THE MIND MACHINE: IMMINENT MARRIAGE OF BRAIN AND COMPUTER
GERARD K. O'NEILL: EXCLUSIVE INTERVIEW
INTERFERON: MIRACLE CURE AT $22 BILLION PER POUND
THE ONCE AND FUTURE MOON
SUPERCYCLES: PEDALING INTO THE FUTURE
Cover art for this month's Omni is an untitled painting by the French artist Pierre Lacombe. Lacombe, who wanted to paint since age fifteen, began only ten years ago at age thirty. He now lives outside Paris.
The accident at Three Mile Island has added new fuel to the controversy over nuclear power. radioactive fuel. I would like to suggest that a couple of key issues in this controversy could be resolved by applying technology and ideas from the space program.

What do rockets and astronauts have to do with uranium reactors and radioactive wastes? Let me explain.

Back in the 1950s, when Vanguard rockets blew up on the launchpad and Soviet missiles made wrong turns in flight, sober mathematical analyses indicated that rockets might never work right. These studies showed that there were so many interdependent mechanisms in large rocket boosters which allowed so many possibilities of failure, that—statistically—the chances were against any rocket's ever getting off the ground.

Rockets did fly, though, thanks to the painstaking care of excellent trained technicians, who beat the statistics by double- and triple-checking every mechanism involved in each flight.

Because the lives of astronauts depended on making everything work right the first time, by the time NASA was ready to send up manned space vehicles, space engineers and administrators came up with the concept of "zero defects."

Almost all manufacturing programs, from those that produce doorknobs to those that make airplanes, are based on the idea that a certain number of defective parts will get through the system, and that being an economically and morally acceptable failure rate. For example, you can take a defective doorknob back to the hardware store, airlines test-fly their new planes before putting them into service, and Detroit calls back with degrading regularity, its new cars for corrections.

But NASA realized that it could neither test-fly a manned rocket booster and spacecraft, since each is used only once, nor call back a spacecraft for defects that were discovered during its flight.

Hence, the concept of zero defects. NASA's goal was to achieve zero defects in every manufactured item it used. Zero defective in workmanship, parts, labor—everything. And zero defects in the performance of its personnel as well. Do it right the first time, because there won't be any second chance.

It took years of training, all up and down the line, from the smallest subparts manufacturers to the guys who worked the control desks at Houston. No one ever pretended that the program actually achieved zero defects. But it got close enough to win us the moon.

Could we use this zero-defects concept in the building and operation of nuclear-power plants? Could we utilize NASA-trained managers to instruct the men and women who operate those power plants? Certainly it would be expensive. But compare the way the technicians in the Three Mile Island plant behaved in the emergency with the way NASA's team behaved during the explosion that damaged Apollo 13 while it was on its way to the moon.

Is the difference in competency worth the cost?

A longer-range question about nuclear safety is the problem of where to store the radioactive wastes. Some of the wastes will be dangerously radioactive for centuries but for millennia.

The answer, of course, is to fly them off this planet and store them in the depths of space.

Even veteran space engineers blanch at the thought of boosting radioactive wastes aboard the space shuttle or its descendants. But the experts are always too close to their problems to see new opportunities. Experts rejected mesopits, airplanes, submarines, wireless radio, radar rockets—even the atomic bomb.

By early next century people will chuckle when they recall the fears their parents had about storing radioactive wastes. The "hot stuff" will be routinely boosted far beyond the orbit of the moon, or farther, if need be.

Nuclear power plants are dangerous. Not so dangerous, perhaps as liquefied natural gas which explodes rather often, or as coal, which kills miners and poisons the air in which it burns, but dangerous enough for us to be careful about them.

Do we need nuclear-power plants? If so, in the face of steeply climbing oil and natural-gas prices. Yes, in the realization that solar, wind, water, and other "soft" energy technologies will not be available for large-scale use for at least another decade, yes.

Should we fear nuclear power plants? Yes, of course, just as we fear fire and poisonous chemicals. But the choice we have is not whether we use with plutonium or ban nuclear energy altogether. If we use our brains and skills, the hard-won knowledge of the space program we can use nuclear energy safely and wisely—until we have the opportunity to go on to something better.
F or over four billion years the moon lay quiet and still—but our understanding of it has changed dramatically since the landing of Apollo 11, ten short years ago. Twelve American astronauts have since walked the lunar surface and more than 200 rock and soil samples have been collected from six different sites. Mostly because of Apollo 11, lunar bases, orbital habitats and zero-g industries no longer seem like impossible dreams.

This month Omni celebrates the Apollo landing with a detailed analysis of man's lunar exploration by NASA scientist Bevan M. French. As discipline scientist for planetary materials, Dr. French is responsible for the care and feeding of real visitors from outer space—the moon rocks, meteorites, and cosmic dust that provide us with the only cold evidence of what the rest of the solar system is like.

Beginning in 1969, French was assigned to study lunar rocks from the Apollo 11, 12, and 14 missions. He was also selected as one of a small group of scientists to study material returned by the Russian Luna 16 unmanned probe, and in 1971 and 1972 he underwent astronaut training with the Apollo 16 and 17 crews.

An "enthusiastic communicator" of space science, French is the author of The Moon Book (Penguin, 1977) and several well-known magazine articles. Turn to "The Once and Future Moon" for a closer look at some of his "pet rocks" and what they tell us (page 44).

"We are closer to building the ultimate computer than most people recognize," writes science author G. Harry Stine. "All that remains is to take these laboratory demonstrations and put them together in the first working 'bionic brain.'"

In this issue Stine probes another side of cybernetics—direct linkage of the human brain to an electronic computer. The result? A device capable of increasing human learning potential several hundred percent.

The question is: Will the computer's crystalline system engulf the much slower human colloidal system? Read "The Bionic Brain" (page 84) and find out for yourself.

While investigating the antiviral effectiveness of the intercellular substance known as interferon, scientists stumbled onto the surprising discovery that this natural chemical greatly inhibits the growth of certain malignant tumors. Late last year the American Cancer Society announced the largest grant in its history—$2 million—for the purchase of interferon to be used in clinical trials against various types of cancer.

"Interferon and Beyond" (page 54) by editor Douglas Gasner profiles the research being conducted on this remarkable substance and explains why it has suddenly been huddled into the forefront of cancer therapy. A graduate of Albert Einstein College of Medicine, Gasner has published articles in New Times, World Saturday Review, Science Digest, Family Health, and Medical Dimensions, among others.

Car lovers will tell you the bicycle is too slow and when it rains you get wet. Well, that's simply no longer true. In "Supercycles" (page 96) engineer Chester Kyle introduces the bikes of tomorrow—fast, streamlined and self-enclosed. "Not only will it keep the rain out," says Kyle, "but it will help generate speeds of up to 55 mph."

Kyle has designed and built streamlined bicycles that formerly were the fastest and he still holds two world records. Says the engineering professor, "It's the most efficient vehicle ever invented."

In his book The High Frontier, Gerard K. O'Neill contends that the unlimited energy produced from solar cells and the vast materials mined on the moon and asteroids will make possible a new and attractive life for thousands, perhaps millions of people. But unlike earlier proposals, O'Neill's space habitats would be huge, open environments with cloud-filled skies basking in reflected sunlight.

This month Omni interviewer Monte Davis talks with the Princeton professor whose ideas on space colonization have started a nationwide craze. The July interview starts on page 76.

Finally don't miss Planet Story by Harry Harrison and Jim Burns. Flashy pictorial novels such as this are swiftly making their way to bookstore shelves. The reader reaction according to two prominent publishers—overwhelming See page 88.
Who took The Crown Jewel of England?  
Solve the mystery—you could win $25,000!

The sleuth who finds the truth may win a $25,000 first prize, $5,000 second prize, or one of five $1,000 runner-up prizes.

The scene is the drawing room of a 17th century manor house in the heart of the Kent countryside. About to be taken is the Contessa as whispering to the Squire. The man in the heavy boots sits holding his favorite drink—a Beefeater Gin and Tonic. The person seated opposite the Brigadier is enjoying a Beefeater Gimlet. The Butler enters with a Beefeater Gibson for the person seated to the right of Lady Trumbull. The Brigadier murmurs to himself to buy a bottle of Beefeater Gin. The Crown Jewel of England—on the way home. Suddenly, the lights go out.

Who took The Crown Jewel of England?


2. IMPORTANT: In order to be eligible for a prize you must hand print on the lower left hand corner of your mailing envelope who you think took The Crown Jewel of England.

3. Entries must be received by August 31, 1979. Entries as often as you wish but each entry must be mailed separately. 4. Winners will be determined in a random drawing from among all correct entries received. If fewer than seven (7) correct entries are received random drawings will be held from among all entries received to award prizes. No substitutions will be made for any prize. Final decisions are at the discretion of the D.L. Blatt Corporation, an independent judging organization whose decisions are final. The sweepstakes is open to residents of the United States of legal drinking age in their state of residence, at time of entry. Employees of D.L. Blatt Corporation and all related businesses, advertising and promotion agencies are not eligible. Those who have won in the Ohio and Utah sweepstakes are not eligible. This sweepstakes is void in Ohio and Utah and wherever prohibited by law. Limit one prize per household. No substitution of prizes is permitted. All Federal, State and local laws and regulations apply. For a list of prize winners send a SEPARATE self-addressed stamped envelope to Beefeater Gin "The Crown Jewel of England" Sweepstakes PO Box 6279 Blair Nebraska 68009. All entries must be in an Official Entry Coupons. For each additional coupon you wish to send a SEPARATE self addressed stamped envelope to Beefeater Gin "The Crown Jewel of England" Sweepstakes PO Box 6279 Blair Nebraska 68009. You request must be received by July 31, 1979.

Clip out this coupon and tell us who you think took The Crown Jewel of England. Write your answer below and also on the lower left hand corner of your mailing envelope. Please hand print (NO PURCHASE REQUIRED). Mail to: Beefeater Gin "The Crown Jewel of England" Sweepstakes PO Box 9241 Blair, Nebraska 68009

Who took The Crown Jewel of England?

Name
Address
City State Zip

For the Record

It was my pleasure to place the article "Some of Us May Never Die" from the first edition of Omni, in the Congressional Record.

I find your magazine thought-provoking and fascinating. The article on biomedical research was well researched and timely with a study being conducted by the House's Human Services Subcommittee. Best wishes for the continued success of the magazine.

Rep. John Paul Hammerschmidt
Washington, D.C.

Sedled Yawn

John A. Wheeler's continued bias (Continuum, April 1979) against the inclusion of parapsychology within the American Association for the Advancement of Science is much the same noise we heard not very many years ago, from medical stalwarts against the recognition of psychology as a health science.

Obviously, the evidential science of parapsychology could not be expected to repose comfortably in the same bed with such physical-science representatives as Wheeler. Such protests as he should not surprise anyone beyond a partially stirred yawn.

Gerry T. Erbacher
Fairfield, Calif.

More Zen

Omni is playing a key role in communicating the interlocking order that usually "falls between the cracks" in scientific journalism. Not only are our authors provocative but their work is supported by the finest graphics on the newsstand. How can you accomplish this for $2 per copy is wondrous — indeed, a sign of good management.

One word of caution, though — your impressive first issue contained a magnificent piece by Thomas Hoover on Zen. Omni's amount of attention paid to the relationship between science and spirit has been in a state of decline ever since. Don't let this trend continue, else Omni shall eclipse as part of the leading edge of scientific creative thought. There are hidden relationships here that must not be overlooked.

At last, someone got it right!—Ed

We do indeed, though many readers apparently missed the subtlety of Mr. Priest's "fractional humor."—Ed

Concerning Christopher Priest's article on static gravity. April fool to you, too! It was a very clever trick, and I must say I really fell for it until I read that a running man actually travels faster than a walking man and that both travel faster than one who is standing still.

What a profound statement! Of course, the real clincher was Mark Chartrand's article on cranks in the same issue.

For a minute there you guys really had me worried. All this talk of gravitational polarity I thought Omni had made a real blander when all the time you were only kidding. Beautiful!

Norman Douglas Moede
Wattstown, Conn.
Home Delivery
I would like to congratulate Gena Corea on her outspoken article "Childbirth 2000" (April 1979).

It is indeed a chilling portrayal of the frightening future faced by expectant mothers, and it makes one wonder just how far professional groups will go to protect their pocketbooks.

While I applaud the tremendous strides made by medicine since the advent of space exploration, it now seems that we have forgotten how to practice moderation and restraint. "Technological know-how is not matched by a corresponding awareness of moral responsibility and the medical situations described in the article are ample proof of a total disregard for the wishes of the patient in every respect.

The question of legal action against midwives in cases of child deaths raises some interesting points. What about similar actions against doctors whose patients die while under their care? It seems always to boil down to the same thing. Doctors are protected by the time-honored assignment of their profession. We must fight this now because our children are the ones who will be affected by this abhorrent medical practice.

Thank you for Gena Corea's article "Childbirth 2000."

As a concerned mother who just recently had my first at home, I feel the facts you reported were long overdue in the media.

I, too, had difficulty finding a doctor to support our home birth without interference. My husband and I finally found one, and all the doctors had to do was sit in a corner and observe my husband receive our perfectly healthy boy.

What a glorious way to enter the arches of motherhood, surrounded by friends and family!

There are still M.D.s at the doorstep trying to convince me I was, and am wrong in my attitude about birth and mothering.

I shall not cease to provide whatever support I can for other families to share in the joy and free choice of home birth.

My congratulations to Omni for bravery in publishing the "facts" out there.

Ma Deva Lola
Los Angeles, Calif

Gena Corea conjures up an impassioned 1984ish view of childbirth in the year 2000 that is truly science fiction and not realistic. Present-day physicians are painted as greedy and uncaring individuals, more concerned with their scalpsels than with patient care, using dangerous procedures haphazardly and destined to enforce their will through police intervention if necessary, on the poor "pathologically ill pregnant women."

Although some of Corea's concerns are legitimate, they're blown out of proportion and frightening to the unknowing. It's clear that technology has lowered infant and maternal mortality—dramatically—and it is my belief and experience that most physicians proceed with good intentions.

Women with uncomplicated pregnancies are being discharged sooner, hospitals are allowing fathers to participate more and more, birthing rooms are on the rise, and midwives are being given full responsibility at deliveries in hospitals.

The problem, as I see it, is: How much must a normal pregnancy endure so that an abnormal pregnancy can be detected and be treated? Toxemia in pregnancy can be fatal to both mother and child; diabetes untreated can be the same; gonorrhea in the birth canal can blind the newborn, herpes in the canal can cause fetal meningitis (and herpes can be present and not detected); a premature rupture of the amniotic sac can lead to life-threatening infections; abnormal positioning of the placenta can cause severe hemorrhaging; a cord wrapped around an infant's neck can strangle it.

At home you take your chances. Many complications can be prevented. Should one fall into that unfortunate 5-10 percentile group of complications, one has only oneself to blame.

Geoffrey Simmons, M.D.
Eugene, Ore.

Due Respect
Thank you for Ben Bova's Last Word in your April edition.

At long last a professional has spoken out on my pet peeve, the careless reference to science fiction as—oh, most horrible of horrors—the term that makes me want to scream "aghghhhhh—so-fi-".

Thank you, Mr. Bova, not only for the request for due respect when referring to our most treasured literature, but also for a most thoughtful article. It should have been the First Word!

I also want to add my sincerest praise of Omni. It is undoubtedly the best magazine to hit the stands in a long time. You deserve nothing but laurels.

Linda Dell
Brookline, Mass
From Arthur, with Love
Dear Un Geller,

Thank you for your letter of March 14. I'm sorry I have hurt your feelings, though I take your protestations with a grain of salt. As a matter of fact, I don't rule out the possibility of real ESP phenomena, even if you may be able to exhibit them. However, in science you have to accept ample explanations until overwhelming evidence to the contrary compels you to seek an alternative.

I haven't obtained my opinion entirely from Randi or Martin Gardner, but from other sources as well. Perhaps the most devastating is the Puharich book — I suspect you must now ruefully agree.

I've gone on record as saying that there is a genuine Geller Effect — viz., one's ability to charm otherwise hardheaded scientists and observers (including me) into temporary suspensions of disbelief.

I expect you know my novel, *Childhood's End* which does assume the existence of ESP phenomena. It is just going into production in Hollywood, and maybe we should hire you as our adviser.

If you ever come here — everybody does eventually — I would like to introduce you to the excellent local magicians. I have seen them do tricks whose explanation I can't begin to fathom. I gather you have been having an interesting time in Latin America.

All good wishes,

Arthur C. Clarke
Colombo, Sri Lanka

Denying UFOlogy

Omni thus far has failed to pinpoint the event in recent history that explains the current enthusiasm for the UFO phenomenon.

On June 24, 1947, Kenneth Arnold flying in his private airplane saw a group of UFOs over Mount Rainier in Washington. This event more than any other sparked the beginning of the UFO movement in the United States. Out of this incident evolved a need for a better understanding of the phenomenon and its implications for the future. As a result, various research organizations were founded — as early as 1952.

The express purpose of these groups is to find out the origin and purpose of UFOs and to attempt to validate their existence. Of equal importance to these organizations is their opposition to any governmental censorship. They also seek to alleviate the release of any classified information held by both the federal government and the military regarding the study of UFOs.

By the addition of new scientists to their ranks, the various UFO organizations hope to gain some authority and integrity necessary to maintain their power base. An intense sense of competition exists among the various individual groups. They vie with one another for prominence in the movement through the use of the media.

Plant Poison

Isn't stretching it a bit to claim that plants are a major causative factor in the smog levels recorded today? [See *Plant Pollution*, Continuum March 1979] I wonder how it is that preindustrial Earth could possibly have survived, surrounded, as it were, by unbroken fields and forests. Perhaps the all-pervasive vegetable life-forms — in realizing the deadly quality of their so-called natural functions collectively decided to curtail these dangerous processes until such time as they were assured of the good, "cover" that internal-combustion engines and chemical industries of today afford.

Only with such cover could plants remain blameless and unpunished for their devious and shameful attempts to mislead and endanger human life as it is today on this planet. Alas for them, though, for it appears that they have finally been found out.

To follow this line of reasoning, I would wholeheartedly propose that we begin immediate action to level, pave over, and plow under all vegetation on this planet, beginning of course with the particularly offensive growths that are within sight (and downward as well) of the major freeways and cities within the Bay Area Air Pollution Control District.

However, I wonder whether it is possible that the so-called dangerous emissions from these forests and fields could somehow be attributed to the pollution of the air and soil around them, which they breathe and eat just as we do. After all, we breathe out and otherwise attempt to eliminate the numerous poisons that are forcefully introduced into our bodies through the air and "soil" that we ingest. Is it too far fetched to assume that plants may attempt to do the same?

Greg Thompson
Bigfork, Mont.

Unscientific Happenings

I read Fred Kendig's commentary [First Word, April 1979] with considerable interest. After comparing his position and my own experience, I gather that we have reached an area within which the scientific method may not be operable.

What comes to mind is other shifts in the prevailing manner of deciphering any given phenomenon. For the shift to empiricism there had to be someone like René Descartes to assist in building a new construct to include information that did not fit into the world view of the medieval philosophies. It may well be that ESP may not fit into the current scientific mode. We may have to design a system that takes cognizance of "unscientific" happenings.

My own interest and training are in psychic healing. I have had experiences as healer and patient in which the healing process was speeded up. Although these experiences do not fit in with current orthodox, scientific medicine, something did happen.

George Leonard's book *The Silent Pulse* and *Stalking the Wild Pendulum* by Bantock suggest a new construct. Perhaps by viewing the universe as a hologram, we may begin to gain insights into such areas as ESP that resist conventional inquiry.

I celebrate Omni. I perceive it as an exciting adventure in imagination and creativity.

Max Gillaspoy
San Antonio, Tex.

A Third View

In the eyes of properly trained and knowledgeable practitioners working in the field of extrasensory and paranormal phenomena, the adherents of both the "pro" and "con" groups in the scientific community are guilty of blundering.

Both groups are operating as if some unproven basic assumptions were established facts.

One such assumption is that the observed phenomena cannot be produced within the framework of known physical, biological, and/or psychological laws and principles.

One result of these misassumptions is that the "con" group must deny the existence of phenomena experienced by everyone in one way or another a number of times in their lives.

Another result is that the experimental procedures of the "pro" group are so contrary to known psychophysical principles that a test subject would likely become unable to tie his shoes if shoe tying were the test focus.

Finally, of course, the results are inconclusive in view of the fact that only "spontaneous" and untrained practitioners will submit themselves to testing by the current scientific plunders.

As a basic suggestion to both "pro" and "con" groups, you could explore how the observed phenomena can occur within known scientific law and principle, instead of assuming that they cannot.

All the needed keys are available.

Rev. George Dew and
Rev. Linda Hillshafter
Wheatridge, Colo.

CONTINUED ON PAGE 12?
This month in London, the International Whaling Commission (IWC) will convene for the thirty-first time. Delegates from the various member nations will debate, once again, the fate of the planet's whales. It's sure to be interesting.

Last year at this time, IWC delegates were greeted by demonstrators. On one side were antiwhaling pickets bearing placards: "REPROVE FOR LEVIATHAN," said one; "PEACE FOR THE WHALES," said another. The placards and killer-whale suit will be dusted off and will march again. The Japanese whaling men will countermarch demonstrating their unique good humor. The bobbies assigned to police the crowd will circulate, looking amused by it all but only marginally so. Occasionally, messages will crackle over the small walkie-talkies that London's finest carry under their epaulets. The bobbies will incline their heads to listen.

A large Alaskan Eskimo contingent attends meetings of the IWC. Eskimos are the planet's oldest whales, having begun the practice four millennia ago. To the past two meetings they have brought a model of an umiak, a small vessel in which they have pursued whales from time immemorial. The skin of the model, as for the real thing, is seal skin stretched drum-tight and translucent over a skeleton of wood. The doll crew is dressed in fur parkas and each man strokes with a miniature, leaf-bladed wooden paddle. The umiak's curves are as beautiful as those of any craft ever designed by man, the lines as clean as those of any rocket or schooner. The Eskimo dolls will paddle it across piles of pro-whaling literature on a table outside the conference hall.

Unless the Bedouins—say or the Masai—are admitted to the IWC at the last moment—and this is most unlikely—the Eskimos will be the most impressive people at the conference. Eskimos are an unusual form of Homo sapiens because of the extreme latitudes in which they live. In the spot on their name tags that shows the organization to which they belong will be the word innuit. "The People." This is the Eskimos' name for themselves, a name from the days when many Eskimo tribes, in their polar isolation, believed themselves to be the only humans on Earth. There will be representatives—whaling captains, mostly—from each of the arctic villages where subsistence whaling is still alive. With rolling bowlegs gait, the whaling captains will enter the hall. Chairs will be vacant, but the captains will prefer to stand. They will watch the proceedings expressionlessly as men scanning ice floes for the distant blow of a whale. (There will be, in fact, a whale before them.) The stylized animal painted on the IWC banner above the chairman's dais, but this is not the whale they know. The IWC's whale seems to be a sperm whale. It lacks, at any rate, the distinctive dip in the rostrum that marks the bowhead that endangered species the Eskimos depend on.) Western clothes won't fit the polar gait that each captain carries about with him. Each face will squint into it.

Last year's IWC meeting nearly ended in violence. On the final day of the session a group of radical environmentalists commandeered the chairman's dais in protest. The demonstration was peaceful until the end, when one of the demonstrators—an Australian—poured blood on members of the Japanese

Minke whale is hauled aboard Japanese ship

as go the whales

by kenneth brower

the demeanor was that of uncertain joviality. There is every reason to expect the same again this month. The ritual of the annual meeting is maddeningly familiar to those who have attended several times. The placards and killer-whale suit will be dusted off and will march again. The Japanese whaling men will countermarch demonstrating their unique good humor. The bobbies assigned to police the crowd will circulate, looking amused by it all but only marginally so. Occasionally, messages will crackle over the small walkie-talkies that London's finest carry under their epaulets. The bobbies will incline their heads to listen.

A large Alaskan Eskimo contingent attends meetings of the IWC. Eskimos are the planet's oldest whales, having begun the practice four millennia ago. To the past two meetings they have brought a model of an umiak, a small vessel in which they have pursued whales from time immemorial. The skin of the model, as for the real thing, is seal skin stretched drum-tight and translucent over a skeleton of wood. The doll crew is dressed in fur parkas and each man strokes with a miniature, leaf-bladed wooden paddle. The umiak's curves are as beautiful as those of any craft ever designed by man, the lines as clean as those of any rocket or schooner. The Eskimo dolls will paddle it across piles of pro-whaling literature on a table outside the conference hall.

Unless the Bedouins—say or the Masai—are admitted to the IWC at the last moment—and this is most unlikely—the Eskimos will be the most impressive people at the conference. Eskimos are an unusual form of Homo sapiens because of the extreme latitudes in which they live. In the spot on their name tags that shows the organization to which they belong will be the word innuit. "The People." This is the Eskimos' name for themselves, a name from the days when many Eskimo tribes, in their polar isolation, believed themselves to be the only humans on Earth. There will be representatives—whaling captains, mostly—from each of the arctic villages where subsistence whaling is still alive. With rolling bowlegs gait, the whaling captains will enter the hall. Chairs will be vacant, but the captains will prefer to stand. They will watch the proceedings expressionlessly as men scanning ice floes for the distant blow of a whale. (There will be, in fact, a whale before them.) The stylized animal painted on the IWC banner above the chairman's dais, but this is not the whale they know. The IWC's whale seems to be a sperm whale. It lacks, at any rate, the distinctive dip in the rostrum that marks the bowhead that endangered species the Eskimos depend on. Western clothes won't fit the polar gait that each captain carries about with him. Each face will squint into it.

Last year's IWC meeting nearly ended in violence. On the final day of the session a group of radical environmentalists commandeered the chairman's dais in protest. The demonstration was peaceful until the end, when one of the demonstrators—an Australian—poured blood on members of the Japanese

continued on page 121
What has the moon done for you lately? Have you sailed on the tide? Perhaps you’ve been a bit loony? Did you feel lycanthropic on June 16 or will you on the ninth of this month? Did your moonlighting pay for your moonshine? Did you recite “Jack and Jill”?

All these phrases refer to the moon, our natural satellite and by far the most noticeable object in the night sky. Its changing shape and brightness have long fascinated watchers. Consequently moonlore, beliefs, and stones have greatly enriched our culture.

The moon was a natural timekeeper. An American Indian word for “moon” and our word “month,” both measures of time, attest to that. Indeed, modern linguists have found, in the prehistoric language Proto-Indo-European, a root word they write as “*mē.” No one knows for sure how it was pronounced, but from it sprang our words: moon, measure, mensuration, meter, and even meal! (A measured, appointed time of day.)

Just as the 29 1/2-day-long cycle from new moon to new moon gave us the month, the seven- or eight-day intervals from new moon to first quarter, first quarter to full moon, and so on, gave us the week. Before clocks became common, people often carried moondials, to tell the time at night as well as sundials for the day.

Consider some of the descendents of the Anglo-Saxon word mona (“moon”), with their definitions: mooning—wandering aimlessly or exhibiting infatuation; mooncalf—a fool from birth (from the supposed evil influence of the moon on unborn children); moonfaced—round-faced, moonlight—to hold a second job; by the light of the moon moonscape—a harsh, desolate region moonshine—nonsense or booze (not because illegal stills are operated at night to hide from the “revenueers” but from an older time when brandy was smuggled at night into England from France); moonstruck—crazed, moony—dreamy or absentminded.

Then there are words from the Latin root, luna: lunatic, lunette, both an architectural feature and an old name for a small telescope; loony, also spelled luny, and lunate: crescent-shaped.

Selene, the Greek name, gave us a name for an element, selenium, and a clear mineral, selenite.

The Anglo-Saxon and Latin roots show the very old beliefs in the affect of the moon on people. If the moon can affect the tides, so the argument goes, surely it can affect people and change their nature. This is a great oversimplification. For the tides reflect more than just a pulling by the moon. They are caused by the variation in the pull of the moon on distant parts of the earth. Certainly the difference between the pull of the moon on your head and that on your feet is very slight.

And yet there are behavioral correlations between people and the moon. The female menstrual cycle is probably the most obvious. Police departments often tell you that crime rates are higher at times of full moon. Some psychiatrists suspect that more people behave abnormally during the new and the full moon. As far as I know, no one has yet done a good statistical survey to document these affects.

One old belief held that moonlight could harm an unborn child. Even to sleep in the light of the moon was thought to cause lunacy. The most dramatic purported lunar effect is lycanthropy, in which people turn into wolflike creatures (from lycos, “wolf,” and anthropos, “man”). As every horror-film watcher knows, a silver bullet can kill a werewolf. Silver has long been sacred to the moon for its similar luster, just as gold has been sacred to the sun.

We should not forget the phrase “once in a blue moon.” It turns out that with just enough impurities in the air to scatter light properly, the moon (and the sun) really can appear blue. So the phrase, taken to mean “rarely,” has a basis in fact.

More often than once in a blue moon farmers used to consult their elmanaces to find out when to plant when to harvest, and when to do other farm chores. Some

*Spooning in the Moon* portrays nineteenth century lovers enjoying one favorite aspect of lunar lore.
Questions about learning to fly? Get Cessna’s “Answer Book” absolutely free.

You're curious about what it's like to really fly a plane. And, you'd like to know the details about earning your pilot's license. Now, at Cessna, we want to take the mystery out of becoming a pilot. That's why we're making "The Answer Book" available for a limited time absolutely free!

"Cessna's dollars and sense factbook about learning to fly.
"The Answer Book" contains:
How long does it take to obtain your license?
Straight talk about costs.
How to use your license for business and pleasure.
Where to go to get started.
And more, much more.

But that's not all.
Along with "The Answer Book," Cessna will send you a certificate good for a Cessna Discovery Flight for only $10.

We're not just offering you a ride in a Cessna. We're offering you a chance to actually fly our 152. After a unique audio-visual demonstration, you take the controls, guided through basic flight maneuvers by an instructor. And after your discovery flight, you'll get more answers about the Cessna Pilot Course and why more people earn their "wings" at Cessna Pilot Centers.

But first things first. Call our toll-free number* for the Cessna Pilot Center nearest you. Or complete the coupon below and send it to Cessna. Either way, we'll send you a free copy of "The Answer Book."

The sky is waiting for you. What on earth are you waiting for?

*For the name and location of your nearest participating Cessna Pilot Center "TakeOff" flight school in the U.S. (except Alaska and Hawaii), call toll-free 800-447-4700. In Illinois call 800-382-4400 and ask for the Cessna "TakeOff" operator! Call 24 hours a day, 7 days a week! In Canada call 604/823-8238. In Toronto call 445-6831.

Call toll-free 800/447-4700 or return this coupon.

Cessna, send me "The Answer Book" plus the name and location of the Cessna Pilot Center closest to me so I can "TakeOff."

Name
Address
City, State, Zip
Phone

Mail Coupon to Cessna, "TakeOff", Dept. GMN
P.O. Box 3600
Perris, California 92571, U.S.A.

Cessna '79
WE MEAN BUSINESS
ILL-DEFINED PARAMETERS

LIFE

By Dr. Bernard Dixon

The last few years have witnessed a subtle shift in the basic theme of medical scandal stories published on both sides of the Atlantic. In the early Seventies we were warned, day by day of health hazards associated with substances old and new. The thalidomide tragedy, for example, led quite rightly to stricter standards. But journalists were not satisfied. The most remote evidence of possible hazards was highlighted to confirm that such regulatory bodies as the Food and Drug Administration were by no means strict enough. Today those same watchdog agencies are coming under increasing criticism for being too cautious and authoritarian. As a result of their judgments, we are told, patients are sometimes denied potentially valuable drugs—which is just as calamitous as allowing them to consume toxic drugs.

The most curious example so far of this new wave of criticism is one that beset the whole purpose of medical science. Earlier this year, officials of the U.K. Department of Health and Social Security declined (in a sufficiently damning letter) requests by Dr. Ian James, of the Royal Free Hospital in London, to conduct experiments with people who had failed their driving tests because of excessive nervousness. Dr. James wanted to find out whether oxyprenolol, a member of the beta-blocker group, might possibly alleviate anxieties and thus allow otherwise competent drivers to perform to their full capabilities.

Beta blockers do exactly what the name implies. They block the beta receptors on the surface of cells, preventing adrenaline from binding at these sites—a reaction that prolongs and intensifies the effects of a stressful situation. These compounds could easily become the panaceas of the 1980s, just as tranquilizers have been the panaceas of the past decade. The difference is that the new drugs act on cells throughout the body instead of only on cells in the brain.

Dr. James is a viola player and at the end of 1977 he reported a series of tests highlighting just one potential application of beta blockers—boosting the morale of nervous musicians. The location for his experiments was London's Wigmore Hall, a venue that has seen disasters for many aspiring professional soloists. The design of the investigation was simplicity itself. Thirty-four healthy young string players (not selected for undue nervousness) performed on separate days after receiving oxyprenolol or a placebo (an inert compound). Their playing was then assessed by two experts who did not know which of the two compounds the musicians had received. The aim of the experiment was to determine the effect of what Dr. James termed "stage fright—the natural anxiety and stress of performing in public." He chose string players because he felt the adverse effects of tremor would be more noticeable in them.

As reported in The Lancet (1977, Vol. II, p. 952), the outcome was striking. Musical quality improved significantly—especially on the first occasion when the players took oxyprenolol. All aspects of their playing improved: right- and left-hand dexterity, intonation, and control of tremor. Although the overall mean improvement was only 5 percent, some subjects registered 30 percent and one registered 73 percent. As the musicians were not selected for being particularly prone to anxiety, the results suggest that some people might benefit greatly from such medication.

Earlier this year, Flum Hall reported in New Statesman (March 16, p. 354) on the positive effects of beta-blockers on a jittery violinist with a major London orchestra. His nervousness, which had been bad enough to spread to those around him, disappeared after he spent a few weeks on beta-blocker treatment. Hall, a harmonchord player, also expressed satisfaction after trying oxyprenolol herself before performing in public.

So who will dare argue that such therapy should be withheld? One reason for caution is, of course, the risk of side effects. In some instances, oxyprenolol can cause such bothersome effects as rashes, vomiting, and hallucinations. Oxyprenolol comes from the same drug family as propranolol, which was removed from the market after being found to produce an extremely serious condition, sclerosing peritonitis.

But if beta blockers, or something like them, were proved to be entirely safe, what then? Would the puritan ethic still dictate that timorous musicians must be left with tremors, twitches, and those otherwise skilled car anvers be denied a little help to get them through a fruitful period with an examiner?

That is a key question for modern pharmacology. There is much talk these days about the instant recourse to drugs to assuage social and personal problems. Such criticism of pharmacological escapism is well founded. But a modern equivalent of Aldous Huxley's soma pill is quite different—something to relieve simply and safely the occasional totally unhelpful undercurrents of the psyche, not to befuddle one's individuality. After all, the pathologically nervous closet or car driver is in a real sense behaving abnormally when under imminent scrutiny.

Beta blockers may ultimately prove not to be the answer. Assuming, however, that the perfect soma pill for restoring such people to normality were found, who would deny them medication?
PSI ON CAPITOL HILL

OFFICIAL CIRCLES

By William K. Stuckey

It is not clear whether Charlie Rose seeks the ever-growing Mind-Over-Far-Out (MOFO) vote — Governor Jerry Brown of California certainly does — or what Rose would do with it if he got it. The MOFO vote is not very conspicuous in the tidewater district of North Carolina that Rose represents as a Democratic congressman. But Charlie (that's what he puts on his letterhead) certainly has the pulpit and connections, possibly the power and definitely the inclination to produce a MOFO spectacular.

What Representative Rose would like to do is call a congressional hearing soon to confirm publicly that the CIA and the Pentagon have successfully demonstrated that certain psi powers are real and can be used for intelligence purposes and that the Soviet Union is probably ahead of the United States.

Rose is the chairman of the evaluation subcommittee of the House Permanent Committee on Intelligence and, as such, is a principal watchdog of spook affairs. In that capacity he has recently witnessed several classified demonstrations of "remote viewing" by Stanford Research Institute (SRI) and intelligence personnel — in which the experimental subjects viewed persons and places thousands of kilometers away in certain "interesting" countries.

"All I can say is that if the results were faked, our security system doesn't work," Rose told me cryptically. "What these persons saw was confirmed by aerial photography. There's no way it could have been faked.

As for the Soviet Union's undertakings in this area, Rose disclosed, "I've been told by the CIA that the Russians are very interested in psychic phenomena and that their whole effort is underground. They have a national screening program to detect mathematical, artistic, or psychic abilities in children. The CIA on the other hand spends next to nothing in this area, except to find out what the Russians are doing."

The witnesses Rose would call include CIA officials who Rose said, "know this remote-viewing stuff works but who have been blocked by publicity-shy superiors."

Another key witness might be Dr. Robert Jahn, dean of engineering and applied science at Princeton University who with graduate student Carol Curry is developing an instrument to detect small-scale psychokinetic effects — not of the theatrical Geller spoon-bending type, but a more modest effort to determine whether a subject might "will" a grain of sand to move.

Dickard Mobbers will also recognize the names of other potential witnesses: such as Edgar Mitchell, the astronaut who conducted an ESP experiment (with apparently ambiguous results) between the moon's surface and Earth, Dr. Harold Puthoff and Russell Targ, two Stanford Research Institute psychic researchers whose reports, claiming that literally every person they have tested can perform remote viewing, have been published in Nature and the IEEE Proceedings, and Dr. Willis Harman, an SRI futures researcher widely sought after by major corporations and foundations, who is so convinced of the reality of psychic phenomena that he "wouldn't walk across the street to witness a levitation."

Congressman Rose, like Harman and the other potential witnesses, in other words, has seen and believes.

"Some of the intelligence people I've talked to know that remote viewing works, although they still block further research on it, since they claim it's not as accurate as satellite photography," Rose asserted. "But it seems to me that it would be a hell of a cheap radar system. And if the Russians have it and we don't, we are in serious trouble. This country isn't afraid to look into the strange physics behind lasers and semiconductors, and I don't think it should be afraid to look at this."

When I first met him, Charlie was concerned that some of the academic debunkers of the psychic-—whose principal spokesman is Martin Gardner, of Scientific American—might affiliate objective, High Science research in this fiercely debated area. That he might even "investigate" the debunkers adds another dimension to the hearings. Rose proposes Charlie might also find himself in a locked-horn mode with some of the keenest thinkers of the day. Dr. John Wheeler for example, a renowned physicist, who wrote the first paper on nuclear fission with Niels Bohr and who associated with Einstein for more than 20 years, recently suggested the expulsion of parapsychology groups from the respected umbrella organization, the American Association for the Advancement of Science.

But Wheeler and Gardner are not close to His Leadership and Democratic Highness Boston's own Thomas "Tip" O'Neill, and Charlie Rose is. Rose fits some, but far from all of the stereotypes that New York parachutals would attach to Southern congressmen. It is true that he is a Southern Presbyterian and a "religious one" that he loves his chancellors of various agricultural subcommittees on poultry, dairy products, and tobacco.

Rep. Charlie Rose in front of the Capitol

CONTINUED ON PAGE 42
The eighth International Paris Festival of Science Fiction and Fantasy Films, which convened for ten days this March, was the largest gathering of its kind ever held in Europe. Some 50,000 fans converged on the Rex Cinema, Paris's largest movie theater and nearly half of them were turned away.

