

OMNI

JULY 1979 \$2.00



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

OMNII

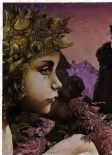
JULY 1979

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Cover art for this month's *Omni* is an untitled painting by the French artist Pierre LaCombe. (Landscape with woman) from 1964, since age fifteen, began only two years ago at age forty-eight. He now lives outside Paris.

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BEYOND BOOM

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.

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 1960s, when Vanguard rockets blew up on the launchpad and Spunk 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 painstakingly careful work of exceedingly 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, there being an economic and morally acceptable failure rate. For example, you can take a defective doorknob back to the hardware store, airline test-fly their new planes before putting them into service, and Detroit calls back, with depressing 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 defects 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 support 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.

Couldn't we use the zero-defects concept in the building and operation of nuclear-power plants? Couldn't 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 not merely for centuries but for millennia.

The answer, of course, is to fly them off the 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 antineutronics, airplanes, the submarine, wireless radio, nuclear 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 pollutes the air in which it burns, but dangerous enough for us to be careful about them.

Do we need nuclear-power plants? In the face of steadily 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 go with plutonium or boron nuclear energy altogether. If we use our brains, or skills, and 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. ☐

CONTRIBUTORS

OMNIBUS



FRENCH



SIMS



GASNER



O'NEIL

For 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 2,000 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 *Omnis* celebrates the Apollo landing with a detailed analysis of man's lunar exploration by NASA scientist Bryan M. French. As discipline scientist for planetary materials, Dr. French is responsible for the "bite and feeding" of real visitors from outer space—the moon rocks, meteorites, and cosmic dust that provide us with the only solid 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 scientist-author G. Harry Sims. "All that remains is to take these laboratory demonstrations and put them together in the first working 'bionic brain'."

In this issue Sims probes another side of cybernetics—direct linkup 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 explores why it has suddenly been hailed into the forefront of cancer therapy. A graduate of Albert Einstein College of Medicine, Gasner has published articles in *New Times*, *Monthly*, *Saturday Review*, *Southern Digest*, *Fairly 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 95) 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-laced skies basking in reflected sunlight.

This month *Omnis* 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. Harry's action novels such as this one swiftly making their way to bookstore shelves. The reader reaction, according to two prominent publishers—overwhelming. See page 88. **OO**

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.



The Drawing Room

There are five people in the manor house. Although no one knows it, The Crown Jewel of England is



The Butler

about to be taken.

The Countess is whispering to the Squire.

The man in the heavy boots is holding his favorite drink - a Befeater Gin and Tonic.

The person seated opposite the Begadler is enjoying a Befeater Gimlet.

The Butler enters with a Befeater Gibson for the person seated to the right of Lady Trumbull.

The Begadler mumbles to himself to buy a bottle of Befeater Gin - The Crown Jewel of England - on the way home.

Suddenly, the lights go out.



Lady Trumbull



The Countess

The Gibson Girl swarms into the waiting arms of the Mamm Man.

Lady Trumbull faints. No one could hear any footsteps.

It should be easy to deduce who turned out the lights, dear reader.

But now, more importantly, clip

out the coupon and tell us (for a chance at \$25,000) who takes

The Crown Jewel of England. That is a far thicker problem, and no one, not even you, is above suspicion. Good luck and good hunting!



The Squire



The Begadler

Who took The Crown Jewel of England?

OFFICIAL RULES: 1. No purchase required. 2. Clip out this entire coupon. On the coupon, hand print your name, address and city or town you think took The Crown Jewel of England. Mail in a total self-addressed envelope no larger than 10 1/2" x 15 1/2" (including Befeater Gin™ "The Crown Jewel of England" Sweepstakes #01, Box 9241, Blue, Nebraska 68099 & BEEFEATER™) 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 in letters by you will, but each entry may be mailed separately. 4. Winners will be determined in a random drawing. Names among all entries received. Names that are (1) already among an accepted random drawing will be held from among all entries received in usual years not revealed you consent to any Random drawings are under the supervision of the D. I. Ryan Corporation, an independent judging organization whose decisions are final. 5. This sweepstakes is open to residents of the United States of legal drinking age in their state of residence at time of entry. Employees of Heublein Corp., its distributors, retailers, advertising and promotional agencies and their families are not eligible. This sweepstakes is void in Ohio, Utah and those and wherever prohibited by law. Limit one entry per family. No substitution of prizes is permitted. All Federal, State and local laws and regulations apply. For a list of prize winners send a \$25.00 SASE self-addressed stamped envelope to Befeater Gin, The Crown Jewel of England, Winner, Ltd. P.O. Box 8278, Blue, Nebraska 68099. 6. All entries must be an Official Entry Coupon for this self-addressed coupon your name and a BEEFEATER™ self-addressed

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Mail in BEEFEATER GIN™ "THE CROWN JEWEL OF ENGLAND" P.O. BOX 9241, BLUE, NEBRASKA 68099

Who took The Crown Jewel of England?

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Address _____

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State _____

Zip _____

BEEFEATER GIN, The Crown Jewel of England.



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LETTERS

COMMUNICATIONS

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 of Human Services Subcommittee. Best wishes for the continued success of the magazine.

Rep. John Paul Hammar Schmidt
Washington, DC

Sheer Stale

I must protest the claims made by Christopher Preist about Professor Tomerash and his whole theory of static gravity (April 1979). There is no real relation between electric current and gravity as the first is a flow of energy from high to low potential and the second is an elementary property of space itself. Furthermore, on page 78 Preist tells us that the farther one is away from the center of gravity the greater the weight. This is absolute idiocy! The weight decreases, and while it is true that the potential momentum increases, that is not weight. Another thing is that worldwide "conspiracy" to keep the atomic projector a secret. The United States did not succeed in keeping the A-bomb a secret. It is inconceivable that such a weapon could be kept from the public interestingly enough: in this same issue there is an article on orphans. Don't you think the story belongs in that category?

Robin Carpenter
Roca, Neb.

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

Concerning Christopher Preist's article on static gravity: Very 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 orphans 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 blunder when all the time you were only kidding. Beautiful!

Norman Douglas Meload
Watertown, Conn.

At last, someone got it right! — Ed

Biffed 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 his should surprise anyone beyond a paralytically dazed yawn.

Gerry T. Erben
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 your authors provocative but their work is supported by the finest graphics on the newstand. How you can 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 the trend continue: else Omni shall eclipse as part of the leading edge of scientific creative thought. There are hidden relationships here that must not

CONTINUED ON PAGE 125

DIALOGUE

FORUM

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

Home Delivery

I would like to congratulate Gene 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.

W D Tigg
College Bridge, N.B.,
Canada

Thank you for Gene 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 doctor 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 Gene for bravery in putting the "facts" out there.

Ma Davis Loka
Los Angeles, Calif.

Gene Corea conjures up an impressioned 1984-ish 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 scalps 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 healed? Issues in pregnancy can be fatal to both mother and child, diabetes untreated can be the same, preeclampsia in the birth canal can blind the newborn, herpes in the canal can cause fetal meningitis (and herpes can be present and not be 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.

Godfrey Simmons, M.D.
Eugene, Oreg.

Due Respect

Three cheers 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—an most horrible of horrors—the term that makes me want to scream "aghiiiiii!" so-iv.

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 be the stands in a long time. You deserve nothing but laurels.

Linda Del
Brookline, Mass.

From Arthur, with Love
Dear Uri Geller:

Thank you for your letter of March 14. I'm sorry if 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, or even that you may be able to exhibit them. However, in science you have to accept simple explanations until overwhelming evidence to the contrary compels you to seek an alternative.

I haven't obtained my opinion article from Randi or Martin Gardner, but from other sources as well. Perhaps the most devastating is the Puhatch book, as 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 other wise headheaded 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's 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

Demythologizing UFOlogy

Orin has far 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, many of which exist today 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 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

These groups are the prime exponents of new theories and revelations concerning the "truth about UFOs." This constant debate will soon subside with the apparent takeover of the investigation of UFOs by the United Nations. At that time perhaps many of the groups active today will assume an auxiliary role in seeking a solution to this very important question. They should be asked to assist in coordinating the voluminous amount of material coming in from each participating nation. It would also be advisable to utilize the expertise of those scientists already committed to the study of this phenomenon to help remove the veil of mystery that surrounds the UFO enigma.

Harry Lobeason
Weehawken, N.J.

Plant Poison

Isn't it stretching it a bit to claim that plants are a major causative factor in the smog levels recorded today? (See "Plant Pollution," *Coruscant*, March 1978.) 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 maul and endanger human life as it is today on the planet. Alas for them, though, for it appears that they have finally been found out.

To follow in the 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 freely 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 Frank Kardig's commentary ("First Words, 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 applicable.

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 philosophers. 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 *Shaking the Wild Planet* by Bentov 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 Orin. I perceive it as an exciting adventure in imagination and creativity.

Max Gillaspay
San Antonio, Tex.

A Third View

In the eyes of properly trained and knowledgeable practitioners working in the field of embryonic and parapsychological 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 be his shoes if shoe flying 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 blunders.

As a basic suggestion to both "pro" and "con" groups, you could observe 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. Georgia Dow and
New Linda Hillshofer
Wheatridge, Colo.

AS GO THE WHALES

EARTH

By Kenneth Brower

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 the time, IWC delegates were greeted by demonstrators. On one side were antiwhaling pickets bearing placards. **RESERVE FOR LEADERSHIP**, said one. **PEACE FOR THE WHALES**, said another. **LET THE WHALES RECOVER**, said a third. One sign was illustrated with a drawing of a whale in whose bleeding back the flags of Japan and the Soviet Union, the two remaining big whaling powers, were imprinted by a harpoon. **AS GO THE WHALES SO GOES THE SEA**, the sign prophesied. At the door of the Mount Royal Hotel where the convention was held, a person in a killer-whale suit chased each new arrival a flipper to shake. Most delegates accepted the flipper with a smile, even those from Japan.

The cut of the killer-whale suit was remarkably true to the shape of a whale until you glanced down. Protruding from beneath the black-cloth flukes was a pair of very long, bare, slender male feet. The feet were pale, testifying to the sun leanness of English summers. They were dirty, testifying to the grime of the underground. They were eloquent of waterless London flats in which man's inhumanity to whale is denied, through a haze of hash smoke, late into the night. Above all they were incongruous. For one of the principal items of terminal apparatus that whales dispensed with in becoming whales. And whales are nothing if not clean.

On the other side were pro-whaling pickets—members of a Japanese seaman's union, whose placards protested the environmentalist threat to their livelihood. The antiwhaling demonstrators, for the most part, were scruffy and youthful. The Japanese seamen were well scrubbed and somewhat older. If the antiwhalers had a characteristic demeanor, it was one of earnest anguish. The Japanese seamen's

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 tossed off and will march again. The Japanese whaling men will countermarch demonstrating their uneasy 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 spaullets. The bobbies will incline their heads to listen.

A large Alaskan Eskimo contingent attends meetings of the IWC. Eskimos are the planet's oldest whalers, having begun the practice four millennia ago. To the past two meetings they have brought a model of an umiak, a small version of the 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 doli crew is dressed in fur parkies, 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 chase or clipper ship. The Eskimo doli 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 "Inuit," "The People." This is the Eskimos' name for themselves, a name from the days when many Eskimo Inuits 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, bowlegged gait, the whaling captains will enter the hall. Chairs will be vacant, but the captains will prefer to stand. They will watch the proceedings intently, expressionlessly like men scanning ice floes for the distant blow of a whale. (There will be, in fact, a whale below them, the stylized animal printed 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 hide the polar gaze that each captain carries about with him. Each face will squint into it.

Last year a IWC meeting nearly ended in violence. On the first 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 hoisted aboard Japanese ship

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A BIT OF LUNACY

SPACE

By Mark R. Chartrand III

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 10, or will you on the nights of this month? Did your moonlighting pay for your moonshine? Did you teetle "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 moon lore, beliefs, and stories 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 **meh₂*. No one knows for sure how it was pronounced, but from it sprang our words moon, measure, menstruation, meter, and even *meas* (a measure, appointed time of day).

Just as the 29.5-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 moonrises, to tell the time at night, as well as sundials for the day.

Consider some of the descendants 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 hope from the "revenuers," 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*, lunaris, *lunatic*, both an architectural feature and an old name for a small telescope, foxy, also spelled *luny*, and *lunatic*, crescent-shaped.

Selenia, 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 effect 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 will 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 effects.

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 wolf-like creatures (from *lykos*, "wolf," and *anthropos*, "man"). As every horror-film watcher knows, only 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.

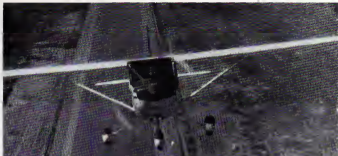
We should not forget the phrase "once in a blue moon." It turns out that with just enough impurities in the air to scatter light properly, the moon (and the sun) really can appear blue. So the phrase, taken to mean rarely, has a basis in fact.

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



"Spooking to the Moon" parodies nineteenth-century lovers enjoying the romantic aspect of lunar lore. 18 (left)

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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 these 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 begs 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 oxyphenolol, 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 simply itself. Thirty-four healthy young string players (not selected for undue nervousness) performed on separate days after receiving oxyphenolol 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 oxyphenolol. 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 75 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 *Rum 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. Half a harpsichord player, who expressed satisfaction after trying oxyphenolol 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, oxyphenolol can cause such bothersome, although relatively harmless, reactions as rashes, vomiting, and hallucinations. Oxyphenolol comes from the same drug family as propranolol, which was removed from the market after being found to produce an extremely serious condition, sclerosing pericarditis.

But if beta blockers, or something like them, were proved to be anxiety saks, what then? Would the purist critic still declare that timorous musicians must be left to fret and fidget, and that otherwise skilled car drivers be denied a little help to get them through a hectic 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 solve social and personal problems. Such criticism of pharmacological escapism is well founded. But a modern equivalent of Aedon 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 underactive cellist or car driver is in a real sense behaving abnormally when under intimate scrutiny.

Beta blockers may ultimately prove not to be the answer. Assuming, however, that the perfect soma pill for restoring such people to normalcy were found, who would deny them medication? **DB**



Do medical safeguards hinder jittery musicians?

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 purplé 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 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 "viewing" 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 schoolchildren. 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 Gellé or spoon-bending type, but a more modest effort to determine whether a subject might "will" a grain of sand to move.

Deirdre MoJores 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. Willie Herman, an SRI former 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 Herman 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 yet 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 wasn't wired 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 stifle 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 muddle with some of the keenest thinkers of the day: Dr. John Wheeler, for example, a renowned physicist, who wrote the first paper on nuclear fusion 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 intellectuals would attach to Southern congressman. It is true that he is a Southern Presbyterian and a "religious one" that he loves his chairmanships of various agricultural subcommittees on poultry, dairy products, and tobacco



Rep. Charlie Rose in front of the Capitol

CONTINUED ON PAGE 142

THE ARTS

By James Delson

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. Inside, science-fiction and fantasy filled the screen, outside, riots, traffic jams and defiant devotees filled the streets.

"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'Écran Fantastique*, France's only publication devoted entirely to fantasy and science-fiction films, Schlockoff has been a life-long fan of the genre. His passionate pursuit of fellow fanatics has led him, through the magazine and the festival, 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 lines roiled 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 coffee 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 is quite simple," explained Stan Barzic, 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 genre because there is so little that is worth seeing compared to the riches available in print. There is 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*, *Turner Trap*, *Devil Times Five*, *Alien Factor*, *The Bermuda Depths*, *Alien Zone*, *Nocturne*, and *Sanctuary for Evil*, were supplemented by a sprinkling of better-quality fantasy and SF films from Italy, a smattering of Star Wars ripoffs, and a few excellent U.S.-made children's

The Rex Cinema is a beautiful dinosaur.

CONTINUED ON PAGE 102



Halloween was one of the few new American films to be screened at the Science Fiction Festival.

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THE ARTS

By James Delson

While attending the eighth International Paris Festival of Fantasy and Science Fiction (FFS), 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.

Likewise captivated by the same master wheel, the various aspects of the French SF scene are independent but interconnected: books, magazines, fanzine art is comic-book form, television and film. Each has affected all the others, with books leading in popularity. Only fanzine 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 200,000, 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 usual legible 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, Isao 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



Science fiction is serious business in France.

between science-fiction readers in France and those in the United States. Most of the French devotees are intellectuals, students, and academicians who are attracted by the Freudian aspects of Dick's work and the sociopolitical work of other American and 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 *Picote* and *Mitral Hurlant*, for light diversion.

Comic art in France is far more sophisticated than in America. *Picote* 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 works.

Mitral 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 is. With its enormous success, *Mitral 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.

Entered through mutual reliance, fanzine-art and comic-art magazines are nearly inseparable. But artists win wider recognition through books that contain the four- to six-part stories that usually appear in magazines. The books have been

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THE ARTS

By Bibi Wein

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 Burkhardt/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 225 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, as they've always been, in the executive suite, not in the lab.

Focus groups, sound-lab tests, listener-environment studies, melody-attention tests, and ongoing surveys conducted by local stations, along with innovative analyses of record-sales data, are among the techniques that Abrams combines to determine the suitability of an album for Superstars airplay.

One of the first things he does with a new album is to distribute 100 copies on the street to people who will listen to it at home for a week, then rate it. Past studies have shown that among 100 persons chosen at random 20 can pick a hit each time. Those 20, once spotted, continue to test records until—usually after three to six tests—their spontaneity burns out, or as Abrams puts it, they start catching on to what he re-dubs. "Not that they were disinterested, but we don't tell people eighty radio stations are going to play this record if you like it."

However, that is exactly what will happen, provided the album does well in other testing situations, such as focus groups.

A typical focus group might consist of a number of sixteen- to twenty-year-old males gathered in a room where they are questioned by a skilled researcher and observed through a one-way mirror by others on the Burkhardt/Abrams staff. Questions range from those about specific songs or musicians to "What would happen if your parents found you smoking dope?"

In addition to ongoing studies of new and established albums, Abrams often does one-time experiments to answer such questions as "Why do people over twenty-four generally dislike hard rock and roll?"

"We got a group of people in their late twenties and sat them down under headphones with a Boston album," Abrams told *Omni* in a recent interview. "Generally the reaction was, 'Can't handle it. Too loud.' Then we took a control group and equalized all the highs out of the record so it was all bass and midrange. The reaction was positive. The problem

with intense hard rock is just the high sound frequencies—the screaming guitars and synthesizers."

With a graphic equalizer, Abrams measures the exact frequency that listeners will tolerate. He applies such data both to the play list and to the technical sound of a station, in this case by knocking off the highs a little and emphasizing the bass. Another study revealed that women have a particularly positive response to rich, clear, bassy signals. Abrams urged clients to adjust their equipment accordingly.

