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APRIL 1982

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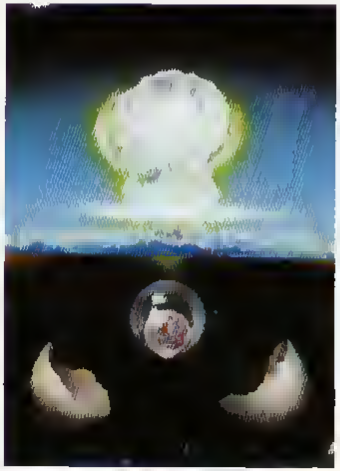

The striking vision depicted on this month's cover is by Japanese artist Yoshihisa Sadamatsu. The emergence of an egg-encased infant beneath a horrific mushroom cloud foretokens an ironic hope for mankind's continued existence in this quintessential science-fiction art

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FIRST WORD

By Ben Bova

"The best way to bring about economic well-being is to invest significantly in scientific research and new technology."

The first year of the Reagan Administration has been called the Year of the Budget. President Reagan and his advisers have tried to solve the economic woes of the United States mainly by cutting taxes and slashing the federal budget—almost everywhere except in defense.

Why is the U.S. economy staggering so badly? All the industrialized nations are in economic trouble. Across the world, with few exceptions, the number of the unemployed in industrialized nations is increasing, inflation is eroding the value of money, and productivity is plummeting. Communists claim that capitalism is inevitably doomed and that economic downturns are merely symptomatic of the system's ultimate collapse. Yet the Communist nations are in deeper economic trouble than the capitalist nations. More than six decades after Lenin's seizure of power, the USSR cannot feed its population and must import grain from its archenemy, the United States. From Kampuchea to Poland, economies run by Communist governments have produced famine and privation. One disenchanted Communist Pole remarked ruefully when martial law was imposed there last December, "I guess you can't have communism without tanks."

In the industrialized West, ask three economists for the reason behind our hard times and you'll get 17 different answers. OPEC's price increases, excessive wage demands by the labor unions, burden some government regulations of business, high interest rates, too much government spending, not enough investment in capital goods, and so on.

Some economists have revived a discarded theory first suggested in the 1920s by the Russian economist Nikolai D. Kondratiev, who perceived a 50-year-long cycle in the economic affairs of nations. Kondratiev died in a Soviet prison camp, possibly because he dared to link Communist economic trends with those of the capitalist nations.

According to the Kondratiev Cycle, we are now in the fifth price upswing in America's 200-year history. Upswings in the 50-year long Kondratiev Cycle are marked by price inflation, high interest rates, and a comparatively beneficial position for the producers of raw materials, which include farm products. In downswings, farmers and other raw-material producers suffer relative losses as their prices deflate while the real wages of workers rise.

Since approximately 1972, when OPEC began its price hikes, a new stage of world economic development has begun. A leading stimulus to this development is provided by population pressure. As world population grows, the demand for food and other resources forces prices up. Even clean air and water are becoming expensive, and this is true everywhere.

We tend to see all this as a "crisis." Studies such as the Club of Rome's *Limits to Growth* and President Jimmy Carter's *Global 2000* foster the notion that we are approaching a very crucial phase of history. A worldwide cataclysm is staring us in the face. This may well be true, but it is hardly inevitable. Our economic troubles today may be an opportunity to create a better, healthier tomorrow, if we act prudently. Many economists have drawn the conclusion that the best way to get economic well-being out of the current situation is to invest more in scientific research and the development of new technology.

Since the Great Depression of the 1930s, economists have suggested—and politicians have gone along with them—that economic downturns can be turned around if the money supply is expanded to stimulate consumer demand. This has been called Keynesian "pump priming," although it is not quite what British economist John Maynard Keynes had in mind. Despite President Reagan's bold rhetoric about a new economic revolution, the Reagan tax cut is essentially a pump-priming measure, an attempt to put more money into the consumers' pockets and thereby stimulate the flagging economy.

An increasing number of economists are coming to think that stimulating consumer demand will not work by itself. Investment must be made in *production* as well as in consumption. These economists insist that we must invest in research and development if we want to achieve economic health. Particularly, we must invest in those areas of R&D that can create profitable new industries: energy, transportation, satellite communications, electronics, pollution control.

Bruce Nussbaum, associate editor for international money management of *Business Week* magazine, has written: "... the economic base of U.S. strength is as important a projection of general U.S. power around the world as the number of missiles the country has aimed at the Soviet Union."

Today we hear loud cries for a "reindustrialization of America." But reindustrialization does not consist of propping up failing old industries such as steel and automobiles. That is investing in the past. We must invest in the future.

"One way to get private business moving again is to increase spending on research and development," Nussbaum writes. He insists that the road to economic health lies in R&D investment.

Because Reaganomics is *decreasing* investment in R&D, it seems doubtful that the administration's economic remedies will cure our sick economy. Without a vigorous commitment to science, technology, and the education that underpins them both, all the sacrifices we make in the nation's social services and all the weapons we buy for our defense are not going to make us any safer, stronger or richer.

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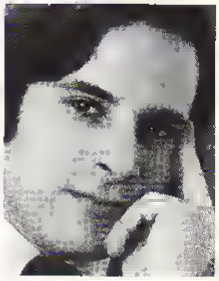
WILLIS

DIPIETRO AND MOLENAAR



SANDER

No one paid much heed to the Viking photograph of Mars labeled HEAD. The human face peering out into space was not a Martian equivalent of Mount Rushmore—only a geological formation. The resemblance, many experts assumed, was merely coincidental. Thus, the mysterious photograph was filed away and forgotten until electrical engineer *Vincent DiPietro* stumbled upon it nearly four years later. DiPietro, an expert in satellite image processing, labored to improve the clarity of the picture with the help of colleague *Gregory Molenaar*, a computer programmer. "It started strictly as a hobby," DiPietro recalls, "but when our color enhancements revealed such fine details as eyeballs with round pupils, we began sinking a lot of our time and money into the project." For the latest evidence in the interesting case of 'Face in Space,' turn to page 54. "With each new clue that surfaces," the Space Age sleuths say, "the mystery only intensifies."

When roving journalist *Gordon F. Sander* arrived in southeastern Washington to report on the baptism of Robert Redford's Institute of Resource Management, his initial request for an interview with the mediaphobic actor-activist was rebuffed. Sander's persistence paid off a month later when he was granted the first of three lengthy tête-à-têtes with Redford in New York. The resulting article, "Sundance: to a Different Drummer" (page 78), sheds new light on the movie star's passionate concern for protecting the environment. A writer with a special affinity for iconoclasts and idealists, Sander is now at work on a biography of Rod Serling (who, coincidentally, gave Redford his first break as an actor in the old *Playhouse 90* days). Sander's work has also appeared in publications as diverse as the *New York Times Magazine* and the *Encyclopedia Americana*. "I know it's a cliché," says Sander of his foray into Redfordiana, "but Redford is probably the closest thing to a rugged individual I have ever encountered."

Unlike some other sociologists who place man on a lofty pedestal high above the rest of the animal kingdom, Lionel Tiger looks to our biological heritage for an understanding of the complex ways in which members of our species interact. In this month's Interview (page 90), he speaks to *Omni* contributor *Bill Moseley* about the evolution of human society from earlier primate hierarchies. Moseley says, "Name any modern social phenomenon—feminism, marital breakups, the gay rights movement—and Tiger will trace its origins back to the days when our grunting fore bears swung from trees." A self-proclaimed urban phenomenologist, Moseley conducts his field work in the living laboratory of New York City, where he writes on such varied topics as the Guardian Angels, graffiti art, and boom boxes.

There's nothing magical about writing, is *Harlan Ellison*'s standard retort when asked about his prolific and highly accomplished career as an author of science fiction. And to prove it, he creates stories in full view of live spectators. Sitting in the window of Dangerous Visions, a bookstore in Sherman Oaks, California named after his classic anthology, Ellison performed for eager fans, indeed for anyone who happened to be passing by. Few writers would welcome strangers peering over their shoulder at their prose in the making, but Ellison seems to thrive on the attention. In fact, he will even compose stories to order, generously incorporating titles, themes, and characters suggested by onlookers. "When Auld's Acquainfance Is Forgot" (page 72) is the culmination of such an exhibitionist effort. Included in this offering are ideas from four friends: Dottie Amlin, Diane Duane, Mark Valenti, and David Gerrold. Completed in only one day, the story epitomizes Ellison's philosophy of bringing literature home to the masses.

Finally, *Connie Willis* makes her debut in this month's *Omni* with "And Also Much Cattle" (page 58), the tale of a galactic troubleshooter's encounter with a thirsty flower in a terrifying locale. Though new to these pages, Willis has had short stories published in *Galileo*, *Chrysalis*, *A Spadeful of Spacetime*, and *The Twilight Zone*, among other science-fiction showcases. She has also been nominated for both the John W. Campbell Award and a Hugo. Her novelette, entitled *Fire Watch*, will be published in *Isaac Asimov's Science Fiction Magazine*.

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APRIL

LETTERS

COMMUNICATIONS

British Support

I wish to express my support for *Omni's* stand against a trend in the United States I refer to the Moral Majority, of course

From this side of the Atlantic Ocean it seems America is becoming polarized religious fascists at one end and virtually everyone else at the other If the Moral Majority has its un-American way, America will become a nation of imbeciles Having experienced your warm hospitality and high standards I see this as a very troublesome development

Surely America's role is to lead this planet toward the exploitation of outer space—a feat beyond every other nation on Earth This ideal may indeed be endangered by the ramblings of an absolutely ludicrous organization

Unless Americans are careful they will become the laughingstock of this planet

Tony Norden
Redbridge, England

Fact or Fiction?

In Continuum [February 1982] you published an item about Dr Peter Lewin's attempt to prove that sounds have been recorded on ancient plates pottery and other artifacts

This theory was also proposed by Gregory Benford in his science-fiction story Time Shards, reprinted in the anthology *The Best Science Fiction of the Year #9* (Ballantine Books 1980)

In the story by Benford the feat was accomplished by integrating a turntable, a stylus and a computer

Robert G Mest
Tennessee Colony Tex

There has been some debate in the past in your Letters columns about "Soft Ions" [October 1981] I would like to clarify the story's categorization It was not science fiction; it was science fiction come true

Steven Colnek
San Francisco, Calif

Semen Collectors

In 'Laurels (and Hardys)' [January 1982], a topic headlined "One-Upmanship Cup" describes MEGS, or Male Electronic Genital Stimulator as uniquely appropriate for certain uses This kind of device was being used at least 25 years ago by veterinarians Its name is Electro Ejaculator, and it was used to collect semen from animals

Wes Buller
Brookshire, Tex

Here Come the UFOs

UFO investigators have had a slow year, but things should pick up once Terry Gudgel starts selling his illuminated frisbees [Antimatter December 1981]

Most interesting, especially since so many UFO investigators including Dr J Allen Hynek tell us that there are as many as 100 reports of UFO sightings per day

Come April 25 and August 25 (give or take a week or two), UFO sightings should reach peaks According to Jeff Hecht, author of the Antimatter article areas of the world likely to experience good to excellent encounters (including abductions) will follow these routes

Across 40 degrees latitude in Turkey Greece, Italy Portugal and Spain and into the northern New England States across the U S -Canadian border and up toward Alaska

From 60 degrees latitude in the USSR and southward toward China the UFO paths will continue through the northern portion of India and on to the southern tip of the Arabian peninsula

The first really good sighting is likely to be in Spain or Portugal

Janina Leeds
San Francisco, Calif

First Earth Nihilism

Lieutenant Colonel Jim Channon's concept of a so-called First Earth Battalion [Continuum February 1982] seems to be nothing more than an elite paramilitary force Such a vigilante group if allowed to purge the world of evil, would only become an autonomous nihilistic strike force bent on imposing its own sense of morals on others Hitler's SS might seem like Boy Scouts in comparison

Timothy Theophilakos
Perth Amboy, N J

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.*

Nutty Nostradamus Aside

With reference to the article on Nostradamus [Antimatter, January 1982] some readers might be interested in what Nostradamus really said, all the nutty interpretations aside. There is a modern scholarly edition of his quatrains, titled *Prophecies and Enigmas of Nostradamus* edited and translated by Liberte E. LeVert. Older readers of science fiction might be able to work out the editor's name as an anagram of an old-timer in the field.

Everett Bleiler
Ridgewood, N.J.

Serious Issue

I am glad to see professionals in the scientific community are beginning to take the life-after-death issue seriously. ["Recollections of Death," February 1982] It is about time that those people who have near-death experiences be listened to as rational, sane human beings.

Walter L. Isenhour
Thorntown, Ind.

***Omni* Knights Crick**

In your March interview Francis Crick is given the title Sir. I was unaware he had been knighted by the Queen of England. When did this occur?

Brian Chase
North Springfield, Va.

Crick has been knighted only in a few copies of Omni's *March 1982 issue. This error occurred in a moment of misplaced enthusiasm. We do feel, however, it is an honor certainly appropriate for the father of molecular biology.* — Ed.

Tasteless, Not Cute

The item titled "Golden Hayes Award" ["Laurels (and Hardys)," January 1982] should be awarded the "fickle finger of fate." I cannot imagine any magazine taking so much out of context in order to get a cute filler.

You do not get a "cute" award for this article. However, I would be more than willing to give you the 1981 Tasteless Award.

Vernon Lowe
Exposition manager
Hazardous Materials
Workshops and Exposition
Cincinnati, Ohio

Postal Response

In Forum [February 1982] you printed a letter about the Postal Service. Your editorial response cited an incident in which a mailman threw his mail in the garbage. I am a subscriber to your fine magazine, and I am extremely upset and feel insulted by this letter. I am a mailman. In any occupation there are going to be "bad apples" in the bunch. Why must the mailman be harassed by the public?

I care about the people on my routes and I go out of my way to help anyone with a postal problem or any other kind of trouble. So how about a kind thought for your mailman tonight?

Paul N. Camarda
Jamaica, N.Y.

Heavier-than-air Error

My colleague Patrick Moore has repeated a common error about the well-known statement by Simon Newcomb regarding heavier-than-air flight [Stars, January 1982]. Moore writes: "And after the Wright brothers had successfully flown, Dr. Simon Newcomb . . . claimed that the only possible heavier-than-air machine was one powered by birds."

In the first place, Newcomb made the statement before the Wright brothers' flight. In the second, he did not say it was impossible, only that it would require "the discovery of some new principle." Newcomb was right. At the time he spoke, several people were trying unsuccesstully to fly with steam-powered machines. The "new principle" was the internal combustion engine. Soon after Newcomb made the statement, the engine was developed to the point where its greater power/weight ratio brought manned heavier-than-air flight within reach.

L. Sprague de Camp
Villanova, Pa.

Troubled Reader

I have just read Hans A. Bethe's "First Word" [January 1982] and I found the article quite troubling.

My concern over nuclear facilities is not with an accident. Three Mile Island *does* show the system works. My concern is with the waste generated by nuclear plants. If the industry is finding it difficult to store wastes now, what will it be like 10 to 20 years from now? Until the nuclear industry gets involved in a meaningful program to rid the environment of its wastes, I will continue to heat my home with solar and wind power.

David M. Chanley
Nuclear chemist
New England Nuclear Corporation
Billerica, Mass.

Utter Nonsense

In the article "UFO Update" [Antimatter, November 1981] Allan J. Hendry states that the famous star map allegedly found in 1961 by Betty Hill onboard a landed UFO "proved to be so logical that, after seven years of investigation, not even Carl Sagan could do much to damage its credibility." This is utter nonsense. If Hendry had taken the trouble to read two articles written jointly by Carl Sagan and me in *Astronomy* magazine, he would have understood that the interpretation given to the map can be shown, on grounds of elementary statistics, to be entirely worthless.

Furthermore, it did not take us "seven years of investigation," but rather about two hours. Finally, we did not "damage" the credibility of the map; we demolished it.

Steven Soter
Cornell University
Ithaca, N.Y.

Radio Relays

When I first heard that, at some point, we will lose radio contact with *Voyager 2*, I

CONTINUED ON PAGE 130

PLANT REVOLUTION

EARTH

By Pamela Weintraub

Imagine grains of rice as big as a fist, or tomatoes and potatoes on a single vine. Have a yen for cheese? Pluck it from the tree under your window. And on that long-awaited trip to Mars, take just enough food for the flight, as you plummet to the Red Planet's surface, you'll see acres of Martian wheat billowing in the breeze.

It may not be long before such dazzling plants dot every field and grove. Scientists at dozens of universities have already begun manipulating plant genes, turning old breeds into new superspecies. At such companies as Monsanto and Du Pont, biochemists are designing plants that will fend off parasites and disease. The pharmaceutical industry plans to make a "veggie tranquilizer" with lettuce full of nonaddictive morphine. The Campbell Soup Company has invested $10 million in search of less watery tomatoes and hardier, more productive carrots. And researchers seeking food resources for the Third World are testing crops, looking for ones that would flourish in the barren soil of Subsaharan Africa.

This plant revolution comes in the nick of time. Today more than a quarter of the people on Earth suffer from malnutrition, and millions starve to death each year because they lack affordable food. Complicating matters, world population should double in the next 40 years, forcing us to produce twice as much food just to maintain the status quo.

This vast store of nourishment will have to be grown on less and less land as millions of acres disappear beneath housing developments, highways, and shopping centers. And the soaring cost of fossil fuel, necessary for the production of fertilizer, will push food prices impossibly high, threatening a worldwide famine from which we might never recover.

But plants of the future will help solve these problems. Unscathed by cold and drought, they will span the tundra, the deserts, the Kansas plains. Bursting with proteins and vitamins, they could grow ten times larger than today's crops in the course of only days or weeks instead of months. They would taste better, look prettier, and be easier to digest. Moreover, because these extraordinary new species could produce their own fertilizer, they would require none of the expensive nurturing that is showered on the plants we grow today.

Future plants. Will they obtain beauty from genes that are now found only in birds?

THE MUTANTS ARE COMING

Thanks to James Shepard, of Kansas State University, the first supervegetable to hit the supermarket could be the potato. Shepard, a plant pathologist, has spent the past decade trying to come up with the consummate potato, one that is tasty, nutritious, and resistant to every known plant disease.

From the start, he knew that other scientists had attempted this same feat with conventional breeding—crossing two superior potatoes in the hope of producing a still better offspring. But these researchers soon found breeding better potatoes more difficult than winning the jackpot in Las Vegas. There you get the prize if three cherries line up. But you won't get a great potato unless *50* genes line up, in a *very particular way*. As Shepard points out, "the chances of that happening with conventional breeding are infinitesimally small."

To improve his odds, Shepard decided to manipulate the genes themselves. After experimenting for a few years, he found a way. He could make a potato's genes change spontaneously simply by dissolving its cells in an enzyme solution that removed the hard cell walls. These unwalled potato cells, called protoplasts, mutated 20 times more frequently than normal cells, and the potatoes grown from them were drastically different from the parent potatoes.

Shepard then spent years exposing thousands of tiny potatoes grown from protoplasts to diseases like the deadly blight that caused the Irish potato famine in the mid-nineteenth century. Most of the potatoes died, but a few—the sturdiest, naturally—had mutated so as to develop resistance to disease. These were then cloned into groups of 50 and cultivated in the field.

Last summer Shepard grew 2,300 potato clones on farmland stretching across North Dakota and Colorado. Some

CONTINUED ON PAGE 126

LIFE

By Dr Bernard Dixon

Little more than five years ago distinguished scientists warned of the horrendous dangers associated with recombinant-DNA experiments. "I fear for the future of science as we have known it, for humankind, for life on Earth," wrote Nobel laureate George Wald. The new technology excites me for its sheer virtuosity and its intellectual and practical potentialities, yet the price is high, perhaps too high."

Another luminary, Erwin Chargaff, saw "an irreversible attack on the biosphere" as a consequence of ill-conceived gene splicing. My generation has been the first to engage, under the leadership of the exact sciences, in a destructive colonial warfare against nature," he wrote. "The future will curse us for it."

Politicians followed suit. British Member of Parliament Leo Abse warned about the incalculable hazards of "dicing with domesday." And Alfred Vellucci, mayor of Cambridge, Massachusetts, wrote to Philip Handler, president of the National Academy of Sciences, to inquire whether a "strange, orange-eyed creature" allegedly seen in New Hampshire was a mutant that had escaped from a DNA lab.

Why, then, are such critics today so much less worried? Why are even those biologists who first raised the alarm now desperately keen to convince the general public that all is well? As the fledgling technology moves from laboratory bench to large-scale industrial production, will the public believe them?

As discussed at a recent symposium held in London by the Centre for Medical Communications (CMC), there is in fact much cause for confidence. With the explosion of new knowledge in molecular biology, today's genetic manipulators have a far better understanding of the risks associated with the technology. For example, we now know that the danger of genetically engineered organisms escaping from laboratories and causing epidemic cancer or other horrors has been grossly exaggerated. The bacterium *Escherichia coli*, the commonest tool for such manipulations, is a mediocre candidate for the role of the Andromeda strain, because it has been so enfeebled by laboratory life that it can scarcely survive in the human gut. Meanwhile other microbiologists are preparing even safer hosts for recombinant work. Two likely candidates are the bacterium *Bacillus subtilis* and the yeast *Saccharomyces cerevisiae*, whose safety record is unblemished after more than 40 years' use in the food-processing industry.

More reassuring still is the experimental disaster that fell flat. Like nuclear engineers simulating a reactor failure, genetic engineers at the National Institutes of Health inserted genes for polyoma cancer virus into *E. coli* and then infected mice with this bacterium. The result: The microbes were noninfectious or at least infinitely less so than the virus itself. In other words, a worst-case experiment, set up to show what might happen if recombinant-DNA work went amok, had a benign outcome.

Finally, Dr Stanley Cohen, at Stanford University Medical School in California, has shown that DNA maneuvers of the sort that caused Wald, Chargaff and others acute anxiety are not, after all, to be categorized as new creations of modern science. Bacteria can incorporate foreign DNA by using the same enzymatic methods first highlighted by Cohen and Dr Herb Boyer, once thought to be radically unnatural and potentially hazardous innovations. Of course scientists may exploit such processes with exquisite precision. But they are not confined only to high-powered university laboratories.

Man-made microbes: The fears diminish

So the prevalent mood among pharmaceutical-company representatives attending that CMC meeting was one of the utmost optimism. Illustrative of that high spirit was another happening in Europe shortly before the CMC conference. COGENE, a committee of the International Council of Scientific Unions, announced that the proceedings of its working party on risk assessment were being wound up.

Such confidence and buoyancy seem well justified since genetic-engineering companies large and small, perceiving that they have been given the go-ahead signal, contemplate the astounding array of products that may soon be developed. But caution is still the byword. An abundance of evidence for the safety of new technology does not constitute a cast-iron case. Any accident or hazard during "scale-up" in just one biotactory would forfeit public confidence. And that could set this burgeoning technology back throughout the world.

There is one other important lesson of the recombinant-DNA furore. It would be a pity if overreaction to the (fortunately) ill-founded fears voiced five years ago were to discourage other scientists in the future from blowing the whistle concerning possible hazards arising in scientific research. George Wald and others have been bitterly criticized by hard-line advocates of untrammeled science. And they together with such insiders as Paul Berg, have found themselves spending an inordinate amount of time in public debate. It's to be hoped that anxious researchers on any similar occasion in the future will not feel that such time is wasted.

SPACE

By Owen Davies

Winter, biologists tell us, is the time when life battens down to await more comfortable seasons. But while bears slumbered and orange crops froze, space activists put on a burst of activity. Among the major developments this winter:

- A space enthusiast in the White House began what could be the most elaborate private space venture to date—an attempt to send a profit-making research probe to Halley's Comet, possibly launched from the space shuttle.
- Two leading pro-space organizations, the L5 Society and the World Space Federation, decided to join forces.
- Work started on Spaceweek '82.
- A private group hoping to search out and catalog asteroids, small mineral-rich chunks of matter in space, set off on a quest to raise the additional $700,000 required for the survey.

The private Halley mission was the brainchild of Barbara Honegger, a Reagan Administration policy analyst specializing in space development, and Stan Kent, president of Delta Vee, Inc., a space-activist organization (3033 Moorpark Avenue, Suite 27, San Jose, CA 95128). Their plan is to send a camera-carrying probe to Halley's Comet, to reach its destination in 1985. The profit would come from advertising and promotional tie-ins and from TV stations and theaters licensed to show live coverage of the flyby. According to one movie-industry analyst, U.S. theater owners could gross some $600 million from such a spectacular. At that rate, licensing fees could easily recoup the project's cost, estimated at $150 million. Half of that budget would pay for the mission itself—one third of what it would cost NASA—and the rest would go for publicity.

Technically, the scheme just might work. The probe chosen for the six- to seven-month journey to the comet would be a modified version of RCA's Atmosphere Explorer/Dynamics Explorer satellites, proven in several Earth-orbiting research flights. The company has already studied the task of modifying one of its satellites for a NASA-sponsored Halley Sample Return Mission, which was killed by federal budget cuts. Design changes, assembly, and testing would take slightly longer than three years, according to Dr. Ronald C. Maehl, manager of science programs at RCA's astroelectronics department. That means the mission must get a firm go-ahead this year.

Costs depend on the extent of alterations needed to put armor on the comet probe. To photograph the comet's nucleus, the craft must penetrate a thick dust cloud. This requires a dust shield, which would raise the craft's weight, slow the design and construction, and boost expenses. Yet, without the closeup photographs, the mission's scientific payoff would be severely limited. The shield cannot be designed until the flyby distance has been set. So far, the tradeoff question has not been resolved.

The other technical problem is to design a camera for the mission. None exists, and developing one quickly could be a formidable challenge. As plans stand, that task would fall to Delta Vee, not RCA. It requires a technical prowess not yet demonstrated by this organization, which has specialized in raising funds to support NASA projects threatened by budget cuts. The probe's data, communications, and attitude-control systems all require modifications that cannot be planned until the camera's features are designed.

Even if these mundane problems are resolved, the probe may not make it into space. Competition for room on the shuttle has been high, and funding losses have forced NASA to postpone launch missions long scheduled. Whether room could be found for such a latecomer as the Halley probe is a moot question. Honegger notes that the craft could also be launched by the venerable Delta booster, or even the European Space Agency's Ariane, but even these might be unavailable. Ground stations, too, must be leased, and it is far from certain that any such arrangements can be made. RCA sees this as the most significant problem the project must tackle.

Few space activists want to shoot down a fellow enthusiast's ideas in public, but grass-roots reaction to the Halley project

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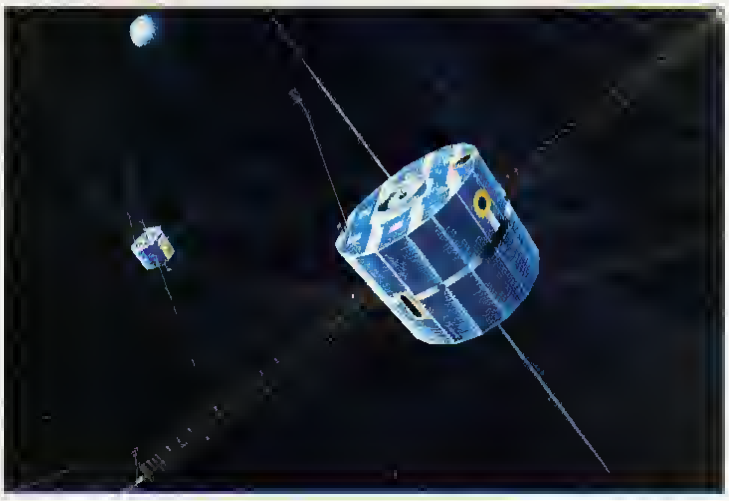

Private mission to Halley's Comet would use an RCA satellite like these, shown in Earth orbit

THERAPY BY MAIL

mind

By Anne Klein

Imagine how stunned I was after spending more than three years and $20,000 on psychotherapy to come across a full-page ad in my favorite psychology magazine that promised to identify my problems and set me on the road to a happier life for just $25.

"The going therapy fee today is $40–$90 a session," the ad read, as if I didn't know. "Nevertheless, our fee for the entire program is only $25. We believe that the $25 you spend for your program will be the biggest bargain of your life."

I'll say.

"We all have beliefs hidden in our minds which cause unnecessary problems for us," the promotion continued. "This Self-Help Therapy Questionnaire is designed to identify and reveal your particular Problem-Causing Beliefs. Most people who have taken the Questionnaire have found it to be much to the point."

I'm too intelligent to fall for this nonsense, I said to myself, still not ready to turn the page. The authors clearly had a gift for exploitation unmatched since P. T. Barnum died, and the ad's claims were so grandiose as to be irresistible.

If you're like most people who have taken the Questionnaire you'll be amazed to discover what your Problem-Causing Beliefs are. Suddenly patterns in your life that you had never quite seen before can come into focus. You can start to understand feelings, anxieties, and behavior characteristics that dismayed you in the past."

I studied the picture of the two men who were offering to counsel me through the mail. William Cavender, M.D., and Robert Fischer, Ph.D., were respectable-looking fellows. One had a mustache, the other had dimples and a blow cut. Together they invited me to fill out a 25-item multiple-choice Self-Help Therapy Questionnaire, printed on the same page. I was to circle N (Never), S (Sometimes), M (Most of the time), or A (Always) in answer to such questions as: Do you try to fool other people by the way you act? Do you feel guilty about certain thoughts or feelings you have? Do you experience feelings of hopelessness on a daily basis?

I had the sense that my responses would not be any more revealing of my inner turmoil than a sample of my hand writing or the lines on my palms.

"After you have filled out and sent us your Questionnaire, we will subject it to an individualized and confidential Analysis," the doctors pledged, adding that there were more than a million possible Analyses that could result. Indeed, a little multiplication on the back of an envelope ($25 \times 25 \times 25 \times 25$) showed that there were 9,765,625 possible ways to respond.

The Diagnostic Phase of my analysis, rich though it was, would be only Step I in the procedure, they said. Then I could look forward to Step II, the Solution Phase.

"In this Phase we will provide you with new Healthy Beliefs to replace each of your Problem-Causing Beliefs. We will also provide you with explicit instructions on how to bring the new Healthy Beliefs into your daily life."

They offered me a money-back guarantee within ten days if I were not totally satisfied—something my therapist had never remotely suggested.

So I put them to the test. I got a money order for $25 and had a serious dialogue with myself as to whether I always, most of the time, sometimes, or never felt ashamed of wanting to be loved by others, cried with tears and sobs when I felt sad, got down on myself when things didn't go the way I wanted, and so on.

Soon there came by return mail, in an envelope marked "Confidential," my do-it-myself kit for my at-home attainment of insight. It contained a copy of the original ad (perhaps I had a friend?), an instruction sheet, and six yellow cards printed with one of my Problem-Causing Beliefs on the face and a New Belief to replace the old on the flip side.

"Begin by picking the Problem-Causing Belief you most want to change," the instructions read. "Take the card with that belief on it and post it in a prominent place where you will see it every day so that the New Belief is facing you. Study your New Belief every day. Repeat it over and over so that it begins to sink into your mind. Once in a while, turn the card over and read your old Problem-Causing Belief to contrast it with your Healthy New Belief. In this way you can remind yourself of

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THE ARTS

By Gordon Mc Comb

Have you ever wished you could stop the hero of a novel from making a terrible mistake? Or perhaps you're the sadistic sort and wish that some of the less lovable characters would make a few more mistakes than they do. Now with computer-programmed fiction, you can write novels while you read them. A new cadre of writer/programmers have made it possible for us to interact with the characfers and make them behave exactly as we choose.

"Interactive games, adventures, and literature are experiencing a tremendous explosion," says Robert Latore, an author and computer programmer. Lafore is one of the leading proponents of interactive fiction, a new form of computerized role-playing that combines the "intelligence" and speed of a computer with the wit and entertainment of a good novel. The unique property of interactive fiction is that the reader is also a player in a game—a role-playing adventure game. What he says and does determines the turning points in the story.

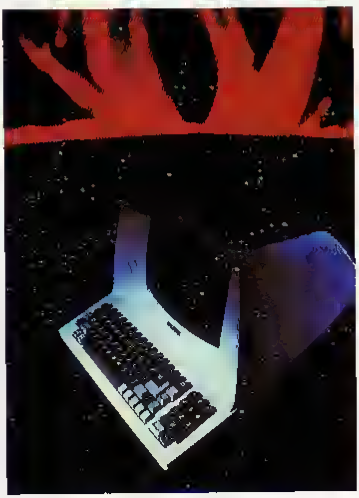
Interactive stories are like the war games played by the military, although they aren t quite so complicated. The reader/player chooses a situation and characters that have been programmed into a computer. The text unfolds on the video monitor and builds until a turning point is about to occur. The computer then waits for a response to be typed into its keyboard. Then it calculates how the player s decisions will affect the story.

Interactive-fiction programs are made possible by the computer s ability to scan its data files rapidly. When a player types in a word or string of words, the computer will shuffle through its memory to see whether it can find a match. If, for example, the player is confronted with an evil wizard who possesses great powers, the player might enter the statement "Cast disappearing spell." The computer will successively sample each word, search out the stored definitions of these words, link them all together, and then determine the consequences of this statement.

If, instead, the player inputs "Summon demons of darkness," the computer, repeating its sampling process, will decide the outcome of a confrontation with evil forces. In interactive fiction, the computer acts as confidant, storyteller, referee, and scorekeeper.

Consider that you have many pathways to follow," Lafore says. "Every time you come to a branch or fork, you must multiply the story possibilities by two or more." A story can get large and complicated very quickly. A typical short-short interactive story might have dozens of plot lines. Often, however, there is only one "correct" ending or goal. The object is to reach that specific ending.

Lafore has developed five interactive-fiction computer stories. Each one injects a large dose of adventure, risk, deduction, and cause and effect. One of Lafore's most interactive stories, entitled "Two Heads of the Coin," involves solving the mysterious disappearance of a friend's wife. The reader/player takes the role of the "world's greatest detective" and "asks" the heartbroken husband questions that are expected to elicit correct responses. By piecing these answers together, one should be able to solve the mystery of the woman's disappearance.



Sit down and let me tell you a story

"The interactivity in these stories is now somewhat limited," Lafore says. "I believe that the advancement of interactive role-playing will be restricted only by the technical means available, such as memory space or data-handling techniques."

The implications of role-playing have created a stir among psychologists, sociologists, and behaviorists. Fictional interactivity is considered unhealthy by a few, a harmless fad by others, and a godsend by the rest.

James Milojkovic, a graduate student specializing in the psychology of computing at Stanford University, in California, sees role-playing/interactive computer games becoming an integral part of our life-style. "There's no question that people will become more involved with this type of game-playing with compufers. People are growing increasingly distant from one another. Computers fill a psychological need, an attachment. They are so responsive, so intimate, that one gets hooked on them very fast. They're much worse than drugs."

This personal attachment that humans share with computers and role-playing games alarms many psychologists. But it is the driving force behind the growing acceptance of, and in fact the hunger for, interactivity.

Experimentation with computerized role-playing certainly is not new. As technical limitations have been overcome, the field of simulation has expanded remarkably. It is, however, a science that only now is catching public attention.

Dr. Gerald Shure, professor of psychology and sociology and director of the Center for Computer-Based Behavioral Studies at the University of California at Los Angeles, has employed computerized role-playing for many years. "We have games where we can simulate certain social and psychological problems for players and see how they resolve them." Shure says. "We can examine the role of threats and see how they affect us. For the players, this is one of the most involving

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THE ARTS

By Spider Robinson

One of the nicest things about the silicon revolution is that miracles are coming into the price range of the ordinary consumer. The latest field to benefit from this boom in cheap computing power is music. Now for less money than you might pay for a good piano or a decent second-hand car you can have at your fingertips the equivalent of a whole orchestra in the form of a compact but powerful electronic synthesizer, a computer-controlled music maker of a thousand voices.

Synthesizers of course have been around for years. Today they are more sophisticated and ever more expensive. A few years ago a New York firm, Digital Keyboard, Inc. (a division of Music Technology, Inc., 105 Fifth Avenue, Garden City, NY 11040), came out with what is generally considered to be the Rolls-Royce of synthesizers: the General Development System, or GDS. Larry Dunn, of Earth, Wind and Fire, plays one on the new Stanley Turrentine album, and Michael Urbaniak, Tangerine Dream, and several university music departments are quite happy with theirs. Fully digital, user-programmable, and equipped with more than 1,500 "voices" or distinct musical sounds, the GDS has at its heart a computer powerful enough to handle an orchestra's worth of playing and still manage a small financial empire on the side. And you'd need one to own a GDS. It currently lists for $30,000.

This year Digital Keyboards unveiled a new synthesizer that gives electronic musicians much of the power and the range of the GDS for a lot less money. This new model, Synergy, lists for one sixth the price of the GDS, or $5,000. Even at that price what you get is a very advanced, very sophisticated machine.

Synergy's computer is capable of producing uncanny duplications of acoustical instruments, down to the scratch of the bow or the pluck of the string. It is also equipped with a 74-key keyboard—remember Bach had only 61 keys to work with and Mozart, 73—which is, in the jargon of the trade, velocity and pressure sensitive. Very simply what this means is that a player can modulate the volume of the music as a pianist does when he adds texture to the music by either gently depressing or slamming down on the keyboard. Previously this was available on only the most expensive synthesizers, like the GDS.

In addition, a Synergy musician can play anywhere from 8 to 16 notes at the same time by using as many as four different voices that can be interchanged among the notes without getting the machine mixed up.

