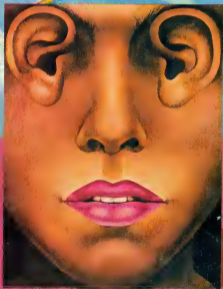


OMNI

NOVEMBER 1979 \$2.00



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ANTIMATTER: THE ULTIMATE FUEL

ALIENS AND THE LAW: OK TO SHOOT 'EM SIGHT

BRAVE NEW TOYS: SANTA COMPUTERIZES

INTERVIEW: CAMBRIDGE'S FIRST DOCTOR OF PARANORMAL PSYCHOLOGY

OMNI

NOVEMBER 1979

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Cover art for this month's *Omni* is a 1973 painting by the German artist Günther Rambow titled *Untitled (Carp Eye)*. Painted in acrylics, it reflects the photographic approach that characterizes Osterwälder's paintings. She lives in Hamburg, West Germany.

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● *No private enterprise will risk billions of dollars on a moon-based silicon factory if most of the world disputes its legal right to profit from that factory* ●

Some months back, while everyone was busy celebrating the tenth anniversary of our moon landing, a significant treaty concerning that celestial body was simultaneously placed on the agenda of the United Nations General Assembly. The treaty spells certain doom for America's future on the moon. Yet Soviet bloc and Third World countries are deliberately downplaying its importance, attempting to make its passage routine. From all indications, the United States is buying the ticket, lock, stock, and barrel. And what we're buying is a giant step backward for America in space.

If Soviet and Third World sponsors of the treaty have anything to say about it—and indeed one heavily gives them just such counsel—celestial bodies will be governed precisely in the way that the oceans, deep seabeds are. Everything belongs to everybody and is to be shared by everyone. Each pound of iron or titanium mined, every lunar factory, each dollar made from the moon, will be shared equally among all.

Certainly the humanitarian motive underlying the treaty can't be disputed. All of Earth must share in the fruits that space will bring, but there are ways other than outright socialism to reap such benefits. Consider the predicament of an executive at Rockwell International or Boeing who must satisfy the requirements of the agreement. Will he want to manufacture moon-mining equipment when he knows that the control and profit of such technology will go to Sn Lanka? Certainly the benefits of his technology could be bought by Sn Lanka, but giving them away just down Larkin Avenue?

It's not. The Outer Space Treaty has been cleverly designed by Communist and Third World parties to demote private industry's role in developing the resources of outer space—beginning with the moon. No private enterprise will risk billions of dollars for a new silicon producing factory on the lunar surface if most of the world disputes its legal right to profit from that factory.

Typical of the language contained in the treaty is paragraph 5 of Article XI, which obligates member countries "to establish a new joint regulatory body for resource exploitation... its such exploitation is about to become feasible." One valid reading of this text is that a new regulatory body must precede actual resource exploitation. In effect, the moon treaty is telling NASA that no lunar operations can take place until a UN General Assembly-type body is called to approve such operations. The political implications here are that to obtain such authorization, a country would have to forfeit a large share of its profit potential to an international organization.

As a further deterrent, industrialists would be compelled to transfer their technology to other countries, perhaps on a subsidized basis.

Moreover, a strong legal inference in paragraph 2 of Article VI and again in paragraph 8 of Article XI bars commercially oriented enterprises from engaging in experimental or pilot lunar operations. The treaty does permit the use of resources in "scientific investigations," but then the issue becomes one of defining "scientific investigations." You can't bet that excludes commercial space developments designed for future profit. This is how international monopolies are created, thereby legitimizing Soviet bloc and Third World influences. Once the treaty is signed by the United States, it is doubtful that the Department of State would authorize American companies to begin commercial lunar exploitation for fear of interfering with international negotiations.

Many Washington bureaucrats involved in the treaty's drafting don't seem to recognize the danger signs. They don't see that the agreement is seriously antithetical to the free-market development of space resources. And yet, as we've revealed through countless articles in the pages of this magazine, free enterprise is the very basis needed to get America into sustained orbit. Even if this time-out isn't to be brief, it seems incredibly shortsighted of our nation to sign a binding treaty in which the political will of other countries will dictate the pace and substance of space exploitation.

We can still try to change the treaty or head it off entirely. What remains is to advise your congressman immediately. The United States has already approved the new treaty at consular sites at the United Nations, where it will be virtually rubber-stamped by the General Assembly this fall. In fact, the moon treaty may already have been passed as you read this, but like all major international agreements, it must be ratified by the Senate. Through quick and effective political action, we may be able to encourage our legislators to take a second look. Beyond your own congressman, key targets of a letter-writing campaign should include Senator Frank Church (D-Idaho), chairman of the Senate Foreign Relations Committee, and Representative Don Fuqua (D-Rx.), who chairs the House Committee on Science and Technology. If the United States finally does ratify this agreement, the prospects for private enterprise on the moon and other celestial bodies will disappear. ☐

J. Anderson Davison is the managing editor of *Omni*.

CONTRIBUTORS

OMNIBUS



FREITAS



FORWARD



KAGE



GELTON

Can you "murder" an alien being and get off scot-free? Probably so. In the eyes of the law, visitors from space would fall somewhere between horses and stagecoaches. In this issue of *Omnibus*, space-law specialist Robert A. Freitas, Jr. tells why illegal aliens just aren't safe on planet Earth. Freitas, an attorney with degrees in physics and psychology, has been working for the past five years on a comprehensive review of xenobiology (the study of life on other planets). Author of several articles published in *Analog* magazine, last year he published a handbook dealing with political space activism entitled *Lobbying for Space*. His insightful interpretation of the law as it pertains to the warring aliens begins on page 84.

Seven thousand feet above Lake Tahoe sits the British home, considered "the most innovative solar home in the world." Ronald Diane probes the perfect habitat for the 1980s in "Dream House" (page 50), an in-depth report on the joys of "passive" solar heating. Diane, a graduate in electrical engineering, has been working in the computer field since 1965. Formerly a consultant with the Fusion Energy Corporation, he is currently working on a documentary for *Omnibus*.

Back again is Dr. Robert L. Forward, senior scientist at the Hughes Research Laboratories in Malibu, California. Dr. Forward describes what he calls the "ultimate fuel" animator. This incredible substance, a phenomenon essential to the

basic structure of matter, is being made captured, cooled, and stored for days at a time in Switzerland right now. It turns out that the question is not whether dynamite can be produced for fuel in interspace travel but simply whether "we want to do it." Look for the answers on page 44.

Germany's leading photomicrographer Manfred Kage has spent most of his life exploring the visual world of science and maximizing its graphic appeal. A castle deep within the foothills of Germany's Schwäbische Alb is Kage's laboratory where continuing projects include the transformation of sound waves into brilliant colors and forms. This month *Omnibus* provides a spectacular display of Kage's magic with a profile of the artist by Herbert W. Franke, one of Germany's leading SF novelists—beginning on page 66.

As any ufologist will tell you, physical evidence has always been the stumbling block for skeptics and believers alike. When *Omnibus* acquired two metal fragments purported to be of extraterrestrial provenance, we arranged to have them analyzed by MIT. Harry Leibelson, a New York investigator for the Aerial Phenomena Research Organization, details a fascinating experiment that raises more questions than it answers. Read for yourself in *UFO Update* (page 30).

Phaser guns, laser-firing vehicles, robots that talk and analyze voice patterns, computerized hovercraft that shoot photon torpedoes—are these new secret weapons commissioned by the

Pentagon? Not quite. They represent a new generation of computer toys that may change the way children play. This month *Omnibus* provides a detailed look at some of these revolutionary devices, all of which you'll find appearing on department-store shelves this holiday season. Break out the shopping lists and turn to "Cyber Fun!" Special-effects photographer Peter Tomar provides the graphics (page 90).

James Gelton previews the upcoming science-fiction and fantasy films for 1980 in *The Arts* (page 20). Deep in numerous delays caused by the mad rush to beat one another to the screen, Dolson reports that motion-picture companies are now prepared to release the long-awaited *Star Trek: The Motion Picture*, *The Black Hole*, and *The Empire Strikes Back*.

Headlining this month's fiction is the exciting conclusion of Robert A. Heinlein's "The Number of the Beast" (page 58). Joyce Carr marks her *Omnibus* debut with an extraordinary tale about childbirth (or lack of it) in the not-too-distant future ("Malthus's Day" page 76).

Rounding out our November issue is an exclusive interview with Dr. Carl Sargent, the first man ever to be granted a doctorate in parapsychology by Cambridge University, England's grand old academic institution. Dr. Sargent's controversial techniques to determine the reality of ESP have created quite a stir in British scientific circles. Find out why in this intriguing probe by contributing editor Christopher Evans, on page 60. **DO**

FORUM

In which the readers, editors, and correspondents discuss topics arising out of *Omnis* and themes 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 *Omnis* Forum, *Omnis* Magazine, 909 Third Avenue, New York, NY 10022.

Antiquarian Vibes

With all due respect to Carl Sagan as a probing and speculative professional, I am surprised that in his "White Dwarfs and Green Men" (August 1979) he fails to acknowledge the possibility that if extraterrestrials did indeed visit Earth in the past, they may not have been even slightly interested in leaving a purposeful incision and explicit marker for a future society to marvel at. Chances are that an extremely superior technology would not be impressed with just another outlying barbaric planet. Let's face it: our civilization, in general, has been no great joy to deal with—an attitude well defined, say by Charlton Heston in *Planet of the Apes*.

Stan K. Stephenson II
Berkshire, Fla.

I was intrigued by Carl Sagan's article "White Dwarfs and Green Men" and would like to add some information that I feel supports the notion that Sinus B may have been a red giant in earlier times. In 1662 Antoine Arnaud, a French Renaissance philosopher, wrote a book entitled *The Art of Thinking*. In it is a passage by Vergil that reflects the belief of the people of that day who credited the Dog Star, called Sinus in Latin, with the heat of August.

Even as fiery Sinus
Beaver of drought and plague to teeming man
Rises and saddens the sky with baleful light.

(Aeneid X, 273—75)

The key word here is fiery. Webster defines this word as "of the color of fire, intensely or unaturally red."

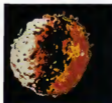
Don Peterson
Los Angeles, Calif.

Natural Defense

In regard to Douglas Gaerner's article "Interferon and Beyond" (July 1979) I must say that while the information contained therein is rather interesting, it leads one toward unwise goals and hopes for the future.

Gaerner fails to comprehend the implications of the discovery of interferon as being part of the cells' natural defenses. He fails to realize that interferon, in conjunction with the body's other means of defense, known and unknown, will fulfill its function under normal circumstances, thus making laboratory production of the substance superfluous. The body is capable of defending itself against the external (and often internal) threats of bacterial, viral and fungal attack, as well as the basically internal threat of cancer. Colds, diabetes, mellitus, angina pectoris, arthritis, cancer and so on—which we call disease—are more manifestations, symptoms, if you will, of disease. They indicate a lack of ease or a lack of health. It is interference with the nervous system, that which maintains and controls every cell in the body that causes this lack of ease. Perhaps we should look to the removal of this interference in the functioning of the nervous system in order to attain and maintain good health. Perhaps we should look to chiropractic rather than to immunology.

In spite of all the amazing strides that



Cancer cell under attack by lymphocytes

science and technology have made (recorded in the pages of *Omnis* and other publications throughout the world), no scientist has been able to create a living organism—not even a single cell! Independent of the crude and meager assistance of any scientist, there exists a life force, an innate intelligence that should be recognized and respected. It is the force that unites the sperm and the ovum to form the zygote that will divide and differentiate until we see an adult. Homo sapiens, of between 25 and 40 quadrillion perfectly coordinated cells of varying and specific form and function. But if there is interference with the nervous system,

Donald E. Harte
Great Neck, NY

Nothing Ventured, Nothing Gained

Having been employed as a co-op student in an engineering branch of NASA's Marshall Space Flight Center, I must heartily agree with all the points covered by Mr. Grey's article (First Word, August, 1979).

We cannot blame NASA, and not even Congress, which has NASA's budget for our declining space program. American society is at fault—public apathy toward the once-glorious space effort has reached its zenith. I frequently hear from people "We landed on the moon, didn't we? What else do you want?"

To these same people I say: What do you want? To be a citizen of the most militarily secure nation on Earth? To live in a country that enjoys the prosperity and comforts of worldwide technological leadership?

No American would deny having these desires, but so pitifully few recognize the direct link between these aspirations and a conscientious space program. I would especially like to commend and encourage *Omnis*'s maintenance of pro-space attitudes. Encouragement of NASA's objectives is crucial to our nation's economy, security and scientific advancement. Come on, America! Nothing ventured, nothing gained!

John Vassar
Atlanta, Ga. CC

EARTH

By Kenneth Brower

On January 5 of this year the anti-nuclear activist David Dinsmore Corey was killed in an automobile crash in Wisconsin. No one has hinted at foul play as many have in the death of Karen Silkwood, another anti-nuclear activist killed on the highway. This absence even of hints is sad. It points to a failure of imagination in the antinuclear movement—a failure coincident with Corey's departure. It never would have happened had Corey been around to elaborate a theory for his death.

David Corey was a paradox, deliberate and self-made. He was an environmentalist who dressed like a captain of industry, an outrageous hyperbole (when playful) with a passion (when serious) for the truth. Corey's account of *The Death of Corey* would have been outrageously larded and funny, but it would have left you wondering whether it might, after all, be true.

"He was one of the most effective in seeking out the vulgar vulnerability of nuclear power," says Dr. John Golman, a former member of the Atomic Establishment, now one of its foremost resistors. "Corey was colorful, dogged, persistent. He kept an air of joviality throughout it all. He wasn't the paranoid crusader."

"He had an insatiable appetite for the facts, pleasantly favored with humor—sometimes devastatingly flavored," says David Brower, president of Friends of the Earth. "If he had lived a little longer, he might have named some corporate heads into being ethically responsible. More than anything, we needed him to take on [James] Schlesinger."

"Electrical utilities building or planning nuclear-power plants would probably do well to try to understand David Dinsmore Corey and what motivates him," the trade journal *Nuclear Industry* reported in 1975. The journal called Corey "the most formidable—because perhaps the most rational or at least the most sharply focusing—foe of nuclear power." In 1974 the Environmental Protection Agency presented Corey with its first annual Environmental Quality Award "for services

that have immeasurably improved the design and safety review of nuclear reactors."

One of those who worked most closely with Corey was Jim Harding, formerly an energy adviser to the state of California now energy director of Friends of the Earth.

"When I first met David," Harding told me recently, "I suspected some lean young environmental activist. Instead, here was this well-fed Chicago beefsteak. There are such lies about David, with his handmade suits, his gold pocket watch and chain, his bowler hat, his Cross leather luggage, his Dunhill pipes, his Gucci shoes—real Gucci loafers—that I'm both believing and disbelieving. You get from his tales the same things you get from his clothes. You don't quite believe, though it may all be true."

(Harding's slip into the present tense surprised me. The past tense he must have felt, hurled Corey like mortar, too quickly toward oblivion.)

"David has a very incisive wit. He cuts to the bone analytically in his writing and thinking. He found the holes in reactors."

He was fluent in Russian and German.



Corey's prophecy came true at Harnsburg

He had a B.A. in philosophy from Princeton, and he taught the philosophy of science for a while at Cornell. He came around a briefcase saying, "CIA Legal Department." He said he had been in the CIA in Geneva.

"He told me he had found evidence of a Swiss atomic weapon. He said he was diving once in Switzerland on a high mountain road. A piece of the earth moved aside, and a couple of strategic warplanes came out of the side of the mountain. He found out later that the mountains of Switzerland are full of tunnels—long ones half a mile or more—so the planes could build up speed before coming out."

I asked about this story. Harding saw me smile and smiled himself, but was widely. He had been there to hear Corey tell the tale, in all its Corey verisimilitude and detail, and he could not demure it entirely.

David Corey played a spy. He had code names for the people inside the Nuclear Regulatory Commission who sipped him information ("My contacts in the NRC"). His old employer, the CIA, was "The Company" or "Acme Plumbing Company." He called himself "Dinsmore," or "Eise Dinsmore Corey," or "Peter Rabbit." Communiqués from Peter Rabbit were signed with a paw print. "Shred this," recipients were sometimes instructed. With Jim Harding, whom he code-named "Green Hornet," Corey sometimes called himself Broderick, because Harding had once accused him of looking like Broderick Crawford in *All the King's Men*.

Corey entered the nuclear controversy in 1968, when the New York State Electric and Gas Company announced its intention of building a nuclear reactor on Cayuga Lake, near Cornell, where Corey was director of the Research Institute on Soviet Science. He became chairman of a local group worried about thermal pollution of the lake. (He was not concerned yet about reactor safety.) His method of attack was worthy of an ox-dirty fuck artist with the CIA. He studied *Who's Who* for details about members of the board of New York Electric and Gas, and he interviewed friends of board families. He established a profile

CONTINUED ON PAGE 134

THE SHRINKING SUN

SPACE

By Mark R. Chartrand III

Jack Eddy thinks the sun is shrinking. If it is, this gradual contraction could be the current source of all solar energy. It would also be yet another example of erratic behavior on the part of our local star, which until recently we thought was well behaved.

The sun's energy source has long been a subject of study. Most of the ancients simply thought of the sun as a glowing ball of fire. Others thought it was a huge piece of burning wood. The Industrial Revolution ushered in the image of a lump of coal. But wood and coal were much too weak to furnish such heat and light.

The last half of the nineteenth century and the first part of the twentieth saw a vigorous debate. The German Hermann von Helmholtz and the Englishman Baron Kelvin proposed that the sun was shrinking. A large gas sphere, such as the sun, can shrink, turning gravitational potential energy into heat energy. The sun would have to shrink only a very very small amount each year to supply all the energy we measure coming from it.

But if it were shrinking, it would have

been larger in the distant past. In fact, only a few million years ago the sun would have been the size of the entire solar system. Fossil evidence shows Earth has been around far too long, and the Helmholtz-Kelvin theory had to be dropped.

Over the years other ideas popped up. Meteors might hit the sun and heat it, but there aren't enough meteors to do the job. Radium and uranium fission could produce heat, but there isn't enough of these elements in the sun. Some subatomic process might do it, but no one could think of a mechanism.

Finally, in 1938, Hans Bethe discovered a series of nuclear reactions that could explain the enormous amounts of solar energy that are produced at the 15-million-degree-Celsius temperature known to exist at the heart of the sun. Bethe's scheme has been found to apply in larger stars than our sun, and the fusion of light elements to make heavier ones, releasing energy, is operative in the sun. Or so we have thought.

In the string of nuclear reactions that eventually produce helium from hydrogen,

a couple of elusive atomic particles, called neutrinos, are created. They have no electrical charge and can pass through most matter almost unimpeded. Billions penetrate your body each second. A neutrino could pass completely through the earth with only one chance in 10 billion of being stopped. Yet we can detect neutrinos with surprisingly little trouble.

Physicists from Brookhaven National Laboratory on Long Island, recently built a neutrino "telescope" in a gold mine far underground in South Dakota to shield it from normal cosmic rays, which would give results like those produced by neutrinos. If the sun is heated by fusion, the experiment should detect a certain number of neutrinos per day.

What the scientists found was only a fifth of the number expected.

There could be several explanations. We may not understand the physics of neutrino production or detection. Or the temperature inside the sun—and hence the rate at which the nuclear fires produce energy—is much lower than we thought. Both may be correct.

Enter Jack Eddy's discovery. He looked into measurements of the sun's size made at England's Greenwich Observatory from 1863 to 1953. The original data were collected by measuring the edges of the sun to determine solar time very precisely.

What Eddy found was a slight shrinkage, about 0.1 percent per century. That's only about 13.7 kilometers per year, but more than enough to supply the solar energy by the mechanism Helmholtz and Kelvin proposed long ago. Perhaps the nuclear fires are banked, or temporarily turned off. Perhaps gravity alternates with nuclear power in providing the energy.

Other studies over the past century hint that the sun's energy output may be becoming slightly reduced. Over the past few billion years the sun's energy cannot have varied very much, or we wouldn't be here now. But maybe it varies a little. The situation is anything but clear.

Eddy has fomented a revolution in solar physics. Our complacency about our parent star has been shattered, and the answers are not yet in. But solar physics has again found a place in the sun. ☐



The sun's fusion fires supply all our heat and light, we thought. Now it seems they're going out.

BLINDED BY THE BLIGHT

LIFE

By Dr. Bernard Dixon

When the impossible is eliminated, what must be left is the truth, however improbable. Sherlock Holmes once told his loyal assistant, Dr. Watson, it is not every day that a scientist cites this aphorism in a learned journal, but an oyo specialist at the University of Glasgow did just that. The quotation was rightly apposite, because his story—and its conclusion—has more in common with an adventure of the great English detective than with the sober deliberations of many present-day researchers.

The tale began when Stephen Cobb was lecturing young teachers about defective color vision. He alerted them to the possible damaging influence of the handicap on their students' careers and explained how to diagnose it with the colored lantern plates.

The following week a teacher reported to him that 5 of the 15 boys in her class and 2 of the 14 girls were color-blind. This seemed rather unlikely because earlier surveys had shown the rate of color blindness to be minimal in that part of Scotland. Cobb asked the teacher to check her results. A week later she confirmed his once more. She had tested all the students in the school, and 29 percent of the boys and 6 percent of the girls were color-blind.

Still far from convinced, Cobb and the head of his university department, Professor Ralph Pickford, decided to investigate for themselves. The result? In all but one case the previous diagnosis of defective color vision was borne out.

At this point the researchers could think of only two remotely plausible explanations for the astonishing number of pupils at the school handicapped in this way. Perhaps close inbreeding had occurred over several generations on the estates from which most of the children came. Second—an even more bizarre notion—perhaps the very high proportion of Roman Catholics among the students was an influential factor. Could religion be linked to defective color vision?

It soon became evident that the first idea was absurd. Cobb's calculations

showed that an incredible degree of inbreeding would have been necessary to produce the observed frequency of color blindness. Not only would the number of illicit relationships have been unbelievably high, but conditions such as hemophilia would have reached such epidemic levels as to create a major public-health problem in the sector of Scotland under Cobb's scrutiny.

Was there really any ophthalmological significance in Roman Catholicism? Do adherents of this church generally have a higher incidence of color blindness? Or were the inhabitants of the area descended from a population disproportionately afflicted by the condition? Widening his field of study, Cobb turned to another school, which he understood was in a cosmopolitan area of Glasgow. There he discovered that 17 percent of the males were color-blind.

Then it turned out that he had been wrong about the history of the area, which in fact contained a significantly large proportion of people descended from those who migrated to Scotland from Ireland after the Irish "troubles" at the turn of the century. I had asked the right question for the wrong reasons, found the right result, and interpreted it wrongly until I [went] back and found my initial assumption, on which I had based the

experiment, to be incorrect." Cobb writes in *The Optometric Optician* (Vol. 19, page 262). This, I suppose, is where any self-respecting scientist should go and hang himself, or at least have a good think.

As the scope of the survey broadened a link with immigration from Ireland became more and more convincing. That was the common factor in all of the areas where defective color vision was unusually prevalent. But the theory was not yet fully supported. Cobb needed to look at another region, one where the population could be divided into Celtic and non-Celtic, on a basis entirely separate from any religious affiliation. He was able to do that on several Hebridean islands, where he maintained a practice and could simply ask about the forebears of people waiting him for an eye examination. The results confirmed Cobb's hypothesis. The ophthalmologist is now convinced that there are many communities in Scotland whose defective color vision is strikingly common, and these are composed of folk descended from Irish immigrants arriving at the turn of the century.

But why? Just as the potentially fatal sickle-cell trait protects carriers against malaria, the abnormality of color vision may have become more common by selection, among people on whom it conferred some unrelated advantage. No such benefit could be found. Then one of Cobb's students, James Binney, suggested another explanation—a fantastic one, but one that has stood up to critical scrutiny. The political troubles in Ireland coincided with the horrendous failure of the potato harvest. Conceivably many of the people who left Ireland were those who, because of defective color vision, could not pick out the good potatoes from the bad. At first, Cobb and Binney treated this as a flippant flight of fancy. Now they are less inclined to be so dismissive. The number of immigrants at the time of the blight, and the genetic analysis of their descendants, does indeed suggest that Binney's idea may be correct. Fact, to be sure, is often stranger than fiction. **DD**



Pupils with defective color vision could not see the numbers in the dotted circles and squares.

THE ARTS

By James Deison

In *Omei's* first issue a year ago I surveyed the upcoming science-fiction and fantasy films. That column covered a total of 26 pictures; only a fraction of the 72 already released at the time of this writing. This month we'll update last year's list and look at what's in store for 1980.

Though science-fiction films have only begun to establish themselves as serious drama, they have proved fiscally sound. One SF film or another topped Variety's weekly list of 50 top-grossing films more than half the time. An average of 2 pictures appeared in the top 5, 3 in the top 10, and 5 in the top 20 weekly for the past year.

Though none of these films has garnered the incredible box-office profits of the earlier *Star Wars* and *Close Encounters of the Third Kind*, several—notably *Superman*, *Moonraker*, *Alien*, *The Amityville Horror*, and *Love at First Sight*—grossed between \$30 million and \$100 million each. Another dozen grossed more than \$10 million, and 12 more topped \$5 million at the box office. These unprecedented figures have made 1979 the most successful year in the history of science-fiction and fantasy films.

SPACE OPERAS

Following the awesome *Star Wars*, released in May 1977, it's hardly a surprise that no film has been able to match its thrills and excitement, although 11 have tried in the past year. The best in the field, *Alien* (20th Century-Fox) and *Moonraker* (United Artists), were original in concept, artful in presentation, and effective as lightweight summer entertainment.

The incessant nature of the special-effects field was obvious. *Moonraker's* director, Derek Meddings, was winner of this year's Academy Award for *Superman*, and *Alien's* team shifted over almost intact to *The Empire Strikes Back!* Additional nods go to the outstanding creative talents of director Ridley Scott for his marvelous vision of space in *Alien* and to Ken Adam, production designer of *Moonraker*, the most complex film in the very complex James Bond series.

The remaining space operas brought

out during *Omei's* first year were generally low-budget spinoffs of *Star Wars*, with little original thought given to character effects or plot. *Space Cruiser* (Fox Company Ltd.) presented an animated story of intergalactic warfare between sophisticated alien ships and the World War II Japanese battleship *Yamato*, raised from the floor of the Pacific and refitted for space travel. *The Shape of Things to Come* (Allied Artists), bearing virtually no resemblance to the outstanding film made in the 1930s under the guidance of H. G. Wells, was produced in Canada with bargain-basement effects and production values. The others were no better.

Battlestar Galactica (Universal), *Buck Rogers* (Universal), and *Destination Moonbase Alpha* (ITC), a feature-length version of the *Space: 1999* series, were originally produced for television, then shown in movie houses to capitalize on popular interest. Though their excellently produced special effects worked on television, the enormous blowup to the big screen lacked the detail and excitement of films produced for release to theaters. By comparison, the rerelease of the original *Buck Rogers* (Crystal Pictures) proved

that if a film has spirit and charm, its shoddy effects, production values, and nonexistent acting can be overlooked.

The element of wonder so essential to this kind of film, was sorely lacking in most of 1979's space operas, and its absence made them more wooden and less charming than they should have been. It doesn't take a big budget to create character or to simulate hardware, as evidenced by *Dark Star*, the cult favorite that cost under \$100,000 in 1975.

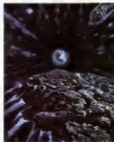
Most important, most anticipated, and most welcome of the films now in production is *The Empire Strikes Back!* (20th Century-Fox), the sequel to *Star Wars*. Reuniting the original cast (with the voice of Alec Guinness), the new film features more mythic creatures, battles on an ice planet, and effects that promise to outdo those of the original. Hold your breath until May 25.

Most of the big-budget hardware films now in production have had their share of postponed starting dates, replaced directors, dismissed effects teams, and canceled openings. Much of this trouble could have been avoided had there been proper preparation, which the rush to beat one another to the screen blushed aside. *But Star Trek: The Motion Picture* (Paramount), *The Black Hole* (Disney), *Milob* (American International), *Saturn 3* (ITC), and *Flash Gordon* (Dino De Laurentis) are all finally on their way to general release.

The sole low-budget entry confirmed in the space race is *Battle Beyond the Stars* (New World), a derivation of Akira Kurosawa's *The Seven Samurai*. Other inexpensive space operas will appear throughout the year from Italy, Japan, and the United States. You can expect revivals of classics as distributors learn that audiences want to see good films, not just new ones.

ALIEN INVASIONS

Films about alien invaders have usually been low-budget horror quickies, with a biped monster carrying off a scientist's daughter and with the rest of the world trying to blow the creature to smithereens.



Nebula: the threat to Earth from outer space

The year there were a few switches on the basic theme, including one of the year's top films, Philip Kaufman's remake of *Invasion of the Body Snatchers* (United Artists). Extraterrestrial seed pods travel through space and sprout on Earth, taking on the form of human beings and compelling the population to their will.

The continuing phenomenon of the Rocky Horror Picture Show (20th Century-Fox) bears mention here. Produced in 1975, but never given a regular commercial release, it has been playing once or twice a week in midnight shows across the country ever since. A marvelous, campy musical satire on science-fiction films, with book music and lyrics by Richard O'Brien, the film has grossed well over \$10 million to date.

With the film companies putting their big money for the next season behind space operas, little was left over for horror chills. *The Dark* (Cinema Shares International) was originally planned as a project for Tobe (The Texas Chainsaw Massacre) Hooper, but Hooper dropped out just before shooting began, leaving the rest of the production team to cope with an alien who chops off people's heads or kills them with his laser vision. *The Gendarme and the Extraordinary*, a French comedy about aliens invading the Riviera, has already outgrossed *Superman* in France. *Time Warp* (Compass International) will be a tale of intergalactic travel through a "dimensional whirlpool." Fans suggest that flying saucers are still visiting Earth.

SCIENCE GONE AWRY

Despite all the publicity nuclear power has received in recent years, it took two accidents to bring the problem to the fore this year. If *The China Syndrome* had been released after the Three Mile Island accident, it would have been considered a

no-op. If there had been no film, the excitement might have died down sooner. But the coincidence of the film's release just before the near meltdown in Pennsylvania meant additional press for both. *The China Syndrome* might have been just another melodrama. Instead it became one of the year's most important films.

Science bungled or misused also figured in a number of other films released in 1979. There were horrific cloning experiments to resurrect the Third Reich in *The Boys from Brazil* (20th Century-Fox), more Obermarchon's machine to create water-breathing soldiers in *Shock Waves* (Cinema Shares International), a mutant created by industrial waste in *Prophecy* (Paramount), and an astronaut afflicted with a disease that forces him to eat human flesh or else disintegrate in *The Incredible Melting Man* (American International).

Next year's films seem primarily concerned with the brain, but other focuses share the spotlight. *Altered States* (Warner Bros.) presents a somewhat metaphysical transformation of man into primate. Directed by Kon Russell from a screenplay and novel by Paddy Chayefsky with special effects by John Dykstra, it looms as one of the year's major pictures. *Meltdown* is a nuclear accident drama written and directed by John Carpenter, one of the hottest young directors in the business since his successes with *Dark Star*, *Assault on Precinct Thirteen*, and *Halloween*.

Originally scheduled for Carpenter but now lacking a director is *Brainstorm* (Sandy Howard Productions), a murder mystery with genetic overtones. *Death Match* deals with neurological death in a deathless society. *Human Experiments* examines a psychotic prison psychiatrist

who plans to reform criminals from their antisocial patterns by reworking their brains through extreme mental cruelty.

The incredible Hulk (Universal) will be adapted from TV for European distribution. *The Fishermen* will follow in the wettest footsteps of *Snock Waves*, showing men "created" to work underwater who prove to be more trouble than expected. *The Incredible Shrinking Woman*, starring Lily Tomlin, will finally go into production in January. *And Simon* (Orion), the first film written and directed by Marshall Brickman, will examine computer manipulation.

THE SUPERNATURAL

Receiving only average attention before its midsummer opening, *The Amityville Horror* (American International) has turned out to be one of the year's top-grossing films. A "true" story about a house containing the "ancestral to hell," it was dramatically disappointing because once the entrance was shown, no one had the guts to go and see what things were like down there. Perhaps in a sequel?

Other major titles this year included *Carpenter's Halloween* (Compass International), a film that cost \$320,000 but that has grossed 50 times that at the box office. Its ratio of dollars spent to dollars earned makes Carpenter the most successful filmmaker of the year. *Dead of the Dead* (United Film Distributors), the second of the three "Dead" films directed by George Romero, grossed audiences out for the sheer amount of blood and brains spilled and made a lady profit at the same time. *The Exorcist* (Warner Bros.) was released this summer with a newly mixed sound track, which improved its already excellent production values. And though it received little notice from general audiences, *The Wicker Man* was a remarkable story of paganism by Anthony Schäfer, author of *Sleuth*.

Most supernatural stories seem to emerge from the woodwork, play out their brief runs, and then migrate to television; they don't have a lot of advance publicity. Only two films of any consequence have been announced in this genre: Stanley Kubrick, the world's leading director, even though he produces films only two or three times a decade, is re-doing *The Shining* (Warner Bros.) for showing next spring. Based on the terrifying novel by Stephen King, the Kubrick film stars Jack Nicholson and Shelley Duvall. Carpenter, who is suddenly everywhere at once, is presenting his new supernatural suspense film *The Fog* (Aeco Embassy), early in the year.

Whether by coincidence or through timely planning, the past year has seen 12 vampire films in circulation. The best of the lot, John Badham's *Deliverance* (Universal) starred Frank Langella as the count and Laurence Olivier as his nemesis, Van Helsing. With stylish, though mediated, sets and costumes and excellent matte work for the background, the film just



In *Return of the Robots* both help and hinder the film's stars, Fenish Fawcett and Ash Douglas.

mased being a classic. Though many thought the campy vampirism of *Love at First Bite* (American International) would be too ghastly for a mass audience, it turned out to be one of the year's biggest hits.

The other films in this year's cycle of vampire pictures comprised a mixed bag of comedy drama and rip-off: Werner Herzog's almost shot-for-shot remake (20th Century-Fox) of F.W. Murnau's silent classic *Nosferatu* was a lifeless letdown. The only saving grace of three cheap exploitation films *Mary, Mary, Bloody Mary*, *Vampire Hookers* (Capricorn Three), and *Nocturne* (Compass International) was John Carradine's playing Dracula in all of them. *Nightwing* (Columbia) was a tale of vampire bats. *Count Dracula* and *His Vampire Bride*, starring Christopher Lee and Peter Cushing, the leading lights of the horror-film field, was a disappointing story with dated effects. That was the first Australian vampire film, and *The True Story of Dracula*, a Romanian picture, was the first historical reexamination of the life of Vlad the Impaler, who inspired the Dracula legend.