Melody-attention testing, a laboratory version of *Nirve That Tune*, is used primarily to isolate the musical elements that people are responding to. Subjects are exposed to three or four tunes and a week later are tested on what they remember. They do not play the whole song this time, nor even a few original bars, but merely a bass line, a few chords maybe a guitar solo performed on a piano.

By picking a song full of things that melody-attention tests show are retained, Abrams is convinced he can make manufacture singles and have a hit every time. "We don't want to—and can't do it legally anyway—but it would be hard. It's just a matter of analyzing certain critical things like the lyric content, the instrumentation, the frequency."

Abrams is more interested in the notion that every musical key "has its own vibe." He believes he can determine what keys are most effective for different artists to play in. "This hasn't been fully tested yet, but I feel pretty confident it works. We might find that the most popular, power records with an eighteen- to twenty-four all-male audience are in E, and that the songs appealing to another group are in A. It's difficult to put this into a radio format and actually program by key, but for an artist it can be valuable information."

I asked Abrams, who plans to become a recording artist himself (guitar, key boards), how he'd feel about that kind of input. "It's very frightening—1984. But the fact is that information is there. If NASA can send a man to the moon, nobody should be surprised that we can figure out



Lee Abrams, the wizard of new record research

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TRANCE FIGURES

UFO UPDATE

By Alan Hendry

No subset of UFO reports has aroused the public's interest or supported the extraterrestrial hypothesis more than the 1,000-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 UFOists aboard a spaceship.

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 regressed—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 Hill's experience in 1961. Both cases involved witnesses who, under hypnosis, described similar events. Both couples spoke of boarding a UFO (spacecraft) 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 UFOists 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 kidnaped a busload of

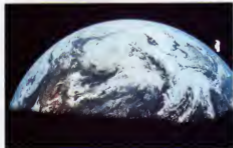
children in Chowchilla, California, the bus driver could not remember the license plate number on the van. Under hypnosis, however, he recalled it sufficiently well for the kidnapers to be apprehended. Such experiences have served to bolster public confidence in hypnotic regression universally. Such 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 intonations, 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 may be taken by [his] fantasy. I do believe that the abductees are unable to separate fact from subconscious fantasy."

Dr. Leo Spink, 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 tape recordings of one UFO abductee's tale. This Missourian 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 seen in a newspaper's comics section.

More 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.



Often touted as a UFO, this object appeared on Apollo 11 film as spacecraft left earth orbit.

CONTINUUM

FRIENDS AND ENEMIES

Scarcely ten years ago, when the environment first became a cause célèbre, practically everybody agreed to behold 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 their understanding of basic cell functions 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 the work, including a possible "Andromeda Strain scenario," in which the earth 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 FOE'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 con-

vinced of the technology's relative safety, heads rolled in the ensuing fracas. René Dubos and Joshua Lederberg, two distinguished biologists at Rockefeller University in New York City, opposed the environmentalist 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 citizens' 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 environmental groups have been clamoring for is now completed, and it confirms the lack of danger in these investigations. (The results of the so-called Martin-Flowe experiment were scheduled for publication in *Nature* when this month's *Oms* 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."

—DANA SOBEL

CONTINUUM

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., est.

mates that for a city of 150,000 people, a worm farm would cost \$9.5 million; \$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' general manager. "They won't grow big from all that garbage. They won't escape from their pens or wrap themselves around people and choke them to death. But they can replace topsoil lost by erosion, give the soil desperately needed organics, and help solve the garbage problem."

—Stuart Diamond



Earthworms, Inc. executive holds a group of his employees. "They won't wrap themselves around people and choke them to death."

SPACE ARM

What has three wrists, one elbow, two shoulders, a hand that not only grasps but sees, 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.

The futuristic device will be mounted in the cargo bay of the space shuttle orbiter, allowing the astronaut 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 has to match the dexterity of the human arm. Not surprisingly, it resembles the human arm in many respects. It has:

- Six rotating joints—two 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 its 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 the



Canadian researcher with space arm. It can't be tested on Earth; 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't 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 an agreement with NASA, Canada will donate the first arm and NASA will purchase additional arms for future flights.

—Dan Floss

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 to 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 not free deuterium but hydrocyanic acid, which contains deuterium.

This molecule is 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 changes. 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, estimate 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 Arye 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



Dolphins were trained all last winter to prepare for Nessie.

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' expeditions.—D.D.



The seven meter radio telescope at Bell Labs was used by Arno Penzias to detect deuterium (heavy hydrogen) in the universe's haze.

CONTINUUM

ON THE BEAM

A major objection to beaming power in the form of microwaves to Earth from solar-power satellites is the

signal an interrupter controlling power output to shape, dim, or douse the beam immediately.

The scattering characteristics of objects that might



Artists' concept of a solar-power satellite in earth orbit. A good power source—but will the beam blast robots and fly airplanes?

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 Reports*, 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

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 temper 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



W. Paul Dmowski: Two forgetful couples skewed the results.

spin-off, too. The sperm sample obtained also happens to be free of abnormally shaped sperm and sperm with acrocentric 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—all have their gurus and their long-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 Shettle'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 colour markers, 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 cerebral 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 stimulus, the patient simply places a small radio transmitter over the receiver which then sends direct cur-

rent 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 80 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 unobservable fingerprints—the laser.

Dusting with 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 prints. 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 Daumlype, 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 sub-



Laser-detected fingerprint instrumental in drug conviction

borized 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. 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



Yoshio Hosobuchi (at right) holds radio transmitter over receiver embedded in patient's chest, which then sends current to the brain

CONTINUUM

EMI POLLUTION

Imagine a toaster that delivers meals 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 shoveling 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 system for paging doctors.

These facts and many others are indicative of an emerging new consumer problem: the interference of electromagnetic signals with the operation of electrical or electronic 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 Ambler, 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 \$7.1 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 devices, 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 1990s," said Chris M. Kendall, a private EMI consultant.

—Phyllis Wolfman

CLEVER CUCKOOS

Contrary to popular belief, the cuckoo is one of the smartest—and laziest—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 birds' 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 sparsely 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 idleness.

Only the European cuckoo is so clever. Its American counterpart, unschooled in Old World customs, builds its own nest—S.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 that may be near a CB antenna mounted on a recreational vehicle.

keep them cool," explains David M. Sapanuk, of Cornell's Department of Agricultural Engineering. In winter, they take in water at 1°C (35°F) and spit it back out at 7° or 10°C (45° or 50°F). But if that warmed water de-aerated through a greenhouse, Sapanuk thinks, it might be a prime source of heat for winter crops.

By August, Sapanuk's group will have built a test model on campus. If a one-year trial proves successful, the group will construct a demonstration greenhouse system at the state-owned Astoria power plant in New York City.

"Most greenhouses are heated with radiators and fans," Sapanuk says. "The only difference here will be that the energy comes from the power plant's waste—not from burning fossil fuels in the greenhouse."



Cornell grows chive bolts; plastic tubes for carrying waste water.

Sapanuk adds that a similar idea could be used at power plants that use cooling towers (like Three Mile Island in Pennsylvania) in stead of rivers or lakes. By diverting cooling-tower water, which is typically 27° to 38°C (80° to 100°F), Sapanuk says, waste heat from a single power plant could warm 320 hectares of greenhouses.

—Dava Sobel

HELIUM-3

The concept of "appropriate" technology has entered even the ultraphysics-laden 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



Karen Silkwood, *Dead since 1974* but very much alive in court.

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 Terrorist 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." The reason for the publishing ban? The article was too thorough in its explanation so much so that it qualified as a classified document. The men who wrote it got the information simply by talking bomb experts the truth—that he was a reporter writing an article on the workings of the hydrogen bomb.

- An old atomic mystery was renewed 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 a 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 Coligan

"The most beautiful experience we can have is the mysterious: it is the fundamental emotion that stands at the cradle of true art and true science.

—Albert Einstein

CONTINUUM

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 talking the authorities about everything from gunshots to thunderclaps. Not until U.S. 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 that 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. Mitre consultant 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 boom 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 in 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 every hour 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. 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—\$ D.



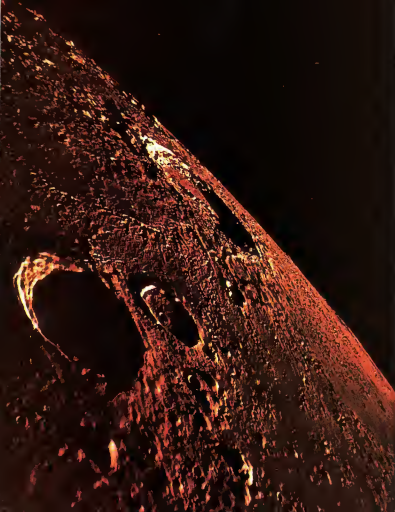
The 6-centimeter IBM memory chip, held in tweezers, is the smallest, most compact ever developed and can hold 64,000 bits of information—roughly equal to 7,000 eight-letter words. It is compared to a 9-centimeter Babylonian clay cuneiform tablet in background, which was used to record a single business transaction in 1200 B.C.

"If the scientists tell us truly, the gasoline supply of America, at the present rate of production and consumption, will be exhausted in twenty-seven years. But, were every one of the American cars equipped with Goodyear Cord tires, this supply would last seven years longer, or thirty-four years."

—Advertisement, *Collier's Magazine*, December 16, 1916



Most of the mysterious booms heard on the East Coast were caused by supersonic aircraft, but others may have been quake warnings.



Thousands of research hours
have barely tapped
Apollo's scientific legacy

THE ONCE AND FUTURE MOON

BY BEWAN M. FRENCH

It was good to be back on the moon. The trip down to Earth had been tiring. Since Russians 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 Crisum. From where we stood, of Korolev (only a few old-timers still refer to it as Korolev Base) spread out before us. The panoramas hadn't changed. Pit 1 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 rear end, accelerated along the track, and vanished into space above the curve of the moon's

surface. Another load of processed lunar material was heading up to where the huge colonies of Novaya Moskva and New Leningrad hung in space near the L-5 point. Probably Herium sponge, we thought. The zero-g refining facility at Novaya Moskva was turning out structural members for the half-completed shell of New Boston, while Americans worked the bugs out of their own solar refining 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 spacefaring; we know we can leave the earth. Lunar bases, space habitats, and zero-g industries no longer seem so impossible. Difficult and expensive, yes. Nevertheless, they may become real in another generation or two.

Humanity 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 exploration stage. And what exploration! Twelve American astronauts walked on its surface. More than 2,000 lunar samples



Micro-twin section of moon rock reveals aluminum, iron, titanium, and magnesium-iron materials for future construction.

PHOTOGRAPHS BY NASA

Imagine Columbus
returning with photo maps,
chemical analyses
of the entire U.S., and
2000 soil samples

were 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 probe its interior. From lunar orbit, spacecraft photographed the entire moon and chemically analyzed moon then 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 dozens 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 not a uniform, homogeneous world but has an outer crust and an underlying mantle of denser 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 drier, 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 airless, and its surface has never felt the

touch of wind or water. Large and small meteorites constantly bombard the moon's surface, making craters, breaking and scattering bedrock and gradually building up a thin layer of shattered, powdery rubble. So slowly does this shrapnel 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 hundreds of scientists who are still prying new knowledge from them. Step into the sterilized rooms of the Lunar Sample Custodial Facility at NASA's Johnson Space Center in Houston and meet these silent witnesses face to face, dark chunks 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 lifeless and harmless, other facts began to emerge. The rock samples had formed in a dry environment, one without free oxygen. Some of the most important chemical elements were present in very low concentrations, and the samples could be easily 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 those chips to a laboratory



Astronaut Harrison Schmitt collects rock samples next to a huge, fissured boulder examined during the third moon walk of Apollo 17. Abundant scientific data have been extracted from the lunar minerals, but structural metals and plentiful oxygen may prove every more practical discoveries.

Watch as a white-coated technician centers 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 glistening colors under polarized light. Here is the moon, brought down to where we all can look at it. The crystals are fresh and unaltered 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 clays 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. In 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 their 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 meteorites, 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; only to be struck again and again by huge meteorites. 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 or organic matter and nothing live.

Moon rocks hold the history of the moon, but lunar soil holds the histories 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 spreads continuously out from the sun. Other specimens have caught and held higher-energy atoms from the interstellar gusts 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

❖ *Mysteries remain.*
Why are the dark lava flows almost all on the moon's front side?
What is the strange red glow seen in Alphonsus and other craters? To find out, we must go back. ❖

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 starting 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 turn 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. How 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 glows that have been seen in such craters as Aristarchus and Alphonsus? 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 Russian Luna XIV, could land at Aristarchus to see what causes the glows. 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 poles. 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 (low Earth orbits, 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 magnesium; 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 winduppanes, 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 cinerite-like 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. **OO**

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BRITISH STERLING

TEXTOR

FICTION
FIVESIGHT

*Ordinary foresight is
fine in most places, but not enough
in Callahan's bar.*

BY SPIDER ROBINSON

I knew 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 Pat Eddie sat in joyous combat with Eubie Blake's old rag "Thick Fingers," and a crowd had gathered around the piano to cheer him on. It is a demonically off-beat rag, which Eubie wrote for the specific purpose of humiliating his competitors, and Eddie takes a crack at it maybe once or twice a year. He was playing it with his whole body grunting like a murderer and spraying sweat in all directions. The onlookers led 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 whined 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, clutching my third drink in fifteen minutes, and concantrated on not bursting into tears.

PAINTING BY EVELYN TAYLOR



Doc Webster caught me at it. You would not think that a man bragging that much mass around a crowded room could pay attention for anything else. Furthermore, he was dancing with Marie 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 fall on mine, they stayed there.

His other professional gift is for color and delicacy. He did not glance at the calendar; he did not pause in his dance; he did not so much as frown. But I knew that he knew.

Then the dance whirled him away. I spun my chair around to the bar and gulped whiskey Eddie brought. "Jockey Fingers" to a triumphant conclusion, hammering that final chord home 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 bar-top together, and happy conversation began everywhere. I finished my drink. For the hundredth time I was grateful that Calahan 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 lose it.

"He me again, Mike," I called out. "Halt a sec, Jake!" Calahan boomed cheerily. He finished drawing a pitcher of beer, stuck it down into it, and passed it across to Long-Drink McGarragle, who farmed it to Eddie. The big barkeep ambled my way, running damp hands through his flaming red hair. "Beer?"

I produced a very authentic-looking grin. "Trish again."

Calahan looked over so slightly pained and rubbed his big broken nose. "I'll have to have your keys, Jake."

The expression on too many has only a limited meaning at Calahan's 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 an intelligibly. But no one drinks drives home from Calahan's. When he decides you've reached your limit, you have to surrender your car keys to keep on drinking. Then let Poley—who drinks only ginger ale—drive you home when you bid.

"British constitution," I lied experimentally. The lethal policeman drowsed us. Peter Pepper packed his pipe with paquet.

Mike kept his big hand out for the keys. "We heard you sing 'Shiny Stockings' blind drunk without a single syllable!" Jake.

"Damn it," I began and stopped. "Make it a beer, Mike."

He nodded and brought me a Lowenbrau 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. "Waybe 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 brick fireplace. He is considerably taller than somewhat, and he towered over everyone. He waited until he had our attention.

"Ladies and gentlemen and regular customers," he said then, "you may find this difficult to believe, but in my youth I was known far and wide as a jockey." This brought a scattered response, which he endured stoically. My only passion in life, back in my college days, was guessing people out. I considered it a holy mission and I had a whole crew of other jockeys to tell me I was just terrific. I would type long letters on a roll of toilet paper, smear mustard on the last square, then roll it back up and mail it in a box. I kept a deskmate 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 to gross out. Foul Phil, they called me in 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. ◆

days. I'll tell you what cured me. "He eats his white," confided of our attention.

The only trouble with a reputation for oddness 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 sized to myself. *Fresh blood? What'll I do?* I've got the mouse in one pocket, the actual thermometer-wizze stick 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 sits, sit in' talkin' to Poley LaFave on a little couch. I came up behind her like, up to me trousers, out with me 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 men. "Well, I said I was a jockey," the Drink said, and we all applauded.

"No reaction whatsoever do I get from her," he went on, dropping into his fake brogue. "People grin'n or growl'n all round the room just like here. Poley's eyes

poppe', but this lady gives no sign that she's aware of me presence at all. At all. I kinda wiggle it a bit, and not a glance does she give me. Finally I can't stand it. 'Hey!' sez I, 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 penis, only smaller.'"

An explosion of laughter and applause filled the room.

"wherefore," continued Long-Drink, "I propose a toast to me youth, and may God save me from a relapse." And the cheers overcame the laughter as he gulped his drink and flung the glass into the fireplace. I nearly ginned myself.

"My turn," Tommy Jarosien 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 shaved.

"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 million 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 insolent, and the burning question in my mind is: Are the coastdown buses still running? Because if they are, I can catch one a block away that'll take me to bright lights and safety—but I've forgot ten how late the coastdown bus keeps running in this part of town. It's my only hope. I keep on 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' worth of beard, 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 stammer, 'Uh, coastdown bus run all night long?' And the fella goes, 'Tommy, I'm a ferocious-looking giant with his hands in his pockets. Then suddenly he yanked them out, clapped them rhythmically and sang, 'Ooo-dah! ooo-dah!'"

The whole bar dissolved in laughter. "—tells whipped out a pint, 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 Limes, who is the exact color of roasting peas, came over and gave Tommy a beer, a grin, and some skin.

Suddenly I thought I understood some thing, and it killed me with shame.

Perhaps in my self involvement I was wrong. I had not seen the Doc communicating in any way with Long-Drink or Tommy, nor had the bastards seemed to notice me.

at all. But all at once it seemed suspicious that both men, both proud men, had packed tonight to stand up and uncharitably tell egg-on-my-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 hands down.

Or was I, with the egoism 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 stunned.

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 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 winking 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 know 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 lock swiftly focusing on me, but when they did, there was no one looking out of them. She enunciated her words.

Is it to me to 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 sneezed on the inhale.

CONTINUED ON PAGE 100

(**)



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INTERFERON AND BEYOND

Cells' natural defense against virus attack has also emerged as a promising new weapon in the fight to conquer cancer

BY DOUGLAS GASNER

Keep your computer-enhanced pictures of Jupiter Don't fault their colored spectacle before my eyes. Sever your theories about life on the Red Planet, roll them on your own tongue. I prefer other tastes. Come, test your eyes on this." Erasmus Darwin: His phrasology and the timbre of his voice were compelling, as befits a man whose genetic destiny had been shaped by some of the most profound thinkers of the last two centuries. Autocratic chromosomes were a higher credential these days than blood that radiated at 4,700 angstroms in the visual spectrum, and so researchers gathered at his beckoning.