"No one believed there would be an audience for this type of film when I started the festival in 1972," explained Alain Schlockoff, who created and organized the festival. "But the number of people attracted every year has grown enormously. We've had to move to larger and larger theaters over the years, but there still isn't nearly enough space to accommodate everyone." Founder and editor of L'Ecran Fantastique, France's only publication devoted entirely to fantasy and science-fiction films, Schlockoff has been a lifelong fan of the genre. His passionate pursuit of fellow fanatics has led him through the magazine and the festival's almost single-handedly to galvanize the French science-fiction film audience into a recognizable force.

Of course, the organization of such a group is still to come. With neither funds for proper security nor fully subtitled prints of many of the films being shown in the festival, Schlockoff's problems at this year's gathering were manifold. Police were called upon to disperse the angry crowds that had been denied entrance to the overcrowded theater. Their anger was justified, however, because many people had stood in line in the rain for up to five hours to get in. "While the traffic jams spread, paralyzing the area for hours, the films ran on inside—two, three sometimes four a night—from early evening until 1 a.m. Though there weren't any real riots inside the theater, the spectators were the most vocal—unsophisticated, and least considerate I have ever seen. Their antics included fleets of paper airplanes hurled toward the movie screen and buckets of confetti poured from the top balcony, as well as shouted jokes, curses, songs, and catcalls at any time the screen was not filled with horror violence or mayhem of the lowest common denominator. Though Schlockoff's festival is the biggest in Europe, it is also representative of the wide gap between science-fiction film fans and the readers of "serious" mainstream novels.

"It's quite simple," explained Stan Barets, owner of Paris's largest science-fiction bookshop. "The people who come to the festival are generally kids who have dropped out of high school and who work in unskilled jobs. They don't come to see imaginative stories or good performances. They come for the blood. Perhaps only twenty percent of the audience has ever read a science-fiction novel. French readers are the opposite. They are generally well-educated and have discarded the science-fiction cinema because there is so little that's worth seeing compared to the riches available in print. There's almost no crossover.

Schlockoff has elicited an immense response from the public, but he has found himself caught in a double bind situation. Since the festival has been unable to attract large numbers of important films (i.e., Classy Big-budget productions), audiences have grown accustomed to experiencing the event instead of trying to appreciate the pictures. Because the audiences are both demanding and unsophisticated, the major film companies have generally avoided submitting their movies to the potential embarrassment of this ordeal. Moreover, the festival cannot really help a good film, because Schlockoff's awards like those given by most festivals carry little weight with the general audience.

This year's entries were dominated by American-made horror films unlikely to be released in first run theaters in the States. These movies, including Summer of Fear, Tourist Trap, Devil Times, Five, Alien Factor, The Bermuda Depths, Alien Zone, Nocturna, and Sanctuary for Evil, were supplemented by a sprinkling of better-quality fantasy and SF films from Italy, a smattering of J. W. Star Wars ripoffs, and a few excellant U.S.-made chillers.

The Rex Cinema is a beautiful dinosaur.
"ALL ABOARD" the world's smallest operating model railroad.

Your eyes are not playing tricks on you. No, we did not use trick photography or a giant size walnut in illustrating the remarkable trains shown on this page.

They have been photographed and reproduced to their actual size. The effect is startling, but nothing compared to watching them in action.

THE WORLD'S SMALLEST RAILROAD
We've named them Micro Trains. Brought to the U.S. by Beacon Scientific, they were developed and are manufactured in West Germany by Marklin. Micro Trains simply cannot be compared to other small-scale model railroad gear you have ever seen. To put them in proper perspective, our Micro Trains are about three times smaller than HO gauge. In model railroad terminology, they are rated as Z gauge.

SMALL IS BEAUTIFUL
Each Micro-Train represents a masterpiece in miniature. The scale is a gem size 1:220 with every feature perfectly detailed. The tank-type locomotive has a precise dual cast of every detail of the German Federal Railway 0 4 0 0 class 89 locomotive. Its die cast zinc body is finished in matte black with bright red headlights and wheel accents. There are six driving wheels which employ a specially designed non-skid, sure-grip surface for amazing traction and power. The scale detail and finish are remarkable when you consider that the locomotive measures only a fraction over two inches from end to end.

CONSTRUCTED WITH WATCHMAKER ACCURACY
The design and construction of working miniatures as small and detailed as our Micro-Trains most closely resemble that of a fine watch. Assembly is carried out under strict white-glove, atmospherically controlled clean room conditions. At completion the power modules are encapsulated against dust and moisture due to their rugged design and construction. It is unlikely they need repair or service ever.

EXPANDABLE
The Beacon Micro-Train program incorporates a complete model railroading system. Cars, engines, and accessories add up to over 140 different items available, and the list is still growing. In addition to the tank locomotive our basic set consists of a low sided freight car, tank car, box car, and caboose. The power pack is engineered to provide complete control. A single knob enables you to control speed and polarity reversing so trains can be run in either direction.

SHEER PLEASURE
Model railroading is a fascinating and relaxing hobby. Our Beacon Micro-Trains make it practical as well. Imagine a complete operating railroad so small you can fit an entire layout in your desk drawer! A setup that normally would spread out over an entire playroom floor or the top of a ping pong table can now be constructed in an area smaller than a cocktail table.

INDULGE YOURSELF
Let's face it, there are times when you need a change of pace to relax your mind and get the creative juices flowing. Construct your own Micro-Train layout on a corner of your playroom floor. Better yet, put a set in your office or reception area. Makes a marvelous conversation piece, as well as provides relaxation for you and your visitors.

Don't forget the children. A Micro-Train system is the gift of a lifetime, a present that will be remembered for countless years. Ask nicely, and they may even let you play with their trains.

NATIONAL SERVICE NETWORK
Because of the precision, care, and quality control standards under which Micro Trains are produced, we sincerely doubt that service will be required. However, your purchase is protected by a network of authorized service centers located throughout the U.S.—one probably right near you. Or, if you wish a central service by mail, facility has been established and will promptly handle any problem.

WE PUT OUR REPUTATION ON LINE
We're Beacon Scientific, a division of Beacon Photo Service Inc. (a public company.) We're proud of our company and the products we market. Each product must meet a stringent set of guidelines with respect to quality, value, and unique appeal. Our reputation rides along with every product we advertise and every package we ship.

As a measure of our confidence in our extraordinary Micro-Train system, we invite you to try them yourself for 15 days at your risk. Use them at home or set it up in your office. If for any reason you are not satisfied, return them for a prompt refund of purchase price.

The entire set as pictured here includes 18" x 30" track layout at $124.95. It can of course, be expanded into an infinite variety of layouts and shapes. A complete 20 page booklet in full color illustrates the entire Micro-Train system. Includes dozens of different locomotive cars and freight cars as well as track layouts and accessories. Order your Beacon Micro-Train set at no obligation today.

CREDIT CARD ORDERS 24 HOUR TOLL FREE SERVICE 1-800-322-7840 IN NJ CALL 800-322-8650 ASK FOR OPERATOR 178

BEACON SCIENTIFIC
Dept. 171 482 Burnside Ave. Rockville Centre, NY 11570

[Ad image of a locomotive and train layout]

[Address and contact information]
While attending the eighth International Paris Festival of Fantasy and Science Fiction Films, I had the opportunity to talk with several leading figures in the French science-fiction field. The picture that emerged from our conversations was one of an American-dominated market in which European talents are fighting to retain their national character while striving to enlarge their influence over the audience.

Like five cogs turned by the same master wheel, the various aspects of the French SF scene are independent but interconnected: books, magazines, fantastic art in comic-book form, television and film. Each has affected all the others with books leading in popularity. Only fantastic art, however, has found a place for France on the international scene.

The audience of hard-core SF readers is estimated between 10,000 and 50,000. As the important novels sell about 30,000 copies, and best sellers often top 50,000, it seems to be a healthy market. The most popular author among critics and serious fans is Philip K. Dick, an American whose books deal with concepts and issues rather than with adventure. Dedicated readers regard science fiction as a political and social forum, not as escapist entertainment. This fact is reflected in the work of the French writers, but, ironically, their books are considered to be too political by most of the audience. As a result, caught between the desires of their readers and their own goals, French authors take a place behind the unchallengable Americans.

Though Dick is the most respected author in France, he doesn't sell more than 60,000 copies of any given title. More traditional writers, such as A. E. Van Vogt, Isaac Asimov, Ray Bradbury, Arthur C. Clarke, and H. P. Lovecraft, often pass 200,000 in sales. Harlan Ellison and John Brunner hover around 40,000. The market is not growing very quickly hampered by, among other things, the ten-year gap between American publication and European translations of most novels.

Translations from English take a long time—and what is even more unfortunate—almost none of the work done in other European countries is ever translated into French. Living on a continent of varied tongues and cultures, Europe's science-fiction community is virtually nonexistent. The only continuing attempt to survey available work is being made by France's sole SF literary magazine, Fiction.

**MAGAZINES AND FANTASTIC ART**

With more than 300 issues behind it, Fiction, the French edition of America's Science Fiction and Fantasy magazine, is the oldest established science-fiction publication in the country. Though editorial policy dictates that each issue must contain several short stories that had already appeared in the U.S. edition, it has been possible to use the additional space to feature up-and-coming French SF authors and important foreign writers as well. Translations of short stories from Germany, Italy, Japan, Poland, Spain, and Sweden have appeared, and an all-Italian issue is soon to be published.

There is a considerable difference between science-fiction readers in France and those in the United States. Most of the French devotees are intellectuals, students, and academicians and who are attracted by the Freudian aspects of Dick's work and the sociopolitical work of other American and of French authors. Relatively few books are published in the space-opera or sword-and-sorcery area.

Those whose interests lie in adventure tales must turn to comic-art magazines such as Pilote and Métal Hurlant, for light diversion

Comic art in France is far more sophisticated than in America. Pilote has launched a raft of France's leading fantastic artists. Allowed far more time than American artists to complete their stories, French cartoonists will work on one panel of a ten-page strip for several days. Their U.S. counterparts must churn out their art with less attention to detail. The French artists are not well compensated by their magazines, but they do better through books that offer collections of their work.

Métal Hurlant, a more daring and colorful comic-art magazine, four years old now, has become an international success. Some 90,000 copies are sold in French markets each month, and its U.S. franchise, Heavy Metal, prints more than 200,000. A combination of fantasy and science fiction, the magazine has drawn a readership that is closer to the average American reader than any other French publication. With its enormous success, Métal Hurlant is about to begin production of an animated television series and a feature-length film; future plans call for a widening of its audience potential through advanced-marketing techniques.

Moreover, some of its better-known artists have already influenced the American film business. The costumes used in Alien (noted last month), for example, were designed by Moebius.

Entrained through mutual reliance, fantastic-art and comic-art magazines are nearing inseparability. But artists win wider recognition through books that contain the four- to six-part series that usually appear in magazines. The books have been

*CONTINUED ON PAGE 134*
Playing music that people want to hear has always been the idea of radio. But for the first time we have the technology to do it. Not only can we prove people will like a record, but we can tell programmers where and how to play it.

So says twenty-six-year-old radio consultant Lee Abrams, who relies on scientific research to shape the sounds of the more than 75 radio stations that subscribe to his Superstars format.

Through the Atlanta-based consulting firm Kent Burkhard/Lee Abrams and Associates, Abrams and his staff advise client stations on every aspect of on-air sound up to — but not yet including — the exact words a disc jockey should say. And within two years after signing up according to Abrams, the average Superstars station improves its overall rating by 20 percent.

Market research has never been applied to an art form as intensively as Abrams has applied it to music. Nor has it been used so assiduously by any other medium. Even in commercial television programming, decisions are made with feedback from audiences and tests of new products. In radio, however, the feedback is from the ear. Abrams' research team uses various technical devices attached to headphones to see how listeners react.

Abrams, the wizard of new record research, has conducted studies of more than 200 records released in the past 16 years.

'The audience reaction to a song is as important as the song itself,' says Abrams. 'We can determine the overall reaction to a song by listening to the audience reaction to the song. We can determine the exact sound of a song by listening to the audience reaction to the song.'

Abrams' research team uses a variety of techniques to determine the effectiveness of a song on the radio airwaves. They record the reactions of listeners, using devices attached to their headphones, and compare the reactions to different versions of the song. They also use computer programs to analyze the data and determine the best time for a song to be played.

Abrams' research team has conducted studies of more than 200 records released in the past 16 years. They have found that the most popular songs are those that are played at the right time and in the right place.

Abrams' research team has also conducted studies of the effects of different programming techniques on the success of songs. They have found that the most successful songs are those that are played at the right time and in the right place.

Abrams' research team has conducted studies of the effects of different programming techniques on the success of songs. They have found that the most successful songs are those that are played at the right time and in the right place.

Abrams' research team has conducted studies of the effects of different programming techniques on the success of songs. They have found that the most successful songs are those that are played at the right time and in the right place.

Abrams' research team has conducted studies of the effects of different programming techniques on the success of songs. They have found that the most successful songs are those that are played at the right time and in the right place.

Abrams' research team has conducted studies of the effects of different programming techniques on the success of songs. They have found that the most successful songs are those that are played at the right time and in the right place.

Abrams' research team has conducted studies of the effects of different programming techniques on the success of songs. They have found that the most successful songs are those that are played at the right time and in the right place.

Abrams' research team has conducted studies of the effects of different programming techniques on the success of songs. They have found that the most successful songs are those that are played at the right time and in the right place.

Abrams' research team has conducted studies of the effects of different programming techniques on the success of songs. They have found that the most successful songs are those that are played at the right time and in the right place.

Abrams' research team has conducted studies of the effects of different programming techniques on the success of songs. They have found that the most successful songs are those that are played at the right time and in the right place.

Abrams' research team has conducted studies of the effects of different programming techniques on the success of songs. They have found that the most successful songs are those that are played at the right time and in the right place.

Abrams' research team has conducted studies of the effects of different programming techniques on the success of songs. They have found that the most successful songs are those that are played at the right time and in the right place.

Abrams' research team has conducted studies of the effects of different programming techniques on the success of songs. They have found that the most successful songs are those that are played at the right time and in the right place.

Abrams' research team has conducted studies of the effects of different programming techniques on the success of songs. They have found that the most successful songs are those that are played at the right time and in the right place.

Abrams' research team has conducted studies of the effects of different programming techniques on the success of songs. They have found that the most successful songs are those that are played at the right time and in the right place.

Abrams' research team has conducted studies of the effects of different programming techniques on the success of songs. They have found that the most successful songs are those that are played at the right time and in the right place.

Abrams' research team has conducted studies of the effects of different programming techniques on the success of songs. They have found that the most successful songs are those that are played at the right time and in the right place.

Abrams' research team has conducted studies of the effects of different programming techniques on the success of songs. They have found that the most successful songs are those that are played at the right time and in the right place.
TRANCE FIGURES

UFO UPDATE

By Allan Hendry

A subset of UFO reports has aroused the public's interest or supported the extraterrestrial hypothesis more than the 1,100-odd known accounts of close encounters of the third kind. The most dramatic of these have been abductions, including the celebrated experience of Betty and Barney Hill (see UFO Update: November 1978). The Hills suffered a joint loss of memory after a distant observation of a UFO. Under hypnotic regression, they independently provided stories of medical examination at the hands of UFOs and a spaceship aboard.

Yet how many people are aware that this claim is only one of more than 160 similar tales in the UFO literature? That half of these have occurred since 1970? And that a large proportion of these events—including some of the most widely reported—required the use of hypnotic regression to break through the participants' amnesia?

Equally surprising is the consistent sequence of events provided by all of these people under hypnosis. A 1976 abduction (which I closely followed) of a couple in western Kansas has all the same elements as the Hills' experience in 1961. Both cases involved witnesses who, under hypnosis, described similar events. Both couples spoke of boarding a UFO (spaceship) against their will and of undergoing extensive, often painful, physiological examinations by their humanoid "captors." Even long after their experiences the "abductees" were aware of physical marks on their bodies without being consciously aware of what had caused them. In this recent incident "psychic" apparitions of the UFOs appeared to one of the witnesses some months after the abduction had occurred. Indeed, these elements are common to nearly all assertions that there was an abduction both in this country and elsewhere.

The question, of course, is whether the stories provided under hypnosis accurately portray events. It is widely known that police agencies have successfully used the techniques of hypnotic regression to aid in their investigation of crimes. In 1977, after three men in a van had kidnapped a busload of children in Chowchilla, California, the bus driver could not remember the license plate number on the van. Under hypnosis, however, he recalled it sufficiently well for the kidnappers to be apprehended. Such experiences have served to bolster public confidence in hypnotic regression universally. Such misconceptions as perfect recall or the inability to lie or fantasize under hypnosis are widespread.

William McCall, M.D., a former president of the American Institute of Hypnosis who has used the technique in 30 UFO cases notes: "It is theoretically possible for a skilled hypnotist to make [a] person say or do anything under hypnosis when it comes to regression. This is because the patient is acutely aware of the hypnotist's inflections, words, and body language. Since his primary desire is to please the hypnotist, he will often say things that are perhaps not completely true but are tainted by [his] fantasy. I do believe that the abductees are unable to separate fact from subconscious fantasy.'

Dr. Leo Sprinkle, well known for his work in abductee regression, says: "It is possible—but not likely in my opinion—that abductees substitute a fantasy for an experience. It is not impossible for a subject to lie or fabricate information while responding to hypnotic suggestion.'

My first reason for regarding UFO regressions with suspicion was provided by UFO researcher Ted Phillips, who listened to taped recordings of one UFO abductee's tale. This Missouri man told of being taken on board a spaceship and being physically examined. He was taken briefly to another world and then returned to Earth. The "glitch" occurred when he was asked to describe his abductors appearance. He made them seem so outrageous that the hypnotist asked him whether he was sure. Under hypnosis, he changed his mind, asserting that their appearances were something he had been a newspaper comic section.

Recently UFO researchers on the West Coast performed a controlled experiment in UFO hypnosis and presented the results before a meeting of the American Psychological Association.

CONTINUED ON PAGE 106
Sarcely ten years ago, when the environment first became a cause célèbre, practically everybody agreed to befriend or defend it. But today numerous scientists are discovering that to be for the environment in an organized way means taking a stand against their own research. A bitter battle over guidelines for recombinant-DNA studies recently caused several well-known biologists to pull out of such groups as the Environmental Defense Fund (EDF), the Natural Resources Defense Council (NRDC), and the Friends of the Earth (FOE).

"We never expected that we would be branded as polluters by the environmental movement," wrote James D. Watson (who won a Nobel Prize for his part in deciphering the structure of DNA) in the Washington Post. "For until recombinant DNA came along, we always thought we were on their side."

Calling himself a friend of DNA, Watson withdrew his support from Robert Redford and the EDF.

Recombinant-DNA technology, first announced in 1974, enables scientists to transplant small quantities of genetic material from one species to another. By manipulating DNA exchange, geneticists hoped to better understand the functioning of basic cell processes and disease processes—and, in what sounded at first like a fantasy, to use the technique for making microorganisms produce needed hormones, such as insulin.

Environmentalists, however, see many hazards in this work, including a possible "Andromeda Strain scenario," in which the world is overrun by some lethal new microbe created in a lab.

"The ecological-disruption potential is our major concern," says Pamela Lippe, assistant legislative director of the EDF's Washington office. "I think recombinant DNA is the most unforgiving technology we've ever developed, because the organisms have lives of their own. They can reproduce. At least when you deal with toxic chemicals, you have only as much as you create. Even radioactive wastes decay eventually."

"We're not trying to stop science or recombinant DNA," Lippe continues. "We just want it to proceed slowly so we can have the benefits of this new capability without unnecessary risks."

To that end, environmentalists lobbied in Congress to toughen the rules governing recombinant-DNA experiments. But since their objections surfaced just when scientists became convinced of the technology's relative safety, heads rolled in the ensuing fracas. Rene Dubos and Joshua Lederberg, two distinguished biologists at Rockefeller University in New York City, opposed the environmental position on DNA—even though they were both members of the NRDC's board of trustees. Paul Ehrlich, of Stanford University a FOE trustee, tried unsuccessfully to change that body's opinion, and Lewis Thomas, president of the Sloan Kettering Cancer Center, quit his post on the FOE advisory council.

Environmental-group pressure delayed the issuing of the new recombinant-DNA guidelines from late October 1978 to January 1979 and won seats for two nonbiologists on the biosafety committees that monitor local research activities.

According to Norton Zinder, at Rockefeller the objections from environmentalists came at least two years too late—after the issue had been amply debated by citizen's groups and long after scientists themselves had considered the risks. As one of the first to experiment with recombinant DNA, Zinder recalls how respectful early researchers were of the possible dangers. "We no sooner figured out how to do it," he says, "than we called an international conference and laid out rules for policing ourselves. We did that in 1974 and again in 1975. The government issued its first guidelines through the National Institutes of Health in 1976, and that's when conservation groups started speaking out. By that time, however, we had proved we were wrong about the potential dangers. The work turned out to be far safer than most disease-oriented studies."

Zinder says the risk-assessment experiment that environmentalists have been clamoring for is now completed, and it confirms the lack of danger in these investigations. (The results of the so-called Martin-Rowe experiment were scheduled for publication in Nature when this month's Omni went to press.)

"I have never blamed the public for being frightened of DNA," Zinder adds. "Genetics is a science that was born to be in trouble. It includes the whole nature-nurture debate, eugenics, in-vitro fertilization, even cloning. And while these issues have nothing to do with recombinant DNA, they remain inextricably linked in the minds of many people." He predicts another clash in five years: "When genetic engineering may be feasible."

—DAVA SOBEL
WORM POWER

The idea at first sounds either nauseating or frighteningly science fictional—600 million slimy, wriggling worms eating the garbage of a medium-sized city and excreting a nutrient-rich fertilizer.

But Earthworms, Inc. of Elk Grove, Illinois, has convinced a number of Midwestern communities to consider the idea. Tests have shown that the worms, which would be kept in pens, can eat sludge and biodegradable garbage.

For example, a test in Orlando, Florida, showed that 1.5 acres of worms could consume three to five tons of garbage a day in Shelbyville County, Texas, a few thousand pounds of worms ate 3,600 feet of sewage sludge, six inches deep, every day.

Earthworms, Inc., estimates that for a city of 150,000 people, a worm farm would cost $9.5 million and $600,000 for the worms and the rest for the processing equipment to remove the nonbiodegradable material which would be processed further or thrown out. The worms would eat up to five times their weight in garbage every day. The worm population would double every 60 days.

"They are just ordinary redworms, the kind used as bait for fish," says Rex Talmage, Earthworms, Inc.'s general manager. "They won't grow big from all that garbage. They won't escape from their pen or wrap themselves around people and choke them to death. But there can replace topsoil lost by erosion, give the soil desperately needed organic, and help solve the garbage problem."—Stuart Diamond

SPACE ARM

What has three wrists, one elbow, two shoulders, a hand that not only grasps but feeds, and its own self-contained brain and nervous system?

An arm? Yes, of course, but not your everyday flesh and blood upper limb. This is the remote manipulator of the space shuttle, designed as a robot analog of the human arm.

This futuristic device will be mounted in the cargo bay of the space shuttle orbiter allowing the astronauts to reach outside without ever leaving their cabin. The equivalent of two telephone poles in length (15 meters) it will be able to manipulate objects as big as a bus—up to 18 meters long and 4.6 meters wide—and weighing 29,500 kilograms.

To perform a wide variety of tasks—everything from repairing satellites to building space stations—the device had to match the dexterity of the human arm. Not surprisingly, it resembles the human arm in many respects. It has:

- six rotating joints at the shoulder, one at the elbow, and three at the wrist,
- a hand of ingenious rotating wire grippers,
- a skin of thermal blankets to protect it from the temperature extremes of outer space,
- a nervous system of electric sensors to measure joint angles and rates of rotation,
- a computer brain to translate the commands of the shuttle astronauts into coordinated movements.

In addition, the manipulator has a sense that the human arm lacks: a television-camera "eye" mounted on the wrist so that the astronaut can see what his "hand" is doing.

Built with lightweight materials for the weightless environment of outer space, the arm is not strong enough to be used on Earth. It can be tested in advance. Except for computer simulations and pretesting of individual elements, the arm will not actually be operated until launched on the first shuttle flight next year.

The arm is being built by a consortium of Canadian industries sponsored by the Canadian government under agreement with NASA. Canada will purchase the first arm and NASA will purchase additional arms for future tightness.

—Dan Ross
NO ENO IN SIGHT

Astrophysicists have argued for a decade whether the universe will expand forever or someday collapse and trigger another big bang. They may finally have their answer: It will expand.

In theory, the element deuterium should show whether the universe contains enough matter for gravity to cause another contraction. Given that much matter physicists reason, the deuterium would have been so densely packed during the first three minutes after the big bang that it would all have fused into helium.

If primordial deuterium still exists in deep space, it means there was too little matter to cause fusion. In that case there must also be too little to pull the universe back in on itself.

It turns out that interstellar deuterium can still be found, Dr. Arno Penzias, a Nobel laureate physicist with Bell Laboratories, reports. Dr. Penzias discovered the element but hydrogen and which contains deuterium.

This molecule is a much more common in space than gaseous deuterium and is easier to detect with Bell’s microwave radiotelescope (shown below).

Dr. Penzias is almost sure the deuterium he located was formed when the universe was born. It is ten times more abundant near our galaxy’s edge, where primordial elements would be relatively undisturbed, than in the center, where most gas comes from the stars.

The finding makes it nearly certain he says, that the universe will continue to expand ad infinitum.

—Owen Davies

ELECTRIC CARS

Almost a million electric vehicles ply the world’s roads. Most are trucks that deliver milk and mail, but there are also about 50,000 battery-operated cars which are recharged through a conventional wall outlet used for heavy-duty appliances.

The cars, which cost about $3,500 each, can travel at 50 mph and go 50 miles between battery charges. They operate almost soundlessly except for the slight whine of a motor.

They look like conventional subcompact cars. In fact some people have converted Volkswagens and other small cars into electric ones. They require little maintenance and are ideal for running errands.

To encourage the use of electric cars, a number of utility companies now offer cheap, nighttime rates when most of the power plant capacity is idle. You plug in your car and go to sleep. With the improvements in battery technology expected in the next few years, 3 to 4 million electric cars could be operating by the end of the century, estimates federal officials.

The alternate-energy answer to the electric car is the solar-electric car. One model, developed in Israel, has solar cells on the roof that convert sunlight into electricity to charge batteries.

The trick is to park the car in the sun,” says Professor Arne Braunstein, who developed the concept at Israel’s Tel Aviv University. —S D

LOCH NESS DOLPHINS

Two more searchers are joining the decades-old quest for the legendary Loch Ness monster. A pair of camera-carrying dolphins trained to seek out large swimming animals.

The choice of dolphins is the latest innovation of Dr. Robert H. Rines, a Boston patent attorney who has probed the loch with cameras and sophisticated sonar for the past ten summers. The seagoing mammals trained in Florida all winter and should be ready to join the hunt sometime this summer.

Though dolphins usually live in warm climes, they are well able to tolerate the cold, fresh Scottish waters, according to Howard Curtis, executive director of the Academy of Applied Science, which sponsors Rines’s expeditions. —O D
ON THE BEAM

A major objection to beaming power in the form of microwaves to Earth from solar-power satellites is the possible danger to birds—or people in airplanes—that would fly through the beam. Getting cooked to death in a 747 or having toasted robins fall on you is not a pleasant prospect.

Richard Dickinson, of the California Institute of Technology, may have come up with a solution, though As reported in a recent issue of NASA Tech Briefs, anything intruding in the path of the beam would alter its transmission and reflection characteristics. Dickinson’s system would have computers in the satellite transmitter and the ground station receiver instantly detect any changes in the beam caused by such an intrusion. The computers would then signal an interrupter controlling power output to shape, dim, or douse the beam immediately.

The scattering characteristics of objects that might fly through the microwave-power beam would be determined ahead of time and preprogrammed into the computers. A cloud of insects might be expendable, flocks of birds and passenger planes would not.

—Joel Davis

SEX SELECTION

The perennial impulse to tamper with Nature’s fifty-fifty odds on gender (Aristotle advised would-be parents of boys to arrange conception during a north wind, the south wind being propitious for girls) has finally borne scientific fruit. The first clinical trials of a sperm-separation technique invented by reproductive physiologist Ronald Ericsson of Sausalito, California, indicate it raises the chance of having a boy to 75 percent.

Ericsson’s method takes advantage of the fact that y-bearing (male producing) sperm swim faster than the x-bearing sperm do. By filtering sperm through layers of human serum albumin in a vertical glass column, he is able to isolate a sample composed of about 80 percent y-sperm at the bottom. Conception is then accomplished through artificial insemination.

The score so far— from Michael Reese Hospital in Chicago, where Dr. W. Paul Dmowski is the high priest of clinical sex selection—is boys nine, girls three (discounting two girls born to forgetful couples who had intercourse within 24 hours of insemination).

There’s a serendipitous spin-off, too. The sperm sample obtained also happens to be free of abnormally shaped sperm and sperm with eccentric swimming patterns. If it turns out that eliminating odd-shaped sperm amounts to cleaning up the chromosomes (still an unknown) the sperm-separation technique could have far-reaching consequences.

Parents who want a female child still have to trust Mother Nature—or wait until Dr. Ericsson has time to begin lab trials of the girl-producing method he has “all worked out in my head.”

Do-it-yourself sex-selection techniques—strange diets, exotic douches, and coital timing—still have their gurus and their loyal suffering devotees. A Gender Selection Kit put out by the National Gender Selection Center in New York City comes complete with thermometers, test tapes for measuring vaginal pH, douches of vinegar (for producing girls) or of baking soda (for boys), and a copy of Dr. Landrum Shettles’s Sex Choice Manual. And in Manchester, England, a spermicide suppository called Choice will soon be placed on the market. Unfortunately none of these home methods has been proved more effective than Aristotle’s formula.

—Luna C. Grant

“Scientists have odious manners, except when you prop up their theory, then you can borrow money of them.”

—Mark Twain
PAIN RELEASE

Chronic-pain sufferers may soon find relief—without drugs or going into the hospital—through the use of a wearable device that sends electricity into the brain.

Developed by neurosurgeon Yoshio Hosobuchi of the University of California at San Francisco, the apparatus relies upon tiny electrodes implanted into the central part of the brain. When activated, these electrodes cause the release of beta-endorphin, a recently discovered natural opiate-like substance involved in modulating pain sensations.

Wires extend down from the electrodes to a radio receiver embedded in the patient's chest. To turn on the stimulator, the patient simply places a small radio transmitter over the receiver, which then sends direct current along the wires to the brain. After as little as 15 minutes of stimulation, pain relief may last from a few hours to several days.

Dr. Hosobuchi developed his technique to help patients who responded to narcotic drugs but wished to avoid the risk of addiction. (When chronic pain cannot be alleviated by narcotics, Hosobuchi's method does not work, either.)

Of the 60 patients who have received these implants, there has been only one death due to the procedure. In general, Hosobuchi feels his technique has proved to be both safe and effective—particularly for alleviating the type of chronic pain that arises from backaches, cancer, and discomfort in the lower extremities.

Tolerance—the need for more and more frequent stimulation to obtain the same degree of pain relief—has been troublesome, but Hosobuchi has already come a long way toward solving this problem. He has found that L-tryptophan (an amino acid) is helpful in reversing tolerance—a discovery that holds important implications for the treatment of drug addicts.

—Kathleen McAuliffe

LASER COPS

Police now have a new tool for finding otherwise undetectable fingerprints—the laser.

Dusting is the most familiar method used to find fingerprints, but it's messy and doesn't always work. Ideally, the powder reveals a print by sticking to the oils and moisture left by fingertips. But these oils evaporate after a few days, making the print undetectable. The powder also tends to stick to some surfaces such as rubber and plastics even if they're clean, making it impossible to detect prints.

Other methods are also used, but none of them can detect all fingerprints.

The laser technique relies on fluorescence, in which molecules absorb light of one wavelength and reemit light at a longer wavelength; the same process is responsible for the bright colors in Day-Glo or blacklight paints. To detect fingerprints, a surface illuminated with blue laser light is observed through a special filter that absorbs the laser light but transmits the print in the form of yellowish fluorescence, explains Brian Dalyrimple, of the Ontario Provincial Police, one of the developers of the new technique.

The Ontario police have used the method to uncover a fingerprint left on rubbed-in, unobtrusive electrical tape. Normally undetectable, the print was instrumental in a drug conviction.

Some important detective work remains to be done, however. No one yet knows why only some fingerprints fluoresce, or why other molecules fluoresce. Scientists at the National Research Council of Canada and at the Xerox Research Center in Mississauga, Ontario, are trying to answer these questions and develop ways to detect more fingerprints by fluorescence. It may even be possible to detect fingerprints that are months, or even years old. Ontario police, meanwhile, are using the technique to try to solve crimes.

—Jeff Hecht
EMI POLLUTION

Imagine a toaster that delivers news or music along with the toast. Or how would you feel if your new expensive sports car stalled because the car's electronic fuel-injection system was affected by a CB radio in the car alongside yours?

Can you believe that shaving might be hazardous to health? Electric shavers have been known to interfere with the rhythm of implanted cardiac pacemakers. And in one hospital's intensive care unit, electronic life support equipment malfunctioned because of interference from the hospital's paging system.

These facts and many others are indicative of an emerging new consumer problem: the interference of electromagnetic signals with the operation of electrical or solid-state devices.

EMI, electromagnetic interference, is a comparatively new kind of air pollution. Although it can't be seen or smelled, electromagnetic "smog" might become a major environmental problem.

"EMI will only grow worse as electronic devices become even more widespread and sources of EMI continue to multiply," said Ernest Ambert, director of the National Bureau of Standards, at the bureau's second annual EMI workshop.

And sources of EMI are multiplying. Today there are about 120 million television receivers in use in the United States and about 400 million radios and millions of other electronic products. Microwave ovens, for instance, have grown to a $1.1 billion industry in just a little more than ten years.

Because some of these products emit microwave radiation, scientists and physicians are worried about possible health hazards posed by the increasing use of hand-held items, including two-way radios, a pocket size television set, a wristwatch radio that uses the human arm as an antenna, and a personal electronic diary that flashes important appointments on a tiny screen.

This radiation is a more insidious form of electromagnetic pollution because it is capable of producing thermal effects that are injurious to body tissue. Nonthermal biological effects that have been observed in experimental animals include cancer and cataracts.

The United States is on the threshold of an electronics revolution, and today's EMI problems will pale beside those to be encountered in the 1980s," said Chris M. Kandall, private EMI consultant.

"Phyllis Wollman

CLEVER CUCKOOS

Contrary to popular belief the cuckoo is one of the smartest—and fuzziest—of all birds. The European cuckoo, in fact, is so clever that it gets other birds to raise its young.

First the cuckoo seeks out other birds whose eggs most nearly resemble her own. (Some cuckoo eggs are blue while others are speckled) Then she nudges the other bird's eggs out of the nest. Finally she lays her own eggs there. How does the cuckoo know what her

eggs will look like before laying them? Experts theorize that cuckoos simply seek out the nests of birds that resemble their own "foster parents ."

The American cuckoo actually feeds its own chicks. The other birds are, it seems, too stupid to realize the eggs are alien. The cuckoo meanwhile flies off and sings its one-note call, gaining a reputation for idiocy.

Only the European cuckoo is so clever. Its American counterpart, unschooled in Old World customs, builds its own nest—a D.

PLANTS AND POWER PLANTS

Build a greenhouse next to a power plant, say researchers at Cornell University, and you may cut the cost of food production while putting waste heat to work.

Most electric-power plants in the United States rely on a nearby body of water to

Energy density meter is used here to measure the radio-frequency energy level near a CB antenna mounted on a recreational vehicle.
In that year only fans... Astoria crop...— Don Fabun

By power... By power...— Dava Sobel

Helium-3

The concept of 'appropriate' technology has entered even the ultra-sophisticated field of thermonuclear-fusion research. Most research has concentrated on deuterium (heavy hydrogen) as a fuel, but physicist John M. Dawson of UCLA, told a recent meeting of the American Physical Society that more attention should be paid to helium-3 because it is more efficient and creates no dangerous radioactive by-products.

His argument is that while most helium-3 escaped from the earth, because of its weak gravitation, at the time the planet was formed, some of it might still be trapped in gas bubbles inside the earth.

In any event, the outer planets must have retained their helium and because it is very light it is probably floating on top of the planetary atmospheres.

In a few hundred years, Dr. Dawson suggests, 'space technology will be far enough along to skim off the planetary helium and bring it back to Earth.'

— Don Fabun

Year of the Atom

While the world has yet to see a serious incident of nuclear terrorism, recent happenings indicate that 1979 may well be remembered as the Year of the Atom, for all the wrong reasons. Such as:

* In February the FBI arrested a thirty-nine-year-old construction worker for stealing 150 pounds of uranium from a General Electric facility in North Carolina. According to Intersearch, the newsletter of the International Terrorism Research Center, he threatened to send portions of the radioactive material to President Carter and other prominent people unless he received $100,000 in extortion money.

* In early March a magazine, The Progressive, was forbidden by a Federal District Court judge in Milwaukee, Wisconsin, to print an article it had sent to the Department of Energy to verify its accuracy. The name of the article: 'How the Hydrogen Bomb Works.' What reason for the publishing ban? The article was too thorough in its explanation, so much so that it qualified as a classified document. The man who wrote it got the information simply by telling bomb experts the truth that he was a reporter writing an article on the workings of the hydrogen bomb.

... An old atomic mystery was revived during a damage suit filed against the Kerr-McGee Corporation by the estate of the late Karen Silkwood. A controversial employee of that company, Kerr-McGee was never able to account for missing 40 pounds of plutonium in one of its plants: now shut down. An expert witness, Dr. Karl Morgan of the Oak Ridge plutonium-diffusion plant in Tennessee, testified that that was more than enough plutonium to build several nuclear weapons. The company claims the missing material is lost in the piping system of its plant. (Silkwood had criticized the plant's safety precautions.)

In the midst of the Three Mile Island nuclear accident, the FBI admitted it was investigating reports of sabotage threats against the faltering power plant.

— Douglas Colligan

The most beautiful experience we can have is the mysterious. It is the fundamental emotion that stands at the oracle of true art and true science.

— Albert Einstein
THE EARTHQUAKE BOOM

Scientists at a nonprofit think tank named the Mitre Corporation have stumbled onto what they hope will be an improved technique for earthquake prediction.

Remember the mysterious booming noises heard up and down the East Coast in the winter of 1977-78? No one could explain them at first and the media had a field day.

Encouraged by reams of sensational headlines, alarmed easterners began telling the authorities about everything from gunshots to thunderclaps. Not until US Navy researchers noticed that the loudest booms coincided with offshore supersonic flights by military aircraft and the Concorde did the media hype—and the volume of reports—ease off.

Researchers at the Mitre Corporation agreed that there was a reasonable explanation—as far as it went. But their curiosity was piqued by all the other noises reported at the time—noises that, perhaps, occurred all the time but went unnoticed without the media attention.

First, taking a look at the Navy’s study, they discovered that nearly one third of the reported booms could not be attributed to aircraft. Then they looked back at historic records and discovered that booming noises were often reported before earthquakes.