Though no further vampire films have begun production, four pictures have been announced: *Divorce, Vampire Style*, a sequel to *Love at First Bite*; *Interview with the Vampire* (Paramount), based on the best-seller by Anne Rice; *Salomè's Lot* (Warner Bros.), based on Stephen King's novel, and an untitled film to be directed for American International by Roger Vadim.

DOCUMENTARIES

Neglected for the past decade, the documentary seems to be on the ascendency again, especially in science. *Dolphin* was a well-intentioned but covering attempt to portray the creature

in a friendly light. *Genesis*, produced for the William L. McKnight Omnitheater at the Minnesota Science Museum, was an incredible success. *Germol* (New Line) was a history of creative inventions. *The Late Great Planet Earth* (Pacific International), narrated by Orion Welles, featured productions from the last book of the New Testament and a semidocumentary look at the end of the world. *No Act of God* (National Film Board of Canada) stirred up a controversy in Canada because of its forecast that the spread of nuclear power could lead to an increase in terrorism.

The Space Movie, the only upcoming documentary on the list, is a compilation of U.S. and Russian space footage, with music by Mike Oldfield. It's being billed as "the most expensive film ever made" because of the amount of money that was spent in putting the cameras into space to photograph its wonders.

FANTASY

Fantasy films are slowly gaining in budgets, creativity, and a audience level, and may rival the hardest film for leadership during the 1980s. There are three reasons why fantasy is on the rise: *Superman* (Warner Bros.), the most popular film of the past year; *Lord of the Rings* (United Artists), which proved the potential of animation in mass-market adventures; and *Quintet* (20th Century-Fox), which, although a box-office failure, was the first of the new fantasy films to attract the talents of a leading "art" director, Robert Altman.

Some other popular films this year were *Time after Time* (Warner Bros.), Nicholas Meyer's tautful tale of H. G. Wells chasing Jack the Ripper through time, *Amecation* (United Artists), a comic swipe at telethons, the government, and

the futuristic sci-fi action film, and *Magic* (20th Century-Fox), with Anthony Hopkins's brilliant portrayal of a ventriloquist slipping into disastrous schizophrenia.

On the lighter side there were *Meltemiopolis* (Santo Films), an animated retelling of five mythical stories by Ovid, and undisciplined *Flying Oddball* (Buena Vista), a switch on A Connecticut Yankee in King Arthur's Court, in which an astronaut crashes back through time and bedazzles the English king and his entourage with magic from the future.

The coming decade will see the blooming of a new fantasy cycle, with such leading directors as Ridley Scott, Altman, John Boorman, and John Milius approaching material that until recently would have been considered box-office poison. Two years ago, the major studios began to give space operas newsworthy budgets, stars, and directors. Now they are doing the same for fantasy. Ten are already under way, with more to follow.

Due out this month is "347" (Universal), Steven Spielberg's answer to *Animal House*, the *Second World War*, and movie heroism. It's based on an off-the-wall story by Milius (who produced the film) called "The Day the Japs Arrived."

This spring will see the arrival of a host of effects-oriented fantasies: *Arabian Adventure* (Orion), a Star Wars-esque story in which flying carpets invade spaceports; *The Day the World Ended* (Warner Bros.), the newest disaster epic from Irwin Allen, creator of *The Poseidon Adventure* and *The Swarm*; and *The Phoenix*, a classical adventure starring Richard Kiel.

Scheduled for release in two years are *Superman II* (Warner Bros.), *Clash of the Titans* (MGM), a multimillion-dollar extravaganza with special effects by master animator Ray Harryhausen, *The Final Countdown* (Bryna), a story of nuclear confrontation starring Kirk Douglas, *The Questers' Conclusion*, a British television miniseries destined for theater release in the States, and *Somewhere in Time* (Universal), a love story with overtones of time travel, starring Christopher Reeve (*Superman*).

Due to enter production within the next year are blockbusters that will test the strength of big-budget fantasy: *Merlin and the Knights of the Round Table* (Orion), a retelling of the Arthurian legend by director Boorman; *Dune* (Orion DeLaurentis), with a screenplay by Frank Herbert, based on his novel; *Conan* (Orion DeLaurentis), the ultimate in sword and sorcery, now being prepped for shooting by director Milius; *Robot* (Warner Bros.), an adaptation of Isaac Asimov's stories, and possibly the year's most bizarre project, a lavish, live-action musical version of *Popeye*, under Altman's direction, with a screenplay by Jules Feiffer and music by Harry Nilsson, starring Robin Williams. ☐



H. G. Wells pursues Jack the Ripper through the centuries in Nicholas Meyer's *Time after Time*.

It's five miles wide...it's coming at 30,000 m.p.h....
and there's no place on Earth to hide!

METEOR

SCREENED / ADAPTED BY SANDY HOWARD
A SANDY HOWARD / BARBRIE KATZKA / SID HUN BUN SEGA Presentations
SEAN CONNERY - NATALIE WOOD
KARL MALDEN - BRIAN KEITH
METEOR



STORY BY MARTIN LANDAU DIRECTED BY TREVOR HOWARD
CASTING BY RICHARD DYSART COSTUME DESIGNER HENRY FONDA
EXECUTIVE PRODUCERS SANDY HOWARD AND GABRIEL KATZKA
PRODUCED BY JERE BENSCHAW
SCREENPLAY BY LAURENCE ROSENTHAL
DIRECTED BY STANLEY MANN
EDITED BY EDMOND H. NORTH
EXECUTIVE PRODUCERS ARNOLD BORGOLINI AND JUDITH PARSONS
DIRECTOR OF PHOTOGRAPHY RICHARD NEAME
MUSIC BY AMERICAN INTERNATIONAL
DISTRIBUTED BY AMERICAN INTERNATIONAL
CAST BY PAUL HORNBERG

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NOW PLAYING — CHECK NEWSPAPER FOR THEATRE NEAR YOU

SPEAKING ENGLISH IN SPACE

STARS

By Patrick Moore

Last July 18 the Soviet Union sent the first full-sized radiotelescope into space. The device, KRT 10, is a ten meter parabolic antenna backed by sensitive multichannel receivers and every other "mod con." It was taken up by the unmanned space freighter Progress 7 and turned over to cosmonaut Vladimir Lyukov and Valeri Ryuren in the Salyut 6 station. It is being used in partnership with a 70-meter dish located in the Crimea.

The system has one telling advantage over previous equipment. The longer an antenna system's "baseline" (the distance between its separate radiotelescopes) the more detail it can perceive. And at times KRT 10 and the Crimean instrument will be separated by a full 10,000 kilometers. This combination should be able to pinpoint small radio sources very precisely, perhaps even to measure their diameters.

Personally I'd like to look further into the radiotelescope's future in space. Will they ever pick up intelligent signals from other stars? That is their greatest promise.

The trouble is, light pokes along at a mere 300,000 kilometers per second. Send a message to say "Au Get—one of the nearest stars similar to our sun and one that could well be ringed with planets—and you can't hope for a reply in less than 22 years. If Tau Cetians could pick up our television programs, they would not yet have seen Neil Armstrong step out onto the surface of the moon. Beyond about 70 light years, no one can

know anything about our civilization. Powerful radio transmissions first left Earth much less than a century ago and have not yet penetrated far into space. To be going on a planet circling the star Altair, 210 light-years away, Earth would still be absolutely "radio quiet."

And yet, according to modern physics, radio is our only hope of picking up an intelligent signal from space. Sending an interstellar probe would take too long—roughly 50 years even for nearby Alpha Centauri—even if we had the technology and funds to accomplish it. But radio is too slow for much dialogue. The most we can hope for from it is to establish the existence (or more accurately the former existence) of another civilization.

It's quick, convenient exchanges we want. We must look into such exotic techniques as telepathy and teleportation. I am no believer in flying saucers, but I doubt that contact by one of these unproved technologies is quite out of the question. (In fact I would not even discount the possible existence of flying saucers. I simply don't believe that there is any valid proof that we have been visited by them. We may yet find such proof.)

Then what about communication? I'd like to suggest a possibility that may sound outrageous. I maintain that it is entirely sensible. I believe that if aliens can get in touch with us directly—and have any wish to do so—they will contact us in some recognizable language; and they

will most probably choose English.

Let's assume that a "manned" probe has arrived from some planet orbiting a distant star. (Just how it makes the journey is irrelevant. Assume that they use teleportation, if you like.) The first thing our visitors will do is hide until they find out just what kind of beings we are. If they arrive in the middle of a global war, they may decide to sneak away and hope that we remain isolated.

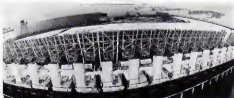
If they decide to approach us, though their best technique is not hard to figure, beings intelligent enough to make an interstellar voyage without taking thousands or millions of years about it should surely have no trouble learning our speech. Still unannounced, they will monitor our radio and television stations, recording our languages. Eventually they will select one to use in contacting us. I propose English partly because it is used all over the world and partly because, as an Englishman, I find it much more logical than any other tongue.

Picture the scene aboard the alien ship. Linguists will hold earnest classes. Crew members will struggle to pronounce our words recognizably. Conversations will be held, and tests will be administered. At last there will be enough English-speakers to cope with any emergency. Then they will reveal themselves.

Of course they will face problems other than language, especially if they look too complexly inhuman. But if the alien ship can land, bearing out greetings in plain English, we will at least have proof that we are dealing with beings as rational and intelligent as we are. In fact, they will almost certainly be a great deal more rational.

Today this is only a fantasy. Someday it could be far more. When contact is made, if it is made, language will be a vital key to interstellar friendship. An alien who steps from his spacecraft, waves his tentacles and says, "Wazzik booy colig?" will be met with fear. If he bows politely and says "Good morning, I am from Delta Pavonis C. May we disembark, please?" he will be treated with respect.

At least, I hope he will. ☐



Life in space may first appear in a radiotelescope, the USSR's Ratan-600 is the world's largest

ALIEN METALS

UFO UPDATE

By Harry Leibelson

Physical evidence remains the decisive factor in the search for UFOs, but would finding it really be enough to prove their existence? People assume that if the evidence itself were alien to anything we know on Earth, verification of its being extraterrestrial would be immediate. If however the article were made of materials familiar to us, its authenticity would likely be doubted.

This problem surfaced recently when *Omni* acquired two metal samples purported to be extraterrestrial. The bizarre circumstances surrounding their discovery led the magazine to commission an analysis of the samples by the Massachusetts Institute of Technology (MIT) in Cambridge. To understand better the significance of both specimens some background regarding their appearance is in order.

The most intriguing of the two specimens is the Ubatuba, Brazil, magnesium sample, reputed to be part of an unidentified flying object that exploded off the coast of Brazil in 1957. The other specimen, a seven-centimeter metallic bar etched with symbols, allegedly materialized in the Charleston, South Carolina, home of William Hoffmann. The metal ingot is supposedly a "gift of friendship" from extraterrestrial visitors.

On September 14, 1957, Ibrahim Sued, a well-known Rio de Janeiro columnist received a strange letter from one of his readers. A fisherman who was fishing with some friends near the town of Ubatuba, São Paulo, Brazil, reported that they had seen a disk maneuvering at unbelievable speeds in the sky. Suddenly the object made a sharp upward turn, climbed rapidly and exploded into flames, sending thousands of fiery fragments into the sea. A small number of these pieces fell close to the beach and were picked up by the fishermen. Three small fragments were sent to Sued, who sent them to the late Dr. Olavo Fontes, the Brazilian representative of the Aerial Phenomena Research Organization (APRO). The fragments were of a lustrous, dark gray and highly oxidized metallic substance. A white,

powdery substance was seen in the cracks of the samples.

Upon receiving the pieces, Fontes kept one and sent the two others to APRO in Tucson, Arizona. In an attempt to analyze the material, Fontes submitted his sample to the National Department of Mineral Production of the Agricultura Ministry of Brazil. Dr. Lusa Maria A. Barbosa, a chemist-technologist, reported that "the spectrographic analysis showed the presence of magnesium of a high degree of purity and the absence of any other metallic element." To ensure the accuracy of this report, an additional spectrographic analysis was made by Elson Tewars. He stated that "the spectrographic analysis identified the unknown metal as magnesium and showed it to be absolutely pure. No impurity or other metal was detected in the sample analyzed, even trace elements usually found with any metal, were not present." Additional analyses were made of the metal, two of which were done by the Brazilian Army and Navy. The results of these additional tests are unknown, however. Unfortunately because of extensive laboratory testing, sample 1 has been completely oxidized.

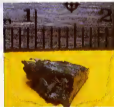
Meanwhile, in the United States, APRO, which had possession of the two remaining samples, submitted a portion of sample 2 to U.S. Air Force

spectrographic laboratory for analysis. For unknown reasons, the entire piece was burned before conclusive results could be obtained. The Air Force requested another sample, but APRO refused the request. The next series of tests was conducted by the Atomic Energy Commission's Oak Ridge National Laboratory on another portion of sample 2. The results of this analysis showed that sample 2 was less pure than sample 1 was reported to be by the Brazilian scientists. A comparison of the test results of all three samples shows that each varies in purity.

In his 1969 study of the Ubatuba magnesium samples, Dr. Walter W. Walker, who has a Ph.D. in metallurgy, stated: "The Ubatuba magnesium has been widely acclaimed as direct physical evidence of the extraterrestrial nature of UFOs. But, as of the present, after more than a decade of investigation, the extraterrestrial nature of the Ubatuba material has yet to be conclusively proved or disproved. The lack of subsequent verification of the Ubatuba purity has been the reason that all investigators to date have discounted extraterrestrial origin. Walker continues: "Ufio further study along the line of chemical analysis would be fruitful. It is also apparent that the structural aspects of the Ubatuba samples have been ignored. These are the aspects that show the most promise for further study."

Now ten years later, the controversy still persists. Advocates and detractors alike continue to voice their opinions. Carl Sagan, a professor of astronomy at Cornell University, states: "There have been debates on the purity of magnesium samples from purported crashed UFOs, but their purity was within the competence of American technology at the time of the incident." Yet a two-page CIA foreign-intelligence information report obtained under the Freedom of Information Act and dated January 29, 1976, states: "There is a rumor that fragments of a possible UFO found in Brazil bore a relationship to superconductors and magneto-hydrodynamics."

Omni's own efforts to clarify the mystery



Ubatuba magnesium fragment analyzed by MIT

CONTINUUM

THE EMPEROR'S NEW CLOTHES

The tabloid emperor was sold a bill of goods—test-talked into buying out a lot of gold for some fancy threads that didn't exist. The swindling salesman told him that only people with very fine taste could actually see the fabulous garments, and the emperor took the bait. Like him, the entire royal entourage and palace guard refused to admit that they couldn't see the invisible outfit, called it the emperor on, and sent the emperor out on parade in his birthday suit. Only when a little boy in the crowd shouted out that the emperor was naked did anyone react to the already obvious fact.

Unfortunately however, nobody was taken by the prime minister's new clothes, which were not only tangible but sensible. Earlier this year, in the heat of the Japanese June, Prime Minister Masayoshi Ohira appeared before press photographers and television cameras modeling a suit of clothes with a short-sleeved jacket, designed for businessmen to wear in air-conditioned offices. This prime minister's new clothes were a call to action in a country that has no oil of its own and that is experiencing a fuel shortage (but the idea fell flat). Sales of the "energy-saving" jacket were abysmally low. And Mr. Ohira himself eventually renounced it.

If Mr. Ohira sweated through the summer while air conditioning was out back, at least he had lots of company. The Japanese Foreign Ministry urged diplomats to forsake jackets and ties, but none of them did. At the Dai-ichi Kangyo Bank, the largest in Japan, employees were told not to wear neckties at work, unless of course they handled a big manufacturer's accounts. (Despite this courtesy, the Kansai Cooperative of Necktie Commerce and Industry boycotted the bank because of its no-necktie edict and registered a complaint with the Ministry of International Trade.)

Here in the United States, where the oil situation and the summer weather were just as troublesome, conservative attitudes kept most people from being able to tolerate conservation in comfort. First, President Carter decreed that public places should be no cooler than 78°F, which raised the question, "What shall I wear?" to a new level of importance. The President's designated new secretary of Energy Charles W. Duncan, Jr., responded appropriately. He smiled and stripped off his jacket while the Senate Energy Committee debated his confirmation in a sweltering hearing room.

But House Speaker Tip O'Neill would brook no dishabille on the House floor. When Representative Jim Mattox casually divested of jacket and tie, tried to discuss the subject of casual summer dress in Congress, the speaker refused to recognize him, saying, "I will ask the gentleman from Texas to remove himself from the floor and return in proper dress. The gentleman can address the House at such time as he is in the proper dress. The gentleman is embarrassing the chair. I don't know if he is embarrassing himself." (And both of them Democrats!) When it got around to a formal vote on the matter later that same afternoon (July 17, just one day after the new ruling took effect), the House trounced all hope of working in shirt sleeves: 303 to 105.

"I still say there's no need for a rag around your neck and the like in these temperatures," Mr. Mattox said heatedly. "The President said change our ways, and we could have done it and set a mighty good example for the rest of the nation."

Meanwhile restaurant and theater owners begged unsuccessfully to be exempted from the regulations, so that they could compete with the comfort level of private homes. They argued that patrons would rather cook cool than eat out and that hot critics would pan the heat of Broadway. Special dispensation was granted, however, to hospitals, elementary schools, museums, hotels, and buildings for equipment, plants, or animals that require special temperatures. Any employer or employee who suggested that human beings fit that latter category was rebuffed with a flurry of data from scientific investigations proving otherwise. Even the American Society of Heating, Refrigerating and Air Conditioning Engineers said that genuine impairment of human performance doesn't set in below 86°F.

All the experts offered the same advice to suitors: "Wear less," they said. But the people wore more. Caught between the oil magnates, the dress codes of the workplace, and the manufacturers of ties and party hose—and lacking leadership to cast off their layers—they just wiled.

The wintertime energy conservation ruling, which limits ambient indoor temperatures to 65°F, is much easier to take, since long underwear, sweater vests, jackets, extra socks, or the like can make up for a lagging thermostat without flouting fashion. When warm weather returns next summer, though, we'll have to face the stoker questions all over again. —DAISY SOBEL

CONTINUUM

SUPERSAURUS

Vital statistics: height, 50 feet, length, 80 to 90 feet, weight, 80 to 90 tons. No, it's not a ferryboat or an apartment house—but a dinosaur discovered last summer in a slope of the Rocky Mountain in western Colorado. Not only is it the biggest dinosaur ever found, it is the biggest land animal as well.

Paleontologist Dr. James A. Jensen of Brigham Young University in Provo, Utah, who found the huge reptile, says it could have peered in a top-floor window of a five-story building, supposing that one existed 140 million years ago, when the dinosaur was alive.

Thus far, Dr. Jensen has found the animal's shoulder blade, nine feet long; a rib vertebra, four and a half feet long; a neck vertebra, about the same length; and ribs ten feet long. Although no

leg bones have been unearthed, Jensen estimates the leg height at 18 feet.

The Colorado dinosaur was a brachiosaurid, a member of a group of plant-eating dinosaurs with columnlike legs, long giraffe-like necks for reaching foliage on trees, and small heads with small brains. Until recently, only one was known: a 40-foot-high armadillo found in Africa, whose skeleton is now in a museum in Berlin, Germany. In 1972, near the site where he is now digging, Jensen found an eight-foot-long brachiosaurid shoulder blade from a beast bigger than the African specimen but smaller than his most recent find.

He thinks that the Colorado giants probably died near the banks of a river and that their bones were pushed downriver in a "bone jam," which was later covered by a mountain. The deposit has been eroding, and some bones may have disappeared. Next year, Jensen will be back at the site for the sixth year, looking for more bones from the largest dinosaur.

"I don't anticipate finding enough bones to put a whole skeleton together, but I hope—I live on hope," he says.—Barbara Ford

"The most important fact about Spacelab Earth, an instruction book that I come with."

—Buckminster Fuller

"Science is the religion of the suburbs."

—William Butler Yeats

CLOSE SHAVE

Shaving every day is a nuisance for any man, but blacks in the armed forces may find it painful.



Actor Jim Brown models cuts for shaving bumps. A beard, infection-producing, and even litigation-provoking.

To get the close shave that military regulations require, a man has to pull his face taut and cut his beard off below the level of the relaxed skin. If the hair follicles are curved, which is so for most black men, the hair curls as it grows back in, burrowing into the skin rather than heading straight out. The skin reacts to the puncture just as it would to a splinter of wood or metal. It becomes inflamed, sometimes infected, and the infections can become abscesses. Since the neck is the likeliest site for this condition—called shaving bumps or pseudofolliculitis barbae—some sufferers find every

nod or turn of the head to be excruciating.

The cure? Simple: Grow a beard. Unless, of course, you're in the army now. Then you may have to fight for that right.

Repeatedly black servicemen have brought suit against the military, charging that its shaving regulations are discriminatory. (Shaving bumps may occur among whites, but they are rarely as painful.)

By now, according to a spokesman for the National Association for the Advancement of Colored People, the NAACP's Military and Veterans Affairs Office has standard operating procedures for helping afflicted men with a medical need to go bearded.

"Learning is discovering that something is possible."

—Fritz Perls

PREGNANT MEN

If a woman without a uterus can carry and bear a child, as happened recently in New Zealand, what's to stop a man from trying to become pregnant? Theoretically, he could donate his own sperm for in vitro fertilization of an egg and have the embryo implanted somewhere in his abdomen, then wait the required time for delivery by Cesarean section.

(The New Zealand woman was able to give birth despite a hysterectomy, because an errant fertilized egg lodged in her abdomen where it received enough nutrients to grow to term.)



Brachiosaurus model. New dinosaur is smaller, but bigger.

Robert Creasy, M.D. of the University of California medical school, is worried that this idea may take hold of the popular imagination. He is worried because a recent article in the *National Enquirer*, listing his name to the New Zealand event, brought him more mail than he could possibly answer.

"It's theoretically possible," Dr. Creasy says, "but highly dangerous and inappropriate to even attempt such a thing in a man or a woman."

In the course of normal obstetrical practice, he adds, doctors periodically see women with embryos that have implanted themselves outside the uterus for a variety of physiological reasons. Creasy says the risk of this condition to the mother's health is so great that she should be operated upon immediately to remove the fetus. — Dave Sobel



It is theoretically possible for a man to become pregnant.

PIGEON PILOTS

The newest technological innovation in sea rescues uses pigeons. In an effort to improve the 40 percent detection rate of human helicopter crews at finding survivors at sea, the Naval Coastal Systems Center in Honolulu, Hawaii, is training a few pigeons. Researchers believe that the birds, strapped to the underside of the helicopter, could spot survivors 80 percent of the time.

The birds are being trained to peck at a switch when they see the color orange, often used in life vests, yellow (the color of most life rafts) and red, from flares. The switch is connected to a light in the cockpit, telling the pilot where to look—and which bird to reward with food.

Douglas Conley, a Coast Guard electronics engineer, who conceived the program, said the pigeons have keen eyesight and a long attention span. In tests the pigeons have spotted a sixteen-inch practice buoy from a helicopter traveling at 100 miles an hour, 500 feet high and a quarter mile away. The research program began about two years ago and will be ready for operation in another two years.

Asked why he chose ordinary pigeons, Conley said, "They're cheap, docile, and very light." As for the proverbial dumbness of pigeons, Conley added, "They find the target long before the pilots do. They can't be too dumb."

—Stuart Diamond

3D TV

Citizens of Sydney, Australia, are seeing something new on station TVN-9 these days.



Television cameras equipped with three-dimensional optics are now being used to make 3D films for an Australian TV station.

Three-dimensional color television. Wearing special glasses, viewers can perceive depth in what otherwise looks like an ordinary flat TV image.

Developed by Digital Optical Technology Systems (DOTS), of Amsterdam, the Netherlands, the system works by discriminating focus and color elements of the image to produce a small fringing of color, barely visible to the naked eye, around the edges of the objects in the image. When viewed through the glasses, which are colored differently on either side, the scene appears in three dimensions.

Using the DOTS system, 3D is encoded into the signal transmitted over the

air so that it is entirely compatible with conventional color televisions. The viewer has only to buy the special glasses which, according to

Nat Myers, of the Ancom Company, American distributor of DOTS, cost from \$2 to \$14.

The fringing effect can be produced optically by means of filters and lenses as well as digitally through a computer, allowing the technique to be used in a variety of different media. For instance, using the digital method, film originally shot in 2D can be converted for 3D viewing. Or, by installing the filters in a conventional camera, 3D photographs can be taken.

—Keran Colman

"Just because everything is different doesn't mean that anything has changed."

—San Francisco Oracle

CONTINUUM

GAY VACCINE

A possible vaccine for a form of liver cancer is being tested upon a rather unconventional cross section of the population—gay men.

The vaccine was originally formulated to combat a sexually transmitted disease called type-B hepatitis, but Dr. Baruch Blumberg, of the Institute for Cancer Research, in Fox Chase, Pennsylvania, discovered that the vaccine might also work for a form of liver cancer called PHC.

It seems that areas with a high incidence of type-B hepatitis also have high rates of PHC. Now it appears that up to 90 percent of people with PHC also have chronic infections of type-B hepatitis.

PHC isn't common in the United States, but it is in Asia and in Africa, where nearly

everyone who contracts it dies.

Small-scale tests of the vaccine, developed at the Merck Institute for Therapeutic Research, in West Point, Pennsylvania, are now under way in the People's Republic of China, France, and Korea. Also, a series of tests in five American cities is using homosexual men.

Why? Researchers found type-B hepatitis to be quite common among gay men—in at least 45 percent of those tested. The disease virus is sexually transmitted and has been found in many bodily fluids, including saliva and semen. There's also a suspicion that the medical trauma associated with anal intercourse may be involved.

Researchers such as Blumberg obviously hope that if the vaccine cuts down the incidence of type-B hepatitis in gay men and

others, it might also work for people afflicted with PHC.

It is a long-term study. Liver cancer takes 20 to 40 years to develop. What's more, Mother Nature may be taking care of the PHC problem herself. Liver cancer is already decreasing in Africa, and no one knows why—Joel Davis

FUEL SAVER

An automatic electronic "tuning" device, called the Optimizer, which can significantly reduce fuel consumption in automobiles, airplanes, and heating furnaces, has been developed by engineers at Pennsylvania State University.

"It's like having a mechanic under the hood, asking the engine what timing change is needed, and adjusting the timing several times a second," says Dr. Paul H. Schweitzer, the inventor and professor emeritus of engineering research.

The Optimizer could cut fuel consumption 10 percent or more in most cars and up to 20 percent in cars with poorly maintained, inefficient engines, he says. Not yet on the market, each such device would cost about \$10 in mass production, he adds.

A box the size of a miniature cassette player, it would be wired to the distributor and electronic ignition or coil. It would reduce gasoline consumption by constantly changing spark-plug timing, then adjusting the distributor in response to driving conditions. The Optimizer compensates for

variables that waste fuel, such as outside temperature and humidity, engine temperature, octane rating, and sudden bursts of speed or braking, explains Thomas W.



Paul Schweitzer watches Thomas Collins install the Optimizer.

Collins, director of the university's electronic services and coordinator of the patent.

—Alton Blakelee

"Once in my life I would like to own something outright before it's broken. I'm always in a race with the junkyard! I just finish paying for the car and it's on its last legs. The refrigerator consumes belts like a goblin's maw. They bind these things. They tie them so when you've finally paid for them, they're used up."

—Willy Loman in Arthur Miller's *Death of a Salesman*

"The nation that controls magnetism controls the universe."

—Dick Tracy



Homosexual march, shown here marching for human rights, may hold the key to the cure of two diseases: Hepatitis B and PHC liver cancer.

UNLEADED PERUVIANS

In the 4,500 years since humans first mined and smelted ores to extract their precious metals, the entire

30 b.c.) mummies. Lead, the by-product of most metallurgical processes, is now a ubiquitous presence in everything from soil moisture



Present-day Peruvian stands in front of an ancient Inca ruin. Her ancestors had no experience with metallurgy or lead contamination.

world population has sustained increasingly higher—and potentially more dangerous—concentrations of lead in teeth and bones. The skeletons of contemporary Britons and Americans, for example, contain more than 500 times as much lead as the normal biologic levels found recently in the bones of ancient Peruvians.

Jonathan Encson, Clair Peterson and Hiroshi Shitahata, writing in the *New England Journal of Medicine*, have shown that the bones of the Peruvians, buried 1,600 years ago, contain considerably less lead than present-day samples, or even samples from Paleolithic Era (200 to

to the reagents and controls in laboratories.

"Since prehistory," says Encson, "we have been faced with someone else's pollution."

The Peruvians have proved to be a highly accurate standard by which to measure lead levels. Metallurgy in South America lagged behind that of the Old World, and consequently the Andeans were not exposed to industrial lead, which is absorbed by plants and then travels up the food chain.

In ancient lead mines to calcium and silica where calcium is located, such as the central nervous system. It messes about with the electronics of the synapses,

according to Encson.

In terms of world health, the significance of the enormous increases in biologic lead levels has yet to be studied, but scientists speculate that sterility and other problems that afflicted wealthy Romans during the height of the empire may be attributed to the inordinately high amounts of lead in their diet and plumbing systems. The Roman poor, whose lead levels were high, but not as high as the aristocrats' suffered fewer afflictions.

An ominous sign is that present-day lead contamination, according to Encson, is rapidly reaching the level of the Roman poor. —Kathleen Sloan

ITCHING

Itchiness is now a multimillion-dollar industry. Surveys have found that sales of rich suppressants applied to the skin have reached \$11 million a year in the United States.

The medical word for itchiness is pruritus, from the Latin *prurire*, meaning "to itch." Curiously, *prurire* is also the root of the word *prudence*, which means "sexual longing" or colloquially "the sexual itch." Thus fortified with etymology, one easily sees how some lotions—those containing menthol, phenol, or camphor—can relieve itchiness by substituting a feeling of coldness, as in giving the itch a cold shower. In fact, the traditional remedy for itching was an ice cube or cold compress. Ask a nationally known

operational definition of richness, and you get "that which creates the desire to scratch," according to Dr. James H. Herndon Jr., a Dallas, Texas, dermatologist.

Dr. Herndon, former chairman of the dermatology department at Southwestern Medical School of the University of Texas, said richness, scientifically, is produced by enzymes located under the skin. Like pain, he said, itching is a warning sensation. It alerts people to insect bites, allergies, skin diseases and other irritations so that they can take remedial action.

Many pruritus specialists believe that 20 to 30 percent of the victims of severe chronic itchiness—nonspecific itchiness, with no skin marks—are really suffering from an underlying disease, such as liver or bone disorders.—S.D.



Rich suppressants are now an \$11 million a-year business.

CONTINUUM

AGING CLUE

Why people age and die has been a mysterious puzzle for centuries. Now two scientists at the Delta

Primate Research Center in Louisiana, think they've hit on the trail of the culprit—a cellular pigment called lipofuscin. Called the "wear and tear pigment," lipofuscin accumulates in the tissue of certain parts of the brain as a person grows older, according to Drs. Kenneth Britzen and J. M. Ord, who recently completed brain studies on 52 rhesus monkeys.



Rhesus monkeys used in study. 8-year-old monkey (left) has age equivalent to 24 human years; 28-year-old (right) is 84 in human years.

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The theory is that a buildup of lipofuscin may lead to the deterioration of some sensory, associative and motor functions. But the doctors admit they've found a correlation, not a connection. "We're not sure yet whether lipofuscin is the

process and may help immobilize enzymes that break down cells.

But Ord feels the research he and Dr. Britzen are doing shows the opposite. Lipofuscin begins accumulating in the tissue from birth, when it's about one percent. As one gets older, it can make up as much as seventy percent of the total cytoplasm of a cell. There's got to be some interference because of that," he says.

If lipofuscin does turn out to be the aging "villain," there's hope of a chemical method to slow or halt the aging process. It's known that some drugs inhibit lipofuscin accumulation, Ord says. "In theory one

could develop other drugs to halt the accumulation of the pigment in the tissues and thus arrest the aging process. It's a hot area," says Ord.—J.D.

NUCLEAR PACEMAKERS

Are nuclear-powered pacemakers safe for their users? And the users' neighbors? The tentative answer is yes, considering the device's good safety record since the first plutonium-238 pacemakers were implanted in 1973. Six years later some 3,000 have been implanted worldwide, and the medical establishment is now reviewing their success—and shortcomings.

Dr. Victor Parsonnet, of the Newark (New Jersey) Beth Israel Medical Center, who's the first implantations were done, outlined some of the medical considerations for nuclear pacemakers at a recent meeting of the American Heart Association.

Cost and lifetime were among the chief concerns, but another worry was possible contamination from the plutonium power pack. Such fears now appear to be partially ungrounded. Cancers have developed in five patients, but none of the tumors was near the power unit. Thirteen of the first 15 patients to receive the units are still alive and well.

But another concern has nothing to do with medicine—namely the threat of terrorism. Could a dedicated gang of terrorists kidnap and murder enough

pacemaker wearers in order to obtain sufficient plutonium for an atomic bomb? The answer to that is an unqualified no. The isotope in a pacemaker cannot be used to make a bomb. Plutonium-239 is used for that. However, the stuff is still poisonous. Only 0.0005 microgram of plutonium-238 is needed to cause severe radiation damage in humans. And a pacemaker contains quite a bit more than that—160 milligrams, to be exact, according to Terry Kranich of Medtronic, Inc. which makes the device.

For those who are really paranoid, what about the possibility of a pacemaker user being caught in the crossfire of a gunfight, for example, and having his deadly plutonium supply scattered to the wind? Not to worry, says another Medtronic spokesman. Nuclear pacemakers have



Disassembled pacemaker. Plutonium packed in at center.

been dropped from airplanes, shot at with various firearms, and heat-treated—and not one of them has ruptured.

In any case, plutonium pacemakers are being replaced by chemical ones which should have equally long life spans and pose less potential danger.—J.D.

CATFISH

Officials in DeKalb County, Georgia, have proposed an interesting alternative to an \$85-million sewage-treatment plant: catfish.

Instead of installing advanced processing equipment, engineers would pipe the partially treated effluent from the Honey Creek sewer plant into ponds. There, the 38 million gallons of daily sewage would cause algal blooms. Catfish in the ponds would eat the algae. The catfish would multiply. The extra catfish would be caught and used for chicken feed. The cycle would be completed.

Sewage, rich in nutrients is becoming increasingly promising these days as a future animal food. Since 1975 steers in Denver, Colorado, have been eating a 4 to 12-percent sludge diet, with no perceptible ill effects.

In Albuquerque, New Mexico, scientists are sterilizing sludge with radiation. The sludge is then used as a soil conditioner and food supplement for sheep and cattle.