Darwin II's room into which his colleagues flowed, resembled a cross between a planetarium and a bathysphere. In reality it was a holograph-enhancement chamber designed by its proprietor for simulated journeys into the subcellular world of organelles: a Jules Verne version of *The Fantastic Voyage*. Verne and Darwin II's marmosets, the original Dr. Erasmus D., grandfather of Charles, had shared similar visions of the world in the days before the blossoming of technology had fulfilled their dreams. The symmetry of those ancestral thoughts to his own electrified Darwin II in the same way an elegant mathematical statement electrifies a physicist.

It was with these charged expectations that Darwin II dimmed the room lights and took his seat along with the others against the rim of the amphitheater.

Rhodopsin, a purple pigment in the external segments of the retinal rods of the people in the room, adjusted to the diminished light, and Darwin II, who had witnessed the intercellular drama before, was the

PAINTING BY JULIA TURCHUK

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 trisser's beam.

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

Merely was perhaps the wrong 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; they destroy the invaders in the chemical crucible of an enzyme-killed 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-end-scavenger systems, 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 substance. 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 see seeking now. His view was at another level. But both weapons are intrinsically and irrevocably linked. Dr. Darwin wrote in his journal that a patient of his, a 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 leukocyte surfaced like large, indolent spheres that floated like glistening. As the magnification and trisser 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 gulped and swallowed.

Suddenly a menacing shaft appeared in the upper region of the holograph scene, a minuscule needle dwarfed by the translucent leukocytes.

The needle at one end bore a hexagonal head. Piniclike legs sprang from the other end of the needle, like spines from a landing craft. It had the appearance of the lunar module seeking the moon. But this seemingly mechanical structure possessed one feature that was undeniably 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 in, or even brushed up on, virology. The tension in the room was palpable.

"In 1957," the narrator intoned, "The British virologist Alick Isaacs and his Swiss colleague Joan 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 incubated 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 from the viral assault,

● *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 that 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 the mysterious factor *Darwinicins*. 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 stealthily creeping toward its immense victim, now seemed to move in a series of choreographic leaps, for every advance, it was reeled half the distance. In this manner the combatants closed the distance between themselves.

The virus was slightly askew when it contacted the outer cellular membrane, but it righted itself and inserted its hollow sanger deep into the leukocyte's surface. In unwrapping its hexagonal body launched its nucleic cargo. Having transmitted its

genetic material, the shell of the virus, like an empty syringe needle, dropped away.

Once inside the leukocyte, 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 leukocyte host began assembling hexagonal shells, spindlers, and new viral nucleic acid.

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

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

Darwin had found his matter 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 leukocyte 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 onto the surface of a neighboring cell.

With the binding of interferon, chromosome 21 started to air within the leukocyte 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 leukocyte's organelles began churning out a 48,000-dalton protein.

This is the antiviral substance that cells have been using to disarm the virus, the ancient molecule 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 holograph had large, single-nucleated white cells crept toward the devastation. Interferon has attracted them to the battlefield, and those macrophages began engulfing inactivated virus and cellular debris.

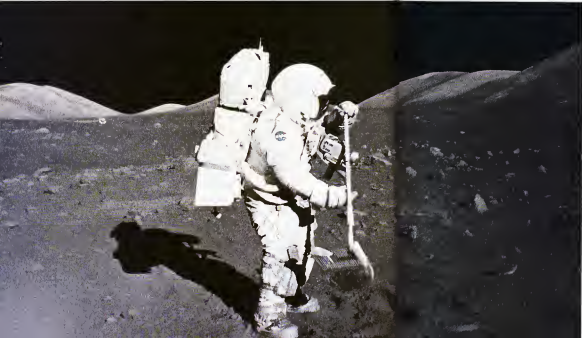
LUNAR CELEBRATION

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 1 turned Jupiter's moons into front-page news, they too were featureless dots seen through our largest telescopes. We have learned

BY OWEN DAVIES



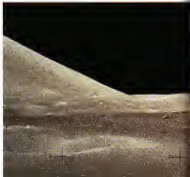
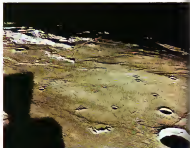
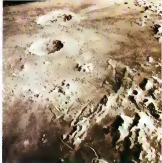
Chronicle from left: Apollo 17 astronaut (now U.S. Senator) Harrison Schmitt collects rock samples during his first moon walk; view from the departing Apollo 17 shows, at right of photo, lunar horizon from Earth; astronaut's footprints mark the once-brilliant moon; crescent overhead is seen from GC International over the lunar far side.

◀ 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.

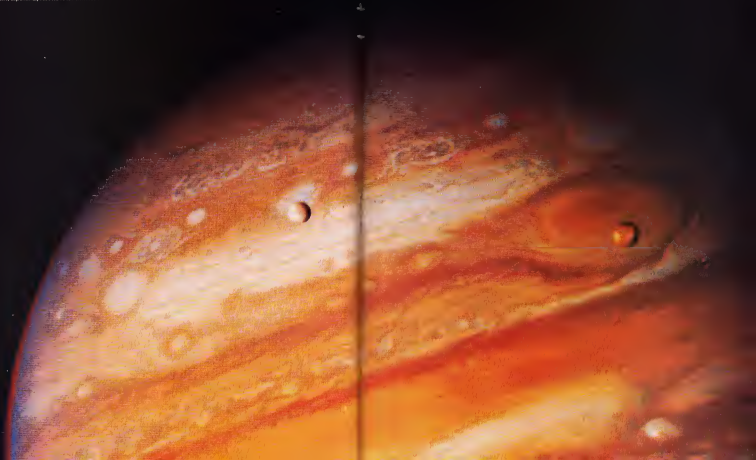
The Rangers, Surveyors, Lunar Orbiters, and Apollos brought back about 40 different kinds of data, from photos to gravitational perturbations, abundance measurements to gamma-ray scans—so much information that space scientists now need many hours of computer time to make even simple analyses. The Lunar 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



Clockwise from right:
Astronaut Schmitt
works by the rover
and the orange soil
he discovered. Inside
crater 80 kilometers
across, was shot from
Apollo 11. Apollo 15
landing site is seen
from over the
Approach Massif.
Crater Masseyville, at
bottom left of photo,
was a major landmark
as Apollo 11
approached its
touchdown.

Whyager took this false-color
of Jupiter and two satellites on February 13, 1979,
five weeks before its closest approach to the
planet. In, on the left, turned out to be shot
with volcanoes. Io, heavily pockmarked by volcanic
craters, superficially resembles our own moon.

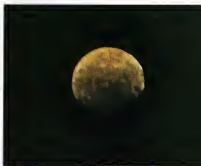
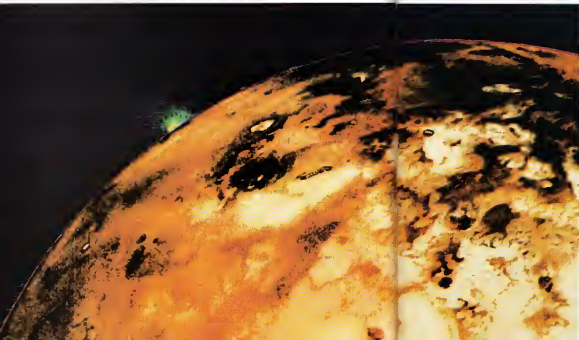
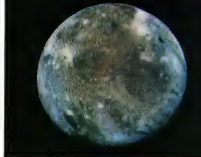


Moons may have formed, as the sun and planets did, from a whirling ball of gas.

originated here. Such a discovery could have been made from Earth. That leaves two hypotheses, and the data from our space missions weigh as heavily for one as for the other. The capture theory holds that moons begin as cosmic wanderers that travel through space until they pass 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-fused ball of ice; Callisto's ancient surface seems almost featureless; Europa, seen here 2 million kilometers away, will be examined by Voyager 2 this month; a volcanic eruption towers 100 kilometers over sulfuric to

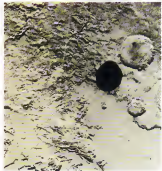




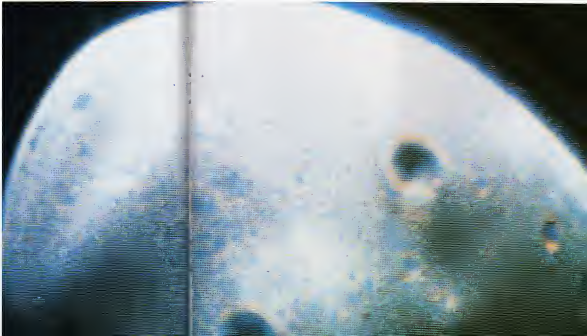
Moons are not stable in their orbits, our own is moving farther from Earth

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 viewed far out of Jupiter's orbital plane. Astronomers now think that both types are possibly 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. ☐



Closeup from right.
Gray Dunes. Mars's
smallest moon, seen
by Viking Orbiter 1.
Phobos is silhouetted
against Mars.
Olympus Mons, at
center, stands three
times as high as
Mount Everest. Pitted
Phobos averages only
20 kilometers across.



FICTION

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 distracted. 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 breaths were exactly in synch. Brian's rasping breath upstairs, tick with the rascal of a child's sleep. Colly's deep breaths as she labored with the dough. It got 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 cats!" Dale yelled back when closed the door. He barely left had about not helping her out but reminded himself that he was already running 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

PAINTING BY RENE MAGRITTE



anyone. Colly had a habit of inadvertently turning 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 of 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 odd, solitary. Most of the people at the funeral had come for Dale's sake, to comfort him. *Are/ 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 mingled 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 baseballs 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 cramped 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 knew her at all, he could not find an answer: not one he was sure of. And 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 even the rhythms of their bodies were together. It pleased Dale somehow to think that they had drawn their last breath together too, the unison continuing to the graves, 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 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 breathe 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 always left 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. Each a stewardess and the pilot sat near them, waiting silently for the plane to arrive.

It was in one of the deeper silences that Dale noticed that his father and the pilot were both swinging their crossed legs in unison. Then he listened and realized there was a strong sound in the waiting area, a rhythmic coughing of many of the passengers inhaling and exhaling together. Dale's mother and father, the pilot, the stewardess, several other passengers, all were breathing together. It unnerved him. How could this be? Colly and Brian had been mother and son. Dale's parents had been together for years. But why should half 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 somewhere 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 wherever he got distracted from things he tended to speculate on this. It was better than dealing on the fact that he, a man to whom family had been very important, was now completely without family. That the only people with whom he was completely himself 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 was 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 died, and so they would have breathed in unison, and 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. It began to hurt his work. He slowed 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 breathing was still in unison at every table right to the door of the restaurant.

The maître d', predictably was annoyed at his leaving without paying and called out to him. Dale did not answer. "Well, you don't pay," cried the man, following Dale out into the street.

Dale did not know how far he had to go for safety from whatever danger faced everyone in the restaurant, he ended up having no choice in the matter. The maître d' stopped him on the sidewalk, only a few doors down from the restaurant, and tried to

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. I'll pay you right here." And he fumbled 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 know," he said. "You know!"

Dale was acquainted 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, while Dr. Howard Rummung spent hours in conversation with Dale, trying to understand his madness, 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 had gone into it, most of the people there were voluntary commitments, which meant that 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, began to relax, to lose his obsession with breathing, to stop listening quite so intently for the sound of inhalation and exhalation, the way that different people's breathing rhythms fit together. Gradually he began to be his old, distracted self.

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

The doctor sighed. "I know it, Dale. I have to admit it—I'm disappointed. Not in your cure, you understand. It's just that you've been a breath of fresh air, you should pardon the expression." They both laughed a little. "I got so fed of middle-aged women with fashionable nervous breakdowns or mid-life crises."

Dale was harmonized—the dice were all against him. But he took it well, knowing

that next time he was quite likely to win handsily—he usually did. Then he and Dr. Rummung 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. Rummung walked over to the set, intending to turn it off, but the words coming over the air were so alarming that he could not tear himself away.

from satellites fully capable of destroying every major city in the United States. The President was furnished with a lot of fifty-four cities targeted by the orbiting missiles. One of these, said the communique, 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

• 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 he was trying to achieve. •

evacuation." There followed the normal parade of special reports and deep background, but it was pitifully clear that the reporters were all afraid.

Dale's mind could not stay on the program, however, because he was distracted by something far more compelling. Every person 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 newsman stopped and breathing heavily listened to something coming through his earphone.

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

"Dale," Dr. Rummung said.

Dale only breathed, feeling death posed

above him in the sky.

"Dale, can you hear the breathing?"

Dale heard the breathing.

The newsman 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 range of the camera. No one turned any equipment off in the station—the tube kept on showing the local news set, the empty chairs, the tables, the weather map.

"We can't get out in time," Dr. Rummung 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, twisted, complied with the voice of authority.

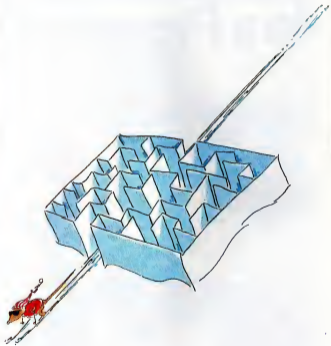
"So much for my cure," Dale said, his voice trembling. Rummung managed a half smile. They lay together in the middle of the floor, leaving the furniture for everyone else because they knew that the furniture would do no good at all.

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

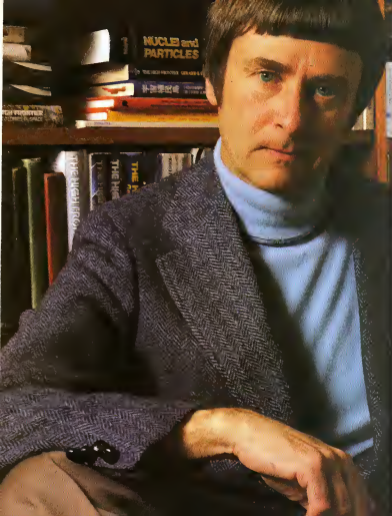
Dale was distracted, however. Instead of his impending death he thought of Colly and Brian in their coffin. He imagined the earth being swept away in a huge wind, and the coffin in being ashed immediately in the white explosion from the sky. The driver is coming down at last, Dale thought, and I will be with them as completely as it is possible to be. He thought of Brian learning to walk, crying when he fell, he remembered Colly saying, "Don't pick him up every time he cries, or he'll just learn that crying gets results." And so for three days Dale had listened to Brian cry and cry and never lifted 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 perfectly 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 ribbed from them so suddenly that they all involuntarily shouted and then, forever, were silent. Their shout was taken up in a violent wind that swept the sound, wrung 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. ☐



3002



"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?"

INTERVIEW

GERARD K. O'NEILL

Ever since Columbus made the rounds of potential royal backers the exploration of new worlds has required as much persuasive eloquence as it has inspired 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 (mined 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 skies 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 exploitation 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 fast-acting magnet with Princeton student V. Koenen, 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 law 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 to 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 very worthwhile. The ideas kept evolving all along, but there's nothing I regret or would like to retract."

In 1974 space colonization began to draw national attention after a small conference at 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 college industry. At home his wife, Tashi, 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, lecture halls, and Washington, DC.

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 hatched out 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 *Centri* by contributing editor Morde Davis.

Centri: 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. Has it surprised you to see this polarization?

O'Neill: No, because the motives that originally led me into the whole business were largely humanistic ones. The Club of Rome's limits-to-growth study, for example, concluded that because of inescapable physical facts we would have to abandon the development of greater individual freedom and accept a much more regulated life, with diminished options—not just for us but for our children and their children and so on. I reacted to that with dismay and shock. It sounded like a hell of a world to live to my kids.

Centri: 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. Succeeding drafts became more technical in order to answer the technical questions and objections that were raised along the way.

Centri: 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 here, 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 recoiled from high-technology plans, noted 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, not technologically motivated.

Centri: 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 look 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 Marxist 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.

Centri: But doesn't the scale of the proposals work against variety? Your Island Three, for example, is twenty miles long and may house ten million people. Many people think as Freeman Dyson does (*Centri* Interview, October 1978) that any project that big, involving 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 four-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 discrepancy 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.

Centri: What is the minimum scale for the first step? What kind of industrial base do you need to collect and process the lunar raw materials, 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 dicky situation at NASA. Besides Brian O'Leary and myself from Princeton, the workshops included Dave Criswell, of the Lunar and Planetary Institute; Bob Weldon, an extractive metallurgist; Jim Arnold, of the University of California at San Diego, an expert on lunar geology; and Chesley 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 process two thousand tons a year, and it could operate unattended for long periods. Weldon and Rosen found that the only components subject to wearing out would be containers for the higher-temperature chemical reactions—and these could be replaced from space by standard hand-and-arm industrial robots in feed mountings. Our overall conclusion was that you could make the first quantum jump to a minimum productive level with less than twenty shuttle launches. To reach that first level, only a few people would be needed, mainly for installation and occasional maintenance.

Centri: 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 the shuttle's cargo bay. There'd be a shakedown period first, mostly to check the pressure and the vacuum joints. On the moon you'd connect the pretested processing plant to its solar-cell power supply,

landed separately. The first products could include silicon for more solar cells, to power a mass driver that would install lunar. That, too, would be interesting. Remember, a mass driver that could send up six hundred thousand tons per year would weigh only two hundred fifty tons, far less than the big solar-pool array that would power it.

Orni: What about copper?

O'Neill: For the first step? Well, as I said, there's no denying it's a big step. I can't imagine doing it for less than billions of dollars. Quite possibly, though, 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 contributors from all over the world.

Orni: 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 would be happening now, because it could have a continuing direction and purpose.

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

O'Neill: Orni! 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!"

Orni: The President's chief science adviser, Frank Press, has told us [Orni 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 find 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.

Orni: In an era of lowered expectations— however short it may be— aren't 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 should be filling, and that's 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, and that's one of the main reasons they're outperforming us economically.

Orni: 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 a lot 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— three for this or that, and still have our original dollar.

Orni: 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?

Orni: 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 on 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





FICTION

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 onrush of human history with cold curiosity. They were perplexed 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 the world, and the atmosphere was rich. Whatever the world differed from the home worlds of the Comarion, the difference favored the new planet.

Its dominant race was energetic, with some physical resemblances 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 reactions of this pleasant planet were brisk, scattering life creatures who lived their lives at an incredibly accelerated pace. Study of them promised to be interesting.

Like Anpreene was 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 studied surprises.

