proportions and in habit. Surely it would be a most unhappy birthday present for a lady to have her name so associated. Secondly, I would never be able to provide my colleagues with a rational explanation for my action. The ensuing scandal would envelop us all.

However, I am not unmindful of your plight in selecting a birthday present, and I would agree with the implication in your letter that records and books are a bit of a bore. Toward this end I am sending a piece of the rock in which the fossil was found; hung on a suitable gold chain, it ought to be at least a very unusual pendant. And I'm also sending an 8" x 10" glossy of the jaw, suitable for framing and inscribed from

Farlah A. Jenkins, Jr.
Harvard University