In one of those lucky coincidences, scientists dream of, their suspicions were confirmed in the middle of their research. Explosive noises were reported along the Ramapo Fault in New Jersey and New York seconds before a minor earthquake.

Gordon Macdonald speculates that the booms are caused by subterranean gases released by movements of the earth’s crust. Armed with this hypothesis, the Mitre Corporation recommends setting up arrays of microphones to pinpoint systematically the booms’ locations. If any occur along known fault lines, the presence of released gases can be tested chemically.

In China, Macdonald adds, unusual noises are already monitored as one component of that country’s earthquake-warning system, considered the most sophisticated in the world.

—Dan Ross

ENERGY MONITOR

On the theory that pushing someone’s nose in his own energy waste will cause a reduction in energy use, R. B. Fitch of Chapel Hill, North Carolina, has devised a machine that will tell you how much money you are spending on electricity.

Tests have shown it works. The University of Colorado found that the $125 Fitch Energy Monitor will cause residents to cut their consumption by about 12 percent. An average time to recoup investment less than two years with an all-electric home.

Fitch, a builder, says he invented the monitor to educate his son, who kept leaving the light on in his room. The monitor is about 15 centimeters square and 5 centimeters thick. It is attached to the conventional electric meter and gives a digital readout. If you switch on an air conditioner, for example, the monitor will immediately tell you how much you are spending to run it — S. D.
Thousands of research hours have barely tapped Apollo’s scientific legacy

THE ONCE AND FUTURE MOON

BY BEVAN M. FRENCH

It was good to be back on the moon.
The trip down to Earth had been trying. Space Russian returning from the moon were no longer a novelty: we were spared the embarrassing reception that would have been our fate a decade earlier. Still, it was hard to get used to Earth. We always weighed six times what we should have. We had trouble sleeping in the thick atmosphere. We felt naked going outside without a spacesuit. No, it was nice to visit the earth, but we were glad to be standing on a familiar world again.

As if to reassure ourselves, we climbed a low ridge that rose a full 15 meters above the plains of Mare Cram. From where we stood, all of Korolev (only a few old-timers still refer to it as Korolev Belo) spread out before us. The panoramas hadn’t changed. That lay to our left, growing by a few meters each day as the loose powdery lunar soil was trucked away to the extraction plant.

Beyond the pressurized domes of Korolev ran the dark line of an electromagnetic launcher, four kilometers long. As we watched, a dark spot appeared at the near end, accelerated along the track, and vanished into space above the curve of the moon’s surface. Another load of processed lunar material was facing up to where the huge colonies of Novaya Moskva and Novii Leningrad hung in space near the L-6 point. Probably titanium sponge, we thought. The zero-G refining facility at Novaya Moskva was turning out structural members for the half-completed shell of the Boston Space Station. The Americans worked the bugs out of their own underwriting plant.

Science fiction? Think what people in 1945 would have thought of the Apollo 11 landing. Yet today a whole generation is reaching voting age barely able to remember when it was “impossible” to go to the moon. Because of Apollo 11, we have become spacefarers. We know we can leave the earth. Lunar bases, space habitats and zero-G industries no longer seem impossible. Difficult and expensive yes. Nevertheless, they may become real in another generation or two.

Humankind has always approached new lands in three stages: first discovery, then exploration, finally settlement and use. Ten years ago Apollo advanced the moon into the exposition stage. And what exploration! Twelve American astronauts walked on its surface. More than 2,000 lunar samples

PHOTOGRAPHS BY NASA
wrote collected from six different sites. Russian robot spacecraft brought back samples from three more sites. Laser reflectors and seismometers were placed on the moon's surface to protect its integrity. From lunar orbit, spacecraft photographed the entire moon and chemically analyzed more than a fourth of its surface. The data returned from the moon in ten short years have already filled dozens of books and thousands of technical articles. To put the results of Apollo in perspective, imagine Christopher Columbus returning from his fourth voyage in 1504 with the following: a complete and accurate aerial photographic map of North and South America, a chemical analysis of the entire surface of the United States and Mexico; a diagram of the earth's crust and mantle beneath the eastern United States; 2,000 rock and soil samples from six locations across the United States; and doz- es of measurements of the distance between Spain and America, each one accurate to less than a meter.

We now know that the moon is native to our solar system and that it formed about 4.6 billion years ago. We have learned that it is a uniform, homogeneous world but has an outer crust and an underlying mantle of granitic rock. A tiny metallic mass may even be at the moon's core. Light-colored lunar crust, made of aluminum-rich rocks, is covered in places by dark-colored volcanic lavas rich in iron and titanium. These lavas spread across the moon's surface billions of years ago to form the features of the man (or the woman) in the moon.

Lunar chemistry is akin to that of the Earth, but some real differences remain. The moon seems to lack water and certain volatile elements, notably sodium and potassium. It is apparent that moon matter was strongly heated before or during its formation, producing a slax, more refractory world than the earth.

Despite chemical ties between the two, the surface characteristics of Earth differ entirely from those of the moon. The latter is arid—its surface has never felt the touch of wind or water. Large and small meteorites constantly bombarded the moon's surface, making craters, breaching, and scattering bedrock and gradually building up a thin layer of shattered, powdery rubble. So slowly does this shaping take place that if people had looked at the moon 3 billion years ago, it would have appeared to them almost the same as it does to us now.

Where does this knowledge come from? Most of it is revealed in moon rocks. Thousands of samples were collected by astronauts and carefully returned to thousands of scientists who are still poring new knowledge from them. Step into the sterilized rooms of the Lunar Sample Curatorial Facility at NASA's Johnson Space Center in Houston and meet these silent witnesses face to face. Dark clumps of basalt lavas, white crystalline rocks from the lunar highlands, black powdery samples of the surface layers of the moon. They sit behind glass in an atmosphere of dry nitrogen, and they are handled carefully with gloves and special tools—not for man's protection, but for theirs.

When the first lunar samples came back, fear was expressed that they might contain some dangerous alien life form. The samples and the returning astronauts were carefully quarantined and examined. By the time we learned that the moon rocks were free of harm, heavy metal is a key element in the samples, and the samples could be safely contaminated. Now the problem was reversed. The moon rocks had to be protected from Earth—from the water and oxygen in our air and from the contaminating dust and dirt that surround every human being and all human activity.

No complete lunar sample ever leaves the protection of these laboratories. But thousands of tiny chips and pieces are sent out each year to hundreds of American and foreign scientists.

Follow one of these chips to a laboratory.
Watch as a white-coated technician cements the chip to a glass microscope slide and then carefully grinds it down until the lunar rock is thinner than a sheet of paper. Under a microscope, the specimen is nearly transparent. The fabric of the crystals is clearly displayed, and the crystals themselves flash into glorious colors under polarized light. Here is the moon brought down to where we all can look at it. The crystals are fresh and unweathered even though the rock may be 4 billion years old. Why? Because no water has ever touched them. The moon rocks contain none of the water-formed rust and clay that are present in even the freshest youngest terrestrial rocks.

Scientists determine the genealogy of moon rocks by examining the shapes and textures of their crystals. The long interlocking crystals of one specimen were formed by rapid cooling of lava on the lunar surface. Another shows more regular crystal shapes, which tell of slow cooling deep under the lunar highlands. Yet another rock, crystals are deformed and shattered by the forces of ancient meteorite impacts on the moon.

These samples also function as lunar time capsules. Within each rock tiny amounts of radioactive elements have been ticking off those eons since the rock formed. One of the great triumphs of Apollo was that it has enabled us to apply the same radioactive age-measurement techniques to moon rocks that we have used in deciphering the history of Earth. Watch as tiny crystals are separated from the rock and dissolved in ultrapure reagents. See a tiny drop of solution placed on the filament of a huge mass spectrometer. Then watch as the machine analyzes the separated atoms and traces out on graph paper the history of another world.

The oldest rocks brought back by Apollo are about 4.6 billion years old, far older than any rock preserved on the active, changing earth. These lunar rocks are as old as the theories, and their age reveals the moon's historic link to our solar system. It was not a captured wanderer from Outside but coalesced at the same time as the sun and the planets.

Other rocks tell the rest of the moon's story a violent early youth with intense melting until gradually a solid crust formed. Then, at intervals, it recurved by huge impacts. About 4 billion years ago great floods of lava rose to the surface and poured out over the moon for half a billion years. Then the moon sank into a near eternity of quiet. The nearby earth continued active, developing an atmosphere oceans and life.

Continuous erosion volcanism, and mountain building destroyed the earth's ancient rocks and completely erased any record of what our planet was like when it was young. The moon remained virtually unchanged, a museum world. A cosmic Tomb of Tutankhamun, preserving the record of what the earliest history of a world had been. The only change was the steady rain of meteorites, gradually building up a layer of fine broken rubble a few tens of meters thick. Called lunar soil for convenience, it contains no water, no organic matter, and nothing live.

Moon rocks hold the history of the moon, but lunar soil holds the stories of the stars. Unprotected by any atmosphere, lunar soil has been exposed for eons to all the radiation from the sun. Tiny crystals and bits of glass in the soil have trapped and held the stream of low-energy atoms (solar wind) that spread out continuously from the sun. Other specimens have caught and held higher-energy atoms from the intermittent eruptions of solar flares. In still other fragments are the permanent tracks of high-energy cosmic-ray particles from beyond our own solar system. These radiations trapped during periods ranging from billions of years ago to the past few decades are now being analyzed.

By going to the moon, we have collected pieces of the sun. It is as if the moon were an instrumented satellite, launched into orbit 4.6 billion years ago to record the life history of our own personal star. We are only now beginning to read this record. Over long periods, like a few hundred million years, the sun seems to have behaved about the same as it does now. But over the shorter term there are some interesting anomalies. Lunar samples show apparently higher solar-flare rates over the last few decades than we have measured from Earth. There also seem to be changes in cosmic-ray intensity, which is related to the strength of the sun's magnetic field, during the past 2 million years.

One of the greatest future uses of lunar samples will be to help us understand the sun. There is still much we do not know about it. We don't know why it puts out fewer neutrons than it should. We don't know how, or even whether it affects our long-term climate. But as lunar samples help us read the sun's past, we will better understand the sun's inner workings and how it will operate in the future.

So much learned about the moon in a few short years. Have we learned everything? No. Many pre-Apollo mysteries remain, and many new questions are being asked simply because we have learned so much. Why are the dark lava flows almost entirely on the front side of the moon? What produced the unexpected "fossil magnetism" detected in lunar rocks although the moon has no magnetic field? What causes the clouds and red glow that have been seen in such craters as Aristarchus and Alphon- sus? What was the gas that produced the bubbles now preserved in lunar lavas? Does the moon have an iron core? What causes the magnetic anomaly near the crater Van de Graaff on the far side?

Some of the answers may lie in the samples we have already collected, many of which still await detailed examination. Other long core samples of lunar soil remain unopened, and in the hundreds of layers still preserved may be a 2-billion-year-old record of the lunar surface and the sun. Sediment cores drilled from the bottoms of terrestrial oceans are giving us a record of the climates of our world. In the same way cores of lunar soil will enable us to trace the storms and climates of the sun.

Other lunar mysteries can be solved only if we return to the moon or send robot spacecraft ahead of us. Automatic sample-return missions, like the Russians LUNA XV, could land at Aristarchus to see what causes the glow. An instrumented satellite in lunar polar orbit could efficiently map and analyze the moon, settle the problem of the iron core and search for frozen water in the permanently shadowed lunar polar. A relay satellite beyond the moon would open up the moon's far side to exploration.

But beyond the stage of further exploration, will the moon ever enter the stage of colonization and use? The scientific reasons for staying on the moon are as old as science fiction itself, and most of them remain valid today. From vantage points on the moon astronomical telescopes could probe the universe in all wavelengths. The low temperature and total vacuum would make possible unique, large-scale experiments in chemistry, physics and engineering. Geologists with roving vehicles and surface instruments could probe deeper into the structure and history of a world that still remains largely unknown. A radio telescope on the moon's far side, shielded by 3,500 kilometers of rock from the radio noise and chatter of Earth would be in the quietest place in the solar system. We might even hear for the first time the voices of Others amid the hiss and crackle of the stars.

How else might we use the moon? According to Dr. Gerard O'Neill at Princeton University, the moon in the near future could become a source of materials to build humanity's first spaceborne civilization. When we reach the point of building large structures in earth orbit (be they habitats, solar power stations or observatories), O'Neill notes that it will be cheaper to mine raw lunar materials rather than pay a frightful
penalty in fuel costs to haul finished products up from Earth. Several groups of scientists and engineers are already developing plausible schemes to scoop up lunar soil, shoot it down to Earth orbit, and refine it at space habitats using solar power.

The Apollo program was never intended as a prospecting expedition, but the returned lunar samples prove that the resources are there—in theory. A million tons of lunar soil could be scooped up from a pit only 200 meters square and 20 meters deep. This much soil contains 220,000 tons of silicon (for glass and solar-electric panels), 70,000 tons of aluminum (light structural members conductors, mirror coatings), 140,000 tons of titanium and iron (structural girders and plates), 60,000 tons of magnesia, 80,000 tons of calcium, 420,000 tons of oxygen (breathing and rocket fuel).

It sounds good, but it’s still too early to assume that the moon’s surface is paved with windowpanes, steel hull plates, mirrors, and solar panels. For one thing, lunar soil is not easy to process. It is a fine, clinging powder, a complex mixture of rock and mineral fragments, glassy beads, half-melted cinderlike particles, and finely divided iron metal. Even in a terrestrial smelter, the soil would be hard to manage, process, and separate.

Worse yet are the elements that aren’t present in lunar soil, particularly hydrogen (needed for water, rocket fuel, plastics, and hydrocarbons). There are other elements critical to a technological civilization that are dispersed in parts-per-million quantities in the lunar soil, almost impossible to concentrate—copper, germanium, mercury, gold, tungsten.

Do we write off lunar mines as a twenty-first-century growth industry? Maybe not. Changing economic conditions, a new effort in space—or new technology might turn lunar rubble into profit-making ore. The future of mining the moon is a complex question of economics, politics, will, and new technology none of which can be predicted very well.

But even before we go back to the moon there is much we can do on Earth. We can devote further study to lunar samples and extract the still-hidden knowledge about the moon, the sun, and the stars. We can construct quantities of simulated lunar soil and learn how to separate valuable elements from it. We can study the economics of space travel to see how profits can be realized. The problems of inhabiting the moon are far greater, but so is our technology. We know we can go back to the moon to stay if we wish to.

For more than 4 billion years the moon lay quiet and still, but our view of it has changed drastically in our own short history. For us the moon has been a light, a deity, and an unknown world and now it is a familiar companion planet. It may become the materials mainstay of our first space civilization. Finally it may become what the Azores were to Columbus—a haven, refueling stop, and point of departure for those who sail the unknown seas beyond CC.

For Further Reading

Collins Michael Carrying the Fire New York: Ballantine Books 1974 478 pp. paperback $1.95 Memoir of Apollo 11


I know what the exact date was of course, but I can't see that it would matter to you. Say it was just another Saturday night at Callahan's Place.

Which is to say that the joint was merry as hell, as usual. Over in the corner Fast Eddie sat in jovial combat with Eubie Blake's old rag "Tricky Fingers," and a crowd had gathered around the piano to cheer him on. It is a demonically difficult rag, which Eubie wrote for the specific purpose of humiliating his competitors, and Eddie takes it crack at it maybe once or twice a year. He was playing it with his whole body, grinning like a murderer and spraying sweat in all directions. The onlookers fed him energy in the form of whoops and rebel yells, and one of the unlikely miracles about Callahan's Place is that no one claps along with Eddie's music who cannot keep time. All across the rest of the tavern people whirled and danced, laughing because they could not make their feet move one fourth as fast as Eddie's hands. Behind the bar Callahan danced with himself, and bottles danced with each other on the shelves behind him. I sat stock-still in front of the bar, clutched my third drink in fifteen minutes, and concentrated on not bursting into tears.

PAINTING BY EVELYN TAYLOR
Doc Webster caught me at it. You would not think that a man navigating that much mass around a crowded room could spare attention for anything else. Furthermore, he was dancing with Margie Thomas, who is enough to hold anyone’s attention. She is very pretty and limber enough to kick a man standing behind her in the eye. But the Doc has a built-in compass for pain, when his eyes tell on mine, they stayed there.

His other professional gift is tact and delicacy. He did not glance at the calendar, he did not pause in his dance, he did not do much as known. But I knew that he knew.

Then the dance whirled him away and spun my chair around to the bar and gulped whiskey. Eddie brought sticky fingers to a triumphant conclusion hammering that final chord homoe with both hands, and his howl of pure glee was audible even over the roar of applause that rose from the whole crew at once. Many glasses hit the fire place, together, and happy conversation began everywhere. I finished the drink. For the hundredth time I was grateful that Callahan keeps no mirror behind his bar. Behind me, I knew, Doc Webster would be whispering in various ears, unobtrusively passing the word, and I didn’t want to see it.

‘Hit me again, Mike,’ I called out.

‘Half a sec, Jake,’ Callahan boomed cheerily. He finished drawing a pitcher of beer stuck a straw into it and passed it across to Long-Drink McGonnigle, who referred it to Eddie. The big barkeep ambled my way running clamping hands through his thinning red hair.

I produced a very authentic-looking gnn ‘Irish again.

Callahan looked ever so slightly pinched and rubbed his big broken nose. ‘Ll have to have your keys, Jake.

The expression on too many faces has only a limited meaning at Callahan Place. Mike operates on the assumption that his customers are grown-ups—he’ll keep on serving you for as long as you can stand up and order em intelligently. But no one drinks home from Callahan’s. When he decides you’ve reached your limit, you have to surrender your car keys to keep on drink ing, then let Pyotr—who drinks only ginger ale—drive you home when you fold.

British constitution. I tried experimentally. The lethal pectoral dismembered us. Peter Pepper packed his pipe with paraffin.

Mike kept his big hand out for the keys. ‘I’ve heard you sing “Shiny Stockings.” Blind drunk without a single syllable. Jake,

‘Damn, I began and stopped. “Make it a beer Mike.”

He nodded and brought me a Lowsen- broar dark. “How about a toast?”

I glanced at him sharply. There was a toast that I urgently wanted to make to have behind me for another year. Maybe later.

‘Sure, Hey Drink! How about a toast around here?’

Long-Drink looked up from across the room: “I’m your man.” The conversation began to abate as he threaded his way through the crowd to the chalk line on the floor and stood facing the deep black fire place. He is considerably taller than somewhat, and he towered over everyone. He waited until he had our attention.

‘Lades and gentlemen and regular customers,’ he said then, “you may find this difficult to believe, but in my youth I was known for wide and as a jackass.” This brought a spirited response which he endured stoically.

My own passion in life, back in my college days, was grossing people. I considered it a holy mission and I had a whole crew of other jackasses to tell me I was just terrific. I would type long letters onto a roll of toilet paper smeared mustard on the last square, then roll it back up and mail it in a box. I kept a dead mouse in my pocket at all times. I streaked Town Hall in 1952. I loved to see eyes glaze. And I regret to confess that I concentrated mostly on ladies, because they were the easiest. I went out Foul Phil they called me them.

**Her face was of the second type. I suppose it could have been cancer or some such, but somehow I knew her pain was not physical. I was just as sure that it might be fatal.**

..."

Time, I thought, must have passed without my awareness. It’s a curious thing but as I was alone in the room, it seemed longer. I took a glance around the room: I’m your man. The conversation began.

...I’ll tell you what cured me.” He wet his whistling confidence of our attention.

The only trouble with a reputation for crudeness is that sooner or later you run short of unsuspecting victims. So you look for new faces. One day I’m at a party off campus, and I notice a young lady. I’ve never seen before, a pretty little thing in an off-the-shoulder blouse. Ooey. I see to myself. fresh blood? What? I do? I’ve got the mouse in one pocket, the rectal thermometer wizzed in the other but she looks so virginal and innocent I decide the hell with subtlety, I’ll try a direct approach. So I walk over to where she’s sitting fakin’ to Peteys LeFors on a little couch. I come up behind her, like, upap my mousers out with my instrument, and lay it across her shoulder.

There were some howls of outrage from the men as much as from the women, and some giggles from the women as much as from the man. Well, as I said I was a jackass, the Drink said, and we all applauded.

“No reason whatsoever do I get from her, he went on dropping into his fake brogue. ‘People gonna grow in all round the room just like here. Peteys eyes poppin’, but this lady gives no sign that she’s aware of me presence stall, all I kinda wagle it a bit, and not a glance does she give me. Finally I can’t stand it. ‘Hey!’ I say, tappin’ her other shoulder and pointin’ what do you think this is? And she takes a leisurely look. Then she looks me in the eye, and says, ‘It’s something like a man’s parts, only smaller.’

An explosion of laughter and applause filled the room.

...wherefore,” continued Long Drink.

“I propose a toast to you, my—may God save me from a relapse.” And the cheers overwhelmed the laughter as he gulped his drink and flung the glass into the fireplace. I nearly grinned myself.

My turn. Tommy Janssen called out, and the Drink made way for him at the chalk line. Tommy’s probably the youngest of the regulars. I’d put him at just about twenty-one. His hair is even longer than mine, but he keeps his face mowed.

This happened to me just last week. I went into the city for a party, and I left it too late, and it was the wrong neighborhood of New York for a civilian to be in at that time of night, right? A dreadful error! Never been so scared in my life, I’m walking on tippy toe looking in every doorway, I pass and trying to look insolvent, and the burning question in my mind is, ‘Are the crosswalk buses still running? Because if they are I can catch one block away that’ll take me to bright lights and safety—but I’ve forgotten how late the crosswalk bus keeps running in this part of town. It’s my only hope. I’m walking, scared as hell. And when I get to the bus stop, there leaning up against a mailbox, is the biggest meanest-looking ugliest blackest man I have ever seen in my life. Head shaved three days, with one big scar on his face hands in his pockets.

Not a sound in the joint.

So the essential thing is not to let them know you’re scared. I put a big grin on my face and I walk right up to him, and I say, ‘Upl crosswalk bus run all night long?” And the fellow goes, ‘Tommy mimed a forcerous-looking giant with his hands in his pockets. Then suddenly he yanked them out, slapped them rhythmically, and sang, “Doo-dah doo-dah!”

The whole bar dissolved in laughter.

...fella whipped out a joint, and we both got high while we waited for the bus. He went on and the laughter redoubled. Tommy finished his beer and cocked the empty. So my toast is to prejudice. He finished and pegged the glass square into the hearth, and the laughter became a standing ovation. Isham Laimer, who is the exact color of recording tape, came over and gave Tommy a beer, a grin, and some skin.

Suddenly I thought I understood something, and it filled me with shame.

Perhaps in my self-involvement I was wrong. I had not seen the Doc communicate in any way with Long-Drink or Tommy nor had the toasters seemed to notice me.
at all. But all at once it seemed suspicious that both men, both proud men, had picked tonight to stand up and uncharacteristically tell egg-on-their-face anecdotes. Damn Doc Webster! I had been trying so hard to keep my pain off my face. So determined to get my toast made and get home without bringing my friends down.

Or was I, with the egotism of the wounded, reading too much into a couple of good anecdotes well told? I wanted to hear the next toast. I turned around to set my beer down so I could prop my face up on both fists, and was stunned out of my self-involvement and was further ashamed.

It was inconceivable that I could have sat next to her for a full fifteen minutes without noticing her—anywhere in the world, let alone at Callahan's Place.

I worked the night shift in a hospital once, pushing a broom. The only new faces you see are the ones they wheel into Emergency. There are two basic ways people react facially to mortal agony. The first kind smiles a lot, slightly apologetically, thanks everyone elaborately for small favors, extravagantly praises the hospital and its every employee. The face is animated, trying to ensure that the last impression it leaves before going under the knife is of a helluva nice person whom it would be a shame to lose. The second kind is absolutely blank-faced, so utterly wrapped up in wondering whether he's dying that he has no attention left for working the switches and levers of the face—or so certain of death that the perpetual dialogue people conduct with their faces has ceased to interest him. It's not the total deanimation of a corpse's face, but it's not far from it.

Her face was of the second type. I suppose it could have been cancer or some such, but somehow I knew her pain was not physical. I was just as sure that it might be fatal. I was so shocked I violated the prime rule of Callahan's Place without even thinking about it. "Good God, lady," I blurted, "what's the matter?"

Her head turned toward me with such elaborate care that I knew her car keys must be in the coffee can behind the bar. Her eyes took awhile focusing on me, but when they did there was no one looking out of them. She enunciated her words.

"Is it to me whom you are referring?"

She was not especially pretty, not particularly well dressed, her hair cut wrong for her face and in need of brushing. She was a normal person. In other words- save that her face was uninhabited and somehow I could not take my eyes off her. It was not the pain—I wanted to take my eyes from that—it was something else.

It was necessary to get her attention. "Nothing, nothing, just wanted to tell you your hair is on fire."

She nodded. "Think nothing of it." She turned back to her screwdriver and started to take a sip and sprayed it all over the counter. She shrieked on the inhale.

---

The timepiece whose time has come.
The Canon CardQuartz. Quartz accuracy in a watch, Canon accuracy in a calculator.

Quartz technology. It's the most reliable in timekeeping today. And now Canon's combined it with their reliable calculator technology to bring you their versatile, stylish CardQuartz. A Canon memory calculator that's also a sophisticated timepiece. Complete with stopwatch, calendar and alarm.

And, of course, Canon accuracy in computing that's always been ahead of its time.

Canon's slim, stylish CardQuartz, available in handsome black or silver satin finish. It leaves all other timepieces behind.

Where quality is the constant factor.

Canon Electronic Calculators

Copyright © 1981 by Canon USA Inc.
Cells' natural defense against virus attack has also emerged as a promising new weapon in the fight to conquer cancer.

BY DOUGLAS GASNER
first to perceive the subtle glow in the center of the holograph stage. A single leukocyte, drifting down from the buffy coat of centrifuged human blood, was caught in the infra-red beam.

An electronic hum vibrated in the overhead speakers and coalesced into a sonorous narration. They cannot think not in the usual sequence of the word. They have no abstract concepts. Their existence is predicated on defense.

Merey was perhaps the word to use in this context for leukocytes (white blood cells) are the Praetorian Guard of the body's immunological system. Some hunt down and engulf their microbe prey then destroy the invaders in the chemical crucible of an enzyme-filled vacuole. Others unleash a linked and folded chain of amino acids that combines with the intruder rendering it inert. But Darwin II did not orchestrate this show for a review of the old antibody and scavenger system, no matter how glorious it looked in full color magnified tens of thousands of times.

No, he had something else on his mind, something worthy of transcending his audience. As several other leukocytes descended into focus, the narration resumed:

"They have no ordinary armor, nothing comparable to the suits of mail and polished metal that Erasmus Darwin kept in his study at the turn of the nineteenth century, but their defense is as solid and their weapon as lethal as the lance. Erasmus Darwin certainly could not anticipate what we are seeing now. His view was at another level. But both visions are intimately and irrevocably linked. Dr. Darwin wrote in his journal that a patient of his young child with common measles remained unaffected by smallpox to which other members of his family succumbed. From that observation and several other similar ones, in which one disease conferred protection against another disease, Darwin conjectured that some unknown bodily fluid must rise up to counter a subsequent infection.

In the cylinder of light, the globular leukocytes floated like large, indescent spheres on the surfaces glistening. As the magnification and infuser intensity increased, the structural components of cells took shape and swirling rivers of cytoplasm. The elongated cigar-shaped mitochondria pulsed in rhythm as they churned out energy for vital cellular processes. Helical spirals of genes punctuated the pale nucleus. Pores located in the outer membrane gaped and swallowed.

Suddenly a menacing shaft appeared in the upper region of the holograph scene. A miniature needle darted by the translucent leukocytes. The needle at one end bore a hexagonal head. Pincalike legs spread from the other end of the needle-like spindles on a landing craft; it had the appearance of a lunar module seeking the moon. But this seemingly mechanical structure possessed one feature that was irrelatorily a sign of life. Within the main body a pair of intertwined strands of nucleic acid flashed into view as the particle yawed out of the vertical.

A fully assembled virus is a chilling sight to any researcher who has worked or even brushed up on virology. The tension in the room was palpable.

"In 1587," the narrator intoned. The British virologist Alex Isaacs and his Swiss colleague Jean Lindenmann were investigating the phenomenon of viral interference in their laboratory at the National Institute for Medical Research at Oxford. They knew that cells infected by one virus are resistant to subsequent infection by another virus, and they sought to find out why. They took a sampling of virus very much like the beastie that looms before you, and inoculated it with chick cells. The virus penetrated the chick cells and began replicating.

"From the broth they extracted a fluid, which they injected into a fresh dish of chick cells and virus. While some chick cells did indeed die, the viral assault on the surrounding cells was protected from viral attack."

Interferon produced in a single cell triggers the antiviral protein, first in one adjacent cell, then in the next and the next, until all the surrounding cells are protected from viral attack.

Most survived and the virus was inactivated. Something had interfered with the viral replication, and something had to have come from the chick cells themselves. Given the nature of this unknown substance — the fluid that Dr. Erasmus Darwin speculated upon — it would have been appropriate to call it the factor Darwincine. However, the Fellows at Oxford thought otherwise and interferon came into being.

One of the leukocytes in the field was directly in the path of the virus. Darwin II would not let the intruder slip by and for effect, he slowed the holographic movement. The virus, which had been steadily creeping toward its immense victim, now seemed to move in a series of chorographic loops. For every advance, it was repelled half the distance. In this manner the combatants closed the distance between themselves.

The virus was slightly awash when it contacted the outer cellular membranes, but it righted itself and inserted its hollow sanger deep into the leucocyte's surface. In a wracking spasm the hexagonal body launched its nucleic cargo. Having transmitted its genetic material, the sheath of the virus like an empty syringe needle, dropped away.

Once inside the leucocyte the viral nucleic acid was indistinguishable from the cell's own RNA. But instead of making the amino acids that would join themselves into human protein, the machinery of the leucocyte bestirs assembling the viral proteins, the enzymes, shells, stingers, and new viral nucleic acid.

Viral progeny began to swell the interior of the impregnated cell. Then, within the leucocyte nucleus, the bands on chromosome 2 and 5 started to glow. An ink protein snaked its way around the disassembled viral parts and escaped into the intercellular space. The fatally infected leucocyte had delivered its chemical messenger, interferon.

Now it was Darwin III's turn, and his voice filled the room. "They suffer the ignominious fate of passively allowing themselves to be penetrated and commandeered by a particle that has no redeeming qualities. Yet they are able to communicate their predicament through the death throes of viral replication. An ancient system that has been found in mammalian cells, avian cells, replication, and insects, and in plants has been called forth. The interferon system evolved at the dawn of life on this planet to defend all living things from the scourge of death."

Darwin had found his métier in intercellular communication and here was visual evidence of cells transmitting information to one another for the common good. Bands of shadowy interferon extruded from the dying leucocyte and stretched to other adjacent leukocytes. The viral progeny, now fully assembled, burst through their membranous confines and sought out further victims. Both interferon molecules and newly replicated virus clamped down on the surface of a neighboring cell.

With the binding of interferon chromosome 21 started to stir within the leucocyte nucleus. A secondary messenger molecule shuttled between the interferon-binding receptor on the cell surface and the membrane surrounding the nucleus. The message of viral attack was confirmed, and the leucocyte's organelles began churning out a 48,000-dalton protein.

This is the antiviral substance that cells have been using to dismantle virus; the ancient antidote that inhibits viral protein synthesis inside host cells. The interferon produced from a single infected cell triggers the antiviral protein, first in one adjacent cell, then in the next and the next, until all the surrounding cells are protected.

Some cells succumb to the viral attack, particularly during the initial invasion before the interferon system is induced. Their sacrificed hulks litter a portion of the brightly lit scene. In another sector of the holographic field, large single-nucleated white cells creep toward the devastation. Interferon has attracted them to the battlefield, and these macrophages begin ingesting inactivated virus and cellular debris.
LUNAR CELEBRATION

Thanks to the Apollo program and our many unmanned probes, the study of moons has come into its own.

There are at least 33 moons in the solar system. Earth has one, Mars and Neptune two. Uranus has five, Saturn ten, and Jupiter thirteen or more. Pluto may have a moon. Even the largest asteroids may have smaller asteroids orbiting them.

Our knowledge of moons is a recent achievement. Until the Viking Orbiters photographed Phobos and Deimos, the moons of Mars, we knew little more of them than Jonathan Swift, who foretold their existence in Gulliver's Travels 150 years before they were discovered. Until Voyager I took Jupiter's moons into front-page news, they too were featureless dots seen through our largest telescopes. We have learned
Clockwise from right: Astronaut Schmitt works by the Rover amid the samples and the discovered Martian crater, Isrside crater, 80 kilometers across, was shot from Apollo 11. Apollo 15 landing site is seen from over the Appenine Mountains. Crater Maskelyne, at bottom left of photo, was a major landmark as Apollo 11 approached its touchdown.

With all our data, we still can't answer the most obvious question about moons. More of moons in the last two decades than in all of recorded history. The Rangers, Surveyors, Lunar Orbiters, and Apollos brought back about 40 different kinds of data, from photos to gravitational perturbations, and attitude measurements to gamma-ray scans -- so much information that space scientists now need many hours of computer time to make even simple analyses. The Lunar Polar Orbiter, if a now-reluctant Congress ever funds it, will extend many of these measures across the lunar map, where only fragmentary data are now available.

With all this wealth of information, we still can't answer the most obvious question about moons: Where did they come from? It was once thought that our own moon was formed when a huge landmass broke away from the still-plastic earth, leaving a pit that eventually became the Pacific Ocean. But the Apollo moon-rock samples were chemically different from earth rocks -- too different, it seems, for the moon to have
Voyager 1 took this family portrait of Jupiter and two of its satellites on February 13, 1979, three weeks before its closest approach to the planet. Io, on the left, turned out to be one with volcanoes. Ganymede, heavily pocked by meteor craters, surprisingly resembles our own moon.
Moons may have formed, as the sun and planets did, from a whirling ball of gas.*

originated here. Such a discovery couldn’t have been made from Earth. This leaves two hypotheses, and the data from our space missions weigh heavily for one as for the other. The capture theory holds that moons began as cosmic wanderers that traveled through space until they passed close enough to a planet to be tugged into orbit by its gravity. Alternatively, the moons may have condensed as the sun and planets did, from a whirling ball of gas that coalesced into solid matter. The latter idea was especially popular in the days when Jupiter had only four known moons because it seemed to explain why nearly all

Clockwise from near right: Tiny Amalthea circles Jupiter every 12 hours. Giant Ganymede is a rock-icy ball of ice. Callisto’s ancient surface seems almost featureless. Europa, seen from 2 million kilometers, will be examined by Voyager 2 this month: a volcanic explosion throws 160 kilometers over sulfurous to
Moons are not stable in their orbits; our own is moving farther from Earth.

Moons orbit their parent planet in the same direction as the planet rotates and in the same plane as the planet orbits the sun. Then it was found that Jupiter's four outermost moons orbit in the opposite—"retrograde"—direction, in paths skewed far out of Jupiter's orbital plane. Astronomers now think that both theories are partially true; that Earth's moon, for example, and Jupiter's largest satellites formed when the planets did, while others are captured wanderers.

Moons are not stable in their orbits. By millimeters per year, they approach their parent planets or recede from them. Pluto may once have been a moon of Neptune that gradually escaped its orbit. Our own moon is moving farther from Earth. Unlike Pluto, it will not escape. Billions of years hence the sun's gravity and Earth's will draw the moon back to its parent planet. Eventually gravitational forces will pull the moon apart, forming a Saturn-like ring.
DEEP-BREATHING EXERCISES

He learned a basic truth: that life begins with a breath, and he could predict the end of your life—with a breath

BY ORSON SCOTT CARD

If Dale Yorgason hadn’t been so easily distracted, he might never have noticed the breathing. But he was on his way upstairs to change clothes, noticed the headline on the paper, and got deflected instead of climbing the stairs. He sat on them and began to read. He could not even concentrate on that, however. He began to hear all the sounds of the house. Brian, their two year-old son, was upstairs, breathing heavily in sleep. Colly, his wife, was in the kitchen, kneading bread and also breathing heavily. Their breath was exactly in unison. Brian’s rasping breath upstairs, thick with the mucus of a child’s sleep; Colly’s deep breaths as she labored with the dough. It set Dale to thinking, the newspaper forgotten. He wondered how often people did that—breathing simultaneously for minutes on end. He began to wonder about coincidence.

And then, because he was so easily distracted, he remembered that he had to change his clothes and went upstairs when he came down, in his jeans and sweat shirt, ready for a good game of outdoor basketball now that it was spring.

Colly called to him: “I’m out of cinnamon, Dale.”

“I’ll get it on the way home.”

“I need it now!” Colly called.

“We have two cars!” Dale yelled back, then closed the door. He briefly felt bad about not helping her out but reminded himself that he was already turning late and it wouldn’t hurt her to take Brian with her and get outside the house. She never seemed to get out of the house anymore.

His team of friends from Always Home Products, Inc., won the game, and he came home deliciously sweaty. No one was home. The bread dough had risen impossibly and was spread all over the counter and dropping in large lumps onto the floor. Colly had obviously been gone too long. He wondered what could have delayed her.

Then came the phone call from the police, and he did not have to wonder.
anymore. Colly had a habit of inadvertently running stop signs.

The funeral was well attended because Dale had a large family and was well liked at the office. He sat between his parents and Colly's parents. The speakers droned on and Dale easily distracted, kept thinking of the fact that all the mourners there only a few were truly grieving. Only a few had actually known Colly who preferred to avoid office functions and social gatherings who stayed home with Brian most of the time, being a perfect housewife and reading books, remaining in the end solace. Most of the people at the funeral had come for Dale's sake to comfort him. "Am I comforted?" he asked himself. Not by his friends—they had little to say were awkward and embarrassed. Only his father had had the right instinct, just embracing him and then talking about everything except Dale's wife and son, who were dead so mangled in the accident that the coffin was never opened for anyone. There was talk of the fishing in Lake Superior this summer, talk of the bastard kids at Continental Hardware who thought that the retirement-at-sixty-five rule ought to apply to the president of the company, talk of nothing at all. But it was good enough since it served the intended function. At least temporarily Dale's thoughts began to wander and he was distracted from his numbing grief.

Now however he wondered whether he had really been a good husband for Colly. Had she really been happy cooped up in the house all day? He had tried to get her out, get her to meet people and she had resisted. But in the end, as he wondered whether he had known her well, he could not find an answer not only he was sure of it, Brian—he had not known Brian at all. The boy was smart and quick speaking in sentences when other children were still struggling with single words; but what had he and Dale ever had to talk about? All Brian's companionship had been with his mother, all Colly's companionship had been with Brian. In a way it was like their breathing—the last time Dale had heard them breathe—in unison as if the rhythms of their bodies were together. It pleased Dale somewhat to think that they had drawn their last breath together too, the unison continuing to the grave now they would be lowered into the earth in perfect unison sharing a coffin as they had shared every day since Brian's birth.

Dale's grief swept over him again surprising him because he had thought he had cried as much as he possibly could and now he discovered there were more tears waiting to flow. He was not sure whether he was crying because of the empty house he would have come home to or because he had always been somewhat closed off from his family. Was the coffin after all just an expression of the way their relationship had always been? It was not a productive line of thought, and so Dale once again let himself be distracted. He let himself notice that his parents were breathing together.