Conscious from human perception, they narrowed the focus of their instruments, closing on a suitable objective. Earthly years whirled by beneath them, and earthly creatures scoured through their life histories. The selector focused on a sequence of events and probabilities. It locked

PAINTING BY
GILBERT WILLIAMS

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 robot figure, and the heap of smoldering 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 earthy species. She collapsed in a heap on the base of the focal area, her writhed legs and lacerated feet unable to support her weight. Raising herself on one bruised, 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 bemoaned. "This myth appears to hold great significance for these creatures. We suggest immediate action in accordance with her beliefs."

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, and Thou hast plucked me from the furnace!"

The Empath searched deep in her tortured mind for the proper terms in which to couch his 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 look of fear came into the hollow, hurtled 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 lee and the creak of the crowd.

From that time and place, the selector took a total of twenty-eight specimens, snatching each one from the instant before death—when the blade was at the nape or the head was just about to close on the throat or the rising smoke and flame at

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 halted the last one back to his destined end on the block, the Anpreene returned their ship and all aboard it to normal life and space and turned to the next stage of their exacting duties.

For the Empath alone, there was no task awaiting. The Empath was released at once to enter the tranquellite state, called *penetrate* by the Anpreene, which is shared body and mind after close communion with an alien identity. Deprived of *penetrate*, 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

☛ *The Assessors communed; the Empath and the Conceptualizers prepared themselves for the next contact, the earth spun through more years. The ship moved. . . .* ☛

Anpreene vessel were busy Conceptualizers structured and collated their findings. Assessors evaluated them, and all the while the selector apportioned its power for the next gathering of specimens.

After long deliberation, the Assessors concluded that the physical heterogeneity of this race had directly 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.

The Assessors communed, the Empath and the Conceptualizers prepared themselves for the next contact. The earth spun through 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 then smiled sardonically. "So, Aclerwinck, I admit sending me here just as I expected to die," he said in a tongue quite different from

that of the first group. "Tell me, where are the rest of the tribuna? Where are the fat priests and the nobles who dine on the people's flesh? Are they hiding somewhere, covering 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 my words, you butchers! But seek where you will, no place will 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 châteaux, 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 bauble. 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 filed his speech into the cultural patterns the ship's instruments had gathered and the Empath probed his mind for a framework in which to structure communication when the Conceptualizers advised it. But the Conceptualizers concluded: "The creature believes his function is the repeated and forceful 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 irreconcilable 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 disunited 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 laws 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 Acquisitors were gathering information and the Zetetics 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. He'd need Cy to do an entire market study and get the writing finished that soon. Cy, a "cybernetic interface device," had cost far more than a home computer terminal would have, even one 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, coding up information and taking action as quickly as he could think. The work was not interrupted by talk-

ing 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.

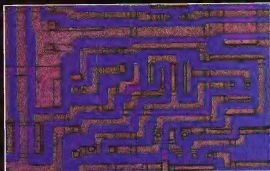
The executive settled back in the interface couch and donned the cap. It took only minor posturing to fit the sensors into place. Then he closed his eyes and pressed the switch built into the headset.

"Good morning, Lee! What do we work on today?" asked Cy's image, projected directly into Lee's brain and programmed to

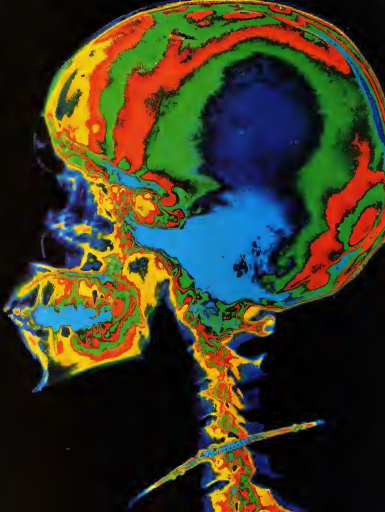
appear as a synthesis of his favorite college professors and respected business leaders.

"The chief wants a preliminary market analysis for miring the Jovian satellites, emphasis on Ganymede," Lee explained. "What have you got?"

"Everything the Space Industrialization Administration has reviewed to date, including some reports that just came in this morning. May I suggest you add the latest data on miring the cloud tops of Jupiter with soap slogs. Here's a run-down...."



It may already be possible to work the speed of crystalline electronics with the conscious versatility of the human mind.



After what seemed like hours, Lee stopped the summary so he could tape his report. As he dictated, the computer made occasionaly asked whether he wanted to rephrase something. Then Cy projected a series of graphs and color photos from the Jovian system onto Lee's video camera. Lee selected several, added captions, and ordered, "Okay, put it on the net to 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 and 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."

CRYSTALS 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 crystalline, 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 carrier: large molecules, called neurotransmitters that flow across the synapse, or gap-between-neuron 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 all information, no matter how complex, is recorded in this two-unit code. Similarly, a neuron either fires an electrical impulse or does not. There are no in-betweeners.

Yet crystalline and colloidal brains pro-

● *The colloidal and crystalline brains both operate electrically, both with a binary code. But nerves work with atoms and molecules. Computers use electrons — a billion times faster!* ●

cess information very differently because of their contrasting structures. Because nerve cells operate by the movement of large, slow atoms and molecules, their reaction times are measured in milliseconds, or thousandths 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 nine 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 appears to bother many human beings, who, 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 feed emotions, it would probably be exceedingly bored.

MESHING THE MINDS

Compensating for this speed difference is one of the most important technical problems in creating an intelligence amplifier. Engineers have spent years speeding up crystalline circuitry. Computers operate so quickly that the need to wait while an electron moves a few thousandths of a centimeter is beginning to delay their operators. 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 slowing 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 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 possible. 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 at once, then recombining them at the receiving end. This technique—electronics engineers call it multiplexing, 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."

The whole area of psychological time, human thought processes, and the multibehavioral 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 periods: swings into Dionysian rhapsody. These substances could have become an important tool for this research. They still may, once the furor dies down. The Oriental shaman may have learned to control psychological time ages ago. If we cannot gather good solid data in the area, let me hope, tips, and mysticism, perhaps we can be led to it by the distressed computer and intelligence amplifier.

All this assumes, of course, that we can actually link the colloidal and crystalline

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PLANET STORY

How an army of lizards missed the train

A new pictorial 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 knaglo planet Sabirus 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 Sabirus to off-load a gold-plated locomotive. The commander's entourage boards the train and roars off down computer-built tracks. It becomes immediately clear to everyone on board that Sabirus 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 at the far side of a simulated London Bridge. The commander asserts that no manner of lizardoid "grease" will disrupt his penchant for rodding and raling.

Illustrations from "The Book Planet Story" by Jim Burns and Harry Harrison. Published in the U.S. by Bantam Publishing, Inc. and in the U.K. by Panther Publishing, Ltd.

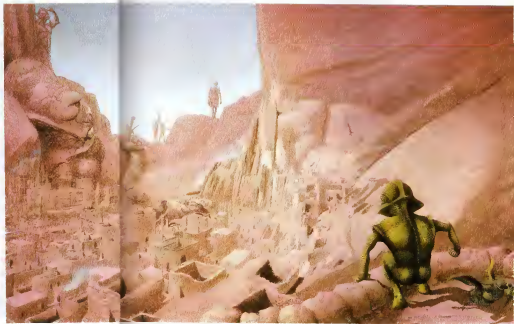


Lasers burned to the accompaniment of shrill alien screams. Depressed by their newest failure, the lizards withdrew.



The commander's exclamations are rudely interrupted by a squadron of lizardoids at riding of rocket-propelled boosters. Their armor is 30 percent of a robot's, so it is as if they're riding a rocket. With the commander's confusion that the aliens are helpless. The alien lizards kicked the next obstacle—a wall built across the tracks. From behind it the lizardoids pelt the locomotive with bullets. Short, powerful bursts of laser are the alien's response. The aliens are gone long before their wall is

• Supertrack out 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 uncaring contraption. The crew 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 latter's mortal enemy, a gaggle of crustaceans. The lizardoids prepare to scout enemy lines in a spy balloon. Several humans go along.

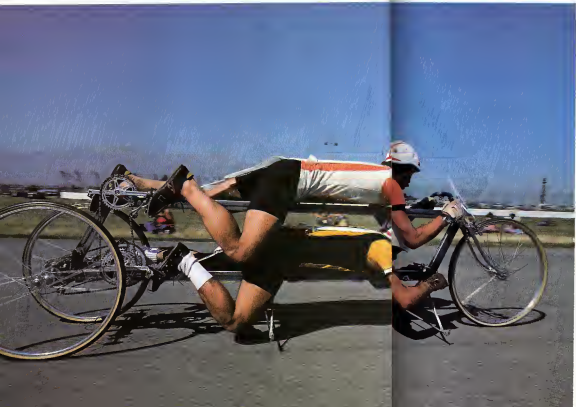


• As soon as those lobsteroids grab us, they'll nationalize your railroad and you'll follow us through the kitchen. ♪

The lobster warts too close to an alien's face. AA butter is and is shot down. In the end, the lobster, our human heroine is captured and carried away to the lobster King. For you want for the civility monarch, she quickly takes him prisoner. He offers to deal. His "people" are in trouble. The lobsteroids want to eat them. Humans, he assures the commander, will be most. Convinced, the commander agrees to drop the lobsteroids into following a train away from the defenseless lobsters. Awes only at the last minute of this trickery, the lizard hinders change after the train—but the locomotive is said. It chugs off into the final episode of Planet Story. brought to you this fall by A&W Publishers (New York)

□





Athlete-inventors prove the human body can break the national 55-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, cat 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 55 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 wheels 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 commutational 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 feet not in dusty 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 1976, 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 \$43 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 meters (17 feet) long, but only 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 a crouching position. They were wholly enclosed in a light streamlined shell made of honeycomb material and fiberglass. In 1974 the machine was clocked at 54.43 mph, with a total power input of less than 1.5 horsepower. This makes it the most efficient vehicle ever invented and the one with the smallest energy consumption in history per mile per pound lost at that speed.

To most North Americans or Europeans the accomplishment might not seem spectacular. 55 mph is not fast—one sees vehicles every day that travel far faster. 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 disapparent speed of 42.2 mph over 200 meters with a flying start. Racing tandems have been timed at over 45 mph, but no one has yet even approached 90 mph on an ordinary bicycle without help. When I say "without help," I mean that bicycles have not exceeded 55 mph on a steep decline or riders' behind motorized vehicles that nearly enclose the cyclists and shield them from all wind resistance. The record for a bicycle following a race car is 140.6 mph, set by Dr. Allan Abbott on the Bonneville salt flats. But this is a different thing entirely. The cyclist has only to pedal against rolling friction, which is a small fraction of the wind resistance. (Dr. Abbott has since become a pioneer of unaided bicycle racing as well—more about him 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 force opposing the motion of a bicycle. One might go slightly faster by improving such things as the tires, the bearings, or the mechanical drive mechanism, but, by improving the aerodynamic shape, the overall drag force of a bicycle can easily be cut in half.

Anyone putting his hand out of an automobile window at high speeds can feel that wind has tremendous force. If you place your hand palm forward, your hand acts like an air and creates a huge drag, whereas, turned parallel to the ground, your hand slices cleanly through the air with a fraction of the resistance. Sky divers use wind drag to maneuver through the sky

if they assume a diver's posture with head and arms downwind; they can drop like a bomb at over 200 mph, or by taking a spread-eagle position and by wearing floppy 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 frontal area facing the wind. Bicycle riders, speed 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 drastically by pedaling a specially designed vehicle while in the prone or supine position. Besides lowering the frontal area, the crouched position is also more streamlined, thus cutting wind resistance even further.

Another obvious way to lower wind friction is to smooth the low surfaces. Cyclists, skiers, and speed skaters wear flight suits 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 stirring up the air in turbulent motion; air should be left as nearly undisturbed as possible. This is the function of streamlining, and also the reason for the strangely shaped fairings in the Speed Championships.

An ordinary bicycle rider has a very poor aerodynamic shape, like the hand facing the wind, and almost any device that helps smooth the airflow around the cyclist will help. Some devices are simple front fairings, and some are based on exotic wing shapes that have been wind-tunnel tested and that completely enclose the rider and machine until nothing is visible, not even the wheels. The simple front fairings may be mounted quickly on an ordinary bicycle, and they are now commercially available. They are very popular with winter cyclists because they decrease the wind-chill factor enormously. They also reduce the overall drag by 12 to 35 percent, depending on the type. The most valuable full fairings cut the overall resistance by almost 70 percent. Thus, 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 for 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 exceeded 40 mph, and old "Pony Grandpa" Delano of California, seventy-two years old, went 34 mph in 1977.

DANGER IN THE HALLS

How did all this begin? In 1974 mechanical engineering students Claude Crawford and Doran Nadeau, collaborating with me, set out to measure the rolling resistance of various types of bicycle tires. We did this by



The long, enclosed vehicle at top (No. 55) was clocked at a top speed of 59.73 miles per hour by two cyclists—the front rider in prone position. The rear rider supports. Attached No. 2 vehicle at left was powered by a single rider at a speed of 48.21 mph. Cyclist supported by a small bell-like shape on stomach and pedals with both his feet and hands. Skating and steering of four-wheeled vehicle is also done with hands. Above: A 1984 model of the Speed Championships used by its side fairing removed

coasting the bicycles through a series of timing switches in a 1/4-mile-long hallway at California State University, Long Beach. This was a rather exciting procedure, flying down the hallway sometimes at more than 25 mph, heading for a glass door at the end. It was even more exciting when a janitor walked out in front of me and I crashed into a water cooler, escaping injury but wrecking the bicycle. Sometimes my wife and I spent half past midnight scrubbing and mopping the floor left by panicked bike riders.

The rate at which a bicycle slows down when coasting is proportional to the drag forces against it. By our tests we were able to show that, as expected, an expensive high-pressure slick tire is not the panacea that a flat would offer less rolling resistance than a standard touring tire. But our tests really showed us that the friction was a minor problem compared to wind drag.

So we started thinking, they streamline airplanes, automobiles, and motorcycles, why don't they streamline a bicycle? We decided to build one. About this time Nadeau and Crawford graduated and began to work on more practical things. So my wife and I built a streamlined steel aluminum tubing covered with heat-shrunk Dacron fabric, and we tested it in the hallway. The results were astounding. The wind resistance was almost too low to measure at the speeds we were traveling at. By sheer coincidence, I then met Jack Lambie, an aerodynamics consultant who was building a streamlined bicycle at the same time as I was. Jack resurrected the sport of hang gliding in the United States. It was he who flew the reproductions of the Wright brothers' aircraft on a 1978 television special. He convinced me that we should try to see how fast our bicycles would go.

Unfortunately we had overdone some things. A healthy side wind would knock our streamliners flat, and they tended to suck up dirt, leaves, and fresh like a vacuum cleaner, making it almost impossible for the rider to breathe. The machines also tended to develop a frightening wobble. By the time we got around to trying them for speed, Lambie's streamliner had crashed several times, and it looked like a crumpled paper bag, this didn't contribute to its aerodynamic efficiency. I had been a little more cautious with mine, and it had not crashed yet. One by one we managed to solve the major problems, and on November 11, 1974, my machine was clocked over a course of one mile at 40.12 mph, ridden by Ron Skarin, a U.S. Olympic cyclist, breaking his existing world record for a standard racing bicycle by almost 10 mph and attracting quite a lot of attention in the press.

Lambie and I then decided to hold a race for all comers, which was optimistically titled the International Human Powered Speed Championships. This title was the creation of Lambie's boss, Dr. Paul McCready, who later won the Kramar Prize for his Russian-powered aircraft, the Goszozor

Concor (See "Man-Powered Flight," by Scot Morris, in the December 1978 *Crave*, page 92.) Dr. MacCreedy was the official limo at our first race and is the current president of our association.

TACHY TAX

On either short notice 14 of the strangest vehicles ever assembled in one place showed up at an automobile drag strip at Inverdale, California, on April 5, 1975. Some of the people were easily as unusual as their vehicles. One of them had a glorious parrot's beard, wore a jump suit, and introduced himself as Victor Vincente of America. (I never did find out exactly where he was from.) His machine was called the Tachy Tax, which is Greek for "speedy" (obviously he was no illiterate). He pedaled on his back using hand and foot cranks attached to an anomalous gear. The rear wheels were steered by leaning, as on a skateboard. Like most of the vehicles, it had been finished about the day before the race, and it still had a few bugs. Vincente couldn't see where he was going and rode off the course at over 40 mph, falling over several times. Somehow Victor was pried out of the crumpled framework, shaken but unharmed. This was the end of the Tachy Tax and Victor Vincente's participation in the Speed Championships.

However, most of the original entrants are still around, along with the 60 or so present competitors. Phil Norton, a psychology teacher from Claremont, California, won the first race in a streamlined tandem at 44.87 mph. His original machine looked like a flying greenhouse. Last year he entered a specially built racing tandem, which became the second vehicle in history to exceed 50 mph.

TRAFFIC TICKETS

Alan Abbott, a young MD from Idaho, California, won the second race at 47.8 mph with a prone streamlined bicycle strung out of science fiction. He pedaled the device lying on his stomach while suspended from the frame like the pod of a jet aircraft, his nose only inches from the flying pavement. His knees were suspended by springs and he straddled the rear wheel to reach the cranks. Abbott once got a traffic ticket from a startled policeman for riding the bare bicycle on a country road. To cite just one of his violations of the California Vehicle Code, Abbott didn't have a rear tail reflector. He no longer competes, but in 1977 he offered a \$3,000 prize to anyone who could break the national speed limit of 55 mph in a human-powered vehicle. At the time it seemed unlikely that the prize would be won in a hurry. However, technology does advance in quantum jumps, and even 60 mph is possible with the present generation of vehicles. Paradoxically the California Highway Patrol has offered to give a commemorative traffic ticket to the winner of the Abbott Prize. The Highway Patrol should also refund the \$10 fine Abbott paid on the reflector violation.

SLOW PROGRESS

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 1968. Racing bicycles have been built and tested on numerous occasions. The bicycle in its modern form has existed basically unchanged for over 100 years. A cyclist from the 1800s 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 Ails Moulton, of England, developed a quite different compact bicycle that could easily be put into the trunk of

● it would take
three horsepower to drive a
standard bicycle
at 55 miles per hour. White
Lightning was
clocked at 54.43 mph, with a
total power input
of less than 1.5 horsepower. ●

a car. It had 16-inch wheels, a shock absorber in the frame, and other innovative changes. After producing several thousands of the bicycles and demonstrating their marketability, he sold his company to Raleigh, the world's biggest bicycle manufacturer with a provision that Moulton could not produce the bicycle independently. Soon afterward Raleigh ceased manufacturing the bicycle in an action that might be interpreted as stifling change.