Beyond the standard 24 voices built into the machine, a Synergy player has the add-on option of a series of special 24-voice cartridges that fit into a slot similar to the ones used on video games for game cartridges. This gives Synergy the full range of the GDS's 1,500 voices, many of which have names as colorful as their sounds—names like Nasalfuz, Bellorgy, Tinkbell, and Pigpluck.

For an opinion on how this high-tech music machine works, I talked to Clark Spangler in Los Angeles. In the past Spangler has done considerable design and development work for some of Digital Keyboard's biggest competitors, and it is no coincidence that Yamaha's CS series of synthesizers carry his initials. You no doubt have heard Spangler somewhere, either on the more than 50 albums on which he's played with people like Miles Davis, Stevie Wonder, the Band, or Dizzy Gillespie, to mention but a few, or in well over 200 movies and TV shows.

In Spangler's view the Synergy is a promising development for the music-and-synthesizer field, gaining it more serious acceptance. "As high-quality, high-tech machines come into the range of anyone who can afford a decent piano, more people will come to realize that the synthesizer is not an intimidating electronic device, but a true musical instrument," he says.

The biggest boon of machines like Synergy, Spangler adds, is to composers. "With a sophisticated synthesizer at his command, a composer has instant access to an electronic orchestra and to textures, timbres, and colors that Beethoven couldn't even fantasize about."

Lurking beneath this innocent-looking row of 74 keys is the electronic Philharmonic of the future

THE ARTS

By Les Ericson

Last July in Houston, Texas, a thirty-six-year-old man was kept alive for three days by an artificial heart. The patient later received a human-heart transplant but died within a week. The surgeon, Dr. Denton Cooley, who has been responsible for dozens of lifesaving operations, neither asked for nor received permission to proceed with the dramatic operation. In a case of art imitating life imitating art, the film *Threshold* (scheduled to open this fall), starring Donald Sutherland, details the case of a surgeon who defies medical authorities and implants an artificial heart into the chest of a dying young woman. One of the film's medical consultants, a man who by the way makes a brief appearance in the movie, is none other than Dr. Cooley.

Threshold has a documentary feel to it thanks to the director of photography, Michel Brault, who shoots with minimal brightness in pools of light. Though soapbox preachy in spots and slower paced than most commercial films, this movie boasts immaculate performances by Sutherland, Jeff Goldblum, Mare Winningham, and John Marley, plus a straightforward script by James Salter (*Downhill Racer*). In *Threshold*, Aldo Gehring, a biochemical engineer, has invented a centrifugal-pump artificial heart. It is opaque, bell-shaped, and the size of an orange. Experiments are performed on calves (one calf lives for 132 days), then monkeys, and then—. After Dr. Thomas Vrain (Sutherland) is refused permission to use the device on humans, he conspires with Gehring to disobey the higher-ups in an attempt to save the life of a young woman who has a congenital heart defect. She has already undergone open-heart surgery to no avail, and is failing fast. The forbidden operation is a success, but the patient is depressed and a sort of reverse Tin Man. The questions of mind/body dualism and the harmonics of prosthetics and humanity hover over everyone and everything. Gehring proselytizes about his invention and gives egotistical interviews to the media claiming, "Surgeons are little more than sophisticated plumbers."

Sophisticated plumbing. Art imitates life imitating art in artificial-heart-transplant film

The real-life designer and proponent of the artificial heart is Dr. Robert Jarvik, a professor of surgery and bioengineering at the University of Utah Medical Center in Salt Lake City, who first worked on the heart in 1971 after laboring with surgical stapling instruments. Soon afterward he designed a pneumatically operated aluminum-plastic heart.

The original organ weighed 15 ounces, but each new heart is shrinking in size. The working model consists of two polyurethane pumping chambers, equivalent to the two ventricles, powered by compressed air pulsations. The patient's ventricles are removed, and the artificial chambers are then attached to the auricles with Dacron or polyurethane cuffs and to the patient's aorta and lung arteries with polyurethane tubes. (It is a step up from the clip on tie—the clip-on heart.) The pumping action is caused by a membrane, flexing with blood in the heart's chamber, which acts in concert with compressed air that surges upward to stimulate the membrane so that it pumps blood out of the heart. Although the ventricles would be capable of sustaining a gallop of 900 heartbeats a minute, the beat would be toned down to the average rate of a healthy heart. At present, in order to sustain the pump mechanism, the minimum weight of a prospective patient is 140 pounds to 150 pounds, but in the near future Dr. Jarvik hopes that figure will drop to 100 pounds.

Dr. William DeVries, of the University of Utah (after whom the Sutherland character is apparently modeled), has implanted the Jarvik heart in 100 calves. The university has given use of the artificial heart the green light for cases that would otherwise be hopeless, but final approval by the Food and Drug Administration is still pending. When that approval is given, the operation would still stand as a last-ditch contingency. Only the consensual agreement of two surgeons that the patient would die if taken off the heart-lung machine could initiate the four-hour implant procedure.

Jarvik hopes the FDA approves the application soon—because "we know

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THE ARTS

By Michael Shore

By the late 1970s tired old rock and roll music had all but ceased to function as a viable vehicle for subversion and rebellion. True, Britain's punk movement provided some savage social commentary set to equally brutal music, but across the Atlantic, dominated by the bland entertainment values of corporate Adult Oriented Rock and disco's passive narcosis, there was no real counterpart. And then, seemingly from out of nowhere, they came. Actually they were from Akron, Ohio—rubber capital of the world—in the industrialized heartland of America. To the tune of a spasmodic robotic, postmodern perversion of rock and roll, they chanted their manifesto: *Are we not men? We are Devo!*

They were Devo all right: de-evolutionized. While you won't find *de-evolution* in any dictionary, the term does have much in common with Webster's second definition of *devolution*—"retrograde evolution." decay. De-evolution says that humankind is regressing rather than progressing. It's Devo's immaculate conception, a handy catchphrase for the Inevitable Decline and Fall of Western Civilization as envisioned by avenging chem-lab eggheads. It focuses most pointedly on the follies of popular science—the way faulty human nature changes technological advances into state-of-the-art Frankensteins.

Devo is not the only modern rock band to make a conceptual statement by taking on futuristic fatalism via science-oriented mutation, but Devo's scope is wider and more ambitious than, say, Germany's Krattwerk, or San Francisco's Residents, who operate under the esoteric auspices of the "Cryptic Corp." Devo has willingly and aggressively tested its aesthetic in the mass marketplace with increasing success. While Devo may have started out as a cosmic conceptual snicker with subversive undertones, their show-biz flair and ever-increasing mastery of the pop "hook" soon made them a force to be reckoned with. Their automaton breakdown of the Rolling Stones' classic "Satisfaction" turned a lot of heads in 1978. And for most of 1980 they had a Top Five smash hit with "Whip It"—a kinetic little ditty that took the familiar guitar figure from Roy Orbison's classic "Pretty Woman" and sent it bouncing through an aural arcade of video-game sound effects, to underpin a mockery of the Dale Carnegie "can do" philosophy. By that time Devo had legions of admirers who wore 3-D glasses, walked robotically and chanted, "We are Devo"—just for fun! Devo had been accepted by the masses whose knee-jerk consumer clone behavior the band had set out to parody.

Along the way Devo had coined this phrase to describe their music: "The important sound of things falling apart." And in a song entitled "Smart Patrol" (from the album *Duty Now for the Future*) this is how Devo characterized itself: *The smart patrol, nowhere to go/Suburban robots who monitor reality!* Audacious, yes, but also as tellingly accurate as the best science fiction.

The patenting of recombinant DNA for corporate profiteering provided, in Devo's mind, the most concrete evidence yet of its own visionary prowess. Last fall ABC-TV's prime-time documentary *The Gene Merchants* detailed corruption already rife in the fast-growing gene-splicing industry: corporate dollars influencing supposedly objective university research, labs raided, research results stolen, and so on. Designer genes were being treated like designer jeans, and it was all discomfitingly reminiscent of Devo's "Mr. DNA"—which the group had recorded in 1979—scooping ABC by two years! So, given all this, perhaps it wouldn't be a bad idea to hear the latest Devo slant on the shape of things to come. *Omni* went to Devo's primary oracles, Mark Mothersbaugh (vocals, synthesizers) and Gerry Casale (vocals, bass, synthesizer)—Bacchanalian and Apollonian halves of the Devo dynamic.

Casale begins by citing some aesthetic fellow travelers. "Our vision of the future," he explains, "runs along the lines of a William Burroughs or a Thomas Pynchon. Within the vulgar aesthetic of popular music, we tend to surface with the same sorts of ideas."

"But the best example of a Devoid vision of the future," Casale says, "would be

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Devo: "We're the court jesters in the corporate castle, the enzymes that eat up the oil slicks."

THE ARTS

By Jim Mastro

Light shone steadily through the thick plant growth, lending the entire aquarium a greenish hue. Small, dark fish moved in and out of the shadows, their long thin tails undulating slowly. The room was silent.

I slipped the headphones on as Mark Ferguson lowered the electrodes into the water. The aquarium came alive with sound. There was a dominant note. A minor perhaps, interwoven with complex harmonics and subtle beats. In the background was an intermittent, staccato crackle. I perceived that each movement of the fish was reflected in tonal alterations. Was it music that I heard? Or was it the collective voice of myriad alien beings, melancholy haunting, as ageless as the universe?

In a way it's a little of both. "The rhythms are decidedly alien, but it was music to me the first time I heard it," says Ferguson, senior aquarist for the Thomas Wayland-Vaughn Aquarium Museum, located at Scripps Institution of Oceanography in La Jolla, California. For the past 11 years he has been refining his skills in fish husbandry and aquarium maintenance. But it wasn't until two years ago that he began to realize the entertainment potential of electric fish.

He was taking a look around a neighboring research building, the Physiological Research Laboratory, when he entered the lab of an ethologist who was studying the electrical location and behavior patterns of a species of knife fish. While Ferguson watched, an electrode was lowered into the tank. It was wired to an amplifier and speaker to help evaluate the field intensity. But Ferguson heard something else in the sounds that were produced. "It sounded like an orchestra tuning up," he recalls. "I was fascinated. I'd always been interested in music and electronics, as well as aquarium keeping. Suddenly I saw a perfect fusion."

It didn't take Ferguson long to set up home aquariums housing several species of electric fish. His knowledge of sound systems provided the background for designing the electronic components. For the most part he was able to adapt currently available audio equipment to suit his purpose, although he found he had to design and construct his own electrodes. The real problem came in determining the most pleasing mixture and density of various types of fish.

There are two main kinds of small freshwater electric fish: those that emit the electrical signal as a waveform and those that emit it as a pulse. There are both Old World (*Mormyridae*) and New World (*Gymnotoidae*) variations of each that apparently have evolved along convergent lines. In a generalized electric fish, electrical organs in the tail produce a field that is interpreted by specialized sense organs in the head. This field functions as a sort of short-range radar, allowing the animals to locate food and avoid obstacles and predators in the murky waters in which they live. Also, alterations in field intensity and changes in frequency allow the electric field to serve as a medium of social communication.

It is this aspect that most interests Ferguson. Each species utilizes a preferred frequency range, which is species specific. The exact frequency can vary somewhat between individuals and between sexes, and it may be affected by environmental considerations, such as water temperature or tank size. In order to avoid jamming one another's signals, members of one species can and will vary their frequency up or down as much as 15 percent in the presence of other individuals. The result of all this is a rich fabric of sound, which reflects the social interactions taking place in the tank.

Choosing just the right alto, tenor and bass wave and pulse species to establish the most pleasing sound can be difficult. "To create the music you want," Ferguson says, "you have to balance the fish." But besides all the species commercially available, which encompass a wide range of frequencies, there are probably still many undiscovered electric fish species living in various remote tropical regions. "The combinations are almost endless."

Two years of experimentation have enabled Ferguson to develop a workable "orchestra," which he has entitled, of course, *Finnish Scales*. It was given its first

"The fish are playing their own rhythms," Ferguson says. "This music has no pretensions."

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EXPLORATIONS

By Scott Cohen

Sport fisherman Tred Barta is aboard his 32-foot custom Prowler *Marika*, in ten feet of water off Long Island heading 90 nautical miles south. According to his white-line recorder—an instrument that records depth the way an electrocardiograph displays heartbeats—the ocean bottom zigzags once in a while and there's a bump every now and then but for the most part the topography is level and smooth. After four hours the slope starts to steepen, indicating the beginning of a hill. An hour later, when Barta reaches the 100-fathom line and the edge of the continental shelf, out of nowhere the bottom plummets thousands of feet and the recorder goes blank. Then a mountain appears on the machine before it goes blank again; then another and another. Looking over the edge of the continental shelf is like peering over a rim of the Grand Canyon at the valley floor below; however, the abyss off the shelf plunges much deeper. This is where Barta comes to fish, 90 miles from New York, over a vast unseen ocean bottom, more rugged, spectacular and mysterious than any other place on Earth.

The continental shelf is basically that—a broad, nearly horizontal platform which is a part of the continental landmass. Every continent has such shelves. Some are rolling, others are marked by channels and shoals. Geographically, the shelf is where continent and sea meet. The distance from land varies. Off Palm Beach, Florida, the shelf is 5 nautical miles out to sea. Off Cape Hatteras, North Carolina, it's 30 miles out.

Most shelves are thick masses of sediment strewn on top of igneous and metamorphic rocks. Much of this sediment was carried from nearby continents by river action. The steep sides are furrowed with canyons and gorges. Some were carved out by rivers when the sea had receded and estuarial slopes were exposed. Some were gouged out by glaciers. Others may have been formed by faults in the earth's crust, earthquakes, or tremendous landslides. Because this gullied terrain is nestled in the calm depths of the sea, it is unaffected by erosion of wind, rain, and powerful currents. The area is protected from time and change.

There are more jagged mountains, more deeper canyons—the most famous being the Hudson, which is 180 miles long and, at one point, 14,000 feet deep—and more fish concentrated in this one area than anywhere else. Scattered along the bottoms of the canyons are the remains of long-extinct animals, an aquatic graveyard for mammoth, mastodon, musk ox, and giant sloth. The trip to the 100-fathom line produces the sensation of traveling backward in time, beginning in modern-day civilization and ending, five hours later, in some prehistoric epoch.

Because the continental shelf off Long Island extends so far out from shore, only a privileged few get to its edge. If for no other reasons than the expense and the risks of getting there. The North Atlantic is one of the most treacherous bodies of water on Earth, with tremendously strong currents moving in many directions, and the weather is extremely unpredictable. When the wind's blowing 40 knots, one place you don't want to be is on the 100-fathom line.

This is where Barta hangs out. His favorite places are the canyons. He fishes off the edge of the shelf exclusively for marlin, swordfish, and tuna, for which he holds eight world records. He's had more experience on the shelf than anyone else in the world. That's why they call him the Canyon Man. He's also known as the Wildman, because he goes out in weather that forces larger boats to hug the shore. He goes out when he's not supposed to and goes out farther than anyone else, to places where fish have never seen a boat before. He never knows whether he's coming back. But that's why he does it. Living on the edge for him is the norm, not the exception. Twenty-nine-year old Barta doesn't expect to live forever.

"The reason why you go out there," he says, "besides for the fishing and the unbelievable challenge of getting there and back, is the unexpected. You're trolling along, and you can easily catch

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Prowler at the edge of the continental shelf, a spectacular landscape beneath the Atlantic

CONTINUUM

Edited by Dick Teresi

THE MALE PILL

A decade ago scientists were promising women that they'd soon not have to bear the sole responsibility for contraception. In just a few years, the promise was, there would be a safe, effective, and reversible male pill. But today it is still the women in most relationships who have to take measures to prevent pregnancies. It is still women's bodies that risk the side effects and feel the discomforts. With this in mind, I decided to find out what had happened to the male pill.

What had happened was the result of years of neglecting to study the male reproductive system. Historically, reproductive studies focused on women. Society put the onus of both fertility and birth control on women. The attitude was: Women get pregnant; men do not. Many feminists claim that if that fact of life were reversed, the men who over the years have controlled research and its purse strings would have been less unwilling to tamper with their own bodies' chemistry and male contraceptives would be in plentiful supply.

The focus on women meant that ten years ago little was known about the action of male hormones, the process of sperm production, and the motility of sperm.

And there was another problem. "It was easier to develop a contraceptive for women," says Dr. Wayne Bardin, of the Population Council in New York City. "It's a numbers game. It's one egg produced each month versus millions of sperms produced continuously. You have to get the sperm count down to zero or render the sperms that are left unable to swim."

Dr. Gabriel Bialy, chief of contraceptive development at the National Institute of Child Health and Human Development, says: "What is required is an intensive research effort. Only lately has there been a big surge in research on men. The reason for this may be that the demand for male contraceptives, according to Bardin, has been increasing incredibly."

One group of researchers, led by Dr. David Rabin, of Vanderbilt University in Nashville, Tennessee, recently treated eight men with an analog of luteinizing hormone releasing hormone (LHRH). Instead of stimulating the production of sex hormones, as LHRH does, the analog paradoxically turns them off. So the sperm count of all eight dropped. That's the good news. The bad news is that the analog's effect is indiscriminate. It also lowered the men's testosterone levels and turned off their sex drive. "That result was expected," Rabin says.

Bialy explains: "The intent was not to see whether these men could perform. To use the analog as a contraceptive, though, researchers must learn how to maintain the men's testosterone and performance levels. The drug has potential, but it may take ten years—if all goes well—to get the drug on the market."

Another potential contraceptive is gossypol, a substance contained in cotton plants. Its effect was uncovered in the 1950s when the cause of sterility in men who live in rural areas of China turned out to be that they were eating raw cottonseed oil. Chinese scientists have since tested gossypol on thousands of men. It induces infertility in more than 99 percent, but it may sometimes cause fatigue, decrease appetite, lower potassium levels, and reduce libido. How reversible its antifertility effect is after several years of regular use is unknown.

Animal studies done here confirm the Chinese findings. They also show that at doses manyfold higher than needed for contraception the drug is toxic. Given the requirements for drug approval in this country, that fact alone may keep gossypol off the U.S. market. Now American researchers are examining how gossypol works, and they hope to alter the drug to eliminate adverse effects while preserving its contraceptive potential.

Meanwhile research on other methods continues. Dr. C. Alvin Paulsen, of the University of Washington in St. Louis, showed that monthly injections of testosterone enanthate (a form of the male hormone) in combination with another steroid prevented sperm production in two thirds of the men treated. Other scientists are trying to develop a birth-control vaccine by using the body's immune system to attack components of sperm (or ova) or enzymes and hormones essential for fertilization. Still others are studying whether vasectomies pose any long-term risks. Others are working on reversible vasectomy procedures.

Of course there is no guarantee that men in great numbers will use a pill or submit to even a reversible vasectomy. Nor is there any guarantee that most women will trust men when it comes to contraception. Still, most women and men would appreciate having a greater choice in birth control. With social pressures building, encouraging researchers to play the numbers game can be won, albeit a bit late. —*CAROL A. JOHMANN*

CONTINUUM

BACTERIAL JEANS

Imagine row after row of bacteria spinning cotton for dungarees and silk for nightgowns. According to physicist Edward Atkins, of Bristol University, England, this idea may be looming just over the horizon.

With bacteria, he says, the sugar fibers could be manufactured anywhere. And they could be grown with far less energy than is required to make fibers of artificial polyester or farm-grown cotton.

If Atkins is correct, the bacterial takeover of the fiber industry will be swift. Bacteria already produce the needed fibers without genetic engineering. Since efficient bacteria-producing facilities are now in place, little new technology would be necessary. —John Newell

Bacteria secreting coats of fiberlike sugar molecules could be exploited to manufacture fabric for a wide variety of clothing

Most bacteria secrete coats of fiberlike sugar molecules for protection against attacking viruses, Atkins explains. Since there are thousands of species of bacteria fighting off just as many viruses, the variety of fibers produced is vast. For example, some bacteria twist sugar chains into elegant, yarnlike fibrils. One species, *Klebsiella*, has 83 subspecies, each with its own unique surface.

Atkins believes it would be easy for people to collect these fibers from bacteria and weave them into fabric. Like the drugs already made

"Mirrors should reflect a little before throwing back images."

—Jean Cocteau

SUPER ROACH REPELLENT

If you sprinkle some bay leaves and cucumber peels through your kitchen, cockroaches will disappear. Is this just an old wives' tale? Not according to Cliff Meloan of Kansas State University, who has found that bay leaves and cucumbers really do repel roaches. He and his students have isolated the roach-repelling compounds from the plants and are trying to purify them into the most potent roach repellent ever.

When Meloan first tested bay leaves in the roach-infested apartments of some graduate students, he noticed that the leaves worked, but not well enough. So he asked doctoral candidate Madan Verma to isolate and identify the repellent in the lab. Not only did Verma discover the substance, a chemical called cineole, but he also learned that only four atoms in the cineole molecule did the repelling.

Meloan then began testing cucumber peels, said to repel roaches even more efficiently than bay leaves do. Working with graduate student Rory Scriven, he has already learned that a cucumber's powerful repellent consists of long molecules of dehydrogenated alcohol.

Meloan knows that the repellent chemicals in bay leaves and cucumber skin attach to roach antennae, afflicting the insects with what seems to be unbearable pain. Though he still doesn't know exactly *how* these chemicals work, he is well on his way toward synthesizing a compound that combines the repelling power of both.

U.S. Postal Service officials, anxious to keep roaches from eating the glue off stamps, have spoken to Meloan. So has Johnson's Wax, which would like to add a roach repellent to its floor wax. —Jeff Hecht

Long molecules of dehydrogenated alcohol in cucumber peels attach to roach antennae, afflicting the insects with unbearable pain

ULTIMATE DIET DRINK

If you've been overweight you know there's one dreadful but foolproof method of reducing—eating less. Now that may change, thanks to the efforts of clinical pharmacologist Sartaraz Niazi of the University of Illinois Medical Center, in Chicago. Niazi has invented a diet drink that temporarily coats the intestinal wall, thus blocking absorption of ingested food, particularly cholesterol and other fats.

The drink, which will come in flavors like cherry and piña colada, is made of fluorocarbons—the synthetic substances that give plastics and paints their coating power. After swallowing, Niazi says, an individual can eat anything he wishes within reason; the food will pass right through the body and out, in the form of waste.

According to nutrition specialist Martin Feldman of New York City, however, "The concept of using a mechanical barrier to intertere in the digestive and absorptive system has potential for serious harm." The drink could severely damage dieters by blocking all nutrients, not just fat, he says. Moreover, it is difficult to determine just how long it might take for the coating to wash out of the system. But Niazi claims his product is safe enough to be used three times a day along with supplements of vitamins A, B, and E. In fact, he is confident that the Food and Drug Administration will approve the drink as a "food additive" rather than as a "drug." If he is right, the product may be sold over the counter in single-dose containers that cost about as much as any soft drink. —Kathrine Jason

A diet soda containing fluorocarbons to coat your intestinal walls may be priced about the same as a can of Coca-Cola

"If you think these Miss Universe contests are interesting now, wait till we start landing on other planets."
—Robert Orben

We should like to have some towering geniuses to reveal us to ourselves in colour and fire, but of course they would have to fit into the pattern of our society and be able to take orders from sound administrative types.
—J. B. Priestley

FIBEROPTIC GUITAR

The electric guitar was considered the ultimate rock and roll instrument during the 1960s, but now it may be replaced by a more contemporary model—the fiberoptic guitar.

Invented by engineer guitarist George Bowley of Dynamic Systems, Inc., in McLean, Virginia, the new guitar has transparent plastic strings with tiny lights at one end. As the guitarist strums, the lights fluctuate along the length of the strings, activating sensors that produce electrical signals. When passed through an amplifier, these signals sound like musical tones similar to, but purer than, those produced by an ordinary electric guitar.

The reason for fiberoptic superiority? Vibrations of electric-guitar strings are changed into a current by magnets inside the guitar. Unfortunately, these magnets also pick up many disparate stray signals—the hum of electric circuitry in the wall, even the sound of a jet passing overhead. In contrast, fiberoptic guitars pick up no stray energy, and their music sounds clean.

Fiberoptic strings will also eliminate the danger of electrocution, which has already claimed the lives of a few guitarists. The phenomenon occurs when faulty wiring leaves a large voltage difference between an electric guitar and a microphone, and a musician puts one hand on each. —Jett Hecht

Fibered guitar. A cleaner sound for rock musicians

CONTINUUM

NATURAL ARTIFICIAL BREAST

Macy Morgan faced a dilemma malignant breast cancer or the prospect of a disfiguring masfecfomy

After a mastectomy an artificial breast can usually be created by transferring skin from the patient s back to the chest area and implanting silicone beneath the skin for dimension and shaping But this cosmetic technique could not be used in Morgan s case because of her small frame and the extremely large area removed by surgery Instead doctors employed a more sophisticated method to imitate nature They borrowed some flesh from her abdomen and transplanted it to her chest The result a totally organic artificial breast

The new process developed by Atlanta-based plastic surgeons Carl Hartrampf Michael Schetland and Paul Black takes advantage of the large blood vessel that runs through the chest to an abdominal muscle Dr Hartrampf explained We simply loop the artery from the abdomen up to the breast area the way you would a garden hose and we move a slice of abdominal skin and fat along with it '

The new technique builds a breast that looks and feels more natural than anything previously possible through surgery, and it has a fringe benefit Patients receive a tummy tuck Morgan says she is delighted with both results Since the first such operation was performed in September 1980 fhe technique has been successfully used on more than 100 women —Phoebe Hoban

On the whole then the prospects of power from uranium are not very good, it may be a useful palliative in the energy shortage, but it almost certainly will not provide a long-term solution
—Charles Galton Darwin

If at first you don t succeed try, try again Then give up There s no use in being a damn fool about it
—W C Fields

Human life is driven forward by its dim apprehensions of notions too general for its existing language
—Alfred North Whitehead

After a mastectomy, a new breast can be created by borrowing flesh from a woman s abdomen and transplanting it to her chest

BUILDING BETTER EGGS

Broken eggs cost the poultry industry millions of dollars each year Building a stronger eggshell is one means of combating the loss and researchers at the University of Illinois in Urbana, have gotten their chickens to do just that Animal scientists Ted Odom and Paul Harrison have found that when hens drink carbonated water, they lay eggs that have thicker shells

Eggshells are made of calcium and carbon compounds Unfortunately hens don t always have enough calcium in their blood to make strong shells One reason for this is that in hot weather hens keep cool by panting

The trick is to get more calcium into the eggshell

The rapid breathing pushes the level of carbon dioxide in their blood down The depletion of carbon dioxide sets in motion a series of chemical reactions that give blood proteins a negative charge The calcium with its relatively positive charge binds to the protein and thus is unavailable for shell production The result Shells are thin chalky and very fragile

Providing hens with carbonated drinking water, the researchers say, replenishes the carbon dioxide and increases the available supply of calcium in their blood According to Odom "There is a fine line between the point when an egg breaks and when it doesn t " Drinking fizzy water lets the hens—and their eggs—cross that line

—Carol A Johmann

SUPERBANDAGE

Stretched end to end the network of capillaries in a human body would wrap around the earth four times It s no wonder that when we cut ourselves we sever a lot of capillaries and bleed Now hematologist John Altshuler of the University of Colorado has found a way around the problem He has created Thromb Aid a bandage that dramatically accelerates blood clotting and stops capillary bleeding within 30 seconds

Thromb Aid is a 2" × 3" gauze pad saturated with cow thrombin a blood-clotting protein similar to one present in man The thrombin converts a blood protein called fibrinogen to a jelly like substance known as fibrin Fibrin "tangles" blood into a web, or clot

The new bandage will be important for hemophiliacs whose bodies do not produce normal levels of thrombin near the surface of a cut In case of an accident in which a major artery has been severed however the bandage will be ineffective because the very high pressure in these larger vessels prevents clot formation

Thrombin has long been recognized as a clotting agent, but its shelf life of 48 hours prevented wide spread use Altshuler however discovered that if he added a glycerin-based solution to thrombin it could be stored for six months under refrigeration

The Food and Drug Administration has approved Thromb-Aid for prescription use and an application is pending for its over-the-counter sale The bandage will soon be marketed nationally, but doctors and pharmacists can now purchase it from Applied Medical Devices, Inc in Denver —Eric Mishara

Surgeons applying Thromb-Aid to a patient It converts blood protein to jellylike fibrin which then tangles the blood into a clot

TOASTED TERMITES

Toasted termite tidbits, caterpillar crunchies or french fried flies? Whether we willingly choose such insect grub most of us inadvertently eat hundreds of insect fragments every day The Food and Drug Administration allows up to 20 drosophila fly eggs in a glass of tomato juice and 75 insect pieces in a two ounce serving of cocoa Frozen broccoli may have up to 60 aphids thrips or mites per serving It s impossible to eliminate all insects from food says Cornell University entomologist Edgar Raffensperger but this represents no health hazard

Americans rarely want to eat insects but people in other parts of the world feel differently Roasted termites are sought-after treats for many Africans, steamed giant waterbugs are prized in Laos as are toasted stinkbugs in Mexico Ants are served with a sauce in Brazil and with curry in Thailand and crickets are seasoned and steamed in banana leaves in Indonesia Commonly eaten insects include bees caterpillars cicadas (one of Aristotle's favorites) flies grubs lice and silkworms

Toasted bugs are often higher in protein than beef

Though most Americans cringe at the thought of eating such fare we don t think twice about devouring an ordinary hot dog whose ingredients may include bull or hog scrotum brains lips, eyes, snouts tail meat, and stomachs

"Our aversion to certain foods is dictated by customs and habits ' Raffensperger asserts "Many insects are delicious and are higher in protein calories, and fat than equivalent amounts of beef

In fact the protein and calorie content of flour and other processed foods could be doubled with insect fortification, resulting in no change in taste or appearance Although the day Westerners dine on beetle bread is probably remote, insects might play a significant role in improving human nutrition in the Third World, where millions of people are malnourished

—Susan S Lang

It s just as sure a recipe for failure to have the right idea fifty years too soon as five years too late

—J R Platt

It's a pity that taxpayers don't read science fiction They might know about the age they re buying

—Frederik Pohl

CONTINUUM

SKULL REBUILDING

The little boy just seven, faced a life of searing headaches and mental retardation The reason a birth defect that caused his skull bones to fuse so that his brain had no room to grow

But now, thanks to an operation at Children s Hospital Medical Center, in Boston the boy has a new skull made of living tissue The skull will grow to accommodate a developing brain, and the boy has a chance to lead a relatively normal life The operation, pioneered by pediatric surgeon M Judah Folkman may correct even the most severe skeletal deformities, curing patients who have always been considered hopeless

To perform the surgery Dr Folkman and a team of doctors removed the top portion of the boy's skull and pulverized it to a paste Then they molded the bone into the shape of a normal skull using two pieces of the child's rib bone for scaffolding The surgeons soon found that the patient s body accepted the new tissue, which grew to healthy bone within a year

Julie Glowacki a biochemist on the team, says that a similar technique may be used for relatively minor operations such as correcting a cleft palate In such instances, however, surgeons need not use the patient s own bone Instead, they can use bones taken from cadavers sparing the patient major surgery

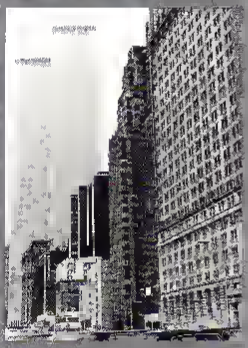
—Sy Montgomery

For those whose skull will not grow, surgeons can remove the pulverize it to paste then remold it to the shape of a normal skull

TALLER SKYSCRAPERS

Survival in the metropolis of tomorrow may depend upon the construction of skyscrapers 250 or 300 stories high says architect Crombie Taylor of the University of Southern California We obviously need taller buildings now, he says

Our cities are dingy, miserable and dark but with bigger buildings such problems as congestion crime and environmental destruction should diminish



Our buildings must be higher and spaced farther apart

Constructed by giant electromagnets, the new edifices would be spaced perhaps three blocks apart Taylor says The gaps would allow each building to soak up large quantities of sunlight and natural heat reducing energy costs Efficient subways and buses would convey the public from one building to the next

Bruce Graham, architect of the 110-story 1 454-foot-high Sears Tower, the tallest building in the world also believes that giant skyscrapers are essential to the well-being of urban America "The higher the density of a city, the more efficient it is economically" he says "The more spread out a city is the more damage you do to the environment With taller buildings transportation, sewage, water and electrical distribution—the entire infrastructure—would be more compact and cheaper to maintain

Revolutionary as it sounds the taller-is-better idea goes back 30 years, when Frank Lloyd Wright suggested building a concrete structure one mile high Most architects resisted Wright s concept because of zoning laws and aesthetic considerations But the decay of today s large urban centers has made the 300 story building an idea whose time has come —Robert Brody

PARACHUTING HAMBURGERS

Foxes raccoons skunks, and coyotes that roam the woods of southern Ontario and the Great Lakes region may receive a pleasant, and possibly lifesaving gift this fall hamburgers from heaven, treated with rabies vaccine

For several years the Ontario Ministry of the Interior (OMI) has been testing an innovative rabies-control method its researchers dropped 100 000 one-ounce meatballs, wrapped in plastic baggies from planes over a 600-square-mile area Evidently the animals liked the idea OMI later found traces of the antibiotic used in the bait in a high percentage of animals obtained from the region

Residents of North America have in effect done the prebaiting for us, says

David Johnston, an OMI research biologist. "All these carnivores have seen these plastic containers with sandwich remains and so on. The containers act as a visual attractant." Other attractants, such as scents, are also used, but the bags themselves serve numerous purposes. Like parachutes, they float the meatballs to the ground, and they record tooth marks, allowing scientists to determine what kind of animal chewed them open.

In test drops, burgers were laced with the antibiotic tetracycline. This drug is absorbed by the teeth of any animal that ingests it. Since the teeth of these animals grow at a specific rate, researchers examining specimens brought in by trappers were able to tell not only which animals ate the meatballs but also the specific day on which they swallowed the bait.

Rabies is a serious problem in the Great Lakes region, where the annual cost of treating the disease is estimated at $15 million. An aerial control program however would cost only $3 million or $4 million.

Fox eats a meatball paratrooper. Hamburger wrapped in plastic bags is feeding wildlife—and protecting them from rabies.

Often we see just the tip of the rabies iceberg—the occurrence in domestic animals and humans," Johnston admits. "The reservoir is in wild animals. By treating wild-animal populations before they are infected, we may be able to stop the spread of rabies at the base."

The specific rabies vaccine that researchers hope to use in the baiting next fall has not been field-tested yet, but researchers so far have encountered only one drawback. Johnston says, "We found that sixty-three percent of the skunks, seventy-four percent of the foxes, and eighty-three percent of the coyotes took the bait. But the raccoon percentage was low. Raccoons don't like the taste of tetracycline."

—Allan Maurer

CHEMICAL SLEUTH

Researchers looking for substances that have special properties can now save valuable time by having a computer scan more than 5 million known chemical structures for the properties they are searching for.

The Chemical Abstracts Service of Columbus, Ohio, has developed a computer system that gives researchers access to "virtually all chemical substances mentioned in the worldwide literature since 1965." Called CAS ONLINE, the system permits users to describe features of interest by building a "picture" of a substance's molecular structure.

A similar system was used to help solve the mystery in the science-fiction film *Outland*. "In the real world," says CAS spokeswoman Jean Horiszny, "many promising drugs and chemicals are developed by modifying known substances that show interesting properties. The new safer forms of cortisone, now available over the counter, were made this way. This approach also helps researchers develop new catalysts and heat-resistant polymers and analyze dangerous street drugs."

In the past, scientists had to conduct a tedious search of known substances and their structures to use this method. A search of the computer's 5 million structures requires only five minutes. Approximately 6,000 new substances are added to the file each week.

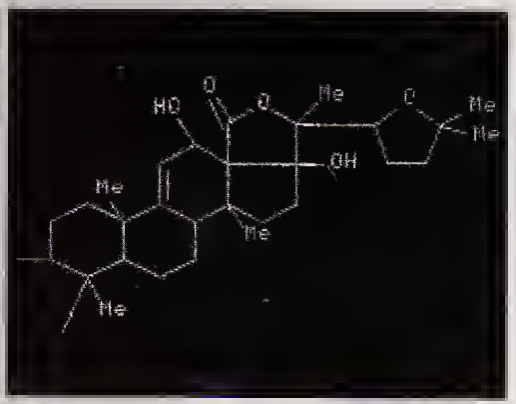
—Allan Maurer

"Ignorance is the womb of monsters."

—Henry Ward Beecher

The real geniuses simply have their bright ideas closer together.

—G. C. Lichtenburg



Chemists draw pictures of a substance's desired structure and the computer tells them whether such a property exists.

CONTINUUM

GORILLA GENETICS

Oscar, a male gorilla at the Columbus, Ohio, Zoo, has fathered five children in four years, but only one has been healthy. The problem: incest.

Son of the famous and fertile Colu, the first gorilla born in a zoo, Oscar is not a bit choosy about his mates. His latest offspring, named Colu 12-G, is the result of his mating with his sister Toni. Colu 12-G was born with a hole in her heart.

Brother-sister and even cousin-cousin inbreeding among zoo animals is a primary cause of infant deaths, infertility and miscarriages, geneticist Paul Fuerst of Ohio State University (OSU), says. Called in by zoo officials to help solve the problem, Fuerst noted that studies done on humans show that every individual carries five to ten lethal or semilethal genes. Recessive and rare, the destructive genes match in nonincestuous mates only once in 100,000 times.