The sterilization solves the potential health hazard of pathogens. Another potential hazard, concentration of metals in animal tissues,

could be removed with more restrictions on industrial wastes discharged into sewer systems.

Sludge handling and disposal costs \$200 million per



Catfish. Cheaper than a \$85-million sewage treatment plant, year nationally or 40 percent of all waste-water treatment. But if the sludge were reclaimed and sold as a product, its extra costs would be all but eliminated, studies indicate.—S.D.

TUMBLEWEED WARS

Thousands of hungry Pakistani moths have been imported into California in an effort to control biologically a plant that is not as harmless as it looks: tumbleweed.

Also called Russian thistle, the rudy-pole bush is a road and fire hazard and a general pain in the drain. It clogs flood-control channels, canal waters, and swimming pools.

Imported into this country

with flea shipments in the 1800s, tumbleweed has no natural American predators. It spread rapidly from the Pacific Coast to the Midwest and is now moving eastward.

In California the tumbleweed is particularly troublesome. We spend a million dollars a year trying to control it or pick it up," said Dan Cassidy, of the state Department of Transportation.

Since burning, chopping, crushing, and herbicides all failed to control the hardy bush, the state hired U.S. Department of Agriculture scientists to bring in *Colaspis parthenica*, cream-colored moths that feed only on tumbleweed, and another pesty plant, the poisonous haloglosson.

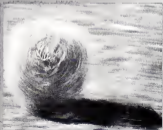
"Where this moth comes from," Cassidy said, "Russian thistle doesn't become tumbleweed." Female moths lay eggs on

the plant's stem. The eggs hatch into caterpillars that bore into the wood, stunting its growth or killing it.

Biological pest control can be risky. Mongooses imported into Jamaica to kill rats that were destroying the sugar crop wreaked havoc on local fauna. Killer bees resulted when Brazil introduced a foreign species to improve the honey output of the native bee. But Cassidy said he isn't worried. "This question is always put to me. So I asked the scientists, Can these bugs mutate into something dangerous in a thousand years? They said, 'Hell, in a thousand years elephants might have wings.'"

—Alan Maurer

"The arts of scientific thought are to see the general in the particular and the eternal in the transitory."
—Alfred North Whitehead



Tumbleweed can be a real pain in the drain. It clogs flood-control channels, canal waters, and swimming pools, and it disrupts highways.

CONTINUUM

WAR GAMES

The U.S. Army plans to spend about \$100 million during the next three years to arm about 39,000 soldiers



M-16 rifle fires blanks and a small pulsed-beam laser

and 6,000 vehicles with laser guns. "The lasers aren't intended to hurt anyone, however. They're part of a system that keeps score in war games, the mock battles in which soldiers practice their combat skills.

The system, called MILES (Multiple Integrated Laser Engagement System), is being built by the Xerox Corporation's Electro-Optical Systems Division in Pasadena, California.

The lasers are attached to weapons that fire blank ammunition. When a gun is fired, the laser emits harmless pulses of invisible infrared light, coded to identify the type of weapon. These pulses are detected by solar cells strapped on soldiers'

backs and military vehicles. If a soldier is "hit," a buzzer sounds in his ear, a "hit" on a tank triggers a smoke grenade and a loud horn. To ensure realism, the coding specifies the range and power of the weapon being simulated, thus making sure that only a rocket or missile can "kill" a tank. MILES also warns intended victims of near-misses.

Xerox designed the system for the Department of Defense under a contract from the Naval Training Equipment Center in Orlando, Florida. However, the first customer was the Department of Energy's Sandia Laboratories, where several systems are used in training guards to protect nuclear materials (see January 1979 Continuum, page 40).

—Jeff Hecht

SPICE OF LIFE

Plants that belong to the mint family not only add spice to life but can also be good for our health, says U.S. Department of Agriculture biologist Dr. James A. Duke.

Menthol and thyme, for example, are used for germicides, cough drops, and nasal inhalants in modern medicine, and just about every mint from basil to water mint turns up in folk medicine.

Dr. Duke recently compiled a list of mint-like remedies for ailments that start with abscess (ground ivy) and end with wounds (hyssop, rosemary and thyme, among others).

Besides the above, lavender

perennials, peppermint and marjoram are favorite folk medicines.

Basil leaves and Spanish thyme, among other mints are also high in certain vitamins and minerals. A few mints are good for adding fiber to the diet, particularly bushmint.

But mints do have a bad side. Last year one person in this country died from consuming oil of pennyroyal and deaths due to high concentrations of rosemary and lavender have been reported. The most deadly toxin in any mint is hydrocyanic acid, but it is found in only one, ocarmin Courmarin and isobutyric acid are also rather toxic, but fortunately they both are found only in lavender.

Duke, a mint-tee drinker, thinks the danger posed by

moderate consumption of mints is negligible. "My daughter makes poppies out of mint tea," he says. —B.F.

"Jupiter's moons are invisible to the naked eye and therefore can have no influence on the earth, and therefore would be useless, and therefore do not exist."

—Pronouncement made by a group of Aristotelian contemporaries of Galileo, following his discovery of four Jovian moons

"I could prove God statistically."

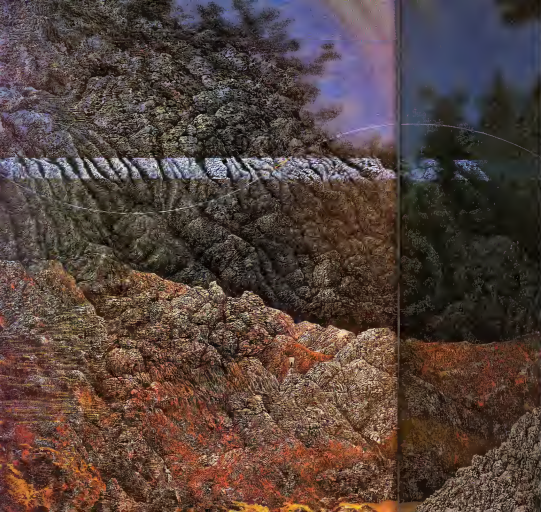
—George Gallup

"They could have done it better with an ax."

—George Weidingerhouse (after seeing first electro-chair execution)



The world's only see-through detector of a nuclear reactor was the "eye witness" at a recent congressional subcommittee hearing on the Three Mile Island accident. Glen Schoonover, the University of Florida nuclear engineering professor who built the detector, points out the containment structure to Congressman Don Fuqua (center).



The fuel that could carry us beyond the solar system lies in cold storage near Geneva

ANTIMATTER REVEALED

BY ROBERT L. FORWARD

You watch the screen. An aging beauty in Paris ponders the stocks you've suggested. Space Elevator and Anti-EPG, the new subsidiary of Space Power General. Your eyes wander to the top of the screen: 15:55 03 THURSDAY 30 JUNE 2005

"Thank God it's Thursday," you mutter as she finally decides to invest her 35,000 credits in Anti-EPG. With a keystroke, you place the buy order; make your monthly salary report to the home office; and switch off the console as the clock reaches 16:00:00. A hard day's work done, you deserve the long Fourth of July weekend you're about to spend at Luna's glamorous Sahara Copacabana, with its sun-baked spas, fabulous casinos, and razzle-dazzle entertainment.

"You step out into the Arizona sunshine, walk over to your AstroCruiser, and make sure that there is enough water in the tanks and plenty of antimatter in the superconducting storage bottle. Then you take off.

Its power tightly reined, the Cruiser taxis into the desert heading for a greenly glowing pillar of fire beaming into the

sky. Dozens of private spacecraft are being boosted into low Earth orbit by tugs that use the light of laser-based lasers far brighter than the sun to heat water to a blazing exhaust too searing to be called steam.

The waiting line is long, so you go into orbit, using antimatter, despite its high price per megagram. Invisible particles of antimatter are mixed with liters of water in the engines, and the jets flare with nucleosynthetic hydrogen and oxygen. At the nearest orbital station, you refill the tank with four tons of water, replace the antimatter with a new 30-milligram capsule from the Anti-EPG station, and take off for the marvellous oasis 382,000 kilometers away in space.

Any such scenario brings up a couple of questions: Is antimatter just a science-

PAINTING BY
MATI KLARWEIN

fiction. Where's it from? Can we really use it as fuel? And if we can use it, how soon?

It turns out that we can. Even now, antimatter is being made, captured, cooled, and stored for days at a time in a little-recognized revolution: the human race is learning to harness the ultimate fuel. One of these days antimatter may allow us to travel the solar system as we now span the globe in our cars and private airplanes.

To travel, you must use energy. To produce energy, you must convert mass. Every time you burn a liter of gasoline, mass disappears. When gasoline is burned, a little of its mass is converted into energy.

With chemical fuels like gasoline and rocket propellants, the amount of mass converted to energy is only a few parts per billion. In fusion reactors using uranium and plutonium, the amount of mass converted rises to a few parts per thousand. The fusion of hydrogen or deuterium converts almost 1 percent of the mass. Antimatter outshines all such fuels, fully 100 percent of its mass is instantaneously converted into energy.

That brings up some questions: What is antimatter? And what makes it ant?

The answer lies in the atom, the knot of protons, neutrons, and electrons from which the world around us is made. Each of these particles consists of a bundle of raw energy wrapped by nature into a compact, long-lasting ball that we call matter. It's as if each particle had some special quantum mechanical "glue" holding it together. The type of glue that unites a particle determines the amount of energy that can be bound and sets the properties of the resulting bundle. Each glue is unique.

For each particle there is an antiparticle. The antineutron is almost identical to the neutron, but its magnetic field is reversed. The antiproton is a twin of the proton, but its charge is negative instead of positive. Similarly, the antielectron has a positive charge in contrast to the electron's equal, but negative, charge.

There is one important difference between the two forms of matter. A particle of normal matter is held together with quantum mechanical glue. Antimatter particles are bound with "antiglu."

Each glue is a solvent for the other. When an antiparticle meets a particle of normal matter, the glues dissolve each other and the energy of the two particles is released in a microexplosion. The mass of both particles is completely converted into energy. Antimatter would be the ultimate fuel for any energy need. It would be especially valuable in space, where its negligible launching weight would be an enormous advantage.

Work on the generation and control of antimatter is taking place at Fermilab, in the United States, the Centre Européen pour la Recherche Nucléaire (CERN), in Switzerland, and Novosibirsk in the Soviet Union. Scientists in these places are using huge accelerators to study these elementary particles. The particle accelerators com-

bine electric, magnetic, and radio fields to increase the speed of electrons and protons to nearly that of light.

The electron volt, or eV, is the unit of measure used to describe the energy levels of particles in accelerators. A metal plate with a positive charge of one volt attracts negatively charged electrons. Just before they make contact with the plate, the electrons reach an energy of 1 eV.

Your television set produces about 20,000 volts, or 20 kilovolts (kV), in the picture tube. The electrons in the tube therefore reach an energy of 20 kilo electron volts (keV), just enough to make the phosphor on the television screen glow. A million-volt machine can accelerate protons and electrons to energies of 1 Mw. At 1 MeV, electrons move close to the speed of light. The heavier protons travel at only 5 percent of the speed of light, their much greater mass compensating for their slower velocity to give them equal energy.

It is difficult to produce energies greater

than 100 MeV. As the rapidly moving protons strike the heavy tungsten nuclei, their energy is converted into a spray of gamma rays and a collection of elementary particles, including antiprotons, antielectrons, and antineutrons, which move at nearly the speed of light.

You'd think that capturing the rapidly moving antiprotons would be as impossible as trying to catch the bees from a locked-over hive. But magnetic separators can easily route the negatively charged antiprotons into a storage ring.

The storage rings are large, doughnut-shaped magnets. The antiprotons enter the magnet in a straight beam and are pushed to one side by the powerful magnetic fields. Since the field strength inside the magnet is uniform, the beam is bent into a circle and the antiprotons orbit endlessly inside the ring. Last year, scientists at CERN placed a few hundred antiprotons with an energy of 2.1 GeV in their storage ring, where they were kept circulating. After nearly four days only about 80 antiprotons were left. The others had been destroyed when they collided with the few remaining atoms that contaminated the nearly perfect vacuum inside the ring.

In future experiments at Fermilab, the fast-moving antiprotons will be slowed down before they are stored. After the antiprotons are generated, the physicists will send them through a linear accelerator, which usually boosts the normal protons before they go into the big ring. Since the antiprotons have an opposite charge, they will be "antibooled"—slowed from 6,000 MeV to 200 MeV. This thirtyfold decrease in energy means that the antiprotons, which used to move at relativistic velocities, will wind up at well below the speed of light—the first stage in practical confinement schemes.

The next step is even more remarkable. The antiprotons will be "cooled." As you might expect from the chaotic way they are formed, each antiproton starts out with a different speed. In the cooling ring, they will be mixed with electrons moving in the same direction; the electrons' velocity carefully matched to the average speed of the antiprotons. The electrons, supplied by a precise electron accelerator, will move at the same speed while some of the antiprotons move a little faster and some move a little more slowly. The antiprotons and the much lighter electrons will interact through their electric charges—both negative—and soon the electrons will soak up the energy difference contained in the off-speed antiprotons.

After a few minutes among the electrons, the antiprotons will be moving at the speed of the injected electron beam, with very little randomness, or "heat," in their velocity. These cold antiprotons will then be able to be decelerated to even lower speeds (the Fermilab experiments will omit this step). They might even be brought to a stop and trapped in an electric or a magnetic "bottle"—a chilled vacuum chamber with two electrically superconducting rings built

☛ *The United States, faced with a Soviet lead, is now developing weapons that will shoot down ballistic missiles with high-energy protons. They can easily be adapted to antimatter production.* ☛

than a few MeV with electric fields because high voltages have a tendency to leak off into the air. However, once the electrons or the protons reach high speeds, it is possible to send radio waves along the beam. If the radio waves are properly synchronized with their motion, charged particles can gain energy from them, just as a surferboard does from water. Energies of thousands of millions of electron volts, or giga electron volts (GeV), have been attained by using this technique. Tera-electron-volt (TeV) machines, designed to produce beams 1,000 times more powerful than that, are under construction.

The energy bound in a proton's mass is 0.931 GeV. Thus, any proton with an energy greater than 1 GeV has more energy in its mass than it has in its mass. So a proton moving at a number of GeV has within it enough energy to make another proton—or an antiproton.

When the scientists at CERN, Fermilab, or Novosibirsk want some antiparticles to play with, they take the proton beams circling in their multikilometer accelerators boost their energy levels to several GeV and dump the high-energy protons into



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into the wall one near other end.

There are a number of ways to control antimatter without touching it. The magnetic storage rings already in use catch moving beams of charged antiprotons and antineutrons, but for larger amounts of antimatter we will probably want to use other containment devices.

If we capture both the antiprotons and the antineutrons formed in the tungsten target, slow them down and put them together, they will form antihydrogen. An atom of antihydrogen consists of a single antiproton with an antineutron circling around it. Antihydrogen like hydrogen has a property called diamagnetism; it has a tendency to avoid magnetic fields. If you put it in a magnetic bottle, the antihydrogen will avoid the strong magnetic fields generated by the rings and collect in the center as a ball. In theory, the antihydrogen ball could be held there forever.

Electric fields can also be used to store and manipulate antimatter. The fields keep just a slight static charge on the antihydrogen, allowing it to move around. A weak beam of electrons can be used to keep a ball of antimatter charged. Alternately the light pressure from an array of laser beams can keep a ball of antimatter suspended in a storage chamber or ball of small amounts of hydrogen gas for use.

Very little antimatter has been made so far. CERN and Fermilab hope to make and store about 10 trillion antiprotons at one time with their research accelerators. However, the total mass of those trillion antiprotons will be only one-billionth of a gram, and they will have the explosive energy of only a small firecracker.

What limits the research groups is that their accelerators are designed for precision, not production. In order to produce protons of extremely high and exact energy, these research tools have beam currents that are too low for the mass production of antimatter.

Machines that will accelerate large numbers of protons to moderately high energies are receiving great emphasis today. The United States, in an effort to overcome a Soviet lead, is starting to develop particle-beam weapons for ballistic missile defense. These will be compact, high-energy machines deployed in space. They will send out short bursts of high-energy protons to burn up ballistic missiles as they rise above Earth's atmosphere. The design goals for these machines sound amazing, yet each element has been accomplished before. Physics and engineering are so well developed in the area that no one familiar with the bold doubts that such weapons can be built.

Beamed-particle weapons will shoot protons with energies of 10 GeV or more—energies much lower than those already achieved in many particle accelerators and well above the 1-GeV limit needed to make antimatter. The beam currents in these machines are amazing. Whereas CERN and Fermilab are content with beam

currents of one thousandth of an ampere, these machines will have beam currents of 10,000 amperes, 10 million times greater. Such currents are commonplace in high-voltage converters and high-energy lasers, so we know that engineers can control the current densities. What has never been achieved before is the combination of high energy and high current.

When you know the power needed to run one of these beamed-particle weapons, you realize why they will be found in short bursts. A 10-GeV machine operating at 10,000 amperes requires 100 terawatts (TW) or 100,000 gigawatts (GW). Hoover Dam produces only 1 GW. The Saturn V rocket puts out 35 GW at takeoff. The total electric power capacity of the United States is about 250 GW and the world power output is only 1 TW. We can actually build a machine (probably small enough to fit in the space shuttle's cargo bay) that will require the power of 100 worlds to run. If these machines could be made to operate

• We can actually build a machine, probably small enough to fit in the shuttle, that will require the power of 100 worlds to run. It could be our key to the solar system. •

continuously—and there is no theoretical reason they couldn't—they could be our key to the solar system.

Research accelerators have other problems that limit their antimatter production. The tungsten target, for example, has been given lesser priority than "more important" experiments. And the design of antimatter collectors and sorters is in its infancy. The present efficiency of converting proton energy to antimatter is somewhere between one part per billion and one part per million. If the conversion efficiency could be brought up to one part per thousand or better, generators based on particle-beam weapons could produce significant amounts of antimatter.

When will we get the energy to run these machines? We certainly wouldn't want to do it by burning fossil fuels here on Earth. But there is plenty of solar energy in space. We receive from the sun 1 kilowatt of energy per square meter. 1 gigawatt per square kilometer. A collector array 1,000 kilometers on a side would provide a power input of 1,000 TW enough to produce grams of antimatter per day. In place, the power generated per square kilometer of solar collec-

tor would be at least twice as great.

Since antimatter requires much more energy to make than we will ever get back, it will always be a very expensive fuel. However, for space propulsion, where every kilogram of rocket fuel put into orbit costs many hundreds of kilograms of propellant in the booster, antimatter's light weight and high energy may make it the best available fuel.

Most early science-fiction writers assumed that antimatter rockets would use equal parts of matter and antimatter. The two would be combined and the resulting gamma-ray exhaust would be used. However, a recent study by engineers at NASA's Jet Propulsion Laboratory revealed that for any speed less than one-third that of light it would be much more efficient to use a small amount of antimatter to heat a much larger mass of matter—hydrogen, water or whatever else is convenient.

Surprisingly, the best mix of matter and antimatter for a given payload and velocity is the same for any mission. Whether you are going to the moon or to the stars, the optimum ratio is four tons of water per ton of spaceship. The only thing that varies is the amount of antimatter needed to heat the water—and that is always such a small variation that its mass can be neglected in the light calculations.

For example, to go to the moon in four hours, we would have to travel the 382,000 kilometers at better than 30 kilometers per second. For an Astro-Cruiser weighing one ton, this would require 30 milligrams—barely a thousandth of an ounce—of antimatter mixed with four tons of water.

Ten grams of antimatter heating 40 tons of water could propel a 10-ton space vehicle to Mars in a week. A kilogram of antimatter would send the same ship to Pluto in a month. And 100 kilograms could send a 10-ton payload to the nearest stars, four light-years away, in 50 years at one-tenth the speed of light.

We know how to make antimatter, and we know how to store it. With a fully developed antimatter technology, the solar system and nearby stars could be ours. There is no question about the workability of the technology. It is only a matter of scale and costs. The question is not whether we can do it, it is whether we are willing to make the investment.

The long trip over. The autopilot beeps, and you lean your gaze from the rotating blue marble you took off from hours before. When you touch the controls, laser light deep inside a zero-cold bottle loses another microgram of antihydrogen from the frozen ball suspended in an invisible cage of magnetic fields. Pulsed electric and magnetic fields carry the speck to the roving head of the rocket chamber, where the still-tigid atomizer meets a decelerator of dirty water. They explode in a blaze of fire, and the lunar dust mass beneath your landing jets to hide the dozens of glittering casino signs towering in the distance. **□□**

DREAM HOUSE

Something in this weird house hated electricity. It snarled angrily at all the utility companies. "Get out. GET OUT!" A true story

BY RONALD DAVIS

It is the dead of winter. While you push your thermostat up another degree and dream about 20-cent heating oil and 30-cent gasoline, Tom Smith enjoys the radiant heat of his "energy-producing house." Seven thousand feet high on a mountainside overlooking Lake Tahoe, on the California side, the house appears no more unusual than its alpine neighbors. But when the thermometer reads 12°F, the winter wind shakes the snow-laden fir trees, and the sun shines for the first time in two days, Smith still doesn't have to turn on the electric heat. When I spoke with him last January, he talked about taking out the electric baseboard heaters. "I haven't used them since I moved in a year ago, and I don't think I'll ever need them."

When you first see the Smith house, there is no way to know that it is solar-heated. There are no exotic collectors on the roof, no complicated plumbing inside, no storage tanks down in the basement, and no walls of black-painted drums. There is none of the paraphernalia that has always been associated with solar homes. Without all these things, Smith's is the most innovative solar house in the world.

The strange thing is that, although Smith has theories about the house, neither he nor top solar scientists can figure out why it works. Not only does Smith have the most innovative house in the world, but it is also the most controversial.

The house employs the deceptively simple technology of radiant heat, long favored by quality builders for its high level of comfort. Heat from an open fire or radiant heat, its soothing, penetrating quality is impossible to match with conventional heating methods. But its cost has always been a major drawback. Most conventional radiant-heating systems use a large network of heating pipes in the ceiling and walls of the home. In Smith's house you are surrounded on four sides by radiantly heated surfaces. No matter where you are in the house, there are no cold spots or drafty corners.

The house is built around what's known as the double-shell/convective-loop concept.

PHOTOGRAPHS BY DAN MCCOY/RAINBOW



• The strange thing about the Smith house is that no solar scientist can figure out why it works. •



a house within a house. The south face consists mostly of double-glazed glass. Ten feet behind it is another wall that rises almost, but not quite, to the roof. What results is a ten-foot-wide greenhouse. Air in this space is heated by the sun and expands and circulates upward. There it hits the outer roof. But there is also a false roof over the inner house, built about 12 inches lower. This creates a foot-thick airspace, which the air moves through to reach the north side of the house. The air travels down a similar passage in the north wall, through the crawl space underneath, and back up through the slatted greenhouse floor. The triple combination of greenhouse in front, a false roof, and false north wall creates a massive blanket of slowly moving warm air that completely surrounds the living space. The air circulates by convection alone, using no fans or mechanical means. It warms the inner shell and buffers the inner house from the icy winter air. Because the air never circulates through the actual living space, there is no need to achieve the high temperatures essential in all other conventional heating methods. While the sun is shining, excess heat is stored in the 2,100 cubic feet of dirt and rock backfilled underneath the house. Heat is also stored in the insulated foundation walls and the inner shell of the house. At night or on cloudy days the greenhouse cools faster than the north wall, causing air to reverse its direction, picking up heat from the earth storage and keeping the inner house warm. When the sun is shining on a clear January day approximately 500,000 BTUs of heat will be collected by the greenhouse windows. This is the equivalent of five gallons of oil burned in a well-maintained furnace, enough to heat a well-insulated house of the same size for a whole day at 15°F. Much of that heat is stored in the inner structure of the house and in the dirt and rocks under the house. The entire structure, being insulated from the outside world, is included in this thermal mass. The overall mass is big enough so that if all the heat gathered during the day were put into storage, the temperature of storage would rise only by 5° to 7°F. This

(Preceding page) The eerie figure of Tom Smith peers out of the house that no one can explain. (Left) The spectacular view from the house is a south-facing double-glazed window, whose greenhouse effect warms a ten-foot-wide air pocket in front of the interior wall. (Above) A side view

large capacity for heat storage is important because the rate of heat loss out of the storage is proportional to the difference in temperature between storage and the surrounding earth. The less heat lost from storage, the more heat there is available to maintain warmth in the house during the sunless periods.

Free energy is certainly appealing, but there are many institutional, economic and social obstacles to its widespread acceptance. The most difficult thing for any society to accept is change, and most people view their homes as symbols of permanence and status. Making any change in housing has always been strongly resisted, as markets of modular homes have discovered in the last 20 years. The construction industry itself is tradition bound by trade practices, the fragmentation of effort, un-sophisticated financial institutions and consumer apathy. Local building codes, which often vary from municipality to municipality, severely handicap innovative architects and builders. The housing industry is aware of such constraints and is also aware of the potential for passively heated and cooled homes.

Such homes use no mechanical means to collect, store or distribute heat from renewable sources. They might better be called integrated houses, but the unfortunate label passive is more often applied. Some 60,000 homebuilders met last January in Las Vegas for their national convention, and there was considerable discussion of prototype designs for passive homes. This interest notwithstanding, an after-heard comment at the convention was, "When the consumer wants solar we will find a way to make it happen."

Tom Smith was aware of this attitude and of other problems when he first decided to build a house. Rather than build just another solar home, he wanted to build a house that would destroy every reason for not going solar. After making a nationwide survey of solar homes, he identified the double-shell/convective-loop idea as the most promising design. He purchased plans from the design's inventor San Francisco architect Lee Porter Butler and assembled a team of people to help him make the design into what he felt would meet nine objectives:

- 80-percent self-sufficiency for heating—100-percent with one efficient wood-burning stove
- 80-percent self-sufficiency for cooling
- Low cost. The house should cost no more than the average house, given the same size, materials, and location.
- 100-percent use of standard building techniques, processes, and materials.
- Complete conformity to the local building code.
- Conventional financing from normal lending institutions.
- Conventional design to blend with the natural and architectural landscape.
- No mechanical aids whatsoever.
- A healthier and more aesthetically pleas-

ing environment for his family.

The Smith house has met or surpassed all of these objectives.

Wood consumption, for example, is three quarters of a cord a year. This is the equivalent of 150 gallons of fuel oil burned in an average furnace, or a total annual fuel bill of under \$100. No air conditioning has been needed, satisfying the second objective. Cooling is provided by the introduction of ground-cooled air into the crawl space. This air comes from a pipe buried five feet below grade on the north side of the house. If the clerestory windows at the top of the greenhouse are opened, the escaping hot air creates a suction that draws cool air into the house from the crawl space.

Even in the inflation-prone California housing market there was little trouble meeting the objective of cost. The Smith house was built for \$23,250 (that's \$29.50 per square foot) by a local Tahoe contractor. This figure compares favorably with nationwide estimates of \$32 to \$36 per

• No mechanical means are used to collect, store, or distribute the heat. Such homes might better be called integrated houses, but the unfortunate label passive is more frequently used •

square foot for homes built in 1978.

Smith's neighbor Dave Leone had a similar house built nearby late in 1978 at a slightly higher cost (\$33 per square foot). Leone's home had much more interior carpentry work including a handcrafted spiral staircase and a Jacuzzi in the greenhouse. Rusty Dunn, the contractor for Leone's house, said, "I was surprised that the house was no more difficult to build than the standard houses I've always built. It was the most interesting house I've worked on. It was something more than the ordinary (build it, stand the walls up, and walk away from it)."

Standard techniques played a crucial role in determining final details of the design process. Selecting materials and processes known to the building trades facilitated construction and ensured some measure of longevity. As reported by William Shurcliff, author of *Solar Heated Buildings of North America*, many solar energy systems, particularly those incorporating water, have proved unreliable over a 10- to 20-year life span. Though this would not preclude their use in certain designs, common sense tells us to employ materials

and processes that will match the buildings' structural longevity.

The only problems presented by the local building code were the air plenum formed by the false north wall and the above average amount of glass. In some codes, potential fire routes between floors must have some automatic means of shutting off the flow of fire. In Smith's house the plenum was classified as part of the heating system, exempting it from this restriction. In other houses that use the double-shell design, it may be necessary to install in the airspace inexpensive sheet metal dampers that can be thermostatically closed, using a fusible link.

The huge amount of glass to be used in the house was considered a problem only until heat-load calculations were submitted to the building inspectors. These calculations showed that the extra glass actually helped the thermal performance, leaving nothing much to argue about. Getting acceptance from local building inspectors for the kind of house may not seem to be a hurdle until you attempt to build any structure that is just the slightest bit out of the ordinary. Such details as minimum heating temperatures are written into codes with little thought given to what is actually needed for personal comfort. Both the Smith and the Leone homes would be termed underheated by many building codes. In the Smith house temperatures on a cold January day range from 62° to 68°F. Out of doors the temperature range is 20° to 30°F. Temperatures in the greenhouse on the day ranged from 50° to 70°F, chilly for bathing suits but just fine for plants.

Financing for Smith's and Leone's homes was obtained from the usually staid Bank of America. The bank required Smith to install electric baseboard heaters as an emergency backup. Seeing how well the house performed, the bank waived this requirement for Leone's house. Such a forward-looking attitude on the part of banking institutions signals a growing awareness of the potential for passive-solar housing.

The largest bank in Rhode Island, the Old Stone Bank, recently funded the construction of a house using the same double-shell/convective-loop system. Garry Ducharme, director of public relations for the bank, indicated that the bank has spent a lot of time investigating the potential for residential solar construction. "We are looking for great development in the field of residential solar for the 1980s and expect to assist in the financing of large-scale solar developments in the coming decade." Discussing the house that has his bank help financed, Ducharme said, "This environment [Newport] is a difficult one in which to be different. So it is important that any solar development [should] look like our traditional New England home. This is typical of the banker's long-term view and cannot be overlooked despite the enthusiastic promotion of new building styles.

In many housing developments, blend-

CONTINUED ON PAGE 90

FICTION

THE NUMBER OF THE BEAST

BY ROBERT A. HEINLEIN

*They possessed the key
to all infinity,
but could they use it?*

PAINTING BY COLIN HAY

In last month's installment (October 1971), Dr. D. T. Burroughs is the young, beautiful daughter of Professor Jacob Burroughs, whom she describes as a mad scientist. "Actually, like Burroughs is a brilliant mathematician, a geometer who has invented a device that can travel not only through space, but through time as well, from one space-time continuum to another, from universe to universe.

Deady has been enlisted by her father to secure the help of Zosadakh John Carter, whom Professor Burroughs believes to be one of the few mathematicians in the world who can understand his six-dimensional, non-Newtonian equations. #

This installment from The Number of the Beast #100 is republished by FANTASY #500. Copyright © 1971 by Robert A. Heinlein.



a party given by sociable Hilda "Sharp" Corners. Deely offers herself as bait to Zeb if he will agree to discuss mathematics with her father. In the meantime, Jake is getting himself into a roaring argument with Professor N. O. Brain, a university mathematician of great composure and little creative intellect.

Zeb falls instantly and hopelessly in love with Deely, asks to marry her and swears that the Dr. Z. Carter her father is looking for is not he, but his cousin, Dr. Zebulon Edward Carter Deely, equally in love, accepts his proposal, whichever he is.

Joined by Sharpe Corners, Professor Burroughs, his daughter and Zeb leaves the party to find a justice of the peace. But the professor's car explodes as they approach it. Someone has had to murder Professor Burroughs.

Zeb bundles all four of them into his car—a souped-up combination automobile, airplane, and rocket that he calls Gay Deceiver. They start out for the Burroughs home in Utah, only to find that it too has been destroyed by blast and fire.

Zeb finds Gay Deceiver in Nevada where he and Deely are quickly married—and so are Jake Burroughs and Hilda—in a double ceremony marked more by its brevity than by anything else.

The four of them fly to the Burroughs hideaway north of the Grand Canyon, a largely underground retreat they call Snug Harbor. There they try to figure out their situation. It is obvious that someone does not want the human race to have a space-time continuum machine. Even Zeb's cousin has been mutilated. They learn

They conclude that their enemies must be aliens, creatures from another space and time who want to keep the power of continuum travel for themselves. Jake tells the others that his calculations show there is an enormous multiplicity of universes at distance—his total number is six, raised to the sixth power, and then raised to the sixth power again: the biblical Number of the Beast.

Realizing that their one hope of safety lies in flight among the universes, the two couples retire for the night. The following morning both women are convinced they are pregnant. Here begins Part 2 of "The Number of the Beast."

Deely

While Aunt Hilda and I assembled lunch, our men disappeared. They returned just in time to sit down. Zebadiah carried an intercom unit. Pop had a wire that he plugged into a jack in the wall and then looked to the intercom.

"Gentlemen, your timing is perfect, the work is all done." Aunt Hilda greeted them. "What is that?"

"A guest for lunch, my dearest." Pop answered. "Miss Gay Deceiver."

"Plenty for all," Aunt Hilda agreed. "I'll get another place." She did so. Zebadiah placed the intercom on the fifth plate. "Does she take coffee or tea?"

"She's not programmed for either, Hilda," Zebadiah answered. "but I thank you on her behalf. Ladies I got ecky about news from Singapore and Sumatra. So I asked my autopilot to report. Jake came along, then pointed out that he had spare cold circuits here and there, just in case—and this was a just-in-case. Gay is plugged into the garage end of that jack and this is a voice-switched, master-master intercom as this end. I can call Gay and she can call me if anything new comes in. And I increased her programming by reinstating the earlier programs. Logan and back home for whoever removal of new data."

"Pop," I inquired, "is this covered by Rule One? Or was Rule One abolished last night in Elko?"

"Eh? The chair must decide that Rule One is suspended until Hilda ratifies or cancels it. Hilda my love, years back Jane instructed Rule One—"

"I rasily it?"

"Thank you. But listen first. It applies to

● We have the most valuable man on this planet to protect.

... Jake, your bodyguard musters two Amazons

... and one Cowardly Lion

But we are all there is, and we'll try ●

meals. No news broadcasts—"

"Pop," I interrupted again, while Rule One is still in limbo, did Gay Deceiver have any news? I worry, I do!"

"Null newsworthy. Dear Even with the amusing conclusion that you and I are presumed to have died here, the news services do not appear to have noticed the discrepancy. However, Miss Gay Deceiver will interrupt if a bulletin comes in. Rule One is never invoked during emergencies. Zeb, do you want the rig in your bedroom at night?"

"I don't want it, but I should have it. Prompt notice might save our skins."

"We'll leave this here and para led another into there, with gain stepped to wake you. Back to Rule One. No news broadcasts at meals, no newspapers. No shop talk, no business or financial matters, no discussion of ailments. No political discussions, no mention of taxes or of laws or domestic policy. Reading of fiction permitted at meals, not with guests present. Conversation limited to cheerful subjects—"

"No scandals, no gossip?" demanded Aunt Hilda.