In the United States one of the more enduring innovations is the kids' motorized bicycle, which can be used to do tricks, such as pulling wheelies and jumping curbs. This has little importance, however, as a transportation vehicle for the general public.

Probably the main reason for this stagnation in human-powered transportation is public disenchantment. Although vehicles that will travel continuously at 25 mph are now possible and even practical, they would have very little appeal to most people at this time. People in the Western nations have a nearly absolute dependence upon the automobile for transportation. Based on current trends, most forecasters will admit that

the automobile is the vehicle of the future, if energy 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 disappeared 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 technology, 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 ½ mechanical horsepower as measured on a bicycle dynamometer (ergometer). The power output will carry pedestrians at a speed of 5 mph, which is a very fast walk or a slow jog. In a riding single scull a rower could travel 8 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 ½ 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 continue to work one way 12 to 15 miles in only one hour a day of travel time, if the roads were fairly 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 for 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.

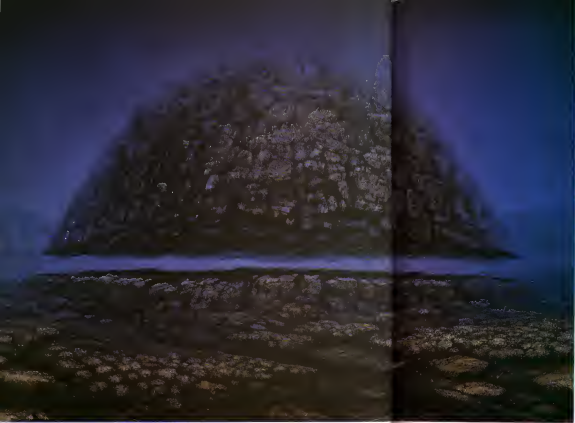
Most likely it would transport only a single passenger with enough room for some packages or a briefcase. Over 70 percent of all urban automobile trips are taken with only one passenger, and a single cyclist would not tolerate the added weight of a two-passenger vehicle. Careful streamlining would be necessary for efficiency and stability in buffeting crosswinds. The enclosure would protect the rider from rain and cold; 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 ridden over in excess of 40 mph without the slightest injury.

Sufficient gear changes would be re-

CONTINUED ON PAGE 126



... and I have a strong suspicion that the murderer is right here in this room!



FICTION

THE ROCKS THAT MOVED

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

BY JOHN KEEFAUVER

When old Kirby Nelson 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 said—blagging 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—and 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, so 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 Klobbie and Fred Kroots 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,

PAINTING BY
DEES SCHWERTBERGER

It's not too late to buy back some of the future!



November 78



December 78



January 79



February 79



March 79



April 79

OMNI, the magazine of tomorrow, means back issues could well be ahead of, instead of behind the times. 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** Back Issues, P.O. Box 1805, FDR Station, New York, NY 10022. **We'll rush you the magazines of tomorrow that were on sale yesterday.**

though, that first time, was that they'd never seen where the rocks had been before, and so there was no way they could really tell if they'd moved. They saw the chalk marks that Kirby had put on them, and they saw how flat everything was all around, like everybody knew would be the case in this part of Texas (there wasn't any hill for the rocks to roll down that is), and they saw of course how big the rocks were, each of them weighing at least a few hundred pounds. But what they couldn't see were any tracks to show the rocks had moved, which, when the wind was blowing, they saw how the wind was almost forever blowing out where they were and would have covered up any tracks. Besides that, it had rained the day before, this being the rainy season.

Kirby finally convinced Burt and Fred, though, to do their own marking with the chalk—writing their initials on the rocks—and walking off the distance to the rock he'd put in the ground. He had them dig their own design around the rock so that he couldn't be accused of moving it on them. Then he said he'd bring them on back to the place the next time the rocks changed positions. They did all this and said they'd come back, maybe to humor him, maybe not. Maybe because they were just curious. Because, funny or not, old Kirby could be very convincing when he was talking about his "communing with Nature," as he calls it. And it turned out, so Burt and Fred said that old Kirby thought the rocks were moving because Nature was fed up with being tampered with by men and their atom bomb and going to the moon and all that, and that she was showing her anger by "loving her rocky muscles," as he put it, secretly annoyed at his own wit.

Of course, in a way whether the rocks were moving or not was secondary to the fact that the rocks were there in the first place, which was actually the biggest part of Burt's and Fred's being curious—at first, anyway. Ordinarily in this part of the country you'd not see rocks the size of Kirby's. You might see one once in a while, but not a dozen or so grouped together. All you'd see were mesquite and cactus and maybe some scrubby oaks, and some little patches of sorcery grass in January and February when it rained, and with the wind blowing the way it does in these parts, nothing stayed still unless it was tied down, not that the wind could move rocks big as Kirby's of course.

Anyway Burt and Fred promised to go back to the place—it was about thirty or so miles out of town, in the middle of nowhere—the next time Kirby told them the rocks had moved. Kirby lived someplace out there, he wouldn't say exactly where his shack was. He didn't want any visitors entering with his communing with Lady Nature.

Well, in a couple days or so—sure enough old Kirby came into town and told the two of them that the rocks had moved again, and out these Burt and Fred went, along with

some others, and, so Burt was to say, the rocks he'd marked had sure enough moved—and of them, in fact, about two hundred feet and it must have weighed close to five hundred pounds. And this time he and Fred could see the tracks the boulders had made because there had been a rim so heavy, below the rocks had moved, that the wind hadn't had time to dry the land enough to blow away the tracks—any tracks. The tracks of Kirby's rock-pushing pickup, say. Or tracks of a bunch of practical jokers doing the pushing. Because, you see, Burt wasn't a rock small enough that Kirby could have pushed by himself, by hand, in fact, as old and scrawny as Kirby was, he could hardly push a marble, not that he wasn't tough. He was about ninety pounds of meanness, getting meaner the older he got. . . . In other words, the only pieces that were those left by rolling rock. There were about a dozen of them, all weighing into the hundreds of pounds and they had all moved.

Well, now when Burt and Fred got back to town and told it around that rocks were moving on their own out there, it got a different reaction from old Kirby's telling it, you can bet. Besides looking respectable, both of them were, and they weren't a couple of kids either. People believed them and most everybody wanted to see for themselves, but by then it was too late in the day for rock watching.

That evening Kirby came on into town, proud as a scrubby peacock, but when he heard how most everybody was planning to go out and see his moving rocks in the morning, he got mad. "Leave them rocks alone!" he said, and kept saying, "Somebody's gonna get hurt out there if you don't!"

Some, making light of it, asked him if he thought the rocks would jump on them. He got madder at that. "If you don't want nobody there, why do you tell us about it?" Sue Webacher asked him. (She's been the postmistress ever since her husband died three years ago of gout.)

"Because I didn't know then what I know now!" Kirby said, getting even madder. "What's that?"

But Kirby wasn't saying. He jumped into his battered pickup and bounced out of town in the direction of the rocks.

It wasn't long before Ed Farrow who runs a weekly paper over in Ginyo came nosing around, asking Burt and Fred a lot of questions and trying to find Kirby in town. Kirby wasn't to be found though. So Ed and Burt and Fred and a bunch of others, including me, went on out to the moving-rocks place. Ed took some pictures, but it was plain that he, not knowing Fred and Burt the way we did and being of a suspicious nature anyway, didn't believe that the rocks had moved by themselves. He wanted to talk to Kirby, but Kirby wasn't to be seen there either, and of course like I say nobody knew where his shack was.

So the next issue of Ed's paper had a

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 long-in-chalk 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 so 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 sneaky ways.

Well, this 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. "Wings 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 sander 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 cussing and screaming soon as he saw the blue

NASA sign on the side of the geologist's brand new white truck.

"Get the goddamni 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 these 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 had 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 I and some others made trips out to the area in the coming days, regardless of Kirby, so 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 most 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



What's gonna happen to us inchworms when the metric system comes in?

was doing it.

We began to wonder, though, as time passed. First of all, we went out three times and saw that the rocks had moved a lot more than they ever had before. Although there was a wind, it wasn't particularly strong. 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 it 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—were 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 believe it.

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—we were getting into March now. The rocks—there were now thirty-seven—had all moved at least three quarters of a mile, 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-softened 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 about 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 rest, 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 stiff 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 Progress 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. Now 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 now 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 minutes, all heading in the same direction, as the crow flies, straight toward Progress!

Burt, 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 Progress, 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 over 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 bearing down on us, 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 faster than a couple of cockroaches.

Then, as if on command, the direction of the boulders changed, both those in front of us and those behind. They began to split—some to the right, some to the left. And I realized what was happening. They were going around Progress, 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 Progress, 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

Genald 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 Stuckey recently spoke with Wasserburg.

QWell, 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 that?

Wasserburg: Well, Congress has finally allowed funding for a new storage building. It's almost finished now. And the remote storage facility will soon be in reasonable shape. The only trouble is that [Senator William] Proxmire has had his will by cutting out any money for scientific work on the rocks.

QWell, 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 reasonable shape.

QWell, you once told me that one moon-rock study group had found evidence there had been water on the moon, when what they really found was that, because of improper storage, there was water [on the rocks] in Houston. Are all the rocks water-contaminated?

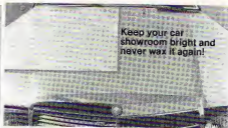
Wasserburg: That's still a very serious problem and difficult to beat. Fifty thirty to fifty percent of the rocks cannot be used for certain experiments.

QWell, what are the real lessons we have learned from the moon rocks?

Wasserburg: Well, here, 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 beyond 3.6 million years ago, since violent planetary processes have altered those rocks.

With moon rocks going back to 3.9 billion years, we can extrapolate some of the earth's geologic period during its three-hundred-million year "blank." The moon has provided the time base line, not arrogantly we hope, for all of the terrestrial planets [Venus, Mercury, and Mars]. That's given us a totally different perspective in interpreting the history of all those planets.

There are new studies of volcanic activity on all of the terrestrial planets. There's no longer discussion 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." **OO**



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FIVESIGHT

CONTINUED FROM PAGE 22

dropped the glass, and fung 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 snike, 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 knucky hand resting light as lint on my shoulder. His expression was mournful. "Prying, Jake? You?"

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

"What you taken 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?"

"The little guy with a face like a foot who has by now tipped up behind me will brush his blackcap across my occiput and I'll wake up tomorrow with the same kind of head you're gonna have. Right, Eddie?"

"That's right, Jake, the piano man's voice came from just behind me."

She shook her head dizzily 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 that long. "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 presence 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 look gentle, just-worthwhile, understanding, weak and strong. I wanted to be more than I was for her. "He's not prying, Eddie," she said at last. "Sure, I'll tell you people. You're not going to believe it anyway. Inkkeeper, 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 "twesht!" she said, and whipped her glass so hard she nearly fell. It smashed in the geometric center of the fireplace, and 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 Stewart 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, and I'll take that any day. Go chase a pretty one up see what it gets you. The coffee seemed to help steadily, her

"It starts out prozoid," she began. "Three years ago my first husband, Freddie, took off with a scotchless named, God help us, Kitten, leaving me with empty savings and checking, a mortgage I couldn't out, and a seven-year old son. Freddie was the life of the party. Lily of the valley. So I got myself a job on a specialist newspaper. Little businessmen's daily, vintage subscriber's median income fifty kays. 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 *Laissez Supplément* 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 reconvered warehouse, one immense office, and the additional department is six desks pushed together in the back, near the post-up table and the library and the wire. Every body else is gone to lunch, and I'm just going leave myself when this guy from accounting comes over. I couldn't remember his name. He was one of those gim, 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 the look and says, "Oh no, not now. I look at him like huh? 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 I get to thinking about how strange his face looked when he gave me those envelopes. So I take out mine and open it. Inside it are two very big dollars—you know, powerful tranquilizers. I sit up straight, I open Tom's envelope, and if I hadn't worked in a drugstore once, I never would have recognized it. Demical Synthetic morphine, 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 the pusher and somehow he's got the idea I'm a potential customer. I was kind of fidgety and tense in those days. So I get mad as hell, and I'm just thinking about taking Tom into the classroom and chasing him out good, and I look up, and the guy from accounting is staring at me from all the way across the room. No expression at all, he just looks. If gives me the heebie-jeebies."

"Now overhead is this gigantic air-



"I don't mind your bringing your work home with you, but just what is it if you do?"

conditioning unit, from the old warehouse days, that's supposed to cool the whole building and never does. What if it does it drip water on editors 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 Mebel and Art and Dolores and Phil and takes two lots off of Tom's right foot and raises me completely. A flying piece of wet snip off one of my pyloric.

"So all these with my mouth open and in the silence I hear the publisher say, 'God damn it,' from the middle of the room, and I climb over the wreckage and get the Democrat into Tom, and then I make a lounquet on her arch out of rubber bands and blue pencils, and then everybody's taking me away and saying stupid things. I look these two tranquillizers and went home."

"She took a sip of her coffee and sat up a little straighter. Her eyes were the color of sun-cured Hawaiian buds. 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 foresight," he told me. "Something just a little bit better than foresight. It was the only joke I ever heard him make, then or since."

I made the gasping sound again. "Pre-cognition," Doc Webster breathed. "Akw-wardly, from my belt'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 Bushmill's on his 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 of his 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 deflected his immense bulk in his chair. "Damn it, what is the verb for precognition? Precognition?"

"Ain't they the guys that sang that 'Jeremiah was a bullfrog' song?" Long-Denk 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 strictly 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 he told me was why hadn't he warned Phil and

Mebel 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 it 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... not permitted."

"Permitted by who?" I asked.

"By whoever or whatever sends me these damned promulgations. 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 I 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 steering 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. Take a chance that I'd think you were—hey, how did you get hold of narcotics on these hours' notice?"

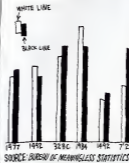
"I had three hours' waiting for the last big blackout," he told me. "I took two sub-cases of stuff out of Smithtown General while they were trying to get their emergency generator going. I... have uses for the stuff."

She looked down into her empty cup then handed it to Eddie, who had it refilled. While he was gone, she stared at her lap, bringing with her whole torso, lungs, and clog 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-depressive like Fiddle, a quiet, phlegmatic kind of guy might suit me better. His favorite expression was, 'What's done is done.' I started dating him. One day Bobby fell... fell out of a tree and broke his leg, and Uncle Cass just happened to be walking by with a hypodermic and his eyes fastened on me. 'Waybe I wanted my kid to be safe.' She looked away again. "Make a long story short, I married him."

I spilled a little Bushmill's down my

GRAPHIC CHART, CHART.



Spill

beard. No one seemed to notice.
"It's funny," she said loudly and getting out that second word cost her a bit. "It's really damned funny. At first, at first, then, he was really good for my nerves. He never got angry. Nothing ruffled him. He never got emotional the way men do. Never got the blues. It's not that he doesn't feel things. I thought so at first, but I was wrong. It's just that living with a thing like that, either he could be intable enough to see people's heads off all the time, or he could learn how to hold it all in. That's what he did, probably back when he was a little kid. What's done is done. He'd say and keep on going. He does need to be held and cared for, how his shoulders rubbed out after a bad one, how one person he can't do about it. I know I've been good for him, and I guess at least it made me feel kind of special. As if it took some kind of genius person to share pain." She closed her eyes and grimaced. "Oh, and Bobby came to love her so!"

There was a silence.
"Then the weirdness of it started to get to me. He'd put a Band-Aid in his pocket, and a couple of hours later said out his finger chopping kit. I'd get diarrhea and run to the john, and there'd be my favorite magazine on the floor. I'd come downstairs at bedtime for vitamins and find every pot in the house full of water, and go back up to bed wondering what the hell, and wake up a little while later to find that a sockie short had set the living room on fire before it tripped the breaker and he had it under control. I'd catch him concealing some little preparation from me, and know that it was for me or Bobby, and I'd carry on and beg him to tell me—and the best of those times was when all I could make him tell me was, "What's done is done."

"I started losing sleep and losing weight. And then one day the principal called just before dinner to tell me that a school bus had been hit by a tractor-trailer and fourteen students were critically injured and Bobby and another boy were... I threw the telephone across the room at him. I jumped on him like a wild animal and punched him with my fists. I screamed and screamed, "YOU DIDN'T EVEN TRY!" she screamed again now and it rang and rang in the stillness of Callahan's Place. I wanted to leap up and take her in my arms, let her sob it out against my chest, but something held me back.

She pulled herself together and gulped cold coffee. "You could hear the air conditioner sigh and the clock wiper. You could not hear cloth rustle or a chair creak. When she spoke again, her voice was under rigid control. It made my heart sick to hear it.

"I left him for a week. He must have been hurting more than I was. So I left him and stayed in a crummy motel, curled up around my own pain. He made all the arrangements, and made them hold off burying Bobby until I came back and when I did, all he said was, what I expected him to say and we went on living.

"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 how ever found out. He must have. He never said anything. I... 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. The afternoon... She opened her eyes. "I made a date with a stockboy at the Putnam 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 packed before Willy showed up. Out of the corner of my eye I saw Cass liplock back into the living room. He was carrying a big

● *And what it does . . . is . . . 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 misses me completely.* ●

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 dried my hands. I went into the living room. On the mantle 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 lanky little legs and slipped down a dollar and said, "Screwdriver, Mike."

Callahan shook 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 mumble word. Eddie brought her the drink. She drained half at once.

Sherry Stanton spoke up, and her voice sounded rusty. "I service air-conditioning systems. The big ones. I was over at Century Lakes today. Their unit has an interest-

less that I can't seem to trace. It keeps cutting in and out."

She shut her eyes and did something similar to smiling and nodded her head. "That's it, all right. It'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 after all. And he tells me that if you try to prevent a death, something worse happens, and I'm going out of my mind wondering what 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 hers, and I couldn't help it. There was just that tiny hope, and so I glanced for the briefest instant at the Countertop 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.

"Me—"

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

Callahan went pale behind the bar, and his nose 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. "Oh, no, I never thought! Oh Christ, Willy, that dumb cocky kid. He'll show up at ten and find the door wide open and figure I went to the corner for beer and decided it's cute to wait for me in bed, and—" She whirled and found the clock and puzzled out the time somehow and wailed, "No!" And I tore in half night down the middle. She sprang from her chair and lurched toward the bar. I could not get to my feet to follow her. Callahan was already holding out the telephone, and when she couldn't dial it, he got the number out of her and dialed it for her. His face was carved from marble. I was just getting up on my feet legs by then. No one else moved. My last made no sound at all on the sidewalk. I could clearly hear the phone ringing on the other end. Once. Twice. Three times. "Come on, Cass, 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 chattered at her an agitated chipmunk. Her eyes went round.