Among incestuous partners, however, there is nearly a 50–50 chance that a destructive gene will be passed on to the offspring.

Fuerst and Margaret Duber Snyder of the OSU Research Foundation suggested several solutions. One is that the zoo should trade animals — bring in nonrelated females for Oscar, in exchange for his sisters, or trade Oscar for another male gorilla. Artificial insemination of female gorillas should also be considered, they urged.

Because it is difficult to bring in new blood from the wild, zoos still face a long-term challenge to maintain genetic diversity, Fuerst says. But he also says we shouldn't be too quick to think the problem occurs only among zoo animals.

Humans engage in incest more often than either chimps or gorillas, Fuerst asserts. — Allan Maurer

Oscar: A liberated gorilla with no sexual hangups. Unfortunately, the results of his reproductive activities are rarely healthy.

It is one of the superstitions of the human mind to have imagined that virginity could be a virtue.

— Voltaire

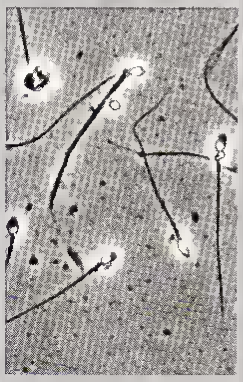
The wallpaper with which men of science have covered the world of reality is falling to tatters.

— Henry Miller

SUPERSPERM

If there is a faster sperm, Alan Barr will build it, or at least design it.

For the past few years, mathematician Barr has been mixing biology, computer graphics and analytical math as part of his research for his doctoral dissertation, "Spermatozoan Head Shape: A Theoretical Analysis," which he is now completing at Rensselaer Polytechnic Institute, in Troy, New York.



Human sperms: Their swimming ability can be improved.

He has been experimenting with different head and tail designs that he distills into mathematical equations and feeds into a computer. The computer takes the numbers and draws them as animated sperms on a TV screen. By observing how his computer-drawn sperms move, Barr can figure out how fast, in what direction, and with what kind of style the sperms travel.

His research began as a study of the mechanism of cell movement. Since a sperm cell has one of the simpler mechanisms, he decided to focus on that. He's been trying to design the fastest head-tail design on his computer. "I'm analyzing the sperm as if it were a machine," Barr explains.

He has discovered that there is a very specific head-tail correlation. Sperms that power themselves with a corkscrew motion, for example, move fastest if they have a flat head, "like a pancake." Also, the head size of human sperm carrying the X chromosome, responsible for girl babies, is a little larger than that of the boy-producing Y sperm. But since boy sperms are slightly faster, he says, this might explain why statistically more boys are born each year.

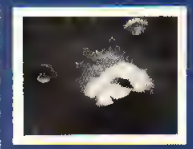
Although his work is pure research, Barr says it may give biologists and fertility experts insights into improving their artificial-insemination techniques.

— Douglas Colligan

FACE IN SPACE

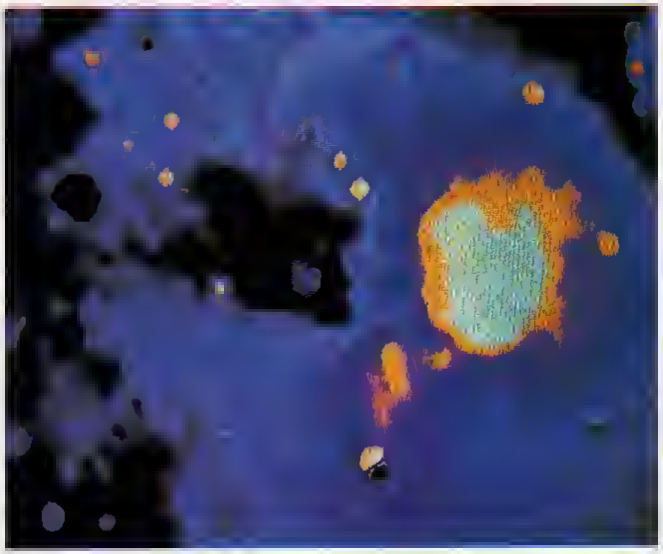
BY VINCENT DIPIETRO AND GREGORY MOLENAAR

Is there intelligent life on Mars? It was 1977 when I (DiPietro) first saw the picture at right. (The larger photograph covering both these pages is a color-enhanced close-up of the same image.) The photo had been made by the Viking Orbiter spacecraft as it circled around Mars. At least that's how the caption read in the magazine where I found the picture.



The quality of the magazine was such that I readily thought the photo could have been a hoax. And whoever had written the article knew nothing about interpreting the data being beamed to Earth from Mars. Another photo, for example, was accompanied by a caption that claimed to show tire tracks across

One Viking photo (below) shows something resembling a column of steam



the Martian surface As an experienced student of space images I recognized the tracks as nothing more than radio-transmission errors technically known as line losses streaking across the picture I soon forgot about what I had seen

Two years later while thumbing through the photo archives of the National Space Science Data Center at the Goddard Space Center in Greenbelt Maryland I came across a familiar image this same serene humanlike face rising up from the Martian land surface NASA's title left no room for doubt as to what appeared here It read simply HEAD At least now I knew this was not a hoax Captivated by my discovery I wrote down the photo identification numbers and requested a copy from NASA to keep in my files

The photograph had also interested one of my colleagues, computer scientist Greg Molenaar We had done work for NASA before I had handled and processed satellite images beamed to Earth and Greg had worked on the special computer programs needed to translate computer data into pictures Greg suggested we combine our expertise and try to improve this picture's quality something no one else had ever attempted We planned to do this by using the original Viking data tapes

We knew the photo number and the date on which it was filed and we also had a picnell number 35A72 This meant the picture was taken during orbit 35 of Viking safellite A and that it was the seventy second frame of image data recorded during that orbit With this we were able to get more information namely the altitude of the satellite and the latitude and longitude at which the image was recorded We now had enough data to request the original digital image tapes from the Jet Propulsion Laboratory in California

We began processing the tapes on our photo-recording equipment in January 1980 The first image that came out was poor It had too many transmission errors that played out as black-and-white flecks of pixels or picture elements across the photo A pixel is the smallest unit of information discernible by a spacecraft camera It is generated from an eight bit computer word that displays that piece of the image in one of 256 shades of gray from almost white to almost solid black A photo composed of pixels looks like a mosaic of small squares We found we could improve the image by strefching the contrasf range of gray shades so that they represented the full band of the spectrum

By using this contrast stretch and by filling in some of the transmission-error pixels we got a clearer picture We then decided to enlarge the mile wide face by using digital computer techniques instead of conventional photographic enlargers which produce grainy photographs The first photo had huge pixels with ragged edges We designed a way to smooth the ragged edges by dividing each large pixel into nine smaller units We call the process Starburst Pixel Interleaving Technique or SPIT because of the way the white flecks of the transmission errors appear like star bursts (The acronym SPIT could also stand for the spitting image)

Not surprisingly there was a nagging suspicion that even this clearer photo was merely some trick of light on the Martian landscape David Chandler's book *Life on Mars* quotes Dr Gerald Soffen Viking image chief as saying that a few hours after it took the first picture the spacecraft took another picture of the area where the face was found And this second photo showed a face less Martian mesa When we looked through the Viking data library we found no pictures that had been taken a few hours later We did however find a second photo made 35 days later The scene was labeled 70A13—meaning it was made during orbit 70 and was registered on frame number 13 of pictures taken by that same satellite

The conditions under which this second picture was faken were very different from those the first time The camera angle the angle of the sunlight the altitude of the satellite and the angle of inclination of the satellite's orbit were all quite different After we got the data tape for this second photo we ran the image through our SPIT process What we found was that even with all the new variables the face was still clearly visible It was obviously not a trick of lighting

We continued to investigate the data for the two images of the face and began to apply other image enhancing techniques Since each photo was so poor in contrast, we decided to improve on the limited range of grays by replacing each gray value with a color One result is the image on fhe previous two pages color-enhanced with the assistance of German photographer/artist Manfred Kage In each picture, 35A72 and 70A13 we detected similar features Most prominent was an object in the eye cavity that resembles an eyeball with a pupil The hairline mouth eye cavity, eyeball, and a 'teardrop' under one eye were all confirmed by the second camera angle

Natural facelike formations can be found on Earth and it is plausible that the face we saw on Mars was created by natural forces But the natural faces found here on Earth are invariably profiles and not nearly as sophisticated as the face seen on Mars It is a frontal view complete with bilateral symmetry and amazing detail If this object was the result of natural formation it indicates nature is a highly intelligent force

CONTINUED ON PAGE 107

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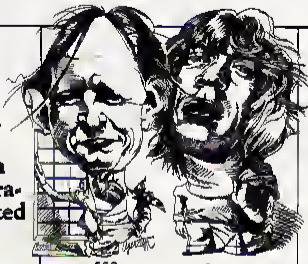

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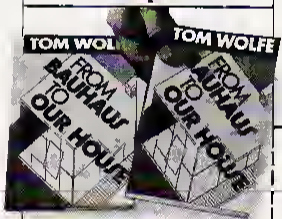

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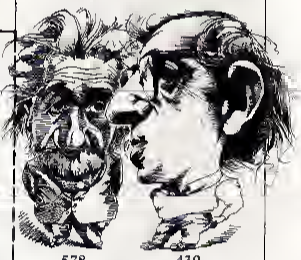

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FICTION

AND ALSO MUCH CATTLE

'Now the word of the Lord came to Jonah the son of Amittai saying, Arise, go to Nineveh But Jonah rose up to flee into Tarshish from the presence of the Lord'

BY CONNIE WILLIS

I figured if the boss was going to try to stop me it would be on Joppa I'd managed to keep one jump ahead of him this far One more jump, and I'd be out of the Arm, that spirally edge of the galaxy the company has jurisdiction over and on my way to Novo Lisbon The boss couldn't touch me once I got to Novo Lisbon But in the meantime the heretic free-trader I was on had suddenly announced it was docking on Joppa to let off all its passengers, including me

I figured that was the company's doing The free traders supposedly don't recognize the company's authority which makes them "heretics but I've seen them turn mighty orthodox when the company starts breathing down their necks Like now I'd have to go off-ship and book passage on another ship and guess who would be waiting for me at the gate

No way Instead, I wandered down to the navigation room and let it slip that I was a holo-conner it had the desired effect One

PAINTING BY
DONALD ROLLER WILSON

look at the rickety computer and the antique intraship speaking tubes told me it was a wonder we'd made it as far as Joppa in one piece.

Computer conning works only when you can believe what the computer tells you. On a tub like this you'd be better off looking out the window. There aren't any windows, but a holographic screen is the next best thing, provided you've got somebody who can read it. I can, and I didn't waste any time telling the navigator I could.

The little navigator was beside himself with joy to think he wouldn't have to navigate the Whale all by himself. He fiddled with the computer, erasing my name from the passenger list, and hid me till we were safely out of orbit.

We almost didn't make it. Company interference again. A request for a beaming of the crew list, followed by a full screen. Since I wasn't on the list, the company went ahead and cleared us without the screen. No damage done, but it scared the spit out of the navigator. He was a squatty little Type Four Alien, and I wondered what the full screen would have shown. A wife and kids on ten different planets? Fours are notorious womanizers. Whatever it was, he was shaking so badly I took over for him as soon as we were safely out of orbit.

To calm him down, I showed him what I was doing. "Holo-conning's simple," I said. "It's just like looking for pictures in the sky. Only these are three-D pictures, and we go right through them. The trickiest part of this trip is *A Baleia*, the Whale, because of all the stars near the tail. But I bring us in through the fluke like this." I showed him on the screen. "And then we go straight for the mouth and Novo Lisbon. Nothing to it. We're right here." I pointed at the dot that was us. Smack in.

"The belly of the Whale," a voice behind me said.

"Hello, Gabe," I said.

"The boss has been looking for you, Tyson," Gabe said.

"Yeah?"

"He really needs you for that job on Nine-V."

"Not interested. We were in open space, nothing for light-years. I put the screen on automatic and turned around. "What are you doing here, Gabe? The company doesn't have any jurisdiction on Novo Lisbon. You know that."

"We're not there yet," he said. The little Four had disappeared, probably hiding. "What do you know about the situation on Nine-V?" Gabe asked.

"The company didn't bother to tell me anything," I answered. "As usual. And don't tell me the boss moves in mysterious ways. But I talked to Hayerdal. I'm not going."

It had been right before they sent Hayerdal. He was drunk, and he didn't have a whole lot of kind words for the Nines.

"They're killers," he had said. "And they stink. They live in a pigsty of a city with their cattle and the dirt of the ages. What would they do with water? They sure as hell never wash."

"The company's sending you to fix the water system?" I asked. "Why can't the Nines fix it themselves?"

"You've obviously never seen a Type Nine Alien," Hayerdal said. "Their strong point isn't manual dexterity; it's meanness. Nine-V used to be a Four colony planet. They killed off all the Fours and moved in. I guess they forgot to ask how to turn on the taps."

They sounded like sweethearts. When I'd heard the boss wanted me instead of Hayerdal on Nine-V, I had immediately taken off for parts unknown.

"I'll be glad to review the situation for you," Gabe said, "just in case you change your mind. There's no naturally occurring surface water on Nine-V. The only water's the original colony system. It's broken, and the Nines can't fix it. If we send in a representative of the company to fix the plumbing, we think there's a good chance we can get them under contract."

> *"Soldiers appeared above the wall and took aim with something that looked like a cross between a longbow and a bassoon. It takes talent to come up with a killer like that."*

"Why didn't you send Hayerdal?"

"We did," Gabe said. He hesitated, then decided not to lie to me—a bad sign. "They killed him. They cut him apart with a lightsaw a decimeter at a time and fed him to their cattle. Their cattle are omnivorous," he added, as if that was supposed to cheer me up.

"The Nines live completely in one city, cattle and all," Gabe went on. "Nobody's even seen their women or children. The planet has a breathable atmosphere, artificially created and maintained by the Nines. The original Four colony was domed. The planet is black, noneroded volcanic extrusion. No rain. No vegetation except for a small wood east of the city, possibly watered by a volcanic vent."

"What makes you think they won't feed me to the cows?"

"Hayerdal went in too early. We told him not to attempt negotiations until they were completely out of water. Their cisterns will be empty in another two days. They'll be ready to talk by the time you get there."

"No, thanks. I don't have any desire to end up as cattle fodder. How come the boss doesn't just let them die of thirst? It doesn't look like they'd be missed much."

Gabe grinned. "The company doesn't tell me its plans. I'm just a humble servant, like you, following orders."

"You may be following orders," I said. "I'm getting the hell out of here."

The chummy approach wasn't going to work this time, and Gabe knew it. He shrugged. "I don't know what the boss wants with the Nines. They're tough. They're smart. They created an atmosphere for the planet out of less than thin air. They speak Revised Standard. How the hell would I know? They've got to have something to be able to build a colony out of solid rock and vacuum."

"They didn't build it. They killed off some harmless little Type Fours and took it over."

All of the Aliens have faults.

The Twos talk too much. The Fours can't resist women. I wouldn't exactly put them in the same class with the Nines. Why doesn't the boss just let them dry up and blow away before they come out of that city and take over the Arm?

"You want to know the boss's plans, ask him yourself."

"No, thanks. We're not exactly on speaking terms. You're still talking to him. You tell him, No deal. I'm not going to Nine-V."

"Tell him yourself," Gabe said and walked out.

An hour later we came to a dead stop. The Four came bustling in on his romantic little legs and said, "We've been denied clearance."

"We're out of the Arm," I said. "The company has no jurisdiction here in the Whale."

"Priority transports coming through *A Baleia*," the Four said. "Company business. Three-week delay or the company'll transfer us to another ship and leave this one on robot." He was wringing his hands, thinking about all those wives and the full screen they'd run on the whole crew as they boarded. I could have told him not to worry. There wasn't any priority transport. It was just the company's method of bullying the heretics into delivering me. Well, Gabe could get me to Nine-V maybe, but he couldn't get me out of the ship.

Gabe must have been thinking along the same lines. He had me thrown overboard. All very civilized. A space suit, a maneuvering pack, and two days' water supply. "This'll give you a chance to contemplate your sins," Gabe said, tucking the contract and a map inside the space suit. "Just in case you change your mind."

I wasn't particularly worried. The Whale's a busy place. Lots of little automated Portuguese galeras flitting through, and all the time in the world wouldn't make me change my mind about the Nines. "You're the one who should change your mind, boss. There's no way they're going to repent their evil ways and sign a contract, and if they did, they'd use it to slash off pieces of the Arm and feed it to their cattle. If they'd sign. Which they won't, Hayerdal said so. You

remember Hayerdal? Nice guy. Loyal.

They'll never sign till they're completely out of water," Hayerdal had said. "Maybe not even then, unless they've got a damned good reason. I don't even know if they'd even do it to save their kids. Or their women."

I had the feeling Hayerdal was right: that they were the types to waste their last water boiling me alive if I were anywhere close and spice the stew with chunks of leftover Hayerdal. Well, I wasn't going to be anywhere close. I was catching the first galera going west.

Three days later I was willing to settle for any ship at all, even one of those fictitious company transports. Nice touch to have the water run out, boss. Make him feel a little empathy, eh? Over my dead body. I've met guys like the Nines before. We got nothing in common.

When a galera did—providentially? oh you bet—appear, I hardly had the strength to flag it down. I didn't punch the destination till I'd checked out the canteen and found a full twenty-liter quota. Then I punched in "Possible course? Novo Lisbon? And it flashed "Override Nine-V." I wasn't even surprised.

And the Lord spake unto the fish, and it vomited Jonah upon the dry land.

They landed me in the wood. Or what was left of it. The underbrush was like tinder, and most of the trees looked the worse for wear. The smaller vines and bushes were still green, but it was obvious that if the Nines hadn't run out of water yet, this little wood had. I was glad I had stolen the galera's canteen, even though it weighed a good sixteen kilos.

I was not so glad after I got to the edge of the woods. They ended abruptly, as if someone had drawn a line, and beyond the line there was nothing but dull black rock as far as I could see. The jagged lava was crossed with converging lines that looked like meridians but were more likely to be volcanic fissures. Whatever they were, they sure weren't water pipes. I was going to have to tote that back-killing canteen all the way to the city of Nine-V, and Nine-V was nowhere in sight. I took a triangulation off the sun and checked it against the map Gabe had given me. I was a full day's walk from the city, and I was standing in the only shade from here to there.

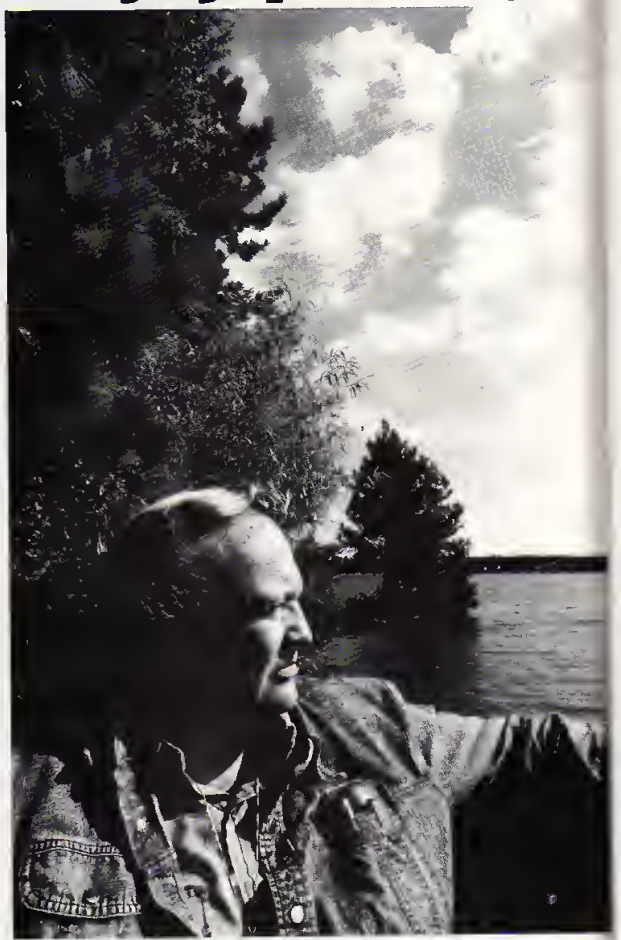
All right, all right, it was only a day's march, and I wasn't going to get any peace from upstairs till I made it. I put my bedroll against the small of my back so the canteen wouldn't crash into my spine with every step, and I set out. The fissures began to converge after half a day, looking more and more like water pipes, and by afternoon I was right next to one. I stopped to do another triangulation and make sure I wasn't veering off to the south, and then I took a look at the pipeline.

It was a vine, almost ten centimeters in diameter and heavy as lead. I could hardly

How to enjoy poetry

by James Dickey

International Paper asked James Dickey, poet-in-residence at the University of South Carolina, winner of the National Book Award for his collection of poems, "Buckdancer's Choice," and author of the novel, "Deliverance," to tell you how to approach poetry so it can bring special pleasure and understanding to your life



"The things around us—like water, trees, clouds, the sun—belong to us all. How you see them can enhance my way of seeing them. And just the other way around."

What is poetry? And why has it been around so long? Many have suspected that it was invented as a school subject, because you have to take exams on it. But that is not what poetry is or why it is still around. That's not what it feels like, either. When you really feel it, a new part of you happens, or an old part is renewed, with surprise and delight at being what it is.

Where poetry is coming from

From the beginning, men have known that words and things, words and actions, words and feelings, go together, and that they can go together in thousands of different ways, according to who is using them. Some ways go shallow, and some go deep.

Your connection with other imaginations

The first thing to understand about poetry is that it comes to you from outside you, in books or in words, but that for it to live, something from within you must come to it and meet it and complete it. Your response with your own mind and body and memory and emotions gives the poem its ability to work its magic, if you give to it, it will give to you, and give plenty.

When you read, don't let the poet write down to you, read up to him. Reach for him from your gut out, and the heart and muscles will come into it, too.

Which sun? Whose stars?

The sun is new every day, the ancient philosopher Heraclitus said. The sun of poetry is new every day, too, because it is seen in different ways by different people who have lived under it, lived with it, responded to it. Their lives are different from yours, but by means of the special spell that poetry brings to the *fact* of the sun—everybody's sun; yours, too—you can come into possession of many suns: as many as men and women have ever been able to imagine. Poetry makes possible the deepest kind of personal possession of the world.

The most beautiful constellation in the winter sky is Orion, which ancient poets thought looked like a hunter, up there, moving across heaven with his dog Sirius. What is this hunter made out of stars hunting for? What does he mean? Who owns him, if anybody? The poet Aldous Huxley felt that he did, and so, in Aldous Huxley's universe of personal emotion, he did.

Up from among the emblems of the
wind into its heart of power,
The Huntsman climbs, and all his
living stars
Are bright, and all are mine

Where to start

The beginning of your true encounter with poetry should be simple. It should bypass all classrooms, all textbooks, courses, examinations, and libraries and go straight to the things that make your own existence exist: to your body and nerves and blood and muscles. Find your own way—a secret way that just maybe you don't know yet—to open yourself as wide as you can and as deep as you can to the moment, the *now* of your own existence and the endless mystery of it, and perhaps at the same time to one other thing that is not you, but is out there: a handful of gravel is a good place to start. So is an ice cube—what more mysterious and beautiful *interior* of something has there ever been?

As for me, I like the sun, the source of all living things, and on certain days very good-feeling, too. "Start with the sun," D.H. Lawrence said, "and everything will slowly, slowly happen." Good advice. And a lot *will* happen.

What is more fascinating than a rock, if you really feel it and *look* at it, or more interesting than a leaf?

Horses, I mean, butterflies, whales,
Mosses, and stars, and gravelly
Rivers, and fruit

Oceans, I mean, black valleys, corn,
Brambles, and cliffs, rock, dirt dust, ice

Go back and read this list—it is quite a list, Mark Van Doren's list!—item by item. Slowly. Let each of these things call up an image out of your own life.

Think and feel. What moss do you see? Which horse? What field of corn? What brambles are *your* brambles? Which river is most yours?

The poem's way of going

Part of the spell of poetry is in the rhythm of language, used by poets who understand how powerful a factor rhythm can be, how compelling and unforgettable. Almost anything put into rhythm and rhyme is more memorable than the same thing said in prose. Why this is, no one knows completely, though the answer is surely rooted far down in the biology by means of which we exist; in the circulation of the blood that goes forth from the heart and comes back, and in the repetition of breathing. Croesus was a rich Greek king, back in the sixth century before Christ, but this tombstone was not his.

No Croesus lies in the grave you see,
I was a poor laborer, and this suits me

That is plain-spoken and definitive. You believe it, and the rhyme helps you believe it and keep it.

Some things you'll find out

Writing poetry is a lot like a contest with yourself, and if you like sports and games and competitions of all kinds, you might like to try writing some. Why not?

The possibilities of rhyme are great. Some of the best fun is in making up your own limericks. There's no reason you can't invent limericks about anything that comes to your mind. No reason. Try it.

The problem is to find three words that rhyme and fit into a meaning. "There was a young man from..." *Where* was he from? What situation was he in? How can these things fit into the limerick form—a form everybody knows—so that the rhymes "pay off," and give that sense of completion and inevitability that is so deliciously memorable that nothing else is like it?

How it goes with you

The more your encounter with poetry deepens, the more your experience of your own life will deepen, and you will begin to see things by means of words, and words by means of things.

You will come to understand the world as it interacts with words, as it can be re-created by words, by rhythms and by images.

You'll understand that this condition is one charged with vital possibilities. You will pick up meaning more quickly—and you will *create* meaning, too, for yourself and for others.

Connections between things will exist for you in ways that they never did before. They will shine with unexpectedness, wide-openness, and you will go toward them, on your own path. "Then..." as Dante says, "...Then will your feet be filled with good desire." You will know this is happening the first time you say, of something you never would have noticed before, "Well, would you look at *that!* Who'd 'a thunk it?" (Pause, full of new light)

"*I* thunk it!"

James Dickey

lift a section of it, even though it didn't seem to be attached to the ground in any way. It was banded into sections like bamboo. I thought of cutting into it to see if I would find water flowing through it or just pulp, but the boss frowns on doing damage to other living things. Except Hayerdal, of course, and me. We're volunteers, right, boss? I squatted beside the vine, peering off toward the west at the converging lines and feeling like a fool for all the time I'd wasted squinting through a theodolite. I wasn't going to get lost, not with this clearly marked road to the city. It was obvious these vines were heading there, to the only water on the planet. Too bad, vines. Nine-V's out of water, too.

I was practically tripping over the vines by the time I got within sight of the city. It crouched in the middle of the converging vines, looking like a big square strongbox. It was the same dull black as the rest of the planet, and it didn't show up until I was almost up to the rusty metal barrier that must be its gate. I smelled it almost before I saw it. Come on, boss, you sure you want these guys in the company? They're mean, they're ignorant, and they don't even smell nice.

Soldiers in black helmets appeared above the wall and took aim with something that looked like a cross between a longbow and a homemade bassoon. Lightsaws. You forgot *inventive*, Gabe. It takes real talent to come up with a killer like that.

"I have come to end your drought," I said. "I represent the company. Will you sign the contract and let me fix your water system?"

The soldiers took aim. Great. I wasn't even going to get as far as old Hayerdal.

"If you don't you'll die in there. Your cisterns are already dry."

I was getting no response at all from the boys up on top with the heavy artillery.

"Come on," I said. "You know you're getting thirsty," and suddenly the gate began to creak upward. There was another gang of soldiers inside, all with their homemade lightsaws pointed at me. One big guy stood in front of them, and the blast of foul air that came from behind the opened gate almost knocked me flat. How'm I supposed to negotiate, boss, when I've got to hold my nose? The big guy stomped up to me. "Are you ready to sign?" I asked. Gabe better not have been lying about them speaking Revised Standard.

"No sign," he said, and the gate slammed down behind him like a guillotine. I jumped. He took two steps toward me, mashing a vine in the process. He didn't seem to care. He just kept coming, looking meaner by the minute. I didn't have any way of knowing what effect the drought had had on them since I didn't know what they'd looked like in the first place. Maybe this guy was a shadow of his former self. Maybe he'd been a real beauty to begin with. Not possible.

"Isn't your city worth saving?" I inquired, fighting the urge to back up. "What about your children, your cattle? You can't let them die of thirst. What about your crops?" I was desperate as he marched straight at me. I had the feeling he could mash me like the vine and with as little concern. "What about your vineyards?" Nobody had said a word about vineyards, but those vines had to be good for something or the Nines would never have let them in.

"I said, What about your women? Aren't they worth saving?" I took one step backward and went sprawling over one of the vines.

I put up a hand to ward him off, and he leaned over me, his wide, dirty face scowling at me. "We sign," he said, pronouncing the word "sahn," like a Southerner.

"You will?" I squeaked, trying to figure out what the magic word had been and scrambled up to follow him to the gate, pulling out the contract before he could change his mind.

He stopped short at the gate and turned on me. He had flattened another of the vines and was standing on it. I shoved the contract at him and fumbled for something

> *"There was another gang of soldiers inside, all with their lightsaws pointed at me. One big guy stood in front of them, and the blast of foul air almost knocked me flat."*

to write with. The gate creaked up behind him and hung there like a blade. He swatted the contract out of my hand and grunted, "Water now. Paper then."

"No way," I said.

What happened next wouldn't have taken Madame Defarge two knitting stitches. The bad guys did an aboutface, the gate crashed down, the soldiers reappeared on the wall above, and I was left looking down at the contract. It was lying on top of the squashed vine, looking pretty squashed itself. He'd stepped on it on his way in. I picked it up and then stooped to get a better look at the vine.

The thick green skin had splintered, making me think more than ever of bamboo. I picked up the less damaged end, the one that came from the city. Water was oozing gently from the inner side of the rind, but the rest of it was hollow. When I peered into it, I was surprised by a cool riffling of air, like a sweet breeze.

I stood up and brandished the contract at the soldiers. "Drought and death to you all," I shouted. Then I taunted them. "You want me, then you'd better come and get me."

So Jonah went out of the city, and sat on the east side of the city, till he might see what would become of the city. And the Lord God prepared a vine and made it to come up over Jonah.

The walk back seemed a little faster, probably because I knew where I was going. I followed a vine like a guardrail all the way back till it disappeared into the underbrush. Then I found a place to sleep under another kind of vine with leaves bigger than my head that wove themselves into a kind of leafy arbor over me. The vine was showing signs of lack of water. The leaves were turning brown at the edges, and the whole vine had a brittle look to it. There was one furled white blossom, but whether it had closed up for the night or for good, I couldn't tell. I curled up under it and slept the sleep of the just.

When I woke up, the vine had bloomed—with one enormous flower, shaped like an open trumpet and colored a delicate pink that radiated from the golden center. It stood away from its stem like a graceful head on a slender neck, definitely the prettiest thing I'd seen lately.

"Well, good morning, you pretty thing," I said.

"Good mahnin'," the flower said. "Mah name's Kiki," she drawled in the slow, lazy speech I had noticed in the Nine who had bargained with me. On him it sounded like a nasty overseer. It was much more attractive on Kiki.

"Hello, Kiki," I said. "My name's Tyson."

"Tyson," she said, pronouncing it "Tahson." "Ah knew a man named Hayerdal once. Do you know him?"

"Yes," I said. I wasn't about to go into details.

"He told me stories."

"Like what, Kiki?"

"Lahk the one about the heretic, the Four, and the company man. They all went into a bah togethuh, and—" Hayerdal had told it to her all right. He had told it to me between drunken descriptions of the Nines. In her voice it sounded like a fairy tale.

I leaned forward as she talked, feeling like I was committing some terrible invasion of privacy, like peering down a blind person's throat. But I had to find out if this was all a set-up of Gabe's. He would be capable of hidden mikes in flowers and, after a few softening-up niceties, some hard-sell petal propaganda. The Hayerdal story would be a nice touch of authenticity.

But she looked like the real thing. The center of the trumpet-shaped blossom was filled with taut, folded yellow bands that were vibrating as she talked. I don't know what a human's vocal cords look like, but I would bet they looked a lot like what I was seeing. Above them was the pollen, blown gently every time a word came out. Any insect sticking its nose in to find out where the sound was coming from would get covered with it. But any sound would do for a dumb bee. There was no reason I could figure for her to be speaking a company

language, let alone Revised Standard. Let alone with a Southern accent.

The heretic said. Ah got a girl on every port from heah to the end of the Arm, and the Four said. That's nothin'. Ah'm married to every girl from heah to.

Did Hayerdal teach you to speak? I asked, interrupting her before she got to the punchline.

She didn't answer for a minute. He taught me new words.'

I almost said, Like what? Then I remembered the end of the story she'd just been telling. But you knew how to talk before? I asked.

I could hardly envision a Nine bent over her trumpet-face teaching her the language, even though they had the same accent. It was more likely that the Fours who lived in the city had learned their Revised Standard from New Georgians and had taught Kiki to talk before the Nines moved in.

'Ah don't remembuh,' she said, and then added ingenuously, 'Ah'm not very clevuh, Tahson.'

'I think you're very clever,' I said. 'I never met a flower that could talk before.'

'Do you know any stories, Tahson?' she asked. 'Hayerdal told me such nahce stories.'

Yeah, well. I wasn't going to tell her that kind of story, and the only one on my mind right now was my adventures among the Nines. There was a little breeze from the west. I stood up and looked toward the city. I wondered when the Nines would start dying and if I'd be able to smell the stench—correction, the new stench—from here.

Do you, Tahson? Know any stories?'

What kind of stories do you like, Kiki?'

'Stories with lessons,' she said.

Are you listening, boss? She likes stories with lessons. You two should get along great. Stories with lessons, huh?' I said.

Okay. Here goes. Once upon a time there was a man who didn't want to do something. He had very good reasons, but his boss wouldn't listen to them. So the man ran away to the side of a big lake, full of water. And he said, 'If I could swim that lake, I could get away from the boss.' And he dived into the lake and started to swim across.

'Ah'm thusty,' Kiki said.

Would you like a drink?' I offered, feeling like an idiot. Of course she'd like a drink. Those brown edges on her leaves aren't there for decoration. I went over to the canteen and drew a hidful of water. 'I shouldn't have been talking about lakes and swimming, should I, Kiki?'

I took the mug over to her, like you'd take a drink to a little kid. I didn't know where her roots were, and I figured she probably wouldn't know either. The best way to find them would be to trace a finger along her stem and follow it down to the ground, but her stem looked terribly fragile, and I was afraid I might inadvertently hurt her in the process. I eyeballed her stem through the huge leaves till things got hopelessly tangled in the underbrush. I could still see the platelike leaves though, bushing thickly on the ground. I lifted them up and soaked the ground under them.

Then I had a drink myself and sat and stared toward the west, wondering if they'd just conveniently forget to pick me up when Nine-V was no more.

What happened in the lake, Tahson? Kiki said.

A fish swallowed him, and he was never seen again.' I told her. Then I felt ashamed of myself. Not true, Kiki. I made that up.'

'Is that lahk lahin, Tahson?' she said in that Southern belle voice.

'Maybe.' I said. 'Lying to yourself. Saying what you wish would happen. Saying what you wish was true.'

'Lahk Hayerdal,' Kiki said. 'He said he was goin' to go water me.'

Poor old Hayerdal. Probably dropped here drunk and without the sense to steal a canteen, making promises he couldn't hope to keep. I frowned.

'Ah lahked Hayerdal,' Kiki said before I could think of some way to explain why he had lied to her. 'Ah lahk you, too, Tahson.'

And what category did that put me in? Liars, drunks, or cattle fodder? I wasn't about to ask for fear she'd tell me.

'Tell me another story,' she said.

You bet, Kiki. And you listen, too, boss. This is a story with a lesson.

'Once upon a time there was a flower,' I said. 'Like you. Her name was Kiki. She wasn't very clever, but she was very pretty, and she had a kind voice and a sweet disposition, which are the best things in the world. She lived in a little wood that was owned by a king. Now the king was a good king, but he had GREAT PLANS for the wood.

I was starting to feel sleepy. I wondered if Kiki slept, if that was what she had been doing when I first saw her, her petals tightly furled. I wondered if after I had droned on for a while, she would say, 'Good naht, Tahson,' and lay her pretty head down on the pillow and go to sleep. I watched her and she did not move at all, not even to sway on her slender neck. Wrong. Not neck, stem. Not head, blossom. It was no good. I kept trying to make a face where there was no hint of one.

That's genetically encoded, boss. You put it there. Is that one of your 'in his image' numbers? It must be. Anthropomorphizing, boss, that's what you're doing. Looking for yourself everywhere, even in the pigsty Nines, but you're overlooking the obvious, boss. You're right here. This is what you should have dragged me all this way to save. So what if she isn't smart or resourceful? So what if you can't use her in your GREAT PLANS. She's the only thing here worth rescuing.

Now there were people who wanted the little wood—dirty, thieving, murdering people, but the king said, 'They are part of my GREAT PLANS. I must give them whatever they want.'

Kiki did not speak. Perhaps she had fallen asleep after all. Perhaps she had never spoken, and I had only hypnotized myself into hearing her. That violin banding in her throat was surely not enough to produce such a sweet and human voice, and who could have taught her to tell the truth that way? Not the Nines. And how could she hear me? There was no golden apparatus for hearing anywhere that I could see. Perhaps she was a sleep-inducing flower instead, like a poppy, and I had only dreamed her.

Tahson,' she said. 'Tahson.'

What?' I said.

You stopped talkin'. Ah thought you went away, Like Hayerdal.