"A matter of your judgment, dear Char-

lot gossip about friends and acquaintances, juicy scandal about people we do not like—fine! Now do you wish to rasily abolish amend or take under advisement?"

"I rasily it unchanged. Who knows some juicy scandal about someone we don't like?"

"I know an item about N. O. Brain—Doctor Neil Brain." Zebadiah offered.

"Ovel!"

"I got this from a reliable source, but I can't prove it."

"Irrelevant, as long as it's juicy. Go ahead, Zebbie."

"Well, a certain zeffig toad told this on herself. She tried to give her all to Brany in exchange for a passing grade in the general math course necessary for any degree on our campus. It snagged to permit prominent but stupid athletes to graduate. Miss Zeffig was flunking it, which takes exceptional talent.

"So she arranged an appointment with the department head, Brany and made her quid pro quo clear. He could give her horizontal tutoring then and there or in her apartment or in his apartment or in a motel, and she would pay for it whenever and wherever he chose. But she had to pass."

"Happens on every campus, son." Pop told him.

"I haven't reached the point. She blabbed the story. She wasn't angry but puzzled. She says that she was unable to get her intention across to him—which seems impossible. I've seen this young woman Brany didn't accept didn't refuse, wasn't offended, didn't seem to understand. He told her that she had better talk to her instructor about getting tutoring and a re-exam. Now Miss Zeffig is circulating the story that Professor N. O. Brain must be a suruch or a robot. Not even a homo. Totally sexless."

"He's undoubtedly stupid." Aunt Hilda commented. "But I've never met a man I couldn't get that point across to, if I tried. Even if he was uninterested in my original carcass. I've never tried with Professor Brain because I'm not interested in his carcass. Even barbecued."

"Then, Hilda my darling, why did you invite him to your party?"

"What? Because of your note, Jacob. I don't refuse you favors."

But Hilda, I don't understand. When I talked to you by telephone, I asked you to invite Zeb because I was under the impression that he was her cousin Zebulon. And I did say that two or three others from the department of mathematics might make it a less conspicuously arranged meeting. But I didn't mention Doctor Brain. And I did not write."

"Jacob, I have your note in California. On your university stationery with your name printed on it."

Pop shook his head and looked sad. Zebadiah said, "Sharpe—handwritten or typed?"

"Typed. But it was signed! Was a mo-

ment, let me think. It has my name and address down in the lower left. Jacob's name was typed, too, but it was signed Jake. Uh... My dear Hilda, a hasty PS to my phone call of yesterday. Would you be so kind as to include Doctor Neil O. Brain, chairman of mathematics? I don't know what possessed me that I forgot to mention her. Probably the pleasure of hearing your dear voice.

Deety sends her love, as do I. Ever yours, Jacob J. Burroughs, with Jake signed above the typed name."

Zabedah said to me: "Watson, you know my methods."

"Certainly my dear Holmes. A Black Hat, in Logan."

"We know that. What new clote?"

"Well, Pop made that call from the house. I remember it. So somebody has a tap on our phone. Had, I mean, the fire probably destroyed it."

"A recording tap. The purpose of that fire may have been to destroy it and other evidence. For now we know that the Blacks in Black Hats knew that your father—and you, but it's Pop they are after—was in California last evening. After killing him in California, they destroyed all they could in Utah. Professor, I predict that we will learn that your office was burgled last night—of any papers on six-dimensional spaces."

Pop shrugged. They wouldn't find much. I had postponed submitting my final paper after the humiliating reception

of my preliminary paper. I worked on it only at home, or here, and moved notes inside in Logan to our basement here each time we came down."

"Any notes missing here?"

"I am certain this place has not been entered. Not that the papers would matter. I have the material in my head. The continuous apparatus has not been touched."

"Zabedah, is Doctor Brian a Black Hat?" I asked.

"I don't know, Deety. He may be a stooge in their hand. But he's part of their plot, or they would not have asked for a letter to get him into Hilda's house."

Aunt Hilda said, "It didn't occur to me to question the signature on Jacob's stationery under a note that sounded like his phrasing. What do we stand now?"

"Stuck in the mud. But we have added data. At least three are involved, two Black Hats and Doctor Brian, who may or may not be a Black Hat. He is, at minimum, a hired hand, an unwitting stooge, or a puppet they can move around like a chessman."

"While two plus Brian is the minimum, it is not the most probable number. This scheme was not whipped up overnight. It involves arson, forgery, booby-trapping a car, wiretapping, theft, and secret communications between points widely separated, with coordinated criminal actors at each end. And it may involve doing in my cousin Zebulon. We can assume that the Black Hats know that I am not the Zeb Car-

ter who is the n-dimensional geometer. I've been written off as a bystander who got himself killed."

"Which doesn't bother them. These playful carings would swell a fly with a sledgehammer or cure a cough with a guillotine. They are smart, organized, efficient, and vicious, and the only clue is an interest in six-dimensional, non-Euclidean geometry."

"We don't have a glimmer as to who—other than Doctor Brian, whose role is unclear. But, Jake, I think I know why and that will lead us to who."

"Why, Zabedah?" I demanded.

"Princess, your father could have worked on endless other branches of mathematics and he would not have been bothered. But he happened—I don't mean chance, I don't believe in chance in this sense—I do work on the one variety of the endless possible number of geometries—the only one that correctly describes how space-time is put together. Having found it, because he is a genius in both theory and practice, he saw that it was a means by which to build a simple, craft—amazingly simple, the greatest invention since the wheel—a space-time craft that offers access to all universes to the full Number of the Beast. Plus unnumberable variations of each of those many universes."

"We have one advantage."

"I don't see any advantage! They're shooting at my Jacob!"

"One strong advantage, Sharpe. The

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Black Hats know that Jake has worked out his mathematics. They don't know that he has built his space-time ball better; they think he has just put symbols on paper. They tried to discredit his work and were successful. They tried to kill him and barely missed. They probably think Jake is dead and it seems likely that they have killed Ed. But they don't know about Snug Harbor.

"Why do you say that Zeb? Oh, I hope they do not! But why do you feel sure?"

"Because these bikes aren't fooling. They blew up your car and burned your fat, what would they do here if they knew? An A-bomb?"

"So, do you think that criminals can lay hands on atomic weapons?"

"Jake, these aren't criminals. A criminal is a member of the subset of the larger set Auran beings. These creatures are not human."

"EH? Zeb, your reasoning escapes me."

"Dusty. Run it through the computer. The one between your ears."

I did not answer. I just sat and thought. After several minutes of unpleasant thoughts, I said, "Zabedah, the Black Hats don't know about the apparatus in our basement."

"Conclusive assumption," my husband agreed, "because we are still alive."

"They are determined to destroy a new work in mathematics and to kill the brain that produced it."

"That is a probability that truly ap-

proaches unity," Zabedah agreed again. "Because it can be used to travel among the universes."

"Conclusive corollary," my husband noted.

For this purpose, human beings fall into three groups. Those not interested in mathematics more complex than that needed for them to handle money; those who know a bit about other mathematics; and a quite small third group who could understand the possibilities.

"Yes."

"But our race does not know anything of other universes so far as I know."

"They don't. Necessary assumption."

"But that third group would not try to stop an attempt to travel among the universes. They would wait with intellectual interest to see how it turned out. They might believe or disbelieve or suspend judgment. But they would not oppose; they would be delighted if my father succeeded. The joy of intellectual discovery—the mark of a true scientist."

I sighed and added, "I see no other grouping. Save for a few sick people: psychotic; these three subsets complete the set. Our opponents are not psychotic; they are intelligent, crafty and organized."

"As we all know too well," Zabedah echoed.

Therefore our opponents are not human beings. They are alien intelligences from elsewhere." I sighed again and shut up.

Being an oracle is a no good profession!

"Or elsewhere. Sharpe, can you kill?"

"Kill whom, Zebbie? Or what?"

"Can you kill to protect Jake?"

"You bet. I'd kill to protect Jacob!"

"I won't ask you, Princess, I know Dejah Thorne," Zabedah went on. "That's the situation, ladies. We have the most valuable man on this planet to protect. We don't

know from what Jake, your bodyguard

musters two Amazons, one small, one

medium-large, both probably knocked up,

and one Cowardly Lion. I'd hire the Dorcas!

I knew their P.O. box. Or the Gray Lensman

and his pals. But we are all there is, and

we'll try. Avete, avete. Nos mortui vos

speravimus! Let's break out that champagne."

"Hids."

In my old age, sucking my gums in front

of the fire and living over my mistakes, I'll

remember the next few days as the hap-

piest in my life. I'd had three honeymoons

earlier, one with each of my term-contract

husbands; two had been good, one had

been okay and—eventually—very lucra-

tive. But my honeymoon with Jacob was

heavenly.

The whiff of danger sharpened the joy

Jacob seemed unworried and Zebbie has

hunches, like a horseplayer. Seeing that

Zebbie was relaxed, Dusty got over being

snippy and I never was, as I hope to end

like a firecracker, not linger on, ugly help-

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less useless.

A spice of danger adds zest to life. Even during a honeymoon—especially during a honeymoon.

An odd honeymoon: We worked hard but our husbands seemed never too busy for pal-fenny, squeeze-fity and unformed kisses. Not a group marriage but two twosomes that were one family, comfortable one with the other. I dropped most of my own spiky-bitch ways, and Zebbie sometimes called me Hilda rather than Shapka.

We settled into a routine. Up early every day, our men worked on instruments and wires and things and installing the time-space widget into Gay Deceiver's gizzard while Deety and I gave the housework a lick and a promise. Our mountain home needed little attention—more of Jacobs' genes. Then Deety and I got busy on a technical matter for which Deety could do with some help from me.

I'm not much good for technical work, biology being the only thing I studied in depth. And I never finished my degree. This was amplified by almost six thousand hours as a volunteer nurse at it our campus medical center and I took courses that make me an uncertified nurse or medical tech or even jacking paramedic. I don't shirk at the sight of blood and can clean up vomit without a quail and would not hesitate to fill in as a scrub nurse. Being a campus widow with too much money is fun but not soul-filling. I like to feel that I've paid rent on the piece of earth I'm using.

Besides that, I have a smattering of everything because of my addiction to the printed page: plus attending campus lectures that sound intriguing, then sometimes auditing a related course. I audited descriptive astronomy took the final as if for credit and got an A. I had even figured a cometary orbit correctly to my surprise (and the professor's).

I can wire a doorbell or clean out a stopped-up soil pipe with a plumber's snake, but it's really technical. I hire specialists.

So Hilda can help but usually can't do the job alone. Gay Deceiver had to be reprogrammed, and Deety who does not look like a genius, is one Jacobs' daughter should be a genius, and her mother had an IQ that startled even me, her closest friend. I ran across it while helping poor-gruel-stricken Jacob decide what to save, what to burn. I burned unflattering pictures, useless papers, and clothes. A dead person's clothes should be given away or buried; nothing should be kept that does not inspire happy memories. I chided a bit and that saved Jacob and Deety from having to cry later.

The next two days were easy for me, I had for Deety I held lights and made notes on a clipboard while she studied Gay's anatomy and binned and got smugged and sweetly getting herself into impossible positions. And once she cursed in a fashion that would have caused Jane to scold. She added, Aunt Nanny Coast, your stop-

in-law has done things to this mass of spaghetti that no decent computer should put up with! It's a bastard! Gay!

"You shouldn't call Gay a, Deety. And she's not a bastard."

"She can't hear us. I've got her ears unhooked, except that piece that is monitoring news-retrieval programs and that goes through his wire to that jack in the wall; she can talk with Zebadah only in the basement now. Oh, I'm sure she was a nice girl until that big ape of mine raped her. Aunt Hilda don't worry about hurting Gay's feelings, she hasn't any. This is an idiot as computers go. Any one-horse college and most high schools own or share one in computers much more complex. This one is primarily cybernetic, an autopilot plus limited digital capacity and limited storage. But the mods Zebadah has tacked on make it more than an autopilot, but not a general-purpose computer. A mabogepfen hybrid. It has bar-number random-number operators than a needs and it has extra func-

● The unformed character sighed, "I got no time to listen to smart talk." He rested his hand on the butt of his gun... "I'm going to search this site and the cabin. ●

tons that IBM never dreamed of."

"Deety, why are you talking off the cover plates? I thought you were strictly a programmer. Software. Not a mechanic."

"I am strictly a software mathematician. I wouldn't attempt to modify this monster even on written orders from my lovable but sneaky husband. But how in the name of Allah can a software hack think about simplification analysis for a program if she doesn't know the circuitry? The first half of this book shows what the autopilot was manufactured to do, and the second half, the Xeroxed pages, shows the folies Zebadah has seduced her into. This breedin' bundle of chips now speaks three logic languages, interfaced, when it was built to use only one. But it won't accept any of them until it has been wheedled with Zebadah's double-talk. Even then it rarely answers a code phrase with the same answer twice in a row. What does it say in answer to 'You're a smart girl, Gay?'"

"I remember. Boas. I bet you'll tell that to all the girls. Over."

"Sometimes Motel cabin, as that answer is weighed to come up three times as often as any of the others. But listen to this,

"Zeb, I'm so smart I can see myself." Then why did you turn me down for that name? Never mind the compliments! Take your hand off my wrist! Not so loud dear! I don't want my boyfriend to hear!"

And there are more. These are at least four answers to any of Zebadah's code phrases. He uses just one list, but the autopilot answers several ways for each of his phrases, and all of them mean either Rigger or Null program, rephrase."

I like the idea. Fun."

"Well, I do myself. I amaze a computer. I think of it as a person. And these random answer list makes Gay Deceiver seem much more alive when she isn't. Not even versatile, compared with a ground-based computer. But"—Deety gave a quick smile—"I'm going to hand my husband some surprises."

"How Deety?"

"You know how he says: 'Good morning, Gay. How are you?' what we sit down for breakfast."

"Yes, I like it. Friendly. She usually answers, 'I'm fine, Zeb.'"

"Yes, it's a test code. It orders the autopilot to run a self-check through out and to report any running instruction, which takes less than a millisecond. If Zebadah didn't get that or an equivalent answer, he would rush straight here to find out what was wrong. But I'm going to add another answer. Or more."

"I thought you refused to modify anything."

Aunt Hilda, this is software, not hardware. I'm authorized and directed to amplify the answers to include all of us, by name, for each of our voices. That is programming elementary. You say good morning to this gadget and it will—when I'm trained—answer you and call you either Hilda or Mrs. Burroughs."

Oh, let her call me Hilda.

All right, but let her call you Mrs. Burroughs now and then, for variety."

"Well, all right. Keep her a personality."

"I could even have her call you—low weighting!—Nanny Coast."

I guffawed. "Do Deety please do. But I want to be around to see Jacob's face."

"You will be, it won't be programmed to answer that way to any word but yours. Just don't say 'Good morning, Gay' unless Pop is listening. But here's one for my husband: Zebadah says, 'Good morning, Gay. How are you?' and the speaker answers, 'I'm fine, Zeb. But your fly is unrippled and your eyes are bloodshot. Are you hung over again?'"

Deety is so solemn and yet so playful. "Do it, dear! Poor Zebbia, who drinks the least of any of us. But he might not be wearing anything zipped."

Zebadah always wears something at meals. Even his underwear shorts are zipped. He dislikes elastic."

"But he'll recognize your voice, Deety."

"Nops. Because it will be your voice modified."

And it was. I'm contrary, about the range

of the actress—or girl band—who originally recorded Gay Deceiver's voice. I don't think my voice has her sultry bedroom quality, but I'm a natural mimic. Deely borrowed a wigglescope—oscilloscope?—from her father, my Jacob, and I practiced until my patterns for Gay Deceiver's original repertoire matched hers well enough. Deely said she could not tell them apart without close checking.

I got into the spirit of it, such as having Deely cause Gay Deceiver to say occasionally to my husband: "Fine, except for my backache, you wicked old billy goat!" And Jacob tripped that reply one morning when I did have a backache, and I feel sure he had one, too.

We didn't put in answers that Deely felt might be too broad for Jacob's "innocent" mind—I didn't even hint at how her father actually talked to me in private. Let us all preserve our illusions, it lubricates social relations. Possibly Deely and Zebba talked the same way to each other in private and regarded us "old folks" as hopelessly square.

Deely

Aunt Hilda and I finished reprogramming in the time it took Zebbadiah and Pop to design and make the leg-saw and other mods needed to turn Gay Deceiver, with the time-space widget installed, into a continuous traveler—which included placing the backseats twenty centimeters farther back (for leg room) after they had been pulled out to place the widget about the bulhead and weld it to the shell. The processing controls and triple verniers were removed to the driver's instrument board, with one voice control for the widget, all others manual.

If any of our voices said "Gay Deceiver, take us home!" car and passengers would instantly return to Snug Harbor.

I don't know why, but I trust my pop. He brought us home safe twice, doing it with no fail-safes and no deadman switch. The latter paralleled the "Take us home!" voice order, was normally clamped closed and covered, but could be uncovered and held in a fist closed. There were other fail-safes for temperature, pressure, air, radar collision course, and other dangers. If we wound up nears a star or a planet, none of this could save us, but it is easy to prove that the chances of falling downstairs and breaking your neck are enormously higher than the chance of co-occupying space with other matter in our native universe—space is plentiful, mass is scarce. We hoped that this would be true of other universes as well.

No way ahead of time to check on the Number-of-the-Beast spaces, but "The cowards never started, and the weaklings died on the way." None of us ever mentioned not trying to travel the universes, besides our home planet had turned unfriendly. We didn't discuss Black Holes, but we all knew that they were still here and that we remained alive by lying doggo and let-



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ing the world think we were dead.

We ate breakfast better each morning after hearing Gay Decaver offer "null report" on news networks. Zebadiah I am fairly certain had given up his cousin for dead. I feel sure Zebadiah would have gone to Sumatra to follow a lost hope, were it not that he had acquired a wife and a prospective child. I had missed my next period, so had Hilda. Our men looted our not-yet-bulging bellies, Hilda and I angrily resolved to be good girls, yes!—and careful. Hilda joined my morning tanning up and the men joined us the first time they caught us at it.

Zebadiah did not need it but seemed to enjoy it. Pop brought his wastline down five centimeters in one week.

Shortly after that feast Zebadiah pressure-tested Gay Decaver's shell—four aspirators inside her and a pressure gauge sticking out through a fitting in her shell.

Zebadiah, sprawled out, looked up over the fireplace. "Pop, you were in the navy?"

No, army—if you count "charitable infantry." They handed me a commission for having a doctorate in mathematics, told me they needed me for ballistics. Then I spent my whole tour as a personal officer signing papers.

Standard opening procedure. That's a navy sword and belt up there. Thought they might be yours."

"They're Deety's—belonged to Jaris's Grandfather Rodgers. I have a dress saber. Belonged to my dad, who gave it to me when the army took me. Dress blues, too. I took them with me, never had occasion to wear either." Pop got up and went into his—then—bedroom, calling back, "I'll show you the saber!"

My husband said to me, "Deety, would you mind my handling your sword?"

"My Captain, that sword is yours."

"Heavens, dear, I can't accept an honor."

"If my Warlord will not permit the princess to gift him with a sword, he can leave it where it is. I've been wanting to give you a wedding present and did not realize that I had the perfect gift for Captain John Carter."

"My apologies, Dejah Thors. I accept and will keep it bright. I will defend my Princess with it against all enemies."

"Helm a proud to accept. If you make a cradle of your hands, I can stand in them and bring it down."

Zebadiah grasped me a hand above each knee, and I was suddenly three meters tall. Sword and belt were on hooks. I lifted them down and was myself placed down. My husband stood straight while I buckled it around him. Then he dropped to one knee and kissed my hand.

My husband is mad north-northwest, but his madness suits me. I got tears in my eyes, which Deety doesn't do much but

Dejah Thors seems prone to, since John Carter made her his.

Pop and Aunt Hilda watched, then insisted, including (I swear) tears in Hilda's eyes after she buckled on Pop's saber, when he knelt and kissed her hand.

Zebadiah drew sword, tried its balance, sighted along its blade. "Handmade and balanced close to the hilt. Deety, your great-grandfather paid a pretty penny for this. It's an honest weapon."

"I don't think he knew what it cost. It was presented to him."

"For good reason, I feel certain." Zebadiah stood back, went into hanging guard, made last mousetraps vertically, left and right, then horizontally, clockwise and counterclockwise. He then suddenly dropped into swordman's guard, lunged, and recovered, fast as a striking cat.

I said softly to Pop, "Did you notice?"

Pop answered quietly, "Knows saber sword too."

Hilda said loudly, "Zebie! You never told me you went to Heidelberg!"

"You never asked, Sharpe. Around the Red Dix they called me the Scourge of the Nedcor."

"What happened to your scars?"

"Never got any, dear. I hung around an extra year, hoping for one. But no one got through my guard ever. Hope to think about how many German faces I carved into checkboards."

Zeb

Before heading for the pool, our wives argued over how Batscomian warriors dress—a debate complicated by the fact that I was the only one fairly sober.

Jake and I agreed to wear adeams. Our princesses had buckled them on, we would wear them. But Deety wanted me to take off the grease-stained shirts I had worn while working. "Captain John Carter never wears clothes. He arrived on Barsoom naked and from then on never wore anything but the leather and weapons of a fighting man. Jeweled leather for state occasions, plain leather for fighting and sleeping sites at night. Batscomians don't wear clothes. When John Carter first laid eyes on Dejah Thors," Deety closed her eyes and moaned. "She was a destitute of clothes as the Green Martians... Save for her highly wrought ornaments she was entirely naked." Deety opened her eyes, stared solemnly. "The women never wear clothes, just jewelry."

Jake wrapped his sardonic into a beachcoat, strapped it in place with his saber belt. I replaced those grimy shorts with swim briefs, which, Deety conceded, were almost Batscomian. "I was no longer dependant on Jake's clothes, my travel kit, always in my car, since I got it, supplied necessities from passport to poncho. Sharpe wore pearls and rings she had been wearing at her party, plus a scarf around her waist to which she attached all the costume jewelry Deety could dig up. Deety carried Hilda's mink cape, then





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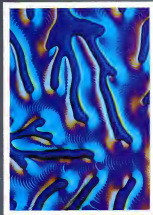
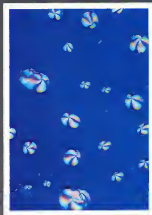
BY HERBERT W. FRANKE

The stark boundaries of microscopic life are transformed into vivid color imagery by an artist who fuses art, technology and metaphysics. His world of brilliant light/dark compositions captures the very fiber of nature's fragile lifelines and brings them into focus.



Crystal moirés, snowflakes, flowers, microbes, and insects—Michael Kage (pronounced "Cage") knows them all. A voyage through dimensions of nature, Kage uses photomicrography to distill the beauty of science through the eyes of an artist. His work with microscopes began early in his career as a chemical technician tasked with microscopic investigations of the structure of cellulose. This led to photomicrographing mineral cuts and the study of crystalline structures, then then—a revelation. "One day it was as if the scales had fallen from my eyes," he says. "Suddenly I saw everything very differently, detached from every scientific way of seeing I had known before. I beheld in the crystalline landscape a mosaic, a rhythmic pattern with fascinating dark/light compositions." For Kage, the marriage between art and

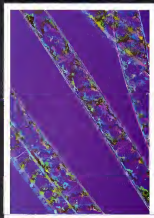
microscopy began in Stuttgart, when, upon drinking a microalcoholic beer of a flower, Dinko, WAS, produced a liquid crystalline substance, just as other microbes. (Below right) decomposition of drinking kegger, paper-plantain B. 8

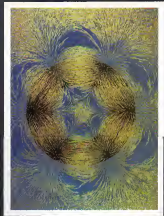
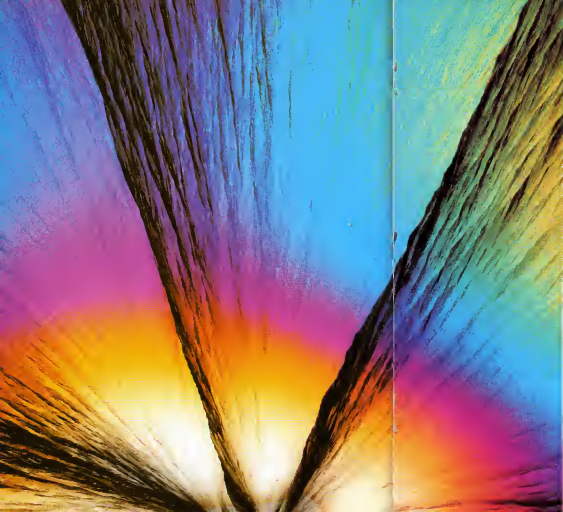


• He combines the visual aspects of the sciences with the graphic appeal of the artist.

science was begun. He undertook experiments designed to represent the visual world of science, combining ultraviolet and graphic appeal. In 1909 Kage founded the Institute for Scientific Photography and Cinematography, pioneering new methods of crystal photography with the aid of two Zeiss lenses specially provided for him. In addition, he is a founding member of the German Group Zero, which presents scientific photographs in art exhibits. For his own exhibit, he took heated crystals of a microscopic slide, allowed them to cool, and, with the aid of a polarizing lens, transformed the colorless crystals into a variegated color spectacle—a feat nearly impossible to achieve through chemical means. Kage has now branched out into all aspects of the scientific/art world, including sound and multimedia presentations, electronic cir-

(left) scanning electron photograph of wing joints on a *Labea* butterfly (below left) *Spargano angus* photographed with an ultraviolet coated apparatus (below right) vitamin C crystals photographed with polarized light





quality television production, and video art. Yet for all of his serious effort, Kage is the quintessential dreamer and looker, constantly looking for new ideas to explore. His Audioscope, a device for converting sound into light forms, in fact came to him in a dream. Upon waking, he simply followed his dream plans to turn the Audioscope into reality. Kage is also a long-term fan of science fiction. He enjoys using SF imagery as a stimulus to his own creativity. A new challenge for him has been to present SF images, using photography, video art, and special effects, on television. The result is a TV special that will be aired in Germany. Kage's special brand of genius is all his own. One Zeiss engineer has said, "Whenever we have some technical problem that we cannot solve, there is one last resort: Manfred Kage." Translated by Inge King DO

(Above) the magnetic field of a round magnet is magnified by iron filings. (Left) a crystal of "cloud," a drug used against tuberculosis.

◆ Whenever we have some problem we cannot solve, there is only one solution: Manfred Kage. ◆

FICTION

MALTHUS'S DAY

They had a nearly perfect world, where babies were the best possible reward

BY JAYGE CARR

The news came while Janica was light-sculpting, with Sylve hovering nervously about the perimeter and trying to make herself useful.

That was typical of both of them. Janica, at that point in her life, anyway lived her art, while Sylve's reason for transferring to Pavlova Village was to sit at the feet—often literally—of one of the acknowledged virtuosos of the newest and most demanding multidiscipline.

So characteristically, Janica stood cool and elegant in her clamorous pearl-dye and projectors while Sylve ylered, checking all the last-minute details—were the projectors perfectly in synch, perfectly centered on waist and forehead and ankle perfectly aligned?—over and over (Most light-sculptors were content with three or at most four projectors, wrists and forehead say or more difficult, wrists and ankles. But Janica was never content with fewer than five, and sometimes with a contemplative easiness that literally averted her young acolyte, she added a sixth at the waist).

But once the music started, it was Sylve who stood, unmoving, scarcely breathing, while Janica's sinuous body swayed in delicate interpretation of the plaintive melody that filled the studio: "Greenleaves," sang a poignant young girl's voice, "is my delight.

And Janica danced, a sad, slow weaving of loss and loneliness, as she moved, the projectors left their trails of living light, ribbons of color, thick and dark for slow, deliberate movements and thin and light for the quick leaps and gestures.

This one, Sylve thought, live one is going—The student in-ringing of a waltz-com stylized through the soft singing, and Janica jerked, destroying the smoothness of the curls of solid living light.

"I thought you know enough to set your corn on hold," Janica snarled, snapping off the projectors and plowing through the stiff-lid curls, ruining the earlier, perfect part of the sculpture.

PAINTING BY WOLFGANG HUTTER



"But I did—1-1-1—"

"You didn't, obviously!" A scornful flip of her still-projected arm behind her. "Wipe that! It's ruined. And answer your bombing com."

It was still ringing—an imperious, teeth-jarring shrillness.

"But it's not my com, Janica, see?" She held out her wrist. The blinking red light that should have accompanied any demand for attention wasn't on.

Janica's silver-rimmed eyes widened just slightly. Then she moved, still with that feline, sinuous grace, to the shelf where her personal ferns were neatly placed. But the red light wasn't blinking, it stared at them, a continuous crimson leer.

"Override," Sylve was puzzled.

"Official override," Janica muttered and smiled slowly and her thumb pushed down.

"Citizen Janica Pilsen Suharto," said the life-size, vaguely familiar holo-image that appeared—"as your officially computerized representative."

The news was all over the village in minutes, and it was the main topic of conversation for weeks—except among those few individuals who were, or pretended to be, indifferent. Janica herself was completely bored. It was, as she occasionally reminded her neighbors, her second time.

Sylve was positively green with envy. Her mind kept producing harmless scenarios: Janica miscalculating one of her unusually high leaps, breaking her leg, and

being rushed immediately to a hosp.

The entire village exposed to some mysterious neuronal disease (nonfatal and eventually curable, of course!), only Sylve, through some strange mutant quirk in her physiology, both immune and a noncarrier.

Even Sylve knew they were only dreams. Nothing, bad or sad, would ever happen to Janica, proud darling of the powers that be or to Phil, other. But who ever noticed Phil, when Janica sleek and elegant, was in view? Besides, this was Phil's first.

"But isn't it exciting!" Sylve whispered to her new tembus, Ray.

Ray older and far more experienced, yawned and switched channels on the holo that displayed over their double bed. "Yeah, sure, but it's not so if we were chosen, hon. You'd do better to watch it on the holo, you'll see more."

"Oh, pooh, stodgy old thing!" she pouted. "Janica's my friend, I'm sure she'll invite me to—well!"

"Uck," he rejected all the choices and stopped the discussion by reaching for his termite.

One hour before M-day they officially closed off all the transmitters in the village—except for one. (There were no fences around the village, but with the ubiquitous transmitters making another continent a step away, who knew—or cared—if the nearest village was physically a kilometer away—or a hundred?)

As M-day began, in the darkness, at least half of the villagers were crowded around the single functioning transmitter. The noise made the people keep a wide opening around the machine.

At precisely midnight the transmitter glowed, and shapes solidified. At first the curious watchers saw only a team of white-clad medics, but as they moved, glimpses of a sealed carrier floating at about chest height were caught.

The chest medic identified himself to the security chief. Although both teams worked in shifts, they had undoubtedly met each other on numberless similar midnights. Still, you didn't get to be a security chief by being careless. All the medics were checked out—the checks carefully designed not to break the integrity of the sealed suits—and the security chief herself ran through the checks on the chief medic.

Once the checks were completed, the chest medic took over. Leaving guards at the transmitter, which would be sealed until M-day ended, the cottage turned toward Phil and Janica's cottage, which was generously sized, Tudor-beamed, and synth-stitch-roofed, but dwarfed by the long glasshouse studio behind it.

Phil stood proudly at the front of the mob. As soon as the medic was certified, he stepped forward. "I'm the—"

"Get back," a security guard snarled, just as if he hadn't helped check Phil out, along with the rest of the watchers, not half an hour before.

Phil stopped, puzzled, his feelings hurt. "But I'm the—" he began again, nervously backing off the grassy path and into the night-blooming moonstreams that lined it, crushing some of the fragile flowers.

One of the medics spoke to the crowd. "Stand out of our way, please. We've a tight schedule to maintain." They pushed past him, and Phil stood staring after them, good-natured face blank, mouth hanging slightly open. It wasn't until one of his neighbors nudged him and said, "Better get along, Phil," that he came out of his daze and trotted along after the parade heading toward his cottage.

(It was a parade that diminished rapidly as more and more of its components decided they could see more on their holo than by trying to crane over their neighbors' heads.)

M-day plus twenty minutes.

The security chief raised her hand to activate the cottage's airlock, but Janica opened her door, making it obvious that she had been watching the whole thing on her holo. The chief checked Janica's I.D. and compared her retina prints and pore patterns with the I.D. and—just to be sure—with central records. "Who else is present?" she asked Janica.

"No one at the moment," Janica frowned. "But I do hope I'll be allowed to invite some of my very special friends later."

"Naturally," the chief nodded. "Within limits, as you've been told. And of course if



they is already here, within the village. We sealed your village as soon as—

My teammate Phil? Janica gestured casually to indicate the red-faced man elbowing his way through the crowd, which was being kept well back from her door. To his outrage, he was checked out again before being allowed into his very own cottage. Then the seccoff nodded and gestured the medics with their canner inside and firmly shut the door.

(Only three of the medics actually went inside; the others either waited patiently in the grassy open space, the targets of numerous staring eyes, or moved off to other duties. Many of the watchers left too. Staring at a closed door seemed rather futile, especially when the holes would be showing the scene inside. Iwa.)

Inside the seccoff was performing introductions: Citizen Janica Pitaan-Suharo, Citizen Phil Jones-Wahnsky may I present Citizen Medic Herve Ling-Hart and his staff. She glanced at her wrist, her throat worked, and a subvocal message went out. (The team has your shelter set up. Herve, if the second and third shifts want to go and relax.)

Congratulations to the both of you! the medic beamed, stepping forward and shaking hands vigorously. If you'd care to see my credentials.

No, no, Doc. Phil grinned heartily. Good enough for the leut here, good enough for this citizen, right, Lieut?

You'll want to know the day's schedule, of course, the doctor nodded.

Schedule? Phil was puzzled. He flopped downward, and an extrude aid out from the wall and caught him in a sitting position with neat precision. I thought we had our choice, I thought—

Yes and no, the doctor frowned. His own throat worked silently. (Wasn't these citizens beefed? Shiraz?) In his ears, a tiny raspberry of disgust echoed. Yes, there is a schedule, and I'm afraid we must insist it be adhered to. However, there is a certain amount of flexibility within that, and considering the subject's physical limitations—

Limitations? Phil interrupted. I thought nothing but perfect was allowed.

Oh, Phil? Janica was disgusted. Have you forgotten? They're amateur.

Oh? Phil's face cleared. If you weren't so borngly handsome, she muttered.