"Wally?" she asked a week. Then even more weakly she said to it "That's his will in that manila envelope," and she fainted.

"Mike!" I cried and leaped forward. The big bikercup underpoked 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 chpmanik. "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 I almost bolted him before I realized it was Doc Webster with smelling salts.

"—No screw fingerprints, this isn't TV. Just make up the goddamn bed and put your cigarette butts in your pocket and don't touch anything else—

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

She stared up at us vacantly, and so I was helping her get 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.

Kathy 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 alcoholics and the one might hit you—and it's not fair it's not right, it's not just. You're gonna sweat 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, it's okay to be glad you're still alive!

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

"I've been here," 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 honkydunk 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 away a whole block. Five years ago tonight at 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 climbed out the window past him and tried to get my wrists on his chainsaw. He cobacked me, and I woke up under restraint. I looked eyes with her. I was glad to be alive, too. That's why I

wanted to do so bad.

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

"I got talking with a doctor the size of a hippo named Sam Webster, and he got me turned loose and brought me around here."

She wanted for me to finish. "You—what's it? What is that?"

"Die 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 sat here in my pain, my hands 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 load to my family without embarrassing myself. You know what gives me the courage to keep on long? The courage to love myself a little? It's having a whole bunch of friends who

There was just that tiny hope. And in that moment of moments, scared silly and three-quarters bagged, she was seeing me clearly enough to know something was wrong.

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 honest-to-God 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 nigger—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, *bright*, not in conversation, but 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, but she made no sound. "Will help you, Kathy," Callahan said.

"Damn straight, Eddie croaked.

"Will help you find your own miracle." Long-Denk assured her. "They come by here regular."

There were murmurs of agreement, on

encouraging words. She stared around the place as though we had all turned into loads. "And what do you want from me?" she snapped.

"That you hold up your end," I said. "That you not leave us holding the bag. Suicide isn't 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 the way!"

My voice softened, saddened. "Upright cops 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 every face, 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 wore 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 arrive over there. Make sure that foolcild didn't screw up. Pyor, you. Urvak Samantini, go on out and wake up your wheels. Hank, drink you get her out to the parking lot. I can't hold her up much longer. Maybe, you're the girl friend she went 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 flesh.

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

We smiled at each other. "It was a plausible miracle that didn't take a whole lot of buildup and explanation. What if I told 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 lushed up and fanned.

"To my family," I said formally, then drained the fish and gently undranked my glass onto the hearth.

And then I turned around and faced them all and added, "Each and every one of you." ☐

INTERVIEW

CONTINUED FROM PAGE 18

thousands of tons of satellites in high orbit. We'll need at least that to do a thorough job of solving problems right here, to do remote sensing and monitoring of the Landsat type, to improve communications, air-traffic control—all the gathering and transmission of information that is clearly going to become an even more important part of our lives than it is already.

Qwer: What about solar-power 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.

Qwer: 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-materials 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.

Qwer: 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 occupa-

tion of space, and they want to grow some food there. It's as simple as that.

The second part of the part involving landscapes rather than utilitarian agriculture, brings up much larger issues. Some people feel on philosophical grounds that it would be good to create a closed environment that would maintain itself and be ecologically stable in all respects. They say—quite rightly—that we're nowhere near achieving that on Earth, so how can we hope to do it in space? Well, that's not what we hope to achieve. Remember, these are botanical gardens all over the world, where many different plant species thrive in a controlled environment—sometimes with desert and sun-forest plants just a few yards apart. You don't just turn it loose, you garden it.... but it's not going to go by itself, it's not going to be a closed, inherently stable ecosystem any more than a botanical garden is. Artistic conceptions of space-habitat landscapes do not represent a natural climax forest, and they were never intended to.

Qwer: So the agriculture would be in greenhouse pods, while the landscape would be aesthetic, rather than practical, in intent?

O'Neill: Yes, in the same sense that our lawns and lower gardens are aesthetic in intent and for that reason are different from a farmer's field.

Qwer: Now I'll be unfair and turn the question around one hundred eighty degrees.

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 spaces? 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 felt I had to do an "essence 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 build.

I think it's fair to say that until I began looking into this question, everyone—even Tokolovsky—had assumed that life in space meant a very unearthlike situation. Tokolovsky 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's 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-



"Do you have the love?"

like environments in space—you get a radical change in viewpoint. Settling Mars or Venus even if we could, would add relatively little to our usable land area and would leave us with all our planet-bound energy problems. Settling 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, you no longer seek 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'd envisioned a rather shiplike space habitat that was more than anything an analogue of the structure of a living cell. That's where 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 imbedded 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 idea of magnetic acceleration goes all the way back to Erwin Bachelet around 1910. He hoped to come up with a package-transfer system for use in mines 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 real 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 electro-magnetic 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 Kaim 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 time the drive coils, 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 following the 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 the every essential part in the whole system is within 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 even once, that's enough to shake 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 every essential element.

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

O'Neill: The first quantum jump is demanding, yes. But when you go 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 when the habitat it's all line-of-sight you don't need high-strength materials. Take a homey 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 precursor 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-



sure vessel, you shouldn't lose any of it, and you'd have plenty of energy to clean it. We have serious problems recycling on Earth because we keep losing bits of what we're recycling, and it gets dispersed in very low concentrations 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 byiterate people.

Orni: 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 tailor 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 bow ourselves up first, the imperative pointing that way is so basic and so consistent with previous human history.

Orni: 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 experimenting in all sorts of offbeat 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 forty percent of the unselected Apollo samples, and which constitutes eighty-five percent of the total mass of rocket propellant. An automated fifteen-ton unit would yield something like four hundred tons of liquid oxygen per year,

which is enough for an awful lot of rocket flights (using materials up into orbit).

Orni: The Apollo lunar module wouldn't make 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 interorbit freight-transfer vehicle, an interorbit 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.

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

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

Orni: No.

O'Neill: Most passengers don't think about it, but when you wonder about the shuttle's prospects.

Orni: 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 fighters, but completely unlike that in most other planes. And I was surprised to find out on my first "landing" in the simulator that you can balloon it.

Orni: Balloon?

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

Orni: I hear the sound of heat shield has breaking. Back to your own drawing board. The fourth Princeton/AIAA (American Institute of Aeronautics and Astronautics) conference is coming up soon, and I understand the latest model mass driver will be demonstrated. Is that coming 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.

Orni: That sounds like the right notes and on. Thank you, Dr. O'Neill.

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THE SAVAGES

Continued from page 12

tyloid. Their technology advanced to the level of powered transportation and atmospheric flight.

On the advice of the Zwaacs, specimens from this period were gathered not from a single locus but from a variety of sites on the planet. And as a cautionary measure, the Argreane ship was moved to a higher, safer orbit.

The first specimen was a woman, dressed in layers of worn and dirty clothing. She fell to the base of the local area, but quickly clambered erect and looked about wildly until her eyes fell upon the Empath.

"Who the hell are you? Where is this place? What happened to the tank?" she demanded. Her language was utterly unlike all the others.

The Empath probed for a proper response. "You will be returned soon enough, comrade. All we seek of you is a few minutes of intelligent talk."

"She said: Talk, hell! Get me back so I can stop that tank."

"You will stop the tank. I promise you. But you will die."

"Do you think I don't know that?" She took a step toward the Empath, shielded her eyes from the surrounding light, and studied the white-robed figure closely.

"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 handful of those bastards to hell. To let my friends escape so they can kill more of them. Smashed? Now got 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 fight," the woman said, leaping into her ragged coat and lurching 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 Argreane 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 hate 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 the race matured. He gazed at the Empath with a look of fearful reverence, then bowed deeply.

"What is this 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 symbol relates to a period on which our data are incomplete, but there are indications that the wearing of the cloth problems one's willingness to die in battle."

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

"It is a conflict of machines guided by members of this race. The specimen seeks to inflict damage on a large water transport vehicle by hitting it with the atmospheric flight machine at 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. "The race seems to have as many diverse myths as it has individuals."

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

"But that is rational, 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 form polany. Within the groupings, and within the units, are strong indicators of latent frag-



Some people will do anything for a seat on the cross-town bus.

mentation leading to repetitions of this conflict among reorganized groupings. The race appears to be self-destructive," concluded the Conceptualizers.

The Empath paused and reflected. Yet they go on.

Further specimens from this taking revealed little. They were fatigued, or their minds were warped with hatred or befuddled with horror, and the Empath was pained by contact with them.

The last specimen from this period was drawn from a crowded place behind the battle lines. He was naked, and the bones showed through his dry, taut skin. His head was shaven, his dark eyes sunk deep into a skull-like face. He stood motionless in the focal area, blinking those hollowed eyes, and when the Empath touched him, there was nothing within except numb, hopeless resignation.

Then the eyes focused. The blinking stopped. The specimen looked directly at the Empath, robed in white, seated above him, and the Empath gasped and turned aside, shaken. The specimen vanished immediately.

"He believed I was his duty," the Empath murmured. "And he hated me."

No more specimens were taken from that period. The Empath, exhausted by the contacts of this taking, the largest of all, went at once to sink deeply into pasteurize. The Assessors labored mightily to evaluate the findings and saw in their work a tangle of paradoxes. These creatures were isolates yet they could form collectivities and feel loyal to them to the point of death even though the collectivity was temporary and arbitrary. That was madness. They believed in things imperceptible to the senses and extrarational, and believed with an intensity that endured great suffering and accepted a horrible death. Yet they could suffer such pains and repudiate the very myth that justified them. That was madness. They fought one another with every weapon of mind and body and all that their developing sciences could provide, and they used those same powers of mind and body and science to preserve and enhance life. Madness. They were irrational. Atmosphere, genetic history, some malign radiation—something had made the race of beings absolutely mad, the Assessors concluded.

This conclusion was not altogether discouraging. It was clear by now that the race of Earth was sure to destroy itself in a very short time. There would thus be no need for an Anprene contact and no risk of having to bring Anprene military power to bear against these little creatures. For all their ferocity they could not withstand the unified might of the Anprene Dominion. They would resist, and it would be necessary to destroy them. And the destruction of even such a race as this would leave a scar upon the Anprene memory far better to let them bring about their own inevitable downfall.

During these deliberations, the population of the world below them had doubled and redoubled. The satellites and nearby planets had been visited.

The Anprene 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 craft constructed in orbit above the planet. It was one of three such craft, and all indicators 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 Anprene.

He glanced about the local 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 Anprene, 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 here? Or perhaps you've been living among us?"

A portion of the Anprene are Empaths with a power akin to what you would call telepathy. It cannot be explained further in terms you would comprehend. We have been studying you since—since your year 1580.

The man from the Earth ship made a low whistling sound 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, "If it took you five hundred years to see that, you certainly weren't a race that jumps to conclusions. We've all known about 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

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DREAM SNAKE

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VONDA N. McINTYRE

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."

"Those 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, looked carefully at the Empath, then went on: "Still, you've been here for five 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 language. These are encouraging signs. Apparently you're a much longer-lived race than we are, probably with a totally different time orientation and value system. A very rational

people, too. Thoroughgoing, cautious in judgment, fascinated. I don't know why you're here, but I see no evidence of outward hostility. What is the nature of your mission?"

"'All' 'ave 'em' all," instructed the Conceptualizers.

"Our mission is like yours," said the Empath. "We seek new worlds for the Anpreene Dominion. Yours is the most suitable we have discovered."

"Do you intend to try to take it?"

"Our Assessors judge that aggressive action will not be necessary. 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 is safe to say this: 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 confirmed with the Conceptualizers and then said yes.

"Is this your doing?" the man asked cautiously.

"No. It is a predicted malfunction."

The man was silent for a moment. Then he looked up, past the Empath, and asked, "Will the others make it?"

All indications are that they will survive.

"Then I suppose it's worthwhile."

"Again your attitude is confusing," the Empath admitted. "Your race seems fond of life, and yet it accepts death willingly. You are dying not in some struggle based on a belief, as your race often does, but in a mere mechanical malfunction. Yet you seem undisturbed."

"My race doesn't like dying quite as much as you think. But we can accept death if it has a purpose."

"What is the purpose of your death?" the Empath asked.

"We helped to bring my 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 Assessors declared the proximate phase of the mission complete and ordered preparations for the long homeward voyage. The Empath and the Conceptualizers, their headed work done, started wearily for their respective living compartments.

The Empath felt drained of vitality. It had been trained from youth to assimilate the life patterns of alien races and had done so on several earlier expeditions, but never with a race so frenzied and spermatic in its ways. Attending to the human race had been an exhausting duty. Even pentecaine had been scarcely enough to sustain wholeness.

"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 and potential enemies. Also, that they are mad."

The Empath still steeped in human attitudes and reactions, made no immediate response. After a time, in inner communication, which in madness was left unguarded, open 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 pentecaine 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 Dominion, the armada from Earth was waiting peacefully to greet it. **DO**

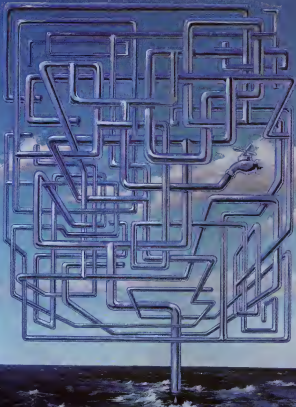


"You can't find Homo erectus with an old dodge like that!"

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I give Timberline...the
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TIMBERLINE
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SUPERCYCLES

CONTINUED FROM PAGE 102

quired for uneven ground, probably two 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 bicycle at over 15 mph; the arms can obviously provide considerable sustained power (approximately 15 to 20 percent as much as the legs).

An existing tricycle meeting most of the above criteria is the Muscar built by Professor Paul Schonhoff, 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 compete 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 fuel consumption in the least. At the present average rate of food consumption, people could exercise vigorously for several hours a day with little weight loss. Every trip not taken in an automobile would mean a conservation of fuel, with the added benefit of no pollution.

Admittedly, these roads are hilly, pedaling a bicycle is slow and laborious. It may then be necessary to add an optional small electric motor-battery package as an aid on hills and in acceleration. By 1985, a tenfold improvement in energy density should be realized in rechargeable batteries, 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 future vehicle come into common use within the next few decades? Probably not in a free economy. More likely we'll see smaller and smarter automobiles with tiny 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 somehow have to be redirected (this might not be all bad). A resister will probably not lose much sleep over this possibility.

And it isn't likely to bother the inexpressible inventors who participate in the Human Powered Speed Championships. They are sure many of their innovations will eventually appear on the world's highways. ☐

BIONIC BRAIN

BY MICHAEL LEVY

brains, and there is a good chance that we can. Since both systems encode information as electrical charges, they produce electromagnetic fields that we can detect, manipulate, and perhaps translate from the brain's "language" to that of the computer and back. Scientists have already made a strong start.

READING THE BRAIN

Last year the Defense Advanced Research Projects Agency (DARPA) reported to Congress "significant progress" in an area called bio cybernetics. 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 isolate 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 recorder.

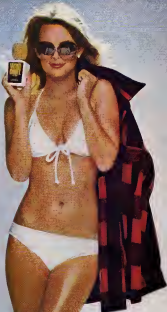
Despite these refinements, it seems unlikely that the EEG will ever be able to operate a human/computer intelligence amplifier. The voltage differences measured by the EEG's widely separated electrodes cannot be traced to specific brain locations—a must for any useful link.

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 went looking for magnetic fields created by biological processes. In 1963 Gerhard Baule and Richard Mofsee 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; even then, sensing coils with 2 million turns of hair-thin 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 skirted around 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



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So he, Kaufman has mapped the response of the visual cortex to simple stimuli and has located the brain's neurons 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 Belton, Texas, had dismantled onto a circuit board 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 amplified and modulated by a hi-fi amplifier. The amplifier fed the combined signal 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-relaxer 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 side 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 Batschelet, 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. Batschelet 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 decided the project did not fit in with its product mix. Shortly thereafter Dr. Batschelet died of a massive myocardial infarction while scuba diving with dolphins in Hawaii, and Flanagan be-

came involved with Oriental mysticism and developed into a leading exponent of "dynamic 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 ever remotely assemble 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-circuited 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 work load. 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 as an intelligence amplifier take over and rule the colonial, 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 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. *Nescis, ne sit, quantitas sapientia, regitur mundus.* Rather loosely translated, this tells me, "You'll never know my 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. **DD**



INTERFERON

CONTINUED FROM PAGE 16

bris. The viral invasion is aborted. Darwin (if's entertainment is finished, but the interferon story does not end here.

In the mid-1970s the Finnish virologist Kai Cantel 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 possessed 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 in 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 permutational role, but, except for warts of the impure substance that are available in drugstores in the Soviet Union (obviously 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—achiness, fever, and runny nose—caused by rhinovirus 4, one of the myriad viruses that cause the common cold. Other medical investigators had similar 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 vaccine, 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 engenders with 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 functions. 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 Strander, a Swedish oncologist at the Karolinska Hospital in Stockholm. He used it in test 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. Strander published his findings, beginning in 1974, but they received scanty consideration from cancer specialists in the United States because Strander's methods seemed suspect. A few researchers, in effect, promoted Strander's findings and they extended their own investigations into interferon's anticancer properties, using Cantel'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 milligram of an ounce costs \$1,500, which translates to some \$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 auspices 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 simmers down, the 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 antiviral activity through its action on cell membranes and DNA replication, and antiviral activity through the mechanisms that the fictional Dr. Darwin described in his holographic 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 uninfected cells, also contain as yet unknown substances, which begin to inactivate the interferon. A balance between inactivation and virus-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 used 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.

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 Genent'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 antidote proves to be ancient, well, so be it. **DO**



"There it is, son, for better or worse—the universe."

COMMUNICATIONS

CONTINUED FROM PAGE 10

be ignored, though I concur with your later statement to the effect that such speculations should be documented, at least intuitively. That's good enough for us in physics these days.

Franz Kromet, Ph.D.
Philadelphia, Pa

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 36 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 *Omn* in England. But, while I was working here in the United States on a science series with engineer "Scotty" 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 photography 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 in *England's Nature*.

Why don't we know more about this magazine in England? Please continue! *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 *Omn*. I am convinced that Stine researched the prospect of space industrialization well and analyzed the data fairly—from an economic standpoint.