I must have fallen asleep.' I said. It was late afternoon, the reddened sun slanting across the black rock, making converging lines of dusty light. Converging lines. Is there a lesson in that, too, boss? No man is an island. All roads lead to Nine-V. You can do better than that.

Where was I?' I said.

So the king said, 'Ah need the Nines for Ah have great plans,' and he proposed to destroy the wood and build them a great city.' Kiki recited. The watering had done Kiki good. She was a deeper pink, almost rose, and her petals were opened wider so that the trumpet lay almost flat.

But as the king rode back to his castle,' I said, 'he became lost in the wood, and night fell, so that he could not find his way. He took shelter under the flower, and she spoke to him and comforted him through the long night, and in the morning he said, 'I would rather have you than all the great Nines in the World.' And he issued a decree that no one could harm the wood or anything in it.'

I had put myself to sleep with my own story, and I dreamed I went to Nine-V to turn on the water. They shook my hand and cheered when I reset the rusty controls and the sluices ran full again. Then they took me to a dark hole and threw me in.

I landed on Kiki. 'How did you get here?' I demanded angrily, as if it were my fault.

'Ah came after you,' she said. I got up and paced out the narrow hole. The floor was deep in filthy straw.

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'When I woke up, the vine had bloomed—with one enormous flower, shaped like an open trumpet and colored a delicate pink, that radiated from the golden center.'

A packet of pills
a day makes the difference between
surviving and thriving

DR. C.'S VITAMIN ELIXIRS

BY KATHLEEN STEIN

For demonstration purposes Dr Michael Colgan has offered us his body The New Zealand scientist currently a visiting scholar at Rockefeller University, in New York City says his individualized vitamin-and-mineral program is now sufficiently developed to permit people to carry out strenuous activities over a period of weeks on nothing but a handful of pills—and water And get stronger in the process"

Colgan would be happy to prove it by spending a week or ten days in the Adirondacks with his vitamins hiking over one of the really hard trails through the mountains He suggests a group of scientists might try to keep up with him He would, of course be fitted out in astronaut fashion with a modified Resperonics microchip cardiac-monitoring device to telemeter continuous readouts of his heart rate blood pressure and other vital signs to a remote recorder There is no doubt in Colgan s mind that he would come back fitter than when he left But then the forty-three-year-old nutritionist ran the 1981 New York Marathon in four hours only five weeks after he suffered a debilitating torn leg muscle—and with no intervening training

We tend to believe Colgan about the Adirondacks experiment if he steals a week away from his research he ll probably do it At one time however we were more skeptical That s before we came to realize that the history of nutrition in twentieth-century industrialized society reads like a black-humor atrocity tale in which the more we overeat, the less nourishment we get, in which people are actually starving to death as they wallow in fat And that was

PHOTOGRAPHS BY ANTHONY WOLFF

also before we ourselves were suited into Dr Colgan's biochemically customized vitamin and mineral supplements and began to feel intimations of Amazonian strengths

Colgan is one of a rapidly growing group of scientists who are attempting to refine nutrition into an exact science Colgan thinks it is an absolutely necessary thing to do Western man he says, is in danger of losing the use of his legs He doesn't get enough exercise eats a great deal of food with little nutritive value and ingests a large number of toxins into his system Since World War II—and the invention of K rations—peoples of the developed countries have undergone a huge dietary revolution In 35 years a small-town single-farmer growing-and-marketing network has mutated into a monolithic highly integrated infrastructure in which says Ross Hume Hall, in *Food for Naught* the object is not to nourish or even to feed but to force an ever-increasing consumption of fabricated products ' Until recently this transformation has gone unmarked by government agencies and learned bodies alike It has not however gone totally unnoticed by the supermarket-going public, who in expanding numbers are getting worried that they are indeed becoming what they eat

When people ask Colgan why with all the advances in modern medicine they need to take extra vitamins and minerals he tells them that modern medicine is not making them healthier or live longer Colgan will cite many findings the most compelling of which is probably *The Impact of Nutrition on the Health of Americans* by eminent pediatrician and public-health scientist Joseph Beasley Bard Fellow in Medicine and Nutrition at Bard College Annandale-on-Hudson New York In this report in final preparation for the Ford Foundation Beasley presents evidence that resoundingly contradicts the government's claim that Americans have never been healthier In stark contrast to the picture painted by the Surgeon General Beasley says, some illnesses symptoms, and conditions are rising markedly—degenerative diseases that afflict upward of 100 million Americans The plague list is long and includes everything from massive killers like cancer and cardiovascular diseases, to diabetes arthritis birth defects retardation obesity hypoglycemia, alcoholism mental illnesses drug addiction and legions of more chronic afflictions Beasley designates this burgeoning phenomenon the Malnutrition Poisoning Syndrome And he says our traditional medical methodology is faltering in the face of these chronic degenerative diseases because ' it is unduly narrow in focus too inflexible and restricted in its considerations of causes and connections

To help turn the tide of this epidemic, Colgan calls for a new order—"to turn the face of medicine away from disease toward health toward preventive medicine toward individual biochemistry which is just the opposite of mass medicine, which is just not working anymore ' Colgan predicts that within 25 years there will be a significant shift toward custom-tailored health care which will involve relatively simple manipulations a person can do to maintain his own body

Colgan views his own vitamin-and-mineral supplement program as such a simple manipulation The correct daily dose of nutrient supplements (an example of which Colgan is holding up, on page 68) can enhance physical and mental performance fight pain and depression and inhibit development of age degeneration in an individual and the diseases that are its inevitable result

Although he dislikes being considered a biological curiosity Colgan is an excellent advertisement for his own system He claims that before he developed his supplement program and started following it seven years ago, his rich chestnut hair was going gray and he got frequent colds and flu I guess I was of no more than average health overweight tired and aging he says Today he has the sleek lines of an athlete and can run ten miles without effort Ask him and he'll demonstrate a one-arm chin-up and then a one-arm push-up "I always wanted to be able to do these things as a youth but I never could My strength has increased more than one hundred percent in the last seven years And I've changed from a complete skeptic about vitamins to one completely convinced When I began my work, my colleagues laughed Now most of them take my formulas Colgan hasn't had a cold in years, and his wife says he's impervious to bugs Perhaps only the expression in his luminous blue eyes gives a hint of the decades he's lived At times they look as if they belong in another older body

"The history of nutrition in industrialized societies reads like a black-humor atrocity tale in which people are actually starving to death as they wallow in fat"

The urgency of Colgan's mission—and it can be called that—is most clearly understood against the backdrop of nutritional statistics that dwarf our attempts to eat right and stay healthy Here's a small sampling (cited by Beasley Colgan and U S government sources)

- In both the United States and the United Kingdom the average life expectancy of an adult twenty-five has not changed for more than 30 years
- In 1973 the Office of Technology Assessment (OTA) estimated that 70 percent of deaths were caused by diseases linked to diet, including high levels of fat sugar and salt
- Autopsies of men between the ages of eighteen and twenty-two killed in World War I showed no signs of atherosclerosis, according to the *Journal of the American Medical Association* In autopsies of American youths killed in Vietnam it was rare to find a soldier who did not have atherosclerotic disease
- Since 1960 there has been a huge rise in the number of children with brain damage hyperactivity and learning disabilities Today one child out of every five is afflicted
- In 1910 10 percent of U S food was factory-refined or treated with artificial additives In 1981 almost 80 percent of our foods were processed
- The amount of salt in frozen vegetables can be 100 percent more than in fresh vegetables
- The use of food coloring increased 995 percent between 1940 and 1976
- A "designer" fast-food meal—burger, milk shake, french fries—contains 22 chemical additives 12 of which in fairly small amounts are known to be toxic
- Fifty percent of an average American's total caloric intake comes in the form of empty calories —refined sugars and carbohydrates
- An average American consumes nine pounds of additives annually
- The OTA states conservatively that 30 percent of American men and 40 percent of the women between the ages of thirty and forty-nine are overweight Twenty percent are by definition obese
- The U S Recommended Daily Allowance (RDA) of vitamin A for pigs is 200 percent greater than it is for humans, for dogs 300 percent greater
- Two U S government studies found that 60 percent of those sampled who consumed a 'good mixed diet based on U S RDAs showed clinical symptoms of malnutrition, regardless of income level
- Because of the reduced need for chewing refined foods lower the amount of saliva produced and the entire metabolic processing and absorbing of nutrients are thereby reduced

Our bodies already being malnourished and progressively and simultaneously being poisoned, are treated to a catalog of additive insults Beasley writes "Every serving of processed food is treated with one or more dyes bleaches emulsifiers antioxidants moisturizers, desiccants extenders, thickeners disinfectants defoliants fungicides neutralizers artificial sweeteners hydrolyzers anticaking and antifoaming agents curers, hydrogenators, fortifiers antibiotics, arsenic artificial sex hormones and pesticides '

So it might seem that everyone in the Western World needs to be on a vitamin-

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FICTION

WHEN AULD'S ACQUAINTANCE IS FORGOT

For some people, the horrors of the past are not easily laid to rest

BY HARLAN ELLISON

That s a federal offense you re suggesting Mr Auld It s not just my job it s the whole franchise The auditors come in, they fall over it—because *I* don t know how to cover it—and the people who own this Bank lose everything they sank into it The young woman stared at Jerry Auld till he looked away She wasn't trying to be kind despite the look of desperation on his face She was telling him in as flat and forthright a manner as she could summon—just in case he was a field investigator for the regulatory agency looking for bootleg Banks—possibly wired for gathering evidence—so he would understand that *this* Memory Bank was run strictly along the lines of the federal directives

Is that what you want Mr Auld? To get us in the most serious kind of trouble?

He was pale and thin holding his clasped hands in his lap rubbing one thumb over the other till the skin was raw His eyes had desperation brimming in them No no of course not I just thought

She waited

I just thought there might be *some* way you could make an exception in this case I really have to get rid of this one last, pretty *awful* memory I know you've gone as far as you can by the usual standards but I felt if you just looked in the regulations maybe you'd find some legitimate way to

Let me stop you she said I've monitored your myelin sheathing and the depletion level is absolutely at maximum There is no way on earth short of a federal guideline being relaxed that we can leach one more memory out of your brain She let a mildly officious—some might say nasty—smile cross her lips Simply put, Mr Auld you are overdrawn at the Memory Bank

He straightened in the formfit and his voice went cold Lady I'm about as miserable as a human

PAINTING BY GOTTFRIED HELNWEIN

being can be I've got a head full of stuff that makes sex with spiders and other small, furry things seem like a happy alternative and I don't need you to make me feel like a tool"

He stood up "I'm sorry I asked you to do something you can't do I just hope you don't come to where I am some day and need someone to help"

She started to reply but he was already walking toward the iris As it dilated he turned to look at her once more "You don't look anything like her I was wrong"

Then he was gone

It took her some time to unravel the meaning of his last words but she decided she had no time to feel sorry for him She wondered who 'her' was then she forgot it

The little man with the long nose and the cerise caftan spotted Auld as he left the Memory Bank He had been sitting on a bench in the mall sipping at a bulb of Flashpoint Soda, watching the Bank He recognized Auld's distressed look at once, and he punctiliously deposited the bulb in a nearby incinerator box and followed him

When Jerry Auld wandered into a showroom displaying this year's models of the Ford hoverpak, the little man sauntered around the block once, strolled into the showroom and sidled up to him They stood side by side, looking at the pak

"They say it's the same design the air-cops use, just less juice," the little man said, not looking at Auld

Jerry looked down at him, aware of him for the first time "That so? Interesting"

"You look to me," the little man said, in the same tone of voice he had used to comment on the Ford pak, casual, light, like a man with some bad memories

Jerry's eyes narrowed Something I can do for you, chum?

The little man shrugged and acted nonchalant "For me? Hell, no I'm fuzz-tree and frilly, friend What I thought I might be able to do something upright for you"

"Like what?

"Like get you to a clean, precise Bank that could leach off some bad stains"

Jerry looked around The showroom grifters were busy with live customers He turned to face the little man

"Why me?

The little man smiled "Saw you hobble out of the Franchise Bank in the mall You looked rocky, friend Mighty rocky Carrying a freightload of old movies in your skull Figured they turned you down for one reason or another Figured you could use a friendly steer"

Jerry had been expecting something like this The Bank in the mall had not been his first stop There had been the Memory Bank in the Corporate Tower and the Bank in the Longacre Shopping Center and the Bank at Mount Sinai They had all turned him down, and from recent articles he'd read on bootleg memory operations, he'd suspected that maintaining a visible image would put the steerers on to him

"You got a name, chum?

"Do I gotta have a name?

"Just in case I go around a dark corner with you and get a sap upside my head I want to be able to remember a tag to go with the face"

The little man grinned nastily "Remember the nose My friends call me Pinocchio"

"Let's go see the man," Jerry Auld said

"Woman," Pinocchio said

"Woman," Jerry Auld said "Let's go see the woman"

The bootleg Bank was on an air-cushion yacht anchored beyond the twelve-mile limit They reached it using hoverpaks and by the time the strung lights of the vessel materialized out of the mist it was night They put down on the forecastle pad and racked their units Pinocchio kept up a line of useless chatter, intended to allay Auld's fears It served to draw him up

"The little man with the long nose and the cerise caftan spotted Auld as he left the Memory Bank. He recognized Auld's distressed look at once and followed him."

tighter than he'd been before the little man had braced him

Jerry saw guards with weapons on the flying bridge

Pinocchio caught his glance and said "Precautions"

"Sure

Pinocchio didn't move Jerry said "Are we doing something here or just taking the night air? He didn't like being under the guns

Pinocchio kept his eyes on the flying bridge as he said "They're making us reporting It'll only be a minute

"What kind of trouble do these people get?" Jerry asked

"Hijackers sometimes You know pirates The market's lively right now A lot of jockeying for territory, getting good product to push One of the armed guards motioned with his weapon and Pinocchio said, "Come on

They went belowdecks The yacht was handsomely appointed Flocked-velvet wallpaper in the companionways, burnished metal banisters, thick carpets Pinocchio knocked at an inlaid teak door The door was opened by an unexceptional-looking woman She smiled *pro forma* and walked back into the cabin, permitting Auld and the little man to enter

The room was a spacious saloon fitted to the walls with the memory-leaching devices Auld recognized from his many trips to legitimate Banks in the city

"Ms Keogh, I'd like to introduce Mr Jerry Auld Met him in the city thought we could do a little business

She waved him to silence "Do you have your own transportation Mr Auld? Or did you come with Mr. Timiachi?

Auld said, "I have my own pak

"Then you can go Mr Timiachi" she said to the little man "Stop by the office and get a check

Obsequious Pinocchio bobbed his head and smiled a goodbye at Jerry Then, sans forelock tugging, he bowed himself out of the saloon Ms Keogh waved at a formfit Jerry sat down

"How close are you to maximum depletion?" she said

He decided not to fence He was in too much pain They were both here for the same thing I'm at the limit"

She walked around the saloon, thinking Then she came and sat down beside him in the other formfit Through the open porthole Auld heard the mournful sound of something calling to its mate across the night water Let me tell you several things" she said

"I want to get rid of some bad stains" Auld said "I know what I need to know"

She raised a hand to silence him Probably Nonetheless this is not a bucket shop Bootleg, yes, but not a crash-and-burn operation"

He indicated he'd listen

"The holographic memory model postulates that a memory is stored in a manner analogous to a hologram—not sited in any specific area, but stored all over the brain To remove one certain memory it is always necessary to break molecules of myelin all over the brain from the densely packed myelin of the corpus callosum—

"The white matter Auld said She nodded "I've heard all this before

"—from the white matter right down the spinal cord, perhaps even down into the peripheral nerves She finished on a tone of dogged determination

"Now tell me about the weak point in the long-chain myelin molecule The A-1 link Tell me how easily the molecule breaks there The point at which muscular dystrophy and other neurodegenerative diseases attack the molecule Tell me how I might become a head of lettuce if I go past the max I've heard it all before I'm surprised you're trying to discourage me I'm also annoyed, lady"

She looked at him with resignation "We don't push anyone and we don't lie It's bad enough we're outside the law I don't want anyone's life on my hands Your choice, fully informed"

He stood up "Put me in the drain and let's get this over with"

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PROFILE

Robert Redford gets a rude awakening to the politics of environmentalism

PHOTOGRAPH BY DOUGLAS KIRKLAND

SUNDANCE TO A DIFFERENT DRUMMER

BY GORDON F. SANDER

The people turned him into a symbol, Robert Redford says. They made a dummy with a blond wig. More than 500 residents of Kane County, Utah, cheered when they hoisted the dummy up and set it on fire. One speaker called him "skunkman, a self-proclaimed voice of the hypocritical obstructionists." They burned him in effigy for opposing a power plant, and when the dummy had turned to ashes, there was no director to call for an end to the scene. It was not a film.

The burning in April 1976 wasn't the worst of it, Redford said recently. "That kind of made me wince around the shoulders a little bit," he says. But what was really upsetting was that my own particular view had become so distorted by people's needs." Out of the ashes of the experience Redford drew renewed determination to fight any attempt to *cast* him in real life, to put labels on him, to turn him into a gold-topped dummy. That's one reason why he seldom gives interviews.

"I've seen too many accounts . . . of what kind of shoes I was wearing, what color my boots were, whether my clothes were hand-tailored or not, and how tall I was and how big I was, or whether my hair was sandy-colored or my teeth were white'—the data of dummies—'rather than what the hell I was talking about.' The incident in Utah also propelled Redford on a long, sometimes frustrating quest. One initial goal

of this quest was nothing less than the establishment of a national Academy for Natural Resources, a sort of Annapolis of the Environment for educating government employees in how to manage natural resources—perhaps training some of those who had burned him in effigy or others who might have wanted to.

Redford recently described his quest, his frustrations, and his expectations in a set of interviews with *Omni* in his cluttered New York office high above Rockefeller Plaza. His workspace confounds the public's images of him. A large poster for *The Solar Film*, a solar-awareness documentary Redford produced, looms over his memo-laden desk. Affixed to a large expanse of corkboard is a letter from an assistant secretary of the Interior thanking the forty-four-year-old actor-activist for his role in testifying for the 1977 Clean Air Act and helping push it through Congress. Next to it, a note from Jimmy Carter praises Redford for his conservation work and for his article in *National Geographic* about his horseback trip down the old Outlaw Trail.

Facing Redford's desk on the opposite wall is a breathtaking photograph of Timpanogos, the wind-swept Utah peak atop which Redford and his wife and three teen-aged children live in a solar house of his own design. Slopes of the mountain also serve as the site for Sundance, the low-key ski resort that Redford owns.

Hardest to find among the memorabilia is the Redford of screen roles. A visitor must look for the small portrait of him and Barbra Streisand, costar of *The Way We Were*, semi-camouflaged amid a wall of family mementoes. There's another familylike photo of the stars of *Ordinary People*, the movie for which director Redford won an Academy Award. And on the bottom shelf of a corner bookcase there are several dozen screenplay spines, some with familiar names (*The Electric Horseman*, *Brubaker*), some with intriguingly unfamiliar titles (*Peking Man* and *Greenpeace*). But other shelves suggest other priorities. A ponderous book called *Global Report on Energy* leans against a small golden apple Redford received as an award for *All the President's Men*.

And during the talks—the first in-depth interviews Redford has granted since 1980—Redford continually avoided predictable positions. *On Secretary of the Interior James Watt, anathema to many environmentalists*: "I happen to think he's the wrong man for the job. In my view he's grossly inadequate. But what I fear is, who they are going to pick to replace him. How do we know they wouldn't be vindictive and replace him with somebody far worse?"

On the balance between conservation and development of the environment: "I'm interested in awakening people to the existence of the environment and what it means and what it has and what the resources are all about. And that includes those resources that *should* be developed because I accept the fact that we're a developmental society. We're not ever going to change that. The wagons will always be rolling as long as we're on this planet."

On the Kane County crowd that burned him in effigy for opposing the power plant: "They'd been standing there in five inches of dust saying, 'How am I going to make a life down here,' and some shit movie star comes along who lives in the mountains and comes down to this country and tells me what I'm going to do with my life? The hell with him. Well, I understand that completely. I would have done the same thing."

Long before work on the power plant had even begun, it had already generated considerable hope for residents of Kane County. The $3.5 billion Kaiparowits facility—capable of supplying electricity for a community of 3 million—would have created a permanent settlement of 15,000 and an increase in payrolls in Kane of more than $100 million a year. Its partners including the Southern California Edison Company said that it would eventually have increased tax revenues in the county by $28 million a year. It was to be the largest coal-fired generating plant in the United States.

> *"I was afraid that we were at a place where we were no longer going to be inheriting life from our fathers, but we were going to be borrowing it from our children."*

Everyone agreed there was an environmental price to be paid for these riches. The plant, which was to supply power to southern California and Arizona, was to be located near eight national parks and three national recreation areas. Planning, which started in 1963—ironically the same year Redford starred on Broadway in *Barefoot in the Park*—focused on the Kane County site because the ground was rich in coal. But burning that coal in the plant would have injected about 300 tons of contaminants a day into the crystalline air of the Glen Canyon National Recreation Area, Bryce Canyon, Zion, and other scenic preservation lands. The question was whether the price was too high.

For Redford—who had already been active in other environmental controversies around the country, though none so close to home—it was. Power-plant partners mounted an expensive campaign to try to show that it wasn't. The Southern California Edison Company was taking PR tours with people in helicopters, consuming great amounts of energy just to convince the public it was a great thing. Redford recalls: "And I went on one. Redford spent most of the time on the tour asking questions of his guide. 'Such as, 'How much are you spending on PR for this thing?' And he said, 'Four million dollars.' And I said, 'How much are you spending on R and D for alternate energy systems?' He said, 'Two million.' Those figures alone told me a lot."

Environmental activist groups, such as the Sierra Club, opposed the project. But Redford, who prefers not to become too closely allied with any group, did his own research. He discovered, among other things, that the developers were proceeding on the assumption that the demand for electricity in California would increase by 7 percent per year. "That was not true," Redford says. "That seven percent was a 1970 figure, a time when growth was really going haywire. So I looked into that, with some people in California, and found out that demand was on the decline because of energy conservation and solarization programs and things of that sort. The growth in demand was more like 2 percent," Redford asserts, and was headed toward less than zero.

There was more. They were going to mine Utah resources, pollute Utah air, thermopollute Utah water, and consume Utah water to ship power to California, and gouge up fourteen hundred square miles of land for transmission lines in doing so. "And I said this is not right."

And—still acting alone—Redford said it to *60 Minutes*. "I said, 'I think you ought to look at this. There's a microcosm of something here.'" CBS producers jumped at the idea and pressed Redford to appear on-screen. Reluctantly he agreed. It was a *role*, a *label* on national display. Redford the power-plant opponent versus Utah Governor Calvin L. Rampton. Redford the environmentalist versus a rough-cut spokesman for the plant. Redford the star from the mountains versus the people of Kane County.

In the end it wasn't Robert Redford who killed the plant. Partners pulled out in April 1976, publicly attributing the cancellation to economic, regulatory, and environmental causes. Among other problems, the cost of construction had multiplied at least five times during the years of planning, and as Redford had discovered, the demand for electricity was waning nationally. But some of the people of Kane County blamed the decision not to go ahead on Redford and strung up their effigy.

It was unfortunate and unfair, Redford says, "but I learned a valuable lesson from them that what's *missing* in all of this is education. What's missing is real leadership, real information, . . . some mechanism that ten years ago would have been able to really look at that idea for a plant and analyze it, and come away saying, 'It doesn't make any sense, we don't have to

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A DANCER'S SECRET WORLDS

Viewers never know whether they are in the cage, or the angels are, and I'll never tell," laughs Evelyn Taylor about her enigmatic *Cage* (left). The painter is intrigued with mystery, living with it all the time. It is her peripheral vision, "the outer edge of vision I try to translate into paint." A former Broadway and ballet dancer, Taylor first painted to relieve the tension of her continually demanding roles. Then painting became the liberating force. She was free to create "real" Renaissance cherubs to join the bronze angel atop New York City's St. John the Divine in *Trio* (above). People tell her the paintings have hooks in them.

In *The Last Resort* (left) Taylor juxtaposes a decaying plantation with a mountain background, "impossible terrain for the South," says this Mississippian. Menacing gingerbreads (above) are *Scylla and Charybdis*

Taylor creates altered seasons in *The Gazebo* (above), where it's always summer inside, and in *Last Summer* (right), where a green world is mirrored brokenly in a vernal wood—mysteries of dappled light and shade

Attacked for his controversial views of behavior, an avant-garde anthropologist argues that humans separate biology from society at their own peril

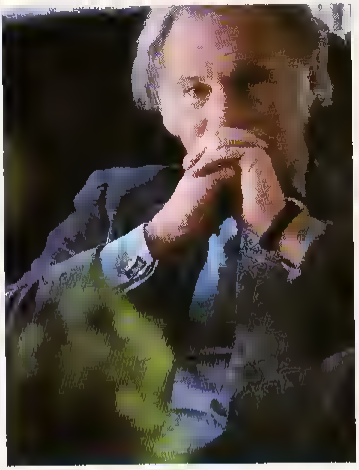
INTERVIEW

LIONEL TIGER

Photographs by Tony Guccione

What first struck me about Professor Lionel Tiger when I arrived to interview him was that he is smaller than I had extrapolated from the photograph of him that appears on the back cover of his last book, *Optimism: The Biology of Hope*. I had pictured him as a great bear of a man whose sheer physical bulk had protected him from the slings and arrows that had been hurled at his every new book, theory, and hypothesis. Instead, Professor Tiger, divorced and the father of a young son, is a short, trim man with slightly graying hair, who has weathered controversy after controversy with work, wit, and wisdom rather than thick skull and brutish frame.

Lionel Tiger is a man of many academic accomplishments and disciplines. Born in Montreal's Jewish community in 1937, he is currently professor of anthropology at New Jersey's Rutgers University—no mean feat for someone with a Ph.D. in political sociology. Professor Tiger has authored two books, *Men in Groups* (Random House, 1969) and *Optimism: The Biology of Hope* (Simon and Schuster, 1979). He has also coauthored *The Imperial Animal* (Holt, Rinehart and Winston, 1971) with Robin Fox and *Women in the Kibbutz* (Harcourt Brace Jovanovich, 1975) with Joseph Shepher. While his books



"The industrial system is just ten generations old. It's still exotic. When we look to the roots of America, we see a little town with a church and bowling alley. Not a whizzing computer plant."

and numerous articles cover a broad spectrum of subjects his underlying message is clear. Look to biology to unlock the secrets of human behavior and civilization.

My first contact with Professor Tiger took place over the telephone, when, on a previous assignment for *Omni*, I sought his thoughts on the noisome penchant of adolescent males to walk urban streets blasting passersby with lethal decibels of rock, disco and salsa from their giant radio cassette players. Tiger likened these youths to dogs peeing on telephone poles. They do it, he said, to mark their territory. Six months later I was sitting in his comfortable midtown Manhattan loft, taping our wide-ranging conversation on my own battered boom box.

When *Men in Groups* was first published in 1969—positing, among other things, that women's historical inequality in society can be traced back to the sexist social hierarchies of our primate forebears—the concatenate feminist outrage sparked by this hypothesis nearly led to a full-blown riot when the author appeared on the *David Frost Show* to defend and amplify his views. This reaction caught Tiger by surprise, since he truly felt he was merely isolating the root of the problem, not condemning women to gather forever while men continued to hunt. In *Women in the Kibbutz* Tiger clarified his position: "Biological differences do exist; the challenge is to prevent them from emerging as inequalities." Since then he has found his way back into the hearts of women and, in 1981, was named to the National Honors Committee of the Women's Hall of Fame.

Lionel Tiger is an avant garde thinker whose thoughts and opinions have more crucified than sanctified him. Just the critics of *The Imperial Animal* alone have accused Tiger and coauthor Robin Fox of racism, sexism, neofascism, propagandism, and methodological irresponsibility. But Tiger remains largely undaunted by those who would have his head and continues instead, eagerly tapping the resources of zoology, sociology, biology, anthropology, ethology, and primatology to understand better just who we really are and how we came to be imperial animals in the first place. Fox once said of his distinguished colleague: "He's had to pay a great price for being original."

Professor Tiger's current book project—the study of the evil inherent in our relatively young industrial system—promises to be both engrossing and controversial. With our planet reeling under the blows of industrial pollution, nuclear contamination, and similar brutalities committed in the name of commerce and profit, perhaps Lionel Tiger can teach us how to harness our energies to create a brave new world, rather than one that no longer exists. —Bill Moseley

Omni: You are a professor of anthropology, a coprincipal investigator in sociobiology, and an ethologist with a Ph.D. in political sociology, and you love zoology. What does that make you?

Tiger: I became interested in biology because it seemed to me that traditional sociology was inadequate to explain some of the regularities of human behavior. I got interested in gender difference when I was teaching political sociology at the University of British Columbia [in Vancouver], and I had to confront the issue of why politics was so overwhelmingly male. This was in 1964. Earlier I had become interested in work that was just being reported on early primatology and also on the excavations of human ancestors in East Africa. That seemed quite portentous for the social sciences. So I decided to take a crack at it, which meant that I had to read biology.

To me, the most interesting part of biology at that time was ethology, which is the study of the underlying nature of behavior. Studies of other animals were being done more sensitively and over a longer period of time than before, and we could begin to see how animals had social structures.

Now in sociology the conventional training is to explain one social fact with another social fact. That was Emile Durkheim's big blunder in his book *The Rules of Sociological Method*. It was a disastrous book, and yet everyone solemnly accepted it. And if an explanation moved to the biological level, people instantly said "reductionist," somehow assuming that reductionism was simplification—which it is not. In this case it simply means you're adding a whole new array of data and theory to what you're trying to do.

So I found myself interested in characters who went around watching fish mating and listening to birds warbling and primates bellowing, and that sort of thing—which is a whole new landscape to encounter. Yet it seemed to me a very real one, and one that, as a social scientist, I had an obligation to understand. That was the start of it, and since then I've taken my social structures where I've found them.

Omni: Where is that?

Tiger: Well, from whichever animal is exhibiting that behavior. I think there are certain similarities in behavioral nature that are at least metaphorically comparable to elements of human social behavior—just as physiologically we can learn a lot about humans by looking at the insides of chimpanzees or even rodents.

Now obviously there are enormous differences between humans and other animals, but those are species differences. And if you want to understand what the differences are, you have to understand what's comparable and similar. There still remains much interesting work to be done on the whole question of human biology. We're just beginning to get to this issue.

Omni: Do you think there has to be a marriage of the natural and social sciences into a whole new science to better understand human nature?

Tiger: One of the advantages I had, as a sociology student, was that I actually learned about social structure as a

phenomenon. And I found that very useful when I was looking at primatological material because the early primatologists had no notion about that. They would say "Animal A scratches its head, Animal B grunts, and Animal C runs away" but they usually couldn't see the internal logic of the social system. So I was very lucky in that I was able to bring something to the study of animal behavior that was a legitimate product of the social sciences.

The situation now, I think, is one in which we rather desperately need to get beyond the parochial boundaries of the so-called natural and the so-called social sciences. Even semantically it's absurd. Is the social not natural? Is that the implication of making this distinction? It's totally crazy, and yet one can still get a degree in sociology from any major university in this country and learn only about one animal—and even about that animal as it has existed only for the last couple of hundred years. And that seems to me absurd and dangerously small-minded.

I think what we're going to find in the next forty or fifty years, as the world becomes much more intensely communal and interdependent, is that anyone who really wants to understand what's going on will have to know something about the endocrines, some comparative material about other animals, and will have to understand the cortical integration of behavior—how the emotions affect cognition and so on. I suspect that we're going to have to begin very actively redesigning certain elements of the liberal arts curriculum to include the grittiness and fundamentality of biology.

Omni: In your academic career, have you had problems with traditionalists who claim that you've gone out of your discipline by blending the social and natural sciences?

Tiger: Oh, yes. I think partly because I happened to hit on a controversial subject in my first book [*Men in Groups*]. But I believe the controversy was really not about feminism and male dominance. I think that was a screen. In fact, I think the great interest in feminism in the Seventies was a mask for an interest in biology. And, even though feminists would say that biology is not destiny—which clearly it is not—nevertheless, the concern about where gender difference comes from has got to be a biological concern or an antibiological concern.

So, yes, it's been a very controversial business, and I must say it puzzled me a lot, because it seemed to me totally obvious that if you're looking at the behavior of a complicated animal, you have to assume that some of the complexity and some of the behavior is animal. Now I don't regard that as a pejorative comment, but it is still possible for judges to sentence somebody to prison, saying that person acted like an animal or a beast. So there is a strong prejudice against animality. And now we have the "razzle-dazzle balloon fliers" called the Moral Majority claiming that we've never had anything to do with other animals. So it is a real issue, and it remains serious.

I think it's typical of a kind of thoughtless environmentalism. A failure to understand the almost tragic nature of biological destiny permits you to say there's no such thing as evolution, no such thing as biology. But there are. And I don't know what those people think just the instant before they die, but I hope they have reassuring thoughts.

Omni: Perhaps, if they don't have enough confidence in themselves as animals, they might need religion to make it through.

Tiger: Well, you know, my last book [*Optimism: The Biology of Hope*] dealt with the human need to perceive the odds in our favor. And I think that we may need an extra bit of help because, since we do have this great cognitive apparatus, we see too much, and we may well need some mechanism for cutting out unpleasant stimuli—such as the fact of death and comparably dolorous phenomena.

There also may have been an evolutionary premium offered to people who said, "We are not animals, we are special." And that's worked fine up until now. However, I think the ecology movement has made it clear that this attitude has very real limits, because neither the planet nor other animals, nor indeed the human species, is totally malleable. We all have our limits.

Now there's a new situation. The population expansion is so rapid, and the industrialization of the planet is so extensive, that we have too many people living in an environment with too many real pollutants. And because of electronic media, we have an enormous amount of psychological density that we never used to have. So all the signs are that somehow we're going to have to rethink this arrogant antibiological attitude, and those intrepid characters who want to break down the barrier have got to expect that they're not going to be loved for it, because the barriers obviously serve some comforting purpose.

Omni: Given the advances in science that continue to extend the average life expectancy, do you think we need more or less optimism to make it through a longer life?

Tiger: Probably more, because we have longer to go for a start, and a longer period of being subject to dread diseases after the age of fifty or sixty. In addition, I think that the loss of a widespread faith in a god is a real loss. We have to replace it with something else, either personal optimism of some sort—which sometimes can be totally nauseating, as in the "I'm all right, you're all right" genuflection—or some genuine sense that life is worth living and that interactions with people are desirable or undesirable, but meaningful in any case.

I've always been impressed with Spinoza's formulation that freedom is the recognition of necessity. Somehow we either embrace the fact that we are where we are or we try to run away. We run away from ourselves if we do.

Omni: You say that optimism is actually a

"It all started when I looked down one day and thought 'What the heck is this little alligator doing on my shirt?'"

substance secreted by the brain

Tiger When I started this book I predicted in my own mind that we would have to find a neurochemistry for optimism, or happiness as we already had one for depression We knew that there are neural transmitters that are related to depression and, if you gave people pills they would often feel better Much still isn't known about why people are happy

Optimism I believe, is a characteristic of human groups that you could study because it gets externalized in the form of God Atlantic City, countless ways But that's a real externalization of an equally real internal protest We know that people tend to remember positive rather than negative stimuli and we know that, by and large they will produce optimistic scenarios The evolutionary trick was to be able to create an adequately optimistic scenario without going off the deep end Witness the manic person who believes he can fly Fortunately for me, when I started writing up the material for my book the endorphins were discovered which were immediately labeled "happiness transmitters And if the endorphins aren't responsible for optimism *per se* then they certainly offer us a metaphor for what they might be responsible for

Omni If, indeed, these endorphins are the cause of optimism, and if they could be synthesized what future applications do you perceive for them?

Tiger The endorphins are being experimented with and many drug companies are struggling to manufacture them in commercial form However there's a problem with most drugs, which is that they have a kind of self-limiting life As with alcohol nicotine morphine or whatever the dosage level has to be increased because the organism adapts to it

It's possible that these are different The endorphins don't seem to be addictive inasmuch as we make them ourselves In a sense we're addicted to ourselves The problem is that endorphins may well be associated with other phenomena There's an interesting study now being done of primate hierarchies in which it seems that there's an association between a high level of endorphins and a high level of social assertion or dominance That has already been demonstrated for serotonin levels and dominance behavior in monkeys What might happen then is that if you make everybody feel wonderful you'll get in a lot of trouble When you deal with drugs such as endorphins or tranquilizers or a contraceptive—which is a very powerful behavioral modifier—you must look at the implications for social structure

At that level again—I think the biological and the sociological sciences must merge The biological sciences are not competent on their own to understand the nature of these reactions That is why the Food and Drug Administration points out that it does not typically investigate the social impact of drugs but looks principally at the internal and immediate psychological impact I don't think that's what it ought to do

Omni You are quoted as saying that it is 'healthy' for humans to reproduce Since our population is fast outstripping the resources of the planet do you think that the stringent birth-control measures that must be applied very soon will produce unhealthy results in our collective psyche?

Tiger There is no doubt that among other animals a good birth rate is a sign of general health and that in humans reproductivity is positively associated with health in the sense that people with children tend to live longer than people without children Now part of that is just a circumstantial variation but we do know that in other animals as well as in humans depression is positively related to sexual inactivity impotence and infertility Therefore I think that the impact of low birth rates is a very critical issue We're now below a replacement birth rate in this country Our birth rate is about 1 68 per couple Every woman must have 2 2 children in order for the American population to replace itself I don't know that there are very many women having 2 2 children And there are many women evidently unwilling to have any

What impact does this have in the long run? I do think it reveals a major shift in the level of confidence that females have in the males in the population To a large extent, women are saying We don't think you males are likely to provide us as reproductive females with the goods and services that we require in order to do this job well I know it's an unpopular view but I think that a certain amount of what went on in the early feminist movement had to do with

women saying Look, you re not useful to us as mates Then give us your jobs Why should you have the jobs *and* the freedom to not take care of your children?