The schedule, the medic hid his disgust better than Janica, begins with awakening at eight six hundred precisely. Medic checks will take approximately ten minutes. Afterward, you two, and as many as four of your friends, can have breakfast with the subject—

Yeah, we know! Phil was nodding. He loved to hand out favors. You should see what mean Janey—! (Janica winced; she had told him and told him.) —have whipped up for breakfast. He's gonna love—

I'm afraid, the medic was very firm. CONTINUED ON PAGE 102

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Cambridge University's first Ph.D. in parapsychology just may have proved the existence of ESP, but his fraud-proof research hasn't quieted committed skeptics

INTERVIEW

CARL SARGENT

Carl Sargent not only is the first man ever to be granted a doctorate in parapsychology by England's prestigious Cambridge University. He is also the first to receive such an honor from any of England's traditionally conservative academic shrines. It looks as if Dr. Sargent's recognition is well earned. His experiments are causing a stir in British scientific circles because they seem to solve two problems that have long bedeviled psi studies. Psychic phenomena often seem too weak to be investigated, and when an experiment does give significant results, it often proves impossible to repeat them. Sargent's tests seem to show that ESP is like a weak sense, hard to pin down because it is normally suffocated by the enormous flow of sound, light, and other information reaching the brain.

He's been testing what is known as the Ganzfeld technique. He wears "white noise" to block out the subject's hearing and places hot ping-pong balls over their eyes to eliminate visual distractions. Under these conditions, the brain empty stage paying attention to

external sights and sounds, and inner visions come to the fore. In a typical ESP test, a person "in Ganzfeld" describes his thoughts while a distant sender tries to project an image into his mind. After about 35 minutes, the experimenter shows the subject four pictures. One is the target. The subject then ranks the pictures according to how well they match his Ganzfeld thoughts. Guessing the target gives only one chance in four of a correct answer.

In their first experiments, Sargent, Terer Hanley and other Cambridge colleagues tested 28 people, who took personality tests before the experiment. After the Ganzfeld trial, but before they saw any of the pictures, the subjects filled in a questionnaire about their experiences. Eight, or 31 percent, then said the target picture fitted their visions. It was better than chance, but not significantly so.

Sargent was encouraged, however. He insisted that if Ganzfeld works by reducing our sensory signals to habits that can be ignored—a process that takes 20 minutes or so—ESP scores should improve with time. That was exactly what he found. Scores

at the start were appalling but, then improved, and ended high.

Two more series gave 45-percent correct answers. A fourth gave 44-percent, and all subjects scored better than chance. In all tests, ESP performance seemed to be related to two personality variables: Extroverts did better than introverts, and people who said on the questionnaire that Ganzfeld had changed their consciousness did better than those who were relatively unaffected.

Omm: Oxford and Cambridge have a tradition of rejecting doctoral theses about ESP. Getting your doctorate in this elusive area seems to represent a significant milestone for parapsychology.

Sargent: When I proposed this topic, I didn't encounter any significant opposition. Quite the reverse. It's really a question of how you do the research. If it's properly conducted, if the methods are correct, then I don't see that there can be any objections to a Ph.D. in any subject whatsoever, let alone parapsychology. Now as for making a novel contribution to science, which is what a Ph.D. is supposed to be about, parapsychology is an extremely easy field because it's one in which relatively little of the groundwork has been mapped out.

Omm: What did you actually set out to do in your thesis?

Sargent: I wanted to research the individual-difference variable—what makes one person apparently capable of ESP and another not—and I started by looking at personality factors. It's long been maintained that certain types of personality are particularly favorable to success in these tests. In a couple of experiments I did indeed find an anxiety factor coming into play. Experimenters who had very low anxiety scores on a standard test got very favorable results from their subjects. Some of the subjects would score very high and some very low. However, experimenters with high anxiety had subjects who clustered very closely around chance.

Now it's been said that the experimenter's task in parapsychology is to liberate the subject's innate capacity and one could argue that that's what the low-anxiety experimenters were doing. But that wasn't really satisfactory because I wasn't finding anything that differentiated between experimenters who got results and those who didn't. Later I had the opportunity to look at the work of another parapsychologist, Adrian Parker, from Edinburgh. He had made certain predictions that I proceeded to test, of which the most important was that successful Ganzfeld experimenters should be more extroverted than those who weren't. And that's exactly how it turned out. What was also interesting was that, as a group, the people who were not getting results were phenomenally introverted.

Omm: From this kind of study you should be able to establish which are the strong ESP-promoting factors, and from then on you should be able to get ESP on tap.

Sargent: Well, it may not be as easy as that. It isn't just the procedures that yield the big effects, are the ones that involve altered states of consciousness—sleep,

hypnosis, and so on—and they might be very difficult to "get on tap," as you put it, and to use in everyday life. The weak effects are all you can get in the waking state, and may be the "important" ones from the point of view of predictability.

Omm: It seems as if you have tied down some critical variables in parapsychology. Unfortunately this is reminiscent of other "breakthroughs" of his kind in the past. For example, in the 1940s Gertrude Schmeidler showed that people who believed in ESP—she called them sheep—were more likely to score above chance, while those who disbelieved—the goats—were likely to score below chance. Those sheep/goal studies were never duplicated, were they?

Sargent: There are many reasons for this. The first thing is that the Schmeidler experiment used enormous numbers of subjects and yet the magnitude of the effect was very small. Many people who reported that they had failed to replicate the experiment simply didn't have a data base big enough to get the effect. The second point is that in many of the repeat studies people used different ways of assessing the sheep/goat variable. Simple things, like the wording of questionnaires, can substantially change the variable that you are measuring.

So, given all these factors, one would not have expected very high replicability. In fact, the replicability isn't as bad as you make out. It's about 35 percent, which means that a bit over a third of the experimenters who repeated the experiment found a significant difference favoring the sheep. That is quite good for what is admitted to be a weak effect.

Omm: By "weak effect" you mean one that doesn't appear to be particularly useful to anyone. What is there in parapsychology that you would describe as a strong effect?

Sargent: An excellent example is the Ganzfeld work. It's one of a range of techniques—hypnosis, meditation, progressive relaxation, dream states—that have at least two things in common. These two things are clearly very important in inducing ESP. One is the induction of distraction by such external factors as visual and auditory stimuli. The other is that the subject's attention is forced into internal processes. It seems that the mind becomes increasingly preoccupied with things that are going on inside rather than outside the head. So distraction and internalization are two key effects in producing ESP and are themselves readily induced by the Ganzfeld. The replicability rate of Ganzfeld studies is higher than anything else in parapsychology—almost 60 percent.

Omm: It sounds as if Ganzfeld might have

in a field as controversial as parapsychology, test methods will be tight enough to eliminate any chance of fraud or of misinterpreting results. Few are—which is why it is so significant that Sargent's repeated experiments passed the strict Cambridge examiners. In their conversation Dr Christopher Evans—one of Omm's contributing editors and a well-known British skeptic—probed the importance of Sargent's work for parapsychology.

immediate practical applications. Is that true? Can you think of other applications of ESP if it could be demonstrated to be true?

Sargent: Yes, but there's a special problem here. Suppose you wanted to transmit telepathically the contents of a letter, a file, or something. Like it or not, you'll have noise within the ESP channel because of what is going on in the mind of the writer, and this might limit transmission or reception. Also, most successful experiments so far have used inherently interesting stimuli, such as pictorial targets, art prints, cartoons, and so on. If you tried to transmit binary code, it would be a damn sight less interesting and might not work.

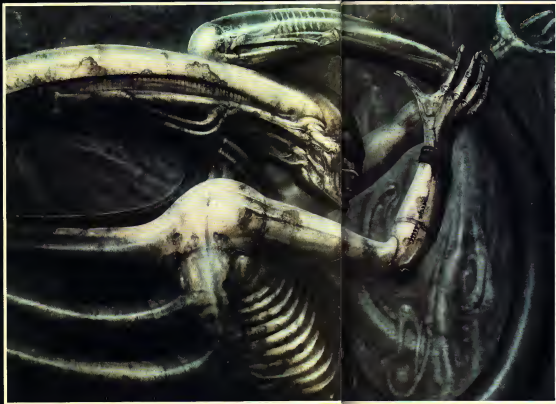
Omm: I would have thought that the transmission of pictures by ESP would be very useful. To take the most extreme case, the CIA might train people to work in Ganzfeld and pump information back to base without having to use a radio transmitter.

Sargent: I'm very skeptical about this. Consider what you are doing psychologically. To obtain successful ESP, it seems that you have to promote a high degree of openness and receptivity. If you started playing around with espionage, where you're dealing with a person in a very vulnerable state and surrounded by hostility and paranoia, then I suspect that the whole system is just going to clam up. In fact there is experimental evidence for this.

A more promising field might be precognition. To give a rather way-out example, one might use a reliable precognitive technique to predict natural disasters. Just think how useful parapsychologists would be in California if they could get information about when it is going to slide into the sea!

Perhaps there's a bit of speculation. Let me give a different example. I have often seen in our own Ganzfeld work that people who work together regularly as a sender/receiver pair soon begin to strike up a quite remarkable rapport. I've observed time and time again that after repeatedly working together they achieve episodes of a special kind of mental receptivity between each other. This overflows into their daily life to produce an unusual degree of openness between them. I can't help seeing an important psychotherapeutic aspect here, coming from the fact that you are working with an altered state of consciousness that simply opens people up to new communication possibilities.

Omm: But surely we've got to the point where either something is beginning to happen in parapsychology or it isn't. If it is—and like lots of scientists, I'd be absolutely thrilled if that were the case—then should we expect some real practical applications?



ILLEGAL ALIENS

Visitors from space
pose legal entanglements
of the third kind

BY ROBERT A. FREITAS, JR.

A light flashes in the night sky over Washington, D.C. Interceptors scramble northward from nearby Andrews Air Force Base. The glowing spot becomes a perfect circle of scintillating orange-red. Beams bay at the false moon while powerful spotlights wave back and forth at the stars, searching for some faint sign of recognition. The President is awakened from his slumber by three uniformed men.

Silently, gracefully, the silver disc settles to Earth on the White House lawn. Secret Service and army personnel stealthily move forward and surround the craft at a discreet distance. A crowd gathers.

A side panel unexpectedly dilates, letting out a blinding light from within. A humanoid figure appears in an airy, ethereal atmosphere, clutching a small cylindrical object in one hand. Its arm rises in friendly greeting.

Suddenly the sharp crack of a rifle pierces the air. Several cracklers scream in vision as a fountain of green, foamy liquid spurts from the visitor's head. His comatose machine slumps down into its pool of "blood," and moves no more.

Is the individual who pulled the trigger guilty of murder? Voluntary manslaughter? Has he committed any crime?

Probably not. Present-day American law divides all living entities into three strictly separate categories. Those incapable of voluntary movement are "plants." Those capable of voluntary movement but not human are "animals." All human beings are "persons."

This distinction is of critical importance. Our federal and state constitutions and our statutes, codes, charters, and treaties af-

PAINTING BY H. R. GIGER

ford legal rights and responsibilities only to persons. Nonpersons—animals, plants, and nonliving entities, such as cars and computers—have no rights and are regarded as mere property. Property may not bring legal action on its own behalf, although its human owner may do so to recover any losses of property.

The extraterrestrial (ET) in the opening scene was not a member of the species *Homo sapiens* and was therefore nonhuman by definition. However, it appears to have been alive and capable of voluntary motion; hence, it cannot have been a plant. Thus the creature was legally by rebuttable presumption, an animal.

Technically, the ET should be classified as *fera naturae* ("a wild animal") because no proof of tameness or ownership was evident. Wild animals running loose on private property may be hunted and killed by or captured and reduced to being the personal possession of any human being armed with buckshot and a little courage. On federal lands such creatures are under the jurisdiction of the Fish and Wildlife Service of the Department of the Interior, on state lands they are subject to the state's Department of Fish and Game. Either authority may declare a "special open season on said game" or the agencies themselves may destroy an animal that is causing injury to human life or property.

BENEATH THE LAW

Even if the extraterrestrial is somehow regarded as domestic nature ("a tame animal"), its legal position hardly improves. Cruelty-to-animals laws exist in virtually all the states, but this does not alter the creature's basic lack of rights. For instance, a surgical operation, even if it produces the most intense pain and suffering, may nonetheless be considered justifiable and noncriminal if its purpose is to "make the animal useful to man." Thus the violent castration of a young horse or bull does not fall within laws prohibiting cruelty to animals. And most statutes specifically exclude invertebrates. If an ET resembles a cross between a sea scorpion and a grasshopper, it may have no protection whatsoever.

The very idea of treating an extraterrestrial visitor to our far planet as a mere animal may at first seem outrageous to many, but this is the letter, if not the spirit, of the law. At various times in human history blacks, children, women, foreigners, prisoners, and Jews have been regarded as nonpersons in one society or another. Citizens of putative high intelligence are routinely slaughtered around the world for dog food. Even corporate personalities of other states are not considered "persons" in another state unless they have strictly complied with conditions set down by that state to carry on business there. We should not expect ETs to fare any better.

How does all this relate to crimes involving off-world visitors?

Consider the crime of homicide. Statutes

defining the corpus delicti for this offense always include two parts: (1) the killing of a human being (2) by a human being. Since criminal laws are always strictly construed by the courts, the corpus delicti for homicide cannot be met under current law in any case involving extraterrestrial beings. If a man kills an alien visitor, he is not guilty of murder since no "human being" has died. Shockingly enough, the converse situation, in which a human is slain by an ET, yields the same result. There is no murder since the man died at the hands of a nonhuman.

Similar difficulties will arise in rape cases. The usual common-law definition of the offense goes like this: "The unlawful carnal knowledge of a woman by a man forcibly and against her will." But woman is strictly defined as a female member of the human species, and man as a male *Homo sapiens*. Even assuming he/she/it they have the necessary physiological equipment, no extraterrestrial being legally can

● If an extraterrestrial commits a technical illegal entry, it may be subject to immediate deportation. With rides on the shuttle costing \$4 million, this should prove interesting! ●

be either the perpetrator or the victim of rape.

Paradoxically, if the female in question gives her consent and no force is used, the human member of the interspecies couple will be charged with the crime of bestiality (copulation with a beast) and may be prosecuted under state sodomy statutes. These offenses traditionally carry stiff penalties. Not too long ago the common-law punishment for bestiality was death, sometimes by burning, sometimes by burying alive. And as recently as 1953 eight states stipulated a maximum of life imprisonment for such "crimes against nature." The alien partner gets off scot-free in the after, since nonhuman animals cannot be held guilty of criminal conduct.

A law-braced-minded jurist has suggested that a "person" is a person not because he is human but because rights and duties are ascribed to him. In this view becoming a person is like joining an exclusive country club. If your appearance is acceptable, your references impeccable and your behavior vouched for by credible sponsors, you're in.

Ultimately, then, the granting of legal

"person" status in our system of justice is a political question, a matter of basic public policy. Society must decide to whom it wishes to grant legal rights and duties. Certainly any sentient being who demonstrates the humanlike characteristics of rationality, possession of technology or a symbolic language, a sense of time, manipulative appendages, emotions, self-awareness or consciousness, or the ability to make moral choices should be considered worthy of personhood in our society.

Assuming we elect to treat extraterrestrial beings as legal persons, what kind of persons will they be considered?

One possibility is that ETs might be afforded refugee status. Refugees are technically stateless persons, neither citizens nor nationals of any country on Earth. A common definition of this status is "any person uprooted from his home who has crossed a frontier—natural or artificial—and who looks for protection and subsistence from a government other than his former one." Space creatures stranded here, out in the galactic backwoods near Sol, seem to fit this description rather well.

If extraterrestrial visitors are regarded as refugees will they have any legal rights? In many nations they won't. However, in the 20 or so countries where the convention relating to the status of stateless persons has been adopted, refugees do have the same rights as those held by any foreign national. (This may not amount to much—Uganda was a signatory even during Idi Amin's regime—but at least it's a start!) In the United States, which is not a signatory to the convention, even stateless persons are protected by the Bill of Rights.

ETs might also be viewed as aliens, persons owing allegiance to a foreign government. Since other worlds are foreign within the meaning of the appropriate statutes, extraterrestrials will most likely fall under this classification in the country aliens, too, are protected by the Bill of Rights and all are subject to the criminal jurisdiction of the United States.

PUBLIC OFFENDERS

There are countless subclasses of aliens. For example, an illegal alien is one who has entered the country without passing through the normal channels of admission administered by the U.S. Immigration and Naturalization Service. In a surprise-contact scenario, the extraterrestrial visitor will commit a technical illegal entry and thus may be subject to immediate deportation proceedings. (With rides on the space shuttle costing about \$4 million [just to low Earth orbit, this should prove interesting].)

A related subclass is the alien enemy: the citizen of some hostile foreign power. If the President feels that the landing of an ET may be a prelude to invasion, he is authorized by law to order the federal marshals to "apprehend, restrain, secure, and remove" all alien enemies. For the alien this could mean isolation, interrogation, and concentration camp. However, even if Con-

21st-CENTURY FOSS

An interstellar gallery from the acknowledged master of realism in SF art

Chris Foss paints spaceships too big for the horizon to hold. He gives form to intergalactic arks that harry and run down entire civilizations from one remote star system to another. Foss's eye for detail is meticulous. His ships endure explosions in space battles that often leave them scarred and blasted, limping home

Click here from above left: a daylight in space, "Sea-Horse in the Sky", an interstellar cruiser, vessel limps at ready-made runways of the Nebula planet in Peru. Foss conveys massive scale through relation to minute, precise detail





to monstrous continental dry docks. Foss says they are "lovely lumpy spacecrafts." And the curiously antiquated qualities of his vehicles evoke memories of Edwardian ocean liners and World War I tanks. Yet his structures are post-modern, asymmetrical, immense, and totally unlike the needle-nosed and streamlined shapes of his predecessors. As a child in Devon, England, Chris was fascinated by the remains of the Industrial Revolution: its aging railway stations, the abandoned mines. Obsessed by speed, color, and hybrid technology, he built models of steam engines and rebuilt wrecked cars from scrap metal. Foss's ambition always was to become an artist, but to placate his

Clockwise from lower right: artwork painting "Invasion from Space"; "The Machine in Shell"; "Asteroid and Skyward" shows a spaceship under attack; Foss's conceptualization of twin towers of Atlantis: the mythical metropolis

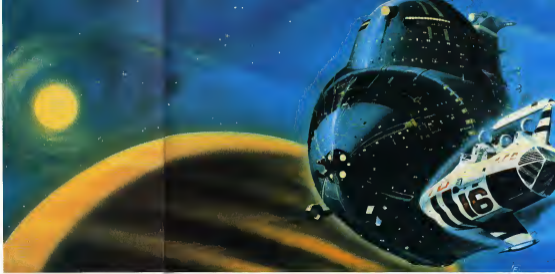
• The giant planetoids of Star Wars are the offspring of Foss's "crazed and rusted leviathans." •

Next to the soul, the most beautiful object in the galaxy is the spaceship. ☛

parents, he entered architecture school at Cambridge. While at the university, Foss sold a six-page cartoon strip to Bob Guccione for his British *Penthouse* magazine. Guccione (later to publish *Orion*) was so impressed that he put the art on retainer so that he could build up his portfolio. Within six years, Foss grew into an internationally acclaimed science-fiction artist. Such authors as Asimov and Clarke asked specifically for him to illustrate their novels. Then came the films. Foss's imagery inspired a small army of imitators, including TV and movie designers. Foss was the first to conceptualize the crystalline planet Krypton for the movie *Superman*. Twentieth Century-Fox asked him to

Clockwise from upper left: alone life forms battle in "The Space Machine"; "A Case of Cosmochemical" an illustration for James Blatch's classic novel; cover design for Joe Haldeman's *Windbridge*; design for "Quest in Time and Space."





work on concepts for *Alien*. But perhaps Foss's most monumental works were executed for a film that may never be completed. In 1975 Alejandro Jodorowsky (director of *El Topo*) was commissioned to film Frank Herbert's SF classic *Dune*, and he asked Foss to design the impressive panoply of the Padishah Empire. Jodorowsky says, "Foss is a being as real and unreal as his spaceships: a medieval goldsmith of future cars, and from him are born the leather and dagger-studded machines of the Sandwalkers, the pachydermatous geometry of Emperor Padishah's golden planes, the delicate butterfly planes and other machines that will one day populate all of interstellar space." **CC**

Clockwise from here right: "Calchovoz"; a pilot ejects from stricken fighter ship in the design for Henry Khodan's "The Vega Sector: Mission to the Stars" illustration for the cover of John Wiley's 1977 sci-fi novel "The Ophuchy Hotline"

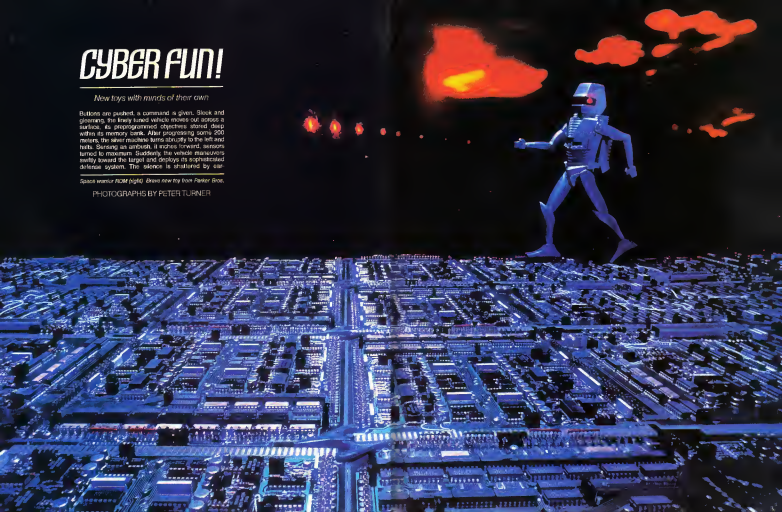
CYBER FUN!

New toys with minds of their own

Buttons are pushed, a command is given. Back and glimmers. The finely tuned vehicle moves out across a surface, its preprogrammed objectives stored deep within its memory bank. After progressing some 200 meters, the sleek machine turns abruptly to the left and hurls. Sensing an ambush, it inches forward, sensors turned to maximum. Suddenly, the vehicle maneuvers swiftly toward the target and deploys its sophisticated defense system. The silence is shattered by air-

Space warrior ROM (right). Kevlar new toy from Parker Bros.

PHOTOGRAPHS BY PETER TURNER



peating bursts of laser cannon and photon torpedoes. In seconds, the target disintegrates, the result of a direct hit. Once again, Big Trak has saved the day.

The vehicle described here is not the end result of some secret government contract but, rather, a toy built by Milton Bradley. Designed for children aged eight to eighty, Big Trak, with its intricate computer control center, is typical of the electronic toys that will be displayed this holiday season. Department-store shelves will be overstocked with large, easy-to-use keyboard toys that will enable children to perform the simplest of programming tasks. "They're priceless learning experiences," says a representative of Milton Bradley, whose Simon computer game made electronic sales history in 1978. "Toys such as Big Trak will help children prepare for the sophistication of that great big computerized world out there." Spurred on by major technological advances, today's toy manufacturers have made more widespread use of microelectronics than any other industry. And the public has responded eagerly.

This tremendous upsurge has been prompted largely by combining human imagination with the electronic microprocessor, the same tiny silicon chips that sparked the intelligence of pocket calculators and eliminated the term slide rule from the vocabulary of the 1970s. Already, toy companies have bought an estimated 50 percent of the \$500 million in chips produced annually, and microprocessor-controlled games have easily become the most sophisticated form of interaction among average Americans.

"We're seeing a new world opening for the toy industry," says Milton Bradley marketing executive George DiMarzio. "The tremendous cleanup we all experienced in 1978 was astounding. Far more twenty-

four-year-olds started coming into toy stores last year, especially males. And not only are older people buying toys, younger kids are using the same toys, and they're displaying a sense of sophistication we never dreamed of a few years ago."

"We're not that far from being able to build a real R2-D2," says astrophysicist Robert Doyle, inventor of Merlin, one of last year's hottest-selling computer toys. Merlin is a little red fellow that looks like a Touchtone phone, sounds like R2-D2, and provides his master with a choice of six games, including blackjack and solitaire. Milton Bradley's Simon is a device akin to the mother ship in *Close Encounters of the Third Kind*, complete with lights and tones offered in increasingly difficult sequences that must be repeated exactly by the player.

"It's almost frightening to think," says Jeff Rochlis, president of Mattel Electronics, "that just two years ago there were only four electronic items. This Christmas there will be literally hundreds." Yet those four items—electronic football, auto racing, submarine chase games, and a brain-buster computer—grossed a respectable \$21 million for the toy industry. By 1978 the figures had jumped 500 percent to a \$152-million share of the \$3.8-billion toy industry. This year toy manufacturers expect electronics to register a staggering twofold increase and push the industry into the \$5-billion sphere.

Parents who struggled in vain last Christmas to locate Simon or Merlin may find their problems severely compounded this year when they search for:

- Phaser Guns, modeled on those in the Star Trek movie. They emit infrared bursts coupled with synthesized audio. Hitting another gun results in a rooster sound, a direct hit on the other gun's sensor triggers

an explosion and shuts that phaser down for nine seconds.

- Microvision, a Milton Bradley innovation that uses liquid-crystal displays to replicate the television Pong games in handheld, \$30 units. Interchangeable chips allow the player to select any one of a half-dozen games, from Space Wars to bowling to Pong.

- Wildfire, a hand-held pinball game that uses light-emitting diodes to re-create the action of bumpers, flippers, and balls. Synthesized sound duplicates the noise of the real game, and the machine won't tilt.

- Brain Barrier, a hand-held game with a complete alphanumeric keyboard that scrambles words, plays hangman, flashes anagrams, shuffles letters randomly, and plays a total of six word-based games against either the computer or another player.

- Electronic Football II, a more sophisticated version of the Mattel original. It sold over a million units last year. This one adds more players to the field and allows passing and out yardage.

- Zodiac, an astrology computer from Coloco. It figures, in a matter of ten seconds, the position of the moon and the planets for any birthdate, time, and place entered into the unit. A book for figuring out one's horoscope comes with the computer. Another unit, the Mattel Horoscope Computer, gives direct alphanumeric predictions for specific dates entered.

And then there is Mattel's Intellivision.

Intellivision is the first home computer that doesn't have to be programmed, and it has as many game functions as it does record-keeping programs. The system is displayed on the home color-television screen, and the resolution is precise enough that baseball players' caps can be seen distinctly.



The Translator, by Craig, an "adult toy" that translates languages and converts to music.



Coloco's Zodiac Computer accurately calculates position of the stars and the planets.



Milton Bradley's computerized Big Trak—the first completely programmable toy vehicle.

The entire unit will sell for \$500, with more memory capability—16,000 bytes—than is now available for nearly twice the price.

"Toys," says Jim Muller, of the vanguard microprocessor firm Texas Instruments, "have become the frontier of consumer electronics."

Never was this more evident than at this year's American Toy Fair, held recently in New York City. Sponsored by the American Toy Association, the annual convention has become a barometer for the world's leading toy manufacturers, consistently forecasting the direction that the industry is taking. Everywhere at the fair there was an encounter with some form of electronic intelligence. Buyers shuffled into a darkened chamber for the presentation of yet another toy and heard a demonstrator innocently announce that Star Rider will be "the hobbyhorse of the twenty-first century."

Lights! Fanfare! Film clips! Enemy ships approaching! Sights! Phasers! Fire lasers!

Even as the noise of the demonstration subsides, an overhead floodlight bathes the spaceship in pure white light while the Star Rider operator points out the salient, indistinguishable features of the craft.

"This is really designed for a three-year-old," he says, "but we've had up to a hundred twenty pounds on it with no problem."

Everywhere at the fair were the products of JSSA, the company that first popped the electronic calculator on an unsuspecting nation through ads in the *Wall Street Journal* seven years ago. "What we've seen till now," says Joe Sugarman, president of the full-size electronics firm, "has been a kind of first generation of electronic items—calculators, watches, and games. We've already seen a plateau in the pocket-calculator market and now I think we're beginning to see some sophisticated re-

processor devices for the consumer."

For example, voice synthesis. One of last year's most intriguing developments was Texas Instruments' Speak & Spell, a small calculator that spouts about 240 different words and then pronounces them electronically—re-creating the sound of human speech from information digitally stored (no tape or moving parts) in three chips the size of a thumbnail.

Merlin Inventor Doyle says the home-computer toy and game frontier is probably expanding more rapidly than any other industry.

"First of all," he says, "we're seeing a tremendous increase every year in the amount of memory available. Two years ago we had one thousand bytes [a combination of eight bits, or the amount of binary digits needed to retrieve one letter from a memory bank, four bits, or one half of a byte, equal to one nibble]. A typical game requires about seven hundred bytes just for the overhead of setting up the play. So we had three hundred left. Now last year we had a two-thousand-byte capacity which gave us a lot more to work with once the basic functions were taken care of."

What happens to toys with a 4,000- or a 5,000-byte capacity?

Besides voice synthesis and expanded memory, Doyle sees alterable memory banks and increasingly complex display-screen technologies making computer games radically more sophisticated in years to come. "In Merlin, for instance," he says, "we have forty-eight bytes of RAM, or read and write [random or changeable] memory. Until last year we had only ROM, or read-only [unchangeable] memory. You can program forty-eight units of musical information into Merlin and he'll play the notes back—enough to play part of Beethoven's Ninth. The problem is that once

you turn off the switch, he forgets. That's called volatile memory. Once you get non-volatile RAM, you have a game that can remember something about the personality of the player and address each one differently."

The Speak & Spell unit shows how this could be taken even further, say to identify a child by name. By using voice analysis, I don't think we're that far from a bank-teller machine that will know your individual voice print and greet you with something like, "Good morning, Joe. Do you have a cold today?"—something that's already been done by Michael Freeman, designer of Megos 2 XL Robot, which is a sophisticated schoolroom robot that analyzes the voice patterns of students and remembers their particular weaknesses.

Children are just going to have to learn to play in a different way," says Frances Noah, a buyer for two small toy shops in North Carolina.

"I think we'll see two major fronts open up in the next two years," says inventor Doyle. "Why shouldn't kids of all ages love this stuff? We're all computers. We're all little adding machines. To a lot of people dealing with a computer sounds scary. The thing to always remember is that it's not the computer you're confronting, it's no more or less than the intelligence of the person who programmed it."

"Electronic chips have been the most incredible introduction to the toy industry since plastic," says Coleco's president, Arnold Greenburg. "By next year you'll see computerized dolls, trains, board games, guitars. This generation is having a love affair with electronics. These kids will be much more scientific and more didactic than any other generation. Our real problem now is that science and technology are way ahead of mass marketing." □



Setback and Righter's Sensor combines the classic Scrabble with space-age technology.



Computer-controlled Simon, by Milton Bradley, challenges you with flashing lights and tones.



Megos 2 XL Robot asks questions and lets jokers. Soon it will analyze voice patterns.

DREAM HOUSE

CONTINUED FROM PAGE 14

ing with the architectural landscape is more easily accomplished than blending with the natural environment. The Smith house achieves the proper blend with both and does so without being bland.

The fact that there are no mechanical aids means no maintenance is needed and also means for a quiet home. This is one of the most striking benefits people accustomed to hissing steam radiators, clanking pipes, and whining pumps will notice. The double shell also helps to ward off outside noise, and the silence in the house is disturbed only by the sounds of the refrigerator and, of course, of the party in progress around the Jacuzzi.

Smith's attainment of his last objective—how the house affects his and his family's health—is difficult to assess. Some of the features, such as the mean radiant temperature, the relative humidity, air exchange rates, and noise levels, yield some data, but there is not even an accepted standard by which to judge all these factors. Even more difficult to measure are the more subtle psychological benefits. For these we must merely depend on our own senses. My impression of the house was that the interior exuded gentleness. I could feel the house working quietly and efficiently and this made a powerful impression. Coming from the noise of New York City, I particularly appreciated the absence of mechanical noise. Other visitors comment, "It makes you aware of subtle differences in climate." "Comfortable in my jeans and T-shirt even when it's twelve degrees Fahrenheit outside." And, "I haven't had to compromise my living style in the least." Members of a ski group who lease Leone's house know little about solar energy but quickly learned how the house operated. Smith feels that this attainment process is a subtle benefit of living in a house that uses natural energy flows. It should play a major part in overcoming consumer resistance to such homes.

A clearer picture of possible heat-flow mechanisms at work in the Smith house was provided by solar experimenter Philip Henshaw whose method of studying air currents and temperatures in passively heated buildings has been the subject of recent controversy. Controversy notwithstanding, his last paper on passive solar heat was among 33 reports chosen as the best of 1978 by the International Solar Energy Society. Henshaw's description of mechanisms in the Smith house, which he needed not be verified by direct observation, mentions "air in contact with the outer wall, which is chilled and falls rapidly down a stream or possibly in a series of pulses. It is this air that goes into the crawl space rather than a movement of the entire one-foot-thick section of air. (It was previously thought that the air mixes moved uniformly as a whole.) This is very difficult to under-

stand unless you have made some very careful observations. This cold air is then warmed by the earth [under the house] and rises slowly back into the air chamber and warms the inner wall. Because we have a small volume of very cold air coming in contact with the storage, considerably more heat can be transferred than if you assume relatively warm air coming in contact with the earth. I think it's a really neat twist in peoples' concepts where it has been assumed all along that you had to use our nice high-powered, high-technology solution, to find out that the lowest power, least technology anything, namely the ground that you build the house on, can be the backup system. It's a nice touch."

The success of the house somewhat surprised Doug Kalbaugh, an analyst at Stanford Research Institute. He had modeled the house for Smith a year before it was built. His findings indicated that the house would use much more fuel than it actually does. He had seen the preliminary

*• I could feel
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plans and had added large floor vents to "improve the air flow." Smith never installed them.

Much less a cause of disagreement are the many problems of conventional housing that have been overcome in Smith's house. In most homes "ghost drafts" are produced by a thin layer of air being chilled by cold surfaces, such as windows. These drafts occur even in tightly sealed houses. The double-shell construction affords fewer cold surfaces to produce the drafts. Summer-time ventilation is drastically improved by the introduction of cool air in the crawl space and by opening the clerestory windows. The mild breeze created gives a sensation of much lower temperatures. For example, at 85°F and with an 80-percent relative humidity, a 3.5-mile-per-hour breeze can make you feel as if the temperature is 75°F.

Central heating systems dry out room air, causing unhealthy as well as uncomfortable effects. Besides drying out mucous membranes, dry air makes moisture evaporate from the body causing chills even in a warm house. Aided by double vapor barriers in critical areas, the en-

velope design of the Smith house helps maintain moderate humidity levels year round. If the humidity rises above a comfortable level, opening a door to the greenhouse allows excess moisture to be quickly absorbed by the envelope.

The U.S. government finally indicated its interest in passive-solar technology last January by placing it on the select list of technologies that might significantly influence our national energy picture in the near future. Mike Maybaum, program director for passive solar in the Office of Conservation and Solar Application, described passive solar as "an idea that can't help but happen...and is already happening without the government."