Although the final decision regarding the implementation of space industries will certainly depend on financial matters, I believe 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—energy that aids in the industrialization of underdeveloped nations. The result would be greater education and, hence, lowered population growth by means of birth-control devices. This theory may at first seem impractical. However, as a rule, industrialization 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 validity if derived, as indicated, from his observation of the membership of Marais and the Four Sigma Society. The self-selected sample is neither random nor representative and cannot be accurately used for generalization about the population of all women. Langdon fails to consider such interfering variables as the proven social conditioning of women to feelings of inferiority, fear of success, and noncompetition with intellectual competition. His demonstrated egocentricity and patriarchal 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 women 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 Coxson
London, Ont., Canada

In an article entitled "The World's Hardest IQ Test," Kevin Langdon says that among men 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 the 56 questions), it is not surprising that those who pass the test are mostly males. (But I think he errs in equating this specific ability with generalized "intelligence," or, as Langdon puts it, finding women he doesn't "have to talk down to.")

The question remains open as to whether the poor performance of women in geometry is due to innate or acquired factors.

George Fergus
Schamburg, IL

In the introduction to the Langdon Adult Intelligence Test (LAIT), I am inaccurately quoted as saying that one of the reasons why I constructed the test and founded the Four Sigma Society was to "meet women [I] 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 nonverbal IQ tests and such IQ-like tests of ability as the quantitative section of the

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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 the 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 (though recent research indicates that there are slight differences between male and female brains) and of moral questions concerning the relationship between man and woman.

Finally, regardless of differences in aptitude 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.

Karen Langdon
Berkeley, Calif.

Scott Morris replies: Langdon sent me a news clipping saying that he devised the test in part to meet women who were as intelligent as he is and that he has been able to find people I don't have to stoop down to. I changed step 6 to talk and look out the quotas.

As for sex differences and IQ, in *Intelligence and Personality* Alice Han (in a chapter she wryly 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 likely 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 suicides. . . . 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 Knew

You were quite right. The meeting at the United Nations was highly unnoted. I had seen 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 "Unaccompanyed Sonata" (March 1979) and I 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 short story that excites such emotion and love. Card has brought home to me a wife "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 evocation that Card has reached with this piece, and I often have doubts as to whether or not I could reach it. But "Unaccompanyed Sonata" has needed 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 Galante" (April 1979). There were surely no flaws designed into this tale and I commend Orson 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 punneer, I was intrigued with Malcolm Kirk's interview of SF novelist Arthur C. Clarke in the March Orson, 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 Duward
Chicago, Ill.

Malcolm Kirk replies: Sometimes it's better not to write, but just sort of drop in uninvited. Granted, this is difficult when your subject lives in Sri Lanka. Fortunately, I was on a round-the-world, eight-monthing courtesy of Pan American World Airways. I had been photographing psychic surgery in the Philippines and interviewing UFO contactee Rev. William Gill in Melbourne, Australia, and 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 letter 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 science and not the fiction. The class will be given every weekday June 25 to August 3, from 9:30 to 11 AM. 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 Spirit, I wish to take this opportunity to thank you for producing such a high-quality publication and personally tell you that it won the 1979 Galaxy Award for best science-fiction magazine by a 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. Make that a quantum leap forward. It would border on absurdity to wish you good luck, for the high standard of excellence contained in the pages of Orson ensure that. Congratulations, Bob! And don't be surprised if you hear these exact words next year.

Dr. Emil Barbadoza
Chairman, SASAS
San Diego, Calif. **OO**



FORUM

CONTINUED FROM PAGE 14

True Believer

I read the article "New Sounds in Psychic Research" (Continuum, April 1979) with some interest. I believe that funding for psychic research should be renounced 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 have also observed that all psychic phenomena are like a car with a faulty starter. Sometimes it works and sometimes it doesn't. It is unreliable. Given this mysterious fact, it 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 makes 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 warring world.

Wickie Lloyd
Shrewport, La.

Power Play

In reference to the article "Power Play" by Frederik Pohl (April 1979), the author agrees with other researchers as to what the critical question concerning our present energy situation is, however, thereafter the article is less adept at contrasting new and pertinent information than 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 appetite, the article would have been for more entertaining.

Jeffrey P. Richetto, Ph.D.
DeKalb, Ill.

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, cer-

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tain 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 one very simple fact, that floating ice already displaces its own weight in water. The net result of an iceberg 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 so 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, a would very possibly cause a slight rise in the overall depth of the ocean, but even then the natural contours of Antarctica would hold quite a bit.

It is the ice that is supported by land—glaciers and such—that we would have to worry 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.

Borry M. 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 Berzbachy
Biloxi, Miss.

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Defending "Cranks"

This letter is sent in response to the editorial "Turning the Crank" (Space, April 1979) by Mark R. Chertland III.

In fairness to the facts of the history of science, it must be granted that there have been some highly commendable "cranks," particularly in the area of physics, and their names are legion. Thomas Kuhn, in his *Structure of Scientific Revolutions*, mentions a few of these, and he reminds us once again that the greatest breakthroughs came from "outsiders," i.e., cranks—such men as Joule (energy), Maxwell (electromagnetic theory), Einstein (quantum theory, relativity, etc.). Let us not gloss over the fact that for a long time they were all treated as cranks (poor Maxwell for nearly 40 years).

The medical doctor Wilhelm Roentgen's discovery of X rays was pronounced to be an elaborate hoax by Lord Kelvin. Count Louis Dornbrogue was booted and hissed off the stage by the Fellows of the Royal Society when he tried to deliver his paper on matter waves, for which he later received a Nobel Prize.

We might mentally review some of the past ideas of otherwise unimpeachable scientists (the medical profession included), which later on were recognized for their capricious and eccentric character.

We might recall how it was due to Johannes Kepler (1571-1630) that Galileo acquired his first telescope. Galileo was so

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 is it not arguable 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 Spagel's article "First Encounter" (April 1979). As a regular reader, I was looking forward to the "gallery of UFO photographs."

However, it is blatantly obvious that the photos on pages 52, 54, and 59 are nothing more than fairly good textbook examples of lenticular clouds—most probably al-

together lenticulars. 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 Spagel's next ploy? Perhaps he'll resuscitate those blurry, overexposed snapshots of alien (?) paper plates and garbage-can 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. Asmod, Surgeon, 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 those last two words). Politicians seem unable to come to terms with the exploration of the ultimate in New Worlds—space.

Kenneth Huff
Riverton, Wyo.

Swan Song

After reading Dr. Bernard Dixon's article (April 1979), I would like to offer a few suggestions to the unworried "swan question."

Perhaps the swan's endocrine system releases a hormonal substance, cyclically, that permits tubular membranes 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 test and not solely out of the need to procreate.

Personally I much prefer this method to that of the angler fish.

Charles Cusumano
Saratoga, 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 Arnold is typical in its irrationality of the nuclear-power critics I have met. It should be explained to Arnold 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 (i.e., the sun, the ground, and building materials) is considerably more than one can expect from living next door to a nuclear-power plant.

If Arnold fears accidents, he should rest easy. According to the Rasmussen Report, a government-sponsored study, the probability 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 over 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 fact-fetched as Arnold's. His statements on government obstruction are not only unimpeachable 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 wester's lying "for eternity," Moon is probably right. Its 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 ramblings put forth in letters like



"Representations, apparently, of a transitional stage between Homo erectus and Homo habilis: Homo homy."

Three of Mr. Azen and Mr. Mox.

W. A. Wozniak, L.I., 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.] Wheeler's overwhelmingly scientific statement that we live in a country that supports 20,000 astrologers and only 2,000 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 other 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. Merely 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 clearly 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 modern brothers. At one time astrology and astronomy were one and the same. It is the astronomers 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, merely humanity.

Dorina L. Crozier
Wappingers Falls, N.Y.

Your point that astrology and astronomy were once 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. Also, as our systems of measurement matured, so did our understanding of the universe —Ed ☐

NEXT OMNI



ISAACS



BALLOONS



LAZARUS LONG



GREEN MEN

WHITE DWARFS AND LITTLE GREEN MEN—Carl Sagan examines the fashionable parody of "ancient astronaut" theories espoused by pop archaeologist Von Däniken and others. Referring to Easter Island, the plains of Nazca, and similar "alien visitation" sites, the astronomer concludes that "none of these cases provides even moderately convincing evidence of extraterrestrial contact." The one baffling exception is the remarkable mythology of the Dogon people of Mali. This primitive tribe seems to possess astronomical information that could only have been gathered through sophisticated optical telescopes. Can this paradox be traced to extraterrestrial visitations? Sagan offers some intriguing clues in the August *Omni*.

THE NOTEBOOKS OF LAZARUS LONG—Robert A. Heinlein's memorable character Lazarus Long has appeared in two novels, the most recent being *Time Enough for Love*. The wit and wisdom of this colorful hero—sage, explorer, lover and the world's longest-lived man—provide the bases for a stunning pictorial.

BALLOONS—The slowest, cheapest and most beautiful way to fly is turning out to be both popular and practical. While a rapidly growing number of amateur pilots are buying hot-air balloons for sport, engineers are looking at lighter-than-air craft for roles ranging from heavy-lift cargo vehicles to atmospheric probes on distant planets. In the next *Omni* a provocative pictorial evokes balloons! Nick Engle to profile what could become the next revolution in flight, photography by Simon Basil.

VAN GUARD—*Omni* reports on the spectacular Voyager planetary probe, whose findings promise to revolutionize cosmology. Scientists expected little from the mission after its budget was cut to only \$199,999.99. Only an imaginative decision made by Dr. Carmo Zollinger, project director at JPL, Thought Productions, Los Angeles, to subcontract "Wet's" construction to a southern California custom shop saved the orbiter, and with it such unprecedented revelations as the existence of yeast, maad drinks, and the potent isotope chl-235 on the third planet from our sun.

INTERVIEW/JOHN ISAACS—Meet one of the world's foremost oceanographers in this exclusive interview. Isaac, director of the Scripps Institute for Marine Research, is a self-proclaimed apologist—someone who believes that problems are solvable if we do something about them. Among his ideas: towing icebergs north for fresh water and pumping nutrients into the oceans to make them more productive. Enjoy a frank conversation with this radical oceanographer in the August *Omni*.

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delegation. It was an ugly episode. Several Japanese men seized the Australian, then several antiwhalers came to his aid, and then Japanese reinforcements arrived. The aisle was instantly jammed with people, which was fortunate, for no one could free a hand to throw a punch. Hotel society officers led the Australian away "for no barbarians!" he yelled at the Japanese. "Whaling is barbaric!"

"You" a weeping Japanese woman shouted back, "you are barbarians."

It sometimes seems, at an IWC meeting, that the gray flink of the whale has become a new color of flak—a smooth, wet, living moribund that confounds human tongues. The deliberations are rife 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 in their, 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 the whaling industry. Conservationists are seldom happy with the IWC, neither are the whalers. The IWC is weak; its regulations are not binding on member nations. Members, if they wish, may file objections and be exempted. The IWC has no powers 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 factors 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 slammingly. While the IWC did not preside over the Great Decimation of the Twenties and Thirties—the commission was not formed until 1949, when the reality of that decimation had become apparent—still, it has presided over, and legitimized, the mopping-up operations.

Conservationists worry about the lifespan 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 whales a disservice by suggesting that something important is being done on their behalf. It is true that the IWC is no longer a whaler's 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 complains regularly 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 in habiting such a vast, mysterious realm.

Conservationists like to grumble about jailing 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.* ●

the IWC has protected, however tardily, the blue gray right and humpback whales from commercial hunting. They remember that the science committee continues to improve its data and doubt that the quotas continue to drop. If the IWC goes, what will replace it? No future commission can be more benign toward whalers than the nations that make it up. The question is not whether the IWC can save whales. It is whether the Argentines, Americans, French, Islanders, Mexicans, Dutch, British, Chileans, and Inupiat Eskimos of Alaska can save such big, profitable animals that wander so internationally. Can humans organize to save another mammal when they have so much difficulty organizing to save themselves?

There are a number of things to watch for this month. Environmentalists in the U.S. delegation are pushing for this country to place a commercial-whaling moratorium on the IWC agenda, and apparently they will succeed. The moratorium would be for an indefinite period, not the ten-year version that made a number of member nations uncomfortable when it was proposed several years ago.

Both sides in the whaling debate concur to pack the commission. The tiny nation of Seychelles, 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 paleontologists, 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 polar summer, somewhere in the Beaufort Sea, a bowhead whale is rising to blow frostily. The ice pack has moved far offshore, and the plankton in the 24 hours of daily sun, has bloomed widely, 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 diminished race will reverse their migration, making their way once again, past those 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 off Newfoundland. In the dimness underwater, the whale service stripes on its pectoral fins show ghostly white. The minke is the smallest of the baleen whales, and one of the shrewd, and its flukes are the most gracefully curved. This minke is lucky. It was not one of its 2,562 fellows in the North Atlantic that the IWC allowed the catcher boats to take last year. 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 torpid in 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 bathtub-warm surface waters. He goes down and down—300, 600, 900 meters—and still down, into arctic cold and total darkness. Heavens out the clicks of his sonar unit, on his inner screen, the blips of squid-like shape. The chemistry of the bull's dive physiology, the source of sound production for his sonar, 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 shape. He gives chase. □

SPACE

CONTINUED FROM PAGE 16

may hold to these beliefs today. After all, it is well known that if you dig a pothole during the wrong phase of the moon, you won't have enough dirt when you go to fill it up.

According to the Pennsylvania Dutch, you should marry in the light of the moon, the time between the new moon and the full. The light of the moon is also a good time to press cider, but if you want wine, do it in the dark of the moon. Trim your carns in the waning of the moon to keep them from growing too fast. If you're short of cash, don't let the moonlight shine into your purse, or you won't get any more money for the rest of the month.

Crops that grow aboveground should be planted between the new and the full moon, underground crops between the full moon and the last quarter. No crops should be planted in the last week of the cycle. To aid the memory, such instructions were often committed to poetry.

Go plant the bean when the moon is light
And you will find that this is right,
Plant the potato when the moon is dark
And to this line you always hark.
But if you vary from this rule,
You will find you are a fool.

Another belief was that when the moon's horns pointed upward, it exerted an upward force. Thus it would hold back water and rain wouldn't fall. When the horns pointed downward, the water would fall out and it would rain.

Everyone knows there is a man in the moon, though sometimes it is called the lady in the moon. The man was supposedly banished to the moon from Earth as punishment for gathering wood on the Sabbath.

There is also a rabbit in the moon, and a fox in the moon. Storytellers from Canadian Indians to Joel Chandler Harris have chronicled the rabbit's adventures.

The ways people have devised of getting to the moon have been imaginative almost to the point of lunacy. One intrepid explorer thought of having his ship pulled by migrating geese. Jules Verne had his man shot from a cannon in Florida, across the state from where the Apollo rockets were actually launched a century later. One inventor had a steam-powered rocket. And Cyrano de Bergerac, cap'n nose, and all, tried to reach the moon by the clever expedient of tying bottles of dew to his belt. As everyone knows, when morning comes, dew rises into space.

A bit of lunacy took over the readers of the New York Sun in August 1835 when they read that the astronomer John Herschel had discovered people (with wings yet), animals, and forests on the moon. The Sun's designers to improve the paper's selling circulation, actually did the trick!

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, Jill, and the pail. As the moon becomes a waxing crescent, the pail appears first, the dark "sea" known as Mare Crisium. Then Jack appears and is completely "up the hill" by first quarter. His head is Mare Serenitatis, his body Mare Tranquillitatis, and his legs are Mare Fœcunditatis 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 Humorum 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 Hag-

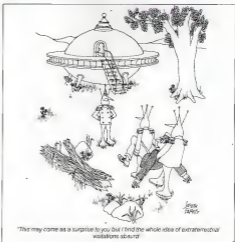
gard from the wrath of astronomers when the book first appeared.

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. These doubtless arose 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. Colorado wrote of "one bright star" within the nether tip, "an impossibility since the moon is not transparent. But the new moon—with the said moon in her arm"—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 light, but the moon is out at night when it is dark and we need the light." ☐



"This may come as a surprise to you but I find the whole idea of extraterrestrial visitations absurd."

of a theater smaller than Radio City Music Hall but with the same grandiose feel of the days when movies were more of an event than a national pastime. Both the main lobby and the balcony feature bars where soda, beer, snacks, and sandwiches of plé and sausage are available, and the seats are plush and comfortable.

Under ordinary circumstances, attending a film festival in such surroundings would have been a treat, but entering the theater on opening night, I was taken aback by the uproar. Used to the staid, sophisticated audiences of the New York and Los Angeles film festivals, I was unprepared for the continuous noise and obnoxious conduct of the crowd. It seemed more like a wrestling match than a film festival.

Lonel Lelwa, a young French critic who has attended all eight Paris festivals, offered the analysis: "People wait all year for this event. It's a tradition. They don't just want to sit and watch the films when they get here. They come in order to shout and sing and throw things. It's like a rock-music festival, where the experience is more important than the music. Of course, in the years when the films have been better there has been less noise, but when the films are bad, what else is there to do?"

This proved true throughout the festival

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," Lelwa 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 derivatives that featured souped-up space ships, laser weaponry, galactic empires, daimails in distress, robots, and outer-space doglights. 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 grisly murders. The only serious non-English-language film at the festival, it was voted the critics' prize as best picture.

Tobe Hooper's *The Texas Chainsaw Massacre*, touted last month in this column by Dan O'Bannon as the state of the art in horror films before *Alien*, was awarded 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 provoking a second riot.

The unqualified hits of the festival were both American fantasy/SF/horror films. George Romero's *Zombie* (U.S. title, *Dawn of the Dead*), the grimly stunning sequel to his 1968 classic, *Night of the Living Dead* is only the second part of a *Dead* trilogy. A chilling vision of a future where living corpses are gradually taking over the world, *Zombie* nearly got a standing ovation, prompting one critic to blurt "Well, the audience finally has all this blood it wanted."

The most important film shown at the festival, winner of its grand prize and the best acting award (Janis Lee Curtis, daughter of Janet Leigh and Tony Curtis), was 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 every viewer 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 the size could influence the genre instead of merely living off it.

Other SF festivals in Avoriaz, Segees, Spain; Trieste, Yugoslavia; and elsewhere do not attract audiences in such numbers. Schlockoff is already planning on the tenth 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 last 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 offer from a surfeit 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. **CC**



MUSIC

CONTINUED FROM PAGE 38

how to make a hit record. It has a 1984 feel to it, but it's really '85 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."

Abrams shares a staff of 10 full-time and 30 part-time researchers with his partner, Kent Burkhardt, 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, Abrams, 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 basic lines these days, rather than the complex chords the average American ear was clinging to a few years back, tells Abrams we're not listening as closely. He concedes 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 Abrams has observed cyclical patterns of intensity and lull each of 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 clicking. A lull is apolitical; there are no major artistic advancements. The music intensity 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 they're not keenly listening to as opposed to another?