With contraceptive technology, males are now able to avoid responsibilities that are consequences of sexual relations Perhaps females are responding by cutting birth rates We need abortion facilities because women are not going to raise babies by themselves unless they have a kinship network which would help, or unless they are teen-agers who don t know any better Teen-agers are the only group in the population having a lot of children The government is going to try to make them even more ignorant by withholding sexual information from them—another bizarre quixotic enthusiasm of the Moral Majority

I don't want to pronounce on what's healthy or unhealthy but I do think that a large community that doesn t have a large number of children to care for and see through to the future is a different kind of community than we used to have What impact this is going to have, we don t know But we have to assume it s going to be serious Not necessarily grave—it might be wonderful—but it does mean that we may have to think differently about how we translate the future into the present and about what kinds of notions of the life cycle people can expect to live with

This is I think a new problem We now have the phenomenon of many professional women in their thirties who realize that if they're going to have children they have to do it pronto And they re facing a real bind as is the community of which they are members as are the males with whom they interact as are their employers

Omni Do you think the choice these women have to make is made more difficult by the male-dominated power structures of business and politics?

Tiger The labor force is still male oriented What we have done—and we ve done this on a planetary basis—is driven a wedge between the productive and reproductive functions It s now gotten to the stage in this country where if you ask people whether they re married or whether they have children or any particular sexual orientation or disorientation you can be issued a civil-liberties charge because it s assumed that the only thing that matters is a person s productive capacity The fact that people do have reproductive and emotional lives gets dealt with afterwards

Hence you have organizations that, having hired people irrespective of their reproductive interests or condition now have to worry about what to do with somebody man or woman who says I don t want to work overtime because I want to be with my kids or, Forget it I m not going to Alaska just because you need somebody there I have a kid in school And those are becoming real issues But for a long time nobody cared You could be an elegant executive and you could be picked up by your employer and shipped to Tulsa Spokane Chicago, Brussels And nobody was supposed to mind that maybe the kids were going nuts and the females couldn't get jobs or make any friends

We re having to think twice about this But, again, I think it s because we haven t understood that the productive function is also related to the reproductive function We've assumed that the reproductive function is not done on company time It isn t done on company time, but it affects the company deeply

Omni Are today s social phenomena—the soaring divorce rate, the rise in single-parent households and the proliferation of homosexuality—attributable to any kind of breakdown in man s ability to bond?

Tiger I think a lot of it actually has to do with changes in contraceptive technology This is the first time in the history of the mammal that one sex can if it wants to control the genetic reproductive future Fifteen or twenty years ago the principal contraceptive was the condom, a social contraceptive Contraception now gives females a tremendous amount of freedom But what it also does is remove from the sexual relationship an element of mutual responsibility Now the woman has that responsibility In a way it s the male who has gotten liberated not the female

But it's partly a result of not understanding the profound impact of technology on biology Now we ve internalized the industrial system into the body with drugs devices and so on A lot of Americans are sterilized In California I gather among people who have been married from five to nine years sterilization equals pill use as a form of contraception That is extraordinary Why would anyone do this? It s a form of suicide—genetic suicide I truly don't understand it And yet there are a lot of people walking around who have made this choice

I think the medical profession and the sexology industry were totally cavalier in not making people aware of the enormity of the sexual revolution I frankly don t believe that it s all such a charming piece of emancipation—that you can copulate your heart out and nothing will happen So I think it does indicate something very weird about the population as a whole What it means about the future I don t know but I refuse to think it s trivial

Omni In *Men in Groups* you talked about how male homosexuality is an attempt at bonding Do you see it as a breakdown in or a more earnest attempt at bonding?

Tiger It may be a more earnest attempt in the absence of other structures For example when it's no longer possible for men to sit around with some sense of dignity and discuss baseball scores—because this is so clearly macho and therefore absurd—it may produce some pressure to go off and sit in a gay bar Who knows? I don t think anyone knows what causes or what is really associated with homosexuality There may be hormonal reasons It may have to do with the kinds of drugs women were

given while they were carrying children It may have to do with the stress level of early mothering It may have to do with the disappearance of clear male models But there s something going on and it s obviously very important and has to be approached extremely sensitively and compassionately

Omni In your writing you point out that the capitalist system is antinatural in that bureaucracy and mass education for example inhibit our primatological impulses to be free and natural Also in the name of profit a lot of the planet has been ravaged and polluted

Tiger Well I m currently working on a book dealing with the relationship between evil and the industrial system because a whole lot of things are happening that are evil in the classical sense these are artifacts of an industrial system that is new and not well understood by its practitioners The industrial system is after all just ten generations old and we forget that it s still exotic—even in a society like this When we look to the roots of America we see a little town with a church and a bowling alley—not some whizzing computer or some chemical refinery So we re still uncomfortable with the system

What seems to have happened is that the demands of the productive apparatus have come to take precedence over almost everything else including the political system So in the so-called Third World modernization and industrialization became the major values—ludicrously don t you think? Because what they needed was enhanced agriculture Countries that had ample rice production began to produce tin cans instead Now they have some tin cans and no rice to put in them

Omni Is there a government a system that seems to be working?

Tiger Enthusiasms wax and wane People like Castro for a while then they like Mao then this person or that person The recent election in France is very interesting They were able to make a quite considerable shift in political nature In England the system worked The people voted out a government and got a new one

Part of the problem is that we characteristically look at the epiphenomenon and not the phenomenon So what becomes important is the ideology and not what the ideology is about I spent twelve days in the Soviet Union and I was really impressed by the way the ideology coerces the social structure and people end up having to do things to serve the ideological god even though the ideological god was set up to serve the people It s troubling how effective the ideology is Again that's because we have these great brains and we have to use them and I think we ve used them too much in a certain sense

I daresay a lot of things happen in politics that we know are wrong and yet we make terrific justifications for them We know it s wrong to torture people, to pick them up and have them disappear in the middle of

the night. Everyone knows that's wrong. It happens because some government official or some local character says that those people are communists or capitalists—whatever you want to name them—and cognitively redefines them as not important, as nonhuman.

Omni: Pseudo-speciation.

Tiger: Pseudo-speciation. You can do what you like to them. Call them Jews, as in the case of Argentina, or Communists, as in the case of El Salvador. Now what is this? This is a cognitive act. It's not an animal act. That's what we don't see. The animal behavior—which is, you don't go around torturing people—would be quite healthy. In fact you really have to train people to torture others, and even then it's uncomfortable. But it's the cognitive redefinition that's important.

Omni: Do you think the earth would be a better place if we all lived in one big kibbutz, or many small kibbutzim? Is that the best operational social model you've seen?

Tiger: I don't think I would like to live that way, partly because I don't like rural life very much. I prefer cities. Cities are healthy and a great phenomenon. The kibbutz, on the other hand, is a very impressive way of life. People there seem quite well, and about eighty percent stay, which is a very high retention rate for intentional communities. I think it's good that people feel they don't exploit other people. We'd all like that. But it's not a model for France or Britain or Indonesia, or any other country because it's a small-scale structure.

Part of our problem is and will be: Can we redefine large-scale structures in such a way as to make them meaningful and useful on a small scale, without becoming inefficient in terms of wider markets? The Japanese seem partly to have solved that problem in their industrial system, and we may have to learn from them, and other people as well.

I was fascinated, when I was in Japan, to see a superhighway, and right up against it—rice. People would come out barefooted the way they've done for six hundred years, and plant rice right next to the highway. Literally. And that's because somebody owns that plot, and every bit of land is important. The community recognizes this. What would probably happen here is the government would say, "Twelve feet on each side can't be planted with anything." So we may somehow have to be willing to intrude the grandmother's rice paddy into a General Motors testing track and not feel we're defiling either.

Omni: If you were asked to design a space colony, would you use the kibbutz as a model? If so, how would you improve on it?

Tiger: I think if you were designing a space colony, you'd need to have basic equity. The kibbutz notion of equity is very important. There they have merged the productive and reproductive functions by making feeding and child care and laundry productive activities. It's institutionalized; it's integral to the whole community. And that provides considerably more flexibility than if all those functions are turned over to the family. In this country a single household may have as much equipment as a whole kibbutz needs for laundry, cooking, and so on. We've taken it a step further now. More and more Americans are living in smaller and smaller families—the ultimate small family being a family of one. And yet the same amount of apparatus is as necessary for one person as for five. So every upper-middle-class person has to have a Cuisinart, and when they have their fifty percent divorces, you get two Cuisinarts instead of one. It's a form of internal colonialism. We can no longer export to other countries. So we're exporting to ourselves by acquiring more and more of the apparatus of domesticity.

In terms of sexual integration, men and women in the kibbutz all work, and they all get equal pay, which is no pay, and it's a viable system.

Omni: Did the women complain of being unequal in the kibbutz?

Tiger: No. Oddly enough, women complained that they couldn't be reactionary enough. That is, they felt that they actually would rather go to the hairdresser than work another hour in the fields. The pressure they're putting on the community is for freedom to do more traditional things.

One example is the visit to the children's house during the day. Women with newborn babies, in particular, wanted to see their infants during the day. It took women out of the labor force for a whole hour. That's a lot of lost time. These are very busy communities. But they wanted to do it, and they're doing it. Men resist this. They say it's expensive and ideologically impure. It may be, but it's biologically likely.

Omni: So in a space colony you would have more of a day-care center than a children's house?

Tiger: Yes. Some place for intimate experience is essential. After all, we're custom-reared primates. We don't have that many offspring, and we tend to be quite particular about how we raise kids. So it's probably not a bad idea to have the kids in contact with their parents some hours of the day.

Omni: Have you made your peace with women?

Tiger: I had always felt that it was a feminist book. And I was rather surprised at the whole thing, because what I was doing was identifying the seriousness of the issue. Anyone interested in feminism has to pay attention to biology. And I suspect that the feminist issue is no longer as challenging, in media terms, because the focus has changed to the biological issue, which is where it should have been in the first place.

As for me personally, I live within that square mile that probably is populated by more feminists per square yard than any other place in the world. So not only have I made my peace, but, as Mao said, I'm living with them, swimming with them. The

issue is no longer acrimonious. It's become clear, at least to some of the people who were most vicious, that I didn't mean to be vicious and that my argument was one that, in some real sense, they had to deal with. I was a useful enemy. It's always good to have an enemy who's on your side and who's unlikely to fight back destructively.

Omni: You once wrote that women would be better off working at the things for which they're biologically suited, rather than spending time trying to do male-oriented things—that they would thereby achieve equality or liberation much more rapidly and effortlessly.

Tiger: I can't remember when I wrote that, but in *Men in Groups* I was concerned to describe the difference between equality and similarity. I didn't think then, and I still don't think, that, other things being equal, you're going to end up with women and men doing the same job. They're just going to want to do different jobs. And the problem is not difference, but equality.

The point is that a healthy community would make it possible for men and women to feel equal, even though they were doing dissimilar things. In the kibbutz, for example, men and women tend to be quite polarized in their work, even though there's no pay. Money has nothing to do with it. Women are more resistant to seeing men go into their work groups than vice versa.

There are obvious inequities that have to be remedied, such as the failure of women to get into high management. One of the problems with corporations has been that they haven't had a woman's point of view. And I mean a self-conscious point of view—someone saying, Listen, you're telling this man to move, but what about his wife and children? It's now gotten to the point where IBM will not allow somebody to be moved within two years unless the chairman of the board permits it. In the old days, IBM used to stand for "I've Been Moved." Had they had women in higher management looking carefully at this issue, they might have avoided the problem.

Omni: But isn't it a problem that, since it's a male system, when women *do* reach higher management, they have had to become more malelike in their approach?

Tiger: That's the difficulty many women face, and it's comparable to the difficulty that many Jewish and Italian and black people faced when they went into the corporate structure. The dominant ethnic had been upper-middle-class male WASP, and it still is, by and large. I know of a number of women who had a hard time. It puts tremendous pressure on them. The superwoman syndrome is a very difficult one for a woman to face up to: a woman who's president of her company and mother of six, who can make a soufflé at the drop of a hat, and yet has ample time for reading avant garde novels. Well, forget it! And yet that's the image that gets broadcast. I think working mothers have the hardest job in the labor force, because there are real emotional claims that children make that may

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Scientists who search for extraterrestrials are driven by the need for religious salvation

ANTI · MATTER

UFO UPDATE

At 9 A.M. it is still pitch-black in the Soviet city of Tallinn. Just across the Gulf of Finland lies Helsinki and due north the Arctic. On this particular day hundreds of people forge through frigid winds and blustering snow to attend a meeting at the sports complex. After removing their parkas and furs arrivals sit eyes darting with excitement and listen to members of their group including the tall fair-haired V. S. Troitsky. The search for extraterrestrial intelligence is a problem facing the whole of mankind, he declares. It is of great scientific philosophical and social significance. When he concludes the applause is swift and resounding.

Seem like some UFO cult in the depths of the USSR? Maybe, but the convention held last December, drew dozens of the world's most prominent astronomers, four cosmonauts and a member of the Supreme Soviet. Troitsky is a shining light of Soviet science.

One contrary physicist, Frank Tipler of Tulane University in New Orleans, was not impressed. Scientists who believe in extraterrestrial intelligence (ETI) live in a world of fantasy, he claims. What motivates them? The hope of semireligious salvation. Why else, Tipler asks, would Carl Sagan, *cosmos* fame, assert that extraterrestrials might send us prescriptions for the avoidance of technological disaster? Why would Frank Drake, of Cornell University in Ithaca, New York, say, "We can expect [the immortals] to spread the secret of their immortality among us"?

While Sagan, Drake and others use complex equations to show there's a high probability of intelligent life out there, Tipler says, Hogwash. Any civilization slightly more advanced than ours, he explains, would already have colonized the galaxy, including the earth, with their own version of the Von Neumann machine—the space-traveling robot dreamed up by mathematician John von Neumann.

Programmed to search for life, the Von Neumann machine would leave its home planet for a nearby world, search in minerals and fuels. Using available substances, the machine could build a dozen copies of itself, sending each to a different sector of the cosmos. Each copy could then make more, until 300 million years hence, the probes would have traversed the universe. The oldest stars are eighteen billion years old, so their inhabitants have had plenty of time to arrive, Tipler asserts. "Since they are not here, obviously they do not exist."

Despite the supreme logic of this argument, Tipler says, ETI advocates, led by Sagan, have unwittingly conspired to prevent him from expressing his views. His proof: Two American journals, *Science* and *Icarus*, refused to publish his study. In both cases, he charges, Sagan influenced their decision. To Tipler that is not surprising. "A characteristic of religious motivation," he says, "is the inability to consider an antireligious argument dispassionately."

Sagan, however, emphasizes that in both cases he was only one of several referees. "I was in no position to *prevent* publication," he adds, "only to advise against it."

PETER RONDINONE

VOICES FROM BEYOND

Are odd sounds captured by tape recorders signals from the spiritual world around us? Sometimes, but not usually, says Dr. William Braud, of the Mind Science Foundation.

Braud has found that many weird sounds are emit

ted by tapes that have been incompletely erased. Other strange noises result when a tape is made with one recorder, then played on another. Voices or music inadvertently recorded backwards on misaligned heads or crimped and folded tape can sometimes sound like bizarre wails and moans. And still other mysterious sounds are created when the machine picks up unconscious whispering, barely audible radio and television broadcasts, or airplanes passing overhead.

Yet Braud has also studied tapes with sounds that can't be explained as any of these things. Known among parapsychologists as electronic voice phenomena, the otherworldly-sounding tape recordings have been attributed to spirits, people from another dimension, and even the rumblings of our distraught, collective unconscious.

Braud says the Mind Science Foundation will continue to collect and examine unusual tapes at its center in San Antonio, Texas. "We're particularly interested in the possibility that some people may be psychokinetically imprinting the sounds," he says. — Allan Maurer

From whence then could arise the solitary and strange conceit that the Almighty, who had millions of worlds equally dependent on his protection, should quit the care of all the rest because they say one woman and one man had eaten an apple!

Thomas Paine

JOAN OF ARC: GENETIC MALE?

Joan of Arc fought bravely to free France from English domination. For her trouble, a tribunal of French clergymen declared her a witch and she was burned at the stake at Rouen in 1431, at the age of nineteen.

Historical records dating from the time of the trial have convinced Georgia endocrinologist Robert Greenblatt that Joan had a rare syndrome known as testicular feminization. Caused by an enzyme deficiency, the syndrome prevents cells from receiving testosterone, the principal male hormone.

People with this condition look and think like females, but genetically they are males, Greenblatt explains. "Their testicles are up in the abdomen, just where the ovaries would be in a female. There is a normal vagina, but no uterus."

Greenblatt, who is writing a book about the love lives of famous people, learned from the testimony of witnesses at Joan's trial that she was a "well breasted woman with a feminine fruited voice," and that evidence of the 'curse common to woman' was never seen on her clothes. He then discovered that midwives had examined her to learn whether she was a virgin. They told the tribunal that Joan was pure and that she had no pubic hair — a sign that she had not reached puberty.

The excellent breast development, the failure to menstruate, and the absence of pubic hair are classic signs of testicular feminization, Greenblatt says. As further evidence for this theory, Greenblatt asserts that Joan had no romantic attachments and that her skin was soft and without blemish. Both are common traits in those with the syndrome. — Eric Mishara

The Europeans did not arrive in America till nearly the end of six thousand years, this time was necessary for them to carry their navigation to such perfection, so as to cross the ocean. The people of the moon know already, perhaps, how to make little flights in the air, and at this time may be exercising themselves. When they shall be more able, and more experienced, we may see them.

Bernard de Fontenelle

DEADLY DREAMS

Lost In a tropical rain forest you hear the swish of leaves and a ravenous growl In seconds you are knocked to the ground by a wild-eyed werewolf with fangs dripping venom You re about to die

then you wake up

When you dream about monsters do you ever get the feeling you ll be killed if you don t awaken? Thomas Bearden believes you would be Dream monsters and other psychic hallucinations he says can acquire weight volume and a frightening will of their own

Bearden an aerospace engineer in Huntsville Alabama, says that the human brain is full of electr cally-charged particles, or mind stuff When a person concentrates this mind stuff condenses getting thicker and thicker until it becomes solid stuff or real matter Thus a dream monster can become real And you might eventually find $1 million just by thinking about it

Dream monsters or tul pas originated in ancient Tibet where mystics had incredible powers of concentration Bearden says They were able to channel their total mind into assem bling living beings They did it particle by particle, layer by layer until they had the physical lorm they wanted In fact Bearden claims the Tibetan yeti (or Abominable Snowman) was a tulpa created by the area s inhab itants to protect their sacred land Peter Rondinone

"Do there exist many worlds or is there but a single world? This is one of the most noble and exalted questions in the study of nature

St Albertus Magnus

HUGE UFO

It was the evening of Oc tober 23 1980 and the Clif- ton, Arizona, High School band had gathered in the town stadium for its weekly rehearsal The music surged and waned as parents and teachers watched from the bleachers But suddenly the music stopped The 150 people present saw a boomerang-shaped constel- lation of lights appear from out of nowhere

At first I found it hard to make the object out recalls bandleader Bruce Allen who guessed it was a plane But once the brilliant boomerang had de- scended filling the entire stadium and maneuvering back and forth for about an hour, I grew certain it was nothing conventional

Since then the UFO has made numerous visits to the Clifton area Superior Court Judge Lloyd Fernandez for instance, saw the strange craft while he was taking an evening walk last December In support of Allen s descrip- tion, the judge noticed six or seven lights in a distinct arrow shape

And that same evening the craft visited the home of Betty Jo and Don Sorrell I was trimming the Christmas tree when my husband yelled in that there was something strange In the sky Betty Jo says I laughed it off but when I heard a low humming I went out Sure enough I saw it steady red lights shaped like a boomerang or a V It cir- cled the house four times '

According to Mrs Sorrell, one rumor around Clifton had it that the UFO was probably an air tanker fuel- ing jets But she is skeptical It s like nothing we ve ever seen out here But I wasn t shocked or scared After all why assume the earth is the only place that has life? '

—Kathrine Jason

All UFOs may not prove to be of extraterrestrial origin but experts do agree that any glowing, cigar-shaped aircraft capable of rising straight up at twelve thousand miles per second would require the kind of maintenance and spark plugs available only on Pluto

— Woody Allen

NUCLEAR PREMONITIONS

In March 1979 a nuclear reactor at Three Mile s and in Pennsylvania broke down spewing radioactive gas that endangered thousands of area residents But according to Larry Arnold director of Harr sburg Pennsylvania s Para Science International (PSI), the accident might have been pre vented Arnold conducted a door-to-door su vey of Harrisburg residents (like the woman above) and discovered that many people had been forewarned months before the accident

As many as thirty people experienced the same prophetic nightmare in which hey saw the cooling towers of Three Mile Island glowing deep red with light ning crackl ng all around Arnold says He also claims that a woman who lives only seven miles from the atomic plant heard a news broadcast about the disaster one week before the accident

To help avert future nuclear disasters PSI has set up a national telephone hot l ie (the number s 717 236 0080) Should Arnold notice an inordinate number of psychic warnings from the area around a power plant, he ll alert the manager and request a shutdown

The hot line has already yielded disturbing information Three Mile Island is headed for another acci dent Peter Rondinone

CHAMPLAIN MONSTER MEETING

Scientists recently gathered on the shore of Lake Champlain (right) to discuss Champ the Lake hamplain Monster First reported in 1609 by explorer Samuel de Champlain Champ is rapidly assuming the same exalted position as Nessie the well-known Scot tish lake monster, communities along both sides of the lake have even begun vying for tourist dollars

The Lake Champlain Committee, the citizen group that sponsored the symposium arranged for tes timony to be heard from witnesses including Sandra Mansi the Connecticut woman who obtained a 1977 color photo of the animal s long neck and back Then Roy P Mackal a University of Chicago zoologist suggested that Mansi and 150 or so other witnesses had actually seen survivors of the whale species *Zeuglodon* a primitive serpen ne animal believed to have died out millions of years ago Another

participant George Zug of the Smithsonian Institution agreed that the reports indi cate the presence of large animals still unknown o science

While the symposium was the first formal session ever held to discuss Champ attempts at systematic searches may be low-key Lake Champlain has an area of 440 square miles compared to Loch Ness's modest 22 square miles As one exasperated monster hunter asked while scanning the lake Where do you begin?

—J Richard Greenwell

ELF-WAVE ANTIDOTE

Soviet radar scans American airspace night and day, bombarding us with extremely low-frequency (ELF) radio waves One Pentagon official Lieutenant Colonel John B Alexander believes the Russians may be using these radio waves to manipulate our brain circuitry His source of protection? A matchbook-size transmitter called an ELF generator made by a backyard inventor in Lakemount Georgia

Alexander a former Green Beret suggests that ELF waves short-circuit or jam our brain signals leaving us susceptible to Soviet propaganda 'ELF waves won t make people run into the ocean on command, he says, 'but they can degrade decision making ability

The ELF generator, Alexander says is battery powered It emits its own ELF waves which ostensibly interfere with Soviet transmissions The generator sets up a protective field It is as if you had a little bubble around you says Alexander who wears the generator only when flying (it combats jet lag) and when forced to make crucial decisions

Eric Mishara

Mankind are here because they are the offspring of parents who were first brought here from another planet And power was given them to propagate their species And they were commanded to multiply and replenish the earth

Brigham Young

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firmly conflict with the demands of work. I don't quite know how it's working out in the large corporations. I do know whenever I speak to a corporate group, for example, and raise some of these issues, inevitably the questions come fast and furious from the females. Very frequently, even in sophisticated organizations, the questions still focus on what can be done about women and mothers. The issue is still a difficult one.

And it also applies to men. I was at the Aspen Institute several years ago, and I talked with a prominent executive of a massive corporation. He said that he had twelve vice-presidents reporting to him, and that particular year, four of them had gotten divorced. He said he spent more time dealing with the divorces of those four people than dealing with this tremendous amount of oil for which he was responsible during a period of shortage. He was surprised to learn, when I talked about it, that this was part of a system—that the kinship system was in some disarray. He thought it was just these four fellows. He got an insight into the fact that he had to pay systematic attention to private lives, because eventually they made an enormous impact on cash flow, one way or another.

Omni: It's very unnatural that this wedge should be driven between the reproductive and the productive functions, but somehow it's a wedge that has many holes in it.

Tiger: It's also an evil one. One of the things I'm interested in doing in my new book is looking at how a relatively thoughtless assumption about the sanctity of the productive sphere has produced such an array of consequences, many of which are grievous to people.

Omni: What is *evil* in your definition? Is it a biological secretion, like optimism?

Tiger: No, we're talking about a misdemeanor of the social system. The social system has its own autonomy and that's its failing. It has become denatured, and the industrial system has permitted us to avoid our natures in a way that's been quite successful until now, but the price is mounting.

A systematic evil exists in structures that are poorly thought out as to means and ends. This may be more dangerous than any one evil person, because it's more pervasive and harder to understand. We're still operating with the moral systems of shepherds with the Judeo-Christian ethic. We're now in an industrial system, and we have to generate an ethic there.

Omni: Is there an essential evil in the system? For instance, can you trace it back to the burning of fossil fuels?

Tiger: That's an interesting possibility. Part of the project is to try to identify what went wrong and, if it went wrong, why.

Omni: Are you optimistic about the future?

Tiger: It comes back to what I was talking about earlier—the freedom you get from recognizing necessity. I'm much more interested in science fact than science fiction, because science fact permits us to build on what we know and go to another level of knowledge. Now I'm certainly not confident that governments will ask scientists what to do about things. They've managed for some time to avoid listening to the advice of scientists, and that is often very discouraging. After all, this is one of the most educated and civilized communities in human history, and there is still controversy about the theory of evolution, which is one of the strongest ideas in science. So we can't reduce our vigilance.

I think we have no choice but to be optimistic, actually. It's a kind of inexorable requirement, because the only alternative is to close down our options slowly and I'm not sure we can do that easily. We can't do it gracefully. I don't even know that we can do it at all. So we've got to keep struggling to conceive ways of doing things that are acceptable to us and also feasible to the planet. I'm optimistic in the sense that I think there are enough facts available and we have enough systematic insight, so that we can begin doing something that's acceptable. I don't think we're all going to wander around in a state of ecstasy, but our lives could well be broadly acceptable. And that's not bad. I remember Albert Camus was once asked what he wanted written on his tombstone. He said he wanted it to read that he was a decent man and a good writer. Not bad, to be a decent man or a decent woman and a good whatever. Perfectly acceptable. And I don't think it's degrading to find the merely acceptable acceptable.

Omni: Do you think it's going to be hard to get to the acceptable? It seems there are a lot of obstacles in our way.

Tiger: Part of it is cognitive redefinition. We have to understand that the world has its limits. This is not to say we have to accept those limits as if we were members of a caste system. No. But with respect to even minor issues such as being able to rev one's loud motorcycle—no, there is a limit on that. Some are limits on the freedom of people to invest in certain things; some are limits on the freedom to make noise. There are certainly limits on what you can throw into the air through your smokestacks, whether you can smoke in an airplane. Those are real limits.

I think we're learning that we must have some limits, because, if not, then we don't have the opportunity to do other things, such as live longer and sleep better. I don't think it's that difficult. We have an overdramatic view of human possibilities. Often we're ill-served by ideologists who try to sell us not a bill of goods but a bill of bests: goals that finally turn out to be unattainable. This does not mean that we have to compromise deliberately. It does, however, mean that we have to recognize what the limits of this life are. ☐

"Your crime, Fyodor, is writing the book Crime and Punishment. *Your punishment will be to watch the TV serialization."*

FACE IN SPACE

CONTINUED FROM PAGE 56

This of course raises the question of whether intelligent life could ever have existed on Mars. With its lack of water in plentiful amounts and its thin atmosphere, Mars certainly cannot support life as we know it. The Martian environment of today, however, is not the same as it was millions of years ago. As Bevan French points out in *Mars—The Viking Discoveries*, "the atmosphere of Mars is more Earthlike than the chemical composition alone would suggest." The ratio of isotope combinations of certain Earth elements is the same on Mars, and there have also been discoveries suggesting that water can still be found on the planet.

Scientists also believe that the atmospheric pressure of Mars was once much greater than it is now and would have allowed enough water to form a layer several meters deep over the whole surface of the planet. French says: Photographs of many areas on the planet show evidence of dried-up riverbeds, and Dr. Leonard Martin of Lowell Observatory in Flagstaff, Arizona, has reported that two successive Viking Orbiter pictures show something resembling a column of steam, perhaps rising up from a Martian volcano. The pictures were taken just 4.5 seconds apart just north of an area called Solis Lacus. The size difference between the first and the second images indicates that the cloud was rising at a velocity of more than 200 feet per second. A color-enhanced version of one of these appears on page 56.

With so much evidence of water or at least water vapor on Mars, it is worthwhile to speculate that some living things might have evolved and may still exist on Mars. The only way to find out for sure is to return to Mars and take a closer look.

Since the Viking satellite cannot reveal details smaller than 150 feet across, the next step should be to orbit a satellite that could resolve small objects, ones less than two feet across. The satellite should fly a polar orbit, from 100 to 300 miles above the Martian surface, and carry a battery of ten cameras to scan an area slightly over one square mile. With this high resolution, much less of the planet could be recorded, but only areas targeted from current Viking imagery need to be photographed.

The satellite would look at a landscape 277 miles wide, but it would record only one twentieth of this path on each polar pass during each half hour orbit.

It is impractical to map the entire planet at this resolution. In every year of operation, however, nearly 9,000 target areas could be displayed with enough resolution to detect evidence of life and to pick landing areas so that someday *Homo technologicus* may colonize Mars. ☐

A book describing the author's work on the Mars data is available for $9 from: Mars Research, P.O. Box 284, Glenn Dale, MD 20769.

MUCH CATTLE

CONTINUED FROM PAGE 66

They'll kill us," I said. "You realize that, don't you?"

"Yes," Kiki said.

"They probably won't even leave us here to die in peace. They'll drag us up out of here and torture us."

"Ah know," Kiki said. She had not risen from the straw. Maybe they had hurt her when they threw her in.

"Would you like a drink of water, Kiki?"

"No, Tahson," she said, and laughed. "Look at me, Tahson."

I knelt over her. Her dark hair curled back damply from her face. She smiled up at me. "Are you hurt?" I asked.

"Oh, Tahson, you're not very clevuh. Look at me," she said, and her face was as sweet as I had imagined it. She twined her arms around my neck and pulled me down to her.

Then said the Lord, Thou hast had pity on the vine, which came up in a night, and perished in a night. And should not I spare Nineveh, that great city, wherein are more than sixscore thousand persons, and also much cattle?

"Tahson," Kiki said, "did you fall asleep again?" It was twilight, a few stars out, and the sky pale lavender.

"Yes," I said wonderingly, looking at her face that was no face at all. She was a deep rose, almost red at the edges of her petals.

"Ah heard somethin', Tahson," she said.

"What did it sound like?" I asked, standing up, but I could hear it, too, and the sound was unmistakable. The pickup galera. It went overhead with a sound like a moan and glittered into the west.

"Oh, that's very good, boss. Land my pickup in the city. If you can't get me in there one way, try another. What next, boss? Dancing girls?"

"What is it, Tahson?" Kiki said.

"Nothing," I said.

"What is the lesson of the story? About the flowuh?" she said, and her voice was as sweet as her face had been.

"You wanta know the lesson, boss? The lesson is, you're going about this all wrong. You shoulda put Kiki inside that city. I would've come in a flash."

"The lesson is that no plan is a great plan unless it has room for the sweet disposition and the kind heart," I said.

I could not seem to keep awake. When I came to again, the night was very dark, the ragged chunk of moon as pale as a vampire. Kiki was calling me softly. "Tahson," she said in that lazy drawl that I could not translate as urgency. "Tahson."

She was dark in the moonlight, a black that must be vivid red, but looked in this sickly light as dark as blood.

"What is it?" I said. I fumbled for my pocketlight and shone it full on her. She was a brilliant red, as I had expected, and her petals were open so far they bent back.

"Would you like a drink of water?" I said, as if she were a sleepy child.

"Yes," she said. "Ah'd so lahk a drink."

I trotted over to the canteen, drew a spilling-over lidful, and poured it under the tangle of leaves. I started back to the canteen to fill the lid again.

"When can Ah have a drink, Tahson?" she said, and I stopped and shone my light full on her.

"I just gave you one, Kiki," I said.

She seemed to bend slightly on the stalk, her petals curling back now, reddish-black at the edges. "How could you, Tahson? You stayed here all the tahm. You nevuh went away lahk Hayerdal. You're just makin' up about the drink."

"What do you mean?" I said, but I already knew what she meant, had already knelt beside her, scrabbling in the matted leaves and grass. I yanked at the leaves that clustered along her stem. They came free and their own vine with them, a vine so thin and delicate I hadn't seen it. It had been wound around Kiki's stem, covering it. I had been watering another vine altogether.

Now that the leaves were out of the way, I could see Kiki's leaves and the vine winding through them into the underbrush. I grasped it and did not let go, pulling along it like a man being rescued by a rope. It twisted through the undergrowth, growing thicker, beginning to look jointed, like bamboo. At the edge of the wood it straightened and stretched away like a pipe, like a meridian, toward the city.

"Why didn't you tell me your roots were in the city, Kiki?" I said. Her petals were as dark as blood even in the glare of my pocketlight.

"Ah didn't know. Ah was s'posed to," Tahson," she said. "Ah'm not very clevuh."

"Hayerdal figured it out, didn't he?" I said. "That's why he went into the city too early. To try to save you." I stood up and slung the canteen across my back. "Hang on, honey. I'm gonna go get you a drink."

"Ah made up a story, Tahson," she said, as if she had not heard anything I had said. "What is it, honey?"

"Once upon a tahm," she said, "there was a flowuh named Tahson."

"I'll be back in no time," I said. "You won't even miss me." But it was too late. She was already gone, the flower flung back on the stalks as if she were a murder victim, the petals already blackened and drying.

"All right," I said. "You win."

"And God said to Jonah, Doest thou well to be angry for the vine? And he said, I do well to be angry, even unto death."

"I've come to fix your water," I shouted over the wall. "No deals this time, boss. You want to dehydrate them into signing a contract, you get somebody else to do it. From now on, somebody asks me for a drink of water, I give it, no questions asked."

The gate creaked open. I walked in, and

"If the drug companies aren't interested, we can package it ourselves and sell it to daytime television."

it flashed down behind me like a blade. It was just like in the dream. They shook my hand. I reset the dirt-encrusted controls. the water poured through the sluices. they cheered and led me away, keeping their lightsaws on me the whole time.

They didn't throw me down a hole. They took me to a city square, probably the one where they diced up Hayerdal. The pickup galera was there, but not close enough to make a break for. They shook my hand again. They cheered. They brought their sons out, dirty-faced replicas of their fathers, carrying cute little lightsaws just like Dad's. You better watch out, boss. They've got great plans of their own. Then they brought out their women.

Now I knew who had watered the vines. Now I knew who had taught Kiki to talk. Now I knew who had sent her out of the city to get me. Poor Hayerdal had said the Nines would never sign a contract unless they had a damned good reason. Well, here it was. Of course they'd sign, to save their women. Maybe they'd even become law-abiding members of the company. Their women were worth it. Their faces were as sweet as Kiki's in the dream.

One of them came forward to me, her flower face lifted up to me. Her gown was drenched and clinging, and her dark hair curled back damply from her face. "You have done us a great kindness, Tyson," she said. Her voice was as sweet as Kiki's, but more clipped and clear. What I had taken for a drawl had been only a voice slurred and slowed by thirst. Kiki had been dying when I met her. The girl twined her arms around my neck and kissed me.

I gotta hand it to you, boss. You sure know how to tell a story. Kiki would have loved it. It's got everything: captive princesses and their faithful servant, the talking flower, bad guys! You really outdid yourself on the bad guys, boss. And suspense! Will the talking flower forget the message the captive princesses gave her for the hero because she isn't very clever? Will Hayerdal figure out that the flower is supposed to be saying "Help, help, We're locked in, and we're running out of water!"? Will he figure it out too early and end up as cattle lunch? Will the new hero ever figure it out, or will he sit around complaining because his boss never tells him anything until the poor talking flower keels over and the princesses die of thirst? Or will the stubborn lout finally get the message, and the girl? He will, and there will be a happy ending for all. Well, not quite all. But it's still a great story, boss. Kiki would have loved it.