Their breaths were soft, hard to hear. But Dale heard and looked at them, watched their chests rise and fall together. It unnerved him. Was unison breathing more common than he had thought? He listened for others, but Colly's parents were not breathing together and certainly Dale's breaths were at his own rhythm. Then Dale's mother looked at him smiled and nodded to him in an attempt at silent communication. Dale was not good at silent communication, meaningful pauses and knowing looks allowed him baffled. They always made him want to check his fly. Another distraction, and he did not think of breathing again.

Until at the airport when the plane was an hour late in arriving because of technical difficulties in Los Angeles. There was not much to talk to his parents about. Even his father a wizard at small talk, could think of nothing to say and so they sat in silence.

Their breaths were soft, hard to hear. But Dale heard and looked at them, watched their chests rise and fall together. It unnerved him. He listened for others...

...most of the time, as did most of the other passengers. Even a stewardess and the pilot sat near them, waiting silently for the plane to arrive.

It was in one of the deepest silences that Dale noticed that his father and the pilot were both swaying their crossed legs in unison. Then he listened and realized there was a strong sound in the waiting area. A rhythmic swaying of many of the passengers inhaling and exhaling together, Dale's mother and father, the steward, several other passengers, all were breathing together. It unnerved him. How could this be? Dale had been mother and son. Dale's parents had been together for years. But why should the people in the waiting area breathe together?

He pointed it out to his father.

"Yes it is kind of strange, but I think you're right," his father said, rather delighted with the odd event. Dale's father loved odd events.

Then the rhythm abruptly broke as the plane taxied along the runway and slowed to a halt directly in front of the windows of the airport lobby. The crowd stirred and got ready to board even though the actual boarding time was surely half an hour off.

The plane broke apart in midair some where over eastern Kentucky and they didn't find the wreckage for days. About half the people in the airplane had survived and most of them were rescued before exposure could do more than make them ill. However the entire crew and several passengers, including Dale's parents, were killed when the crippled plane plunged to the ground.

It was then that Dale realized that the breathing was not a result of coincidence or of people's closeness during their lives. It was a messenger of death, they breathed together because they were going to draw their last breath together. He said nothing about this thought to anyone else, but whenever he got distracted from things he tended to speculate on this. It was better than dwelling on the fact that he—a man to whom family had always been important—was now completely without family. That the only people with whom he was completely self completely at ease were gone and there was no more ease for him in the world.

Much better to wonder whether his knowledge might be used to save lives. After all he often thought reasoning in a circular pattern that never seemed to end. If I notice this again I should be able to alert someone to warn someone to save their lives. Yet if I were going to save their lives would they then breathe in unison? If my parents had been warned and changed flights he thought they wouldn't have died and therefore wouldn't have breathed together. So I wouldn't have been able to warn them and so they wouldn't have changed flights and so they would have breathed in unison. So I would have noticed and warned them.

More than anything that had ever passed through his mind before, this thought engaged him and he was not easily distracted from it. He began to work his head slowly down, made mistakes because he concentrated only on breathing. Listening constantly to the secretaries and other executives in his company waiting for the fatal moment when they would breathe in unison.

He was eating alone at a restaurant when he heard it again. The sighs of breath came all together from every table near him. It took him a few moments to be sure, then he leaped from the table and walked briskly outside. He did not stop to pay for the dining. He was eating alone at a restaurant when he heard it again. The sighs of breath came all together from every table near him. It took him a few moments to be sure, then he leaped from the table and walked briskly outside. He did not stop to pay for the dining. He was eating alone at a restaurant when he heard it again. The sighs of breath came all together from every table near him. It took him a few moments to be sure, then he leaped from the table and walked briskly outside. He did not stop to pay for the dining. He was eating alone at a restaurant when he heard it again. The sighs of breath came all together from every table near him. It took him a few moments to be sure, then
pull him back toward the place. Dale resisting all the way.

"You can't leave without paying. What do you think you're doing?"

"I can't go back!" Dale shouted. "I'll pay you the money back right here!" and huddled in his wallet for the money as a huge explosion knocked him and the maître d' to the ground. Flames erupted from the restaurant and people screamed as the building began crumbling from the force of the explosion. It was impossible that anyone inside the building could still be alive.

The maître d'his eyes wide with horror stood up as Dale did and looked at him with dawning understanding. "You knew," he said. "You knew!" Dale was acquitted at the trial—phone calls from a radical group and the purchase of large quantities of explosives in several states led to the indictment and conviction of someone else. But at the trial enough was said to convince Dale and several psychiatrists that something was seriously wrong with him. He was voluntarily committed to an institution, where Dr. Howard Rumming spent hours in conversation with Dale. Trying to understand his fixation on breathing as a sign of coming death.

"I'm sane in every other way aren't I, Doctor," Dale asked again and again. And repeatedly the doctor answered, "What is sanity? Who has it? How can I know?"

Often Dale was tempted to ask him what the hell he was doing trying to help the mentally deranged when he did not know what sanity was, what condition he was trying to bring the insane to achieve, but he never did.

Instead he found that the mental hospital was not an unpleasant place to be. It was a private institution and a lot of money range there were voluntary commitments which meant that the conditions had to remain excellent. It was one of the things that made Dale grateful for his father's wealth. In the hospital he was safe. The only contact with the outside world was the television. Gradually he met people and became attached to them in the hospital. Viewed to relax, to lose his obsession with breathing to stop listening so intently for the sound of inflation and exhalation the way that different people's breathing rhythms fit together. Gradually he began to be his old, drastical self.

"I'm nearly cured." Doctor Dale announced one day in the middle of a game of backgammon.

"The doctor signed, 'I know it, Dale. I have to admit it—I'm disappointed. Not in your case. You understand. It's just that you've been a breath of fresh air you should par don the expression.' They both laughed a little. 'I get so tired of middle-aged women with fashionable nerves breakdowns or middle crises.'

Dale wasgammoned—the dice were all against him. But he took it well knowing that next time he was quite likely to win handily—he usually did. Then he and Dr. Rumming got up from their table and walked toward the front of the recreation room, where the television program had been interrupted by a special news bulletin. The people around the television looked disturbed, news was never allowed on the hospital television and only a bulletin like this could creep in. Dr. Rumming was over to the set, intending to turn it off, but the words coming over the air were so alarming that he could not bear himself away.

"from satellites fully capable of destroying every major city in the United States. The President was furnished with a list of fifty-four cities targeted by the orbiting missiles. One of these, said the communication, will be destroyed immediately to show that the threat is serious and will be carried out. Civil Defense authorities have been notified, and citizens of the fifty-four cities will be on standby for immediate evacuation." There followed the normal parade of special reports and deep background, but it was patently clear that the reports were all afraid.

Dale's mind could not stay on the program however because he was distracted by something far more compelling. Everyone in the room was breathing in perfect unison including Dale. He tried to break out of the rhythm and couldn't.

"It's just my fear. Dale thought. Just the broadcast making me think that I hear the breathing."

A Denver newsman came on the air then overriding the network broadcast. "Denver ladies and gentlemen is one of the targeted cities. The city has asked us to inform you that orderly evacuation is to begin immediately. Obey all traffic laws and drive east from the city if you live in the following neighborhoods."

Then the newswoman stopped and breathing heavily listened to something coming through his earphone.

The newswoman was breathing in perfect unison with all the people in the room.

"Dale," Dr. Rumming said. Dale only breathed. Feeling death posed above him in the sky.

"Dale, can you hear the breathing? Dale heard the breathing."

The newswoman spoke again, Denver is definitely the target. The missiles have already been launched. Please leave immediately. Do not stop for any reason. It is estimated that we have less than—less than three minutes My God," he said, and got up from his chair breathing heavily running out of the room. The camera had turned over to the set because no one tuned any equipment off in the station—the tube was still on showing the local news set the empty chairs in the weather map.

"We can't get out in time," Dr. Rumming said to the inmates in the room. "We're near the center of Denver. Our only hope is to lie on the floor. Try to get under tables and chairs as much as possible." The inmates terrified complied with the voice of authority.

So much for my cure," Dale said, his words stammering. Rumming managed a half smile. They lay together in the middle of the floor leaving the furniture for everyone else because they knew that the furniture would do no good at all.

"You definitely don't belong here," Rumming told him. "I never met a saner man in all my life.

Dale was distracted however instead of his impending death he thought of Colly and Brian in their coffin. He imagined him being swept away in a huge wind, and the coffin being ashed immediately in the white explosion from the sky. The banter is coming down at last. Dale thought and I will be with them as completely as it is possible to be. He thought of Brian learning to walk, crying when he fell. Remembered Colly saying, "Don't pick him up every time he cries, or he'll just learn that crying gets results." And for three days Dale had listened to Brian cry and cry and never offered a hand to help the boy. Brian learned to walk quite well and quickly. But now suddenly Dale felt again that irresistible impulse to pick Brian up to put his son's pathetically red and weeping face on his shoulder to say, "That's all right. Daddy's holding you."

"That's all right. Daddy's holding you. Dale said aloud softly. Then there was a flash of white so bright that it could be seen as easily through the walls as through the window for there were no walls and all the breath was drawn out of their bodies at once. Their voices robbed from them so suddenly that they all involuntarily shouted and then, forever were silent. Their shouts were taken up in a violent wind that swept the sound away from every throat in perfect unison upward into the clouds forming over what had once been Denver.

And in the last moment as the shout was drawn from his lungs and the heat took his eyes out of his face Dale realized that despite all his foreknowledge the only life he had ever saved was that of a maître d'hôtel whose life to Dale didn't mean a thing."

72 OMNI
We have been a nation of new ideas, new technology, new social experiments. Are we going to be a part of the high frontier, or sit back and watch others do it?

Ever since Columbus made the rounds of potential royal backers, the exploration of new worlds has required as much persuasive salesmanship as it historied navigation. Few men in that tradition have been as articulate as Professor Gerard K. O'Neill, a high-energy physicist who has become the most prominent advocate of a wide-open future in space. (O'Neill nearly became an astronaut—he was a finalist when the recruitment of civilian scientists by NASA was halted in 1967.)

In both scientific and popular articles, in lectures and on television talk shows, and in his successful book The High Frontier (William Morrow 1977; Bantam 1978) O'Neill has argued that the unlimited energy (produced by solar cells and mirrors) and materials (stowed on the moon and the asteroids) offered by space could make possible a new and attractive life for thousands or even millions of people. What distinguishes his proposals from most earlier ideas is that the space habitats he envisions would not be metal-walled, compartmentalized "space stations" but large open environments with soil and greenery even with internal skylights in which clouds could float in reflected sunshine.

O'Neill's central point is not a matter of technology but one of basic physics: that the many stable orbital regions in the earth-moon system are "high ground" in terms of potential energy. In O'Neill's view the established pattern of earth-based space exploration by launching costly chemical rockets should be replaced as soon as possible by permanent habitation and large-scale manufacturing in space, where energy is effectively unlimited and the only gravitational forces would be ones created deliberately by rotating the habitats.

It was basic physics, too, that led to O'Neill's major contribution as an experimental physicist: the particle-storage ring. As any high-school physics student knows, a head-on collision between two moving objects yields more energy than the impact of a moving object against a stationary target. In 1956 O'Neill and several others independently worked out a method to bring two beams of
electrons into collision. After developing a needed taste-acting magnet with Princeton student V. Korenman, O'Neill brought a workable design to Wolfgang Panofsky of Stanford University. The storage rings yielded their first data in 1965, and the rings have served as models for many other rings built since then.

In 1969, beginning with an exploratory seminar for a few of his students, O'Neill started to develop the ideas that would grow into The High Frontier. Although it took five years to find a forum in print, O'Neill does not regret the lag. “It gave people a chance to think about the possibilities,” he says, “and to make their own assessments. People would raise questions, and I’d go off and think about them and find solutions, and that was worthwhile. The ideas kept evolving all along, but there’s nothing I regret or would like to retract.”

In 1974 space colonizers began to draw national attention after a small conference on Princeton. Since then O'Neill has divided his time as it has become apparent that even in the supposedly antitechnological 1970s his ideas have revived and expanded public interest in space.

Today he continues to combine his teaching with his vision of the future. Enough of his undergraduate and graduate students are working on projects connected with space colonization to make his office the center of a cottage industry. At home his wife Tasha manages the affairs of the Space Studies Institute. In spare moments O'Neill works on a forthcoming graduate physics textbook and even finds time to relax—by flying a lightplane to workshops and lecture dates, and Washington D.C.

The pace clearly agrees with him. At fifty-two he appears a dozen years younger, and he discusses space colonization with as much enthusiasm and animation as if the idea had just taken hold of him. While the rest of us may have to look to space for unlimited energy, Gerard O'Neill displays it here and now as he points the way. Professor O'Neill was interviewed for Omni by contributing editor Monte Davis.

**Omni** Your proposals have opened a debate that goes far beyond their technical and economic aspects. Some argue that the “high frontier” will bring more of the same aggressive, exploitative behavior that has already gotten us into trouble. Others maintain that it represents an inevitable and desirable next step for humanity. Have you surprised you to see this polarization?

O'Neill: No. Because the motives that originally led me into the whole business were largely humanitarian. As the Club of Rome’s limits-to-growth study for example, concluded that because of man-made physical facts we would have to abandon the development of greater individual freedom and accept a much more regulated life, with diminished options—just for us, but for our children and their children and so on—forever. I reacted to that with dismay and shock. It sounded like a heli of a world to leave to my kids.

**Omni** Then the social implications were in your mind from the beginning?

O'Neill: Yes. The first drafts of my original article which appeared in Physics Today in 1974 after five years and eight drafts were much more concerned with the human aspects. Subsequent drafts became more technical in order to answer the technical questions and objections that were raised along the way.

**Omni** How do you answer the charge that space colonization is a “technological fix,” a cop out that evades dealing with our problems on Earth?

O'Neill: You make solution of any problem more difficult when you constrain the range of solutions you’re willing to consider. By opening up the option tree you find new possibilities, such as moving fuel burning industries off the earth into space where they can run on clean solar energy. Certainly over the last few years we’ve recoupled from high-technology plans—indeed from any large-scale initiatives that might have profound consequences because we’ve felt very acutely the sense of original sin that grew out of the Vietnam War. But that war was politically motivated—technologically motivated.

**Omni** Even among your supporters there are widely different reasons for enthusiasm about the high frontier and widely different visions of the future it could lead to. Are all those reasons, all those visions, really compatible?

O'Neill: I’m sure there’s no single, monolithic idea of how it should go. In my book I took pains to make clear how different my idea is from “classical” utopias in that I don’t prescribe how people should make use of this opportunity. If there are many reasons, many visions—fine—that’s just what I had in mind. I know an avowed Maoist who says that space colonization is the logical extension of Mao’s “decentralization of authority.” Then there are people from the Libertarian party who say it’s the ultimate in individualism, then there are those with a traditional, large-scale capitalist outlook and so on incompatible? It doesn’t disturb me at all.

**Omni** But doesn’t the scale of the proposals work against variety? Your Island Three example is twenty miles long and may house ten million people. Many people think as Freeman Dyson does (Omni Interview October 1978) that any project that involves many billions of dollars and inevitable large-scale organization, can’t avoid having a great deal of regimentation imposed on it.

O'Neill: The question of scale is one that only history will decide. The most difficult thing to do in space is simply to get there, to overcome a gravitational potential equivalent to that of a two-thousand-mile-high mountain. That means there’s a minimum step a “quantum jump” that you have to make. People look at the difficulties of that step—and they are very great difficulties, requiring a great technical effort—and they associate everything afterwards with that scale of effort. But what I have in mind in the long term is that very small groups, even a few families, could be self-supporting and independent.

In fact there’s an interesting diseconomy of scale in building space habitats. Beyond the range of fifty thousand to a hundred thousand inhabitants, the vessels become less and less efficient in terms of structural mass. After that you’d be better off technically—as well as in terms of social variety—building a number of independent habitats rather than one big one.

**Omni** What is the minimum scale for the first step? What kind of industrial base do you need to collect and process the lunar raw material to send it up and to start building space habitats?

O'Neill: That’s a question we’ve been addressing recently in a series of workshops funded by NASA and our own Space Studies Institute—SSI helped out because of the decay situation at NASA. Besides Brian O’Leary and myself from Princeton the workshops included Dave Criswell of the Lunar and Planetary Institute, Bob Waldrin, an ex-metallurgist Jim Arnold of the University of California at San Diego, an expert on lunar geology; and Charley Rosen, one of the world’s leading authorities on practical automation. He built up the Stanford Research Institute group which is responsible for a lot of the industrial robots working in factories today.

We concluded that a setup to process lunar materials into pure elements could be built on a scale small enough to fit in the Shuttle payload bay. A plant that size could produce two thousand tons a year, and it could operate unattended for long periods. Waldrin and Rosen found that the only components subject to wearing out would be containers for the higher-temperature chemical reactions—and those could be replaced from spares by standard hard and arm industrial robots in fixed mountings. Our overall conclusion was that you could build the first quantum jump to a minimum productive level with less than twenty shuttle launches. To reach that level, only a few people would be needed mainly for installation and occasional maintenance.

**Omni** It’s hard to imagine so few people building a chemical-processing plant or a mass driver.

O'Neill: The essential notion is that nearly everything is assembled and tested on Earth before it’s taken up in units sized to fit the Shuttle’s cargo bay. There’d be a shakedown period first, mainly to check the pressure and the vacuum joints. On the moon you’d connect the preprocessed plant to its solar-cell power supply,
O'Neill: What about cost?

O'Neill: For the first step? Well, as I said, there's no denying that it's a big step I can't imagine doing it for less than billions of dollars. Quite possibly that's why we could do it for under ten billion which puts it on the scale of something like the Alaska pipeline. That's not out of reach by an industrial consortium or even by a large group of individuals that gets contributions from all over the world.

O'Neill: To get that kind of commitment from individuals, you'd need a program very different from Apollo—not that it wasn't exciting to see human beings on the moon, but the astronauts were so few and so specially prepared that it was hard to identify with them.

O'Neill: Yes, many people have concluded that it's a pity the Apollo program didn't develop more logically. It was highly visible and goal-oriented but essentially one-shot. What was there to do for an encore? If we had had space manufacturing and habitation in mind from the start, we'd have gone about it very differently—and it could well be happening now because it would have a continuing direction and purpose.

O'Neill: A moment ago, you spoke of the "dicey situation" at NASA. How does that look?

O'Neill: Omni. NASA concluded this year that it's done enough reviews to verify the economic value of using nonterrestrial materials and to identify the technologies for it that should be developed, so those verification studies have been terminated. But no action's been taken yet to develop such identified technologies as chemical processing. The mass driver is in a separate category. Research continues on it because it has application as a general-purpose reaction engine in space. When I was asked after a lecture what NASA's plans were for a return to the moon by Americans, I had to say, none until at least the year 2020—fifty years after Apollo. At that, the questioner came back with "Then we're going to need passports when we land there!"

O'Neill: The President's chief science adviser, Frank Press, has told us [Omni interview June 1979] that "the new frontier in space is not going to be one big, glamorous, expensive thing: it is going to be many, many projects of moderate scale. That certainly seems to exclude your proposals entirely.

O'Neill: That's consistent with the President's statement last October. But I found that everywhere people are excited only by the larger vision of a wide open future on the new frontier in space. It will be interesting to see whether Mr. Carter perceives and successfully identifies with that mood, or whether it will be some later president who does so.

O'Neill: In an era of lowered expectations—however short it may be—are people like Press in a strong position? They can say they're defending the taxpayers' money against wild-eyed dreamers concentrating on immediate goals with immediate payoffs, and so on.

O'Neill: Experience has shown that when the payoff is near term, private industry can do a better job than government. But government does have a unique role that it does fill and that is to support research toward the development of whole new industries that are going to give millions of new jobs in ten or twenty years. Private companies can't fill that role, because it's beyond their time horizon. The Japanese do understand that difference. Perhaps one of the main reasons they're obscuring us economically.

O'Neill: Governor Brown of California is known for both a conservative view of government spending and an enthusiastic advocacy of space activities. How does that combination strike you?

O'Neill: I don't want to put words in his mouth, but it seems to me that those viewpoints are entirely compatible. If the country is in economic difficulties, we ought to be above all, concerned with how to make more money—to create new wealth and productivity. Before you have any money either to save or to redistribute, you've got to go out and make it. My own feeling is that if there's a dollar that's not desperately needed to keep people from starving, we should be spending it in a way that will earn back ten more dollars. Then we'll have seven dollars to spend on improving the human condition. Those for this or that and still have our original dollar.

O'Neill: Then you think that space manufacturing and habitation can be productive on a far larger scale than the "spin-offs" we received in the 1960s?

O'Neill: Much more so. We have a high standard of living and high labor costs and in an increasingly technological world we have only a few years in any new field before others begin selling our innovations back to us at prices we can't match. That's happened with home electronics and a lot of other things, and it may happen soon with computers. Space offers a peaceful new development in which we could play a leading role. What else do we have to offset what some economists predict will be a one-hundred-billion-dollar trade deficit by 1985?

O'Neill: What kinds of payoff do you foresee? It's not likely to be worthwhile to ship either raw material or finished products down that four thousand-mile-high mountain.

O'Neill: One study by the Aerospace Corporation a couple of years ago concluded that over a number of years there will be good reasons to have several tens of continued on page 113.
They were a wild, turbulent race of savages, and studying them led to danger, madness.

THE EMPATH AND THE SAVAGES

BY JOHN MORRESSY

The Anpreene observed the rough expanse of human history with cold curiosity. They were intrigued by a race so heterogeneous and so volatile, and fascinated by a planet so perfectly suited to the projected needs of their own people. Water was abundant on this world, and the atmosphere was rich. Wherever this world differed from the home worlds of the Domination the difference favored the new planet. Its dominant race was energetic, with some physical resemblance to the earlier, smaller stages of Anpreene development. It appeared strong enough to provide useful servants while not sufficiently durable or intelligent to be a source of danger. The residents of this pleasant planet were brisk, scampering little creatures who lived their lives at an incredibly accelerated pace. Study of them promised to be interesting.

The Anpreene were a long-lived people, their ways were methodical and unhurried. They investigated every action and its possible consequences with great care and did not undertake a conquest lightly. Their race disliked surprises. Concealed from human perception, they narrowed the focus of their instruments, closing in on a suitable objective. Earthly years whirled by beneath them and earthly creatures scurried through their little lifetimes. The selector focused on a sequence of events and probabilities. It locked...
on a single person and a single instant. The Empath and the Conceptualizers took their places around the selector locus, and the Assessors gathered to observe.

The selector hummed. The Anpreene ship, the surrounding space, the narrow gathering beam that reached downward to the robed figure, and the heap of shimmering green wood were all instantaneously plucked from the weave of space and time and held suspended in an otherwhere and otherwhen. The first specimen was drawn aboard the ship.

It was a female of the earthly species. She collapsed in a heap on the base of the focal area. Her wrenched legs and lacerated feet unable to support her weight. Raising herself on one bristled, bloody hand she lifted the other high and cried:

"Praise God! Praise to Thy name, O Lord! Thou hast delivered Thy servant from the wrath of the enemy!"

She attempted to rise but could not. She began to recount her sufferings and told of torments inflicted on her and others for reasons the Anpreene Conceptualizers had difficulty assimilating. Her speech grew wild and incoherent. They let her rant on uninterrupted, until she slumped forward and was silent.

The creature believes that she is in the presence of a superior being from her racial myth. The Conceptualizers transmitted: "This myth appears to hold great significance for these creatures. We suggest immediate action in accordance with her belief."

In a gentle, melodious human voice, the Empath asked: "Why hast thou suffered so, my daughter?"

She raised her head and gazed upon the towering white-clad figure of the Anpreene, shining with a subdued golden aura." I would not deny Thee! Not even on the rack would I deny my God and Savior and His one true faith. Thou hast plucked me from the flames!"

The Empath searched deep in her tortured mind for the proper terms in which to couch its response. It stretched forth a pale hand in a gesture of benediction: "My child, the cup cannot pass. This is but a foretaste of the joy that awaits when thou hast passed through the flame. Be steadfast," the Empath said.

A tear of joy came into the hollow haunted eyes and then the woman said. "Thou art just in all things, Lord. Thy will be done."

The selector hummed once again and the woman vanished, returning to her pyre within a nanosecond of her departure. Her scream as the flames rose around her was drowned out by the rumble of the fire and the cries of the crowd.

From that time and place the selector took a total of twenty-eight specimens, nailing each one from the instant before death—when the blade was at the nape of the neck—until the last instant before the mouth was closed on the throat or the rising smoke or flame brought an end to long agony. The selector could not erase memories, but it could take specimens who would never have the opportunity to speak those memories to others of their species.

All those from that period reacted in a similar manner. When the selector had hurried the last one back to his destined end on the block, the Anpreene returned their ship and all aboard it to normal time and space and turned to the next stage of their presecting duties.

For the Empath alone there was no task awaiting. The Empath was released at once to enter the transept-like area called pentrecane by the Anpreene which restored body and mind after close communion with an alien identity. Deprived of pentrecane, an Empath would be overwhelmed by the sheer vital force of an intruding presence, the alien manner and thinking process would be ineradicable.

While the Empath restored its mental and physical integrity, the others aboard the Anpreene vessel were busy. Conceptualizers structured and collated their findings. Assessors evaluated them, and all the while the selector replenished its power for the next gathering of specimens.

After long deliberation the Assessors concluded that the physical heterogeneity of this race had directed and drastically influenced its social development. Unlike the Anpreene, who were a single people with a single purpose, these creatures were fragmented to the point of chaos. Their differences appeared to be deep seated and the cause of great cruelty. It remained to be determined whether this fragmentation was a phase on the race's way to civilization or a racial characteristic inherent in all races.

The Assessors commended, the Empath and the Conceptualizers prepared themselves for the next contact. The earth spun more years, the ship moved to another part of the planet, and the instruments began their search once more.

This time the first specimen was a male. He blinked, looked hard at the Empath, and then smiled sardonically. "A clever trick I admit, whispering me here just as I expect to die," he said in a tongue quite different from that of the first group. "Tell me, where are the rest of the tribunal? Where are the fat priests and the nobles who dine on the people's flesh? Are they hiding somewhere cowering in fear of the words of a condemned man?"

He looked at the featureless walls, then shook a fist and cried in a thundering voice: "Well may you hide from those words you butcher! But speak where you will, there will be no place to give you refuge! You will kill me, but my words will live and rouse the people to action. We will burn your churches. Burn your castles, burn your tax rolls, and feed the flame with your bloated guts. Oh yes, my lords and masters, the people will rise. They've long been patient, but their patience is coming to an end. Does my lady wish a new pendant to grace her white bosom? Squeeze the blood from a thousand peasants, and she shall have her bangle. Does my lord desire a new team for his carriage? Take the food from a thousand hungry children and give my lord his horses. Or perhaps my lord the archbishop."

He spoke on in a torrent of words and angry gestures, while the Conceptualizers fitted his speech into the cultural patterns the ship's instruments had gathered and the Empath proposed his mind for a framework in which to structure communication when the Conceptualizers advised it. But the Conceptualizers concluded:

"This creature believes his function is the repeated and faceless expression of a fixed belief-structure. Productive communication extremely unlikely. We recommend no exchange."

When the specimen had completed his speech he was returned whence he had come. The second specimen said much the same as the first, but the third said the exact opposite of the first two, though he used many of the same terms and concepts in all the selector took nineteen specimens from this period, and the Assessors found them to represent eleven distinct and irascible views of the social reality.

Deliberation on these specimens resulted in a strong reaffirmation of the original conclusion and created much confusion among the Assessors. A race so utterly dissipated as to border on total individualism was all but unimaginable to the Anpreene. Such a race might be spoken of in theory but in existence it could not long survive. Survival requires unity, and unity ensures survival. This was the basic law of the Anpreene Domination; the fundamental principle governing the lives and thoughts of twelve planets and sixteen colonies, and it was beyond question.

And yet this race not only survived its fragmentation but appeared to thrive on it. During the interval—brief by Anpreene standards—in which the Acquirers were gathering information and the Zealots were organizing it for the next mission of the Conceptualizers and the Empath the population of the planet increased twen-
"Well, it seems to be all right in theory, but it's going to take a little more work."
THE BIONIC BRAIN

Half protoplasm, half circuitry, it's due sooner than we think

BY G. HARRY STINE

Lee's report was due the next day. Normally Cy did all his market study and got the writing finished that soon. Cy, a "cyborgic interface device," had cost far more than a home computer terminal would have. Everyone hooked into the Library of Congress and the New York Public Library, but the intelligence amplifier was well worth the price. It responded directly to Lee's thoughts, casting up information and taking dictation as quickly as he could think. The work was not interrupted by talking to the computer or by typing on a keyboard. In fact, when Lee had trouble thinking, Cy would often help organize his ideas into coherent paragraphs.

The executive settled back in the interface couch and dialed the cap. It took only minor positioning to fit the session into flash. Then he closed his eyes and pressed the switch built into the rest seat.

"Good morning, Lee! What do we work on today?" asked Cy's image, projected directly into Lee's brain and programmed to appear as a synthesis of his favorite college professors and respected business leaders. "The chief wants a preliminary market analysis for mining the Jovian satellites, emphasis on Ganymede." Lee explained. "What have you got?"

"Everything the Space Industrialization Administration has released to date, including some reports that just came in this morning. May I suggest you add the latest data on mining the cloud tops of Jupiter with scoop ships. Here's a rundown..."
After what seemed like hours, Lee stopped the summary so he could tape his report. As he dictated, the computer image occasionally asked whether he wanted to rephrase something. Then Cy projected a series of graphs and color photos from the Jovian system onto Lee's visual cortex. Lee selected several, added captions, and ordered, "Okay, put that in the office and let's call it a day."

He checked the clock. It told him he had been linked to Cy for 28 minutes. A good day's work.

Will electronic computers replace the human brain? Will computer directed robots make men obsolete? Or will computers take over so completely that human beings are themselves turned into robots? As electronic computer circuits get smaller and more powerful, robots begin to replace human beings in repetitive clerical tasks and manual labor. Many people have come to believe that these questions have already been answered and that the human race is coming away with the short end of the stick.

They are wrong. Human beings and computers should not be viewed as antagonists. They're not. The electronic computer is a tool developed by humans that happens to be smaller and faster than the tools it has replaced—pencil and paper.

To date, the computer's power has been applied only to complex calculations or to simple repetitive chores. That will not always be so. We will eventually build the first intelligence amplifier, a blend of computer and brain, optimizing both. We will link the brain and nervous system directly to the electronic computer, without the cumbersome keyboards, printers and TV displays we use today. The computer will become not an antagonist but the ultimate extension of our reasoning, memory, and computational ability.

We are closer to building an intelligence amplifier than most people realize. A primitive way to feed information from the human nervous system to a computer has already been worked out, and we may also have the technology to send it from a computer to the brain. It remains only to take these laboratory demonstrations and put them together in the first "interface device".

CRYS TALS VS. COLLOIDS

That is not to say that all the technical details have been resolved. Enormous problems remain many of them stemming from the great differences between the two kinds of systems we are trying to join. The electronic computer is made up of crystal-like, solid-state semiconductors. The atoms in a crystal are arranged in rigid arrays known as lattices. The interatomic forces that hold the lattice together usually make crystalline materials very strong. Most metals, for example, are crystalline.

The human nervous system, in contrast, is made of colloids—amorphous, often jellylike materials in which atoms and large molecules are suspended at random. There is no lattice structure in a colloid.

Electronic computers carry information as a flow of electrons through the crystal lattice. Crystalline "brains" are therefore very fast. The human brain codes its information as a relatively slow flow of atoms and molecules through the colloidal mass. Our nerves use two types of data carriers. Large molecules, called neurotransmitters, that flow across the synapse, or gap between nerve cells, and ions, charged atoms that move along the nerve to generate an electrical impulse.

There is one important similarity in the way crystalline and colloidal systems transmit information. Both seem to operate by a binary code. Data in a computer are broken into "bits." An electronic circuit is switched on or off, and information, no matter how complex, is recorded in this two-bit code. Similarly, a neuron either fires an electrical impulse or does not. There are no in-betweens.

Yet crystalline and colloidal brains process information very differently because of their contrasting structures. Because nerve cells operate by the movement of slow atoms and molecules, their reaction times are measured in milliseconds or thousands of a second. The fastest nerve cells carry electrical impulses at only 20 meters or so per second. The modern crystalline computer operates in picoseconds or thousand-billionths of a second. This is a difference of a billion times or more orders of magnitude. (This is why a modern computer can operate in a "time-sharing" mode: in which hundreds of humans are working with it at once.)

From a human viewpoint a computer operates instantaneously. Push the button, and the answer appears even though the computer has gone through over a million calculations. It is the sheer speed of crystalline systems that makes them so much faster than biology, which by their very nature act slower even though they are vastly more complex than a computer.

For a computer talking with a human being takes a long time. Even with a direct link to the human nervous system, a computer must send its information a billion times slower than it is able to then wait the equivalent of six years for a reply! If a computer could feel emotions, it would probably be exceedingly bored.

MES ThE M IN DS

Compensating for this speed difference is one of the most important technical problems in creating an intelligence amplifier. Engineers have spent years speeding up electronic circuits. Computers operate so quickly that the need to wait while an electronic system moves a few thousandths of a centimeter is beginning to delay their operations.

The state of the art is rapidly approaching the point where the movement of a single electron through the crystal lattice will be enough to transfer a bit of information.

Now somehow we must either slow down the computer's crystalline system or speed up the human colloidal system. Fortunately the crystalline computer presents no problem. Only those circuits that communicate directly with our nervous system must be adapted. After all, this is what the colloidal system does. Our autonomic nervous system doesn't interface with the consciousness and the thinking circuits until we have become aware of our heartbeat or other automatic functions.

The system would be more efficient though, if people could absorb information more quickly. The brain's complexity may make this impossible. Unlike computers which can perform only one operation at a time, the brain compensates for its slow response by splitting up nerve signals and sending them over many channels or at once, then reconverting them at the receiving end. This technique, electronics engineers call multichanneling, and they use it in sophisticated stereo and communications equipment—lets the colloidal brain carry out a vast number of operations simultaneously.

Thanks to multiplexing, we may be able to speed our information intake by a factor of ten or more with special training—once we learn enough about human thought processes. We may actually think much faster than simplistic measurements of neuron response suggest. We already know that psychological time can be quite different from physical time.

This whole area of psychological time, human thought processes, and the multichannel nature of our brain is ripe for serious investigation. It is a real pity that psychedelic drugs came along almost simultaneously with one of our culture's periodic swings into Dionysian romanticism. These substances could have become an important tool for this research. They still may once the furore dies down. The Oriental shaman may have learned to control psychological time ages ago. If we cannot gather good solid data in the area from high trips, and mysticism perhaps we can be led to it by the distrusted computer and intelligence amplifier.

All this assumes of course that we can actually link the colloidal and crystalline...
How an army of lizards missed the train

A new pictoral novel by Harry Harrison and Jim Burns dramatizes the sense of experimentation publishers are now bringing to science fiction.

Planet Story opens with an eccentric space commander who decides that the fragile planet Sabinus is an ideal spot to pursue his hobby driving antique locomotives. A monstrous machine is dispatched to lay track indiscriminately over the tiny planet's surface.

The mothership descends on Sabinus to off-load a gold-plated locomotive. The commander's entourage boards the train and rolls off down computer-built tracks. It becomes immediately clear to everyone on board that Sabinus is not uninhabited. Lizardlike aliens appear everywhere. Their outrage at the earthling assault is a call to battle, but their puny spears are no match for the speeding train.

Having leveled one alien enclave, the train stops on the far side of a simulated London Bridge. The commander asserts that no manner of lizardoid "greenie" will disrupt his penchant for rolling and railing.

Illustrations from: "Planet Story" by Jim Burns and Harry Harrison. Published in the U.S. by Abel Publishers, Inc. and in the U.K. by Century Publishing, Ltd.
Lasers burned to the accompaniment of shrill alien screams. Depressed by their newest failure, the lizards withdrew.

The commander’s ruminations are quickly interrupted by a squadron of lizardoids straddling pterodactyl-like beasts. Their armament, to everyone’s astonishment, is feces. “They’re divecrapping us!” screams the commander, convinced that the aliens are harmless. The train inches toward the next obstacle—a wall built across the tracks. From behind it the lizardoids pelt the locomotive with boulders. Short, powerful bursts of laser are the train’s response. The aliens are gone long before their wall is
Supertrack cut the lizardoid city exactly in two, which is why the aliens had prepared a pointed welcome.

The train rolls on to the outskirts of what appears to be the capital of lizarddom. Awaiting the locomotive is a giant spike set on the tracks, there to impale the oncoming earthlings. The time has come to parley with these aliens. Talking through a translator, the two sides reach an agreement. The train will go free if the humans help the lizardoids defeat the alien's mortal enemy, a gaggle of crustaceans. The lizardoids prepare to scout enemy lines in a spy balloon. Several humans go along.
As soon as those lizardoids grab us, they'll nationalize your railroad and you'll follow us through the kitchen.

The balloon veers too close to an array of AA batteries and is shot down. In the melee that follows, our human heroine is captured and carried away to the lobster king. Far too smart for the crusty monarch, she quickly takes him prisoner. He offers to deal. His "people" are in trouble. The lizardoids want to eat them. Humans, he assures the commander, will be next. Convincing the commander, the heroine agrees to dup the lizardoids into following his train away from the defense/ess lobsters. Aware only at the last minute of this trickery, the lizard hordes charge after the train—but the locomotive is safe. It chugs off into the final episode of Plane! Story, brought to you this fall by A&W Publishers (New York).
Athlete-inventors prove the human body can break the national 65-mph speed limit

SUPERCYCLES

BY CHESTER R. KYLE

The bicycle has always had considerable appeal to those who love clean and silent transportation. The bike is healthy and nonpolluting, uses no fossil fuels—certainly no nuclear energy—and doesn't even require solar panels. But, car lovers say—and this group includes the majority of the American people—the bicycle is slow, and when it rains you get wet. Well, that's simply no longer true. Thanks to a group of inventors who race their strange unmotorized vehicles every spring at the International Human Powered Speed Championships, the bicycle is now capable of hitting the national speed limit of 65 mph. And that, you may recall, is as fast as any automobile is supposed to be driven.

This augurs well for the day when our oil wells go dry for there may be a beautiful, streamlined bicycle waiting for us that anyone in reasonable condition will be able to pedal along at commuting speeds, or even faster. And this bike of the future will most likely be enclosed—not so much to protect the rider against the rain as to help the bike cut through the wind.

The creative people who are responsible for this renaissance in bicycle design will be found at their best in musty laboratories but on the various California drag strips and racetracks where the Human Powered Speed Championships are held. This bizarre bicycle race is a carnival for inventors. It has only one important rule: Race vehicles must be powered strictly by humans, with no help from gravity, wind, or stored energy of any kind. Other than that, anything that goes, goes. Since the inception of the race in 1975, more than 100 vehicles have been specially built for the race, and usually they don't bear even a faint resemblance to one another. Some are pedaled by a rider lying on his belly or on his back. Some cost $40 with a trade-in of used bicycle parts; others cost over...
$3,000. The only thing they all have in common is that they are all trying to achieve the same goal: to reach the highest speed that humans are capable of under their own power.