The Energy Department's "most important function in the area," Maybaum said, "may well be to do public relations for passive solar and allow natural inventiveness to create building designs. Pressure to ensure passage of tax credits for passive-solar construction is also viewed as an important activity by the Energy Department."

Some advocates of passive solar are skeptical about this benevolent attitude on the federal government's part. Bruce Anderson is one of the more vocal critics. He stated this view quite clearly in a January 1979 interview.

Passive-solar design is the kind of technology and knowledge whose proper application is very regionalized, even localized. It is possible for people in Washington [D.C.] to be properly sensitive to all the thermodynamic and social ramifications of using [passive-solar design] properly. I can tell you that people up here [in New Hampshire] know more about building than anyone in Washington ever will. Anything the Energy Department does in this area will vastly complicate procedures for using passive. In fact, it's just not that complicated a business. It's a commonsense kind of thing."

Common sense or not, Smith's house was made possible only by the combined efforts of many people, whom Smith characterizes as "not experts, only people with sincere and professional attitudes." Interest in the design concepts used in the construction of this house is growing rapidly. Architects and builders are talking about it, it was the subject of several seminars at the national passive solar conference in San Jose, California. Smith himself has received thousands of requests for information the past year. He told me recently that he would like to see 100 of these homes built in the United States in the coming year.

In Smith's dream house the house of the future? Perhaps. Smith said, "Our goal is simplicity, and we repeat it in it, the house...will probably be remembered more for what was thrown away than for what was put in." **DD**

For further information, write to Tom Smith, Passive Technology Corporation, P.O. Box 2256, Olympic Valley, Calif. 95730.

MALTHUS'S

CONTINUED FROM PAGE 79

"That the subject will be limited to the food we brought with us. However, you may eat whatever you have chosen."

Phil frowned and reached out a hand with fingers properly positioned, a sonic flasher out of the wall and inserted a lighted smokestick in them. "I can't even give him a taste?"

"Not permitted. I'm very sorry."
(Shirza, damn it, what kind of briefing—)
(They were briefed. Hence. Not our fault it didn't stick.)

"That seems pretty unfair." Phil muttered "I mean, how can I enjoy my meals, if all he gets is—I don't know soyameal or whatever you've picked. I mean, it's my day. How come I don't get to pick the baby's meals?"
(Shirza)

"You can pick your own meals, Citizen Jones-Vninsky, but for medical reasons we must see that the subject's diet is carefully monitored."

"Ya. Thought you said he was A-okay."
"He is, he is. But he could get very sick if everyone just stuffed him with goodies all the time. You do see that, don't you?" So we had to make a rule: diet administered by medic only. If we made an exception for you, well, we couldn't refuse anybody else, either. One treat might not hurt, but treats every day."

Phil pouted.

"Oh, Phil," Janica said, "don't be such a bore. He's right, rules are rules. That's the way it always is." (From her vast experience of once before.)

"Oh." He looked unappressed. He touched his thick robin's-egg-blue nose and continued to look sulky, then he thought of another grievance. "You say—hasn't he got a name, anyway? You say he won't wake until six hundred?"

Herve directed a burning look of reproach at Shirza, who rolled her eyes skyward.

"His name is Johann Meadows-Singh. And he will be awakened at eight six hundred."

"Nyas. How come not until then? How come not the whole day? It's my day, isn't it?"

"Oh, Phil?" Janica exclaimed. "He has to sleep just like anybody else, doesn't he? We won't lose any more time than anybody else."

"Boredom? Why can't he do like anybody else who wants to put off sleeping for a day or two? Let him have some no-sleep like I do."

"But he'd have to make it up later. Don't just like you do." She moved almost imperceptibly on the lounge as she curled up on, and Herve automatically kicked his suddenly dry lips. "So it wouldn't be fair, dear heart, to make somebody else have less just so we could have more." She stretched—and Herve licked his lips again—to walk her fingers up Phil's lung-out arm.

"Don't be a bore, darling. We'll take the no-sleep and amuse ourselves." Her fingers tickled behind his ear.

"Boredom?" Phil muttered again. "Can't even see him for six more whole hours, my very own—"

Herve cleared his throat. "As for that, if you just want to see the subject."

Phil's brow disappeared. "Yeah, hey now that's real blue of you. Doc. After all we worked all these weeks."

The medic made some quick adjustments, and the opaque sides and top of the corner slowly brightened and cleared, until its inside was fully revealed. The subject, naked except for a simple loincloth, was lying on a soft white surface and was attached to various pieces of equipment.

Phil gasped.

Janica drew back instinctively covering her gaping mouth with a trembling hand. Phil spoke first. "What—what's the matter with him?"

"Matter? The doctor's professional

◆ *One of the white-clothed medics spoke "Stand out of our way, please. We've a tight schedule to maintain." They pushed past... and Phil stood staring after them.* ◆

pride was hurt. "Nothing's the matter with him, nothing at all. He's a beautiful mal-gam. A perfect specimen—"

(Herve, you idiot! They were expecting someone older!)

(Deleted!)

"This is our very newest mal-gam for this sector. He was decanted less than six months ago. We've accelerated his growth somewhat, but—"

"Why hasn't he got any hair? And why's his head so big? And why's he so small? And—"

"I assure you, that's all normal at this stage of his development. His hair and the rest of his teeth will come later. But our surrogate leg for subjects at this developmental level. Babies they used to be called. You can stretch out your hands and he'll stagger toward you on uncertain legs—"

"He can't walk?"

"Oh, Phil, do you think you were decanted knowing how to walk?"

"How should I know! You sure he can't walk?"

"Just a little, as I said. Most surrogate parents love teaching children to walk."

"But—but—I was going to take him to the park, see the kid and his old man, and—and—you know—pitch a few balls around, and maybe take him fishing. We've got a beautiful pond right here in the village. Even, if we had time, the old swimming hole. You know simple, old-fashioned things. He, dads did, with their kids in the good old days."

"The doctor shook his head. "No, the park sounds fine—"

(Checked out, Shirza?)

(Need you ask, Herve?)

"—but you won't be able to fish or swim or play ball. But you can play with your subject on the grass, have a picnic, show him around. The subject likes sweet-smelling things, bright colors."

"The pond, then, Doctor," Janica suggested. "We have some lovely ornaments in it—Vegan, I think."

"Vegan? Is the pond seal-topped?"

"Why? I—I don't know. I never stuck my hand in just looked. Noticed it in passing."

(It's sealed, Herve.)

(Good. Might've known you wouldn't miss anything as obvious as that. If I've hated to tell them no, after the eddy I built it up, but—contaminated.)

M-000, 0000. The village park was of about average size, with grassy walks, bursts of color. Works of art here and there from old-fashioned solid statues (trace of modern synthetics, though) to the newest sight/taste/sound synergies. (Several of Janica's light-sculpts were prominently displayed.) The pond, with its fluorescent Vegan gazettee, hooks with seating rocks without. Shade trees. A couple of rabbit courts. The usual.

The baby was chasing a butterfly.

Most of the village inhabitants who had not been personally invited to join the party were out in the park, too, but maintaining a polite distance. Most were content simply to watch, with interest, but many were making holo records, despite the fact that the professional holo-porters were hovering overhead, taking everything down.

Janica was prodding. She was taking advantage of the attention and the parents by running through a whole series of her warm-up routines. When that palled, she took off her brightly colored halter top and dragged it off by one tie, enticingly near the baby. With a crow of triumph, the baby staggered toward the brilliant fluttering cloth. Laughing, Janica backed up, keeping the fascination just out of the reach of the chubby fingers.

The great Phil did, "You know," he said to the doctor, "if I had a ball and just sort of rolled it toward him—"

With a wink, the doctor produced a shimmering ball, and Phil, grinning broadly, rolled it gently along the grass toward the burbling child.

The child abandoned the top for the ball and Janica pouted.

A stranger shyly approached her. Her smile at him was warmer than usual.

"Look," his voice was soft, almost a



whisper his face beet-red under a too-thin smiler plant job. "You don't know me, but I'm visiting a friend in this village today— (Slightly nasal, but wrinkled at by the security officers. If not overly abused? After all, if someone said, "This is my new termhu— or termhu?— probationary, we haven't gotten around to registering it yet," most people would smile and pass on, after thoroughly checking the newcomer out, of course.) "My name's Ai Pawok-Lee, and I really hate to ask, but could I take a few holes of the kid? I mean, who knows when I'll get another chance, and—"

He really was very good-looking, and Janica's voice disappeared. "You didn't need to ask. Plenty of the others are taking holes just because you aren't a member of this village—he may be ours today but he's everybody's baby all the time. You have the same rights as anybody else." A slow smile grew over her face. "But I was sweet of you to ask to make sure it was all right."

"Oh! Impossibly, he hasn't disappeared even more. I know that! Only see, my telephone is broken. I'd have to come close, to be close, to get any good shots."

She pinched his cheek lightly. "Of course, sweetie. Take as many as you want." A shy sideways glance. "You can return the favor sometime."

"Thanks. I—you know, he's the first I've seen, for real. I mean, up close. I—I really appreciate this, I do. I won't forget you—your kindness."

"I hope not," she purred. Then, more loudly. "Phil, daring how about letting Ai here get a few close-ups?"

"Sure thing." He didn't know the guy but if he was a friend of Jimmy's.

Ai took several shots from various angles, and soon everyone was showing off for him, laughing, catching the ball and throwing it, playing to make the baby laugh (Sylvia was amazingly successful with nothing but sticking her tongue out and crossing her eyes), all under the eyes of their friends, the holes, the professional hoop-corders.

Ai made his move with startling suddenness. He tossed his camera at Phil, who was closest to the baby. As Phil automatically caught the flying object with both hands, Ai swooped down and scooped up the chortling child and was off and running.

"Stop, you fool!" Shirza shouted and began chasing after him, afraid to use her weapons because of the child. "There's no place you can go—"

In seconds a mob was forming in pursuit, but Ai had pivoted his direction sharply. There were no cottages between him and open country and no people, either.

Except Sylvia, who had wandered away to pick a spectacularly luscious tiger-striped trumpetbloom for the baby. Sylvia heard the screams, straightened up, and saw the man clasping the baby and heading almost directly toward her.

Ai saw the woman rise up out of her little

depression, out of nowhere it seemed to him, and he averted frantically.

She screamed and began running toward him, waving the flower like a banner. "Watch out for the baby!" Herie roared.

Sylvia could never have stopped him, not without hurting the baby. But his frantic swerve to avoid her gave Janica her chance. Legs flashing, she charged up behind him. An impossible leap, and she was kissing over his head, every light-sculpting-trained muscle acting with perfect precision. As she soared, she flipped, too, and her hands darted out. And when she landed, lightly on her feet, just as Sylvia crashed head on into Ai, the baby was safely nestled in her arms.

And it was all over.

Firm hands pulled Sylvia to her feet, and she embraced her friend, and just for a second she let her own arms a soft, dirty crying, amiably baby.

Ai lay where he'd fallen, crying, surrounded by grim scoffs. "She only wanted a baby of her own," he sobbed. "A day, we only had a day. It wasn't enough! She wanted a baby of her own! She said she'd leave me if I didn't get her a baby of her own, her own, a baby of her own."

(Herie and Shirza exchanged glances over his obvious head. Two for the treatment center...)

Then Herie took the baby and Sylvia's arms fell strangely empty.

The rest of M day was sadly anticlimactic, after the attempted baby stealing, and the whole affair served as a subject for conversation and holes, professional and amateur. Such a heroine Janica was! And how you seen her latest sculpture? And when newer sensations made memories fade, holes got shoved to the back of storage and were eventually wiped or discarded.

Only Sylvia could not forget the powdery-soft skin against her lips, the sweet-sour baby scent, the odd feeling that had welled up within her when she held the baby within the circle of her arms.

Sometimes, during rest periods, with her termhus snoring exhaustedly and satelatedly beside her, she would think about it, but her thoughts always went round and round in the same circle.

Babies were only decanted at the POP centers, to replace the rare accidental deaths, computer-decided recombinant amalgams to replace lost genes and talents. There was no way she could ever produce a baby herself, no way she could have a baby of her own. No way.

And sooner or later she'd nudge Phil until he roused enough to offer her the only anodyne he could. But all too often, afterwards, he'd slide back into contented slumber, while she lay, unable even to distract herself with soliholo lenses, because her thoughts stayed in the same groove no matter what amusements the soliholo presented.

No way—only decanted at POP centers—no way—No way... **CC**



INTERVIEW

CONTINUED FROM PAGE 52

plication in the next decade?

Sargent: That is a valid point. Yet it is unreasonable to expect rapid progress in a field that has had such pitifully small funding and has been put on its heels by skeptics who have always demanded results rather than theories. I would rather have an experiment that was replicated fifty percent of the time and I know why it worked than one that was ninety-percent replicable but whose mechanics were a mystery. **Owen:** Nevertheless, fifty years of parapsychological research has gone by and most scientists are very disappointed in it. **Sargent:** That isn't actually true. There's a survey in the *Journal of Parapsychology* of American scientists' attitudes to parapsychology in the Thirties and Forties, and comparable surveys today show that there has been a marked shift since then toward acceptance of its validity. People also say that it hasn't made much headway but I'm convinced this is actually due to ignorance. If you were to pluck out a psychologist at random, the odds against his having actually seen a copy of the *Journal of Parapsychology*, for instance, would be very substantial indeed.

Owen: That's really my point. If the subject is all it's cracked up to be, the ignorance is astonishing. Something that really should

be part of psychology is steadfastly rejected by psychologists in particular. This is so because they are hopelessly prejudiced against it or because, on independent inspection, it seems as if there's simply nothing in it.

Sargent: There does seem to be a significant subset of people who are emotionally prejudiced against the idea. But let's take those who are rational agnostics and say "Maybe there's something there, but at the moment I'm not convinced." Two things probably concern them.

One is the lack of a theoretical base for the subject. The other—and this is particularly prevalent among psychologists—is a worry about whether the data are reliable or merely represent experimental fraud. Why should there be so much emphasis on fraud? To be blunt, I don't have much hesitation in saying that the reason why psychologists are suspicious of parapsychologists' "fiddling" their experiments is that they do it themselves all the time. So they think that fudging is as endemic in parapsychology as it is in psychology.

Owen: Since fudging has been raised as an issue, let's talk about the scandal a few years ago when Dr. Walter J. Levy, one of the most influential figures in parapsychology, was caught red-handed blatantly fiddling his results.

Sargent: Yes, that was a bad moment for parapsychology but it wasn't the end of the world. We have to distinguish between ac-

tual instances of fraud and the use of the fraud hypothesis to invalidate all the findings. Parapsychology would be unwise if no parapsychologist ever committed fraud. The fact that there is one known instance of fraud is not particularly bothering. Take the Ganzfeld work—twelve laboratories have done repeat studies, and of these seven have gotten significant results. Maybe there is a Levy in that seven, but it doesn't matter because the replicability rate will still be better than fifty percent. To explain away that finding, you'd have to invoke a degree of fraud that would be staggering.

Owen: This highlights again how important replicability is.

Sargent: Yes, it's vital. Without independent replication, all the experiments in the world don't add up to anything. It's the only protection against fraud, experimental error, and all that. I once did an experiment in which to the best of my knowledge, I eliminated any possibility that I could have been tampering with the data. It involved sealed envelopes, deposited subcases, witnesses, Xerox copies. The whole thing was a panorama of paranoia. And we indeed did get significant results that replicated the results of an aerial experiment.

Then I presented the data at a conference where, to my amazement, the whole ignorance was rejected on the grounds that any experimenter who is smart enough to think up a foolproof procedure is surely smart enough to get around it. In the end it's got to be a question of replication.

Owen: A few parapsychologists argue that replicability isn't all that important.

Sargent: That's nonsense of course, but remember that high replicability is only typical of certain areas of the physical sciences. It's not characteristic of anything but the limited areas of human sciences. The only areas of psychology that have very high replicability are certain areas of psychophysics and classical conditioning, in both you are dealing with ludicrously oversimplified environments.

You say parapsychology has been in action for fifty years and hasn't achieved much. That may be true. But experimental psychology has been going for about a hundred years, and what has it achieved? One of my lecturers at Cambridge, in a debate, challenged the audience to list the real achievements of psychology. There was a pause of about a minute before somebody came out with something.

Bony to keep sniping at psychology but my argument is that the only realistic data base against which to examine the achievements of parapsychology is psychology. Remember the sheer complexity of one's subject matter in both cases. Human beings are phenomenally complex systems. When physics starts playing around with complex systems, it soon gets into trouble. Faced with a really complex problem, people with billions of dollars and years of specialized research behind them are capable of spectacular failure.

Owen: One other factor that prevents many



hard so emits from taking the subject seriously is the way in which the field sometimes goes into crazes about sensationalistic developments such as the recent flap about Uri Geller. Here's Geller claiming to bend spoons with his mind or to report his camera to the moon. Anyone who knows anything about parapsychology realizes that Geller simply reeks of trickery. Yet he precipitated a huge wave of enthusiasm throughout parapsychology. When it all turned to nothing, it left many parapsychologists with egg on their face.

Bergert: This may sound like ducking the issue, but I actually have a minimal interest in that kind of thing. I've never been interested in working with individuals, only with groups of people. So I can make generalizations about populations. I would be encouraged if I felt that Geller-type phenomena induced other people to start looking into parapsychology but I'm quite sure they have the opposite effect. With the whole Geller episode, so much drivel was written at second- and thirdhand, pro and con, that it is very hard to get at what has really been going on there.

My feeling, for what it is worth, is that Geller is definitely a fake. It seems to me that there are enough documented instances of definite trickery for us to be able to say this. Whether he's anything more than that, I don't know. But of course one does get annoyed when that stuff is splashed about to the exclusion of sounder,

better-based, and more reputable work. I think that serious parapsychologists as a body never took Geller to heart.

Greer: The cautious, guarded picture you paint of the topic is very different from the one the public sees in the media. As the public sees it, everything is totally down up with an endless stream of sensational experiments and equally dramatic results occurring all the time.

Bergert: I'm very skeptical, but I studiously avoid any connection with these unrelatable characters in the military field. As for the so-called Russian effort, well, the first thing to say is that there is virtually no Soviet parapsychology reporting that is worth even a cursory glance. Parapsychology is treated oddly by the Soviet hierarchy, who try to pass it off as lots of different sciences. In any case, such stuff as is published appears to take place selectively in low-level magazines where the data are never presented in sufficient detail. I've known visitors to the USSR who have come back and said that talk of big Soviet research is all baloney. As for the popular books on the subject published in the West, they're purely sensationalist, written by journalists who sincerely want to be rich.

Omer: I think people would like to know whether there is any hope that anything will happen in the reasonably near future to remove the skepticism of parapsychology out of the areas of dispute and skepticism.

Bergert: It depends on who and what you

are concerned with. Parapsychology has always enjoyed a tremendous level of general public support. The priority for the field now is to increase scientific acceptance. Only in that way is the subject going to get adequate funding and draw in high-caliber people who aren't thinking "This is financial and academic suicide." I don't think that the practical, pragmatic aspect of the subject, which is the angle you seem to be stressing, is the key factor as far as the scientific community is concerned. They're more likely to be swayed by improvements in repeatability of the kind we have been slowly seeing over the last twenty years. I believe there is also going to be increasing theoretical sophistication. Parapsychologists will be able to sit down and say that they have models of what is going on when ESP takes place, that they have tested the assumptions of the models, and so on.

I would also hope for increasing interdisciplinary links, particularly with psychology, and even with things like neurophysiology. Neurophysiology may be looking a bit far ahead. Better acceptance in academic psychology would be enough. The greatest breakthrough of all both for scientific acceptance and in terms of attracting proper research funding would occur if a couple of top psychologists finally stepped forward and said, "Far enough, you've made your case. We'll stake our reputations on it. Furthermore, we're going to work in it." **OO**



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ALIENS

CONTINUED FROM PAGE 65

glass declares war on the visitor's home planet, there is another life-known subclass of aliens in international law called *friendly aliens*. One jurist explains, "A belligerent state is free to exempt enemy nationals from the treatment applied to persons treated with enemy character."

The immigration authorities can be circumvented by classifying an ET as an essential alien. According to law with the concurrence of the attorney general, the CIA director and the commissioner of immigration any alien deemed "essential to the furtherance of the national intelligence mission" or otherwise vital to the interests of national security may be admitted for permanent residence regardless of regular admission procedures. Since any nation on Earth in possession of an extraterrestrial being and its fancy hardware could gain a significant military, technological, or economic jump on the others, the essential-alien doctrine is certainly within the realm of possibility.

There are even easier ways to avoid the immigration laws. The creature might be considered an alien crewman (serving aboard a foreign vessel) or an alien in transit. Both would be exempt because they stay in this country would be only temporary. Similarly if a space visitor entered the United States for "business or pleasure" or as a "born telestudent, scholar, specialist, or leader in a field of specialized knowledge or skill," it would be considered a visiting alien and thus be exempt from immigration laws.

Of course, the President could simply grant an ET ambassadorial status. As a full diplomat the extraterrestrial would serve as the representative of its own government during its stay on Earth and would enjoy full immunity from prosecution in American courts. Or the creature might be deemed a consul, merely a commercial agent for its government and entitled to fewer immunities.

Naturally, there must be diplomatic reciprocity before a foreign envoy of any kind is given ambassadorial rank. However constitutionally the Chief Executive of the United States is our sole representative in dealings with foreign nations. Neither Congress nor the judiciary can complain if the President unilaterally makes the decision to recognize an ET and its government.

Yet another option is open, this time to Congress. The naturalization clause of the U.S. Constitution expressly authorizes the federal legislature to prescribe rules by which aliens may secure full citizenship. There is nothing to prevent a grant of American citizenship to named persons by special act. For instance, Congress passed in 1963 one such bill, which directed the President to declare Sir Winston Churchill an honorary citizen of the United States. This approach bypasses the usual require-

ments of naturalization, so an ET could retain its native extraterrestrial nationality, a rather unique sort of dual citizenship.

If beings from other worlds come to live among us in greater numbers and on a more permanent basis, the legal "quick fixes" we've been discussing may prove wholly inadequate. Congress undoubtedly will be forced to take the real major judicial step—create a special legal classification called *extraterrestrial persons* that would define their rights and duties in American society. Many of our laws may have to be thoroughly revamped to accommodate the complex relations inherent in any multispecies sentient population.

THE CODE OF XENODRABI

Consider once again the criminal law in order to emphasize the illegality of killing and to provide special punishments in specific cases. Lawmakers should define the crime of *xenocide*—the slaying of an extraterrestrial person by any other legal

☛ *A crime for telepathic extraterrestrials is tele Rape, the unlawful mind-reading of human sexual partners, without their consent, during the course of coitus.* ☛

person. *Xenocide* could be committed with or without malice, intentionally negligently or accidentally. If an ET possesses no personal consciousness but is part of a group mind that is deemed, collectively to be an extraterrestrial person, then killing any individual member of the association might be termed *xenocide*. Like mayhem, the criminal act is directed only to a part of the person's substance and not to the whole.

Legislators will probably want to invoke legal sanctions against those who engage in interspecies sexual relations. Humans are already covered by felony sodomy statutes, the equivalent offense for sentient nonhumans could be called *anthroposexus*—unlawful sexual activity with human beings. More specific sanctions of this offense against public decency are likely to be passed by state senates and assemblies. There may be classifications, such as *prostitution anthroposexus*, *forcible anthroposexus*, *adulterous anthroposexus*, and *anthroposexus by seduction*, each with its own set of proscriptions and peculiar penalties.

Laws may also be passed to prohibit *xenogamy*, the marriage between a human

and a sentient nonhuman being of the opposite, similar, or complementary sex. These rules will be closely modeled after the old miscegenation statutes, which the Supreme Court ruled unconstitutional in *Loving v Commonwealth of Virginia* (1967). [This decision cannot invalidate xenogamy statutes, since species, unlike race, has never been ruled a "suspect classification" under the equal protection clause of the Fourteenth Amendment.]

Entirely new criminal codes might have to be enacted for situations beyond the pale of normal human experience. For instance, for a race of sentient flesh-regenerative amphibians, nibbling the body of an acquaintance may be a sign of greeting and approval, much as the human handshake is. All parts quickly grow back and no real permanent damage is done; the bigger the bite, the deeper the friendship. Human beings, unable to regenerate nibbled limbs, would regard the behavior as criminal (*pest cannibalism*) when practiced on people.

Innumerable possibilities may readily be imagined. Involuntary *vivry* could be the crime of exposing one's true, uncamouflaged physical appearance in public, if that appearance is so shockingly ugly as to cause hysteria among human onlookers. A crime for telepathic ETs would be *tele Rape*, the unlawful thought-reading of the mind of one or both partners of a human couple, without their consent, while they are having sex.

OTHERWORLDLY DEFENSES

Naturally all charges of criminal culpability are subject to defenses that may be raised to relieve an extraterrestrial of liability for its acts. One recourse for famed defense attorneys would be to assert lack of capacity on the part of the ET. A plea of insanity is the most common variant. Under the traditional M'Naghten Rule, criminal acts committed by an extraterrestrial could be excused if the ET was unable to understand the nature of its act or if it knew what it was doing, lacked the capacity to distinguish whether its act was right or wrong. Lack of capacity might also be proved by evidence of mental immaturity, insanity, or feeble-mindedness, the intelligence, or the psychological development of the alien being comparatively below the human adult norm at the time the crime was committed.

Another limitation on criminal prosecutors is that an accused cannot be tried for acts that were not criminal when they were committed. If a human to take a simple example, killed an alien in a jurisdiction that had not yet ruled the ET a "person" at the time of the offense, then the application of any criminal law that spoke only of "persons" would be prohibited under the U.S. Constitution (Article I, Section 9).

One highly unorthodox alternative would be the assertion of sociobiology as a defense in criminal prosecutions. Such a "sociobiology doctrine" could expunge all

lapidity for acts committed as a direct consequence of biologically predetermined behavioral patterns in specific situations.

Under the doctrine of intelligent (sexual) extraterrestrials (requiring three distinct sexes for reproduction) would be excused of the crime of bigamy or polygamy. A sentient praying mantid that, during normal intercourse, bit off the head of a careless human zoologist-observer, instead of the torso of her mindless mate, could raise "proven hunger" as a valid defense to the crime of homicide. ETs mocked after the common mole *Antichinus stuarti* among which copulation causes the females to release hormones that kill the male shortly thereafter might use the doctrine to escape prosecution for murder. Extraterrestrials having the same compulsion to steal as the Adélie penguin of Antarctica might be excused of the crime of petty larceny.

It is not clear whether courts would buy the sociobiology doctrine. Claims of compulsion and coercion generally are no defense when the compulsion derives from some natural characteristic of the defendant. Courts have thus far rejected insanity pleas based on the XYX-chromosome defect (the extra Y supposedly causes a higher probability of antisocial behavior) but there is strong evidence that the judiciary would accept this defense if there existed rigorous scientific proof tying the genetic defect to insanity.

Before the case went to trial, however,

there would be two additional complications that would have to be considered.

First, an accused ET could not be tried, sentenced, or punished unless it was "presently sane." If it could not understand the nature and purpose of the proceedings against it, the creature might be judged incapable of standing trial and be committed to a mental institution until it is capable. If it were determined that the alien would not achieve competency in the near future, then the authorities would have to either release the accused or institute permanent commitment proceedings.

Second, the Sixth and the Fourteenth amendments require an "impartial jury" both in federal and in state criminal prosecutions. Generally jurors must be chosen from representative cross sections of the community. Exclusions on the basis of race, national origin, or descent are unconstitutional. If at least one juror of the ET's own species were not empaneled, any conviction resulting from the trial could later be overturned on this basis.

After the extraterrestrial was declared guilty as charged, appropriate punishment would be handed down from the bench. The notion that the alien nature of the defendant should be taken into account leads to the concept of pro rate sentencing. ETs with shorter life spans or whose subjective time passes measurably faster than our own should be given shorter prison terms, and vice versa.

Life-fractions might be an appropriate unit of punishment. For instance, the sentence for voluntary manslaughter is usually ten years, a life-fraction of about 14 percent for human beings who live to age seventy. By the measure, an alien creature guilty of the same crime but with a normal life span of seven years should receive only a single year of incarceration. But ETs with 700-year life spans should be locked up for a century or more.

Stiffer sentences might be appropriate for venereal acts committed against longer-lived or more highly intelligent or sensitive species. All else equal, killing a microbial sentient may deserve ten times as much punishment as an act resulting in the death of a mere centennial human. With crimes of kidnapping or false imprisonment, however, punishment should be increasingly severe when more ephemeral victims are inconvenienced, since a greater percentage of total life time has been disrupted through the investigation of a criminal act.

The slevy disc mutum softly its dis-appointment and glows a faint warning of orange-red luminescence around its perimeter. The talon humanoid briefly sparkles, then vanishes. A hushed crowd falls back as the extraterrestrial machine rears majestically its masters will not return soon, for they have learned that illegal aliens aren't safe on planet Earth.

At least, not yet. **DD**



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Surely not there."

She stuck out her tongue. "Smarty! I have a clock in my head. I never mention it because people give me funny looks."

Deety does have an innate time sense? agreed her father. "accurate to fifteen seconds plus or minus about four seconds, I've measured it."

"I'm sorry, Zebadiah. I don't mean to be a freak."

"Sorry about what, Princess? I'm impressed. What do you do about time zones?"

"Same as you do. Add or subtract as necessary. Darling, everyone has a built-in circadian. Mine is merely more nearly exact than most people's. Like having absolute pitch—some do, some don't."

Are you a lightning calculator?"

"Yes, but computers are so much faster that I no longer do it much. Except for one thing, I can sense a glitch—spot a wrong answer. Then I look for garbage in the program. If I don't find it, I send for a hardware specialist. Look, sweetheart, discuss my oddities later. Pop let's dump that thing down the septic tank and go. I'm nervous, I am."

"Not so fast, Deety." Hilda was still squatting by the corpse. "Zebbie. Consult your hunches. Are we in danger?"

"Wall not this instant."

"Good. I want to dissect this creature."

"Aunt Hilda!"

"Take a Milton, Deety. Gentlemen, the

Bible or somebody said "Know thine enemy." This is the only Black Hat we've seen, and he's not human and not born on Earth. There is a wealth of knowledge lying here, and it ought not to be allowed down a septic tank until we know more about it. Jacob, feel this."

Hilda's husband got down on his knees, let her guide his hand through the "ranger's" hat. "Feel those bumps, dearest?"

"Yes?"

"Much like the budding horns of a lamb, are they not?"

"Oh—?—And I beheld another beast coming up out of the earth, and he had two horns like a lamb, and he spoke as a dragon."

I squatted down, felt for horn buds. "Be damned! He did come up out of the earth—up this slope anyhow—and he spoke as a dragon. Talked unfriendly and all the dragons. I've ever heard of talked mean or belched fire. Hilda, when you held-strap this critter, keep an eye out for the Number of the Beast!"

"I shall! Who's going to help me get this specimen up to the house? I want three volunteers."

Deety gave a deep sigh. "I volunteer. Aunt Hilda, must you do this?"

"Deety it ought to be done at Johns Hopkins, with X ray and proper tools and color holograms. But I'm the best biologist for it because I'm the only biologist. Honey child, you don't have to watch. Aunt Sharp-

ie has helped in an emergency room after a five-car crash; to me, blood is just a mess to clean up. Even green blood doesn't bother me that much."

Deety gulped. "I'll help carry, I said I would!"

"Dagah Thons!"

"So? Yes, my Captain?"

"Back away from that. Take this. And this."

I unbuckled sword and belt, shoved down my swimming briefs, handed all of it to Deety. "Joke, help me get fatt up into lester's carry."

"I'll help carry, son."

"No, I can tote him easier than two could. Sharpe, where do you want to work?"

"Hilda my dear one, what would you say to a workbench in the garage with a drop cloth on it and floodlights over it?"

"I'd say 'Swell!'"

Zeb

I felt better after I got that "ranger's" corpse dumped and the garage door closed, everyone indoors. I had told Hilda that I felt no "immediate" danger, but my wild talent does not warn me until the moment of truth. The Blokes in Black Hats had us located, or possibly had never lost us; what applies to human gangsters has little to do with aliens whose powers and motives and plans we had no way of guessing.

We might be as naive as a letter who thinks he is hidden because his head is, unaware that his little nump sticks out.

They were silent. They were powerful, they were multiple—three thousand? three million? We didn't know the Number of the Beast. And they knew where we were. True, we had killed one—by luck, not by planning. That "ranger" would be missed, we could expect more to call in force.

Fatherhood has never appealed to me. Given a chance to run, I run. I don't mean I'll bug out on wing mate when the unfriendlies show up, and certainly not on a wife and an unborn child. But I wanted us all to run—me, my wife, my blood brother who was also my father-in-law, and his wife, my chum Sharpe, who was brave, practical, smart and unacquainted. That she would joke in the jaws of Moloch was not a fault but a source of spirit.

I wanted us to go far, far, far, axes, rotas, translate whatever—anywhere not infested by gruesomes with green goo.

I checked the gauge and felt better, Gay's inner pressure had not dropped. Too much to expect Gay to be a spacezhip—no equipped to scold and replenish or. But it was pleasant to know that she would hold pressure much longer than it would take us to scam for home if we had to—assuming that unfriendlies had not shot holes in her graceful shell.

The "ranger" was on its back with clothes out awry, open from chin to crotch and spread. Nameless chunks of gizzard were here and there around the cadaver, it gave off a fetid odor.

Hilda was still carving, ice tongs in left

hand knife in her right greenish goo up over her wrists. As I approached she put down the knife, picked up a razor blade, did not look up until I spoke. "Leaving things Sharpie?"

She put down her tools, wiped her hands on a towel, pushed back her hair with her forearm. "Zebbie, you wouldn't believe it."

"Try me."

"Well, look at this!" She touched the capae's right leg and spoke to the capae itself. "What's a nice joint like this doing in a girl like you?"

I saw what she meant, a long joint leg with an extra knee lower than the human knee, it bent backwards. Looking higher, I saw that its arms had similar extra articulation. "Did you say girl?"

"I said girl, Zebbie, this monster is either female or hermaphroditic. A fully developed uterus, two horned like a cat's, an ovary above each horn. But there appear to be testes lower down and a dingsu that may be a retractable phallus. Female, but probably male as well. Bisexual, but does not impregnate itself. The plumbing wouldn't hook up. I think these errors can both pitch and catch."

"Taking turns? Or simultaneously?"

"Wouldn't that be sum'ph? No, for mechanical reasons I think they take turns. Whether ten minutes apart or ten years, dependent sayeth not. But I'd give a proddy to see two of 'em going at it!"

"Sharpie, you've got a one-track mind."

"It's the main track. Reproduction is the main track, the methods and modes of copulation are the central features of all higher developments of life."

"You're ignoring money and television."