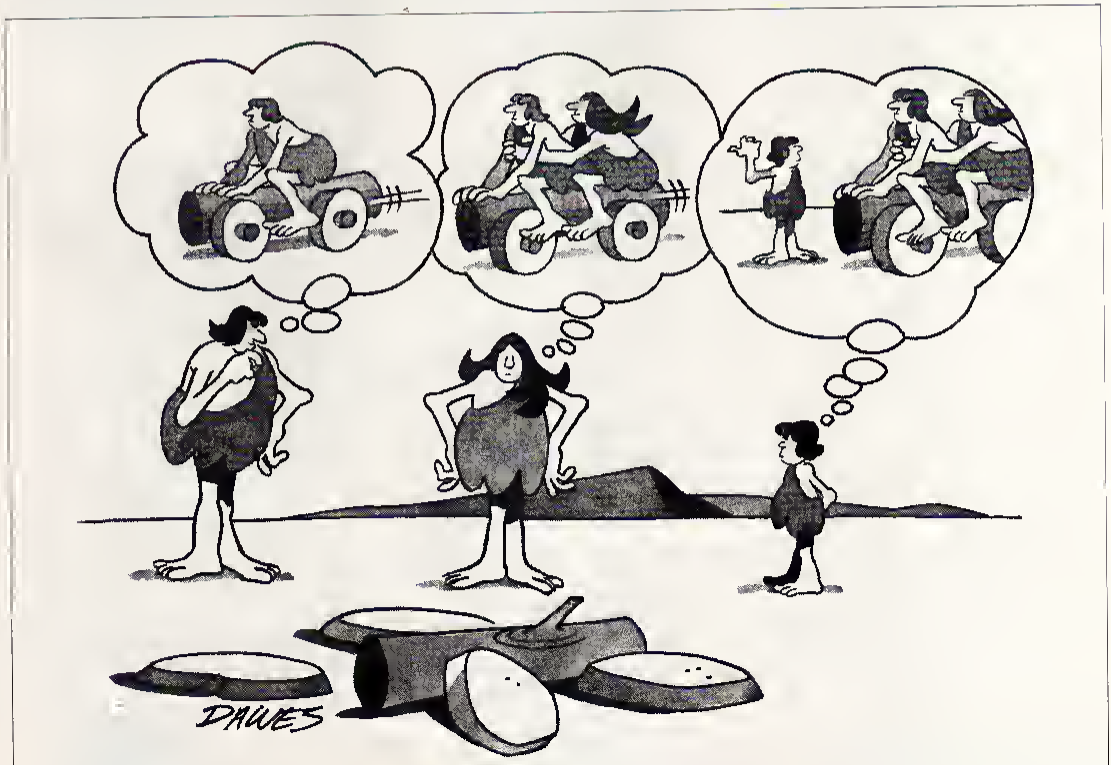
Well, and sure, somebody's got to be the moral of the story, and she wasn't very clever, not much more than a glorified speaking tube for the princesses really, and now that they've got water they can grow as many talking flowers as they want. She won't even be missed. Right, boss? That was the point of the story, wasn't it, boss? That you're always right?

Well, don't worry. Killing Kiki got your point across just fine. Next time you tell me to do something, I won't waste your valuable time chasing all over the Arm. Next time you tell me to save a bunch of smelly creeps, I'll know you've got GREAT PLANS for them and their omnivorous cattle, and I won't worry a bit because their women are so sweet and kind they'll turn their nasty husbands and fathers into real sweethearts who will be a credit to the company. And anyway, who am I to say you shouldn't save the Nines? I tried to save Kiki, didn't I? And she was only one little flower. Why shouldn't you save Nine-V, that great city wherein are sixscore thousand persons, and much cattle besides? Next time you tell me to do something, no questions asked. Yessirree, I've learned my lesson.

But you know what else I've learned, boss? You wanta know the real moral of the story? The moral is: What the hell good does it do to be right all the time when you've got to go around killing *flowers* to prove it?

I disentangled the sweet young thing's arms from around my neck and pulled out the contract. "Just sign the papers," I said. "And do me a favor. Water your plants."

I got in the shuttle and pushed "Destination: Novo Lisbon." This time he didn't try to stop me. ∞



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CONTINUED FROM PAGE 10

mineral supplement program (not to mention the inhabitants of the Third World with their different and crisis-proportioned nutritional problems). Dr. Colgan, you may have come along just in time. Who would have thought the little molecules dubbed "vitamines" by Polish biochemist Casimir Funk—who discovered the first one, vitamin A, back in 1911—could be so vitally important? Today, together with the essential minerals, 48 various substances are recognized as absolutely requisite for full health. As long as one's diet supplies these nutrients, cells and tissues can synthesize the many thousands more compounds necessary for life.

An ultimate definition of vitamins has eluded science, although certain functional characteristics are shared by most vitamins. Vitamins are organic molecules essential for life—in man, beast and plant—in minute quantities. Each vitamin performs a specific task that cannot be accomplished by any other substance. But unlike their sister molecules—the hormones—vitamins (with few exceptions) cannot be made inside the body. They have to be imported in things that are eaten. The absence or diminution of a single vitamin causes biochemical disruptions.

In their catalytic role as coenzymes, vitamins assist enzymes and are critical to the growth, maintenance and repair of every cell. Because vitamins work synergistically—as a team—a single deficiency can threaten the cell's well-being. Vitamins also operate at large in the chemical processes of such tissues as the liver, brain, bone marrow and kidneys, coordinating myriad bodily activities. The body cannot make use of what it eats without vitamins and minerals, although minerals, too, must be present in the body for it to sustain a biochemical balance; they are not chemically as fragile as vitamins, and they can be retained by the body much longer.

Colgan came to understand the importance of vitamins and minerals and discovered the fallacies of the good mixed diet via a strange route. Highways. Born in England, he studied civil engineering and traveled to New Zealand to build bridges and turnpikes. While on the design team of the Wellington Urban Motorway in 1967, he was struck by the idea that highways don't bring people together, but distance them. To find out why humans build highways, he returned to earn a doctorate in psychology at the University of Auckland. He was offered a lecturing position at the university and also was given the opportunity to administer a clinic at the University Medical School. It was there that he began his first nutritional analyses. A very smart M.D. was there, Colgan remembers, who kept saying, "These people coming in with earaches, stomachaches, joint pain, depression—the trouble with them is they're

undernourished. It was just a general comment but I thought about it."

Colgan and his colleagues researched the nutritional literature and drew up a chart of malnourishment symptoms which they put on a wall. Whenever a patient showed any of the symptoms the clinicians noted them. "We suddenly realized that almost everyone coming to the clinic was malnourished," he says. As far as we could determine, however, they all ate reasonably good diets. Colgan began analyzing their food, and he was stunned. It contained nothing like the amounts of nutrients given in the nutritional tables. Some oranges, for example, contained no vitamin C at all.

The tables were sheer nonsense," he recalls. (Today Colgan points out that the American Medical Association has for 15 years recognized that the nutrient content of fresh foods can vary enormously depending on soil, weather, and the time of harvesting, and can fall to zero during some methods of processing.)

Since the good mixed diet wasn't doing the job, Colgan decided to give his patients carefully controlled supplements. But before handing them out, he began analyzing the vitamin pills and, to his consternation, found they were not true to label. "It was a real can of worms. Single nutrients did not contain stated amounts, and multivitamin-mineral formulations did not follow prescribed mixtures of quantities." (Of the brands tested, Colgan found only Parke-Davis and Healtheries Ltd. contained what they claimed to contain.) "In some cases," he says, "the formula appeared to reflect more the commercial advantages of being able to put everything in one pill, including negligible quantities of expensive substances, instead of the requirements of human nutrition."

But what about the requirements? Colgan's next can of worms was dosage. How much and in what combinations? "Initially physicians associated with our group contended we should provide a supplement conforming to the U.S. or British RDAs. But after conducting analyses of these RDAs we decided they were inadequate. The premise upon which RDAs have been established is an absence of disease." But Colgan cautions that minimizing disease is a far cry from maximizing health.

Since little research has been conducted in assessing the optimum RDAs in humans, Colgan has been forced to turn to veterinary medicine. "The assessment of supplementation levels in the breeding of livestock is now a considerable science. Thoroughbred horses, as well as pedigree cats and dogs, are better fed than their owners," he says. "In view of livestock nutrient tables, Colgan began mapping out a set of criteria for determining quantity and combinations that human individuals should have, and means for determining whether or not the dosage was producing the right effect. He compiled a list of 231 variables related to biochemical, clinical, and behavioral evidence of deficiency levels. Nature best responds to a logically and carefully thought out questionnaire," Colgan quotes from the eminent scientist Sir Ronald Fisher. And he developed one with detailed queries about an individual's health and eating, social, and emotional habits. Included for evaluation are biochemical analyses of the subject's hair, fingernails, and blood.

The most difficult consideration was the synergistic nature of nutrient interactions. Although this holistic nature of nutrients is of primary importance in achieving maximum health, most research has been conducted on single nutrients in ways that do not permit the synergy to occur. "The researcher," says Beasley, "who attempts to study the impact of a single nutrient such as vitamin C or E or zinc, without regard to the complexity of human chemical processes is betrayed by the standard methodology itself."

"It took the human body at least three million years to evolve," Colgan notes. "During that time the organism learned to use synergistically a large number of substances. When Nature put it all together, she wasn't considering the ways scientists would come to classify chemicals, but was taking the whole mix available and making the organism fit it as best it could."

> *"In a double-blind study with experienced marathon runners, a six-month regimen of Colgan's vitamin-mineral supplements increased their speed an average of more than 17 minutes."*

"Today, especially with our internal and external pollution," he continues, "an understanding of multiple nutrient interactions and their interaction with toxins is essential. Most physicians, as well as lay people, are ignorant of these complex processes, and most vitamin-mineral supplements are gulped down haphazardly, sometimes by the fistful, with only the flimsiest reasoning—or no reasoning at all—behind the self-dosing or doctor's prescription. The biochemical individuality of each person indicates that most commercial formulas are unlikely to work, no matter how 'super,' 'mega,' or 'multi' the label."

Also, the varying environmental conditions to which each person is exposed radically alter his supplement needs. "A man who smokes twenty cigarettes a day, for example, is under constant biochemical stress and may require fifteen times the RDA of vitamin C to avoid suppression of immune-system function. Women taking oral contraceptives may require as much as ten times the RDA of vitamin B-twelve, six times the RDA of vitamin B-six, and four times the RDA of folic acid to maintain normal cardiovascular function and lipid metabolism."

In 1973 Colgan began giving personalized supplementation to patients, since then he has treated more than 1,000 people, always developing and refining his methodology. From the earliest case studies the results were telling. His New Zealand subjects on whom he has complete data include 11 obese females, 3 female and 6 male alcoholics, 16 female depressives, 9 female and 3 male schizophrenics, 9 hyperactive children, and many others suffering from various paranoias, anxiety reactions, asthma, hypertension—and 74 athletes. "We've had incredible changes in people," Colgan says, and he rates his successes at about 75 percent.

Certain cases sound like miracle cures. There was the malnourished woman on antidepressants who binged on junk food when she was depressed and thereby aggravated her malnourishment. After three months on her supplements she lost 15 pounds. Her heart rate and blood pressure dropped, her blood sugar stabilized. After six months she was no longer depressed and was weaned from the antidepressants.

And there was the case of one elderly woman almost incapacitated by chronic osteoarthritis. On Colgan's vitamin-mineral dosage her arthritis gradually improved to the point where she could go shopping with friends. Previously she had not left home in several years.

But Colgan's prize case is a maximum-security-prison convict with a 12-year history of psychosis, violent crime, uncontrollable rage, disorientation, and schizophrenic symptoms. He was somewhat obese, lacking in energy, a junk-food addict. Today, after nine years on supplementation, Colgan reports, he has no recurrence of the mental problems. His whole temperament has changed. When the fellow was released from prison, Colgan helped him get accepted to the University of Auckland, where he finished a double degree in 1980. "Now he's slim and strong," Colgan says. "He's become the kindest, gentlest person I know."

Although this anecdotal evidence has its own rewards, Colgan was having trouble collecting hard data for nutritional studies. The patients' manifold clinical problems were confounding the purely nutritional information. Colgan chose to test the healthiest people he could find—athletes. And to date, perhaps the most reliable information on human nutrient supplementation comes from his pilot studies with two polarities of athletic performers: long-distance runners and weight lifters. Could any of these men, already in good shape and eating a reasonably well balanced

diet, be transformed into a Hercules or Achilles by changing his nutrition?

In a double-blind experiment with ten experienced marathon runners aged twenty-eight to forty-four, five runners supplemented with Colgan's nutrients for six months bettered their marathon times by an average of 17 minutes and 44 seconds. One thirty-eight-year-old sliced his time from two hours 59 minutes to 2:30. A forty-year-old shaved his record from 2:48 to 2:33. Runners given the placebo bettered their times by an average of six minutes and 43 seconds. (Throughout 1982 Colgan is conducting a year-long study of 40 marathoners at Rockefeller University, many of whom ran in the 1981 New York Marathon. It will be interesting to see whether they beat Alberto Salazar this year.)

The weight-lifters experiment examined the effects of nutrients on an extremely different physical performance. Four experienced iron pumpers, matched for age, lifting ability and stage of training, were divided into two groups. Colgan devised two strength tests: a slantboard biceps curl with dumbbells and a slantboard leg raise with weights. In addition, he measured performance at the Olympic lifts—press and clean and jerk. This experiment, also a double blind, was more complicated. Colgan switched supplements to placebo after three months for one group and changed placebo to supplements in the other group. The results after six months demonstrated a 50 percent increase in the strength tests after three months on the vitamin-mineral regimen. The lifters who started out on the supplements showed the 50 percent increase during the first three months, followed by a discernible slump during the period on placebo. For the musclemen who began with the placebo, the second half of the period was a time of dramatic improvement in their strength. In the Olympic lifts, the supplemented periods showed a 6 percent gain, compared to a less than 1 percent gain in the unsupplemented periods. A 6 percent increase in poundage pressed is enough to elevate a lifter from ignominy to a gold medal. And Colgan reminds us that these were men near the limits of their strength before the study began. They had all used nutrient supplements for years on what Colgan called an ad libitum regimen.

Besides the obvious performance changes, beneficial physiological changes were occurring in these athletes' bodies. For the runners there were small but reliable reductions in heart rate, blood pressure, cholesterol level, and triglycerides (fats) in all subjects, and increased hemoglobin in two. There was evidence that supplemented runners had fewer minor injuries and infections and missed fewer days in training. These data suggest, Colgan says, that supplementation exerted a positive effect upon the immune system. These data are in accord with growing evidence of immune system en-

hancement by vitamin-mineral supplementation.

In clinic patients, runners and weight lifters alike, Colgan saw unexpected results. In all groups there was improved hair, skin, and fingernail condition. There was a lessening of long-standing complaints, including susceptibility to infection, herpes simplex, acne, eczema, chronic joint, muscle and back pains, constipation, nervous indigestion, headache and sinusitis. There were reports of improved memory and alertness. Colgan noticed that all these conditions were more marked in older subjects. Further investigation led him to suspect that the supplements were having a general effect and might be reducing some of the degenerative symptoms of aging. So he conducted a longevity study with 12 rats from weaning until death—6 on supplemented chow, 6 not. The rodents on supplements lived 24 percent longer than the control rats and enjoyed healthier lives.

Are there any indications of rejuvenatory effects in Colgan's vitamin-mineral supplement in someone middle aged or older? "There is absolutely no doubt anymore," he replies. "For example, it has been confirmed by a number of laboratories now that atherosclerosis can be reversed by dietary changes. Atherosclerosis is one of the major degenerative diseases and affects almost everyone by middle age. If you can remove plaque from inside the arteries, restore the arterial wall, reabsorb scar tissue, you are really reversing aging." Colgan speculates that within the next 25 years human life expectancy can be increased considerably. "But it's not going to come from curative medicine or replacement of organs and glands. It's going to come from repairing the system as it is."

"We must consider the human skin as constituting a giant test tube," he continues, "a hairy bag filled with a mixture of chemicals. We can know what is going on inside each test tube by using computerized matrices to correlate the variables in the whole system. We can make changes in the test tube, put the right nutrients in it and watch it develop without invading it. The body is such a dynamic system: every year or so it has a new shot at life. In that time there's a great turnover of cells. Even the liver can regenerate."

Not content to remain a spectator at this parade of living test tubes, this reporter volunteered to become a human bottle, a mobile statistic in Colgan's Health and Performance Nutrient Supplement Program. To become initiated, I donated hair for atomic-emission spectroscopic analysis (for mineral content), underwent a battery of blood tests to determine levels of cholesterol, triglycerides, glucose, red and white blood-cell count, hemoglobin, hematocrit and other biochemical fractions. Blood pressure and heart rate were noted, as well as fingernail condition (nails are records of metabolic activity: even a two-day fast will leave its mark in the growing nail). Colgan's questionnaire is not as lengthy as it is targeted, with questions ranging from basic facts about one's body and its maintenance to queries about dream recall and emotional tone.

These questions were culled from many more by means of "item analysis," a mathematical technique. Items that yield correlations neither with physical conditions nor with other variables are discarded. An item such as the "sexual satisfaction scale" holds more of the variance than many others combined. "Excellent sexual functioning requires good health," Colgan says. "Any dysfunction will reduce sexual satisfaction. It's a delicate mechanism."

After the biochemical information was added to the questionnaire matrix, my equation was complete on one side. The other side was supplied by the 32 uniquely tailored nutrients I now take daily. And the effects? Within a few months I had clipped five minutes off my record for the one-mile freestyle, and without regular swimming workouts. I noticed a diminution of appetite, especially for junk food and other carbohydrates, including alcohol. A 1,200-mile mid-October sail in the Atlantic under ridiculously spartan conditions posed no energy crisis with Colgan's ubiquitous pill packets aboard. And the stresses of urban life seem to have receded. All this is, of course, anecdotal and not really admissible in scientific court. However, a sixth-month analysis of blood has generated tangible facts: blood pressure from 120/80 to 105/80, and cholesterol from 214 to 171 (milligrams per 100 milliliters of blood). "That could be a fairly significant drop," comments Dr. Daryl Isaacs, a specialist in internal medicine at New York's Beekman Hospital. "It augurs well for a modern American, although it's not as good as the ninety-five [mg/mls] you might find in the heart of Africa."

Like many former skeptics, I have become a zealous convert. I think everyone should be on a program such as Colgan's. But the big drawback is that such programs are not widely available, and when they are, they will be expensive ($1,000 for Colgan's). The goal of preventive medicine is such that people will be able to go to nutrition specialists as easily as they now go to dentists. Or the same way they drive their cars in for six-month tune-ups. That easy. Just 60 milligrams of para-aminobenzoic acid, please, and 50 units of mixed tocopherols. And check my triglycerides, if you don't mind.

Meantime, in the world of nutritional supplements, confusion reigns. In the front lines of the additive wars are the millions of Americans who are taking supplements. It has been stated that the 75 million Americans on supplements excrete the most expensive urine in the world, and indeed $2 billion was spent on nutritional components in 1980. And yet few people who take them know enough about what they're doing to effect any positive change. Ignorance is rampant. ("What I need is a big dose of

vitamin G" is an example that was overheard in a restaurant recently)

"Overdosing is the most common mistake Colgan says People think that if they do well on thirty milligrams well why not six hundred? Part of my research is aimed at establishing a true level of efficiency so that people will not go out and buy a formula that's supermegamega with five hundred milligrams of everything in it That is just rubbish! It's a subclinical poisoning!

Everyone's nutrient needs are different but until such time as individual biochemistry clinics are in operation, Colgan has reluctantly offered a readily available combination of nutrients that should take the edge off one's deficiencies "This daily formula is given against my better judgment Colgan cautions but in hopes of doing more good than nothing

Vitamin A (retinol)	15 000 IU
Vitamin B_1 (thiamine)	50 mg
Vitamin B_2 (riboflavine)	50 mg
Vitamin B_3 (niacin 25 niacinamide)	150 mg
Vitamin B_5 (pantothenic acid)	50 mg
Vitamin B_6 (pyridoxin)	75 mg
Vitamin B_{12} (cyanocobalamin)	100 mcg
Folic acid	800 mcg
Biotin	600 mcg
Choline	125 mg
Inositol	125 mg
Para-aminobenzoic acid	100 mg
Vitamin C (ascorbic acid)	2 000 mg
Bioflavinoid complex	250 mg
Vitamin D (calciferol)	600 IU
Vitamin E (d-alpha-tocopherol)	400 IU
Pectin	50 mg
Calcium (Ca)	750 mg
Magnesium (Mg)	375 mg
Phosphorus (P)	400 mg
Potassium (K)	250 mg
Iron (Fe)	15 mg
Copper (Cu)	1 mg
Molybdenum (Mo)	75 mcg
Manganese (Mn)	10 mg
Zinc (Zn)	50 mg
Chromium (Cr) (glucose-tolerance factor)	125 mcg
Selenium (Se)	150 mcg
Nickel (Ni)	50 mcg
Vanadium (V)	50 mcg
Iodine (I)	200 mcg

(IU = International Units mg = milligram mcg = microgram)

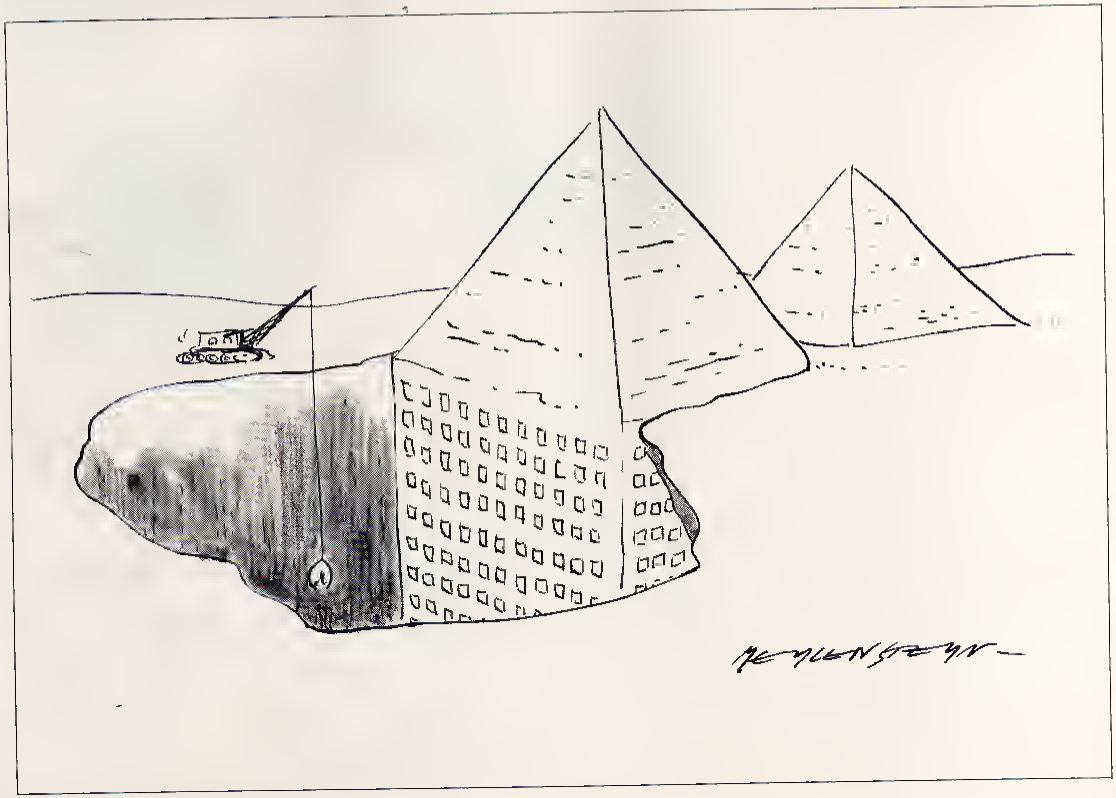
Because of the proliferation of con artists in the health-food business, and the dangers of misuse of readily available supplements scientists cannot make radical statements about nutrition to the public Colgan gives the example of selenium Ten states in the United States are deficient in this trace element and these areas are associated with a threefold higher risk of heart disease because of this deficiency "Yet one can't make a statement about selenium and heart disease, Colgan asserts, because within one hour all the shops everywhere will be sold out of it And there are lots of seleniums on the market some quite useless all highly toxic if taken in overdose "

And the food-processing industry? Oh, they're interested in my work." Colgan smiles. "They offer me weekends, give me the stretch-limousine treatment. Actually though, I'm more disillusioned by drug companies that make vitamins. Many are run by people who know nothing about nutrition, have not one qualified person on the executive staff. Or if they have, these people spend all their time in other research and never come in contact with the vitamins that are being produced by the firm. There is so much rubbish on the market," he adds abruptly. "The majority of vitamins in health-food stores are rubbish!" After some thought, Colgan decided to endorse the Nature Plus range of commonly available vitamins as one brand he knows is true to label. "Let me add," he laughs, "that I do not own stock or have any commercial contract with that company. Merely, tests have shown that their supplements contain what they say they contain."

Best news for Colgan is the recent rise of interest in nutrition and preventive medicine. "We're not going to investigate it piecemeal, but in an integrated way. Historically that's the way it happened with biochemistry and molecular physics. The problems are far too complex for me to be working off in an isolated little lab." Colgan is collaborating with Rockefeller's Jay Weiss, a behavioral scientist whose 15 year research has yielded strong evidence that immunological function can decrease 50 percent under nonspecific stress. Colgan hopes to "tag on to" Weiss's experiments to find out whether nutrient supplements can decrease immunological damages caused by stress. "Nothing has ever been shown to protect you from stress," he explains, "none of the common medications, valium, nothing. If it can be demonstrated that a simple dietary maneuver can protect lymphocyte function well," he grins, "that would support Linus Pauling's hypothesis and would certainly cause a bit of a stir in cancer research."

Colgan is completing a book on nutrition (to be published by Morrow this fall) and will open a clinic in Great Britain next year. It will accept all clients. It will provide nutritional supplementation for each according to his or her biochemical profile. Taking into account," he says with a kind of Shakespearean flourish, "the strength with which the environment and oral gratification hold people to their pleasures and the frailty of human willpower. The Colgan Program," he chuckles, "will correct for, as far as possible, the nutritional sins of the flesh. It took the last hundred years to invent means for humans to destroy their environments and themselves by internal and external pollutions. We need the most audacious, the most innovative developments in preventive medicine if this crisis is to be averted."

Colgan believes that if healthy people can keep away from toxic substances and achieve optimum nutrition, they can excel in any field to which they devote themselves. Limitless transformation. And since athletes are about the only people already intensely involved in this "experiment," Colgan turns again to them. "You can already see it in athletes," he says. "people like Sugar Ray Leonard. And Hearns. Or linebackers in football—if you compare them with linebackers twenty years ago, those people were still big, but they were big and fat, and could run fast maybe fifty yards. Today these guys are bigger still, but with muscle, and they are sprinting the hundred yards in eleven seconds. The same thing happened with the Olympics. You used to see people of all sizes and shapes competing. But now the athletes are like gladiators. It's due to our knowledge of nutrition and physiology. Every athlete I know takes vitamins. They say, 'I eat pasta, junk food, and so forth.' But what they don't say is, 'I have raw vegetables ground up in my blender every morning with my vitamins.' They don't say those things because they don't want to give anybody the edge in top competition. It's very small, you know." Colgan, on the other hand, wants to give everybody the edge. "It can happen to us all. It's really a very exciting future, provided we don't turn the planet into a nuclear fireball first."



SUNDANCE

CONTINUED FROM PAGE 80

put it right smack in between Zion and Bryce and Capital Reef National Parks.

Redford's own education was eclectic. Son of an accountant, he grew up in post-war Los Angeles, where schools were "shabby" and teachers provided little incentive. "I was only inspired to crawl out windows, or look out windows to get out *there*, where *it* was happening," Redford recalls. Out there, in Redford's case, meant the Sierra Nevada. He started climbing mountains with his brother at the age of twelve or thirteen and found the experience much more exciting than ever going to a movie. "His family," he remembers, "couldn't afford movie tickets anyway and he used to spend evenings reading in the Santa Monica Library. His favorites: stories of Greek mythology, books by Rafael Sabatini (*Captain Blood, Scaramouche*)."

Redford went to the University of Colorado on a baseball scholarship, entering in 1955. By then he had developed a habit of tuning out speeches and lectures, but resolving to listen harder. In one science class he sat in the front row, fixing his eyes on the face of a soporific lecturer.

"He didn't like me," Redford says. "I could tell it. At the end of the professor's long dissertation on some scientific point, he said, 'Mr. Redford, would you step up here a minute, please.' Then he said, 'I'd like you to look at me and tell me exactly what I just said.' And I looked at him and said, 'Well, do you know that when you talk, only your lower lip moves?'" Redford dropped out in 1956.

It wasn't the end of his formal education. He spent more time in classrooms in Europe and New York City, studying art (favorite artists: Modigliani, Monet and Renoir) and acting. But much of Redford's education took place off-campus. Some of his best teachers, in fact, were the Indians of the Southwest, particularly the Hopis.

"Now you can go through these villages you can go into the Three Mesas [an Indian reservation where he often sojourns by himself], and feel that people are living in abject poverty, and you'll wonder how they exist. That's the oldest inhabited city in the country. It dates back to A.D. 1100. These people are living up there, and the more you get into their culture, the more you understand their rituals and their dances and their ceremonies, the more impressive it becomes to me that their respect for nature has been the mainstay of their ability to remain alive. There seems to be no reason, they defy gravity. The Hopi Indians *defy* gravity. How do they stay alive? How have they succeeded in not being taken over by outside interests? Well, I believe it's a steadfast and almost mystical knowledge and use of nature."

He took pains to put down the stereotype of the Indian as alcoholic or junkie. "The Hopis have no use for hallucinogens at all. And I find them the most mystical, the most magical of tribes. It just points up the fact that you don't really need that. In the Sixties, when it was fashionable to go get high with the Indians and to adopt their way of life and get on a mind-expansion trip, I found it radical chic. I found it too much of a trendy thing as opposed to what is a deeper experience which is just getting with those people and having the experience without it.

"I remember being at a sun dance where the males and females had two separate branches of ceremony," he says. "There was a tepee ceremony where several peyote buttons were consumed by the women during the course of twenty-four to thirty-six hours. And the men are in a tepee that's open at the top, performing a dance around a pole to exorcise diseases of various kinds, ailments of various kinds. And it's without food and without water and there's dancing.

"So you hallucinate by dehydration, you hallucinate by chanting, you hallucinate by repetition, and you sweat—it's a sweat ceremony.

> *"In the 1960s, when it was fashionable to go get high with the Indians and to adopt their way of life, I found it radical chic. I found it too much of a trendy thing."*

"The sun is over a hundred degrees, and the only rest that you get is when the squaws would come in with peppermint branches and you would lay down and they cover you with peppermint branches, which is cool and refreshing, and you cool off your body temperature to keep from dehydrating or dying. When you're moderate again, you get back up and start dancing, and this goes on and on and on. Well, it has the same effect.

"You can hallucinate without drugs. If we sit here long enough, and I chant with you, and we just tap our feet, and I have a drum, and I'm steady enough, and I'm strong enough in my mind of what I'm thinking and what I feel, I believe we're going to hallucinate, or one of us will.

"But the Indians have a whole different view about it. It's sacred. It's spiritual. They don't do it to go get high and go into town and buzz the shit out of the town or to get crazy with each other. They do it because it's a spiritual-knowledge situation.

"I found a more important value in being with the Indians, accepting and knowing the fact that you could never *be* an Indian, you could never *be* completely of them, but you could be with them and begin to absorb some of their ways and some of their processes and find out what meaning they have for you as a Western person, as a Caucasian or non-Indian, and apply that meaning to yourself.

"My time in college was a booze generation. I certainly did my share of that. But I have no interest in hallucinogens or things like that anymore because I can get so high—I mean this sounds arrogant, but it's just a fact—that I've been so high most of my life on living that I haven't felt the need. I've tried it all at one time or another and found it wanting, because there's nothing that I've ever taken or used that's gotten me to a place where I can't get myself."

Redford also says his philosophy of nature has been shaped by his study of the Mormon Church. He praises the church's condemnation of the Reagan Administration's plan to base the MX missile system in Utah. Mormon opposition was a reconfirmation of the church's doctrine of divine stewardship, he says.

"Yes, divine stewardship. I'm fascinated with the Mormon Church, and I'm fascinated with its beginnings and what it's trying to do. I'm somewhat disappointed that it's become more business-oriented and that it's lost its balance a little bit.

"But I look back to the tenets of the church and various documents, and I find fabulous statements in balance. One is the statement regarding divine stewardship, said by Brigham Young himself and the elders of the church, which founded that valley where they talked specifically about what had to be developed for their survival and what had to be preserved for their spirit and their psyche. I think it's a masterful statement that's gotten lost in the last hundred years. I'm fascinated by how the one end of that two-pronged statement has completely overwhelmed the other, so that anyone who tries to speak about the other is considered a radical environmentalist trying to stop progress. Just reminding the church of its own statement has become something of a negative.

Redford's plans to bolster the education of others went considerably beyond reminding people of the beauty of nature. His first conception was grandiose. He would help establish nothing less than an Environmental Annapolis, an academy for the defense of natural resources. Its graduates would march out into the service of national parks, where they in turn would become foot soldiers protecting resources—which Redford considers equally as important as the national defense—and foster their rational development.

This strategic plan quickly became mired in meetings. One problem—Redford now calls it a great mistake—was seeking government support for the idea. "I really thought that what everybody said could be proved not true, which is that nothing can ever work when you put it in the bureauc-

racy. You want to kill something, you put it in the government Mixmaster and it will die there. . . . And I said, yes, but if it goes through a study phase, kicked and bloodied about within the government, and if it survives it's bound to go. So the idea, kicked around and bloodied in a think-tank group including government representatives, finally won an $80,000 study grant—and went nowhere.

Redford was forced to take on the role he had consistently avoided: front man, fund raiser, spokesman. Increasingly the role meant dealing with the press. It meant that the Sundance Kid had to face the Mexican Army, a gang that in Redford's opinion continually misses the story and hits *him*.

One sore point, *The Solar Film*, a ten-minute short on solar energy that was nominated for an Academy Award. It took two and a half years to make. Redford says. It wasn't saying solar is the future, simply that it's an option for the future and that it should be explored. We managed to crack a major distribution chain by getting that film placed in theaters all over the country. So in a sense we were cracking an audience that hasn't gotten the message yet. PBS [Public Broadcasting System] has the message. Trade schools and environmental groups have the message. Young people have the message. It's the monolithic center section out there that doesn't have the message yet.

So we had a big press showing of the film here in New York to announce its release. Do you think we got any coverage? No. I went to Washington and called a press conference. Washington was suspicious of the whole thing. I was asked questions about who was funding it and why, rather than what the film was.

After that happens enough times, you begin to get wise to what the real nature of the press is. I believe essentially the press is more interested in celebrities when they stay on the screen or when they fuck up off the screen.

Over the years Redford's dream of the academy—which he tried hard to keep out of the press in its earliest stages—became more modest and practical. Its name changed to the Institute of Resource Management, a title intended to convey the message that timber, water, coal, and other natural assets could be developed rationally as well as preserved respectfully. With the aid of former Secretary of the Interior Cecil Andrus and Andrus's assistant for cultural preservation Hope Moore, Redford considered dozens of universities and then finally settled on two, Washington State University and the University of Idaho. In a joint program they would accept up to 20 graduate students a year in a two-year program leading to a master's degree. Students would take existing courses in environmental science and regional planning. But the institute's curriculum would differ from existing programs in offering students business courses, too, including seminars with in-

dustry representatives The institute would pick up virtually all of the $15,000 cost per year for each student The money would come from a $5 million capital fund to be raised privately and the whole plan was to have become public last October

Going public involved substantial risk for Redford For one thing the pieces of the capital-fund jigsaw were far from being in place and many local reporters knew it And once again there was the risk of the public role In facing the press Redford stood to become a target for the questions he dreaded *Just how tall are you? What color are your boots? What radical backpacker group is behind you this time?*

The risks were even greater he finally decided in pulling back and waiting until all the money came in His rationale he recalls "I want to keep the momentum going and I'd better go up there and deal with it" As the time approached for the Washington State President's Convocation—a big campus event for big-name speakers surrounded by the hype of a homecoming weekend—a Spokane paper headlined REDFORD FLIES INTO HORNET'S NEST

The early part of the day went smoothly After he was introduced to a crowd of 5,500 students in the cavernous Washington State Coliseum he was propelled to the mike by a cannonade of Sousa marching music cheers squeals and when the crowd had quieted, the sound of camera shutters His first gesture brought another cheer He pulled the mortarboard off his head "flashing the red hair

The soul of the speech was the future When he was growing up, he noted, his father used to recite a kind of litany about the decades ahead His father used to say he was working hard to make the world a better place "I suddenly came up short one day," Redford said, "and I realized that I didn't know that I could say that to my children "I was afraid we were at a place where we were no longer going to be inheriting life from our fathers but we were going to be borrowing it from our children" He went on to tell the Kaiparowits story and to trace the slow gestation of the institute

But before he reached this part of his prepared message Redford told a revealing story about himself He was playing the role of a senatorial contender named Bill McKay in *The Candidate* In the course of filming Redford had to improvise campaign scenes At Fisherman's Wharf in Monterey California he worked the crowd shaking hands, kissing babies keeping up a stock line about food costs and rising taxes "As I was doing it I got kind of impressed that I was doing all right" he told his audience "And while I was doing this, there was a woman standing there with her nine-year-old son She was looking at me with a sort of squinty eye as the advance men came across and handed out a pamphlet saying 'Vote for Bill McKay'

She looked at this guy and said 'Hey what's the Sundance Kid doing down here on Fisherman's Wharf?' And the guy said, 'That's not the Sundance Kid That's Bill McKay' She said 'Oh yeah?' And then she said, 'You hear that, Tim? Ol' Sundance is running for the U S Senate'"

The anecdote was ironic Redford in a role moved with ease through the curious crowds improvising campaign clichés, drawing friendly interest even when people were unsure which mask he was wearing Now in Washington State at a press conference after the speech, he had removed his actor's masks along with his mortarboard And he faced icy stares

His defensiveness probably contributed to the antagonistic tone of the press conference The aviator glasses he had put on seemed to make him look colder Questioning turned quickly to funding as Redford had expected He was evasive (He said later in one of our interviews that some potential donors were still working out details and he didn't want to embarrass or publicize them prematurely) After several similar probes about money Redford snapped "That's our business"

Standing about six feet from Redford at the conference, William Funk, director of the institute at Washington State University says he could see the color rise in Redford "What impressed me," Funk says, "is that the women reporters were much harder on him than the men It was almost as if they had to prove to themselves they weren't going to be swayed by him"

But Redford held his temper, refused to be drawn into an attack on James Watt parried a query about his rumored political ambitions by quoting his friend, director Sidney Pollack to the effect that if Redford ever ran for office Pollack would leave the country Meeting adjourned

Redford as himself had carried it off The institute early this year reported that it had raised nearly enough to cover a full contingent of students next fall Interest was high Four students had already enrolled in the current academic year paying tuition with their own money One of them, thirty-year-old Susan Ball, said she had met Redford just once during the months she has been studying wildlife management and teaching a course in how to write an environmental-impact statement She was surprised by the meeting "I had thought there might be more hype," she says "perhaps a bit of theatrical shallowness But I found him genuine"

After the conference a crowd of fans surrounded Redford's station wagon An autograph seeker thrust a giant pastel portrait of Redford in front of the window probably unaware that Redford—unlike Gatsby or Bill McKay—never played along with the trappings of public image making

But this was the site of his once and future dream the place where what the hell he had been talking about was becoming real Redford smiling rolled down the window and signed

Miss Stevens, get me everything we have on spontaneous combustion

ACQUAINTANCE

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"It must be nasty."