One approach was a superbly streamlined bicycle called White Lightning, built by automotive engineering students from Northrup University in southern California. Over five miles (eight tenths) long, with a 0.6 meter (two feet) wide, one meter (three feet) tall and weighing 32 kilograms (70 pounds), the vehicle was powered by two riders in reclining position. They were wholly enclosed in a light streamlined shell made of neoprene, material and fiberglass. In 1977 the machine was clocked at $4.5 mph, with a total power output of less than 1.5 horsepower. This makes the most efficient vehicle ever invented and the one with the smallest energy consumption per mile per pound loaded at that speed.

To reach North Americans or Europeans this accomplishment might not seem spectacular. 65 mph is not fast—once-sea vehi-
cles every day that travel faster far. In fact, some people think that an ordinary racing bicycle is capable of 55 mph. This is plainly impossible on the level with no wind. It would take over three horsepower to drive a bicycle at 55 mph, which no human being is capable of achieving. The world's greatest cycle athlete was clocked at a dismally slow 42 mph over 200 meters with a flying start. Racing tandems have been timed at 45 mph but no one has yet approached 50 mph on an ordinary bicycle without help. When I say "without help." I mean that I have observed that cyclists have exceeded 55 mph on a steep decline or hidden behind motorized vehicles that nearly enclose the bicycle and shield them from all wind resistance. The record for a bicycle following a tractor is 140 mph, set by Alan Abbott on the Bonneville salt flats. But this is a different story entirely. The cyclist has only to pedal against rolling friction, which is a small fraction of the wind resistance. (The Abbott has since become a pioneer of unpaved bicycle racing as well—as you'll see later.)

Overcoming wind resistance is the secret to high speed and efficiency on a bicycle. Over 15 mph wind drag is more than 80 percent of the mechanical power required to operate the motor of a Bicycle. One might go slightly faster by improving such things as the tires, the bearings, the mechanical drive mechanism, but by improving the aerodynamic shape of the bicycle and increasing the drag force on a bicycle can easily be cut in half.

Anyone putting his hand out of an automobile window at 65 mph can feel the wind has tremendous force. If you place your hand palm forward, your hand acts like an aileron and creates a huge drag, whereas turned parallel to the ground your hand acts like ailerons and creates lift. It is a fraction of the resistance. Sky divers use wind to slow their descent through the sky if they assume a clean's posture with head and arms downward, they can drop like a bomb at 200 mph, or by taking a spread-eagle position and wearing floating clothes, they can slow down to under 100 mph.

Wind drag can be cut in several ways, almost all of which are used by the participants in the Human Powered Speed Championships. The most obvious way is to lower the front area facing the wind. Bicycle riders, skiers, skaters, and skiers all use this technique. They bend over in a crouched position. In cycling it is possible to reduce the frontal area even more dramatically by putting a specially designed vehicle while in the prone or supine position. Besides reducing the frontal area, the body position is also more streamlined, thus cutting wind resistance even further. Another obvious way to lower wind motion is to smooth the front surfaces. Cyclists, skiers, and skaters wear lightweight costumes that are as smooth as silk. And high-speed aircraft have polished surfaces with no protrusions to ruffle the wind. The most effective of all methods, however, is streamlining. The key to building high-speed land vehicles is to avoid wasting energy by setting up the air at turbulent velocities. Air should be left as nearly undisturbed as possible. This is the function of the streamliner, and also the reason for the streamlined cars in the Speed Championships.

An ordinary bicycle rider has a body like the hard wind, and almost any device that helps smooth the airflow around his body will help. Some devices are simple front windshields; others are based on aerofoil wing shapes that have been wind-tunnel-tested and have completely enclosed the riders and machines until nothing is visible, not even the wheels. The simple front fairings may be mounted quickly on ordinary bicycles, and they are now commercially available. They are very popular with workers because they increase the wind-drift factor enormously. They also reduce the overall drag by about 10 percent, depending upon the type. The more elaborate full fairings cut the overall resistance by almost 70 percent. Higher speeds are possible. Speed increases from 10 to 15 mph are common when streamlining is used. Vehicles can now be built that the average person in good health could pedal an hour or more at 25 mph on level ground with no wind. This has been clearly proved at the Speed Championships. Riders over fifty years old have reached 20 mph, and Ed "Foxy Grandpa" Delano, of California, seventy-two years old, went 34 mph in 1977.

M s. D i n g e n r n b u l l s

How did all this begin? In 1974 mechanical engineers students Delano Crawford and John Skarin, of Northern California State College, challenged me to compete in the Speed Championships. With me to set out to measure the rolling resistance of various types of bicycle tires. We did this by

This long, enclosed vehicle at top (No. 55) was propelled to a top speed of 50.72 mph by two cyclists—front rider in orange pants, rear rider in blue. Aerodynamic No. 2 vehicle at left was designed by John Skarin and built by students. Drag is reduced to a minimum by streamlining and pedaling with both feet and hands. (Biking and streamlining of low-speed vehicle is also done with hands and feet.) Above, a look inside one Speed Championship entry with its side facing removed.
SLOW PROGRESS

This isn't the first time people have been interested in unusual bicycles. In 1914 the
Germans built and raced streamlined bicycles, and such vehicles still appeared
occasionally in Europe up until about 1958. Reclining bicycles have been built and
tested on numerous occasions. The bicycle in its modern form has existed basically
unchanged for over 10 years. A cyclist from the 1930s brought into the present
day would recognize virtually everything on a modern bicycle. Why have so few changes
taken place? One powerful influence has been bicycle racing in Europe an
enormously popular sport. The rules have rigidly excluded anything but a standard
racing bicycle from competition. Another influence has been industry's resistance to
design changes.

In the 1950s Alex Moulton of England, developed a quite different compact bicycle
that could easily be put into the trunk of the automobile, the vehicle of the future. If
ergy supplies remain freely available, Automobiles are convenient, comfortable,
and fast, and many are reasonably priced. But this won't always be so.

Since the coming of the machine age, animal and human power have nearly dis
appeared as important energy sources in the Western world, but this trend may
reverse itself. With future energy or material shortages, human or animal power may
do some of the work presently being done by motorized machines. With advanced tech
ology, this may be more probable than it sounds at first—especially in the field of
commuter transportation.

With training, almost any adult in good health, even into his late sixties, can
produce a 1/4 mechanical horsepower as measured on a bicycle dynamometer (ergometer).
This power output will carry ped
estrians at a speed of 5 mph, which is a
very fast walk or a slow jog. In a racing
single scull a rower could travel 6 mph with
the same power. With Dr. MacCreedy's
man-powered aircraft, the speed would
be about 10 mph, while a standard bicycle
with the rider in racing position could travel
19 mph. If the bicycle were streamlined as
in the Speed Championships, the speed
would increase to almost 30 mph with the
same 1/4 horsepower. This translates into an
equivalent fuel consumption of several
thousand miles per gallon.

SUPERTRIKE

Using a specially designed human
powered vehicle, a person could commute
to work one way 12 to 15 miles in only one
hour a day of travel time, if the roads were
level. What would such a machine
ideally look like? It is unfortunate that most
of the cycles built for the Speed
Championships are impractical for street use.
Nevertheless, they embody improvements that
can be used with modification.

The vehicle would probably be a tricycle with
two wheels forward that steer and one
drive wheel in the rear. This configuration is
very stable and simple to manufacture. A
total weight of less than 40 pounds is
important for rapid acceleration and for going
up hills.

Most likely it would transport only a single
person with enough room for some packages
or a briefcase. Over 70 percent of all urban
automobile trips are taken with
only one passenger, and a single cyclist
would not tolerate the added weight of a
two-passenger vehicle. Careful streamlining
would be necessary for efficiency and
stability in buffeting crosswinds. The
enclosure would protect the rider from rain
and cold, and sufficient ventilation would have
to be provided for proper cooling. The
streamlined shell would also protect the
rider from injury in most accidents except
direct collisions. In the Speed
Championships several competitors have rolled over in excess of 40 mph without the slightest
injury.

Sufficient gear changes would be re

CONTINUED ON PAGE 120
and I have a strong suspicion that the murderer is right here in this room.
THE ROCKS THAT MOVED

Who would believe that the rocks not only moved but had a goal in mind?

BY JOHN KEF AUVER

When old Kirby Neson came into town that first time and told everybody who would listen that rocks—boulders—were moving around on their own out in the scrub, nobody, of course, believed a word of it. Everybody knew Kirby was a little funny in the head. But, as it turned out, it wasn't long before the whole town was talking about those moving rocks.

That first day though, Kirby couldn't even get anybody into his old pickup to take out to where he liked—bragging about it—they were moving. He was proud of those moving rocks, as if they'd done something he knew they were going to do all along—not that he'd actually seen them move. He was very careful to say that he'd only seen that they had moved from one place to another, as if we'd be more apt to believe that. More than once it had happened, he claimed. He said he could tell they'd changed positions because he'd marked some of the rocks with a chalk and then walked off the distance to where he'd driven a stick in the ground. When he checked the rocks a few days afterward, they'd moved. He showed how he'd done it, once he finally got Burt Kolodzie and Fred Knots out there after they'd got tired of listening to him every time he came into town. Kirby knew that if Burt and Fred said those rocks were moving, everybody, by God, would know they were.

Problem with Burt and Fred was moving, everybody, by God, would know they were.

PAINTING BY DE ES SCHWERTBERGER
OMNI, the magazine of tomorrow, means back issues could well be ahead of its time. Limited supplies of the above issues are still available at $2.75 each including postage and handling. List the issues you've missed and need, enclose your check or money order along with your name and address and mail to OMNI Book Issues, PO. Box 1805, FDR Station, New York, NY 10022. We'll rush you the magazines of tomorrow that were on sale yesterday.
front-page picture story about "Moving Rocks Puzzle Progress," which is the name of our town, not that there's any progress going on, in my opinion. All of it was written up in a tongue-in-cheek way and that was how it was treated, too, a day or so later in the Houston paper which had sent a reporter and photographer to the place after they read the story in Ed's paper, I guess. That, in turn, led to a geologist driving out from the space center there in a few days, and it was raining to beat hell! This was all happening just after we'd started bringing rocks back from Mars, and there were some geologists at the center.

The geologist didn't believe it either, as you might imagine—at first, anyway. But he did decide to do his own tests. He made his own markings on the rocks—chipped the boulders—and measured their distance from each other and then took some pictures of them to set their location, too. He estimated their weights with some measuring gadget he had and then said they were all too heavy to be moved by human hand unless you used some big mechanical mover, which would give itself away by tearing up the land.

About a week passed before he came back and maybe we wouldn't have known it if he hadn't stopped in town en route from Houston and asked Fred to show him the place. He didn't think he could find it himself, when he and Fred and some others got there, including me, you could tell right away that the rocks had moved even if there weren't any tracks to see—some of them hundreds of feet. And somebody most likely Kirby everybody thought had tried to cover up the chipped-out markings the geologist had made by slapping some cement on the scars. Kirby still wasn't to be seen though. Nobody had seen him, in fact, since the day he'd shown Burt and Fred the rocks, which wasn't unusual considering his ornery ways.

Well, the geologist measured the distance the rocks had moved and looked at a book and some charts and did some calculations and used more gadgets. When he had finished, he told us that the wind was moving the rocks. "Winds funnel through here pretty strong, he said after saying that the rocks were actually in a dry lake bed so shallow you'd never know it. We had realized, though, that the soil was sandier and harder here than most soil in the area. "When the surface gets wet from rain, the ground gets extremely slick and when conditions are just right movement occurs," he said.

Well, some believed him and some didn't, and as you'd expect, among those who didn't was Kirby.

Just as everybody was getting into cars and trucks to go back to town, Kirby came gunning up in his beat-up pickup. He jumped out of it before it had hardly stopped and started yelling and cursing and screaming soon as he saw the blue NASA sign on the side of the geologist's brand new white truck.

"Get the goddamn hell out of here!" he yelled at the man from Houston. "You bastards can tear up the moon and Mars and bring Nature's rocks back here where they ain't supposed to be, but you leave those earth rocks alone!"

"But sir!" the geologist said, turning nearly as white as his truck. "We haven't bothered these rocks. We haven't moved them an inch. Wind and rain have done it!"

"Wind and rain?" old Kirby roared. "Wind and rain! Nature is doing it!" He was pointing into the sky. "Nature! God!"

I believe if Kirby hadn't had a gun, he would have shot the man right there. As it was, he suddenly ran toward his truck and everybody got out of there fast. When we looked back he sure enough had his old rifle in his hand.

Fred and lad some others made trips out to the area in the coming days, regardless of Kirby, we didn't think the old buzzard would shoot us. We never saw him as it turned out. But we did see that the rocks moved every time it rained (we were still in the rainy season) as long as the wind was blowing hard, just like the geologist had said.

And they always moved in the same direction the wind was blowing. Still it was hard for us to believe that wind and rain were moving those god-awful big rocks. But, unlike Kirby we never thought God
We began to wonder though, as time passed. First of all we went out there once and saw that the rocks had moved a lot more than they ever had before. Although there was a wind, it wasn’t a particularly strong wind. It had rained just before though. This happened more than once.

More and more we'd go out there and discover that the boulders had moved one helluva distance with hardly any wind. Finally one time one of them moved about a quarter of a mile and there’d been no rain for at least a week and the wind hadn’t amounted to a damn thing. And this was the biggest rock—a monster big enough to knock down a house. You knew that rock really had to be moving to cover all that distance in such a short time and I say short time because it just so happened that I saw the movement the boulders had made on consecutive days because I happened to be passing by the place both days, and I'd driven off the road to the site both times.

Also, it seemed that the rocks—all of them—wore getting bigger. Of course I thought this was my eyes or imagination. But when I got Burt and Fred to go out there with me in a few days... they thought the same thing but, like me, they couldn't be wrong.

Another thing. There were more rocks moving now. We were positive of that because one of the first things we'd done was to count the rocks that were moving. There were fourteen of them to begin with. Now there were twenty-three. The extra ones had just appeared out of nowhere, it looked like.

Then the strangest thing of all happened. We went out there one day after it'd been dry for a long time—when we were getting into March now. The rocks—there were now thirty-seven—had all moved at least three quarters of a mile, so we were sure of that because there had been—and was—such a small amount of wind that the tracks weren't blown over by sand, especially those made by the big rocks. And they were all big now. The tracks were so deep that there didn't have to be any rain-drenched ground to show them up. Big deep grooves!

But what I'm getting at is this. All the rocks had changed direction. They were now going in just the opposite way they had been for months—against the wind now.

When we phoned the geologist at the space center, he said he'd meet us at the site the following day.

When we went out there the next day to meet the man the rocks were gone. Not a single one anywhere. They hadn't been gone long, though, because we could still see their tracks leading off in the dry soil and there was a very still wind that day. The rocks were heading right into it.

We got in Burt's four-wheel drive and started after them. We figured the boulders had gone maybe just out of our sight, and that the man from Houston would find us and the rocks easily enough by following the tracks.

Well we drove and drove without seeing any rocks, and Burt started giving the truck more gas until we were going along at a good clip just about being bounced to the roof because, of course, we weren't following any road. It was all desolation for miles and miles, all the way into Progreso and beyond. A good ten or fifteen minutes passed, and we still didn't see the boulders. We saw more rock tracks, though. A lot more. New ones came in from either side. Then we began to hear a strange sound at about the same time we saw what appeared to be a cloud of dust ahead. As the size of the cloud grew the sound began getting louder—a rumbling, a crashing. The ground began to shake.

In less than a minute we saw them, or at least the tail end of them. After Burt gave the truck even more gas we could see more of the dozens of boulders making up the rear end of the rolling mass, and although we were traveling at about forty miles an hour, we were just barely gaining on them—hundreds of boulders maybe thousands with more coming from either side all the time, all monsters all heading in the same direction, as the crow flies straight toward Progreso.

But, who was driving, must have thought the same thing I did at the same time because as I yelled, "Let's get on the road!" he had already started to whip the pickup to the left toward the road into Progreso, the idea being that we might reach town before the boulders did and give a warning. But even before we were halfway to the road, we could see that the rocks were on the highway and beyond as far as we could see.

And then a horrible thought made me look to the far left and then behind us and I saw hundreds more of the huge monsters heading down on us. A huge aiming right for us. Pointing at them I screamed for Burt to turn right and speed up.

He did. But now the rocks ahead of us were rolling faster, leaving us while the ones behind were gaining. In minutes we would be crushed flatter than a couple of cockroaches.

Then as it came on command, the direction of the boulders changed, both those in front of us and those behind. They began to spin—some to the right, some to the left. And I realized what was happening. They were going around Progreso and in the process as far as I could guess— they would miss us.

The town was saved because the rocks had a different purpose in mind.

On the far side of Progreso though, they converged (we would learn) and without ever changing direction again they headed directly ever faster and growing more monstrous at every mile toward the space center in Houston.

"It bothers me that in all probability my final resting place will be a bed of wild rice!"
KEEPER OF THE MOON ROCKS

Gerald Wasserburg is the expert on moon rocks. He currently teaches at the California Institute of Technology where he analyzes moon rocks for clues to the origin of the solar system. Contributing editor Bill Sluckey recently spoke with Wasserburg.

Omni: You've complained that many of the moon rocks stored at the Johnson Space Center in Houston have spoiled because of improper preservation. Is anything being done about this?

Wasserburg: Well, Congress has finally allocated funds for a new storage building. It's almost finished now. And the remote storage facility will be in a reasonable shape.

Omni: How many of the moon rocks are still uncontaminated?

Wasserburg: All of them are contaminated to various degrees. But I would say that fifty to seventy percent of the rocks are still in a reasonable shape.

Omni: You once told me that an early moon-rock study group had found evidence there had been water on the moon, when they really found was that... because of improper storage, there was water (on the rocks) in Houston. Are all the rocks water-contaminated?

Wasserburg: That was still a very serious problem and difficult to beat. From thirty to fifty percent of the rocks cannot be used for certain experiments.

Omni: What are the real lessons we have learned from the moon rocks?

Wasserburg: We have, for the first time in human history, looked at another planet and have been able to discuss and assess what its early stages were like. We know nothing of the earth's geological history because of the moon, and we have a totally different perspective in interpreting the history of all these planets.

There are new studies of volcanic activity on all of the terrestrial planets. There are no longer studies about whether it took place—because of the moon rocks, we know it took place. Because Mercury has been found to share many similarities with the moon, we can make accurate generalizations about it. Mars is an enormous mystery. What the hell were all those rivers doing there? Every time you look at that "Grand Canyon" you say Gee whiz, you've got to do something.

“Glass” your car!

New miracle POLYMER “GLASS” SEALANT completely protects your car’s exterior finish — it even restores original luster to used models!

Available only as a service by new car dealers for $100-200. Now do it yourself in less than an hour for only $29.95.

(16 oz. bottle enough for 3 cars)

The elements vs. your once beautiful car. You've probably experienced it. Your precious shiny new automobile gradually fades and dulls. The once brilliant finish has slowly washed out. Even hours of washing and buffing can't recapture that new car look. Until this new chemical science discovery.

Never wax your car again — GloSeal* is not something like a simple wax or polish. It's actually a miracle polymer glass formulation serving as a powerful cleaner and a beauti-ful exterior finish. When applied lightly to your car's finish and chrome, it excludes the evil Electrohaste Action literally lifts to the surface, locking in luster and a brilliant shine, almost like a new car. Laminating itself to your car for years shutting out harmful sun, rain, pollution, salt deteriorants and other elements that normally ruin the appearance and value of your car.

Prevents oxidation from starting on new cars and actually removes it from used models! GloSeal is literally a Glass Shield that becomes part of your car's finish. Your new car's finish is simply not allowed to continue for 3 years! Then PolyGlass* is again for years more of protection. If your car is not new, GloSeal will actually remove the oxidation, add gloss, and stop further corrosion. For 1 year before you need to apply again. It is similar to covering your car with a non-penetrable cost of polyurethane.

Enamel spray paint can't even get through the clear glass shield. When this new professional automotive product is demon-strated to dealers the "spray paint fest" is used. GloSeal is applied to a car's hood. After it is wiped off and a can of enamel spray paint is sprayed directly on it, along with Magic Marker and other solvents. The observers are astonished as all of these are wiped off the hood with a moist cloth. Nothing, not even dirt and dust can adhere to the surface!

No rubbing, labor or buffing equipment needed. GloSeal goes on easily and quickly. You wipe it on with a cloth, let it dry, and then wipe it off. It takes only a few minutes — less than an hour. The main ingredients are PolyGlass another substance similar to Teflon and a small amount of silicone to ease in wiping it on. (Also highly recommended for boats and airplanes.) Between washes you need only wipe your car with a damp cloth to reactivate its brilliant finish and dust repelling shine.

The incredible GloSeal "Brilliance Guarantee"! If after using it, you are not pleased for any reason, return the unused portion within 2 weeks of receipt for a prompt refund of the entire money, plus storage. Further if GloSeal does not protect your new car for 3 years or your used car for 90 days old or more for 1 year, write to us. We'll take your word for it and return your small investment on a pro-rata basis.

However, due to the extraordinary quality of this truly tested product we are confident that this would not be timely. (Note: GloSeal is 100% safe to use! It can also be removed with mineral spirits.)

CALL TOLL FREE FOR INSTANT PROCESSING: 1-800-333-8935 or if busy 1-800-333-8935 California residents call 805-966-7292, Or Send Coupon

Print out the following order. If not 100% satisfied you can return the unused portion within 2 weeks for a prompt refund of purchase price less shipping cost. Check on:

POL. shop 1 bottle $18.95 and $8.00 shipping & handling.

Save $9.00 per bottle on multiple bottle purchases

Dept.

POL. shop 2 bottles $32.95 and $16.00 shipping & handling.

Dept.

POL. shop 3 bottles $45.95 and $24.00 shipping & handling.

Dept.

Check or Money Order enclosed (CA residents add 6.5% sales tax)

Charge my credit card and number below:

I. American Express

II. Discover Card

III. Visa

IV. Master Charge

Credit Card No.

Exp. Date.

Name.

Address.

City/Glent/Zip.

GloSeal Group

Starshine Group

902 Anacapa St., Dept. 586 SanDiego, CA 92101

107
dropped the glass, and flung her hands at her hair.

Conversation stopped all over the house.

She whirled on me, ready to achieve total fury at the slightest sign of a smile, and I debated giving her that release but decided she could not afford the energy it would cost her. 'I'm truly truly sorry,' I said at once. 'But a minute ago. You weren't here and now you are. And that's the way I wanted it.'

Callahan was there, his big knurled hand resting light on lint on my shoulder. His expression was mournful: 'Prying, Jake? You?

'That's up to her Mike,' I said, holding her eyes.

'What you talkin' about?' she asked.

'Lady,' I said. 'There's so much pain on your face. I just have to ask you. How come? If you don't want to tell me, then I'm prying.'

She blinked. 'And if you are?'

'He's right. Jake,' the piano man's voice came from just behind me. 'She shook her head dizzyly then looked around at friendly, attentive faces: What the hell kind of place is this?'

'Usually we prefer to let newcomers figure that out for themselves, but I couldn't wait.'

'This is Callahan's. Most joints the barkeep listens to your troubles, but we happen to love this one so much that we all share his load. This is the place you found because you needed to... I gave it everything I had.'

She looked around again, searching faces. I saw her look for the prurience of the accident spectator and not find it, then I saw her look again for compassion and find it. She turned back to me and looked me over carefully. 'I tried to lock gentle, trustworthy, understanding eyes and strong I wanted to be more than I was for her.' 'He's not prying,' Eddie said at last. 'Sure, I'll tell you people. You're not going to believe it anyway. Innkeeper, gimme coffee light and sweet.'

She picked somebody's empty from the bar, got down unsteadily from her chair, and walked with great care to the chalk line. 'You people like toasts? I'll give you a toast. To fivesight,' she said, and whipped her glass so hard she nearly fell. It smashed in the geometrical center of the fireplace. Residual alcohol made the flames ripple through the spectrum.

I made a little gasping sound.

By the time she had regained her balance young Tommy was straightening up from the chair he had placed behind her, brushing his hair back over his shoulders. She sat gratefully. We formed a ragged half-circle in front of her, and Shorty Steinitz brought her the coffee. I sat at her feet and studied her as she sipped it. Her face was still not pretty, but now that the lights were back on in it, you could see that she was beautiful. I'll take that any day. Go chase a pretty one and see what it gets you. The coffee seemed to help steady her.

'It's one o'clock,' she said. 'Three years ago my first husband and Freddie, took off with a sculptress named. God help us, Callahan, leaving me with empty savings and checking a mortgage I couldn't cut and a seven-year-old son. Freddie was the life of the party. Lily of the valley. So get myself a job on a specialist newspaper. Little business men's daily, average subscriber's median income fifty k. The front page story always happened to be about the firm that had bought the most ad space that week. Got the picture? I did a weekly Leisure Supplement ten pages every Thursday, with a... you don't care about this crap. I don't care about this crap.

'So one day I'm sitting at my little steel desk. This place is a converted warehouse, one immense office and the editorial department is six desks pushed together in the back, near the paste-up tables and the library and the wire. Every body else is gone to lunch, and I'm just gonna leave myself when this guy from accounting comes over. I couldn't remember his name. He was one of those grim, stolid, fatalistic guys that accounting departments run to. He hands me two envelopes. This is for you,' he says, 'and this one's for Tom. Tom was the hippie who put out the weekly Real Estate Supplement. So I start to open mine—it feels like there's candy in it—and he gives me this look and says, 'Oh no no no, look at him like huuuuh,' and he says, 'Not until it's time. You'll know when,' and he leaves. Okay I say to myself, and I put both envelopes in a drawer, and I go to lunch and forget it.

'About three o'clock I wrap up my work and get to thinking about how strange his face looked when he gave me those envelopes. So I take out mine and open it. Inside is two very big down—know powerful tranquillizers. I sit up straight and I open Tom's envelope, and if I hadn't worked in a drugstore once, I never would have recognized it. Demerol. One of the most addictive drugs in the world.'

'Now Tom is a hippie-looking guy like I say, long hair and mustache, not long like yours, but long for a newspaper. So I figure this accounting guy is maybe his pusher and somehow he's got the idea I'm a potential customer. I was kind of flirty and tense in those days. So I get mad as hell, and I'm just thinking about taking Tom into the darkroom and chewing him out good and I look up and the guy from accounting is standing there from all the way across the room. No expression at all. He just looks. It gives me the heebie-jeebies.'

'Now overhead is this gigantic air-
conditioning unit from the old warehouse days, that's supposed to cool the whole building and never does. What it does is drip water on editorial and make so much goddamn noise you can't talk on the phone while it's on. And what it does right at that moment is rip loose and drop straight down, maybe eight hundred pounds. It crushes all the desks in editorial and it kills Mabel and Art and Dolores and Phil and takes two toes off of Tom's right foot and misses me completely. A flying piece of wire snips off one of my ponytails.

"So I sat there with my mouth open, and in the silence I heard the publisher say, God damn it from the middle of the room and I climb over the wreckage and get the Dem- erol into Tom and then I make a touriquet on his arch out of rubber bands and blue pencils, and then everybody's taking me away and saying stupid things. I took those two tranquillizers and went home."

She took a sip of her coffee and set up a little straightener. Her eyes were the color of sun-cured Hawaiian bugs. They shut the paper down for a week. The next day, when I woke up, I got out my employee directory and looked this guy up. While Bobby was in school, I went over to his house. It took me hours to break him down, but I wouldn't take no answer for an answer. Finally he gave up.

"I've got fivesight," he told me. "Some thing just a little bit better than foresight. It was the only joke I ever heard him make than or since."

I made the gasping sound again. "Precognition," Doc Webster breathed awkwardly, from my tailor's seat. I worked my keys out of my pocket and tossed them to Callahan. He caught them in the coffee can he had ready and started a shot of Bushmills on its way to me without a word.

"You know the expression Bad news travels fast?" she asked. "For him it travels so fast it gets there before the event. About three hours before. More or less. But only bad news. Disasters, accidents, traumas large and small are all he ever sees."

That sounds ideal, Doc Webster said thoughtfully. "He doesn't have to lose the fun of pleasant surprises, but he doesn't have to worry about unpleasant ones. That sounds like the best way to."

"He shifted his immense bulk in his chair. "Damn it, what is the verb for precognition? Precognize?"

"Ain't they the guys that sang that 'Jeremiah was a bullfrog' song?" Long-Drink murmured to Tommy who kicked him hard in the shins.

"That shows how much you know about it," she told the Doc. "He has three hours to worry about each unpleasant surprise—and there's a shockingly limited amount he can do about it."

The Doc opened his mouth and then shut it tight and let her tell it. A good doctor hates forming opinions in ignorance.

"The first thing I asked him when I told him, why hadn't he warned Phil and Mabel and the others. And then I caught myself and said What a dumb question! How're you going to keep six people away from their desks without telling them why?"

"Forget I asked that."

"It's worse than that," he told me. "It's not that I'm trying to preserve some kind of secret identity—it's that I wouldn't do the slightest bit of good anyway. I can ameliorate—to some extent. But I cannot prevent. No matter what I'm not permitted."

"Permitted by who?" I asked.

"By whoever or whatever sends me these damned premonitions in the first place," he said. "I haven't the faintest idea who."

"What exactly are the limitations?"

"If a pot of water is going to boil over and scald me, I can't just not make tea that night. Sooner or later I will make tea and scald myself. The longer I put off the inevitable the worse it get burned. But if I accept it and let it happen in its natural time, I'm allowed to, say, have a pot of ice water handy to stick my hand in. When I saw that my neighbor's steaming box was going to fail, I couldn't keep him from driving that day but I could remind him to wear his seatbelt, and so his injuries were minimized. But if I'd seen him dying in that wreck I couldn't have done anything—except arrange to be near the wife when she got the news. It's... it's especially bad to try to prevent a death. The results are... I saw him start to say 'horrible' and reject it as not strong enough. He couldn't find anything strong enough."

"Okay Cass," I said real quick. "So at least you can help some. That's more than some doctors can do. I think that was really terrific of you, to bring me that stuff like that make a chance that I'd think you were—hey how did you get hold of narcotics on three hours notice?

I had three hours warning for the last big blackout. I told him I took two suitcases of stuff out of Smithtown General while they were trying to get their emergency generator going. I have uses for the stuff."

She looked down into her empty cup then handed it to Eddie who had refilled it. While he was gone, she stared at her lap breathing with her whole torso, lungs clenching slowly from absolutely full to empty.

"I was grateful to him. I felt sorry for him. I figured he needed somebody to help him. I figured after a manic-oppressive like Freddie a quiet phlegmatic kind of guy might suit him better. His favorite expression was, 'What's done is done.' I started dating him. One day Bobby fell out of a tree and broke his leg, and Uncle Cass just happened to be walking by with a hypo and splints. She looked up and around at us, and her eyes fastened on me. Maybe I wanted my kid to be safe. She looked away again. 'Make a long story short, I married him.'"

I spilled a little Bushmills down my
and I started drinking. I mean I started in that motel and kept it up when I went home. I never had before. I drank alone. I don't know if he ever found out. He must have. He never said anything. I just started growing away from him. I knew it wasn't right or fair but I just turned off to him completely. He never said anything. All this started happening about six months ago. I just got more and more self-destructive, more crazy more — hungry for something.

She closed her eyes and straightened her shoulders.

Tonight is Cass's bowling night. This afternoon I opened her eyes. I made a date with a stockbroker at the Parkmark supermarket. I told him to come by around ten. When my husband was gone. After supper he got his ball and shoes ready, like always, and left. I started to clean up in the kitchen so I'd have time to get juiced before Wally showed up. Out of the corner of my eye I saw Cass tiptoe back into the living room. He was carrying a big manila envelope and something else. I couldn't see the envelope was in the way I pretended not to see him and in a few seconds I heard the door close behind him.

I cried my hands. I went into the living room. On the mantel by the bedroom door, was the envelope tucked behind the flowerpot. Tucked behind it was his service revolver. I left it there and walked out the door and came here and started drinking and now I've had enough of this fucking coffee. I want a screwdriver.

Fast Eddie deserves his name. He was the first of us to snap out of the trance, and it probably didn't take him more than thirty seconds. He walked over to the bar on his bunny little legs and slapped down a dollar and said, "Screwdriver Mike." Callahan snapped his head slightly. He drew on his cigar and frowned at it for having gone out. He flung it into the fireplace and built a screwdriver and he never said a mumblin word. Eddie brought her back.

She drained half at once.

Shorty Stenitz spoke up and his voice sounded rusty. "I service air-conditioning systems. The big ones. I was over at Century Lanes today. Their unit has an intermittent that I can't seem to trace. It keeps cuttin' in and out."

She shut her eyes and did something similar to sniffing and nodded her head. "That's it right. He'll be home early.

Then she looked me square in the eye.

"Well, Jake, do you understand now? I'm scared as hell. Because I'm here instead of there and so he's not going to kill me anymore. And he tells me if you try to prevent a death, something worse happens and I'm going out of my mind wondering what it could be worse than getting killed."

Total horror flooded through me. I thought my heart would stop.

"I knew what was worse than getting killed."

Dear Jesus, no, I thought and I couldn't help it. I wanted very badly to keep my face absolutely straight and my eyes holding his and I couldn't help it. There was just that tiny hope and so I glanced for the nearest object at the Counterclock and then back to her. And in that moment of moments, scared silly and three quarters bagged, she was seeing me clearly enough to pick up on it and know from my face that something was wrong.

It was 10:15.

My heart was a stone. I knew the answers to the next questions and again I couldn't help myself. I had to ask them.

"Mrs...

"Kathy Anders. What's the matter?" Just what I had asked her, a few centuries ago. "Kathy you didn't lock the house behind you when you left?"

"Callahan went pale behind the bar and his new cigar fell out of his mouth. No, she said. What the hell has that—"

"And you were too upset to think of..."

"Oh Christ," she screamed. "No, I never thought! Oh Christ, Wally that dumb cocky kid. He'll show up at ten and lend the door wide open and figure I would go to the corner for beer and decide it's cute to wait for me in bed and—"

She whirled and found the clock and puzzled out the time somehow and waited, "No!" And I tore in half right down the middle. She sprang from her chair and turned toward the bar. I could not get to my feet to follow her. Callahan was already holding up the telephone and when she could not dial it, he got the number out of her and dialed it for her. His face was covered from me. I was just getting up on my hunch legs by then. No one else moved. My feet made no sound at all on the sawdust. I could clearly hear the phone ringing on the other end. Once and Twice. I was on Cass's damn you answer me! Four times. Oh dear God, I thought. She still doesn't get it. Five times. Maybe she does get it — and won't have it. Six times.

It was picked up on the seventh ring, and at once she was shrieking. "You killed him, you bastard!" He was just a jerk kid, and you had to—"

She stopped and held the phone at arm's length and stared at it. It chittered at her an agitated chimpunk. Her eyes went round
"Wally?" she asked weakly. Then even more weakly she said to it. "That's his wil in that manila envelope," and she fainted.

Mike? I cried and leaned forward. The big barkeep understood me somehow and lunged across the bar on his belly and caught the phone in both hands. That left me my whole attention to deal with her, and I needed that, and all my strength to get her to the floor gently.

Wally. Callahan was saying to the chipmunk. Wally listen to me. This is a friend. I know what happened, and—listen to me. Wally, I'm trying to keep your ass out of the slam. Are you listening to me, son? Here's what you've got to do:

Someone crowded me on my left, and almost flung me before I realized it was Doc Webster with smelly socks.

No screw fingerprints this ain't TV. Just make up the goddamn bed and put yer cigarette butts in yer pocket and don't touch anything else.

She coughed and came around—sure nobody sees you leave, and then you get your ass over to Callahan's, bar, off 25A. We got thirty holes here'll swear you been here all night, but it'd be nice if we knew what you looked like.

She started up at us vacantly and as I was helping her up and into a chair, I was talking. I wanted her to be involved in listening to me when full awareness returned. It would be very hard to hold her, and I was absolutely certain I could do it. I had to listen carefully to her. You've got to listen carefully to me, because if you don't, in just another minute now you're going to try and swallow one giant egg of guilt, and it will believe me, stick in your throat and choke you. You're choking on a couple already and this one could kill you—and it's not fair. It's not right. It's not just. You're gonna award yourself a guilt that you don't deserve and the moment you accept it and pin it on it'll stay with you for the rest of your life. Believe me. I know. Damn it's okay to be glad you're still alive!

"What the hell do you know about it?" she cried out.

I've been there," I said softly. "As recently as an hour ago.

Her eyes widened.

I came in here tonight so egocentrically wrapped up in my own pain that I sat next to you for fifteen minutes and never noticed you, until some friends woke me up. This is a kind of anniversary for me. Kathy five years and one day ago I had a wife and a two-year-old daughter. And I had a Big Book of Auto Repair. I decided I could save thirty dollars easy by doing my own brake job. I tested it myself and drove maybe a whole block. Five years ago tonight all three of us went to the drive in movie. I woke up without a scratch on me. Both dead. I smiled at the man who was trying to cut my door open, and I crumpled out the window past him and tried to get my wrists on his chainsaw. He cocked me and I woke up under restraint. I locked eyes with her. I was glad to be alive, too. That's why I wanted to die so bad.

She blinked and spoke very softly. "How did you keep alive?"

"I got talking with a doctor the size of a hippo named Sam Webster. He got me turned loose and brought me round around here. I waited for her to finish. 'You—that's it? What is that?"

"This is Callahan's Place." Eddie said. "This place is magic. I told her. Magic? Bullshit magic. It's a bar. People come here to get blind."

"No. Not this one. People come to this bar to see. That's why I'm ashamed at how long it took me to see you. This is the place where people care. For as long as I eat here in my pain, my friends were in pain with me and did what they could to help. They told stories of past blunders to make it a little easier for me to make my annual toast to my family without embarrassing myself. You know what gives me the courage to keep on living? The courage to love myself a little? It's having a whole bunch of friends who really give a Goddamn. When you share pain, there's less of it, and when you share joy there's more of it. That's a basic fact of the universe, and I learned it here. I've seen it work honestly to God's miracles.

"Name me a miracle."

"Of all the gin joints in all the world you come into this one. Tonight of all the nights in the year. And you look like her, and your name is Kathy."

She gaped. "I—your wife? I look—?"

"Oh, not a reject—that only happens on The Late Late Show. But close enough to scare me silly. Don't you see, Kathy? For five years now I've been using that word—love—not in conversation just in my head, as a private label for precognition. I jumped when you said it. For five years now I've been wishing to God I'd been born with it. I was wishing it earlier tonight."

"Now I know better."

Her jaw worked out shame no sound. "Well help you, Kathy. Callahan said. "Damn straight, Eddie croaked."

Well help you find your own miracle. Long Drink assured her. "They come by here regular."

There were murmurs of agreement, an encouraging words. She started around the place as though we had turned into toads. "And what do you want from me?"

She snapped.

That you hold up your end. I said. "That you don't leave us holding the bag. Suicide is just a cop-out, it's a rip-off."

She shook her head, as violently as she dared. "People don't do that. People don't act this way."

My voice softened, saddened. "Upright apes don't. People do."