"Piffle! All human activities, including scientific research, are either mating dances and care of the young or dismal submissions of both losers in the only game in town. Don't try to kid Sharpie. Took me forty-two years to grab a real man and get myself knocked up, but I made it! Everything I've done up to the last two weeks has been ramp till ready. How about you, you shameless stud? Am I not right? Careful how you answer, I'll tell Dewey."

"I'll take the Fifth."

"Make mine a quart, Zebbie. I hate these monsters, they interfere with my plans: a rose-covered cottage, a baby in the crib, a pot roast in the oven, me in a gingham dress, and my man coming down the lane after a hard day finking freshmen—me with his slippers and his pipe and a dry martini waiting for him. Heaven! All else is vanity and vexation. Four fully developed mammary glands but lacking the reductant fat characteristic of the human female—kept me damn it. A double stomach, a single intestine. A two-compartment heart that seems to pump by peristalsis rather than by beating. Cordate. I haven't examined the brain, but it must be as well developed as ours is. Definitely 'humanoid' outrageously nonhuman. Don't knock over those bottles, they are specimens of body fluids."

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"What are these things?"

Spirits to conceal the unhuman articulation. Plastic surgery on the face, too. I'm pretty sure and chatters to reshape the skull. The hair is fake; these Bioquans don't have hair. Something like tattooing—or maybe masking. I haven't been able to peel off—to make the face and other exposed skin look human instead of blue-green. Zebb seven to two, a large number of testing persons have been as gassed per piece before these creatures worked out methods for this masquerade. Swoop! A flying saucer dips down and two more guinea pigs wind up in their laboratories."

There hasn't been a flying saucer scare in years."

"Police license clear. If they have space-time twistors, they can pop up anywhere, steal what they want, or replace a real human with a convincing fake, and be gone in the time it takes to switch off a light."

This one couldn't get by very long. Hangers have to take physical examinations.

This one may be a rush job, prepared just for us. A permanent substitution might fool anything but an X ray and might even fool an X ray if the doctor giving the examination was one of Them—a theory you might think about. Zebbie, I must get to work. There is so much to learn and so little time. I can't learn a fraction of what this carcass could tell a real comparative biologist.

"Can I help?" I was not anxious to

Wait—

I haven't much to do until Jake and Deely finish assembling the last of what they are going to take. So what can I do to help?

"I could work twice as fast if you would take pictures. I have to stop to wipe my hands before I touch the camera."

I'm your boy, Sharpe. Just say what angle, distance, and when.

Hilda looked relieved. "Zebbie, have I told you that I love you despite your goniola appearance and idiot grin? Understand, you have the soul of a cherub. I want a bad as badly. I can taste it—could be the last hot bath in a long time. And the beds—the same of civilized decadence. I've been afraid I would still be carving strange meat when Jacob said it was time to leave."

Carve away, dear, you'll get your bath. I picked up the camera, the one Jake used for record keeping, a Polaroid Stereolindamatic—self-focusing, automatic focusing, automatic processing—the perfect camera for the engineer or scientist who needs a running record.

I took endless pictures while Hilda sweated away. "Sharpe, doesn't it worry you to work with bare hands? You might catch the Never-Get-Overs."

Zebbie, if these critics could be killed by our bugs, they would have arrived here and died quickly. They didn't. Therefore it seems likely that we can't be hurt by their bugs. Radically different biochemistries."

It sounded logical, but I could not forget Koroang's law. "Logic is an organized way of going wrong with confidence."

Deely appeared and sat down a loaded hamper. "That's the last!" She had her hair up in a bath knot and was dressed solely in rubber gloves. "Hi, dearest Aunt Hilda. I'm ready to help."

"Not much you can do, Deely, unless you want to relieve Zebbie."

Deely was staring at the corpse and did not look happy—her nipples were down flat. "Go take a bath!" I told her. "Scran!"

"Do I stink that badly?"

"You stink swell, honey. But Sharpe pointed out that this may be our last chance at soap and water in a while. I've promised her that we won't leave for Canopus and points east until she has had her bath. So get yours out of the way and then you can help me slow while she gets sanitary."

Hilda

By the time I was out of my bath, Jacob, Deely, and Zebbie had Gay Deceiver stowed and lists checked, ran operer cameras, and so on—even samples of fluids and tissues from the cadaver as Zebbie's miracle car had a small refrigerator. Deely wasn't happy about my specimens being in the refrigerator, but they were very well packed, layer on layer of plastic wrap, then sealed into a freezer box. Besides that refrigerator contained mostly camera film, dynamite caps, and other nonatables. Food was mostly freeze-dried and sealed in nitrogen, except foods that wouldn't spoil.

We were dog tired. Jacob moved that we sleep then leave. Zebb, unless you expect a new attack in the next eight hours, we should rest. I need to be clearheaded in handling vermin. This house is almost a fortress, will be pitch-black, and does not radiate any part of the spectrum. They may conclude that we ran for a night after we got their boy—hermaphrodite, I mean, the fake tanger—what do you think?

Jake, I wouldn't have been surprised had we been clubbed at any moment. Since they didn't—Well, I don't like to handle Gay when I'm not sharp. More mistakes are made in battle because of fatigue than any other cause. Let's sack in. Anybody need a sleeping pill?

"All I need is a bad. Hide my love, tonight I sleep on my own side."

I shrugged. "You men have to pilot, Deely and I are cargo. We can nap in the backseats. If we miss a few universes, what of it? If you've seen one universe, you've seen 'em all, Deely?"

If it were up to me, I would lam out of here so fast my shoes would be left standing. But Zebodan has to pilot, and Pop has to set vermin, and both are tired and don't want to chance it. So, Zabadash, don't fret if I rest with my eyes and ears open.

"Hah? Deely, why?"

"Somebody ought to be on watch. It might give us that split-second advantage—split seconds have saved us at least

twice. Don't worry. I often skip a night to work a long day under the same time. Doesn't hurt me. In the next day, and I'm ready to bite rattlesnakes. Tell him Pop."

"That's correct, Zeb, but—"

Zebbie cut him off. "Maybe you gals can split watches and have breakfast ready. Right now I've got to hook up Gay Seabee so that she can reach me in our bedroom. Deely. I can add a program so that she can listen around the cabin, too. Properly programmed, Gay's the best watchdog of any of us. Will that satisfy you duty-struck little broods?"

Deely said nothing, so I kept quiet. Zebbie, however, turned back to his car, opened a door, and prepared to hook Gay's voice and ears to the three house intercoms. "Want to shift the basement talky-talk to your bedroom, Jake?"

"Good idea," Jacobb agreed.

"What a hell while I ask Gay what she has Hello, Gay."

"Howdy, Zeb. Wipe your chin."

"Program, Gay. Add running news retrieval. Area: Arizona strip north of Grand Canyon plus Utah. Persons: all persons listed in current running news-retrieval programs plus rangers, federal rangers, forest rangers, park rangers, state rangers. End of added program."

"New program running, Boss."

"Program. Add running acoustic report, maximum gain."

"New program running, Zeb."

"You're a smart gal, Gay."

"Isn't it time you married me?"

"Good night, Gay."

"Running news retrieval. Boss."

"Report."

"Straits Times, Singapore (Reuters). Tropic News of Marston Expedition. Indonesian News Service, Palembang. Two bodies identified as Dr. Cecil Yang and Dr. Z. Edward Carter were brought by jungle buggy to National Militia Headquarters, Balikpapan. The district commandant stated that they will be transferred by air to Palembang for further transport to Singapore when the commandant in chief releases them to the minister for Tourism and Culture. The whereabouts of Professor Marston and Mr. Smyth-Balshie are still unknown. Commandants of both districts concede that hopes of finding them alive have diminished. However, a spokesman for the minister for Tourism and Culture assured a press conference that the Indonesian government would pursue the search more assiduously than ever."

Zebbie whistled tunelessly. Finally he said, "Opinions anyone?"

"He was a brilliant man, son," my husband said soberly. "An implacable loss. Tragic."

"Ed was a good Joe, Jake. But that's not what I mean. Our tactical situation. Now. Here."

My husband paused before answering.

"Zeb, whatever happened in Sumatra apparently happened about a month ago. Emotionally I feel great turmoil. Logically I am forced to state that I cannot see that our situation has changed."

"Hide? Deely?"

"News retrieval report," announced Gay Report."

"San Francisco (AP). Via satellite from Saipan, Marianas. TWA hypersonic-semiballistic liner Winged Victory out of San Francisco International at twenty o'clock this evening Pacific Coast Time was seen by eye and radar to implode on reentry. Honolulu (AP). U.S. Navy official USS submersible carrier Flying Fish operating near Wake Island has been ordered to proceed flank speed toward site of Winged Victory reentry. She will surface and launch search craft at optimum point. Navy PIO spokesman, when asked what was optimum, replied, "No comment." Associated Press's military editor noted that submerged speed of Flying Fish class and type and characteristics of craft carried are classified information. TWA spokesman released passenger list by order of the Civil Aerospace Board. List follows: California—"

The list was long. I did not recognize any names until Gay reached "Doctor Neil O. Bran—"

I gasped. But no one said a word until Gay announced "End running news retrieval."

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PARKER BROTHERS
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"Thank you, Gay."

"A pleasure, Zeb."

Zebbie said, "Professor?"

"You're in command, Captain!"

"Very well sir! All of you—liberal rules! I expect last action and no back talk. Estimated departure five minutes! First, everybody take a pee! Second, put on the clothes you'll travel in. Jake, switch off, lock up—whatever you do to secure your house for long absence. Deely, follow Jake, make sure he hasn't missed anything; then you, not Jake, switch out lights and close doors. Hide, bundle what's left of that Dutch lunch and fetch it—fast, not fussy. Check the refrigerator for solid foods—no liquids—and cram what you can into Gay's refrigerator. Don't dither over choices. Questions, any one? Move!"

By using my cape as a Santa Claus pack, I carried food into the garage and put it down by Gay—and was delighted to find that I was the first there.

Zebbie strode in behind me, dressed in a coverall with thigh pockets, a pilot suit. He looked at the pile on my cape. "Where's the elephant, Sharpe?"

Capt'n Zebbie, you didn't say how much you just said what. What won't go she can have." I hooked a thumb at the chopped-up catpaw.

Sorry, Hilda, you are correct." Zebbie glanced at his wristwatch, the multiple-dial sort they call a navigator's watch.

"Cap'n, this house has loads of gim-

micks and gadgets and bells and whistles. You gave them an impossible schedule."

"Oh purpose, dear. Let's see how much food we can stow."

Gay's cold chest is set flush in the deck of the driver's compartment. Zebbie told Gay to open up, then with his shoulders sideways, reached down and unlocked it. "Hand me stuff."

I tapped his butt. Out of three, you overgrown midget, and let Sharpe pack. I'll let you know when it's tight as a grille!

Space that makes Zebbie twist and grunt is roomy for me. He passed things in. I fed them for maximum stowage. The third item he handed me was the leavings of our buffet dinner. "That's our picnic lunch." I told him, putting it on his seat.

"Can't leave it loose in the cabin."

"Cap'n, we'll eat it before it can spoil. I will be strapped down. Is it okay if I clutch it to my bosom?"

"Sharpe, have I ever won an argument with you?"

Only by brute force, dear. Can the chatter and pass the chow."

With the help of God and a shoehorn it all went in. I was in a backseat with our lunch in my lap and my cape under me before our spouses showed up. Cap'n Zebbie, why did the news of Brian's death cause your change of mind?"

Do you disapprove, Sharpe?"

"On the contrary, Skipper. Do you want my guess?"

"Yes."

"Winged Victory was booby-trapped. And dear Doctor Brian, who set the trap, I thought he was, was not aboard. Those poor people were killed so that he could sleep."

"Go to the head of the class, Sharpe. Too many coincidences. And they—the Blokes in Black Hats—know where we are."

"Meaning that Professor N. O. Brian, instead of being dead in the Pacific, might show up any second."

He and a gang of green-blooded aliens who don't like geometers."

Zebbie, what do you figure their plans are?"

"Can't guess. They might fumigate the planet and take it. Or conquer us as cattle or as slaves. The only data we have are that they are alien, that they are powerful, and that they have no compunction about killing us. So I have no compunction about killing them. To my regret, I don't know how. So I'm running—running scared—and taking the three I'm certain are in danger with me."

Will we ever be able to find them and kill them?"

Zebbie didn't answer because Deely and my Jacob arched, breathless. Father and daughter were in jump suits. Deely looked cheery and cute, my darling looked grim—but worried. "We're late. Sorry!"

"You're not late, Zeb told them. But into your seats on the bouncer."

Checkoffs completed, Gay switched off lights, opened the garage door and backed out onto the landing flat.

"Copilot, can you read your verner?"

"Captain, I had better loosen my chest belt."

"Do so if you wish. But your seat adjusts forward twenty centimeters—here I'll get it." Zeb reached down, did something between their seats. Stay when."

"There, that's about right. I can read 'em and reach 'em with chest strap in place. Orders, sir?"

"Where was your car when you and Deely went to the space-time that lacked the letter J?"

"About where we ate now."

"Can you send us there?"

"I think so. Minimum translation, positive—entropy increasing—along Jau axis."

"Please move us there, sir."

My husband touched the controls. "That's it, Captain."

I couldn't see any change. Our house was still a silhouette against the sky, with the garage a black mass in front of us. The stars hadn't even flickered.

Zebbie said, "Let's check," and switched on Gay's reading lights, brightly lighting our garage. Empty and locked normal.

Zebbie said, "Hey! Look at that! Look at what?" I demanded and tried to see around Jacob.

"At nothing, rather, Sharpe, where's



NEXT OMNI



RENASCENCE



HUMAN EXPERIMENTS



PRIZES



GURUS

SCIENCE RENASCENCE IN EUROPE—After many false starts and disappointing efforts to recover its pre-World War II scientific glory, Europe is suddenly afoot with ambitious, well-financed, high-quality research. France, Germany and Great Britain have pooled a formidable assemblage of intellectual power and physical resources to build a space program, create high-energy atom smashers, and pioneer new medical techniques. "Twenty years ago the United States was doing eighty percent of the world's science," says Pierre Aigrain, France's equivalent of the White House science adviser. "Now Europe is catching up, and the U.S. share of the total has been going down." Science watcher Daniel S. Greenberg wants to be the Continent's major science centers and brought back the inside story on why Europe is making the grade in *Big Science*. Read it exclusively in the December *Omni*.

HUMAN EXPERIMENTATION—Somebody always has to be the guinea pig before medical science can move forward. But while human experimentation remains as fixed an element of research as theories and test tubes, the wily words make the skin crawl: conjuring up visions of Nazi doctor horrors and brutal exploitation of prisoners, poor people, and hospital patients. In the December *Omni*, Debra Sobel explores the ethical and moral dilemmas raised by human-subject research, taking a look at how new safeguard regulations will affect the course of future discovery.

PRIZES! PRIZES! PRIZES!—What's the greatest untapped resource in science? The desire to win a prize, says *Omni*'s senior editor Scott Morse. Lindbergh's flight across the Atlantic, man-powered flight across the English Channel, a clock that works on board ship, a bicycle that can go over 55 mph, the smallest motor ever built, the breeding of a white margaloed—all were achievements inspired by the offering of a prize. Next month Morse examines prizes past and calls for a reinstatement of the prize as an exciting and economic incentive to stimulate new scientific achievement—while offering some prize-worthy notions of his own.

INTERVIEW/RENE DUBOS—Meet one of the world's most accomplished biologists in this exclusive interview. Dubos, a famed researcher and teacher at Rockefeller University, discovered the first useful antibiotic, helped develop the first tuberculosis vaccine, and won a Pulitzer Prize for his 1968 book, *So Human an Animal*. Today he says that science and society have become too complex for people to cope with, read his prescription for reorganization in our next issue.

your alien?
Then I understood. No corpse. No green bloodmoss. Workbench against the wall and floodlights not rigged.

Zebbie said, "Gay Deceiver, take us home!"

Instantly the same scene, but with convulsed-up corpse, I gulped.

Zebbie switched out the lights. I felt better, but not much.

"Captain?"

"Copilot."

"Wouldn't I have been well to have checked for that letter J? It would have given me a check on calibration."

"I did check Jake. You have bins on the back of your garage neatly stenciled. The one at left-center reads Junk Metal."

"Oh!"

"Yes, and your analog in that space—your twin, Jake-prime or what you will—has your neat habits. The left-corner bin read Junk Metal, spelled with an I. A cupboard above and to the right contained lugs & nuts. So I told Gay to take us home. I was afraid they might catch us. Embarrassing."

Deety said, "Zebbadiah—I mean Captain—embarrassing how sir? Oh, that missing letter in the alphabet scared me, but it no longer does. Now I'm nervous about aliens. Block Hats."

"Deety, you were lucky that last time. Because Deety-prime was not at home. But she may be, tonight. Possibly in bed with her husband, named Zebbadiah prime. Unstable cuts. Likely to shoot at a strange car shining lights into his father-in-law's garage. A violent character."

"You're teasing me."

"No, Princess, it did worry me. A parallel space, with so small a difference as the lack of one unnecessary letter, but with houses and grounds you mistook for your own, seems to imply a father and daughter named Jacob and Leah Thore." Captain Zebbie pronounced the names Yacobi and Dayah Thore.

"Zebbadiah, that scares me almost as much as aliens."

"Aliens scare me far more. Hello, Gay."

"Howdy, Zebbie. Your nose is funny."

"Smart Girl, one goes vertically to one kick. Ho-er."

"Roger dodger, you old codger."

We rested on our backs and headrests for a few moments then, with a stomach-surgingly swoosh of a fast lift, we levitated off and hovered. Zebbie said, "Deety, can the autopilot accept a change in that homing program by voice? Or does it take an offset in the verniers?"

"What do you want to do?"

"Same old and old two clicks above ground."

"I think so. Shall I? Or do you want to do it, Captain?"

"You try it, Deety."

"Yes sir, Hello, Gay."

"Hi, Deety!"

"Program check. Debra home."

"Home. Cancel any/all inertial trans-

tions translations rotations. Return to pre-programmed zero latitude, longitude, ground level.

"Report present location."

"One click vertically above Home."

"Gay Program revision."

"Waiting, Deely."

"Home program. Cancel Ground level. Substitute: Two clicks above ground level, hovering."

"Program revision recorded."

"Gay Deceiver, take us home!"

Instantly, with no feeling of motion, we were much higher.

Zeb said: "Two clicks on the nose! Deely you're a smart girl!"

Zabadiah, I bet you tell that to all the girls."

"No, just to some. Gay, you're a smart girl."

"Then why are you shackled up with that strawbery blonde with the fat knickers?"

Zebbie craned his neck and looked at me. "Sharpe, that's your voice."

I ignored him with dignity. Zebbie drove south to the Grand Canyon, here in starlight. Without slowing, he said: "Gay Deceiver, take us home!"—and again we were hovering over our cabin. No jar, no shock, no nothing.

Zebbie said: "Jake, once I figure the angles, I'm going to cut spending money on juice. How does she do it, what we haven't been anywhere?—no station, no translation."

"I may have given insufficient thought to a linear root in equation ninety-seven. But it is analogous to what we were considering doing with planets. A five-dimensional transform simplified to three."

I said: "Excuse me, gentlemen. Can't we move somewhere away from right over our cabin? I'm jumpy. Black Hairs are hunting us."

"You're right, Sharpie, I'm about to move us. All secure?"

"Captain Zabadiah!"

"Trouble, Princess?"

"May I attempt a novel program? It may save time."

"Programming is your pedgin. Certainly."

"Hello, Gay."

"Hi, Deely!"

"Retrieve last program. Report execute code."

"Reporting, Deely. Gay Deceiver take us home!"

"Negative. Erase permanent program controlled by execute-code Gay Deceiver take us home. Repeat confirm."

"Confirmation report. Permanent program execute-coded Gay Deceiver take us home, negative erase. I tell you three times."

"Deely," said Zeb, "a neg scrub to Gee tells her to place item in perms three places. Redundancy safety factor."

"Don't bother me, dear! She and I sing the same lingo. Hello, Gay."

"Hello, Deely."

"Execute code, new permanent program Gay Deceiver countermarch! At new execute-code, repeat inverted in real time latest sequence, initiate transitions translations rotations below last use of program execute-code Gay Deceiver take us home."

"New permanent program accepted."

"Gay, I tell you three times."

"Deely, I hear you three times!"

"Gay Deceiver countermarch!"

Instantly we were over the Grand Canyon, cruising south. I saw Zeb reach for the manual controls. "Deely, that was slick."

"I didn't save time, sr., I goofed. Gay you're a smart girl."

"Deely, don't make me blush."

"You're both smart girls," said Captain Zebbie. "If anyone had us on radar he must think he's getting cataracts. Vice versa, if anyone picked us up here, he's wondering how we popped up. Smart dodge, dear. You've got Gay Deceiver so deceptive that nobody can home on us. We'll be elsewhere. Jake, are your professional papers aboard? Both theoretical and drawings?"

"Why no, Zeb—Captain Too bulky. Microfilms I brought. Originals are in the basement vault. Have I missed?"

"Not a bet! Is there any geomaster who give your published paper on this six-way system a friendly reception?"

"Captain, there aren't more than a handful of geomasters capable of judging my postulate system without long and intensive study. It's too unorthodox. Your life course was one—a truly brilliant mind! Oh, I now suspect that Doctor Brain understood it and subsidized it for his own purposes."

"Jake, is there anyone friendly to you and able to understand the stuff in your vault? I'm trying to figure out how to warn our fellow humans. A fantastic story of apparently unrelated incidents is not enough. Not even with the corpse of an extraterrestrial to back it up. You should leave mathematical theory and engineering drawings to someone able to understand them and whom you trust. We can't handle it, every time we stick our heads up, somebody takes a shot at us. And we have no way to fight back. It's a job that may require our whole race. Well? Is there a man you can trust as your professional executor?"

"Well, one, perhaps. Not my field of geomatry, but brilliant. He did write me a most encouraging letter when I published my first paper—the paper that was so sneered at by almost everyone except your cousin and his one other Professor Sappo (Rakennonen, of Turku, Finland)."

"Are you certain he's not an alien?"

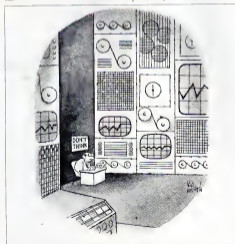
"What? He's been on the faculty at Turku for years! Over fifteen."

I said: "Jacob, that is about how long Professor Brain was around."

"But—My husband looked around at me and suddenly smiled. 'Hids, my love, have you ever taken a sauna?'"

"Once."

"Then tell our captain why I am sure that



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



April 79



May 79



June 79



July 79



August 79



September 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.

my friend Seppo is not an alien in disguise. I—Deety and I—attended a professional meeting in Helsinki last year. After the meeting we visited their summer place in the Lake Country and took a sauna with them.

"Papa, Mama, and three kids" agreed Deety. "Unmistakably human."

"Branry was a bachelor," I added thoughtfully. "Cap'n Zebbie, wouldn't disguised aliens have to be bachelors?"

"Or single women. Or pseudo-married couples. No kids, the masquerade wouldn't hold up. Jake, let's try to phone your friend. Mmm, nearly breakfast time in Finland, or we may wake him. That's better than missing him.

"Good! My comcredit number is Nero Aalph—"

"Let's try mine. Yours might trigger something if Black hats are as smart as I think they are. Smart Girl."

"Yes, Boss."

"Don Ameche."

"To hear a to obey O Mighty One."

"Deety, you've been giving Gay bad habits."

Shortly a fat male voice answered. "The communications credit number you have cited is not a valid number. Please refer to your card and try again. This is a recording."

Zebbie made a highly unlikely suggestion. "Gay can't send out my comcredit code incorrectly, she has it tel-me-three times. The glitch is in their system. Pop, we have to use yours."

I said, "Try mine, Zebbie. My comcredit is good. I predeposit."

A female voice this time. "—not a valid number. Please refer to your card and try again. This is a recording."

"Then my husband got a second female voice. —by again. This is a recording."

Deety said, "I don't have one. Pop and I use the same number."

"It doesn't matter." Cap'n Zebbie said bitterly. "These aren't glitches. We've been scubbed. Unpersons. We're all dead."

I didn't argue. I had suspected that we were dead since the morning two weeks earlier when I woke up in bed with my cuddly new husband. But how long had we been dead? Since my party? Or more recently?

I didn't care. This was a better grade of heaven than Sunday school in Terre Haute had taught me to expect. While I don't think I've been outstandingly wicked, I haven't been very good either. Of the Ten Commandments I've broken six and bent some others. But Moses apparently had not had the Last Word from on High. Being dead was weird and wonderful, and I was enjoying every minute. ... or soon, as the case might be.

Zeb

Not being able to phone from my car was my most frustrating experience since a night I spent in jail through a mistake—I made the mistake. I considered grounding

to phone, but the ground did not seem healthy. Even if all of us were presumed dead, nullifying our comcredit cards so quickly seemed unkindly; all of us had high credit ratings.

Canceling Sharpw's comcredit without proof of death was more than unkindly; it was outrageous, since she used the pre-deposit method.

I was forced to the decision that it was my duty to make a military report, I raised NORAD, stated name, rank, reserve-commission serial number, and asked for scramble for a crash priority report—and ran into "contact" procedure which causes instant ulcers. What was my clearance? What led me to think that I had crash-priority intelligence? By what authority did I demand a scramble call? Do you know how many scramble calls come in here every day? Got off this frequency, it's for official traffic only. One more word out of you, and I shall alert the civil sky patrol to pick you up.

I said one more word after I chapped off Deety and her father ignored it. His said "My sentiments exactly!"

I tried the Federal Rangers. Katsuh Bak-racks at Jacob Lake, then the d'loop at Littlefield, and back to Katsuh Littlefield didn't answer. Jacob Lake answered. "This is a recording. Routine messages may be recorded during beep tone. Emergency reports should be transmitted to Flagstaff HQ. Stand by for beep tone. Beep! ... Beep! ... Beep!"

I was about to tell Gay to zip my tape when the whole world was litgrit by the brightest light imaginable.

Luckily we were cruising south with that light behind us. I gossiped Gay to flank speed while telling her to suck in her wings. Not one of my partners asked a foolish question, although I suspect that none had ever seen a fireball or a mushroom cloud.

"Smart girl."

"Here, Boss."

"DR problem. Record true bearing light beacon relative bearing eastern. Record radar range and bearing same beacon. Solve latitude/longitude beacon. Compare solution with laws in permit. Confirm."

"Program confirmed."

"Execute."

"Roger Wilco. Zeb. Heard any new ones lately?" She added at once, "Solution. True bearing identical with fix. Execute-coded. Gay. Decewer take 5. True range identical plus-minus zero point six clicks." "You're a smart girl, Gay."

"Fishery will get you anywhere, Zeb. Over."

"Roger and out. Hang onto your hats, folks, we're going straight up." I had out-faced the shock wave, but we were close to the Mexican border, either side might send sprint birds homing on us. "Copilot!"

"Captain."

"Move us! Out of the space!"

"Where, Captain?"

"Anywhere! Fast!"

"Uh, can you ease the accelerator?" I

can't lift my arms."

Cursing myself I cut power, let Gay Deceiver climb free. Those vernier controls should have been mounted on armrests. Designs that look perfect on the drawing board can kill test pilots.

"Transition complete, Captain."

"Roger, Captain. Thank you." I glanced at the board: six-plus klicks height-above-ground and hang—in but enough air to bite. "Hang onto our lunch, Sharpie!" I leaned us backwards while doing an im-malman into level flight; course north, power still off. I told Gay to stretch the glide then tell me when we had dropped to three klicks H-above-G.

What should have been Phoenix was off to the right, another city—Flagstaff?—was farther away north and a bit to the east, we appeared to be headed home. There was no glowing cloud on the horizon. "Joke, where are we?"

"Captain, I've never been in this universe. We translated ten quanta positive tau axis. So we should be in analogous space close to ours—ten minimum inter-verse or quanta."

"This looks like Arizona."

"Approaching three klicks, Boss."

"Thanks, Gay. Hold course and H-above-G. Corrector: Hold course and absolute altitude. Confirm and execute."

"Roger Wilco, Zeb."

I had forgotten that the Grand Canyon lay ahead—or should. Smart Girl is smart, but she's literal-minded. She would have held height-above-ground precisely and given us the wildest roller-coaster ride in history. She is very flexible, but with her the "garbage-in/garbage-out" law applies. She had many extra fail-safes—because I make mistakes. Gay can't: anything she does wrong is my mistake. Since I've been making mistakes all my life, I surrounded her with all the safeguards I could think of. But she had no program against wild rides—she was beefed up to accept them. Violent evasive tactics had saved our lives two weeks ago, and tonight as well. Being too close to a fireball can worry a man—to death.

"Gay display map, please."

The map showed Arizona—our Arizona. Gay does not have in her guardians any strange universes. I changed course to cause us to pass over our cabin etc.—its analog for this space-time. Didn't dare tell her "Gay, take us home!" for reasons left as an exercise for the class. "Deety, how long ago did that bomb go off?"

"Six minutes twenty-three seconds, Zebachah, was that really an A-bomb?"

"Pony bomb, perhaps. Maybe two kilotons, Gay Deceiver."

"I'm all ears, Zeb."

"Report time interval since radar-ranging began."

"Five minutes forty-four seconds, Zeb. Deety darning. Was that far off?"

"No, dialing. You reported time since flash. I didn't ask Gay to range until after we were hypersonic."

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"Oh, I feel better."
"Deety, how long has it been since we killed that fake ranger?"

"That was seventeen fourteen. It is now twenty-two twenty-five hours six minutes."

"Check, Jake, I didn't know that Gay could range an atomic blast. Light beacon to her means a visible light just as radar beacon means a navigational radar beacon. I told her to get a bearing on the light beacon directly aft; she selected the brightest light with that bearing. Then I told her to take radar range and bearing on it and spun my prayer wheel and prayed."

"There was white noise, possibly blanketing her radar frequency. But her own radar bursts are tagged; it would take a very high noise level at the same frequency to keep her from recognizing echoes with her signature. Clearly she had trouble; for she reported 'plus-minus' of six hundred meters! Nevertheless, range and bearing matched a fix in her permanent and told us our cabin had been bombed. Bad news. But the aliens got there too late to bomb us. Good news."

"Captain, I decline to grieve over material loss. We are alive."

"I agree, although I'll remember Snug Harbor as the happiest home I've ever had. But there is no point in trying to warm Earth—our Earth—about aliens that blast destroyed the clincher, that alien cadaver. And papers and drawings you were going to turn over to your Finnish friend. I'm not sure we can go home again."

"Oh, that's no problem, Captain. Two seconds to set the verniers. Not to mention the deadman switch and the program in Gay's permanent."

"Jake, I didn't mean that you can't pilot us home, I mean we shouldn't risk it. We've lost our last lead on the aliens. But they know who we are and have shown damaging skill in tracking us down. I'd like to live to see two babies, ben and grow up."

"Amen," said Sharpe. "This might be the place for it. Out of a million billion zillion planets, this one may be vermin-free. Highly likely."

"Holds my dear, there are no data on which to base any assumption."

"Jacob, there is one datum."

"Eh? What did I miss, dear?"

"That we do know that our native planet is infested. So I don't want to base leads on it. If this part the place we're looking for, let's keep looking."

"Mean, logical. Yes, Cap—Zeb?"

"Recommendation?"

"Sir, I suggest maximum altitude. Decuss what to do while we get there."

"Gay Decover."

"On deck, Captain Ahab."

"One gee, vertical."

"Aye, aye, sir." How many answers had Deety taped?

"Anybody want a sandwich?" asked Sharpe. "I do. I'm a pregnant woman."

"I suddenly realized that I had had nothing but a piece of pie since noon. As we climbed, we finished what was left of supper. Done."

per.

"Zet Marsh?"

"Don't talk with your mouth full, Sharpe."

"Zobbie, you brute. I said, is that Marsh? Over there."

"That's Antares, Mars is—Look left about thirty degrees. See it? Same color as Antares, but brighter."

"Got it, Jacob darling, let's take that vacation on Barsoom!"

"Hide dearest. Mars is unrefeasible. The Mars Expedition used pressure suits. We have no pressure suits."

I added, "Even if we did, they would get in the way of a honeymoon."

"Hide answered. "I read a jingle about A Space Suit Built for Two. 'Anyhow let's go to Barsoom! Jacob, you did tell me we could go anywhere in Zip—nothing flat.'"

"Quite true."

"So let's go to Barsoom."

I decided to flank her. "Hide, we can't go to Barsoom. Mosa Kajak and John Carter don't have their swords."

"Want to bet?" Deety said sweetly.

"Huh?"

"Sir, you left it to me to pick baggage for that unassigned space. If you'll check that long, narrow stowage under the instrument board, you'll find the sword and saber with belts. With socks and underwear crammed in to keep them from rattling."

I said soberly, "My Princess, I couldn't mean about my sword when your father took the loss of his house so calmly—but thank you with all my heart."

"Let me add, my thanks, Deety, I sat much store by that old saber, unnecessary as it is."

"Father, it was quite necessary this afternoon."

"Hi ho! Hi ho! It's to Barsoom we go!"

"Captain, we could use the hours still down for a quick jaunt to Mars. Uh—Oh dear, I have to know its present distance. I don't."

"No problem," I said. "Gay gobbles the Aerospace Almanac each year."

"Indeed! I'm impressed."

"Gay Deceiver."

"You again? I was thinking."

"So think about the Calculator program. Data address, Aerospace Almanac. Running calculation, line-of-sight distance to planet Mars. Report current answers on demand. Execute."

"Program running."

"Report."

"Kicks: two-two-four-zero-nine-zero-eight-two-seven-point-plus-minus-nine-eight-zero."

"Display running report."

Gay did so. "You're a smart girl, Gay."

"I can do card tricks, too. Program continuing."

"Jake, how do we do this?"

"Align Lanes with your gun sight. Isn't that registered?"

"By far!" I aimed at Mars as if to shoot her out of the sky—then got cold feet. "Jake? A little Tennessee windage? I think those figures are from center-of-gravity to center-

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of-gravity. Half a mil would place us a safe distance away. Over a hundred thousand klicks!

"A hundred and twelve thousand." Jake agreed, watching the display. I offset one half mil. "Copilot." "Captain."

"Thrust when ready. Exocite."
Mars in half-phase, big and round and ruddy and beautiful, was swimming off our starboard side.

Deety

Aunt Hilda said softly, "Bansoom. Deety. Dead sea bottoms. Green gants." I just gulped.

"Mars, Hilda, daring." Pop gently corrected her. "Bansoom is a myth."

"Bansoom," she repeated firmly. "It's not a myth. It's Mars. Who says its name is Mars? A bunch of long-dead Romans. Aren't the natives entitled to name it? Bansoom."