"I pity the poor sonofabitch you sell these stains to."

"Would you like to meet the head that will be receiving what you'll be losing?"

Not much.

He's a very old man whose life has been bland beyond the telling. He wants action, danger, adventure, romance. He wants to settle into his twilight years with a head filled with wonder and experience.

"I'm touched." He made fists. "Goddammit, lady, *get this shit out of my head!*"

She waved him to the leaching unit on the wall. He followed her as she opened out the wings. She folded down the formfit with its probe helmet, and he sat without waiting for instructions. He had been in that seat before. Perhaps too many times.

"This won't hurt," Ms. Keogh said.

"That's not true," he replied.

"You're right. It's not true," she said, and the helmet dropped and the probes fastened to his skull, and she turned on the power. The universe became a whirlpool.

Lucy spat blood and he touched her chin with the moist cloth. "Jerry, please."

"No. Forget it."

"I'm in terrible pain, Jerry."

"I'll call the medic."

"You know it won't do any good. You know what you have to do."

He turned away. "I can't, kid. I just can't."

"I trust you, Jerry. If *you* do it, I won't be afraid. I know it'll be okay."

It wasn't going to be okay, no matter how it happened. For a moment he hated her for wanting to share it with him, for needing that last terrible measure of love no one should be asked to give.

"Don't let them put me in the ground, Jerry. Nobody can talk to worms. Send me to the fire. I wouldn't mind that, not if you were with me."

She was rambling. He understood about her fear of the dark, down there forever in the cold, with things moving toward her. Yes, he could guarantee the clean fire would have what remained after. But she was rambling, talking about things she was seeing on the other side——

"I know they're over there, past the crossover, Jerry. They were there before, when I thought I was going. Don't let me die alone. Be there to keep them at bay till I can run, honey. Please."

She coughed blood again, and her eyes closed. He held the moist cloth and reached down and lifted her head from the pillow and placed it over her face. "I love you, kiddo."

After a very long time he took the pillow away. It was heavily stained.

Ms. Keogh called two deckhands to help him onto the forecastle. They strapped his pak on him. The mist was heavier now, had slipped into fog. If there were stars somewhere beyond the yacht, they could not be seen.

"Can you travel?" she said. He was looking off to starboard. She took his head in her hands. "Can you travel?"

"Yes. Of course. I'm fine." He looked away again.

"Set the auto for the city," she said to one of the deckhands. She spoke softly. "Do you remember, Lucy?"

"Yes."

"Do you remember the fire?"

"What fire?"

"Lucy."

"Yes." She smiled at me.

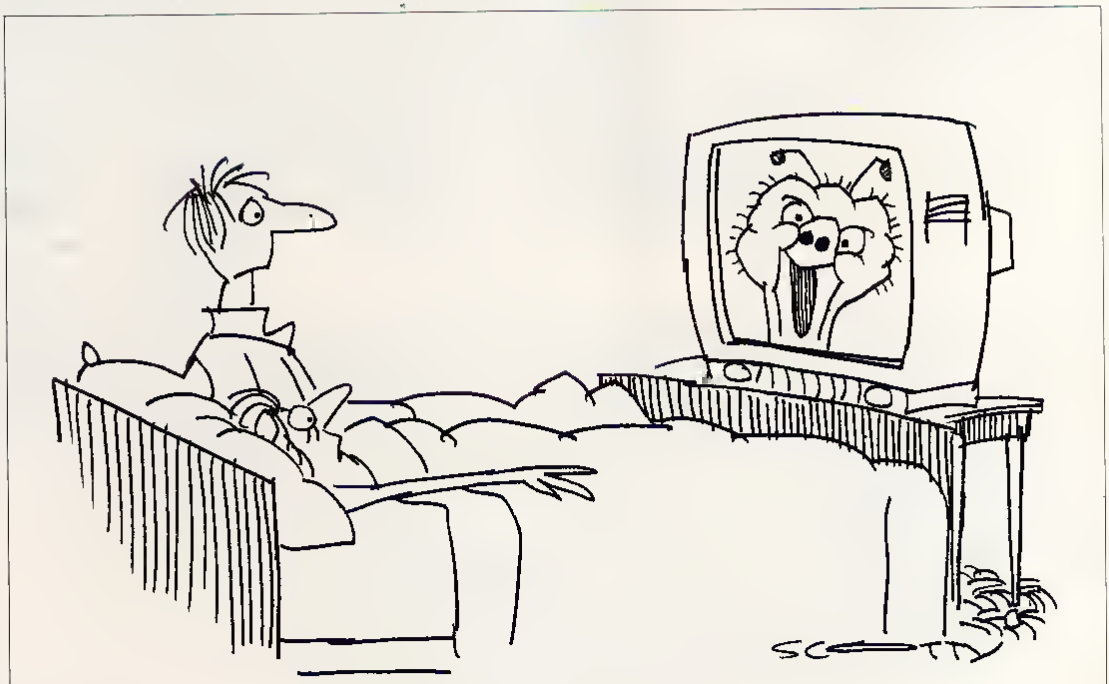
They sent him aloft and he hovered for a moment. Then the autopilot cut in and he moved slowly off into the fog.

She watched for a time, but there were no stars visible.

Then she went belowdecks to purify the stain that had been stored in the unit.

Later that night an old man sat in the unit's formfit, and the balance of pain in the universe was restored. ⊠

The author wishes to acknowledge the assistance of Dottie Amlin, Diane Duane, Mark Valenti, and David Gerrold in the creation of this piece of fiction.



"Good morning, world. While you were sleeping, there was a slight change in your government."

FILM

CONTINUED FROM PAGE 32

enough to do it [the operation] right now" Mobility is still a great liability however, it takes a six-foot lifeline to supply external power for compressed air and electricity The patient would therefore be attached to a permanent unhuman umbilical cord. But Jarvik has already had the foresight to design an electrohydraulic heart to be worn around the waist with a battery belt He says that a compact model is quite a number of years away because of a shortage of funding from the National Institutes of Health

About 5 000 Americans last year died of heart failure after having open heart surgery Donors are rare and the transplant rate of survival is only about 50 percent Most important, a surgical patient cannot survive very long on a heart-lung machine while he or she waits for the elusive donor Artificial hearts may be just the answer The entire system would cost $15 000 plus another $10,000 for hospital expenses as opposed to the $100 000 cost for real transplanted hearts

As someone who was a kind of centrifugal pump for the film's genesis what does Jarvik think of *Threshold*? It is unlikely that the first step would be to implant a heart It's a major jump They would probably use a left heart assist device first" he says But this movie dealt with real technical issues particular aspects of surgery more realistically than any other" In contrast with the considerably less realistic spinal-tap scene in *The Exorcist* and the actual open-heart-surgery footage in *All That Jazz*, the simulated operations in *Threshold* are a breakthrough in realism

The technological authenticity of *Threshold* is due to director Richard Pearce's (*Heartland*) diligent travels to hospitals and research centers Several members of the staff of Toronto General Hospital acted as heart-surgery consultants Nancy Downey a cardiac-surgery scrub nurse, who portrays a nurse in the film as well said the operating set was so realistic that she would put on her mask instinctively whenever she was on the set The hospital in the movie (in Los Angeles in the not-too-distant future) is a composite of five locations including interiors at New Ottawa General Hospital

Up-to-date equipment costing over $750 000 was rented and lent for the operating and intensive care sequences in *Threshold* heart-lung consoles, Boyle Anaesthesia apparatus oxygen monitors scrub stations defibrillator/monitors surgical lighting fixtures and the Spectrum One Mobile computer system to name a few Gordon Smith designed the latex bodies and hearts which are so realistically conceived that medical professors have approached Smith, asking him to continue perfecting models as teaching aids for medical schools

Sutherland has played a surgeon before He costarred with Elliott Gould in Robert Altman's *M*A*S*H* And Dr Bernard Goldman head of Toronto General Hospital's cardiovascular unit who was a consultant on the production, gives an A to Sutherland's skill with the scalpel While *Eye of the Needle* (which sounds like but was not a medical movie) was being filmed, Sutherland began working with surgical instruments and tying suture knots to prepare for *Threshold* which was not to begin shooting for months He was so obsessive about realism that when a line in the script called for a right-angled retractor he demanded to know the importance of that instrument fo such surgery As it turned out there was no need for a retractor in that part of the operation and the line was surgically removed

Jarvik a former carpenter and jeweler says "The heart I built for the movie was more detailed than is shown I had a concept of the heart as a unified sculptural whole And it was real I wanted to design something not completely fake Besides building the dummy heart used in the movie Jarvik also discussed the emotional aspects of implants with the film staff

It is clear that Jarvik's soul as well as his heart is represented in *Threshold* Goldblum who plays Gehring has Jarvik's vocal cadence swarthy good looks and rampaging egocentrism down to the proverbial T Does Jarvik see Goldblum/Gehring as himself? "I certainly hope not The guy is clearly an asshole My wife says the main difference between that guy on the screen and me is that he's dedicated

In the film finally overwhelmed by the certainty his patient will otherwise die, Dr Vrain tells Gehring "Go and get me that thing" Gehring nervously but eagerly complies with the surgeon's order

What would Jarvik do in a similar situation? "There is a difference between disobeying a ruling and just not asking permission [as happened recently in Texas with Dr. Cooley] Criminal prosecution could ensue There could be lawsuits but

Well in the film Aldo is not really completely surprised when he's told to get the heart It's quite apparent technically that you can never be spontaneous That heart has to oe ready to be used

Some health experts say that the amount of money now being spent on artificial hearts should instead be targeted for heart-disease prevention What does Jarvik think? "Prevention is better but there are always cases that show prevention will not work" Then sounding more and more like his screen persona he rambles on about how *Threshold* cost more than the artificial-heart projects how he is actively involved in antismoking and exercise programs, and why he isn't being asked "the only important question" "What about the emotional angle of the film?" The movie is real emotionally he suggests "Just being alive is not the issue The question is What are you going to do with life?" ∞

MUSIC

CONTINUED FROM PAGE 36

A Boy and His Dog, the film adaptation of the Harlan Ellison book Now that's devolving on concrete terms "The quality of life is just lower than ever you've got synthetic Scott Joplin music piped out everywhere Gay Nineties culture on Astro Turf, and killer clowns who go around erasing people while everyone tries to look happy"

"But then" Mothersbaugh continues "the concrete evidence of de-evolution is all around us right now Potholes in the streets Cars recalled because their gas tanks blow up Built-in obsolescence is one of the best examples of a devolved idea"

Casale picks up the litany "and jerry-built lethal toys And Muzak Rampant cheapness Devo believes in the work ethic you know On our last tour we stood and walked on moving treadmills while we played so we know we're part of that scene"

These days Mothersbaugh muses "you hear all these people saying 'Gee it's almost 1984 I wonder if it'll be like the book' What nobody notices is it already *is* like the book! We're already seeing people controlled externally by the threat of violence and material deprivation by the threat of losing their bourgeois payoffs and by a lack of information"

What kind of information? Almost any kind he replies "For example information about cars that Detroit suppresses like cars that could be safer and more economical but they'll never make 'em because it's in their best interests not to Or information about food If things were worked the right way it'd be just as easy for people to eat nutritionally sound food as to eat at McDonald's all the time I've always liked the idea of being able to set up a Devo fast-food chain with biomedical food packets for all body types"

And stuff like Three Mile Island Mothersbaugh goes on "is so disgusting I mean Devo doesn't mind the idea of nuclear energy but not when reactor technology's so comparatively primitive and especially not when the maintenance is so damned sloppy And the big shots who are really responsible for all that happening are of course nowhere around when it nearly melts down"

"It's already begun" Casale joins in "Devo takes that as a given The mutation's nearly complete People despite their neuroses act like happy little pods on the surface anyway Underneath all the atrocities are waiting to come out And look what's happening all around them You've got Ronald Reagan as President which is so devolved not even we or Burroughs could've come up with it It's just perfect Psychotic America turns to a B-movie actor to solve its problems America's become one big halftime show at a football game"

"The whole mass-marketing thing is heavily devo," Mothersbaugh says, gig-

gling like on TV in L A where we all live now there s this commercial for a product called Top Coverage It s a spray on adhesive for people who comb little spaghetti strands of hair across their bald spots It comes in colors to match your hair or lack of it! Now some people might call that a great product a boon for mankind To us it s about as devolved as you can get Or the ad on New York City TV for the men s clothing store [Brooklyn s Male Shop] where a guy can buy all these socks and shirts and ties in addition to the suit for the price of a single suit at another store It's insidious

When did all this de-evolution start anyway? Well Mothersbaugh answers, it s like we said in the title of one of our videotapes—*In the Beginning Was the End—The Truth About De evolution*—there s a flaw in the plan that s been there all along I d guess it goes back to the time the first pre-Neanderthal ape sat in front of his TV set on a Sunday watching football and drinking beer and then he beat his wife after the game And then she beat their kids while they were all out shopping at the supermarket Man's just basically an insane species of brain-eating ape that devolved from harmony with nature Biology is destiny Once you have that pattern of paranoia set it becomes self-perpetuating '

So is there any hope? Are there any answers? Subversion rather than anarchy which is just too obvious Casale answers "You ve got to be subtle and subversive Be a chameleon be a termite and get into the corporate superstructure and eat away at it from inside Everything comes down to goods and services and information, and all that s controlled by the corporate state So you ve got to deal on that level or else you re irrelevant Even though the corporate state always seems like it's teetering over the edge it has to be pushed along a bit Look at what we did Right from the start we said We aren t even men We are Devo We are entertainment for the corporation " And we managed to hook up with Warner Communications one of the biggest corporate entertainment conglomerates there is It *can* be done

Should Devo be perceived as a subversive example? Sure says Casale but for now we're the most phenomenally misunderstood band around People call us fascists because we re unsentimental and we show discipline People call us clowns because we have a sense of humor"

"I think *mutation* is the answer Mothersbaugh suggests and you can take mutation on a number of levels In the overall corporate sense if you can mutate the corporate structure you can actually get in a position to try to replug the component variables that make up the system

Then again ' Casale sighs "who knows what ll happen with recombo DNA what with the corporate takeover of genetic engineering? There s no reason to trust the corporations to do the best thing with it They could easily spring some sort of abomination on people Imagine what Chrysler Clones could mean! I shudder to think of it Me, who s always said he d like to see a recombo DNA lab in every garage

I don t know Mothersbaugh intervenes The essence of de evolution right now as it happens is the unconscious negative mutation that people let the society put them through If people could exercise the choice they should rightfully have for their *own* conscious positive mutations something would have to happen Even without recombo DNA there s a way to mutate yourself Keep alert and active rather than passive and lethargic get your mind and your body in shape Make intelligent informed decisions But if we had recombo DNA labs I d be there right now working on alternate life forms

Wait a minute What about the possibilities of aberrant strains resulting from the mishandling of the gene pool? Sure sure ' says Casale but like I said what s to stop the corporations from doing the same thing? At the least, it could make things a bit more interesting As it is you see some middle-aged housewives these days who look at least half crustacean

Maybe they could devise a mutant strain of housewife with crab claws to fight their way through the crowds at the shopping malls Mothersbaugh chuckles

We consider ourselves punk scientists Casale says I mean if punk is a style or a fashion obviously we aren t punk But if punk is a state of mind we may be the only true punks And Devo wants to know where the punk scientists are Where s the sixteen-year-old kid who's going to learn plastic explosives from some pissed-off Vietnam vet who got a raw deal and then go in and waste a nuclear reactor? The way the Israelis did with that Iraqi nuke plant Now that was *impressive* disciplined efficient and effective rather than banal and passive not just a smokescreen for the same old bourgeois payoffs

And what will Devo itself be doing in the future? We ll just keep on being Devo as best we can Casale promises and if somehow our entertainment option is terminated so to speak I m sure the same idea will surface somewhere else Otherwise you may hear about me working for a McDonald's in Iowa plowing my paycheck into a recombo DNA lab working up some nice mutations

If Devo survives what would the ultimate Devo concert of the future be like? That s a pet dream of mine, Mothersbaugh confesses "where we do sixty cities in one night nationwide via live simulcast holograms Everyone comes into their respective hall in their city and does calisthenics for the first part of the show Then we spray this nutritional liquid into the audience and everyone strips down to their diapers and wallows in it Then at a key moment an ultrasonic frequency is emitted and every one has an orgasm Then we hose every one down at the end DO

CONTINUED FROM PAGE 26

experiences imaginable. They take it very seriously regardless of the subject."

Despite this serious approach, role-playing games often are not based on realism. "The important point is you want the players to respond to the properties of the game, not to the details."

Miloikovic says, "Video-arcade games and home computer games are not at all like the real world. And in many ways that is an attraction. It's a totally new world and one that's open for you to explore. You're not hindered by the same frustrations you feel in daily life. With games like interactive fiction, you can be perceived as you want yourself to be perceived."

Unlike the standard arcade-type video games that use colorful graphics and sound effects, Lafore's interactive-fiction stories consist simply of a text displayed on a screen. Like old-fashioned books, they leave much to the reader/player's imagination. However, many players feel that it's a bore if it doesn't have pictures.

One of the problems with this nonvisual kind of game is that it takes a reasonable amount of imagination to enjoy it, Miloikovic says. "Adults in particular get bored with these games, and they can't understand why their nine-year-old son or daughter enjoys playing with them so much!"

Charles Platt, a writer and computer experimenter, is marketing a different form of interactive fiction program. The player is offered seven categories, ranging from science fiction to pornography to Westerns. The computer asks for the player's name and gender. The player then selects two categories from the seven—say, science fiction and Western—and the computer plugs in the correct variables, "coming up with a story somewhat along these lines: A spaceman, together with an ally, rescues a woman from a villainous cowboy. In the science-fiction story the ally is a faithful robot and the villain is an alien," Platt explains. "In the pornographic story the ally is a lesbian masochist and the villain is a member of the vice squad."

Though Platt's program can only marginally be considered interactive, "its main thrust is toward fun and games, not role playing in the academic sense. What changes in the story he continues is the scenery, the names, the atmosphere and, of course, the hardware—whether it's a space suit or a black leather outfit."

Writing the interactive story is a time-consuming and difficult task. "I think it's harder to write interactive fiction than it is to write anything else," Lafore comments.

The future of interactive fiction, as is so of all adventure and role playing games, is difficult to predict. "I see people starting to play real-life roles as the next big step in adventure games and interactive fiction," Miloikovic says. "Instead of being a general in control of everything and everyone, which is admittedly unrealistic, you'd be a general in charge of colonels who would do the actual work. You'd need to decide which colonels you could trust, which ones were best suited for each task, and all the while keep the checks and balances in their proper place."

Lafore plans to introduce longer, more complex stories, more interaction and deeper plots. "I'm also experimenting with several variations of the art form, such as interactive movies," he says. "Actors will appear on a TV screen and will talk to you, and of course you can talk back."

The proponents of interactivity emphasize that gaming with computers is much more than entertainment. It is a release. Unlike people, computers will do what you tell them to do. "You're suddenly in command of everything around you. You're interacting with the world as a participant, not just as an observer. It's an incredible power trip," Lafore adds. "You're in control of life and death. Instead of being just a pawn in a game, you are now at the core of existence, deciding who lives and who dies. It will just be a matter of time before we'll be able to talk directly to computers and have them understand us. We'll talk back to the characters in a book or a movie simply by voice, and not by typing on a keyboard. We will actually be able to converse with characters of our creation."

EARTH

CONTINUED FROM PAGE 14

of the clones were more productive and more resistant to disease than the russet Burbank considered the finest potato in the United States.

Shepard is now taking his potato work a step further. He is fusing, or combining, protoplasts from entirely different species of plants. His latest creation is a "pomato," the offspring of a potato and a blight-resistant tomato. He doesn't yet know whether the tomato's blight-resistant genes have been transferred to the pomato, but once he has cloned his pomato into 50 or 100 brethren, he'll expose a few of them to blight and see what happens.

PRECISION ENGINEERING

By cloning and fusing protoplasts, Shepard is sure to produce new plant breeds that will boost agricultural productivity in just a few years. But his success, unfortunately, is slow and uncertain, depending on almost random trial and error. Test a million mutant clones, and a few may outdo the conventional plant breeds.

In the long run, Shepard's efforts will be superseded by those of genetic engineers who can isolate and modify genes with an ultraprecise technology called recombinant DNA. DNA (or deoxyribonucleic acid) is the chemical that makes up genes. It contains the ultimate inherited program dictating the characteristics of all living things, from animals and plants to the tiniest bacteria. By altering, or engineering, DNA, scientists will be able to custom-design genes from scratch and then insert them into plants to perform specific tasks.

Roger Beachy of Washington University in St. Louis, for example, has isolated the gene that instructs the soybean to manufacture its highly nutritious seed protein, the one that goes into Purina dog food and fake steak. He has already cloned the gene in his lab, and his hope is to modify it so it can work in other species, then he will be able to transfer it to relatively productive but unnutritious plants, turning them into food sources. And Joe Key, a biochemist at the University of Georgia, plans to seek the specific genes that allow some plants to withstand heat. He knows, for instance, that extreme heat causes hearlier plants to manufacture survival proteins, and once he finds the genes controlling production of these proteins, he'll be able to modify them for transfer to virtually any plant alive. The resulting species will be able to survive in searing heat, providing long-sought salvation for farmers near the equator.

HYBRID FANTASIES

Still other scientists hope to create species that are part plant and part animal or bacteria. Biochemists have already transferred human interferon genes to plants. And one researcher with only minimal whimsy suggests engineering trees that will grow pork chops, failing that, he says we could at least make trees that would be the nutritional equivalent of pork, capable of manufacturing proteins now found only in cows or pigs.

In the vanguard of such efforts is Harvard's Fred Ausubel, who began his career in agriculture during the politically turbulent Sixties because of his concern about world hunger. Back then he realized that a likely explanation for the high price of food was the cost of nitrogen fertilizer. He also realized that almost all crop plants needed fertilizer in order to flourish.

The only exceptions were legumes, such as green peas and soybeans, which lived symbiotically with bacteria. The bacteria absorbed nitrogen from the air, then converted it to fertilizing compounds that replenished the legumes. To endow other species with the same good fortune, Ausubel resolved to find the bacteria's nitrogen-converting (or nitrogen-fixing) genes and transfer them to nonlegume crops such as lettuce and corn.

He began by analyzing the strands of DNA in nitrogen-fixing bacteria. Each strand contained thousands of genes, but Ausubel knew that only a few of the genes were required for nitrogen fixation. To ferret out the right ones, he broke the DNA into fragments, then combined each individual fragment with mutant bacteria that he knew *could not* fixate nitrogen. Only one fragment helped these mutant bacteria produce nitrogen compounds, and Ausubel assumed that this fragment contained the nitrogen-fixing genes.

After studying the fragment for a decade, Ausubel has found 17 nitrogen-fixing genes in all. He is now trying to transfer these genes to petunia and tobacco plants, which he hopes will begin fixing nitrogen.

WORKING GENES

This elusive goal—transferring genes to plants and getting them to work—is now within reach because of a stunning series of experiments at the University of Wisconsin. The Wisconsin team got its start two years ago, when biochemist Timothy Hall began analyzing the gene responsible for the French green bean's nutritious seed protein. Before long, Hall's colleague biochemist John Kemp decided he would try to put the gene into an ordinary sunflower.

Kemp knew he needed to find a gene ferry—a vehicle to carry the bean gene through the swirling liquid of a sunflower cell and into its DNA-packed nucleus. Finally he realized that the bean gene might be able to hitch a ride with a destructive microorganism called *Agrobacterium* known for its ability to carry cancer-causing genes into the sunflower cell nucleus. Kemp and a third team member, Preabha kara Choudary, transferred the bean gene to agrobacteria, placing it near the cancer genes. Then they injected the bean-treated bacteria into the sunflower.

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ITT

CORDLESS PHONE SYSTEM

When the sunflower began producing the biological precursors of bean protein late last summer, genetic engineers around the world were elated. It was obvious that the sunflower had incorporated the bean gene into its own chromosome, becoming the first plant ever to manufacture a substance at the behest of a foreign gene.

To make agrobacteria more practical, Mark van Montague and Jeffrey Schell, of the University of Ghent in Belgium, have recently found a way to destroy its cancer-causing genes while leaving the rest of the organism intact. Thus, agrobacteria can now transfer genes into sunflowers and other plants *without* inducing cancer.

The implications," Schell says, "are astounding. For the first time we can endow plants with new genes—and new traits—that are transmitted from one generation to the next. We have the ability to put *any* gene we want *anywhere* we want it."

PLANTS UNLIMITED

The promise of the plant revolution seems limitless, but every miracle has its cost. Because its success requires vast and costly field experiments, this brave new world of agriculture will be controlled by the Du Ponts and the Monsantos, not by the plant breeder on the farm. "In time," says Jack Doyle, of the Environmental Policy Center, in Washington, D.C., "America's farms could come under contract to the laboratory-based corporations, using corporate-bred plants, chemicals and hormones. These large companies, interested in making a profit, might pay more attention to a plant's color than to its vitamin content. The historical lessons of corporate irresponsibility on pesticides, toxic wastes, and carcinogens should be all too fresh in our memory," Doyle warns, "to allow another, more insidious form of corporate dominance to emerge."

Another fear is that scientists might make a mistake, creating genetically engineered monsters with dangerous new qualities. Such plants might be extremely susceptible to crop blight or might carry substances harmful to the people or animals that eat them. Once such a plant is widely distributed, its growth will be almost impossible to halt.

With extra care and an awareness of the pitfalls, however, scientists can make the good outweigh the bad. When the first fruits of biotechnology move from the lab to the farm, sometime around 1990, Americans will start producing superabundant stores of superior crops for a fraction of the cost. And Third World farmers will wage war against some of their worst enemies—insects, plant disease, and soil that has too much salt or too few minerals. By the year 2000, these farmers will have access to hearty, inexpensive crops containing every nutrient craved by their malnourished countrymen. Mankind will have its first potent weapon against starvation and the means to provide affordable food for all the people of the world. ΩΩ

FORUM

CONTINUED FROM PAGE 12

started thinking. I propose a way to extend its use. Let's make it a relay system. In my town we have a radio station that's so weak, its signal cannot cover the entire town. Our solution was to put repeaters at the edge of the broadcast range. These repeaters pick up the signal and broadcast it on. If it can be done with a simple AM/FM device, why can't it be done for *Voyager*?

Max Crosley
Bolinas, Calif.

Thinking Away

Patrick Moore, in "Thought Travel" [Stars, January 1982], misses the point of space travel when he uses Julius Caesar's and Shakespeare's reaction to television as an argument for the postulation that contemporary man is close to mind travel. We are no closer to this kind of transportation than mankind in pre-Christian times was.

I suggest Moore think his way over to my place and we'll have a chat about the finer points of transportation.

Flemming Sørensen
Copenhagen, Denmark

His ideas may be controversial today but I, for one, fully believe that Patrick Moore is correct in postulating that the future mode of interstellar travel will be via mind projection. In fact, I believe that in the not-too-distant future most travel from place to place on Earth will be by means of out-of-body projection: no muss, no fuss, no tolls.

But what will we do with all the miles and miles of vacant highways and the empty parking lots and airports? Furthermore, a friend of mine is worried about where he can park his body so that it won't be taken advantage of while he is gone.

Elizabeth Righter
Archaeologist
West Chester, Pa.

Images from Sound

In "Ancient Recordings" [Continuum, February 1982], Dr. Peter Lewin discusses his research regarding sounds that may be captured on ancient artifacts.

It may be of interest to Dr. Lewin and other *Omni* readers to note that in the book *Seth Speaks*, by Jane Roberts (Bantam), Seth discusses an ancient Lumanian civilization which used sound, among other things, as a conveyor of weight and mass to power locomotives and to heal the sick.

In Chapter 15, Seth says, "Consider for example 'something very simple—say a drawing of an animal. You would perceive it simply as a visual object. But these people were great synthesizers. A line was not simply a visual line, but according to an almost infinite variety of distinctions and divisions, it would also represent certain sounds that would be automatically translated into an amazingly vivid image.

"If such a civilization as that of the Lumanians did exist, and their sound technology could be rediscovered, Dr. Lewin might find he can reproduce not only sounds from ancient civilizations but images as well."

Donna MacVicar
Washington, D.C.

Unknown Hyperbole

I write concerning Kathleen McAuliffe's article "Biochip Revolution" [December 1981]. While I was inspired by many of the ideas presented in the article, I must take exception to the article's hyperbolic tone. McAuliffe suggests that "the ultimate biological computer has hit the drawing boards," when in fact such a computer has scarcely breached broad conceptualify.

She then suggests that these new devices "will not process data in the rigid, linear style of earlier computers, but network-fashion, like the living brain." As a neurophysiologist, I feel we don't substantially know what the living brain is like.

James Aldridge
Ithaca, N.Y.

No Schism

Candace Pert declared there is a schism between brain researchers and analytical psychiatrists [Interview, February 1982] as it knowledge of neuroceptors were incompatible with psychoanalytical theories.

I submit that no such schism exists. Neuroscientists and psychoanalysts study human behavior from equally valid, but different, vantage points. It is a simple observation that the brain, regardless of the intricacies of its inner workings, always gives rise to the tangible entity known as the mind. Years of psychoanalytic research have treated the brain as a "black box," enabling the psychologist to study the mind directly which has provided conclusive evidence that behavior can be influenced by early childhood experiences.

An analogy can be made with chemists who, for the most part, treat atoms as "black boxes" that combine with one another in definite ways, regardless of their inner structure in terms of quantum mechanics and mesons elucidated by physicists.

Jerome P. F. Smith
Mexico City, Mexico ΩΩ

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GAMES

ANSWERS TO GAMES (PAGE 144)

1 PATTERN The series is a section of the capital letters of the alphabet beginning with *L*. Each letter is flipped 180 degrees and superimposed on itself. The next symbol is ⊥.

2 FIND THE KEY It's a typewriter key, of course. Miss Sueda, a touch typist, placed her hands on the top row of letters on her typewriter (QWERTYUIOP) instead of on the middle row (ASDFGHJKL;) so that each finger was above and to the left of its usual position. She then touch-typed her secret message. The quick brown fox tripped over the lazy dog; the dog ate him. (Note: Typewriters lacking the numeral 1 in the top row may have a different symbol to represent the *q* in *quick*. We italicized our *1* to signal this possibility.)

3 TWO-SIDED PROBLEM The words on the first list are all typed with the left hand on a standard typewriter; the second list entirely with the right hand. Readers of *Games* magazine found that the longest words that can be typed with the left and right hands respectively are *stewardesses* and *lollipop*. *Omni* readers are invited to try to break these records.

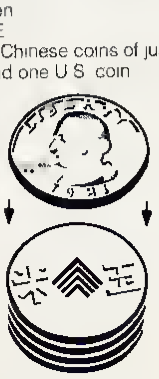
4 MATCHBOXES

5 REMATCH Move the vertical match from the top right to the bottom left to produce the number 6. Or take away 3 from 9 and you still get 6.

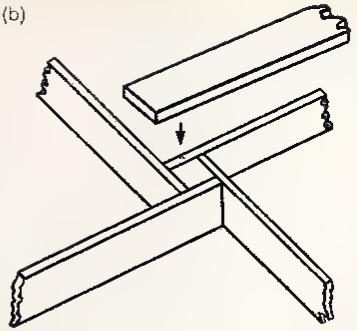
6 ORDER The symbols are arranged according to the number of elements that light up on a digital calculator display. The minus sign uses only one element. The 2, 3, and 5 each use five elements. The 8 uses all seven.

7 TAKE FIVE

(a) Use four Chinese coins of just the right thickness and one U.S. coin.



(b)



(c)

8 DATING GAME March 28, 1984. In each case the product of month and date equals the last two digits of the year. For example, 3/28/84 becomes 3 × 28 = 84.

9 THE QUICK AND THE DEAD The words represent the nine planets in order. The hint "Nine first and last" tells you that the answers to the first Question 9 (this month on the Equations Test) and to the last Question 9 are the same nine planets in the solar system.

10 THE THREE ISLANDS The animals placed on island A were mules. The mule is a cross between a male donkey and a mare horse, and it is virtually always sterile. None of the original mules reproduced, and so they all died out.

Island B was planted with donkeys. They reproduced at a rapid rate, and any mules that may have swum over from island A merely died without reproducing.

The animals placed on island C were horses. The mares mated with a few of the male donkeys that arrived from island B, producing more As (mules). So all the animals A, B, and C were found on island C. But what was animal D? It was the double cousin of the mule, called a hinny. Like the mule, it results from a horse-donkey cross, but in this case from a male horse (stallion) and a female donkey (jenny). The hinny differs from the mule in having a more bushy tail, in having a body disproportionately large in comparison with the legs, and in being of a gentler disposition. Thus a few hinnies were found on island C, even though none had been brought to the planet. Since the original astronauts were all city boys, none of them knew what to expect from their unusual farm system.

11 ELEMENTARY Smith knew too quickly that the dead brother-in-law was Lance, not Edwin or Rufus. Since Rufus was out of town, Smith couldn't know which brother-in-law had been killed, unless he himself had done the killing. ∞

SPACE

CONTINUED FROM PAGE 20

has been mixed "I don't think it has any chance to succeed," says the administrator of one large space organization who asks to remain unidentified. Even if they did get a probe to Halley's Comet, it's just a carnival. There's no way they could produce useful scientific results. The project would be detrimental because it raises the false hope of private funding for exploratory missions. I'd much sooner they put their energy into trying to change the administration's space policy than into something like this."

All the same, a private-enterprise space probe? For many it would be the ultimate dream come true.

A more humble dream, but one that often seems just as improbable, is the idea that space-activist organizations might be able to cooperate with one another. All the groups seem to think theirs is the only true religion," says Stan Nevins, of the World Space Federation (Box 293, Grandview, MO 64030). They fight for their piece of the pie when we haven't even got a pie tin.

The World Space Federation (WSF) and the L5 Society (1060 East Elm Street, Tucson, AZ 85719) set a cooperative precedent this winter by agreeing to consolidate their memberships. For WSF, the union offers economies of scale. The two-year old group has won a reputation as one of the most effective of the hundred-odd societies working to promote space development. But with only 180 members, WSF has lacked the large base of contributors and letter writers on which political activists depend. By joining L5, WSF members gain access to more than 5,000 fellow enthusiasts.

L5 also gains by the coalition. WSF's handful of members are among the hardest-working activists around. The federation brings L5 a large helping of the more level-headed science-fiction writers, including Theodore Sturgeon, Poul Anderson, Jack Williamson and C. J. Cherryh. Their inclusion should win the society many new members from the science-fiction community. WSF also offers some tentative contacts with environmentalists, to whom the idea of moving strip mines and industrial pollution into space should be far more welcome than it seems.

The consolidation gave Stan and Carol Nevins time to become national cochairmen of the L5 efforts for Spaceweek '82. Last year's Spaceweek featured exhibits and public events in 22 cities throughout the country; one display alone drew 65,000 visitors in Kansas City, Missouri. The governors of all 50 states and of Puerto Rico unanimously proclaimed National Space Week and National Space Observance Day as state celebrations. The Nevinses hope to do even better this year. "We expect to draw even more cities into Spaceweek," Carol says. She is also the president

of WSF. We are also going to try very hard to get Spaceweek and National Space Day made permanent."

Spaceweek is set for July 16 through 24 in commemoration of the *Apollo 11* mission but it may be extended to a full ten days. National Space Observance Day will be held on July 20, the date of the first moon landing. As this is written, plans for most local celebrations are still uncertain. Organizers offer a handbook for people interested in planning events in their own communities, a $10 donation is requested for this guide (available from Spaceweek National Headquarters, Box 58172, Houston, TX 77258).