She finished her drink. "But—"

"Listen we just contradicted something you said earlier. It seems like it does take some kind of genius person to share pain. And I think you did a better job than I could have done. Two, three years you stayed with that poor bastard? Kathy that strength and compassion you gave to Cass for so long. The imagination and empathy you have so much of, those are things we badly need here. We get a lot of incoming wounded. You could be of use here, while you're waiting for your own miracle."

She looked around at everybody, looked long at Callahan and longest at me.

Then she shook her head and said, "Maybe I already got it," and she burst finally and explosively into tears, flinging herself into my arms. They were the right kind of tears. I smiled and smiled for some considerable time, and then I saw the clock and got very businesslike. Wally would be along soon, and there was much to be done. Okay Eddie you get her address from her purse and ankle over there. Make sure the fool kid didn't screw up. Pay out Livak Samartian. Go on out and wipe your wheels. Here Drink you get her out to the parking lot. I can't hold her up much longer. Margie, you the girl friend she wants to spend the weekend with yesterday okay? You're gonna put her up until she's ready to face the cops. Doc, you figure out what she's contracted that she doesn't want to bother her husband by calling Shorty. If nobody discovers the body by say, tomorrow noon, you make a service call to the wrong address and find him. Mike—Callahan was already holding out one finger of Irish."

"Say, Jake," Callahan said softly, "didn't I hear your wife's name was Diane? Kinda short and red-haired and jolly gray eyes?"

We smiled at each other. "It was a plausible miracle that didn't take a whole lot of buildup and explanation. What did you tell her we stopped an alien from blowing up the earth in here once?"

"You talk good on your feet, son."

I walked up to the chalk line. "Let me make the toast now," I said loudly. "The same one I've made annually for five years—with a little addition."

Folks hushed up and listened.

To my family. I said formally then draned the Irish and gently underhand my glass onto the hearth.

And then I turned around and faced them all and added. "Each and every one of you."
O'Neill: I began to think about what we lose when we turn to space satellites? A very large part of that trade deficit you mentioned is going to be for oil.

O'Neill: The solar-power satellite is an alternative energy option that deserves very serious study. Two of the weak points that could prevent its being realized are lift costs for satellite components brought from the earth and the environmental impact of heavy rocket traffic through the atmosphere. With lunar materials and a mass driver on the moon, that could change. It appears that you could get ninety percent of the mass for power satellites from the moon, while only the highly complex or precise parts need come up from the earth.

O'Neill: It was Peter Glaser who first suggested earth-launched solar-power satellites. The connection between them and your proposals didn't come until 1974, and you've concentrated on the lunar-matelas route. Are you and he on opposite sides of that question?

O'Neill: Not really—the differences are in emphasis. We both feel it's necessary both to look for weaknesses in the concept and to explore all practical ways around them in view of the energy crisis. I'd say that power satellites are urgent if they are to be considered at all, but they represent only one of a number of energy options not necessarily the most viable one. They and space habitats are not a package deal. You could say that space colonization is inevitable but not urgent, while power satellites are urgent but not inevitable. Peter and I concentrate on different aspects of satellite-power research to make sure all the important alternatives are covered. We're both looking for a viable nonnuclear energy option.

O'Neill: Let's say that the technology and the economics and the politics all work out as you'd like. You have an industrial base on the moon and in orbit, and you can manufacture space habitats of whatever size you settle on. What about the beautiful landscapes inside the habitats we've all seen depicted? Is our biological and ecological knowledge really up to creating and maintaining that?

O'Neill: That's really two questions. First, there's the question of agriculture. The Russians have already started that with people in enclosed environments for six months or so growing wheat, making bread. It's worked out well, and they've even done some experiments in space. They're building up to long-term occu-

You have suggested that the environment in a space habitat could be as pleasant as that of an Italian hill town or say, Carmel, California. But why settle for that? Shouldn't space habitats provide new ways of life? New ways of organizing social space? Obviously one of the most important factors in advancing your ideas has been your demonstration that the habitats could be like Earth, but if you're building a world from scratch, shouldn't the sky be the limit?

O'Neill: I tell! I've had to do an "existence proof" to show that it is possible to create an earthlike environment in space. I have no doubt that in the long run people born in space are going to do all sorts of new, strange, different things with the habitats they'll build.

I think it's fair to say that until I began looking into this question, everyone—even Tsiolkovsky—had assumed that life in space meant a very unearthly situation. Tsiolkovsky came closest with his greenhouses. They were excellent designs, very efficient basically tubular like our "crystal palace." He had a lot of the essential ideas right to go for unlimited, clean solar energy outside the planet, a shadow to make use of the resources of the asteroids. Aside from him, almost everyone thought of space as a route from here to there. The destination was always assumed to be a planetary surface. But once you say that space itself can be the destination rather than just a corridor—that you can build large earth-

---

The image contains a page from a book with a black-and-white illustration. The text is not directly transcribed into a plain text representation, but it appears to be a continuation of a discussion on space habitats and related topics, including the technologica,
Like environments in space—you get a radical change in viewpoint. Setting Mars or Venus even if we could, would almost entirely leave us with all our planet-bound energy problems. Setting free space gives us a full-time clean energy source and bursts the limits to growth argument wide open. It has implications for human development beyond our solar system as well. Every star becomes an appropriate target for an emigrant ship if you no longer seeking the rare habitable planet with a tiny fragile biosphere.

O'Neill: That brings to mind Michael Hart's computer simulations which indicate that the habitable zone around a star may be much narrower than had been thought.

O'Neill: Exactly. If you say that the normal habitat for human beings is going to be in space and that planetary surfaces (except this one) are only incidental, that means a much faster and more certain expansion of the human race through the galaxy. That may not matter right now but looking back from centuries in the future I think it will be seen as the greatest possibility we've opened up.

O'Neill: Whom else would you credit as a forerunner in these ideas?

O'Neill: When I was starting, Freeman Dyson was one of the first people I talked to, of course, and he suggested I look into Tsiolkovsky. I think he may also have put me onto J.D. Bernal, the English biologist who envisoned a rather ship-like space habitat that was more than anything an analogue of the structure of a living cell.

When there was Danridge Cole, who suggested hollowing out and rotating asteroids for use as habitats and sketched some ideas on space mining. I remember getting an initially irritated letter from Arthur C. Clarke who's since become a good friend! He thought my own work had followed his "Rendezvous with Rama," whereas in fact I'd been lecturing about it for several years before.

O'Neill: Clarke had also written about electromagnetic accelerators, hadn't he?

O'Neill: Yes. Although he didn't work out the essential concepts of a mass driver. I credited Clarke in my first paper but his ideas of magnetic acceleration goes all the way back to Emilie Bachelet around 1910. He hoped to come up with a package transfer system for use in cities and had a model that was displayed at a Paris exposition before World War I, where the young Winston Churchill is said to have seen it.

O'Neill: The rest is history... but back to magnetic acceleration.

O'Neill: After Bachelet there was Edwin Northrup, a Princeton physics professor. I don't know whether he was familiar with Bachelet's work, in any case he repeated a good deal of it and also had a working electromagnetic launcher for small projectiles. He wrote a delightful book in 1937 called "Zero to Eighty"—part science fiction— with some photographs of his apparatus.

I was lucky to address the problem at the right time. 1974. By then, high-field superconductors existed so the load-carrier "bucket" could have a strong permanent magnetic field without burning up because of resistance heating. That way, too, it could "fly" magnetically avoiding frictional contact with the guide structure. An article by Kolm and Thornton, of MIT, taught me about magnetic flight and pointed out the advantages of synchronous drive, in which you feed back information from the moving load to the driving coil rather than the induction drive in which the load "surfs" on a traveling wave. The other essential idea for an effective mass driver is that you don't throw away your load carrier the "bucket," with the payload, but decelerate it and use it over and over.

O'Neill: In the following development of your proposals one can't but be impressed by the thorough working-out of the quantitative details. Did you enjoy all the complex calculation involved?

O'Neill: It doesn't have to be complex to be correct. In many cases figures on the back of an envelope will do just fine. What was important was that I was able to show that the essential element in the whole system is our present technical capability. It's like a jigsaw puzzle that isn't really there until it's complete. If you have to wave your arms ever once, that's enough to shoot the whole scheme down. Tsiolkovsky had no choice but to wave his arms when it came to the question of how to get into orbit, because the rockets hadn't been built yet. Most people don't realize that if you want to make hardware that works, there's all the difference in the world between just having a nice idea and actually being able to put down the numbers for each essential element.

O'Neill: Perhaps that's what makes some people uncomfortable with the idea—the feeling that life in space would mean life with a demanding, interdependent technology around them all the time.

O'Neill: The first quantum jump is demanding. But when you get a little further and ask what life would be like in a space habitat, I think it turns out to be in many respects a less demanding technology than we have at present. You don't need internal-combustion engines you don't need big power grids, you don't need elaborate communications networks because within the habitat it's all line-of-sight you don't need high-strength materials. Take a homely problem, the manufacture of fertilizer for agriculture. With a six-inch pipe at the focus of a solar mirror you can combine nitrogen and oxygen to get the high-energy precursors of fertilizer in any quantity you need. That's a lot simpler and cleaner than burning fossil fuels to make chemical fertilizers the way we do now.

O'Neill: Don't you need sophisticated recycling, especially of water?

O'Neill: If you have a reasonably tight-pres-
served and you shouldn't lose any of it, and you'd have plenty of energy to dislodge it. We have serious problems recycling, or better said, because we keep losing bits of what we recycle, and it gets dispersed in various locations throughout the environment, in a space habitat keeping track would be a lot easier. Overall, day-to-day life in a space habitat wouldn't require much technology above the level of some of the better agriculture you find around the world today—agriculture that's not even necessarily carried on by literate people.

O'Neill: When you talk to congressmen and others who influence public planning and spending, how do you appeal to them? Are they more interested in economic prospects or in beating the Russians, or do they share your excitement and belief that this is a challenge we must rise to?

O'Neill: I really don't talk my statements to the audience. Although, I underline some things here and there. I find that elected representatives tend to have quite a good sense of their constituents' underlying feelings and desires—not surprisingly, since they do get elected. And many of them sense a national feeling of frustration, a feeling that the country isn't moving anywhere or is even falling back. We have for so long been a nation identified with new ideas, new technology, new social experiments, and now we seem to be losing that position. Where do we go from here? These representatives look at a new possibility like the high frontier, and they wonder: Is America going to be a part of this revolution or sit back and watch other countries take the initiative?

I think that the movement into space is going to happen, whether it's done by Americans or not. That substantial numbers of people will eventually make space their routine environment is inevitable. If we don't blow ourselves up first, the imperatives pointing that way are basic and consistent with previous human history.

O'Neill: You've at least started the ball rolling toward a national constituency for space colonization. Would it be fair to say that the recent work on reducing the scale of the first quantum jump is 'insurance,' in case no massive government support is forthcoming?

O'Neill: Well, it's certainly interesting to ask Can it be made small enough to be non-governmental? People are now appreciating in all sorts of detailed ways that the smaller you can make the first step the better off you are. That idea ran through the workshops I described earlier. For example, we aren't locked into the plans for a mass driver on the moon. You can draw up a very stripped-down scenario involving only chemical rockets say by setting up the lunar processing plant chiefly to extract oxygen, which is thirty percent of the unselected Apollo samples, and which constitutes eighty-five percent of the total mass of rocket propellant. An automated vehicle unit would yield something like four hundred tons of liquid oxygen per year, which is enough for an awful lot of rocket flights bringing materials up into orbit.

O'Neill: The Apollo lunar module wouldn't be a very effective cargo carrier though. Aren't some new vehicles going to be needed?

O'Neill: Yes, we'd need probably three new but 'conventional' vehicles: an interorbital vehicle, a long-haul passenger carrier, and a vehicle that could soft-land and take off from the lunar surface. None of them requires a big new engine. They're in the class of the Apollo service and propulsion module or the Agena, completely within the limits of what we've been designing and building for the past fifteen years. But we still have to build them.

O'Neill: Speaking of engines, the shuttle itself has had its share of problems and delays.

O'Neill: The shuttle is one of the toughest atmospheric design problems ever tackled. It has to perform both as a rocket and as a heavy-cargo airplane, over a very wide flight regime from eighteen thousand mph to landing speed. I'm confident that it'll work out, though. Engine-development troubles are characteristic of every new aerospace venture. Did you know that the jumbo jets, in their first year of commercial operation, had several hundred in-flight engine failures?

O'Neill: No. Most passengers don't think about that when you wonder about the shuttle's prospects.

O'Neill: You share with Deng Xiaoping the distinction of having flown the shuttle simulator. As a lightplane pilot, how did it feel to you?

O'Neill: Like a lead brick. The instruments were very unfamiliar. It's a setup they now use in many training centers, but completely unlike that in most other airplanes. And I was surprised to find out on my first 'landing' in the simulator that you can balloon it.

O'Neill: Pull up too sharply just before touchdown. You get a ghastly stall of course followed by a crash.

O'Neill: I hear the sound of heat-shield tiles breaking. Back to your own drawing board. The fourth Princeton/AA/ [American Institute of Aeronautics and Astronautics] conference is coming up soon, and I understand the latest model mass driver will be demonstrated. Is that going along satisfactorily?

O'Neill: Bill Snow has just done the first full-power tests on four coils. So far there aren't any surprises or hitches, there's just a lot of work to be done.

O'Neill: That sounds like the right note to end on. Thank you, Dr. O'Neill.

Those who would like continuing news of activities aimed at space colonization can receive it by subscribing to the newsletter of the Space Studies Institute ($15 per year). Write to Space Studies Institute, Box 82, Princeton, N.J. 08540.
"What are you, anyway? Some kind of priest? No, a priest wouldn't call me comrade. Well, you can keep your comrade, too. I'm not dying for the party any more than I'm dying for God."

"Why are you dying, then?" the Empath asked the woman.

"To blow a tankful of those bastards to hell! To let my friends escape so they can kill more of them. Satisfied? Now get me back where I belong."

"You will be returned."

"Do you think you can keep me here until I lose my nerve? I don't know who you are or how you got me here, but you won't keep me without a light," the woman said, reaching into her ragged coat and fumbling toward the Empath.

She was returned at once. The Empath weighed what it had drawn from her and informed the Conceptualizers. "She did not believe that she was in the presence of a deity. She was willing to take Anaprene life in order to return to her companions and destroy the aggression vehicle."

She was extracted from an extreme aggression condition. The vehicle she sought to destroy had already caused harm to those in close bond with her, the Conceptualizers explained.

"She wished to make it possible for others to live on. But she could do so only by the sacrifice of her own continued existence. She was aware of that."

The Conceptualizers made no response. The second specimen was a young boy, slightly built, barely of the age at which this race matured. He gazed at the Empath with a look of fearful reverence, then bowed deeply.

"What is the marked cloth binding this specimen's forehead?" the Empath asked. "I sense a significance, but its purpose is not clear to me."

The Conceptualizers explained at once: "It is symbolic, not functional. The symbolism relates to a period on which our data are incomplete, but there are indications that the wearing of this cloth proclaims one's willingness to die in battle."

"It is strange that a people so eager to die should instead thrive. What is the nature of their battle?"

"It is a conflict of machines guided by members of this race. This specimen seeks to inflict damage on a large water transport vehicle by hitting it with the atmospheric-flight machine in which he travels," the Conceptualizers explained.

The specimen straightened bowed again from the waist, then fell to his knees and prostrated himself. When he began to speak the Empath was perplexed by his revelations: although the desired response was clear at the first brush with the boy's consciousness.

"Like the true Divine Wind, you fall upon the vessel of the enemy and destroy it utterly. You have blossomed into a flower of death to bring honor upon your Emperor and your family. You will be forever numbered among the samurai."

The Empath said in the boy's language. Even as it uttered the words the Empath felt a sense of peace, fulfillment and happiness deep within the boy.

"The boy believed that an Empath was something that at once partook of both divinity and the boy's own nature," reported the Empath when the youth was gone.

This race seems to have as many divinity myths as it has individuals.

Perhaps a stage in development. The specimens of the second taking strongly denied divinities and related myths," the Conceptualizers pointed out. "They appeared to worship an abstract communal concept of selective application."

"But that is irrational, considered in relation to the beliefs of those we've probed in the first taking.

The irrational appears to be not merely tolerated but highly valued among this race and its acceptance increases as the race grows," the Conceptualizers informed the Empath. The battle in which these specimens are engaged is almost planet wide. It appears to us that they have carefully divided the planet into imaginary units, and groupings of these units are systematically endeavoring to destroy one another. Is there unity within each grouping? Have they progressed to at least that level?"

"They have not. The groupings are porous. Within the groupings and within the units are strong indicators of latent trag-
During these deliberations, the population of the world below them had doubled and redoubled. The satellite and nearby planets had been visited.

The Anpreene ship withdrew to a safe distance beyond the orbit of the satellite and began preparations for a fourth and final sampling. In the opinion of the Assessors, a fifth sampling would be impossible the race would be extinct.

The final sampling consisted of a single specimen, a male plucked from an enormous machine constructed in orbit above the planet. It was one of three such craft, and all indications were that it would be destroyed by an internal malfunction as it reached the rim of the solar system. The selector focused, hummed to life and reached out for the gray-haired man who stood on the operations bridge of the great orbiting ship.

His subdued reaction surprised the Anpreene.

He glanced at the focal area and seemed to comprehend the situation at once. Folding his arms, smiling, he said to the Empath "So, you're out here after all. We weren't mistaken."

"Address this specimen in friendly terms, as an equal," the Conceptualizers instructed.

"We come in peace and friendship. We are the Anpreene, and we are your friends," said the Empath.

"You even speak my language. Quite well too. Telepathy, or have you been studying us from up there? Or perhaps you've been living among us?"

A portion of the Anpreene are Empaths, with a power akin to what you would call telepathy. It cannot be explained further in terms you would comprehend. We have studied you and have been living among you since the year 1560."

The man from the Earth ship made a low whistle and shook his head slowly. "You must have seen some incredible things," he said. "Tell me what have you learned about us?"

"Relate our conclusions," the Conceptualizers ordered.

"Your race is irrational."

The man seemed startled, then amused. He looked directly at the Empath and said, "It took you five hundred years to see that you certainly aren't a race that jumps to conclusions. We've all known that for a long time."

The Empath struggled with the man's reactions. This one was not like the others. Words were seldom a clear reflection of inner states in any case, but with this particular man, words and inner states seemed to be self-contradictory on almost every level.

"I do not understand your reaction," the Empath admitted.

"Did you expect me to be terrified? To attack you? To beg and scream for your mercy?"

"None of those things. You are not given..."
to such reactions. What is puzzling is your immediate understanding and acceptance of the situation. It is unlike the reactions of the other specimens.

The man nodded and said, "I suppose that's true. The others must have thought you were a god. Or a demon."

"That is accurate."

"Well, I don't consider you either and I'm glad to see you. In fact, I was hoping to find you, or someone like you."

"Explain."

"These ships—the one I was on, and the two others—are going out to look for other worlds like Earth and other intelligent races. And before I've even left the solar system, you've proved to me that my mission can succeed. Of course I accept the situation. I rejoice in it!"

"Have you no fear that an intelligent alien race might constitute a danger to your own race?" the Empath asked.

"There's always that possibility. I'm sure it's occurred to every people that ever looked up at the stars." He hesitated, then continued, "Still, you've been here for two centuries and haven't attacked us or interfered with us in any way we've been aware of. You aren't too different from us in appearance and you can speak our languages. These are encouraging signs. Apparently you're a much longer-lived race than we are."

A very rational people, too thoroughgoing, cautious in judgment, detached. I don't know why you're here, but I see no evidence of outward hostility. What is the nature of your mission?"

"Tell him all," instructed the Conceptualizers.

"Our mission is like yours," said the Empath. "We seek new worlds for the Anpreene Domination. Yours is the most suitable we have discovered."

"Do you intend to try to take it?"

Our Assessor judged that aggressive action was unnecessary. Your race will soon destroy itself. According to Anpreene calculations your destruction is long overdue.

"Some earthly calculations give the same result. And yet we've managed to hang on. We may surprise you."

"The Anpreene would prefer to avoid conflict with such a race as yours."

"I'm not a spokesman for my race, but I think it's safe to say that we'd rather be your friends than your enemies. I hope we can be. But tell me, Empath, what do you plan to do with me now?"

"You will be returned to your ship and to normal time and space. Your absence will not have been noticed. A faulty coolant valve will cause the ship to explode in seven to eighteen seconds after your return."

"The main valve on C deck, the one just aft of the food processors?"

"The gray-haired man asked.

"The Empath conferred with the Conceptualizers and then said yes. "Is this your doing?" the man asked cautiously.

"No. It is a predicted malfunction."

"Well, I will go in peace."

"I'm not a spokesman for my race, but I think it's safe to say that we'd rather be your friends than your enemies. I hope we can be. But tell me, Empath, what do you plan to do with me now?"

The Empath, what do you plan to do with me now?"

"We've helped to bring your people to the stars. Even if I don't make it, others most certainly will."

When the man had been returned to his ship, the Assessor declared the approximate phase of the mission complete and ordered preparations for the long homeward voyage. The Empath and the Conceptualizers, their hardest work done, started wearily for their respective living compartments.

The Empath felt drained of vitality. He had been trained from youth to assimilate the data patterns of alien races and had done so on several earlier expeditions, but never with a race so frenzied and spasmodic in its ways. Attuning to the human race had been an exhausting duty. Even pentaedecan had been scarcely enough to sustain his strength.

An interesting race, the Conceptualizers observed. "But mad. Their frenzy is the working out of their madness."

"I found much good in them," the Empath responded.

Observe the discipline of the Empath. Do not overlook the fact that these creatures are inferior species."

The Empath, still steepled in human attitudes and reactions, made no immediate response. After a time in inner communication, which in weariness was left unguarded, opened to the Conceptualizers: the Empath reflected. Yes, they are mad. But there is splendor in such madness.

The Anpreene left the solar system in something more of a hurry than was their custom. The journey home was uneventful. The Empath spent the entire trip in deep pentaedecan and arrived fully restored and revitalized. This proved to be fortunate for much unexpected work lay ahead for the Empath.

When the Anpreene ship returned to normal space within the Domination, the armada from Earth was waiting peacefully to greet it.
SKY PIPES MAZE

The water flows from the faucet in the clouds to the sea. Find the correct pipe.
required for uneven ground probably live or six would be enough. Both hand and foot power would be desirable for balanced exercise. John Thomas, a physics graduate from Oregon has invented a quadruped bicycle that allows the use of both hands and feet. Leg and arm cranks drive the front wheel, which also steers. Slightly modified, the bicycle could be ridden by a paraplegic using arms alone. This would give him a sense of freedom and accomplishment unknown with a standard wheelchair. I recently clocked a paraplegic riding a hand-cranked tricycle at over 18 mph; the arms can obviously provide considerable sustained power (approximately 15 to 20 percent as much as the legs).

An existing tricycle matching most of the above criteria is the Muscar built by Professor Paul Schondorf of the Technical University of Cologne, Germany. It is a well-designed all-weather vehicle pedaled from the easy chair position.

Using a human-powered commuter vehicle would have many advantages. Probably the most important of these would be that good health and physical fitness would result. Modern life-styles conspire against exercise of any kind, and people are forced to seek exercise outside their daily activities. Jogging, cycling, playing tennis and engaging in other sports are fine, but to be realistic, exercise is much more easily accomplished if it has a specific purpose.

Human-powered vehicles are also silent and clean but could they really conserve energy? Yes. In the Western world it is doubtful that the use of human-powered transportation would increase food consumption. Any vehicle which would make an auxiliary power package light and convenient. The mistake that manufacturers of mopeds are making is that they have made it impossible for riders to use mopeds as bicycles.

The gearing is wrong, and mopeds weigh too much. Mopeds are not true hybrids but motorcycles in disguise. Their pedals serve little purpose but to start them up. A true hybrid would be human-powered first, with the motor serving only as an auxiliary.

NEW LAWS

Could this hybrid vehicle come into common use within the next few decades? Probably not in a free economy. More likely we'll see smaller and smaller automobiles with any efficient engines, and superb streamlining that get several hundred miles per gallon. Regrettably bicycles and other human-powered vehicles are not safe in the present traffic mix with motorized vehicles. Constructing separate roadways would be wasteful as available land becomes more valuable. However, legislation could change the entire picture almost overnight. Motorized vehicles used for daily commuting could be taxed nearly out of existence by discriminatory laws. Rigid fuel rationing and high fuel prices could limit automobile use to occasional trips or vacations. If this happened, our entire life pattern would have to be altered. The incessant American quest for luxury and ease of living would somewhat have to be redirected (this might not be all bad). A realist will probably not lose much sleep over this possibility.

And it isn't likely to bother the irrepressible inventors who participate in the Human Powered Speed Championships. They are sure many of their innovations will eventually appear on the world's highways.
Last year the Defense Advanced Research Projects Agency (DARPA) reported to Congress "significant progress" in an area called biocybernetics. DARPA researchers have managed to extract useful information from the brain's electrical activity. The electroencephalogram (EEG) is measured by electrodes placed on the scalp or inserted into the brain itself. Although it has been known that the EEG varies with mood—we generate alpha rhythms when relaxed, for example—trying to relate the mysterious squiggles of an EEG to specific thoughts and motor processes has seemed futile.

Recently, though, DARPA researchers have used computers to identify the EEG signals that distinguish thinking, or cognitive, processes from motor responses, such as signals to the muscles. By measuring the EEG signals for motor responses and those for cognitive load, they have been able to assess spare brain capacity from moment to moment.

DARPA also claims that computers can identify EEG waves associated with decision making and action. If the EEG's decision-making component ends before the action component, the researchers say the decision was probably correct. But when the decision-making signal continues after the action component ends, the probability of error is very high. A computer can now tell its operator, "Excuse me, Joe, I think you made a mistake there."

Modern electronics will probably tell us much more about how our elusive neural signals reflect our thoughts and feelings. Scientists can now investigate EEG frequencies of up to several million hertz. This is an enormous increase in sensitivity over the 100-hertz range of the classic EEG chart recorders.

Despite these refinements, it seems unlikely that the EEG will ever be able to operate a human/computer intelligence amplifier. The voltage differences measured by the EEG's widely separated electrodes cannot be traced to specific brain locations—a must for any useful link.

Physiologists have always yearned for a technique that would directly monitor localized brain activity from a distance, so as to avoid interfering with the brain's normal function. Today they have it.

Electrical activity always produces a magnetic field around it. The brain's currents are no exception. Twenty years or so ago researchers were looking for magnetic fields created by biological processes. In 1963 Gerhart Baule and Richard McFee reported in the American Heart Journal that they had detected the biomagnetic field of the beating heart. But the field was only one-billionth the strength of the earth's magnetic field. To detect it required extensive shielding and even then, sensing coils with 2 million turns of hair-fine wire could barely pick it up.

Today the superconducting quantum interference device (SQUID), which uses superconducting niobium coils cooled in liquid helium, is more than 1,000 times more sensitive to magnetic fields. By coupling SQUIDs with other modern electronic techniques, Dr. Lloyd Kaufman and his colleagues at New York University have eliminated environmental magnetic noise almost completely.

A SQUID positioned a centimeter from the scalp can produce a magnetoencephalogram (MEG) far more sensitive than an EEG. Kaufman and his fellow researchers can now locate neural activities in the brain within several millimeters.
So far, Kaufman has mapped the response of the visual cortex to simple stimuli and has located the brain’s reactions to electrical currents applied to the fingers.

Eventually the MEG responses of the entire brain and the spinal cord will be mapped. At that point, computers may be able to decipher our MEGs and read our minds—if we let them.

The Flanagan Affair

But how about the other way around? How can computers talk directly to the human nervous system? On July 24, 1962, I had my own nerves linked to an electronic circuit that fed audio signals directly into my brain without loudspeakers and without any electrical connection.

A teenage gadgeteer named G. Patrick Flanagan of Bellaire, Texas, had stumbled onto creating what he called a neurophone. Because no one had any idea how the device worked, it seemed very complex but technically it was very simple, nothing more than a 35-kilohertz oscillator amplitude modulated by a hi-fi amplifier. The amplifier fed the combined signals from the oscillator and the amplifier through a transformer that produced an output with very high voltage and very low amperage.

An ordinary TV antenna wire carried the signal to two insulated pads that Flanagan had taken from a muscle-walker device. The 7.5-centimeter pads were basically a sandwich of metal mesh connected to the TV lead and insulated by two rubber disks.

If you put one pad on your spine and the other on the sole of one of your feet you could hear perfect hi-fi in your head the moment contact was made.

I investigated the Flanagan neurophone as a possible new product for a small industrial firm. In three years of complex experiments researchers concluded that bone and skin conduction had nothing to do with the transmission of audio information to the nervous system.

Dr. Wayne Batteau, then at Tufts University, proved later that the neurophone was directly activating the human nervous system and that the audio information was not being picked up and transmitted to the brain via the auditory nerve. In fact Dr. Batteau reportedly restored hearing to a nerve deaf patient.

Somehow the Flanagan neurophone seemed to couple electronic circuitry directly to the human nervous system. The device could apparently send audio information along any nerve path to the brain, which recognized the signal as audio data and switched it to the appropriate area of the cortex.

Unfortunately my own research with the neurophone ended abruptly when the company I worked for declined the project, and we developed a new myocardial infarction while scuba diving with dolphins in Hawaii, and Flanagan became involved with Oriental mysticism and developed into a leading exponent of 'pyramidal power.'

Unbelievable as the Flanagan neurophone may sound, I can assure you that it was no hoax. Many responsible people experienced its effects. The experiments were conducted under the most controlled conditions we could arrange.

In 1962 the neurophone, far ahead of its time, was considered only as a new type of hearing aid. Although it has remained unused for more than a decade, I hope that interest in it will be renewed and that research will resume. Technology may now have caught up to the point where the neurophone could be used as the basis for human-to-computer interface.

To Run the World

Of course it is still far too early to say whether the intelligence amplifier will even remotely resemble Cy. But one thing is certain. Advances in our knowledge and technical skills are bringing us closer to a working, fully functional interface device.

The intelligence amplifier will combine our creative, self-aware, multichannel, and many-connec ted nervous system with the high-speed computation of the electronic computer. The crystalline computer will become an extension of our own minds, a new tool to expand intelligence.

Viewed in perspective, the intelligence amplifier is only a logical step in the evolution of computer technology. Computers and robot machines have taken over much of manual labor and painstaking computational work. Yet we have only begun to explore the computer's ability to reduce our mental workload. So much of our time and resources, especially during our education, are still devoted to memorizing an enormous body of information and ideas that forms the basic framework on which all later knowledge is built. Why shouldn't we use computers to help us?

Will the crystalline computer in an intelligence amplifier take over and rule the col lobial, human portion? Only if we humans design it to do so. The computer is a tool and yes tools occasionally get out of hand. The hammer can bang your thumb if you aren't careful. Fire can burn you. But because tools are not always safe is no reason not to have and use them.

Perhaps one last question must be asked. Why try to build the ultimate computer, the intelligence amplifier, in the first place? Why not continue to rely on ordinary human intelligence?

To help me keep some perspective about the world, I've put a motto in Latin above my desk: Necas mi fili quantita sapientia regatur mundi. Rather loosely translated, this tells me, 'You'll never know your son with what little real knowledge the world is run.'

To run the world better, with more real knowledge we need all the help we can get. That is the real purpose of the intelligence amplifier.
The viral invasion is aborted. Darwin II's entertainment is finished, but the interferon story does not end here.

In the mid-1970s the Finnish virologist Ken Cantell developed a method to produce and purify large quantities of human interferon from leukocytes obtained from blood donors at the Central Public Health Laboratory in Helsinki, Finland. It was known at the time that interferon possesses unique qualities to attack many of the more potent viruses that cause disease, but the interferon that was produced by virus infection of animal-culture cells showed little or no activity within human cells.

To obtain sufficient quantities of human interferon, human cells had to be grown and infected with virus. The recovered interferon could then be used in clinical trials. The actual treatment of patients suffering from viral disease.

Taking a natural body substance, purifying it, and finally turning it into a drug that can be used to treat human disease is nothing new in the annals of medicine. Certain hormones—particularly the corticosteroids and insulin—have been put to use this way. As a drug, interferon is a logical contender for this permutation role, but except for one of the impure substance that are available in drugstores in the Soviet Union (ostensibly to combat the common cold) it is being used only experimentally to combat some viral diseases in man.

Interferon's effectiveness against the viruses that cause the common cold began appearing in the scientific literature early in the 1970s. Large doses of the drug, sprayed into the nostrils of volunteers, prevented the major symptoms—aches, fever, and runny nose—caused by rhinovirus 4, one of the myriad viruses that cause the common cold. Other medical investigators had similarly good results after administering interferon by injection to patients suffering from serum hepatitis (hepatitis B), a type of liver disease that is contracted through transfusions of contaminated blood. When interferon is combined with another antiviral drug—adenine arabinoside—the hepatitis-B virus virtually ceases to multiply. This double treatment may hold the long-awaited cure for this chronic viral disease.

In still other clinical experiments interferon apparently enhanced the effect of rabies vaccine, although it had precisely the opposite effect with vaccinia, the vaccine against smallpox. So far interferon seems to be the only substance that can retard herpes virus infection in the eye (herpes keratitis) and along nerves close to the skin (herpes zoster or shingles).

While investigating interferon's effectiveness against certain viruses, researchers stumbled onto a hitherto unsuspected property of the protein. It retards the growth of certain malignant cells. In retrospect, though, this exciting discovery seemed logical. After all, interferon and the proteins it triggers within cells disrupt the protein-assembly mechanism—the very mechanism that both cancer cells and viruses exploit in their rapid replication.

What's more, the normal surface-membrane controls that tell noncancerous cells when to stop growing may be regulated in some way by interferon. When these controls go awry in malignant cells, the tumor grows haphazardly, invading tissue and choking off vital organ function. Extra interferon caused some tumors to recede through a combination, researchers believe, of surface and growth inhibition. Normal cells were hardly affected at all.

For the first time researchers had a drug that would attack cancer cells alone. And the drug was a natural cellular product.

The first trickle of relatively purified human leukocyte interferon from the Helsinki blood banks went to Dr. Hans Strand- der, a Swedish oncolgist at the Karolinska Hospital in Stockholm. He used it to treat patients suffering from acute leukemia, Hodgkin's disease, multiple myeloma, or osteosarcoma. Not all the patients' conditions improved. In some cases the disease diminished, only to progress again. But in his 34 osteosarcoma patients the survival rate was twice that of patients receiving conventional bone cancer therapy. Most remained free of metastases, the dreaded spread of the malignant cells that break away from the original tumor and migrate to other organs.

Dr. Strand published his findings, beginning in 1974, but they received scanty consideration from cancer specialists in the United States because Strand's methods seemed suspect. A few researchers, in effect, promoted Strand's findings and they extended their own investigations into interferon's anticancer properties, using Cantell's interferon.

The major holdup was the slow production of the interferon, which proved to be extremely difficult to purify in large quantities. (Three pints of blood provide only enough white cells to produce a single day's supply of interferon for one patient.) A millionth of an ounce costs $1,500, which translates to $22 billion per pound. Strapped for dollars. U.S. researchers began their own production lines.

Cell biologists found that slightly varying types of interferon could be harvested from different human cell lines. The National Institute of Allergy and Infectious Disease supported a pilot project for the production of interferon from fibroblasts (connective tissue cells) at New York University. The Massachusetts Institute of Technology has begun its own production facility for fibroblast interferon under bioengineer David Levine and Professors Daniel Wang and William Thilly. Using 40 million tiny glass beads in a flask to multiply surface area on which fibroblasts can grow, the research—

And you say that each time you swallow it's accompanied by a soft whirring sound?
ers have achieved a tenfold increase in the number of fibroblasts yielded. A human leukocyte production line has been established at the University of Berne in Switzerland. Under the auspicies of Sloan-Kettering, Dr. Christian Anfinsen, a Nobel Prize-winning biochemist, has been put in charge of the National Institutes of Health's effort to isolate leukocyte interferon at the empty biological warfare facility at Fort Detrick, Maryland.

Such efforts at production were directed at obtaining sufficient quantities of interferon for purification and analysis. The substance was proving to be devilishly difficult to purify and biochemists needed the pure essence in order to work out its amino acid sequence. Their thinking was that they might be able to synthesize it in the laboratory circumventing the human cell culture production method.

Other researchers would like to insert human interferon genes into harmless bacteria in an effort to induce these microscopic factories to produce an endless supply of the valuable protein. Once the controversy over safety regulations for recombinant DNA research subsides down this approach will undoubtedly be tested on a broader scale. (Such gene-splicing techniques are already being used to produce human insulin and somatostatin—a growth hormone inhibitor used to control pituitary gigantism.)

As more interferon was produced and as more researchers took an interest in the substance, a new picture of interferon's role in the body emerged. The substance was no longer regarded as a mere stimulator of antiviral protein; in fact, its antiviral effect is now thought to be only one aspect of its regulatory control of the body's immunological system. Current knowledge suggests that interferon is an intercellular messenger—in effect a hormone—with antitumor activity through its action on cell membranes and DNA replication, and antiviral activity through the mechanisms that the fictional Dr. Darwin described in his 'holistic demonstration.'

Researchers have discovered, that besides being made in leukocytes and fibroblasts, the substance is manufactured in a third cell—and without prior viral prompting. These cells, called lymphocytes, are a vital link in the immunological system, responsible for producing antibodies and controlling the rejection phenomenon by which the body distinguishes its own tissue from foreign tissue. Interferon from one specific kind of lymphocyte, the T-lymphocyte, which originates in the thymus, can suppress the immunological response and delay graft rejection. Its medical applications in organ-transplant therapy are now being actively studied.

Naturally occurring interferon, produced when any virus attacks the human body, is released into the intercellular fluid within a matter of hours after the invasion. These same body fluids, which transport the interferon to unaffected cells, also contain as yet unknown substances which begin to inactivate the interferon. A balance between inactivation and viral-induced interferon continues for the duration of the acute stage, when virus is being assembled and released to infect other cells.

Although interferon is the first line of defense that the body's immunological system hurls against viruses, it is by no means the sole defense. Antibody and sensitized lymphocytes together with the scavenger macrophages all enter the intercellular arena to contain the spread of the virus. Indeed, the antibody against specific viruses is more deadly to the invaders than interferon alone. Interferon will never displace the need for vaccination because the natural cellular substance cannot protect cells from viral penetration as does the antibody which immobilizes the virus before the cell-membrane attachment stage.

Interferon, though, may find a use in combating viruses for which no vaccine is effective. Influenza among other respiratory viruses can alter its surface chemical structure so as to bypass the antibody system that had been aroused by previous infections with a slightly different influenza virus. In such instances interferon that can be applied in a nasal spray may have some salutary effect. An experiment with nasal interferon on flu victims several years ago in England met with disappointing results, but the interferon was not as pure as, the interferon being produced now.

As important as its application is against virus, the real promise of interferon seems to lie in cancer therapy. This was not widely recognized, however, until last year. After researchers and cancer clinicians in increasing numbers had begun their own trials and experiments with interferon, the American Cancer Society decided to throw its considerable weight in monetary terms into the forefront of interferon treatment.

Late last year the society through its director of research, Dr. Frank J. Rauscher, Jr., announced the largest grant in its history—$2 million—for the purchase of Cantell's interferon to be used in clinical trials against four kinds of cancer: breast cancer, non-Hodgkin's lymphoma, myeloma, and melanoma.