That elusive factor called image has never been more important in maintaining listener loyalty and to this end Superstar stations are being encouraged to evolve toward what Abrams calls "eighteen to thirty-four H-style radio."

The responses to a million open-ended questionnaires filed out annually on the street, together with special investigations into the state of the art, enable Burkhardt/Abrams to feed client stations a wealth of data about who their 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—even their own personal fears and

deeply private and obsessional fantasies.

John Panikhal, who prepares psychographic analyses for Burkhardt/Abrams, is a Canadian researcher and a former student of Marshall McLuhan but, according to Abrams, "not a McLuhanite." Panikhal's concerns are best illustrated by a sampling of his monthly memos, which Abrams 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 answers 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," Panikhal 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 countowns, appeal because they "provide an arbitrary or real order to things and events."

Elsewhere Panikhal 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, career and morality. It is causing incredible stress that has no focus. It is particularly acute in women. . . . This party sterility that prevails is making the fact that more people than ever are actively looking for help."

Panikhal thinks "this massive unrecognized emotional crisis" can be turned to radio's advantage and he urges stations to create an image 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 radio station? Abrams, certainly a mild-mannered, likable fellow himself, insists the application couldn't be more benign. "We just try to give the listener exactly what they're into—a bit before everybody's into it. Because music isn't very hot right 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 love home video units for example love them. And the more people who get involved with, 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 is that 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 *his*? ☐

On self-help and awareness A DOCTOR REPORTS:



Melvin Kupper, 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 Melvin Kupper, M.D. "A pastor I respected recommended Dianetics. I explored how human beings function and interact. I laid out techniques

"Dianetics made me more alert, more alive."

for handling psychosomatic illness.

"I read it and it worked."

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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 library 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 five 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 disconcerting to French listeners. If it ever gets the green light, it will need to be redubbed.

A monthly series, hosted by Robert Clarke, *L'Avant 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 brief time 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 uncut 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, suburban or revival. The first-run showings included Superman, Battister Galois, Magic, and Halloween (all from the United States); Werner Herzog's *Nosferatu* (Germany); *Sher Crabb* and *The Continent of the Fish-Men* (Italy); *Message from Space* (Japan); and *The Gendarme and the Extraterrestrials* and *Ecoute-Vor* (France). Impressive re-releases of several classics with beautiful

prints, shown in fine theaters, included 2007 *A Space Odyssey*, *The Five Machine*, *A Clockwork Orange*, *Around the World in Eighty Days*, F. W. Murnau's *Nosferatu* (1925), an uncut print of *The Fearless Vampire Killers*, and *Young Frankenstein*.

The Gendarme 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 Funès, who also appeared in *The Mad Adventures of Rabbi Jacob*. *The Gendarme and the Extraterrestrials* combines the unsophisticated humor of the *Three Stooges* and the *Carry On* films with a typical 1960s alien-invasion Earth plot. Perhaps it was the laughable but clever grade-C special effects or the charm of DeFunès, or even the variety 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 Méliès, the first master of fantasy and science-fiction films. Made in France before the sound era, these movies displayed an imagination that very few films today possess. People disappointed objects moved about the screen through stop-motion animation, and the crowd that packed the sidewalk 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, 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. Gallic 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 shamed country since the surrender in 1940, and it has subsequently 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 escape, whether through time or of venture comics, is young and uneducated. The readers of serious SF literature are more aware of the troubles that surround them. Yet they escape into books, reading 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, its opposite parts making an engaging, if limited, market possible. **DD**



SPIRIT IN SPACE

STARS

By Patrick Moore

When I first began to take a real interest in astronomy, which was in 1929, I had heard a great deal about "empty space." The general idea was that as soon as one ventured beyond the thin atmosphere, a few tons 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 Mira, 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 Mira and found that some of them did not exhibit the Doppler shift of the overall spectrum. The reason was obvious. The impossible 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 plow through the Orion Nebula, scooping in material steadily the amount collected would weigh less than a billion dollars' worth.

Tenuous as they are, these interstellar clouds are of fundamental importance in astronomy. Viable 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. Then 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 molecules 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 far-fetched 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 speculated 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. ☐



Alcohol pervades Orion's Great Nebula

held in Toronto. Two UFO investigators, Dr. Aymn Laveon and John De Herrera, and Dr. McCall carefully selected a number of volunteer subjects, tested for their lack of familiarity with the UFO subject. No one who "had ever had" a sighting or who knew much about the subject was used. Under a hypnotic trance, each volunteer was told to imagine that he was being abducted by a UFO. The volunteers were provided with a script to include "medical examination" and possible physiological and psychic aftereffects. What concerned these investigators were the details developed by the "abductees." Would they be dry and colorless? Would the subjects have to be prodded every step of the way?

To the researchers' amazement, all the hypnotized volunteers provided tales virtually indistinguishable from the "real" abduction accounts in the UFO literature in terms of imagination, patterns, richness of detail and facility of recounting. Yet critics have noted that in "real" abduction scenarios no one is asked to invent anything, nor is any outline of events provided. Furthermore, "real" abductees frequently display strong emotional reactions to understate their related experiences. McCall has counterargued that, in a heightened state of suggestibility, a hypnotized subject (desiring to please the hypnotist) is acutely aware of cues, even nonverbal ones (e.g., body language, voice inflections). Strong emotional reactions toward nightmares do not undermine their physical reality. Still the point is taken: No controlled experiment like this can be an exact replication of the regressions of "real" abductees.

Yet how else could the accuracy of UFOlogical applications of hypnosis be checked? In my own role as chief investigator for the Center for UFO Studies, I have sometimes envisaged setting up a phony UFO for a hapless victim, drugging him into unconsciousness, and later hypnotizing him to see how he accounted for his "lost period of memory" following the sighting. Unethical, certainly, but what were the alternatives?

That on July 14, 1978, an alternative option presented itself. I was contacted by a forty-three-year-old woman on Long Island, New York, who had undergone a "quasi-abduction." She went outdoors at 12:30 A.M. and her attention was immediately attracted by a whirring noise. Looking up, she saw a saucer "twenty feet in diameter" hovering low over her house. She said: "Hundreds of white lights were arranged underneath it, and a red dome light was seen blinking on top of the craft. She could hear humming and whirring noises. As the woman watched in amazement, a red beam shone down from the UFO and paralyzed her. She was still standing on her front doorstep. Within her mind, a deep voice asked her, 'Are you afraid?'"

The woman replied inevitably, "No, I'm not really believing in this."

"Do you believe now?" they queried.

"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 UFOcraft's replies. When the UFOcrafts 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 "FALL TO," or "FALL 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, goal-oriented and sincere as any of

● *She saw a saucer hovering low over her house, hundreds of white lights underneath and a red dome light blinking on top. A red beam paralyzed her, and a deep voice asked, 'Are you afraid?'* ●

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 (and 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 thinks 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 AF-

LANTIC CITY" (It takes time.) At last, the perfect hypnosis 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 hypnotherapist 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 hypnosis 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 hypnotherapist; 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 violated by memories or subconscious fantasies.

Something else of interest: Our UFO "debarrier" claimed to have experienced a 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 "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 Reporter*, 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. Huxley is chief investigator for the Center for UFO Studies and author of the forthcoming book *The UFO Handbook*, due from Doubleday & Co. in August.

ROCKET WONDERLAND

EXPLORATIONS

By Dave Dooling

Ten years ago this month an awesome Saturn 5 rocket thundered off its launchpad and formed 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 a reusable spaceliner. 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 museum dealing with spaceflight, featuring the Gemini 9 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, open 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 enclosing

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 though, 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.)



Delta 142 launch from Kennedy Space Center

If you want a fantasia 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. (8 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 displays 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 fettered—in 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 of one lunar gravity (one sixth that of the earth). And the Lunar Odyssey is a giant centrifuge that passes 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—was the shuttle—is taking shape. Here you can walk through a full-scale mock-up of the Skylab space station and see the 4.84-million-liter neutral buoyancy simulator, a deep pool of clear water in which astronauts rehearsed space

maneuvers to save Skylab in 1973. Today the tumbler 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 tested without leaving the ground.

NASA's most famous control center is the Johnson Space Center in Clear Lake City, two miles south of Houston. Texas. Although this 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 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 Center for Aeronautics (NACA)—was established in 1918. Langley was responsible for the Wing project, which orbited and landed spacecraft on Mars in 1976 to investigate geology and life. Today Langley's visitors' center includes Wing 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. This branch 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 1978 Explorations column.)

Major space artifacts range from one of Robert Goddard's early rockets and 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 backup Skylab 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, rocketry and spaceflight, the results from Project Apollo, and the Albert Einstein Spacearium, a bicentennial gift from West Germany. There is also the South Entrance, graced by artist Bob McCall'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 the:

- 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 213-354-8357 for more information.

- Ames Research Center in Mountain View, California, just south of San Francisco, center of planetary science and aeronautical research. Call 415-965-6091.
- 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 804-824-9411.
- National Space Technology—Laboratories, Bay St. Louis, Mississippi, center for the space-shuttle engine tests and remote-sensing satellite research. Call 601-688-3341.
- Dryden Flight Research Center at Edwards Air Force Base, Edwards, California. Call 805-258-3311. **DD**

ROCKET LAUNCHES FOR 1979

This schedule is deliberately vague because launch times frequently slip, sometimes from day to day. To get specific dates as the month approaches, call 1-301-867-2050 or in Florida call 1-800-432-2153.

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. It just happens, rise and watch the best light show of your life.

July: Westco-C communications satellite atop a Delta rocket launch from Cape Canaveral.

August: Intelsat 5A communications satellite atop an Atlas Centaur, Cape Canaveral.

September: High Energy Astronomy Observatory C atop an Atlas Centaur, Cape Canaveral.

Plus: Magsat magnetic survey satellite atop a Scout, Vandenberg AFB, California.

October: Solar Maximum Mission solar observatory atop a Delta, Cape Canaveral.

Plus: Navy 21 atop a Scout, Vandenberg.

November: Intelsat 5B communications satellite atop an Atlas Centaur, Cape Canaveral.

Plus: first space shuttle test, Cape Canaveral (will probably slip to December).

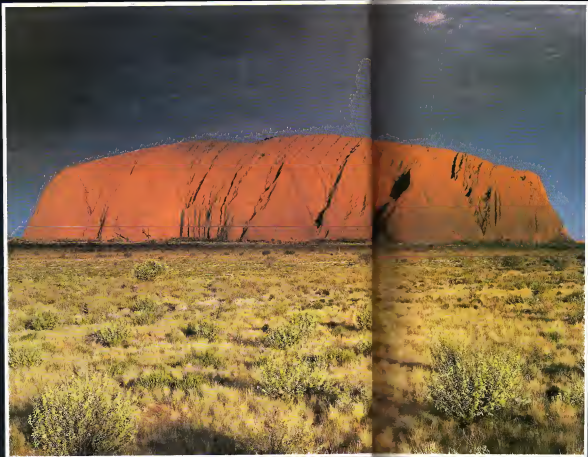
December: NOAA-B weather satellite atop an Atlas F, Vandenberg.

Plus: RCA-C communications satellite atop a Delta, Cape Canaveral.

Dave Docking is science editor of the *Huntsville Times*, specializing in space technology.



Corrective procedures for problems that could occur on a space mission are rehearsed by astronauts in the deep waters of the Neutral Buoyancy Simulator at Marshall Space Flight Center.



PHENOMENA

The Northern Territory of Australia is a land of vast, dry plains, with one important exception: the Ayers Rock. More than 280 kilometers from the nearest town, the rock rises out of the plains to a height of 348 meters. It is more than 2.5 kilometers long and 1.6 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 it is held sacred by the aboriginal tribes that inhabit the regions surrounding it. Carves at the base of the rock, decorated with aboriginal paintings, are now a popular tourist site. Malcolm Kirk visited the Ayers Rock for *Onix* and took this photograph with a Nikon F camera and Kodachrome. **25 00**

[Please feel free to smoke Mr. Stucky] 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 wilded rural DAs who might say "Now Jake, we know you killed your wife. So don't go lyin' about it. Just get your story together while I go get you a cup of coffee."

The other Charlie Rose, however, is a protégé of Terry Sanford, the former southern liberal governor of North Carolina, ex-university president, and a one-hospital 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, one who doesn't mind doing the necessary but 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 the 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 on 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-5 space colony people, the anarchic appropriate technology of wordwise Karl Hess, the soft-energy boys, the worker-owned-corporation cooperists, the cosmic-consciousness adepts, and the Committee for the Elimination of Death. Under its imaginative director, Ann Chestman, the clearinghouse also holds its monthly Chautauquus 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 Chautauquus will deal with future housing, "soft" appropriate technology vs. "hard" conventional technology, the scientific nature of life, including genetic manipulation, the future social cultures, and even "cosmic consciousness.")

You ask how good old 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 much 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 moves 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 future research, and by 1976 Rose and Chestman were sending the House a stream of both close-in and far-out futurists 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 contributors from interested members of Congress and other supporters. Many Senate liberals are firmly behind the project.

Though I 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. ☐



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GAMES

By Scot Morns

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
burn her, and about several men named
Rowney who read this magazine and
suffer from insomnia.

After we sorted nearly 4,000 limericks
into NO, MAYBE, and YES piles, there
were 500 YES and in the YES pile—more
than ten times the number we could print.
Further sortings 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 rhyming 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 gleaming. 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 Gross flavor and eventually
agreed on this selection.

GRAND-PRIZE WINNER

It inside a globe, 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 free trucks and said,
"EVEN adders can multiply on a log table!"
—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 "err"
For they all know that Mom's peas are
round!
—Robert P. Wams, Albaster, Ala. (\$25)

A young sports car driver named Brent
Had the latest machine on the scene
He drove fast as light,
And with no cops in sight
He'd blueshift the red lights to green
—Timothy Cowden, Bryan, Tex. (\$25)

TURKEY 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.
—Jeanne Carr, Youngstown, N.Y. (\$25)

A renowned archaeologist of West,
Who unearthed an Egyptian clay urn
Found himself overwhelmed
When the markings translated
Clearly read, "No Roll/No Return"
—G. A. Ludwig, Crown Point, Ind. (\$25)

The voice from the UFO cried,
"To the starport we'll give a bird ride!"
Several men volunteered,
But the ship disappeared
With a whale and two dolphins inside
—Burl Ross, Lake Oswego, Oreg. (\$25)

THE VOICE EFFECT

Her voice is so high it's absurd
It's so shrill that you can't hear a word
When she's got something to say
She starts running away

So the pitch drops enough to be heard
—Steve Olfner, 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 I'm
Cursed I'm that explain me at 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 the message related
"I'm sorry this line is disconnected"
—Carl Carson, Riverside, Calif.

A hockey ref "Penalty!" accused
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 Zaleski, Redlands, Calif.

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.

A young rancher longing to own
A horse like his daddy's red roan
Said, "Daddy, to hell!
I'll just steal me a colt!"
Now he's riding a strawberry clone
—Dorothy M. Smith, Miami, Fla.

The meticulous space lady left
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, Brownsburg, Ind.

If I give an N-gon to you,
And read, "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 resonator of speed,"
The directions read,
"Fold on the dotted plane."
—William R. Baldorosi, 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 Weidner, 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
—Burt 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 Fairback, Brownsville, 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 Preszmine
—Donna Schmidt, Finney, Nove, Mich.

A tessaract is rarely due mention,
For counting its cubes spurs contention,
It has two, no, three's eight!
Ah, it's hard to relate
When the wop's from another dimension
—Steve Peters, Indianapolis, Ind.

The most frightening instance of chaos is
California's, rather than Laos's
It's your underground vault
Filling up, and the fault

Isn't yours—no, it's all San Andreas's
—Ted Melnechuk, 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 Vela, Calif.

For those who debate on such rarities,
A black hole's a source of dependencies,
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 equinox procession
Now your Gemini's really a Taurus
—Bruce 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 believe!"
You can't even quit the damn game!"
—Harry O. Borath, Plantation, Fla.

A tourist to Alpha Centauri
Came back with a fantastic story—
That binary sea
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 cuss!"
He was jailed for an obscure clone fall
—James D. Hedreth,
Kaneohe, Hawaii

A quick-witted astronaut, Dwight,
When asked about his upcoming fight,
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 dits
And when things get weary
Try something less dreary
Like playing with binary bits
—Chuck Neumannschwander, 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 Pb his friends to Cl
This prospector was bold
But while looking for Au
He got killed while lighting an In
—Tom Collier, Manville, 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
Mung
—Mike Jenkins and Jim Slinkman,
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 hole's existence
—Brian E. Schroeder, Rossmore, Ill.

Null gravely's awkward for lovers,
Especially pushers and showers
The problems of docking
And then interlocking
Are greatly increased when one hovers
—Janet L. Snake and Jeffrey A.
Raphaelson, Fort Collins, Colo.

The first time I saw in the store
Your Omni, I hoped there'd be more
The pages are packed
With fiction and fact
I've become a complete Omnivore
—F. Brown, Messisauga, Ont., Canada

Thanks to all! 

MEET DR. SWINGER

LAST WORD

By Daniel S. Greenberg

Orms 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 scammer side of science and government relations.

Orms: Dr. Swinger, for readers who are not familiar with the Breakthrough Institute, please explain what it is.

Dr. Swinger: Since everyone is impatient for scientific breakthroughs, that's all we promise when we apply for funds to do research. We don't talk about slowly moving back the frontiers of knowledge or anything like that. We tell them that we'll deliver the goods.

Orms: But do you?

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.

Orms: Does this system always work?

Dr. Swinger: Not always. Like everyone else in research these days, we have to hustle. You probably noticed our motto over the main entrance: "Take Nothing for Granted."

Orms: But your institute seems to be very busy. What's going on here? What's everybody doing?

Dr. Swinger: We are in 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.

Orms: Please do.

Dr. Swinger: It's like long and short skirts, wide and narrow lapels. The institute got a headstart into space. When that began to fizzle, we baited 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 hotfooting it to nutrition research, herbal medicine, and Third and Fourth World appropriate technology.

Orms: 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.

Orms: 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.

Orms: 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.

Orms: Perpetual motion?

Dr. Swinger: Don't rule it out. Just because the problem hasn't been solved so far doesn't mean...

Orms: 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 Illiteracy: Fact or Fiction. A lot of interest in that, I expect.

Just to show you how fashions change we had to get a conference going on acupuncture, and no one showed up. Three years ago, that really would have been a winner.

Orms: Really?

Dr. Swinger: Some thing applies to desalinization—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 if it would attract too many demonstrators.

Orms: Your other big 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's 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 all that.

Orms: 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...

Orms: Thank you, Dr. Swinger. **DD**