From Delta Vee and Massachusetts Institute of Technology activist Stewart Nozette came a plan to gather funds for the Spacewatch Project at the University of Arizona. Spacewatch aims to catalog the nearly 1,000 asteroids that pass near Earth's orbit during their travels around the sun. These fragments of matter—some of them hundreds of miles in diameter—are rich in clues to the origins of the solar system and rich in minerals and metals including platinum. One controversial supposition holds that an asteroid several miles in diameter struck Earth some 65 million years ago, hurling a cloud of pulverized rock into the air. The cloud blocked sunlight, leading to the extinction of the dinosaurs, according to the theory developed by Dr. Walter Alvarez of the University of California. Other researchers have suggested that a future asteroid collision could destroy human civilization either by its own impact or by being mistaken for a nuclear attack, triggering a war.

For all these reasons, many argue, a census of Earth-approaching asteroids would be one of the most valuable of near-term projects in astronomy. "I've never seen anything like the approval this received," says Dr. Thomas Gehrels, principal investigator at the University of Arizona. "Usually if three quarters of the people you ask approve of something, you're doing well. I've never heard anyone say a word against this project."

Spacewatch requires a special 72-inch telescope with computer controls and advanced imaging equipment designed for the project. The device is still under construction. NASA funded the earliest studies, but budget cuts have compelled the agency to back out of most of its commitment. With full funding, the equipment would take about two years to complete. As things stand, the University of Arizona has been forced to split Spacewatch with the Physical Research Laboratory in Ahmedabad, India, delaying completion until about 1986. Once finished, Dr. Gehrels estimates, Spacewatch should locate an average of one new asteroid every three days. Ten years after it begins, the census will be complete.

Another $700,000 worth of work remains to be done. Contributions of any size are welcome (to the University of Arizona/Project Spacewatch, c/o the Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ 85721). For Gehrels, though, a single donor would be ideal. "He might even work in the project if technically qualified," he says wistfully.

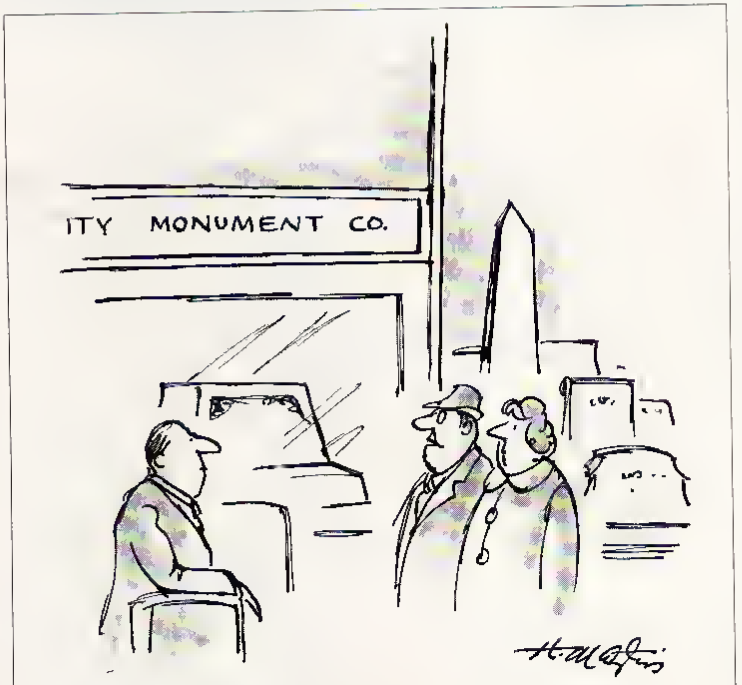
Both Delta Vee and the Planetary Society (Box 3599, Pasadena, CA 91103) have begun to raise money to support the search for extraterrestrial intelligence, one of the first programs NASA lost because of falling budgets last year. Scientists at the Ames Research Center in Mountain View, California, were then working to develop signal-processing equipment capable of listening simultaneously to several million radio channels and identifying intelligent signals in them. Contributions to Delta Vee's "Extraterrestrial Connection" will go to support this effort and to foot the bill for observations of stars considered likely to have habitable planets.

The Planetary Society chose to back the development of a small, portable receiver for use with radiotelescopes. Being built by Harvard's Dr. Paul Horowitz, who is working at Stanford this year, the device will listen in on some 250,000 radio channels, retrieving any signs of intelligence from them. The receiver will take about two years to finish and will then be moved from telescope to telescope as researchers are offered time for the search.

Other coming events as grass-roots groups prepare for spring.

L5's national convention, to be held April 2–4 at the Hyatt Hotel near Los Angeles Airport, will feature Dr. Hans Mark, NASA's assistant administrator, as the keynote speaker. Science-fiction writer Robert Heinlein and *Apollo 13* astronaut Fred Hayes will be honored guests. One highlight of the meeting will be an attempt to do the preliminary design work for a lunar colony. "We figure we can do free what most companies would charge two to three million dollars for," Dr. Jerry Pournelle, a member of L5's elected governing board, says.

The Space Foundation (Box 58501, Houston, TX 77058) will decide on awards for graduate work related to space industrialization. Last year the businessmen's organization gave out eight prizes and fellowships of up to $7,000 each. Award-winning projects included a study of refining techniques for extraterrestrial nickel-iron alloys, a prototype of a digital video disc that might be used to distribute satellite data, experiments with closed microbial systems, work on the possible effects that argon-fueled engines would have on the atmosphere, and a study of marketing strategy for processing materials in space. Administrator Nancy Wood notes that awards this year may be raised to $10,000 and that the foundation's Get-Away Special may be given to one of the winners. The closing date for applications, not yet final, is expected to be June 1. ∞



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SINGING FISH

CONTINUED FROM PAGE 38

public performance in June 1981 in a live concert at the Center for Music Experiment on the campus of the University of California at San Diego

For this demonstration, Ferguson set up a specially constructed 45 gallon aquarium in the center of a small auditorium His several electrodes were wired into a quadraphonic system A speaker in each corner of the room allowed the movement of fish through the tank to be translated into the movement of sound across the room An oscilloscope was used to make visible the waveforms as they were created

The turnout for this performance was about 50 people mostly music students and neurophysiologists Preparations are under way for at least one return engagement at the university

Ferguson may eventually use his finny players for movie soundtracks and other such things, but he sees real vitality in the fish musicians as live performers "Or he says "I could see a human orchestra with regular instruments using fish as an accessory although I prefer to keep the whole thing in a natural vein"

Ferguson sees the greatest potential for his system in people's homes it adds another dimension to an aquarium Even a small aquarium can give you continuously varying entertainment The fish provide a sound stimulus as well as a visual stimulus and both are very complex

All this is yet to come however For the time being Ferguson is mainly concerned with refining the system to enhance its marketability—no simple task considering the multidisciplinary nature of the idea "It's a challenge just to put it all together" he says "It requires a knowledge of physiology aquarium maintenance music and electronics"

First one should have a working knowledge of electric fish, particularly of their behavior and biological requirements And it's equally important to know how to design and maintain the low-stress aquarium environment And you need some knowledge of music to allow you to combine the fish and the different tones produced in a pleasing fashion That knowledge is also helpful when it comes to understanding some of the things you hear such as beat phenomena and how the shape of the waveform will determine the timbre of the sound"

Ferguson's experience with electronics enabled him to create an electrode that reduces background electric noise but still picks up the desired fish signals efficiently Even then it took him two years to get what he considers a good design But there is no doubt in his mind that the result is worth the effort He envisions a time not so far off in which an aquarium is an integral part of every home stereo system One could return home and immerse himself in another seemingly more peaceful world—a world where there are no human voices no artificial instruments

"I see it as intelligent creatures communicating" he says "There is unpredictability Music today seems predictable one doesn't get too many surprises But this is divorced from man the fish are playing their own rhythms The animals are just doing what they're doing—not to make money, not even for art This music has no pretensions

And we're not controlling them entirely You can play with the electrode placement and you can develop the most pleasing combination of frequencies and musical events but this is really minimal control" Yet the music and the songs without any affectations, seem to hold some indecipherable meaning Perhaps in some way the music is making contact with a basic voice of life itself Is this why the music has such a hypnotic quality? Human beings after all are electric creatures who evolved from other electrical animals Might patterns of electric discharge be similar between fishes electric field and ours? Could the voices of these animals be striking a hidden chord evoking some primal memory in our own minds?

CONTINUED FROM PAGE 24

how you are changing your thinking '

The doctors further suggested I share my New Belief with an important other person—a family member or a clergyman

Then I was to perform at least one action each day that would reflect my New Belief to notice how I felt in doing so and to write down in a personal journal at the end of the day both the action and my reaction

"When you have mastered your New Belief in thought *and* action decide whether you want to keep your New Belief or return to the old one When that decision is made pick another card and begin the whole process again Do not worry about the length of time you spend working on changing one belief Take as much time as you need to do the job ' The doctors however were finished with theirs

I decided to call Cavender and Fischer to see how they were making out with their mail-order business

"Our questionnaire offers people permission to get started dealing with their problems Cavender told me

And Fischer claimed that the questionnaire was in perfect consonance with what he called 'the new age

As consciousness changes," he said over the telephone from his new home in Walnut Grove California "we all need a lot of support to help us let go The numbers of people who will be involved in this transformative process are going to be too great to be helped by therapists "

The doctors had spent about $30 000 to establish the program and they launched it in June 1981 with ads in *Psychology Today* and *Cosmopolitan* The response they said, had been modest to fair A few people had asked to have their money back Cavender told me although he would not say how many and a few had written letters to tell the doctors how well they were doing Then the doctors really believed they were providing a worthwhile service? Absolutely

"In years of practice in psychotherapy Fischer explained we found that eighty percent of people s problems centered on problem causing beliefs Our focus as therapists was to change their minds You can t be happy if you don t accept yourself

Colleagues in the psychiatric field Cavender found had been typically reticent in their reactions to the questionnaire

You know psychiatrists he said They refused to make any comment either positive or negative

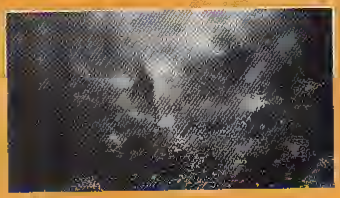
As for the propriety of the venture Cavender said he d shown the whole package to the Ethics Committee of the American Psychiatric Association Fischer had informally showed it to the American Psychological Association

"And did they approve of it?" I asked

Well Fischer replied they said we weren t doing anything illegal "∞

NEXT OMNI

DINOSAUROID



EISELEY

FICTION

LOREN EISELEY'S LOST NOTEBOOKS—For more than 20 years the revered and celebrated naturalist Loren Eiseley kept a private journal in which he gave free play to his thoughts on nature the universe and his fellowman Some of these musings found their way into his published work but others lay buried in the pages of his notebooks, unread and nearly forgotten Now in an *Omni* exclusive the excerpts from his journals are being published for the first time For a special look at one of the great gentle spirits of this century, as he s been called see our May issue

FUTURE FASHION—Heat molded body suits will come with solar collectors to keep us warm Men will wear makeup and women will don paper dresses specially designed by computer after a day s wear and tear, women will throw them away And the supernich the masters of the race will dress in expensive demigod costumes made of silver and gold These are the speculations of some of the world s top fashion designers including John Stavros and Scott Barrie To examine their spectacular future fashions in detail pick up your copy of next month s *Omni*

ELECTRONIC ECONOMISTS—What s next? Bull market? Bear market? Depression? To find out more and more business and political leaders are turning to electronic seers Engaged in a very young and very controversial science known as econometrics these experts are using computer models of our economy to predict when it will zig and when it will zag The science has had its share of failures as well as successes but it has arrived Without it for better or worse Reaganomics would never have existed To find out how it all works and to get the very best expert projections on where the economy is heading this year see the next issue of *Omni*

CORPORATE 007—Beneath a traditional facade many business executives today are armed with a cache of antiespionage and personal defense gear Some of the voice scramblers lie detectors transmitters wiretap sensors, and light guns are small enough to fit inside the elegant leather skin of an attaché case Other intricate inventions turn an ordinary limousine into an armored fortress For an inside look at the arsenals that most companies prefer to keep secret read the May *Omni*

IF DINOSAURS HAD LIVED—Huge reptilian eyes dominate its greenish face Like a turtle it has no teeth But in other ways the dinosauroid is arrestingly humanoid It walks on two legs has a rudimentary thumb opposing other fingers, and delivers live offspring It s one scientist s model of what dinosaurs might have evolved into had they not become extinct Next month *Omni* portrays a creature that might have been—and one whose existence would have made human life impossible

FICTION—A new technique in recalling past lives makes possible the production of a play about Joan of Arc With the Original Cast Nancy Kress s story explores the theater s fine line between reality and illusion A man who cannot die provides a costly entertainment for the rich in Gregg Kerzer s story I Am the Burning Bush

EXPLORATIONS

CONTINUED FROM PAGE 42

the largest blue marlin ever caught The variety of species is spectacular porpoise dolphin fifteen varieties of whales, migrating turtles, migrating birds, and monarch butterflies bound for Mexico

What is this fascinating menagerie doing in these canyons off Long Island? Smaller fish are carried there by the Gulf Stream which flows onto the face of the shelf When the four to six-knot current hits this wall a mighty upwelling occurs forcing the water up toward the surface and with it a multitude of squid and other tasty morsels that attract game fish

In a place like Palm Beach, where the sea floor drops precipitously only five miles from shore, everyone s a canyon fisherman But off the northeastern coast of the United States, where the term originated, canyon fishing is a relatively new sport made possible by turbo-charged diesel engines and fast sportfishing boats with exceedingly long range Even with swifter craft, however, it takes five hours to get out there, and after two hours of fishing Barta decides it's time to go home It made for a long, boring day Not until a handful of people like Barta, who were brave and crazy enough to stay out overnight miles from shore did we know that some of these fish even existed

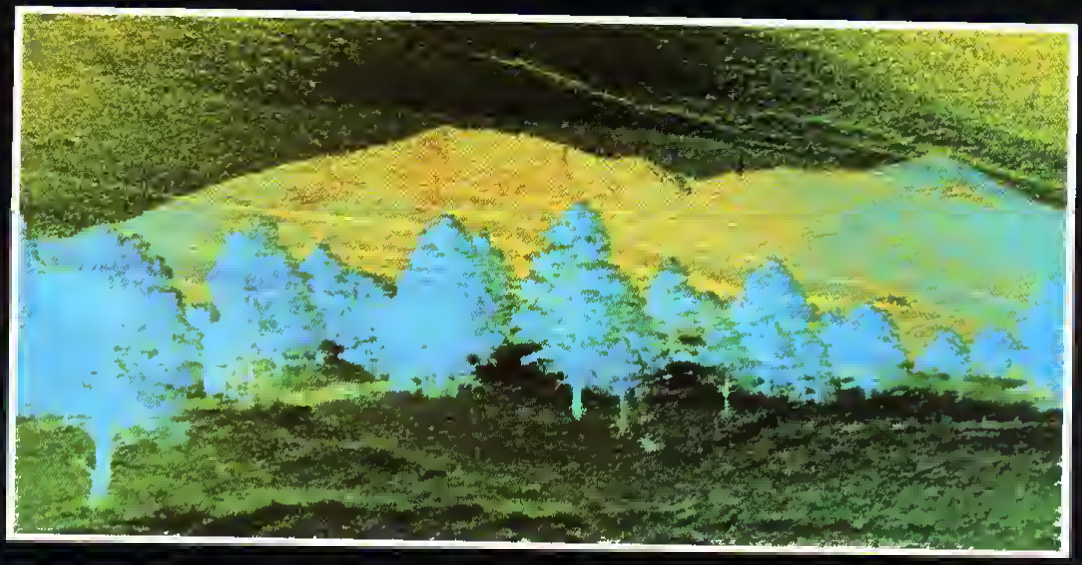
"Up until ten years ago Barta says in all of Long Island they didn't know what a bigeye tuna was " Bigeye tuna is one of the finest game fish in the world They were formerly caught only off California They are deepwater fish that migrate twenty thousand to thirty thousand miles a year We don t know where they come from or why they're showing up off Long Island What we re finding now is that bigeye, yellowfin, albacore blue marlin, and swordfish are resident right off Long Island all year

Barta proves this point by going out in the spring and catching fish 60 days before they would be expected to be in these waters He says that if there were as many fishing boats hewing to the 100-fathom line as there are on the so-called hot spots, the catch would be unrivaled in terms of both the number and the variety of fish hooked

There's an overwhelming feeling when you go over the edge, when you go so far you need to know exactly where you are at all times Five to ten degrees off course could mean you run out of fuel Sometimes it can be as calm as a lake, and a few hours later be choppy with seven-foot seas Sometimes as far as the eye can see there are migrating porpoises blue whales, humpbacks dolphin tuna marlin

"Every place in the world—the Amazon the Azores Africa Antarctica—has been explored and documented the animal life studied and classified, but amazingly little is known about the mountains and canyons along the shelf That explains why people throw away their marriages and life savings to go there It s the last frontier

OMNI
THE NEW FRONTIER



Three years ago OMNI magazine
pioneered a revolution in science publishing,
travelling to and beyond the
known horizons of our world, returning with
fascinating and fantastic stories,
in language we could all understand.
OMNI looked inside the atom
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the human mind, searched for UFO's
soberly and described genetic
engineering simply. And OMNI continues
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HOLE IN SPACE

STARS

By Mark R. Chartrand III

It is one of the most basic principles of science that our universe is uniform. By that scientists mean the average density of matter, the number of galaxies, in short, all of the gross properties we can measure will be constant no matter where we choose to look. This belief is summed up as the cosmological principle.

Therefore, it came as a bit of a surprise to a group of astronomers when they found what could be called the largest example of nonuniformity ever seen, in the form of a gigantic hole in space, estimated to be roughly 1 percent of the volume of the entire observable universe. It measures 300 million light-years across, as far as its discoverers can tell, it is an area totally devoid of any visible matter.

The find was made serendipitously by astronomers Robert Kirshner of the University of Michigan, Augustus Oemler of Yale University, Paul L. Schecter of Kitt Peak National Observatory, and Stephen A. Shectman, of Mount Wilson and Las Campanas observatories, while they were doing a study of the way galaxies are flying away from us, a consequence of the expansion of the universe. Using telescopes at Kitt Peak National Observatory and on Mount Palomar, in California, they were looking at three small regions of the sky near the constellation Bootes (the Herdsman), searching for galaxies as dim as one ten-thousandth that of the faintest stars visible to the unaided eye. What they found were some galaxies clustered at a distance of about 300 million light-years from the earth, more galaxies 600 million light-years away, and in between, the largest hole ever seen. What they think they've discovered are the borders of a vast, empty region of space with galaxies concentrated on its edges.

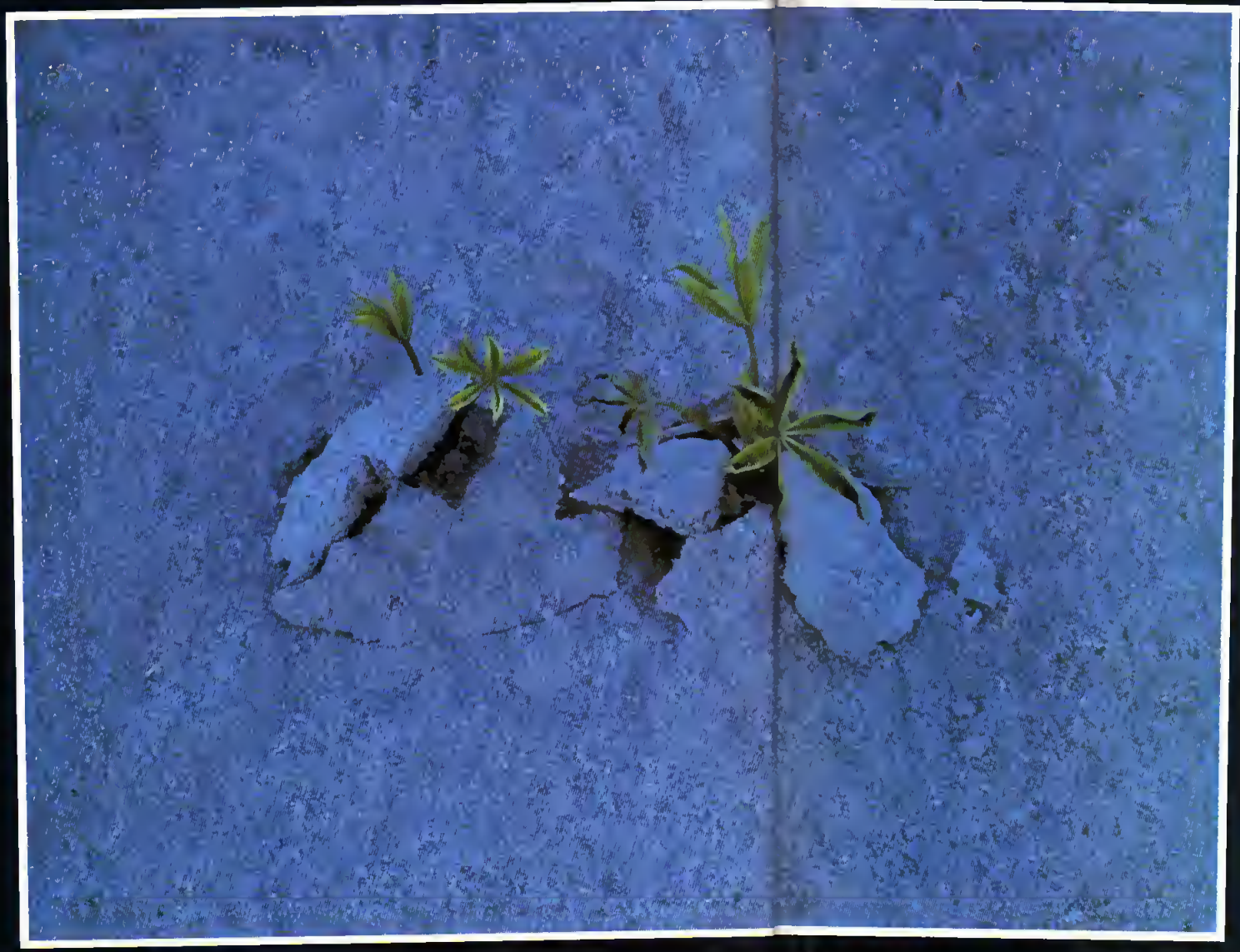
Of course matter is not spread evenly around the universe. If it were, we wouldn't be here. Instead it is concentrated into stars (mere planets are beneath our concern here). Stars are arranged in galaxies of various sizes. Galaxies may be gathered together in clusters, and there is even some evidence of superclusters, that is, clusters of galaxies. (We cannot yet see far enough to find out whether there are any superduperclusters.) In between the galaxies, clusters, and superclusters are large voids, similar to, but much smaller than, the giant one recently discovered, 300 million light-years away.

If you took all this matter from the galaxies, clusters, and superclusters and spread it evenly throughout the universe, then measured it, you would get the average density of the universe, a very, very small number, only 10^{-30} grams per cubic centimeter. This may seem like a useless figure, but it is a crucial, indeed the sole, determinant of the fate of the universe. If it is too low, matter is extremely diffuse and the universe, unchecked by the gravitational pull of its galaxies, will continue to expand forever. If it is higher than a certain value, gravity will slow, stop, and finally reverse the present expansion, perhaps eventually bringing about the exact opposite of the big bang, what some have called the Big Crunch.

So far no drastic changes are expected. For one thing, based on what we've been able to measure of the average density of the universe, it is not possible for the universe to have many more of these voids and still retain the concentration of matter it now has. For another, it is still possible that this region may not be entirely empty. Clouds of hot gases, as well as voids, can exist between galaxies and possibly between clusters of galaxies. This giant hole may contain some unconsolidated clouds of gas, or even small galaxies whose luminosity is so low they are too faint to discern.

Future observations in which astronomers try out their search at fainter limits and try to measure this hole with greater accuracy might answer some of the questions raised by this discovery, for the moment its chief significance is that it indicates that voids on the scale of hundreds of millions of light-years, as well as hundreds of thousands of light-years, can exist. For all its immensity, this void can be accommodated within our present theories and assumptions about the universe. In the words of its discoverers, it is "large enough to be interesting, but not so large as to undermine confidence in the cosmological principle."

Beyond star clusters like these, astronomers found the biggest hole in space ever seen



PHENOMENA

Shoots of a green lupine plant push through six inches of volcanic ash and signal the rebirth of nature around Mount St. Helens. Five months after the first major eruption and ashfall on May 18, 1980, photographer Gary Braasch explored the devastated terrain to catalog new generations of posteruption plants. "The stress, beauty, and violence of an exploding volcano," Braasch says, "is countered by the gentle persistence of life." He found this plant on the south slope of the mountain, in the "Red Zone," a restricted danger area closed off for safety and geological research. On special assignment for Red Zone scientists, Braasch photographed the tenacious plant with a Nikon FE and a 55mm lens. He captured this symbol of survival on Kodachrome 64 film.

The Equations Test
and 11 new reader games

GAMES

By Scot Morris

Every couple years a new bit of xerographic folklore makes the rounds Sometimes it's a comic petition sometimes a chain letter or a set of mock rules and regulations This year it's the Equations Test Readers in New Jersey Minnesota, Colorado, and California have all sent us copies of the test, each version slightly different but always with the same 24 standard' items As usual, no one claims to know the originator—everyone seems to have gotten a photocopy from someone who got it from someone else who etc The pattern is familiar (For a sociological study of past examples see *Urban Folklore from the Paperwork Empire*, by Alan Dundes and Carl R Pagter [American Folklore Society])

We have added several new items to the list, including some suggested by readers Robert Lax, Tom MacDonald and John Kirkland, and have arranged them in ascending order Few solve more than half the items on the first try, but most report that after they put the test aside answers come at unexpected moments especially when their minds are relaxed

THE EQUATIONS TEST

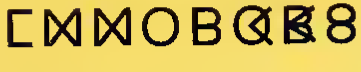
INSTRUCTIONS Each equation below contains the initials of words that will make it correct Find the missing words For example 26 = L of the A would be 26 = Letters of the Alphabet

1 = W on a U _____
>1 = W to S a C _____
3 = "B M (S H T R)" _____
4 = T Z in the C U S _____
5 = D in a Z C _____
6 = F on a D _____
7 = W of the A W _____
8 = T on an O _____
9 = P in the S S _____
9 = J on the S C _____
10 = D in a P N (I the A C) _____
11 = P on a F T _____
12 = S of the Z _____
12 = P on a J _____
13 = S on the A F _____
14 = L in a S _____
14 = D in a F _____
16 = O in a P _____
18 = H on a G C _____
20 = C in a P _____
24 = H in a D _____
24 = "B B in a P" _____
29 = D in F in L Y _____
32 = T in a H M _____
40 = D and N of the G F _____
50 = W to L Y L ' _____
54 = C in a D (with the J) _____
57 = H V _____
64 = S on a C _____
76 = T in the B P ' _____
88 = P K _____
90 = D in a R A _____
200 = D for P G in M _____
300 = a P G in B _____
1,000 = W that a P is W _____
1,001 = A N _____

READER ORIGINALS

It has been some months since we last printed a puzzle sent in by a reader This month we present 11 of the best ideas readers have shared with us Each of these correspondents will receive a one-year subscription to *Omni* or a one-year extension on a current subscription

1 PATTERN Dan Barker of Ontario California sent the following designs What he asks is the next figure in the series?



2 FIND THE KEY The following code came in from Ellen Sueda, of Honolulu Hawaii Please decipher it %y3 178dl g492h r9s 548003e 9f34 5y3 oqa6 e9t 5y3 e9t q53 y6j

3 TWO-SIDED PROBLEM Alida Griffith of Baton Rouge Louisiana, posed a problem in two parts

First, what do the following words have in common *fez aster, grate cards tread*

On the other hand, she asks what characteristic is shared by these words *you, punk, phylum, killjoy milk*

4 MATCHBOXES R McCauley of Louisville, Kentucky, drew the matched boxes as shown,

and asked "By moving three of the lines, can you change the ten straight lines into five? Lines cannot touch or be joined end to end to form a long straight line from two or more short lines " It may help to set up the problems with matches on a tabletop

5 REMATCH Use six of the matches from the previous problem to make the arrangement shown here Now, either moving one match or taking away three

can produce the same result How? (From Howard Chaput, Broken Arrow Oklahoma)

6 ORDER Tom Meekins of Virginia Beach, Virginia, sets up the following sequence and asks you to explain their relationship (think calculators)

—, 1, 7 4, (2 3, 5), (0, 6, 9), 8

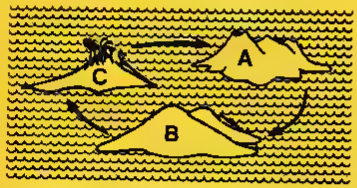
7 TAKE FIVE Mel Stover of Winnipeg, Manitoba, recalls a series of puzzles of the form *Take five x and make a perfect cube* "Some of the ideas got pretty gruesome," he writes (Example sleeping pills Answer Swallow them This makes one die A die is a perfect cube) Here are three that are slightly less farfetched You are asked to form a cube with (a) five coins, (b) five paper matches (c) five cigars

8 DATING GAME From Don Monson, of North Vancouver British Columbia what is the next date in this series
April 20, 1980

May 16, 1980
August 10, 1980
October 8, 1980
March 27, 1981
September 9, 1981

9. THE QUICK AND THE DEAD. Dr. Verne R. Costich, of Mountain View, California, asks you to discern the significance of the following series of words: *fast, beauty, home, war, king, feast, sky, ocean, dead.*

10. THE THREE ISLANDS. L. A. Dillard, of Temple, Texas, poses this strange problem with a biological twist. Astronauts were to place a small group of many kinds of animals on a certain planet, so that on a later date when the planet is settled by people from Earth, a useful population of these animals would be available. In one area of the planet were three rather large islands, A, B, and C. A single type of Earth animal was placed on each island, animal A on island A, animal B on island B, and animal C on island C.



Because of a swift, whirlpoollike current in the area, the animals could swim from one island to another, but only in the direction shown. The swim in the fast current was such a frightening experience that no animal ever made a second trip, and none of its descendants ever entered the water.

About 100 years later, agents were sent to check out the animal populations on the planet and found some puzzling things. On island A there were no animal A's at all. There were a fair number of animal C's—which makes sense since these animals could have migrated from island C, then reproduced.

On island B was a large group of animal B's. No other animal was found on this island.

It was island C that astounded the census takers. Here they found herds of C's and B's, but also a fair population of A's, which could not have migrated from Island A because of the current. What's more, they even found a few D's walking around, even though no D's had been brought to the entire planet.

The puzzle is, what were the animals A, B, C, and D? (Hint: The original astronauts had grown up in New York, Chicago, and Boston.)

11. ELEMENTARY. Michael Stueben, of Annandale, Virginia, sent us the following detective story. Stueben does the puzzle column in the Washington, D.C., area Mensa newsletter, *Capital M*.

"Mr. Smith? This is detective Conrad Sleuth," said the voice on the telephone. "I have some bad news. Your brother-in-law has been murdered."

"Poor Lance!" said Smith. "My wife will be horrified."

Later that evening, Mr. and Mrs. Smith sat in their apartment with Sleuth.

"I think the killer knew Lance well," Sleuth said. "Who do you think would kill him?"

"There's my sister Sonya's husband, Rufus," said Mr. Smith. "He's really weird. He's been in several fights this year and recently threatened Lance. But he's been out of the country since yesterday."

"There's my other brother, Edwin," said Mrs. Smith. "But he and Lance were quite good friends."

Uncle Lew once told me he was afraid Lance would kill him and take his money," Smith said. "He might have murdered Lance. Or maybe cousin Phil. He owed Lance quite a bit of money in gambling debts, and I once heard him tell Lance that he would lose no time in paying off the debt."

"What did he mean by that?" Sleuth asked.

"I don't know," said Smith, "but Phil is a very tricky man."

"Mr. Smith," Sleuth said, "I think you murdered Lance. You're under arrest."

How did Conrad Sleuth deduce the murderer's identity?

HINTS: (1) Questions 2 and 3 are related. (2) Question 6 is related to questions 4 and 5. (3) Question 9: first and last. (4) Don't forget: this is the April issue.

Answers to the Equations Test next month. Other answers: Page 132.

COMPETITION #24: A & Q

Here are the answers:
1. Dr. Livingstone, I presume.
2. Strontium 90, Carbon 14.
3. Jacks or better.
4. I don't know, I've never kippled.
5. A buccaneer.
6. Electron, neutron, quark.
7. Go west.
8. A Greek letter.
9. The SALT talks.

And with acknowledgments to Steve Allen ("The Question Man"), Johnny Carson ("Carnac"), and Art Flemming (*Jeopardy*), here are the questions: (1) What is Dr. Presume's full name? (2) What was the final score of the Strontium-Carbon game? (3) What does it take to open a New York City bus window? (4) Do you like Kipling? (5) What is too high a price to pay for corn? (6) Name two subatomic particles, and then imitate a duck. (7) What do wabbits do when they get tiwed of wunning awound? (8) What's nu? (9) What happens when you have dinner with a ventriloquist?

You get the idea. First the answer, then the question. Send us postcards only, please, with one A & Q per card. All entries become the property of *Omni* and will not be returned. The grand prize winner will receive $100; runners-up (2–10) will each receive $25. Send entries, postmarked by May 15, 1982, to Omni Competition #24, 909 Third Avenue, New York, NY 10022. Entries from outside the United States are routinely given an extra two weeks' grace.

Next month we hope, the results of Competition #21, "Small Steps." ∞

LAST WORD

By Paul Nahin

"Today we can begin realizing the ancient dream of the Universal Library. Better yet, we can do something more impressive put together the Universal Photo Album"

Just about everyone who learns to read eventually comes across the story of the monkeys and the typewriters. The idea is elegantly simple. Merely put a bunch of monkeys in front of an equal number of typewriters (and a *lot* of paper) and let them bang away on the keys. They'll produce mostly gibberish, of course, but the immutable laws of probability predict they will also reproduce verbatim *everything* that has ever been written. Like this issue of *Omni*, this essay included.

And they'll produce everything else that will and even could be written. All the books of the future will be included in the monkeys' output: masterpieces of science fiction, fascinating volumes of history describing and analyzing events yet to occur and a lot that won't, and treatises on marvelous scientific breakthroughs.

This cosmic collection of written words is called the Universal Library, a term coined by Kurd Lasswitz, a German philosopher and mathematics professor. According to Willy Ley, the original concept of such a collection can be traced back to the medieval Spanish philosopher and mystic Ramon Lully.

Whatever you want to call it, this incredible storehouse of knowledge would lead to tantalizing revelations. If a time machine could ever be built, somewhere in the megatons of paper spewing from the typewriters will be contained the directions on how to put one together. So would the recipe for a faster-than-light spaceship drive, a cure for cancer, and the secret of longevity.

But the rub, of course, is that there would be a multitudinous quantity of chaff with the wheat. How could we search through this literary equivalent of the Augean stables to find such gems? Until now, we couldn't, and the idea has remained just a vague speculation, good for a quick chuckle, but soon discarded, so we can attend to more practical and more pressing matters.

No more. Using high-speed digital computers, coupled with the latest innovations in high-resolution imaging, instant developing, and reusable microfilm, we could begin right now realizing the ancient dream of the Universal Library. Better yet, we can do something more impressive: put together the Universal Photo Album (TUPA).

To understand TUPA, it is necessary to grasp just a few elementary concepts. First, any black-and-white photograph is nothing more than a composite of small flecks of brightness levels varying from black through various shades of gray to white. Second, a computer can easily be programmed to generate sets of flecks in a fine-mesh grid. The programmer can also instruct the fleck-generating machine never to repeat itself. The computer would toil, like a team of monkeys, to produce all possible combinations and permutations of brightness levels. Instead of generating a mountain of typed gibberish, it would create a mountain of visual gibberish: countless random images flying out from this tireless image factory.

Then, to examine the enormous number of images, we could take advantage of recent advances in machine vision, artificial intelligence, and work in pattern recognition. Special computers would be used to process the first batch of photos, rejecting the ones that are clearly nonsensical and referring the interesting ones to humans for interpretation. (Since this would require just about every piece of film ever made, we could save on film costs by recycling the rejected photos and using the film over again.)

What would we get from all of this? Simply all possible black-and-white photographs: all that have ever been taken, all now being taken, and all that could ever be taken. We get TUPA.

What a treasure it would be! In TUPA would be included pictures of every human who has ever lived—Moses, Jesus, Henry VIII, you, me—as well as every human who will ever live. There will be images of every creature in the universe, some of them more incredible than we could imagine. You'll see in TUPA all the vacation photos you will ever take, including the ones where you left the lens cap on. It is clear that purveyors of pornography, for example, will be galvanized by the discovery of such a hoard of titillating photos in TUPA. Best of all, the Universal Library will be there as well, because TUPA will have a picture of every page in every book ever published.

This entire project could be started immediately with a front-end capitalization of $20 million—give or take a few million—for computers, laser equipment, computer-program development, and film-chemistry engineering. We would also need a sustaining budget of $3 million for computer time, film, and salaries for the photo interpreters. This level of funding is trivial compared to the Defense Department's and is well worth the investment if you consider the potential payoff militarily. TUPA would include pictures of every top-secret Soviet military document, present and future.

Project TUPA could be our next great endeavor, rivaling the Apollo and Manhattan projects. But we must act now, because, as the Russians will soon realize, if they haven't already, TUPA contains photos of every top-secret American military document, too. ∞

Paul Nahin is a visiting professor in electrical engineering at the Naval Post Graduate School in Monterey, California, and a professor of computer engineering and electrical engineering at the University of New Hampshire.