Some 200 patients at 10 leading cancer treatment centers are receiving this novel treatment. The physicians heading the trials are cautious and their statements about their expectations are guarded. But there is little doubt from preliminary results in ongoing clinical trials, which began before the American Cancer Society's program, that interferon holds great promise. Perhaps not for all cancers, but time will tell.

In any case investigations into how interferon inhibits tumor growth will continue to unmask the still hidden mechanisms by which cells communicate with one another through the complex immunological system. If the antibody proves to be ancient well, so be it.
COMMUNICATIONS
CONTINUED FROM PAGE 10

be ignored, though I concur with your later
statement to the effect that such expositions
should be documented, at least intuitively.
That's good enough for us in physics
these days.

Franz Kromm, Ph.D.

Misplaced Star
In your April 1979 issue, time traveler
Patrick Moore indicates that an observer near
the star Arcturus would be looking at Earth
from the Big Dipper. However, an observer
on Earth, training a telescope at the Big
Dipper, would not be seeing Arcturus. This
spot of light, the fourth-brightest star in the
heavens and prominent in the northern
skies from March to September, is located in
the constellation Boötes approximately
38 light-years distant.

Further pondering Moore's article, I note
with interest that should any observer be
capable of traveling faster than the speed
of light he could, upon reaching a distant
star system, stop, turn around, and watch
himself coming. I find that difficult to believe!

Gerald Maxson
Los Angeles, Calif.

America's Secret?
I came from Europe to Los Angeles only two
months ago and I did not come across
Omni in England. But, while I was working
here in the United States on a science
series with engineer "Scooter" of Star Trek
fame (whose acting is only his occupation,
science is his preoccupation), several
friends mentioned your magazine. Finally,
someone brought me a copy, and I was
staggered by the beauty of the publication.
The photographs and the layouts are better
than those in National Geographic, the
interviews are more interesting than
Playboy's, and the articles are as
informative as, and more readable than, the ones

Why don't we know more about this maga-
zine in England? Please continue forever.

Marie Hoy
Los Angeles, Calif.

Space for Humans
I was both entertained and intrigued after
reading G. Harry Stine's article "Industry
Goes to Space" in the April Omni. I am
convinced that Stine researched the pros-
pect of space industrialization well and
analyzed the data fairly—from an eco-
nomic standpoint.

Although the final decision regarding
the implementation of space industries will
certainly depend on financial matters, I be-
lieve that the strong points in favor of such
projects are humanitarian.

Instead of concerning ourselves with
Dick Tracy wrist radios or stock-market
quotations on electric toasters in India, we
should think about the energy that could be
provided by solar-power satellites—en-
ergy that aids in the industrialization of
underdeveloped nations. The result would
be greater education and, hence, lowered
population growth by means of birth con-
tr ol devices. This theory may at first seem
imperialistic. However, as a rule, industril-
ization yields a higher standard of living.

Kenneth Altman
Brooklyn, NY

Intelligence by Design
Kevin Langdon's conclusions ["The World's
Hardest IQ Test," April 1979] about the
average intelligence of women have no val-
dility if derived, as indicated from his
observation of the membership of Menela and
the Four Sigma Society. The self-selected
sample is neither random nor representa-
tive and cannot be accurately used for
generalization about the population of all
women. Langdon fails to consider such in-
tervening variables as the proven social
conditioning of women to feelings of in-
feriority and nonconformity with intellectual
competition. His demonstrated egocentricity
and patrician attitude may well be the causes of his
inability to meet women he doesn't "have to talk
down to." All that his test "conclusively
shows" is that some woman of average
intelligence (relative to one another)
bothered to complete his test. Langdon's
intellectual ability may well benefit from
application to a course in basic research
design.

Sally-Anne Cozens
London, Ont., Canada

In an article entitled "The World's Hardest
IQ Test," Kevin Langdon says that there are
more geniuses among men than among
women. I think he should be made aware
that this applies only to tests involving
geometric figures and what is called "spatial
visualization" ability. Since his own test
loads heavily on this factor (35 out of
his 100 questions) it is not surprising that
those who pass the test are mostly male. But
I think he is erring in equating this specific
ability with generalized "intelligence," or, as
Langdon puts it finding women don't
have "to talk down to."

The question remains as to whether
the poor performance of women in geometry
is due to innate or acquired factors.

George Fergus
Schaumburg, Ill.

In the introduction to the Langdon Adult
Intelligence Test [LATT], I am inaccurately
quated as saying that one of the reasons
why I constructed the test and founded
the Four Sigma Society was "to meet women [I]
who wouldn't have to talk down to. I never said
this, and, in fact, it does not reflect my views.

People vary in their abilities, and it
appears that, on the average, women tend
to do somewhat less well than men on non-
verbal IQ tests and such IQ-like tests of
ability as the quantitative section of the

FABULOUS PRICE
ONLY $29 95

Outstanding features:
• CREDIT CARD SIZE (fits in your pocket)
• ULTRA TRIM (4 1/4 inch thin)
• SUPER LIGHT (weights only 2 ounces)
• COLOSSAL FEATURES:
TIME continuously displays hours, minutes, and seconds
(User can change from 12 to 24 hour time at will)
CALENDAR with month, day, and date
• Functions as ALARM CLOCK
2 SEPARATE ALARMS can be set to any 2 times of the
day or night
Special alarm CRIMES every hour ON THE HOUR
Complete calendar functions with memory
Includes reminders (birthdays/business card dates)
and one-year warranty

Have your business card reproduced
on the back of the Time Card computer
for only $55!

Stand riding this business card for each Time Card purchased
and we'll reproduce it in black on the back of the Timex
computer. What a great premium and gift idea!

Why Shop By Mail?
What's new in our line is convenient, easy and fun. We ship all
orders promptly to your home or office. You can change your
order to any major credit card. Most of our products are
available at your local stores. And if that isn't enough you have
a 30 day no risk money back guarantee.

Try any one of our products for 30 full days and if you are not
happy with the performance, features or for any reason you wish
to return a product, we will refund your full purchase price
including the insured postage and handling charges.

CREDIT CARD BUYERS. TO ORDER CALL TOLL FREE
24 HOURS A DAY
To order in California call toll free (800) 854-3831
(800) 854-3831
DWS Marketing International 17875 Sky Park Wg. Suite G
Irvine, California 92714
(714) 540-8484
Get our free directory for purchase information is read our book.
M.D. (in熟知 card is Square. We accept Ame. Exp, Master
D, Visa, Discover, or 30 card and $25 for prepaid post
and handling. No return or 30 card is $25 for prepaid post
G I address and 0% sales tax. ©DWS Marketing International 19/95

0

The New One! Multi-function calculator
A SENSATIONAL TIME CARD COMPUTER
Graduate Record Examination

My test in common with most IQ tests focuses on abilities that lend themselves to "objective" testing procedures such as the multiple-choice format employed in the LAIT.

These abilities while important and useful are only a few of the mental traits that taken together constitute what I regard as intelligence.

In particular the LAIT does not measure more than one aspect of the vital area of common sense or judgment. The interpersonal aspect is not touched at all. Yet it is precisely here (in my subjective judgment) that women on average have a significant advantage over men.

Obviously I don't mean to deny that there are women with outstanding spatial and quantitative abilities or that some men have extraordinary insight into people, but there is a pattern of psychological differences.

This pattern is a matter of observation and is independent of the question of genetic vs environmental origins. Recent research indicates that there are slight differences between male and female brains and of moral questions concerning the relationship between men and women.

Finally, regardless of differences in ability there is no excuse for talking down to anyone. The patronizing attitude from which talking down derives is a sign of immaturity and feelings of inferiority.

Kevin Langdon
Berkeley, Calif.

Scott Moms replies Langdon sent me a news clipping saying that he devised the test in part to meet women who were as intelligent as he and that he has been able to find people I don't have to step down to 'I changed step to talk and look out the quotes.

As for sex differences and IQ in Intelligence and Personality Alice Haz (in a chapter she wrote titled "The Mediocrity of Women") says "There is a tendency for males to be more so than females, whatever is being tested. Thus on intelligence tests comparable young men and women tend to gain mean scores which are similar but the highest and lowest scores are liable to be male. Men rather than women are found at the extremes. There are more male geniuses, more male criminals, more male mental defectives, suicides and sluttresses. The list is a long one with relatively few exceptions." I would add that variability is a male characteristic in virtually all mammals, not just human beings.

Not Known
You were quite right. The meeting at the United Nations went highly unnoticed. I had seen some bits and pieces about a U N meeting concerning a UFO probe, but your magazine was the first to give any kind of lengthy report on it.

John Harding
Alexandria, Va.

Inspiration
I just finished reading Orson Scott Card's "Unaccompanied Sonata" (March 1979), and must thank you personally for having printed such a moving piece of literature. This short story was my introduction to Card's fiction, but in no way will it be the last. I have rarely found a story that evokes such emotion and love. Card has brought home to me a writer "just how terrible it would be to lose my craft. I am painfully aware of the time it will take for me to reach that fine level of expression that Card has reached with this piece and I often have doubts as to whether or not I could reach it. But "Unaccompanied Sonata" has needled me. I will reach it!

Laura S. Diaz
Coral Gables, Fla.

In honor of Alfred
Alfred Bester must have put some Ray Bradbury and Isaac Asimov into the programming of "Galatea 32" (April 1979). There were surely no flaws designed into this tale, and I commend Omni for recognizing Bester's talent.

I hope you will honor Bester by inserting 50 more of his stories into future issues. A totally enjoyable reading experience.

Edward J. Burke
Queens, N.Y.

Interviewing Arthur Clarke
As a fellow journalist, I was intrigued with Malcolm Kirk's interview of SF novelist Arthur C. Clarke in the March Omni, not only because of the content but also because Kirk was able to interview Clarke at all. I have written Clarke several times, asking for an interview and each time receiving a polite but standard letter explaining that he no longer granted such audiences. How did Kirk pull it off?

Grant Durward
Chicago, Ill.

Malcolm Kirk replies Sometimes it's better not to write, but just sort of drop in instead. Granted, this is difficult when your subject lives in Sri Lanka. Fortunately, I was on a round-trip flight to the Philippines and interviewing UFO contactee Rev. W. Irwin Gatl in Melbourne, Australia. I figured that as long as I was in the neighborhood, I'd try to see Clarke.

I wrote him from Singapore and received a polite refusal, probably similar to the latter you were sent. I followed this up with a phone call from New Delhi and again asked to see him. He agreed but told me not to make a special trip. Of course, I did anyway and the result of that meeting was the March interview.

For helping make it all possible, I'd like to thank Pan Am and particularly Richard Barkle, director of public communications, who, besides getting me to all these exciting spots provided me with unflagging advice and support.

Summer School
On page 32 of your April issue there was a brief article about a science-fiction class. It was of interest to me and I shall write in for further information for the summer of 1980.

Some of your readers might be interested in the class to be given for the second time this summer at California State University at Northridge. The class is called "Colonization of Space" and stresses the sciences and not the fiction. The class will be given every weekday June 25 to August 3, from 9:30 to 11:15 A.M. If you would like further information, call the Office of Continuing Education (213) 885-2644.

Shelly Pearson
Granada Hills, Calif.

Congratulations
On behalf of the Society for the Advancement of Science Fiction and Fantasy I wish to take this opportunity to thank you for producing such a high-quality publication and personally tell you that I won the 1979 Galaxy Award for best science fiction magazine by an unanimous vote of our board of directors. We could not begin to praise your magazine enough. We'll leave that up to your countless readers. But we will say that your publication has set a new precedent for the entire science fiction industry, and we are very pleased to see science fiction taking a new step forward in space exploration. Make that a quantum leap for the future. It would border on absurdity to wish you good luck, for the high standard of excellence contained in the pages of Omni ensure that Congratulations! Bob! And don't be surprised if you hear these exact words next year.

Dr. Emil Barbadoza
Chattanooga, S.A.S.
San Diego, Calif.

THE MAZE ANSWER

126 OMNI
True Believer

I read the article "New Scandal in Psychic Research" (Continuum, April 1979) with some interest. I believe that funding for psychic research should not be reduced to more worthwhile projects not because I don't believe in psychic phenomena, but because I do believe in them.

I have seen within my family too many instances of prophetic dreams, precognition,clairvoyance, etc., to discount them totally. However, I also have observed that all psychic phenomena are like a car with a faulty starter. Sometimes it works and sometimes it doesn't. It is unreliable. Giving this mysterious fact is not possible to go into a lab hook up a machine, and expect to get results. Experiments cannot be repeated. This makes the whole project frustrating and invites serious scientific investigators to relegate research to charlatans.

In my opinion, psychic phenomena should be given no more serious research than parlor games. Let's spend the money on something more tangible, and something that will be of use in this overcrowded and warn world.

Vickie Lloyd
Shreveport, La.

Power Play

In reference to the article "Power Play" by Frederik Pohl (April 1979), the author agrees with other researchers as to what is the critical question concerning our present energy situation is, however, thereafter the article is less adept at contributing new and pertinent information. It is in offering unwarranted criticism.

For example, Mr. Pohl rightly points to the urgency for stepped up development of renewable-resource energy technologies but fails to comprehend the physical, technological, and political constraints that accompany such alternatives. In particular, solar power is not an option to be found everywhere, i.e., there are not enough cloudless regions in the United States to provide continuous solar-based electricity. In fact, all of the renewable-resource options identified by Pohl are geographically confined. Thus, if Pohl had even hinted that the energy-producing options he lists were additive ingredients instead of the only ingredients in supplying our energy appetites, the article would have been far more entertaining.

Jeffrey P. Richato
Ph.D.
DeKalb, Ill.

Defending "Craneks"

Let me begin by saying that I am a great fan of Frederik Pohl. His work has amused, informed, and entertained me for years.

However, I noticed an error in his article entitled "Power Play."

The writer states a concern that if the polar ice caps were to melt because of a "heating" of the earth's atmosphere certain coastal cities would sink under 90 meters of ocean water. He also expresses a concern for ice masses calving into icebergs, which would float away and melt.

Pohl overlooked a very simple fact, that floating ice already displaces its own weight in water. The net result of an iceberg's melting would only be less water depth, not more.

The North Pole is entirely covered by a mass of floating ice. It poses no threat if it melts, at least as far as the possibility of its flooding the world Antarctica, however, is covered by ice which is supported by land. This ice could hardly break off and float away except at the very edges. If all that ice were to melt, it would very possibly cause a slight rise in the overall depth of the ocean, but even this natural contours of Antarctica would hold quite a bit.

It is the ice that is supported by land—glaciers and such—that we should be worried about. Since a great deal of the permanent ice in the world that is land-supported is found at such high altitudes, the amount of heating of the earth's atmosphere would have to be quite considerable to provide those higher altitudes with enough heat to melt their ice.

Mr. Pohl, back to the drawing board— as far as New York, Miami, and Los Angeles being under 90 meters of ocean if the poles melt is concerned.

Ed Bertachy
Bicicof, Miss.

LAST CHANCE!

TO GET SLIDES & MOVIES OF
APOLLO MOON FLIGHTS

35mm Slides & 8mm Movies made from
NASA Negatives will only be available
for a LIMITED TIME.

First Moon Landing, July 1969
A. Apollo 11, Set of 24 Color Slides $10
B. Apollo 11, 450 Ft. 8mm Color Movie $50
First Use of "ROVER AUTO" On Moon, April 1972
C. Apollo 11, Set of 24 Color Slides $10
D. Apollo 11, 200 Ft. 8mm Color Movie $20

Last Moon Landing, December 1972
E. Apollo 17, Set of 54 Color Slides $22
F. Apollo 17, 400 Ft. 8mm Color Movie $40
Includes all full circle photo of earth ever taken
U.S. & Russian Manned Flight, July 1975
G. Apollo Soyuz, Set of 48 Color Slides $20
H. Apollo Soyuz, 400 Ft. 8mm Color Movie $40
Includes shots of various parts of Earth From Space.

When Ordering 8mm Movies Please Specify
Super 8 or 16mm Film
Foreign Orders add 10% for AIRMAIL Postage

Money Back Guarantee

MOVIE NEWSREELS, 5
Box 2589, Hollywood, Calif. 90028

Enclosed $ For Apollo 11—Gemini 4
Videotape, my Player/Recorder as
Name
Address
City, State, Zip

FOOTPRINTS ON THE MOON

Spectacular Hard Cover Book By The Associated Press 215 Pages. Includes 124 Full Color Photographs of U.S. Astronauts, Russian Cosmonauts, Rockets, Space Hardware, etc. Many Photos Taken In Space And On The Moon. Complete Accounts By AP Of Major Space Flights.

Out of Print! Collector's Item!

Originally $10—While They Last!

$7.95 POSTPAID
MOVIE NEWSREELS 8268 Santa, Box 2569
Hollywood, California 90028

STOCKING STUFFERS...Atlantic Equipment & Supplies

VIDEOTAPE CASSETTE!

Now available: One Hour Videotape Cassette of APOLLO 11 Flight, and GEMINI 4 Spacewalk—both on one videocassette. See them on your own BetaMax, RCA, Zenith, JVC or any of the Video Player/Recorders now on the market.

APOLLO 11 and GEMINI 4—On ONE Hour Tape

Only $50 Postpaid
Give Name and Model No. of Your Video Player/Recorder When Advertising. Please Use Envelope.

Videotape, CASSETTE!

The Continuum Staff

"FOOTPRINTS ON THE MOON"

Spectacular Hard Cover Book By The Associated Press 215 Pages. Includes 124 Full Color Photographs of U.S. Astronauts, Russian Cosmonauts, Rockets, Space Hardware, etc. Many Photos Taken In Space And On The Moon. Complete Accounts By AP Of Major Space Flights.

Out of Print! Collector's Item!

Originally $10—While They Last!

$7.95 POSTPAID
MOVIE NEWSREELS 8268 Santa, Box 2569
Hollywood, California 90028

"FOOTPRINTS ON THE MOON"

Spectacular Hard Cover Book By The Associated Press 215 Pages. Includes 124 Full Color Photographs of U.S. Astronauts, Russian Cosmonauts, Rockets, Space Hardware, etc. Many Photos Taken In Space And On The Moon. Complete Accounts By AP Of Major Space Flights.

Out of Print! Collector's Item!

Originally $10—While They Last!

$7.95 POSTPAID
MOVIE NEWSREELS 8268 Santa, Box 2569
Hollywood, California 90028

"FOOTPRINTS ON THE MOON"

Spectacular Hard Cover Book By The Associated Press 215 Pages. Includes 124 Full Color Photographs of U.S. Astronauts, Russian Cosmonauts, Rockets, Space Hardware, etc. Many Photos Taken In Space And On The Moon. Complete Accounts By AP Of Major Space Flights.

Out of Print! Collector's Item!

Originally $10—While They Last!

$7.95 POSTPAID
MOVIE NEWSREELS 8268 Santa, Box 2569
Hollywood, California 90028

"FOOTPRINTS ON THE MOON"

Spectacular Hard Cover Book By The Associated Press 215 Pages. Includes 124 Full Color Photographs of U.S. Astronauts, Russian Cosmonauts, Rockets, Space Hardware, etc. Many Photos Taken In Space And On The Moon. Complete Accounts By AP Of Major Space Flights.

Out of Print! Collector's Item!

Originally $10—While They Last!

$7.95 POSTPAID
MOVIE NEWSREELS 8268 Santa, Box 2569
Hollywood, California 90028
excited and impressed by what he saw—Jupiter with its moons, like a miniature solar system of its own—that he invited some eminent members of the church hierarchy to join with him in his observations. We know the results from Galileo’s letter to his friend Kepler which followed the meeting: “My dear Johannes, if only you had been here, how you would have laughed. They refused to look.”

How shall we characterize the mentality of these proud fellows in positions of responsibility who so readily pinned the “crank” label upon fellow searchers (not all of whom were crazy)? Is it the herd instinct of an establishment overprotective of the status quo (on which are based its operating budgets)? For it is not unarguable that to believe in all things, just as to believe in none, only indicates either a rank inability or a downright refusal to use our God-given brains responsibly?

A C Abajian
New York N.Y.

Almonds and Plates
I was extremely dismayed by certain aspects of E. Lee Speigel’s article “First Encounter” (April 1979) As a regular reader, I was looking forward to the “gallery of UFO photographs”

However it is obviously obvious that the photos on pages 52, 54, and 59 are nothing more than fairly good textbook examples of lenticular clouds—most probably al-
toculus lenticulians. These cloud types are very common to the leeward sides of mountains, and they can resemble lenses, almonds, or plates.

It’s a sad state of affairs if these photos were part of a presentation that UFOlogists made at a U.N. briefing. What will be Speigel’s next play? Perhaps he’ll resurrect those blurry, overexposed snapshots of an (7) paper plates and garbage-cans lids that permeated UFOlogy in the 1950s and 1960s.

Paul F. Krause
Woodbridge, Va.

New Worlds
Ben Bova is once again proving that he is among the finest science-fiction editors around. During recent years Bova has provided a frequent showcase for the amazing talents of Orson Scott Card, who is now considered one of the hottest science-fiction writers going. Many of my favorite authors have already appeared in your pages: Asimov, Sturgeon, Ellison.

I also applaud Bova on his penetrating editorial in your last issue (April 1979). It is fortunate that our government wasn’t asked to consider funding Columbus’s voyage to the New World (catch the irony of these last two words). Politicians seem unable to come to terms with the exploration of the ultimate in New Worlds—space.

Kenneth Huff
Riverston Wyo.

Swan Song
After reading Dr. Bernard Dixon’s article (April 1979) I would like to offer a few suggestions to the unanswered “swan question.”

Perhaps the swan’s endocrine system releases a hormonal substance cyclically that permits tubular membrane permeability or possibly, there exists a chemotaxis-like response to the body’s ability to sense excess spermatozoa, thus allowing phagocytosis.

What Dr. Dixon failed to mention in an otherwise interesting article is that male humans are the only creatures who spill their sperm out of lust and not solely out of the need to procreate.

Personally, I much prefer this method to that of the angler fish.

Charles Cusumano
Sterling, Colo.

Nuclear Accident—Not Likely
I noted with a certain amount of dismay, though little surprise, the two letters on nuclear power in your February issue.

The letter from Richard Asinof is typical in its irrationality of the nuclear-power critics I have met. It should be explained to Asinof that since the first U.S. nuclear reactor was put into operation in 1957 there have been no nuclear-related deaths, of industry personnel or of private citizens. The amount of radiation that a person receives from natural sources (e.g., the sun, ground and building materials) is considerably more than one can expect from living next door to a nuclear-power plant.

If Asinof fears accidents, he should rest easy. According to the Rasmussen Report, a government-sponsored study, the periodicity of a significant accident is once in a billion reactor-years. This is to say if all the power in the United States were generated by nuclear power, you could statistically expect an accident once in every 3 million years. Even the pessimistic Union of Concerned Scientists doesn’t feel that an accident will happen any more than once every 30,000 years.

Scott Moon’s comments are as far-fetched as Asinof’s. His statements on government obstruction are not only unsupported but ludicrous. And his fancy for solar power is ideologically nice but realistically without merit. The cost of a present-day solar-power generating station is astronomical. The chances of future technology coming up with an economical solution are small. The cost of material alone is prohibitive.

As for the probability of the waste’s lying “for eternity,” Moon is probably right. The potency will be drastically reduced in a few hundred years and after 500 years it will not be any more toxic than any number of household items are.

It is indeed a pity that antinuclear is the chic thing to be today. For the question is of the utmost importance and solutions must be based on well-thought-out ideas, not emotional rambles put forth in letters like...
Those of Mr. Ansell and Mr. More.
W. A. Weronko, Lt. USN
USS Independence (CV 62)
FPO, New York
This letter arrived three days before the
Three Mile Island accident — Ed.

One and the Same

I wholeheartedly agree that parapsychology
should clean up its act, but so should a
lot of other so-called sciences.

My main objection is to [John A.] Wheel
er's overwhelmingly scientific statement that
we live in a country that supports
20,000 astrologers and only 2,000 dons.
Astronomers. I suppose, because Wheeler
says it is so that we must take it as gospel.

But I would contend that there are probably
more than 40,000 practicing astrologers in
this country. And the more astrologers we
have, the more we shall be able to gather
statistics and either verifying data to give
even more credence to the art and science of
astrology.

Yes, there are charlatans in every area of
life, and the best thing one can do for their
specific discipline is to root them out.

Knowledgeable astrologers like myself
have been trying to tell this to the public for
years. Mainly because every time we turn
around we hear 2,000 astronomers casting
aspersions on astrology. Yet if astronomers
are properly to verify or refute, they should
study astrology but they never do.

I dearly hope that those ancient astrologers—yes, I said astrologers—Tycho Brahe, Kepler, Copernicus, Newton and others are not turning over in their graves at
the remark that came from one of their
modem brothers. At one time astrology and
astronomy were one and the same. It is the
astrologers who prefer to call their brothers
bastards.

Perhaps because the astronomer's nose
is always up in the air he cannot see what
is right in front of him—mainly humanity.

Donna L. Crozier
Wappingers Falls, N.Y.

Your point that astrology and astronomy
are one synonymous is unarguable. The
people of antiquity needed a way to explain
what they saw and experienced around them
and, lacking optical instruments, fashioned an astonishingly comprehensive
view of the universe. As is, our systems of
measurement matured, so did our
understanding of the universe. —Ed.

PHOTO CREDITS

It was an ugly episode. Several Japanese men seized the Australian, then several antwhalers came to his aid, and then Japanese reinforcements arrived. The scene was instantly jammed with people, which was fortunate for no one could have a hand to do a punch. Hotel security officers led the Australian away "You're barbarians!" he yelled at the Japanese. "Whaling is barbaric."

"You!" a weeping Japanese woman shouted back. "You are barbarians!"

It sometimes seems that an IWC meeting, that the gray flank of the whale has become a new tower of Babel—a smooth well-living monolith that confounds human tongues.

The deliberations are filled with misunderstanding. The blood-spattered Japanese, in earnest meetings with environmentalists after the incident, tried their best to understand the motive behind the attack on them, but from the expression in their eyes it was clear they could not. Ready understanding of other peoples has never been a Japanese trait. The Japanese delegates, myopic still I think from Japan's long cultural isolation, tried to peer into the sentiments of the whale lovers and failed. Finding those sentiments inscrutable. The whale lovers were not big on understanding either—certainly not the British girl who screamed, "Jap bastards!" and jumped repeatedly on the backs of the Japanese men who had seized the protesting Australian.

The IWC is one of those international organizations designed to please nobody. Perpetual conflict is built into its charter specifically into Article V which obligates the commission both to conserve whales and to protect the interests of whaling industry. Conservationists are seldom happy with the IWC—it neither is the whalers. The IWC is weak. Its regulations are not binding on any member nations. Members, if they wish, may file objections and be exempted. The IWC has no power of enforcement, relying instead on each of its member governments to police itself. These weaknesses are not unusual in international fisheries commissions, but they are depressing just the same.

Of the two main factions in attendance this year, the conservationists have the greater cause for dissatisfaction. The world's whale populations have not been exploding as a result of overzealous IWC conservation measures. Whale populations have been declining, steadily and alarmingly. While the IWC did not preside over the Great Decimation of the Twenties and Thirties—the commission was not formed until 1946—when the reality of that decimation had become apparent—still it has persisted over, and legitimized the mopping-up operations.

Conservationists worry about the illusion of the IWC. In its history, the commission has often set whale quotas that the whalers do not or cannot fill. Such quotas, obviously, offer no protection at all. They do whaling a disservice by suggesting that something important is being done on their behalf. It is true that the IWC is no longer a whaling club, as it was at the beginning. In the old days, the commission cheerfully ignored the recommendations of its scientists and set high quotas, then the scientists' predictions of disaster came true. So today, the IWC usually follows their scientific advice. But even this advice is a kind of mirage. Science knows next to nothing about the biology of whales. The IWC science committee經常 complains about having to make recommendations on the basis of scanty data. But the committee is usually forced to make them anyway. The fault is not the scientists. It is the whalers' for habituating a vast mysterious realm.

Conservationists like to grumble about juggling the IWC and starting from scratch. Then they remember, most of them—that

*The question is not whether the IWC can save whales. It is whether humans can organize to save another mammal when they have so much difficulty organizing to save themselves.*

Both sides in the whaling debate continue to try to pack the commission. The tiny nation of Seayelles, which is interested in establishing marine sanctuaries in its Indian Ocean waters, is joining the anti-whaling contingent. The minor whaling nation of South Korea has joined the other side and Peru and Chile are thinking of joining. The resulting new balance would look bad for the whales, except that Australia, a minor whaling nation, has just decided, in a study conducted by one of its justices, Sir Sidney Frost, that it should cease its whaling. The bias of the Australian delegation should change markedly this year, providing a better balance in the commission.

The IWC's recent reduction of the sperm-whale quota in the North Pacific to zero has given environmentalists cause for optimism. "The feeling is," says one, "that the end of commercial whaling is imminent if we just do it right."

At this moment in the perpetual sunlight of the polar summer, somewhere in the Beaufort Sea, a bowhead whale is raining blow frosted. The ice pack has moved far offshore, and the plankton in the 24 hours of daily sun has bloomed wildly turning the cold waters cloudy. The whale feeds round the clock. Bowhead paradise is seasonal, and this whale is in the middle of hers. She'll have few worries until October, when she and her diminutive race will reverse their migration, making their way once again past those three points of land from which for 4,000 years the Inuit have watched for them.

In the North Atlantic right now a minke whale is moving through the greenish waters of the continental shelf of Newfoundland. In the dimness underwater, the white stripe, confined to its pectoral fins, shows ghostly white. The minke is the smallest of the baleen whales and one of the shiest and its flukes are the most gracefully carved. This minke whale is one of the 2,552 listed in the North Atlantic that the IWC allowed the catcher boats to take last year. If its luck holds the quota will go down this year, and its number won't be called.

In the North Pacific a bull sperm whale hyperventilates at the surface after a dive. The whale is fortunate that the quota for his kind in the region was zero last year. If he is doubly fortunate, it will be zero once again this year. The whale shows his flukes and dives leaving behind the bathub-warm surface waters. He goes down and down—300. 600, 900 meters—and still down into the nearly cold and total darkness. He reconverts the clock of his sonar until, on his inner screen the blips of squid take shape. The chemistry of the bull's dive physiology is the source of sound production, for his sonar is the function of his great spermaceti organ, the thought processes of his enormous brain, are all mysteries to science. He focuses his acoustic powers on one squid, and its milky blip jumps into sharper relief. He gives chase.
The moon has been much praised in poetry, one favorite nursery rhyme that doesn't even mention the moon is really a moon poem.

Jack and Jill went up the hill
To fetch a pail of water.
Jack fell down and broke his crown
And Jill came tumbling after.

The story of Jack and Jill mimics the actual phases of the moon. If you look at the face of the moon, you can find Jack and Jill and the pail. As the moon becomes a waxing crescent, the pail appears first, the dark field known as Mare Crisium. Then Jack appears and is completely out of the way first. His head is Mare Serenitatis, his body Mare Tranquillitatis, and his legs are Mare Fecunditatis and Mare Nectaris. Jill, somewhat less well outlined, appears as the moon moves around to full. Mare Imbrium is her head, and Mare Nubium and Mare Humborum are her feet. Then, after full moon, Jack falls down and disappears by last quarter Jill comes tumbling after.

Many writers have used the moon as a device without any knowledge of its behavior. In H. Rider Haggard's King Solomon's Mines, an impossible solar eclipse occurs less than a week from full moon and there seems to be more than one full moon in a four-week span. The eclipse saved the story's protagonists but didn't save Haggard from the wrath of astronomers when the book first appeared.

Other impossibilities abound in cartoons. Look carefully and you will find many contradictions between the time of day and the location and phase of the moon. This doubtless arises from the deplorable ignorance of the sky most people display today. We know less about the sky than did our ancestors of a century ago. Not a month goes by without a caller who asks anxiously, "I saw the moon out in the daytime. Is something wrong?"

Another common misconception is that the far side of the moon and the dark side are the same. Even comet-born Mark Twain didn't know that this is true only once a month. Coleridge wrote of "one bright star in the nether tip" an impossibility since the moon is not transparent. But the new moon, with the cold moon in her arms, is quite possible. The new moon here is the crescent and the old moon is the dark portion of the lunar disk faintly illuminated by sunlight reflected from Earth.

This reminds us that moonshine too, is just sunshine once removed, which recalls the story of a student who was asked which was more important, the mighty sun or the lowly moon.

Of course the moon is more important, came the reply. "The sun is out in the daytime when it is already bright, but the moon is out at night when it is dark and we need the light!"
When a good movie was screened, the audience behaved fairly normally. But since that was rarely the case, the experience of the event was one of constantly coping with trouble instead of judging the films. Even when the films were of superior quality, one thing never ceased: the throwing of paper planes toward the screen. Perhaps a thousand or more were launched every night, though only a few actually reached their goal. “That’s the big game here,” Lehva said. “It is a great thing to have your plane reach the screen. Few of the films receive as much applause as any of the planes that manage to fly all the way in.”

Of the 10 shorts and 23 features shown, several merit particular attention. The most laughable films screened were Message from Space (Japan) and Star Crash (Italy). Two Star Wars derivations that featured souped-up space ships, laser weaponry, galactic empires, damsel in distress, robots and outer-space dogfights. Though neither would satisfy an American audience they were respectively the opening-night and closing-night selections of the festival. Star Crash was awarded the public’s prize as the most popular film.

Two Italian films proved the most interesting of the non-American pictures at the gathering: The House of Laughing Windows, directed by Pupi Avati, was a haunting mystery with supernatural overtones. A cross between Don’t Look Now, Bad Day at Black Rock, and High Noon, the story told of a village’s collusion in the cover-up of a series of gory murders. The only serious non-English language film at the festival it was voted the critics’ prize as best picture.

Tabo Hooper’s The Texas Chain Saw Massacre, touted last month in this column by Dan O’Bannon as the state of the art in horror films before Alien, was awaited with the greatest anticipation of any entry. Record crowds estimated at 5,000 or more were turned away causing the first riot outside. When the movie was shown it turned out to be a heavily censored version, sorely disappointing the audience and almost providing a second riot.

The unequalled hits of the festival were both American fantasy/ SF/horror films: George Romero’s Dawn of the Dead (U.S. title) and Night of the Living Dead is the only the second part of a Dead trilogy. A chilling vision of a future where living corpses are gradually taking over the world. Zombie neatly got a standing ovation, prompting one critic to quip, “Well the audience finally has all the blood it wanted.”

The most important film shown at the festival was its grand prize and the best awarding (Jamie Lee Curtis’ daughter of John Carpenter’s Halloween). It was chosen earlier this year as best film at France’s Avoriaz Festival of Science Fiction. Its story of a mad killer on the loose kept everyone on the edge of his seat for two hours. Carpenter, codirector, cowriter and composer of the music for Dark Star (also mentioned here last month), has directed only three features: Halloween demonstrates his potential to become one of the leading American directors of the 1980s.

Unlike other international film conclaves the Paris Festival of Science Fiction and Fantasy Films has always been intended as an audience event instead of as a journalistic convention to drum up publicity for the pictures being screened. This is its strength but also its weakness. Strength because Schlockoff is responsible only to his audience but weakness because an event of this size could influence the genre instead of merely living off it.

Other SF festivals in Avoriaz, Sitges, Spain, Trieste, Yugoslavia, and elsewhere do not attract audiences in such numbers. Schlockoff is already planning on the ninth festival scheduling it for this coming November instead of next winter. The fall is a better time for films that are due to be released. With Christmas ahead Schlockoff will have a better chance at a wider selection including more studio pictures.

This will be the first step toward making his event not only the biggest but the best festival in Europe. Now that he has found his audience, he needs publicity and prestige to raise the profile from a reunion of paper-plane hurlers to a viable survey of the current possibilities of the genre. Science-fiction films continue to proliferate and this could be the showcase they need to gain recognition in the world market.
how to make a hit record. It has a 1964 feel to it, but it's reality. It's all in how it's used.

We're not trying to do anything but turn people on and make them happy. You want to hear Foreigner? Great! Here's Foreigner."

Aramis shares a staff of 10 full-time and 30 part-time researchers with his partner, Kent Burkhard, who programs Top 40, country and disco formats. This staff will be augmented for the firm's latest project—radio news for the national NBC network.

Young as he is, Aramis, who opted for radio over college, has been conducting some of his research projects over a ten-year span long enough to have developed a solid base for projecting trends. The fact that people are retaining bass lines these days, rather than the complex chords the average American ear was clinging to a few years back, tells Aramis we're not listening as closely. He concludes the differences may have something to do with the way records are produced, but he leans toward his theory of the "natural evolution" of music in American life.

Through an exhaustive study of music in America over the past 25 years, Aramis has observed cyclical patterns of intensity and fullness which has its distinct musical and cultural characteristics. For some time now we've been in a lull. This means that people stop listening and start dancing. A lull is apocalyptic, there are major artistic advancements. The music literally fades into the background, and producers play a very strong role.

How is the current lull affecting radio? Although they're using their radios just as much as ever, listeners are keeping the volume turned way down. This poses a problem for the programmers. How do you get people to stay tuned to one radio station, that they're not really listening to as opposed to another?

That elusive factor called image has never been more important in maintaining listener loyalty and to this end, Superstars stations being encouraged to evolve toward what Aramis calls 'eighteen to thirty-four life-style radio.'

The responses to a million open-ended questionnaires filled out annually on the street, together with special investigations, into the state of the art enable Burkhard/Arams to feed client stations a wealth of data about who the listeners are, not just demographic breakdowns by absolutes such as age and sex, but far more suggestive "psychographic profiles," based on behavior patterns.

Such profiles not only detail the role of radio, music, and a variety of other leisure pursuits in an individual's life, but also extend to his or her attitudes toward work family leisure, consumer goods, world affairs—everyone's own personal fears and deeply private and obsessional fantasies.

John Pankhau, who prepares psychographic analyses for Burkhard/Arams, is a Canadian researcher and a former student of Marshall McLuhan, according to Aramis, and a McLuhanite. Pankhau's concerns are best illustrated by a sampling of his monthly memos, which Aramis passes on to client stations.

"Time and the Body" is the title of one memo and in it he discusses the effect of sunlight on the radio listener. He reminds the local researchers of the role played by perception when an individual makes a question containing the phrase How long?

Another memo elaborates the differences in left-brain/right-brain recall of radio call letters—a factor that influences ratings.

In a third brief essay simply called "Lists," Pankhau discusses contemporary insecurity. Most people are uncertain of where they stand in life. They are not sure about their social status or their relation to many of the things and events of the world. He suggests that lists of all kinds, even old-fashioned record countdowns, appeal because they "provide an arbitrary or real order to things and events."

Elsewhere Pankhau goes into greater detail, noting evidence of "a massive emotional shift taking place among twenty-eight to thirty-five-year-olds. They are reevaluating life, work and morality. It is causing incredible stress that has no focus. It is particularly severe in women. The party mentality that prevails is masking the fact that more people than ever are actually looking for help."

Pankhau thinks this massive unrecognized emotional crisis can be turned to radio's advantage and he urges stations to create a memorial of leadership. He reminds programmers that at this time "the hidden despair in much of the public is attracted by humor uptempo rhythms, and a solid quality facade."

How are such alarming and potent data used by a rock station? Aramis certainly a mild-mannered, likeable fellow himself insists the application couldn't be more benign. "We just try to give the listeners exactly what they're into—a bit before everybody else is. Because music isn't just for now, we're hitting other areas more and more. Home technology is a good example of something people are really interested in but don't know anything about. We've been betting on it, with consumer features, hoping to spread that interest. People who have home video units for example love them. And the more people get involved with it, say, home video and remember the station as a source of finding out about it, well, it's going to be good for us."

And good for the public as well—or at least harmless—one is asked to assume it gives one pause.

Soon when 1984 arrives, will Big Brother be watching us, or will we be listening to him? DO

On self-help and awareness

A DOCTOR REPORTS:

Marcus Kuppers, M.D. — Houston

"I'd had enough of philosophy class debates. I was looking for something to apply in both my professional and personal life," says Marcus Kuppers, M.D.

I found out for yourself how Dianetics has helped so many people realize their own potentials and abilities.

Buy It. Read It. Use It.

550 pages
$2 paperback

At your bookstore or use the convenient order form below.

Send me Dianetics:
The Modern Science of Mental Health
by L. Ron Hubbard

Dept 0-3 Publications Organization
4833 Fountain Avenue, East Annex
Los Angeles, California 90029

Send me: ______ paperback copies @ $2 each

Enclose S ______ (check cash money order)

PLEASE SEND ME MORE INFORMATION ON DIANETICS.

Name:

Address:

City/State/Zip.: ______

All orders shipped within 24 hours. Please make checks payable at Los Angeles, California. Money back guarantee if not fully satisfied.

Dianetics is the best answer to the search for a universal system of mental health.
translated into a dozen languages and are sold throughout Europe. Though the phenomenon has not yet arrived in the States, entire shops in Paris have been given over to the sale of these books, and no Parisian librairie is complete without a shelf of comic art. With proper distribution, comic art could be equally popular in America.

**TELEVISION AND FILM**

There has never been a French-produced dramatic television series using SF as a central element. French television relies largely on the United States and Great Britain for such shows as *The Man from Atlantis*, *The Invaders*, and *Space 1999*. This is one of the obstacles to be overcome if science fiction is ever to stand a chance of achieving popularity in France. If television were to provide SF programs on a regular basis, interest might be created.

*Star Trek*, which brought quality science fiction into America's homes through four years of continual syndication, has been bought for French TV. But it has never been shown because the government claims it is too violent for children to watch. Compounding the problem, while awaiting its release from political hassles, the show was dubbed in Canada. This means that if it were to be shown in France, the sound track would be somewhat disjointed for French listeners. If it ever gets the green light, it will need to be redubbed.

A monthly series hosted by Robert Clarke, *L'Avenir du Futur*, is a hybrid of film and talk show. A science-fiction film is shown to the home audience and a panel of experts. Those on the panel then discuss the scientific consequences of the picture. Unfortunately, in order to fit the whole program into a one-hour slot, the films generally are edited. The panel members cannot therefore fully understand what each of these films is about, and the audience is deprived of the pleasure of seeing an entire movie. The series was canceled after a three-year run, leaving French television without any domestically produced regular SF programming. All that remains is the occasional teleplay or special.

With television almost completely SF free, the situation with movies proved a pleasant surprise. Two French-made SF-related films were in release during my stay in Paris: an additional *40 Odd SF* and fantasy films were in first-run cable or revival. The first-run showings included *Superman*, *Battlestar Galactica*, *Magic and Mystery*, (all from the United States), Werner Herzog's *Nosferatu* (Germany), *Star Crash* and *The Continental of the Fishmen* (Italy), *Message from Space* (Japan), and *The Gendarmes and the Extraterrestrials* and *Ecoute-Voir* (France). Impressive revivals of several classics with beautiful prints, shown in fine theaters, included 2001 A Space Odyssey, *Time Machine*, A Clockwork Orange, *Around the World in Eighty Days*, *F.W. Murnau's Nosferatu* (1923), an uncut print of *The Fearless Vampire Killers*, and *Young Frankenstein*.

*The Gendarmes and the Extraterrestrials* is the latest in a series of gendarme movies, low comedies about some policemen in the South of France. The gendarme films feature Louis de Funes, who also appeared in *The Mad Adventures of Rabbi Jacob*. *The Gendarmes and the Extraterrestrials* combines the unsophisticated humor of the Three Stooges and the *Carry On* films with a typical 1950s alien-invasion Earth plot. Perhaps it was the laughable but clever grade-C special effects or the charm of de Funes or even the very idea of having the film's flying saucer built by France's leading aerospace company but it proved rather amusing.

Having failed to appreciate current French SF films, I went to see 17 short movies made by Georges Mélès, the first master of fantasy and science-fiction films. Made in France before the sound era, these movies displayed an imagination that few films today possess. People disappeared objects moved about the screen through stop-motion animation, and the crowd that packed the side street theater had a wonderful time.

It was then that I realized the basic problem with contemporary French science fiction. I had talked with a dozen prominent people who had seen 30 films with a screaming audience, and spent many hours trying to learn why the two never met. Why there was so little crossover between readers and filmgoers. Now it all seemed clear. Fantasy and science-fiction films are fun and they furnish an enjoyable experience. Gothic taste in science-fiction literature, however, is very serious, pondering the mysteries of our universe, with all its sociopolitical implications laid bare. Readers want answers while filmgoers want escape. They both use SF as a means to their goals.

Since World War II France has gone through difficult times. It has been a shattered country since the surrender in 1940, and it has consequently fought a series of lost wars which led to the dissolution of its empire. There have been many strikes, revolutions, and riots and too many governments. There hasn't been time to look forward to speculate on a rosy future, except through imported films and books.

That part of the audience that has embraced escapism with forthcoming illustrative SF ventured comics is younger and uneducated. The readers of serious SF literature are more aware of the troubles that surround them. Yet they escape into books, reading stories about circumstances more depressing than their own. Both groups are ultimately seeking the same solution but they take opposite routes in their quest. French science fiction ultimately emerges as a schizoid whole if opposite parts making an ongoing, unlimited, market possible.
When I first began to take a real interest in astronomy which was in 1926 I had heard a great deal about "empty space." The general idea was that as soon as one ventured beyond Earth's atmosphere, a few tens of miles over our heads, there was absolutely nothing there! It was a total vacuum—not an atom within range. A complete void!

Although the idea of empty space had been disputed long before, it was really disproved by the work of a German astronomer named Hartmann. In 1904 he was looking at the spectrum of the star Mintaka, in Orion's belt, when he noticed something very curious that his predecessors had overlooked.

But before going any further, perhaps I had better pause to say something about stellar spectra themselves. Just as a telescope collects light, so a spectroscope splits it up. When the light of a normal star is refracted through the spectroscope, it is split into bands of color that are separated by dark lines. The spectrum formed carries the distinctive trademarks of the chemical elements that make up the star. If you see two bright yellow lines close together in a characteristic position, you may be quite sure that the star contains the element sodium.

Next, let us consider the Doppler effect named in honor of the Austrian physicist Christian Doppler who first drew attention to it in 1842. If a star is moving away from us, the wavelength of its light is slightly lengthened. All the lines in its spectrum are shifted over to the red- or long-wave end of the rainbow. If the star is moving toward us, the shift is to the blue, or short-wave, end. An example would be the change in pitch of the horn in a passing car. The pitch produced by a horn in a car moving away from us would be lower than it would be in a car moving toward us.

Hartmann looked carefully at the dark lines in the spectrum of Mintaka and found that some of them did not exhibit the Doppler shift of the overall spectrum. The reason was obvious. The immovable lines did not belong to the star at all. They were caused by clouds of material in space between the star and Earth, that absorbed some of the stellar light.

Hartmann was, of course, quite right and the study of interstellar material began in earnest. As more sophisticated methods of investigation were developed, it became possible to identify some of the interstellar substances. Hydrogen proved to be particularly plentiful, and it became obvious that hydrogen is the most abundant substance in the universe, as had long been suspected.

There have recently been new discoveries. Between the stars we find not only single atoms but also simple molecules. Then came the revelation that even organic molecules are present. This discovery came as a real surprise to many astronomers, but the results left no room for doubt.

One of these interstellar molecules is our old friend ethyl alcohol. Astronomers surveyed an inconspicuous star cloud in the constellation Sagittarius, near the center of the galaxy, and estimated that it contained enough ethyl alcohol to make more whiskey than Homo sapiens has distilled throughout the history of civilization.

"Ah!" I can imagine some people saying "another reason for going into space. We can scoop in parts of the interstellar cloud and regale ourselves with whiskey throughout the journey." Unfortunately, nothing could be further from the truth. The interstellar clouds are unbelievably tenuous, less dense than the most perfect laboratory vacuum we can produce. This is true even of the "thicker" clouds—the bright nebulas, such as Messier 42 in the sword of Orion. If you could take a bucket and blow through the Orion Nebula, scooping in material steadily the amount collected would weigh less than a billiard ball does.

Tenuous as they are, these interstellar clouds are of fundamental importance in astronomy. Visible nebulas are places in which new stars are being born. Invisible clouds probably contain a large part of the mass in the universe as a whole, much more than the stars themselves.

Some scientists have suggested that life began not on Earth at all but in space. It was brought here either by a meteorite or, according to Sir Fred Hoyle, by a comet. Indeed, Hoyle and his colleague Chandra Wickramasinghe believe that materials as complex as cellulose form spontaneously in interstellar space. To most people, this hypothesis raises more difficulties than it solves, but we cannot rule it out. The presence of organic molecules between the stars makes it seem less farfetched than it would otherwise be.

Research is going on energetically, and new interstellar molecules are being discovered with amazing rapidity. I think that the discovery of ethyl alcohol is particularly fascinating. Poets have often rhapsodized about the "spirit in space." Well, the spirit is there—even if not in quite the form that the poets meant. Many astronomers think this interstellar material indicates whether the universe will expand forever or will collapse, causing another big bang.
The woman replied mentally, "No, I'm not never believed in this."

Do you believe now?" they quizzed

Yes, I do.

This telepathic discussion took place in only a few minutes. The witness asked questions of her own such as: 'What planet are you from?' and 'Why don't you land here right now?' While she felt certain that these questions were answered, she had lost all conscious memory of the UFOnauts replies. When the UFOnauts removed the paralyzing beam and continued on their way—to the northeast—the woman could see a message spelled out in the lights in block letters. It appeared to read "FAIL TO" or "FULL TO" but she wasn't sure. She ran across the street screaming for a neighbor to come out, when the neighbor did come out the UFO was too distant to be seen clearly.

During my phone conversation with the witness, she sounded as articulate, serious, good-natured and sincere as any of the hundreds of UFO witnesses with whom I have spoken. 'People look at you like you're crazy but believe me,' she said, 'I know what I experienced. This is not something that one dreams up out of a clear blue sky. I am not the type of person to go around telling stories that do not occur.'

Because of her description of the white and red lights and the message that they spelled, I called all the nighttime advertising-plane companies in the New York area. Experience with hundreds of previous cases based on poorly seen ad planes has long since revealed them to be excellent Rorschach inkblot "tests of the degree to which UFO witnesses anticipate how UFOs are supposed to look and behave."

The intense emotional reactions exhibited by witnesses of such aerial messages rival those expressed toward the best UFO cases, too.

But who would be advertising anything over Long Island at 12:30 A.M.? The Brooklyn School of Aviation turns that's who. One of its planes was flying above the town where the woman lived. And the message being spelled out by the white lights underneath the plane: CHARTER FLIGHTS TO ATLANTIC CITY" (italics mine.) At last, the perfect hypnotic experiment. What would such a person who sincerely believed that she had undergone such an experience say under hypnosis? Would she tell the same story?

I hired a professional clinical hypnotist in practice near New York City to perform the regression. I spoke with him at length to make sure that he had no particular bias pro or con about the UFO subject. Furthermore, in order to prevent his performance from being negatively biased, I didn't tell him that I knew what had stimulated the woman's "experience."

The result? Exactly the same story was told under hypnosis as before with no new information added. The woman still couldn't remember what planet the visitors had come from and other details were vague. Taking a test for hypnotic susceptibility having a range from 0 to 5, she scored a soft 2. Her description given under hypnosis was related in the past tense, revealing that she was not genuinely reliving the event, only recollecting it. This fact didn't surprise the hypnotist; he said that only 5 percent to 10 percent of the population can be truly time regressed, his premise had never been stressed in previous abduction regressions. One can only surmise how many previous such sessions had been similarly vitiated by memories of subconscious fantasies.

Something else of interest: Our UFO "data" doesn't claim to have experienced an physiological aftereffect following her experience, a feeling of nausea. Returning home after reliving the incident hypnotically, she again felt nauseous.

Why would an otherwise normal individual react in such a bizarre way to an advertising plane? I had the therapist provide her with a Minnesota Multiphasic Personality Inventory, a simple computer-graded examination useful in revealing psychoses. The results of the test were described by him as 'far removed from the report one would get from a psychologically well person.' The report concluded that she exhibited "childish demands for attention," that she "suicide attempts are a possibility," and that she was strikingly "overconcerned about her bodily functions and physical health."

She may experience generalized aches and pains without clear organic etiology." This may explain her recurring nausea.

Further developments on this case will be published in the International UFO Report, the monthly newsletter available from the Center for UFO Studies, Evanston, Illinois. Already it is safe to conclude that UFO abduction tales plucked from the subconscious may have more to do with a new technological mythology than with true close encounters.

Mr. Hendry is chief investigator for the Center for UFO Studies and author of the forthcoming book The UFO Handbook due from Doubleday & Co. in August.
Ten years ago this month, an awesome Saturn 5 rocket thundered off its launchpad and ferried three astronauts to the moon. Today you can still time your vacation to catch an old-fashioned blastoff, but within a few years all expendable rockets will be replaced by reusable spacefaring. The National Aeronautics and Space Administration (NASA) has only a half dozen launches of expendable rockets planned for the rest of 1979, and about as many for 1980. After that the leftovers will be destined for museums.

The main launch facility is at Cape Canaveral, Florida, even without launches the cape is magnificent for space buff and neophyte alike. Actually, the cape is two facilities: Cape Canaveral Air Force Station and Kennedy Space Center.

It was at the Air Force station that the United States first concentrated its efforts to catch up with the Soviet Union's space program. This station has most of the launch sites for NASA military and commercial rockets. On a clear day from Cocoa Beach you can see this amazing stretch of launchpads, known as Gantry Row.

The Kennedy Space Center is the moonport, located on Merritt Island and built solely to launch the massive Saturn 5 moon rocket with its Apollo spacecraft. It is now being modified to handle the space shuttle. Signs on U S 1 and I-95 lead to Gate 3, where the visitors' information center is located. Several lecture halls are here, along with movies, exhibits, and a minimuseum dealing with spaceflight, featuring the Gemini 3 and Apollo 13 spacecraft. Outside, the sun glints off such rockets as Gemini-Titan, Mercury-Atlas, a full scale model of the lunar module, and Swing Arm 9—the last six meters of ramp that astronauts crossed before boarding the craft bound for the moon.

The Kennedy visitors' center opens every day except Christmas from 9 a.m. to sunset, is also the point of departure for a bus tour that takes in the flight crew training building, launchpads, and the cavernous Vehicle Assembly Building (VAB). Over 50 stories high and encasing 3.87 million cubic meters, the VAB is where the enormous components of Saturn 5 were assembled. Shuttle hardware is now in the VAB, but NASA has sealed off the visitors' pen on the grounds that solid-fuel rocket segments present too great a safety hazard to the public. Letters to your congressman, however, might get the Vehicle Assembly Building reopened.

After the Space Center the tour moves on to Gantry Row. Here you get a close look at the launchpads, although many of the historic ones have been torn down. The main stop is at the Air Force Space Museum, built where Explorer 1 and later Alan Shepard began their journeys into space. Scattered about the site are dozens of launchers and guided missiles and the blockhouse that controlled the Shepard launch.

During the tour of Gantry Row the bus may take a detour if the range is hot—that is, ready for a launch. After the tour you can still get a good view of the rocket launch itself from the beaches or from the road leading into the south gate at Port Canaveral. (See the schedule of launch dates on page 138.)

If you want a foretaste of what it will be like to ride the shuttle into space, try the Alabama Space and Rocket Center. This delightful blend of museum and amusement park is in Huntsville, Alabama—a town that went from cotton mill to Rocket City within a ten year span. The rocket center is on Highway 20, just south of the Tennessee state line, and except for Christmas is open year-round from 9 a.m. to 5 p.m. (6 p.m. in July and August). Look for the Saturn IB at the welcome center.

Quite properly billed as the earth's largest space museum, it has many hands-on exhibits designed to make space a personal experience. Exhibits include Mercury Gemini, and Apollo spacecraft, Spacelab, the Space Telescope, and a forest of rockets ranging in size from the V-2 to the Saturn 5. But the center of attention is Miss Baker, a tiny squirrel monkey whose brief hop into space in 1959 paved the way for man. Although her mate, Big George, recently died, Miss Baker is still going strong at age 22. She was recently remarried—by a judge no less—to five-year-old Normal Norman, of the Yerkes Primate Institute.

The three amusement park rides are Shuttle Spaceliner Space Walk and Lunar Odyssey. The Spaceliner uses a portion of a Boeing 737 fuselage to simulate a passenger module on a five-minute ride into space that features a rendezvous with a space station. The Space Walk has counterbalanced arms to let you float for a few seconds between steps at one lunar gravity (one sixth that of the earth). And the Lunar Odyssey is a giant centrifuge that presses you into your seat with the force of two gravities during part of a simulated trip around the moon.

From the Alabama Space and Rocket Center you can take a bus tour to the nearby Marshall Space Flight Center, where the future of space—via the shuttle—is taking shape. Here you can walk through a full-scale mock-up of the Skylab space station and see the 484 million-liter neutral-buoyancy simulator, a deep pool of clear water in which astronauts rehearse space
Today the simulator is helping astronauts prepare ways to build mile-wide structures in space. Another stop in the tour is at test stands where rocket stages were once erected without leaving the ground.

NASA's most famous control center is the Johnson Space Center in Clear Lake City five miles south of Houston. Texas. Although the center is now busily preparing for the space-shuttle era, the past is not ignored. The visitors center has a lecture hall and a museum that traces the history of manned spaceflight with a delightful film clip on the legacy of the Skylab that conveys the exhilaration and the wonder of weightlessness. Walking tours take you through Mission Control, a full-scale mock-up of Skylab, and the world's largest vacuum chamber (featured in the film Future World). The public is welcome from 9 A.M. to 4:30 P.M.

If you are still eager to see more, visit the Goddard Space Flight Center in Greenbelt, Maryland. There you are guided through satellite control centers—can make a telephone call to the next phone booth through the intermediary of a satellite link and participate in monthly model-rocket competitions. Goddard is open Wednesday through Sunday from 10 A.M. to 4:30 P.M.

While on the East Coast, drop into the Langley Research Center in Hampton, Virginia, where NASA's predecessor—the National Advisory Committee for Aeronautics (NACA)—was established in 1918. Langley was responsible for the Viking project which orbited and landed spacecraft on Mars in 1976 to investigate geology and life. Today Langley's visitors center includes Viking and Apollo spacecraft and the lunar landing simulator. The city of Hampton also features an Aerospace Park with missiles and spacecraft.

Finally, you won't want to miss the National Air and Space Museum on the Mall in Washington, D.C. The王牌 of the Smithsonian Institution started with a gift of Chinese kites in 1878, and today draws more visitors than any other museum in Washington. (The aviation section of the museum was described in the December 1976 Explorations column.)

Major space artifacts range from one of Robert Goddard's early rockets to the Apollo 11 command module (both enshrined in the "Milestones of Flight" Hall) to maps and food tubes used by the astronauts. You can take a walking tour through the biggest exhibit, the space shuttle in which astronauts lived and worked in space for up to three months.

The largest space artifacts are on view in the Space Hall and the East Hall. Other space galleries include life in the universe, satellites, rockety and spaceflight, the results from Project Apollo, and the Albert Einstein Spacearium, a biennial gift from West Germany. There is also the south entrance, graced by artist Bob McCull's sweeping interpretation of creation and man's future in the cosmos.

Hard-core space buffs may additionally want to visit the museum's restoration facility at Silver Hill, Maryland, where still more artifacts are on display.

Six other space centers around the country are also open to the public. Briefly described, they are:

- Jet Propulsion Laboratory in Pasadena, California, where missions to the planets are controlled. Guided tours last two and a half hours, and open house is held the last Sunday of each month from 1 P.M. to 5 P.M. Children under twelve are not allowed. Call 213-574-2331 for more information.
- Ames Research Center in Mountain View, California, just south of San Francisco. Center of planetary science and aeronautical research. Call 415-655-5081.
- Lewis Research Center, Cleveland, Ohio, directed at advancing technology for aircraft and rocket propulsion. Call 216-433-4000.
- Wallops Flight Center, Wallops Island, Virginia, home of sounding rockets and aeronautics. Call 804-382-3411.
- National Space Technology Laboratories, Bay St. Louis, Mississippi, center for the space-shuttle engine tests and remote-sensing satellite research. Call 601-688-3341.

ROCKET LAUNCHES FOR 1979

This schedule is deliberately vague because launches times frequently slip sometimes from day to day. To get specific dates, please call 1-301-867-2050 or in Florida call 1-305-432-2153.

Air Force launches are rarely announced, but both Air Force and NASA launches are posted on the front page of the newspaper Cocoa Today.

Note: Many rockets are launched at night to reduce the heat load when cooling off cryogenic fuels. Hotels in the Cape Canaveral area will frequently ring all their phones just before a launch. If that happens, rise and watch the best light show of your life.

July: Westar-C communications satellite atop a Delta rocket launch from Cape Canaveral.

August: Intelsat 5A communications satellite atop an Atlas Centaur, Cape Canaveral.


October: Solar Maximum Mission satellite atop a Delta, Cape Canaveral.

November: Intelsat 5B communications satellite atop an Atlas Centaur, Cape Canaveral.

December: NOAA-B weather satellite atop an Atlas F, Vandenberg.

Plus: R-2C communications satellite atop a Delta, Cape Canaveral.

Dave Dooling is science editor of the Huntsville Times specializing in space technology.
The Northern Territory of Australia is a land of vast, dry plains, with one important exception: the Ayers Rock. More than 380 kilometers from the nearest town, the rock rises out of the plains to a height of 348 meters, 1.5 kilometers long and 1.5 kilometers wide—roughly the size of 25 football fields laid end to end.

The Ayers Rock is the second largest rock in the world (surpassed only by Mount Augustus, also in Australia), and is held sacred by the aboriginal tribes that inhabit the regions surrounding it. Caves at the base of the rock, decorated with aboriginal paintings, are now a popular tourist site. Maxim Koren visited the Ayers Rock for OMNI and took this photograph with a Nikon F camera and Kodachrome 25.
OFFICIAL
CONTINUED FROM PAGE 24

("Please feel free to smoke Mr. Stuckey") and that he is not a scientist or intelligence professional, but a Chapel Hill, North Carolina, lawyer and former county prosecutor. You see that trap jaw and hear the accent and you think of those relaxed rural DAs who might say "Now Jake, we know you killed your wife. So don't go lycin' about it. Just get your story together while I go get you a cup of coffee."

The other Charlie Rose, however, is a protege of Terry Sanford, the former southern liberal governor of North Carolina, ex-university president and a once-hopeful entrant into Democratic presidential primary elections—which attracted all the bright young Southern liberals like Charlie Rose—and not one veteran Capitol observer. Elected to Congress in 1972, Rose made a key early commitment to support O'Neill for House majority leader. Tip, now speaker of the House, considers Charlie one of his key Southern lieutenants who doesn't mind doing the dirty and no publicity value jobs that keep Congress functioning. The House Intelligence Committee (chaired by another of Tip's buddies, Massachusetts Representative Edward Boland) is one super job since most of its hearings are closed to the life-giving (to congressmen) press and don't have much effect on the constituents back home.

There are two more Charlie Roses that don't fit country stereotypes. One is the Rose who is House's acknowledged expert on computers according to Gary Hymel, the speaker's right-hand man. And Rose is founder of Capitol Hill's most Mofo activity, the Congressional Clearinghouse of the Future—the science-fiction wing of Congress—according to a science-oriented congressman.

The Mofo aspect of the clearinghouse is detected in the pages of its fascinating monthly newsletter "What's Next?" There one finds the news and views of the L-6 space colony people, the anarchistic appropriate technology of wondrous Karl Hess, the soft-energy boys, the worker-owned corporation boosters, the cosmic consciousness kids, and the Committee for the Elimination of Death. Under its imaginative director, Ann Cheatham, the clearinghouse also holds its monthly Chautauqua Congress—think-and-talk sessions with both "futures" and more conventional experts, who produce recommended legislation with a longer than usual-term twist. (For the remainder of the year Chautauqua will deal with future housing "soft" appropriate technology vs. "hard" conventional technology, the scientific nature of life, including genetic manipulation, the future social culture, and even "cosmic consciousness").

You ask how good ole Charlie Rose was moved to lead the Mofo prophets? Well, he is yet another convert to Alvin Toffler the respected futurist author of Future Shock. Toffler convinced Rose that Congress was playing Russian roulette with the future by ignoring it in most of its legislation. He introduced Rose to that growing think tank industry of futurology which according to one (of several conflicting) definitions uses available information and mixes in hunches and personal theories to predict what is going to happen in crucial and vital areas. In 1974 Congress passed an internal act requiring its committees to conduct periodic futures research, and by 1975 Rose and Cheatham were sending the House a stream of both close-in and fathest-out futuroists to prophesy what lay in store for all of us.

Today the clearinghouse functions as a "caucus" not an official congressional committee, but rather an informal Hill-based activity financed by contributions from interested members of Congress and other supporters. Many Senate luminaries are firmly behind the project.

Though it can't yet claim many legislative victories, Rose's clearinghouse—in conjunction with Rose's hearings on psychic intelligence gathering—will no doubt lead to some of the oddest debates: most astounding legislation and weirdest witnesses in congressional history. California has set up shop on Capitol Hill...

(Continued on page 25.)
HOW MUCH
WOULD YOU PAY TO SEE
THE FUTURE?

Would it be worth a thousand dollars — a million? Could you even put a price on it? Now, with OMNI, the magazine of tomorrow, on sale today you can! And the price is right! In the knowledge that there’s so much to know, learn, do and enjoy and so little time, we’re helping hurry you into the twenty-first century without missing any of the wonders of the twentieth. We’re a concise package of light and heavy, fantasy and fact. We cover the past, present and especially the future.

Your future. Bargain on it. Get involved. You can easily afford to (only $18 for a one-year subscription). Can you afford not to?

OMNI Subscription Dept.
P.O. Box 908,
Farmingdale, N.Y. 11737

Yes I want to get involved and I want to save $6 on the newsstand price. Here’s my □ check □ money order of $18 for a one-year subscription (12 issues)

Name

Address

City

State Zip

Notes: For U.S., APO and P.O. addresses, Canada and elsewhere add $3 per subscription. Allow 6-8 weeks for shipping of first issue. Payment must accompany order.
Competition #4
Brought us limericks galore

By Scot Morris

From the rooftops our 4th challenge went
"Send limericks!" 4,000 were sent
We hated to pass 'em off
But finally asked Asimov
To help pick the best 1%

This competition brought far more responses than any other. We should have anticipated that. As one reader warned: "Since limericks are more of a compulsion than an art form, I predict you will be swamped with limericks."

We were. We read about the clone who wasn't alone, about the laser that didn't have a laser, and about several men named Romney who read this magazine and suffer from insomnia.

After we sorted nearly 4,000 limericks into NO, MAYBE, and YES piles, there were 500 entries in the YES pile—more than ten times the number we could print. Further sorting reduced the pile to 200, then 150, then 100. At this point an advanced case of limerickitis set in—a condition in which the victim cannot read or hear any English sentence without compulsively remixing it. We called Isaac Asimov, author of Lecherous Limericks (1975), More Lecherous Limericks (1976), Still More Lecherous Limericks (1977), and Limericks Too Gross (1978) as well as of several works of nonpoetry, for suggestions on the final cleaning. From a typed selection of 100, without names, Dr. A. picked 50 favorites.

When we found out how many limericks we'd be able to print in this issue, we consulted again with America's one-man Book-of-the-Month Club in choosing the most publishable finalists. We weighed factors of rhyme, scansion, cleverness, humor, apparent originality, and appropriate Omni flavor and eventually agreed on this selection.

GRAND-PRIZE WINNER
If inside a circle, a line
Hits the center and runs spine to spine,
And the line's length is D,
The circumference will be
D times 3.14159
— Arthur Stock Westfield N J ($100)

RUNNERS-UP
To bear offspring, Noah's snakes were unable.
Their fertility was somewhat unstable
He constructed a bed
Out of tree trunks and said
"Even adders can multiply on a log!"
— Sarah Fulton Mobile, Ala ($25)

Equations when spoken will sound,
To youngsters, in class, quite profound.
But you may get a stare
When you say π²
For they all know that Mom's pies are round!
— Robert P. Wams, Alabaster, Ala ($25)

A young sports car driver named Braun
Had the fastest machine on the scene
He drove fast as light,
And with no cops in sight
He'd bluelight the red lights to green
— Timothy Cowden, Bryan, Tex ($25)

TUNNEL VISION
"Can't you look see where this is all leading,
This nightmare of selective breeding?
He spat on the ground
And then turned around
And continued on with his weeding.
— Jeanine Carr Youngstown N Y ($25)

A renowned archaeologist Vern
Who unearthed an Egyptian clay urn
Found himself devastated
When the markings translated
Clearly read: "No Refill/No Return."
— G. A. Ludwig, Crown Point Ind ($25)

The voice from the UFO said,
"To the smartest we'll give a tree ride!"
Several men volunteered,
But the ship disappeared
With a whoosh and two dolphins inside.
— Burl Ross Lake Oswego, Oreg ($25)

THE DOPPLER EFFECT
Her voice is so high it's absurd,
It's so high that you can't hear a word
When she starts running away.
— Steve Oither Pittsburgh Pa ($25)

Salutations to Arthur C. Clarke,
Who's constantly hitting the mark.
He has a class act
In both fiction and fact.
And he gives off more charm than a quark.
— Hugh Downs, New York N Y ($25)

First, let me explain that I'm cursed.
I'm a poet whose time gets reversed.
Reversed gets time
Whose poet am I?
Cursed, I'm that explain me let first.
— Brad Williams, Coventry Conn ($25)

HONORABLE MENTION
To Rigel a beam was projected
Years passed, a reply was detected
The code was translated
And this message related
"I'm sorry this line is disconnected.
— Carl Carson, Riverside Calif ($25)

A hockey ref 'Penalty!' squealed
And from flat on his back he appealed
"Not one player backed me
And both teams attacked me
That's proof of the United Field.
— Rita Zielinski Redlands Calif ($25)

A quantum mechanic's vacation
Left his colleagues in dire consternation
While studies had shown
That his speed was well known.
His position was pure speculation
— Jeff Harvey Liverpool N Y ($25)

A young rancher longing to own
A horse like his daddy's red roan.
Said: "Dang it to hell! I'll just steal me a cell.
Now he's riding a strawberry clone
— Dorothy M. Smith Miami Fla ($25)

The meticulous space lady felt
It was cluttered in space where she dwelt.
So she hooked a long pole
To the nearest black hole.
And vacuumed the asteroid belt.
— Richard Fishback Brownburg Ind ($25)
If I gave an N-gon to you
And said, 'Here's what I want you to do
Sum the angles interior'
An answer superior
Would be 180(N-2)
—Arthur Stock Westfield, N.J.

A fourth-dimensional Dane
Bought a prefabricated toy train
"With the tesseract spread",
The directions read,
"Fold on the dotted plane."  
—William R Baldorossi Orlando, Fla.

The Crab Nebula is a cosmic delight
A jewel in the darkness of night
But to its neighbor next door
It is quite a bore,
He wishes they'd turn off the light
—David Welden, Portland, Oreg.

Two inventors named Morrow and Day
Bravely entered their time travel ray
But a flaw brought them sorrow
For, to Day it's tomorrow
While, to Morrow today's yesterday
—Burl Ross, Lake Oswego, Oreg.

"The universe is curved," noted Fred
An astronomer learned and read
"This scope has such power
I've just spent an hour
Observing the back of my head!"
—Richard Finchback, Brownburg, Ind.

Oh, space is the place! Let's go higher!
To colonize it we aspire
But the problem that seems
To endanger our dreams
Is how to enlighten Proxima
—Donna Schmidt Finney, Novi, Mich.

A tesseract is rarely due mention,
For counting its cubes spurs contention
It has two, no, there's eight!
Ah, it's hard to relate
When the view's from another dimension
—Steve Peters, Indianapolis, Ind.

The most frightening instance of chaos is
California's, rather than Lao's
It's your underground vault
Filling up, and the fault

Isn't yours—no, it's all San Andreas
—Ted Melnichuk, La Jolla, Calif.

When Asimov penned long ago
The Three Laws that all robots know
Had Star Wars shown then
The Fourth would have been
"A robot must not steal the show"
—William Ny, Chula Vista, Calif.

For those who debate on such rarities,
A black hole's a source of disparities.
For no one agrees on
The principal reason
They don't all become singularities
—Jo Cornelison, Dallas, Tex.

Astrology wizards you floor us.
Writing bunk that at best will bore us
You've ignored the old lesson
Of the aquinox precession
Now your Gemini's really a Taurus
—Brace Phillips, Las Vegas, Nev.

A wise man was heard to exclaim
"This entropy's really a shame,
You can't win, or break even,
And now I'm believing
You can't even quit the damn game!"
—Harry O. Boreth, Plantation, Fla.

A tourist to Alpha Centauri
Came back with a fantastic story—
That binary sex
Was so damned complex
That cloning was now mandatory!
—Sandra Forrest and David Saltman,
New York, N.Y.

Frustrated young Mr. Hall
Pushed his clone off a very high wall
He said with disgust,
"All it does is copy"
He was jailed for an obscene clone fall
—James D. Hildebrant
Kaneohe, Hawaii

A quick witted astronaut, Dwight,
When asked about his upcoming flight,
Did he have worry one
"Bout landing on the sun?
Heck no, we're landing at night!"
—John Stuart, Von Ormy, Tex.

If binary digits are bits
Then decimal ones could be devs
And when things get weary,
Try something less dreary
Like playing with binary bits
—Chuck Neuenschwander, Eagan, Minn.

"The physicist's wife will be late
Said the host to his guests as they ate
"For it seems that the powder
She splashed all about her
Was uranium 238"
—Ken Duffin, Guelph, Ont., Canada

There once was a man named Lw
Who Pd his friends to Ct
This prospector was bold
But while looking for Au
He got killed while trying to get
—Tom Colliner, Marlville, Ill.

Two Martians were out one day hiking
When they found a new plant to their liking
So they sat down to lunch
And started to munch
And the signals stopped coming from
Viking
—Mike Jenkins and Jim Stinkman
South Burlington, Vt.

Though Cygnus X-1 is at a distance
Its matter is lost with persistence
It's shrinking, you see
Continuously
Suggesting its black holes existence
—Brian E. Schroeder, Rosemont, Ill.

Null gravity's awkward for lovers
Especially pushers and showers
The problems of docking
And then interlocking
Are greatly increased when one hovers
—Janet L. Snode and Jeffrey A.
Raphaelson, Fort Collins, Colo.

The first time I saw in the store
Your Omv, I hoped there'd be more
The pages were packed
With fiction and fact
I've become a complete Omnivore
—F Brown, Mississauga, Ont., Canada

Thanks to all.
MEET DR. SWINGER

LAST WORD

By Daniel S. Greenberg

Omni is happy to introduce its readers to one of the most outrageous characters in the world of science. Dr. Grant Swinger, the mythical director of the nonexistent Breakthrough Institute and chairman of the board of the equally nebulous Center for the Absorption of Federal Funds. Dr. Swinger is interviewed here by a longtime acquaintance, Washington science writer Daniel S. Greenberg, who, along with the fast-talking Dr. Swinger, is a close student of the seamier side of science and government relations.

Dr. Swinger: Of course not, but when we go out to get more money no one remembers. More than you realize. My friend, it's the promises that keep laboratories going, not the deliveries.

Omni: Does this system always work?

Dr. Swinger: Not always. Like everyone else in research those days, we have to hustle. You probably noticed our motto: Take Nothing for Granted.

Omni: But your institute seems to be very busy. What's going on here? What's everybody doing?

Dr. Swinger: We are at the forefront of scientific fashion, by which I mean, we sniff out what the agencies in Washington want to spend money on. And that's how we zero in on the big bucks. I'll explain in some detail if you like.

Omni: Please do.

Dr. Swinger: It's like long and short skirts. Wide and narrow lapels. The institute got a head start into space. When that began to fizzle, we beat the crowd to oceanography. Then we zipped off to cancer—with a short side excursion to population control—and then we made the move to environment. When that market got a bit limp, we were in on solar, and now we're hot footing it to nutrition research, herbal medicine, and Third and Fourth World appropriate technology.

Omni: In other words, you've got to keep moving.

Dr. Swinger: Moving! Let me tell you, I hold the Pan American Chair here at the Institute.

Omni: In Latin American studies?

Dr. Swinger: No, it's a reserved seat on Pan Am. You've got to keep up with the conference circuit if you want to stay ahead of the crowd.

Omni: What conferences have you recently attended?

Dr. Swinger: I was at a session titled 'A New Look at Perpetual Motion,' and we're hoping for support from the Energy Department.

Omni: Perpetual motion?

Dr. Swinger: Don't rule it out. Just because the problem hasn't been solved so far doesn't mean.

Omni: Yes, of course. What else?

Dr. Swinger: Coming up is the second International Congress on Writing Grant Applications, and then we're planning a conference to be called the Chemical Treatment of Literacy Fact or Fiction. A lot of interest in that, I expect.

Just to show you how fashions change we tried to get a conference going on acupuncture, and no one showed up.

Omni: Three years ago, that really would have been a winner.

Dr. Swinger: Same thing applies to desalination—you know, make the deserts bloom with seawater from nuclear power. Lyndon Johnson was going to build a big nuclear reactor right between Israel and Egypt and make water for them to share. Today you couldn't give it away. It would attract too many demonstrators.

Omni: Your other organization, the Center for the Absorption of Federal Funds—what does that do?

Dr. Swinger: I'll try to explain. When Congress appropriates money to a government agency, the agency is supposed to spend it before the end of the fiscal year. If it is left over it goes back to the Treasury which is scandalous. I'm sure you'll agree. The center has the fastest bookkeeping and paper-handling department in the game. As the end of the fiscal year approaches—and the paperwork backlog raises the specter of money not being spent—we're available at a moment's notice. We can write up, receive, and spend a grant before you can say 'Happy Fiscal New Year.' Simple as that.

Omni: Many scientists feel that there is a conflict between research, teaching, and administration. Have you resolved this problem?

Dr. Swinger: You have put your finger on a great dilemma, one that can prove to be a terrible burden to the individuals who are involved. My approach to the conflict of research, teaching, and administration is simple. I don't do any of them. How could I, what with traveling to conferences and filling out grant applications? Now we're looking for support for a project to turn sludge into sandwich spread. There are some problems with flavor, but

Omni: Thank you, Dr. Swinger.