"My dearest, there are no natives. Names are assigned by an international committee sponsored by Harvard Observatory. They confirmed the traditional name."

"Poch! They don't have any more right to name it than I have. Deety isn't that right?" I think Aunt Hilda had the best argument, but I don't argue with Pop unless it's necessary. He gets amokish.

Pop and Zebadiah got busy again. Presently Pop said, "Over twenty-four kilometers per second! Captain, at that rate we'll be there in a little over an hour."

"Except that we'll scream before that. But, lochis, you'll get your closer look. Dead sea bottoms and green gants. It any."

"Zebadiah, twenty-four kilometers per second is Mars's orbital speed."

"My father answered, 'Di? Why so it si?'" He looked very puzzled, then said, "Captain, I confess to a loolish mistake."

"Not one that will keep us from getting home, I hope."

"No, or I'm still learning what our continuous craft can do. Captain, we did not aim for Mars."

"I know I was chicken."

"No, sir, you were properly cautious. We aimed for a specific point to empty space. We transitioned to that point but not with Mars's proper motion. With that of the solar system, yes. With Earth's motion subtracted, that is in the program. But we are a short distance ahead of Mars in its orbit, so it is rushing toward us."

"Does that mean we can never land on any planet but Earth?"

"Not at all. Any vector can be included in the program—either before or after transition, translation, or rotation. Any subsequent change in motion is taken into account by the inertial navigator. But I am learning that we still have things to learn."

"Jake, that is true even of a bicycle. Quit worrying and enjoy the ride. Brother, what a view!"

"Jake, that doesn't look like the photo graphs the Mars Expedition brought back."

"Of course not," said Aunt Hilda. "I said it was Bansoom."

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I kept my mouth shut. Ever since Dr. Segan's photographs, anyone who reads the *National Geographic*—or anything—knows what Mars looks like. But when it involves changing male minds, it is better to let men reach their own decisions: they become somewhat less pig-headed. That planet rushing toward us was not the Mars of our native sky. White clouds at the caps, big green areas that had to be forest or crops, one deep blue area that almost certainly was water—all this against tuddy shades that dominated much of the entire planet.

What was lacking were the rugged mountains and craters and canyons of "our" planet Mars. There were mountains—but nothing like the Devil's Jockey known to science.

I heard Zebadiah say, "Capitol, are you certain you look us to Mars?"

"Captain, I took us to Mars—ten, via plus on the axis. Either that, or I'm a patient in a locked ward."

Take it easy, Jake. It doesn't resemble Mars so much as Earth—ten resembles Earth.

"Uh, may I point out that we saw just a bit of Earth—ten, on a moonless night?"

"Meaning we didn't see it." Conceded.

Aunt Hilda said, "I told you it was Barsom. You wouldn't listen."

"Hilda, I apologize. Barsom, Capitol log it. New planet, Barsom, named by night of discovery by Hilda Cornelia Burroughs, science officer of Continuum Craft Gay Discoverer. We'll all witness Z. J. Carter commanding, Jacob J. Burroughs, chief officer, D.T.B. Carter, uh, astrogator. I'll send certified copies to Harvard Observatory as soon as possible."

Hilda

I knew that "my" Barsom was not the planet of the classic romances. But there are precedents. The first nuclear submarine was named for an imaginary underwater vessel made famous by Jules Verne; an aircraft carrier of the Second Global War had been named Stargy-La for a land air reconnaissance as Enewark, the first space freighter had been named for a starship that existed only in the hearts of its millions of fans—the list is endless. Nature copies art.

Or, as Deety put it: "Truth is more fantastic than reality."

During that hour Barsom rushed at us, it began to swell and swell, so steadily that brocade was a nuisance, and my heart swelled with it, in childlike joy. Deety and I unstepped ourselves so that we could see better, floating just "above" and behind our husbands while steadying ourselves on their heads.

We were seeing it in half phase, one half in darkness, the other in sunlight—ocher and amber and olive green and brown and all of it beautiful.

Our pilot and copilot did not sightsee. Zebbie kept taking sights, kept Jacob busy calculating. At last he said, "Capitol, if our

approximations are correct, all the height at which we will get our first radar range, we will be only a bit over half a minute from crashing. Check?"

"To the accuracy of our data, Captain."
"Too close. I don't fancy arriving like a meteor. Is it time to hit the panic button? Advise, please. But bear in mind that that puts us—should I put us—two clicks over a hot, new crater, possibly in the middle of a radioactive cloud. Have any of you got any good ideas?"

"Captain, we can do that just before crashing—and it will either work or not. If it works, that radioactive cloud will have had more time to blow away. If it doesn't work—"

"We'll hit so hard we'll hardly notice it. Gay Discoverer isn't built to reenter at twenty-four clicks per second. She's beefed up—but she's still a Ford, not a reentry vehicle."

"Captain, I can try to subtract the planet's orbital speed. We've time to make the attempt."

"Capitol."

"Captain?"

Along Axis, subtract vector twenty-four clicks per second—and for God's sake don't get the signs reversed!

"I work!"

"Execute."

Seconds later Jacob reported, "That does it, Captain. I hope."

"Let a check. Two readings, ten seconds apart. I'll call the first, you call the end of ten seconds. Mark!"

Zeb added, "One point two. Record."

After what seemed a terribly long time Jacob said, "Seven seconds—eight seconds—nine seconds—mark!"

"Our man confirmed that, Jacob said, 'Captain, we are still falling too fast. Do you get that feeling?'"

"Of course," said Deety. "We've been accelerating from gravity. Escape speed for Mars is five clicks per second. If Barsom has the same mass as Mars—"

"Thank you, Astrogator Jake, can you tell me, uh, four clicks per second?"

"Sure!"

"Do it."

"Uh, done! How does she look?"
"Uh, distance slowly closing. Hello, Gay."

"Howdy, Zeb."

"Program Radar Target dead ahead Range."

"No reading."

"Continue ranging. Report first reading. Add program. Display running radar ranges to target."

"Program running. Who blacked your eye?"

"You're a smart girl, Gay."

"I'm sorry too, Over."

"Continue program." Zeb sighed, then said, "Capitol, there's atmosphere down there. I plan to attempt to ground Command? Advice?"

"Captain, those are words I hoped to hear. Let's go!"

"Barsom—here we come!" ☺

GAMES

ANSWERS TO GAMES PAGE 140

1. **MATCH UP** Steinfeld's solution is at left. Balow's is at right.



2. **POTS** If the pots have hollow handles as the drawings suggest, the smaller pot would hold more coffee because its entire handle is below the spout line.

3. **TRIANGLES** Many readers sent the solution at left, with six triangles. Jim Schmalzer of Wabash, Indiana, created eight equilateral triangles in the Star of David pattern at right.



4. **WALL** John H. Stango, of London, England, and Edward Hurttres, of Skillman, New Jersey, pointed out the fact that nothing in the problem requires you to keep your heels together or to touch your toes with both hands at once. They suggested sliding the right leg up against the wall until one can bend over sideways to touch the left toes, then reversing the procedure to touch the right toes. Hurttres adds, "I conquered this by trying the exercise. I hope the pain stops soon."

5. **CAKE** Redock the pieces after the second vertical cut, then make the last slice down through the four-wedge tower.



6. **PETS** No puppies, 20 kittens, and 80 goldfish.

ANSWERS TO READERS' PUZZLES

7. **FIVE ROOMS** The line must either enter a room from outside or start within it. With the exception of the starting and ending room, each room entered must also be

exited. Rooms with an even number of walls pose no problem: A line enters twice and exits twice to cross each wall. But three of the rooms have five walls each—an odd number. In this case, if a line starts outside the room, it must end within it after all five walls are crossed. If it starts inside, it ends outside. If there were only two such rooms, the line would simply start in one and end in the other. But there are three such rooms, and so a continuous line must always fail to cross all the walls in at least one room.

8. $2 = 1$ The fallacy is in step 5. Dividing by $(x - y)$ is the equivalent of dividing by zero, an operation that has no answer—not "zero" or "infinity" or any other number. It is simply an operation that is not allowed in mathematics, precisely because it leads to such absurd conclusions as this one.

9. **THREE UTILITIES** This puzzle was first posed by English puzzler Henry Ernest Dudeney in 1917. To prove it is impossible, imagine first that only two houses are to be connected to the utilities.



(Doing this divides the plane into three regions [labeled 1, 2, and 3 in the drawing]. Your lines need not be exactly as shown, but however you draw them, you will divide the plane into three areas that are structurally identical to those shown. House G must go in one of the three regions. If it goes in 1, it is cut off from water; if it goes in 2, it is cut off from gas; if it goes in 3, it is cut off from electricity. Whatever house C is placed, it is cut off from one of the utilities; hence, the problem is insoluble.

10. **NICOTINE FITS** Seven cigarettes. The butts from the six new cigarettes are combined to make the seventh. Recently L. Y. Wu demonstrated that one can actually start with fewer than 36 butts and achieve the same result. He starts with just 35 butts and borrows a butt from someone else to make the sixth cigarette. He then returns the butt of his seventh cigarette to the lender.

11. **NINE DOTS** The classic solution, with four lines, is this:



Stanford University instructors, using the puzzle to show how old habits block think-

ing, had the lesson shown back at them when a student realized that nothing in the rules requires the lines to go through the centers of the dots and offered a three-line solution.



If that weren't enough, according to Eugene Raudsepp's *Creative Growth Games*, a friend of Stanford Professor James L. Adams came up with the ultimate "two-way" way to fold the paper so that all nine dots can be crossed off with one straight line.



12. **THE BEAR** The explorer could be standing near the South Pole, so close that when the bear walks east, its 100-meter path carries it once around the Pole and back to where it started. The man could stand even closer to the Pole, allowing the bear to circle it twice or three times, and so on.

Benjamin Schwartz found two other families of infinite solutions. In one, the bear stops exactly opposite the man on the other side of the Pole, after circling it one and a half or two and a half times, etc. In the other, man and bear start on opposite sides of the Pole; the man farther from it. The bear's hike can then be a half circle, full circle, one and a half, two, etc., ultimately becoming a prowl on the Pole itself!

Bear-hunting season is still open, according to Martin Gardner. R. S. Burton offered a solution that took into account the earth's spin (the Coriolis effect). Schwartz replied that this solution was impractical because the bullet would have to fly impossibly slowly for the earth's spin to have any noticeable effect on its trajectory in the spirit of gamesmanship; however, Schwartz offered a substitute Coriolis solution. "The shot has a muzzle velocity of about 17,000 mph, just sufficient to keep the bullet in orbit at an altitude of five feet above the ground. It continues to circle the earth indefinitely with its orbit precessing to the west, until (with probability 1) it hits any bear of height more than five feet.... [Note: After shooting, the hunter is required to duck.]" **DD**



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UFO

Continued from page 10

of Ubatuba led to Robert E. Ogilvie, a professor of metallurgy at MIT, who conducted an analysis of a fragment supplied to the magazine by APRRO.

The specimen was examined by metallographic analysis to determine its mechanical and thermal history. Electron probe microanalysis was employed to determine the chemical composition and the distribution of elements within the specimen. Results of these tests showed the metal to be pure magnesium. No impurities or alloying elements, such as aluminum, zinc, manganese, or tin, were found. An oxygen x-ray map picked up magnesium and oxygen x-ray signals, thus confirming the network to be magnesium oxide.

"My conclusion," says Ogilvie, "is that the specimen from Brazil has a composition that would be found in magnesium weld metal. However, the structure is indeed unusual. In my opinion it could only have been formed by heating the magnesium very close to its melting point in air, it would be necessary to hold the temperature for only a minute or so. This would produce an oxide coating on the material, which is clearly visible. Also, oxygen would diffuse down the grain boundaries, thereby producing the oxide network. It is therefore quite possible that the specimen from Brazil was a piece of a weld metal from an exploding aircraft or a rearing satellite."

Another intriguing example in the search for extraterrestrial substances is the William Herrmann case. Despite its sensationalistic overtones and parallels with the film *Cosmo Encounters of the Third Kind*, the Herrmann case has generated little or no publicity. Herrmann had decided to minimize the details of his experience because of his wish for privacy. However, because of a recent turn of events, he has decided to publicize his case in the hope of acquiring some insight into the origin of the phenomenon.

The Charleston UFO observations began on November 12, 1977. On a clear day, with 20-mile visibility, Herrmann observed a bright silver metallic disk. The object was describing strange triangular patterns in the sky near the South Carolina Electric and Gas power towers adjacent to the Ashley River basin west of Dorchester Road. This object was also seen by other residents in the North Charleston area. The sighting would set the stage for a series of inexplicable events. In a brief period of a year and a half, more than 40 sightings, 9 of which were by Herrmann, of a similar object occurred in the Charleston area. Not only has Herrmann photographed the object, but he claims to have been abducted by alien visitors on two separate occasions, March 10, 1979, and May 16, 1979. Perhaps the most significant event in terms of validating his experience was the materializa-

tion of the metal bar in his home on the night of April 21, 1979.

While Herrmann was in the bedroom of his mobile home that Saturday night, the room suddenly brightened. He looked around and saw a ball of blue light emanating from the top of his dresser. The light grew in intensity and then, just as suddenly, began to fade. As it did so, Bill made out a faint object in the center of the vanishing ball of light. Gazed and puzzled, Herrmann crossed the room and probed up a rectangular bar similar to a small ingot of precious metal. Overwhelmed by the experience, he remained silent and distant as he perceived the strange, symbollike markings engraved in the bar. Immediately after regaining his composure, he notified Wendell Savens, who had been the initial investigator in the case. Savens notified APRRO, which arranged for Dr. Walter Walker to analyze the bar. A careful visual and microscopic examination revealed that the artifact was a casting. Precision thermal analysis and qualitative and semi-quantitative chemical analysis identified the material as hard lead containing 4 to 8 percent antimony.

Two small metal fragments of the Herrmann bar were sent by Orin to MIT for metallographic and electron probe testing. Results of MIT's analysis fairly duplicated APRRO's conclusions. The specimen was made of a cast alloy and its composition approximated that of lead water pipes or of lead grids from an automobile battery. This analysis corroborated APRRO's finding that the fragments contained 6 percent antimony.

The second time Herrmann was abducted, he was told the following by an alien aboard the UFO: "In regard to the bar, we have been authorized to give solely and without favor to you. It is a gift of respect and appreciation. You are one of the few to receive such a bar. It has much value to us, though it is regarded as worthless to you when its value is estimated according to your primitive measure of comprehension."

A statement that was made by Dr. Walker some time ago while studying the Brazilian magnesium specimen best suits all this up. Perhaps the extraterrestrials used methods within our technology and materials available on Earth, and therefore their handwork cannot be distinguished from our own. Whatever the conclusions pro or con, one thing is certain: events of that type help to give us a better understanding of an enigma yet to be solved. Of course, the whole world is waiting for the moment when the proverbial flying saucer lands on the White House lawn (see *UFO's* page 84). Until then, however, we'll have to settle for random chunks of metal accompanied by stories so weird they cannot be ignored.

If you know of anyone who has knowledge of, or possesses, any hard evidence relating to the UFO phenomenon, contact the Aerial Phenomena Research Organization, 3910 East Klandale Street, Tucson, Arizona 85712, or phone 602-323-1029. **DO**

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The solemn trait of the board members was that they had children in their late teens. Just before Christmas vacation, he called the children and described for them the damage a nuclear reactor would do to Cayuga Lake.

"The kids made their parents' Christmas absolutely miserable," Harding recalls. "David got into calls from board members. But I was too late. He had caused a bunch of small upstarts. It was the beginning of the end. Four out of ten board members opposed the site, at which point I was hard for the staff to push for it."

Comey went on to become a specialist in reactor safety and he would become skillful, big, at finding holes in industry evacuation plans, in reactor-reliability claims, in industry boasts on reactor economics. He was among the first to use the Freedom of Information Act to force nuclear secrets out into the light. His motives were not those common to his movement. He seemed less concerned with stopping nuclear power than he would admit to being "anti-nuclear" than with stopping its proponents from lying so much. The dissonance of nuclear power seemed to offend him more than the threat of it, and the last ten years of his life were spent forcing out the truth (or badgering since Comey was a stubby man).

When Comey ever revealed himself publicly it was in a speech he gave before the Atomic Industrial Forum in February 1975. There, in the den of the opposition, he began, "The Greek playwright, Aeschylus once wrote, 'Wise men often learn from their enemies. I will assume you are wise men, I think you probably assume I am your enemy.'"

"When Carl Goldstein called me two weeks ago to invite me to give a talk to you about the nuclear industry's lack of credibility, he said he did not want me to spend thirty minutes firing your past mistakes in your faces. [he wanted] something positive, such as what the industry could now do to improve its credibility. He also wanted me to 'spill my secrets' on how I operate."

I later ran this by the Acting President of the Anti-Nuclear Cabal, and there was some consideration that I would even consider leaving my methods. I later received a cable instructing me, "Tell them nothing they can use." Although there is an old Neapolitan adage, "You surrender your liberty to him to whom you tell your secrets," I have decided that I can safely tell you what they ate.

His secrets, Comey explained to the nuclear men, had been learned from R.H.S. Crossman, the British officer in charge of Allied psychological warfare in Europe during the Second World War. Crossman, an Oxford don and a lecturer on Plato's Republic and on Marx, also had been a genius at propaganda: a man with "a lovable and likable but extremely egotistic personality" according to a colleague. That description

would have served well for Comey himself, and in 1963 the younger lovably insidious personality listening to a Crossman lecture liked what he heard. Crossman's seven principles for successful propaganda became Comey's own. As you listen to Crossman's principles, "he now told his listeners: 'I am sure you will understand what the French writer Fontenelle meant when he said: "Truth enters the mind so naturally that when one hears it for the first time, it seems one is only remembering what one already knows."'"

Crossman's first principle was, perhaps the most unexpected: The base for all successful propaganda is the truth. "It is a complete delusion to think of the brilliant propagandist as being a professional liar," Crossman had told Comey. "The brilliant propagandist is the man who tells the truth and tells it in such a way that the recipient does not think that he is receiving any propaganda. The art of the propagandist is never to be thought a propagandist, but [to]

**Comedy was a paradox,
deliberate and self-made, an
environmentalist
who dressed like a captain
of industry, an
outrageous hyperbolist with
a passion (when
serious) for the truth.**

seem to be a bluff, simple, honorable enemy who would never think of descending to the level of propaganda."

Principle Two: The key to successful propaganda is accurate information.

Three: The most successful propagandist is the person who cares about education.

Four: To do propaganda well, one must not fall in love with it.

Five: A successful propagandist cannot afford to make mistakes.

Six: The propagandist must be credible to the other side, not your own.

Seven: It is the underestimation that succeeds best.

And that Comey told his enemies was all there was to it.

Comey went on: "Crossman says the successful propagandist is the person who cares about educating the public. He wants people to think for themselves, as individuals, and not accept the party line. That is hardly a philosophy many industry executives embrace, they want the public to accept nuclear power, and that is quite another thing."

"Should you wish to become credible, a

prerequisite beginning would be to start telling the truth.

Admit that low-level radiation can cause cancer and long-term genetic effects.

"Confess that important safety research on light-water reactors has never been done and that some has been done improperly.

"Stop hiding your computer codes under the cloak of a proprietary designation and let them be analyzed by the academic and engineering community at large.

"Admit that you are not enchanted with the reliability and deliverability of presently operating nuclear plants.

"Reveal all of the costs of nuclear-generated electricity both present and twenty years into the future.

"Do an energetic input-output model of the nuclear program as a whole, then do a comparable one for alternative energy sources and reveal which ones come out ahead on this basis.

"Tell the public why you have not been able to reprocess spent fuel and what impact the lack of sufficient storage ponds may have over the next ten years.

"Talk about the ethics of our consuming electricity from fission reactors for fifty years and adding twenty thousand future generations with the social and environmental problems of perpetually caring for the actinide-contaminated high-level radioactive wastes.

"Discuss the threats to democratic society posed by a plutonium economy.

"You may like [Aleksandr] Solzhenitsyn ask, 'If the first tiny drop of truth has exploded like a psychological bomb, what will happen in our country when waterfalls of truth come crashing down?'

"The more you ignore us the less credible you become.

"Perhaps you fear that a full and frank discussion of these issues will result in no further use of light water fission reactors.

"So be it. That is the price of living in a democratic republic.

"But the nation's economic health demands use of nuclear power, regardless of how a majority of the public feels about it: some of you may say.

"Thanks! You have just had an insight into your own totalitarian tendencies.

"I hope I have fulfilled Carl Goldstein's request that I talk both about how I operate and about how the nuclear industry might become more credible.

"I rather suspect I may also have complied with my cable instructions not to tell you anything you will use. I have told you all you need to know, namely Crossman's principles, but I doubt that more than a handful of you believe me, and I am reasonably confident not a one of you will use one bit of it.

And in this predicament—on the evidence at least of Three Mile Island, where industry denied or minimized each danger until it became impossible to do so a moment longer than minimized the next danger—David Comey proved right. **☐**

COMPETITION

By Scot Morris

In the April Oms we asked for speculative, provocative questions, suggestions for novel experiments, unusual applications of technology, machines that should be built—in short what J. Good, in his book *The Scientist Speculates*, calls partly baked ideas (pbis).

Some pbis were banally warm. We got several designs for perpetual-motion machines and one trash-the-angle scheme. Others were too familiar: solar cells on the roof of electric cars, holographic television, EEG-pattern music, the old idea that atoms are small solar systems containing microuniverses (or, conversely, that our galaxy is a molecule in God's toilet!) and endless fanciful, impractical schemes to tap such "unused" energy sources as pedestrians, highway or subway traffic, and even the kinetic energy of falling leaves or water draining out of the bathroom sink.

Despite the growing fear that one of the ideas we listed in the reject pile might turn up as a Nobel Prize winner in 1990, we boldly dismissed about three quarters of the entries on various grounds—impractical, unclear, too esoteric, too long, not new, and so on—then passed the rest along to guest judge J. J. Good for his helpful suggestions and perceptive comments. (Some of his comments, and our own, are appended to the pbis below.)

We cannot vouch for the premises of some pbis, nor for their ultimate originality. Inevitably some of these pbis will have been proposed independently somewhere else. But an attitude of "Somebody must have thought of this before and found it wouldn't work" is a primary inhibition to fully baking an idea and publishing it—a bias that this competition was designed to remedy. Since we couldn't guarantee the originality of any of the winning ideas, we awarded top prize to a frivolous suggestion that caught our fancy for its very outrageousness. Most pbis listed below have been paraphrased for brevity and clarity; most are serious, but some are humorous—not always intentionally. We leave it to you to decide which is which.

GRAND PRIZE WINNER (\$100)

The leaves of the prayer plant open in daylight and close in darkness. In a room gradually shorten the 24-hour light-dark cycle to 23 hours, then 22, and so on until the light is flashing on and off at strobe frequency. At that time, if the soil and the pot are lightweight enough, the prayer plant will flap its leaves. Flap off the table and fly away.

—Steven L. Olear, Baltimore, Md.

RUNNERS-UP (\$25)

Perhaps during times of stress, such as a change in environment, the body produces gene-modifying chemicals that increase random mutations in descendants to ensure the filling of any new ecological niches created?

—Dennis S. Murray, Kent, Wash.

Certain cerebral arteries, if "hypertensed," may burst and cause a stroke. A polyethylene tube, thin enough to rupture just below the "popping pressure" point, could be threaded into any exterior abdominal artery, be worn on a belt encased in transparent plastic, and be monitored like a fuse. "Blown fuse" warnings might prevent brain damage.

—Sumner L. Shapiro, M.Q., Encino, Calif.

Bats catch insects by using their "sonar," so it seems reasonable that some insects might have evolved a way to detect these sounds as a defense. If so, an electronic insect repellent could reproduce the bat's sound to frighten insects away.

—John McGowan, Camargo, Ill.

Some people dream in black-and-white, some in color. Since the concept of black-and-white dates from the origin of photography and is less than 200 years old, did our forefathers presumably always dream in color?

—Gary Peterson, Chicago, Ill.

In 1978 Kansas suffered an infestation of grasshoppers. There was talk of flying bars on dangerous insects, topes. A better solution: Harvest the

grasshoppers, collecting them in traps at boundaries of fields, process and market them as "prairie shrimp" for animal and human consumption. Industries exploiting other "pests," such as starlings, walking catfish, the crown of thorns, rats, flies, and cockroaches, should also be explored.

—Terry B. Grund, Lawrence, Kans.

Tooth decay is caused by the secretions of bacteria (*Streptococcus mutans*) that colonize our mouths. So far, efforts to prevent decay are aimed at reinforcing tooth enamel, scrubbing *S. mutans* off, etc. Instead, why not treat tooth decay as an ecological problem? Create a hybrid nondecay-producing bacterium that will crowd *S. mutans* out of its cozy little niche in the mouth. Look Ma, no cavities!

—Draper L. Kaufman, St. Louis, Mo.

The problem with the common umbrella is that one can't stand under the middle of it because the handle is there. How about an umbrella with the handle to one side so the user can stand where maximum rain protection is.

—Alan Wallace, Pleasant Hill, Pa.

How about a car that a deaf person can drive? A microphone triggers a red light inside the car—continuous light for a horn flashing for a siren, brighter as the sound gets louder.

—James Martin Prochink, Fairfax, Va.

My pbis involve ESP and photography. What I've done is photograph with the lens cap in place and rely on an audience's inner resources, to say the least. Someday I plan to have a gallery showing of my credit slips from the photo lab.

—Laurence E. Leidecker, Warren, Pa.

[This entry was accompanied by a totally black 35mm slide.]

HONORABLE MENTION

The Aztec number system is base-12 instead of the more common base-10. How do we know that the original Aztecs weren't mutants with six fingers on each hand?

—Cindy Groszkowitz, Sarasota, Fla.

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For family planning, a woman should know precisely when she is ovulating, but keeping charts is a drag and susceptible to error. I propose a small calendar clock with a computer memory in which to record such data as the date of the last ovulation, signs of mucus, bleeding, and daily temperature. The alarm clock rings once, and the woman straps its thermometer under her arm and goes back to sleep. In five minutes the alarm goes off again, having recorded and stored her basal temperature.

—C. Moyer Houston, Tex

It is possible that the pools of oil lying in our earth's substrata act as shock absorbers or as lubricants for the earth's surface platelets. Could the pumping out of this oil cause more friction in the platelets, normal shifting, more jerky movements, more earthquakes?

—Robert A. Albert, Jacksonville, Fla.

Portrait painters and photographers could play the biggest compliments (and get the highest commissions) by depicting a subject in reverse: left-right image, which is the only way a person ever sees himself when he looks into a mirror.

—Sharon Lataul, New York, N.Y.

A wide-angle TV camera pointing back from a car is monitored on a dashboard display for complete rear-view watch.

—Howard Garton, Montrose, Mich.

Let's have one standard time throughout the world. When it's 5:00 PM, May 30, in Greenwich, England, it's the exact same time in New York, Tokyo,

Moscow—everywhere. This would eliminate the international date-line, time zones, and daylight saving time. Work shifts would be more economic, scientific measurements of time would be more consistent, and international appointments misread because of "my time, your time" confusion would be a thing of the past.

—David Kahn, Burlingame, Calif.

Can suitable hypnotic suggestions make one a calculating prodigy? After all, multiplying big numbers merely involves the repeated use of a few arithmetical algorithms, easily within the capabilities of the "subconscious."

—Paul Hsieh, Kalamazoo, Mich.

The bacterium *Escherichia coli*, a normal inhabitant of the large intestine, is the most common cause of recurrent urinary-tract infections (UTIs). It would seem that the shorter the distance from the anus to the urethra or vaginal orifice, the more likely an *E. coli* is to migrate that distance. Is there a correlation between anus-urethra proximity and incidence of recurrent UTIs? If so, the measurement could be used to identify persons at risk and to institute prophylactic measures.

—Steven C. Hiers, M.D., New York, N.Y.

In her native North Africa, the basing bitch has existed once a year. The American basing first introduced here in the late 1930s, now comes into season two or even three times a year, regardless of climate, nutrition, or activity. Why? America the Fertile?

—Ann Marchess, dog breeder, Nordene Kennels, Staten Island, N.Y.

How about a regular publication for printing ideas. The *Journal of Creative Speculation*? If he so requests, the submitter can sign with a number instead of a name.

—Bryn Kenny, Centex, Calif.

[This suggestion as mentioned in *The Sovietist Speculator*, in which a 1958 proposal is cited. Also, there is a new periodical in Australia called *Speculations in Science and Technology*. —I. J. Good]

I've heard that people who live near airports die of heart disease and strokes, while those who live near railroad tracks don't. If this is so, perhaps it is because the train makes a low rumble and the jet aircraft emits a high-pitched whine.

—Alexander Fure, Caroga Park, Calif. (Or is it that the noise of the train increases more gradually than that of the plane?) —I. J. Good]

Clock radios with timers for "music to fall asleep by" need two volume controls, one adjustable for soft levels when falling asleep, the other preset to a desired alarm-volume level, usually rather loud, for waking up.

—Mark Smith, Stone Mountain, Ga.

Why not develop a synthetic "isak cholorophyll" that will absorb energy from types of radiation outside the visible spectrum, for a new avenue for solving our increasing food problem?

—John Miller, Clifton Park, N.Y.

My observations of alcoholics that I have known showed that all had a strong dislike for milk and a preference for salted foods over sweet foods. If these correlations hold up, perhaps there is a link between blood chemistry, food preference, and the predisposition toward alcoholism.

—Gwenne A. Zibel, Madford, Ont.

The existence of ESP has been hard to demonstrate using ordinary statistical methods and ordinary numbers. Mathematicians should try examining irrational phenomena with irrational numbers.

—Pamela Bethke, Detroit Lakes, Minn.

After many years lying awake listening to male family members make noises like ferocious beasts, it occurred to me that perhaps snoring evolved in primitive man because the fierce noise frightened dangerous intruders away.

—Christina Lupper, Sonoma, Calif. ☐

EXPLORATIONS

By Cheryl Simon

Author David Macaulay in his new book *Model of the Mysteries*, describes a cataclysmic reduction in postal rates that causes modern civilization to be buried by tons of third- and fourth-class mail. Like so many fantasies, Macaulay's is based partly on fact. Every year the average American uses enough newspaper, cardboard, paperboard, and copy paper to fill six steamer trunks. This translates to 636 pounds per person.

Though information is transmitted increasingly by electronic means, we depend more and more on paper to contain food, present news, and provide structure for homes and fodder for voracious photocopiers.

Not surprisingly, almost every state has a booming papermaking industry. While the technology undergoes continual refinement, the basic process has changed little since a Chinese court official, Tsai Lun, invented paper in A.D. 105. Fibers from the inner bark of a poplar subany tree and from bamboo were cooked, pressed, and dried. Despite modern machinery, awareness in its speed and efficiency, this is essentially the same process used today.

The S. D. Warren plant in Westbrook, Maine, is but one of many paper mills where this ancient art has been adapted to meet present-day needs.

The five of us waiting for a tour shuffle restlessly in a corner of the front lobby. Then our tour guide arrives. We don't herd hats as he leads us down a narrow passageway to a cavernous room where wood chips begin their conversion from timber to paper.

Our first stop is the digester, a steel-gray vessel three stories tall. The wood, debarked and chipped into inch-long pieces, is cooking at temperatures from 180° to 190° C.

But this is no ordinary kitchen, with wholesome aromas exuding from conventional ovens. The overwhelming impression is one of moisture. Though there is ample light, a steamy haze enshrouds the gurgling digester. Our guide reaches into the overflow vat,

scops up a handful of the chips, and invites us to look at it. It resembles an overruled cotton ball, wet and gummy.

The rotten-egg smell emanating from the digester results from the chemicals—a solution of sodium hydroxide, sodium carbonate, and sodium sulfide—used to cook the wood chips. After about three hours the combination of chemicals, heat, and live steam pressure degrades and dissolves the lignin (the cement that holds the wood fibers together). Still in the form of chips, the wood then enters a blow tank where a rapid drop in pressure loosens the adhesive and reduces the chips to pulp.

After the fibers are mixed with water and are screened to remove wood slivers and dirt, the pulp is mixed with chemicals and bleached in four stages until it turns white. After the first cycle, a sample sheet, resembling the brown paper used for grocery bags, is made for testing. Then the pulp enters a beater. Color, if desired, along with other chemicals are added as required for specific papers.

Our group straggles to the far side of the enormous room, skirting the digester

and we roll up our sleeves. We become conscious of our breathing in the thick air. The humidity clinging to our clothes and skin is an insignificant fraction of the 20 million gallons of water that the plant consumes each day.

This plant, 130 years old, is in transition. Old-style drag-green passageways and metal stairs lead to rooms glazing with fluorescent light and modern steel blue equipment. The papermaking machines never stop. The machines spew out a million pounds, or 453,000 kilograms, a day. A thousand workers are employed here.

From the beater, the pulp flows to rollers, and the fibers are cut to uniform size. Their surfaces are roughened so that they will bond together properly on the paper machine.

The pulp is now ready to be mixed with water to form a slurry, which is about 99.5-percent water and .5-percent pulp. We watch as it flows onto the Fourth tier, where the papermaking machine named for the brothers who first used such a machine in London in 1804. A screen



Raw material from which over 60 million tons of paper are produced annually in the U.S.

which can be more than nine meters wide moves forward continuously vibrating constantly from side to side to interlock the fibers and extract the water. Most of the water drains off as the newly formed web of fibers moves forward at speeds as fast as 914 meters (3,000 feet) per minute.

The sheet passes to the second section of the winding papermaking machine which snatches the sheet from the wire and whisks it on to the press section. Felted rolls press out more water. Most paper retains about 5 percent of its water but still more than 153 cubic meters of water must be removed for every ton of paper produced. Gradually as we progress with the sheet down the length of the machine, the air becomes hotter and drier. The sheet is wrapped around the steam-heated drums and then flattened

between heavy calender rolls to develop softness and a final smooth finish. Now the paper can be rolled onto "parent" rolls.

The production of paper is merely one part of the papermaking business. Depending on the kind of paper desired paper can be coated, embossed, laminated, or calendered to yield a variety of strengths and shiny matte or textured finishes. These choices may be governed by the kinds of raw wood that are used. Softwood, the wood of needle-bearing trees, yields higher quality papers, because the longer fibers adhere to make a stronger product. Hardwood comes from broad-leaved trees. Because of its shorter fibers, it is used for lower grades of paper. It is often blended in varying proportions with softwood pulp at the paper machine.

The remainder of our two-hour tour consists of strolling down seemingly endless corridors. Our group is herded aside to dodge a manned vehicle zipping by with its load of paper rolls. We enter a room where a machine called the Jaganberg Van-Roll splits the rolls into as many as five smaller rolls of manageable size. Conveyors near the high ceiling carry suspended parent rolls into the room for splitting.

In the coating room we watch as the paper runs through a gooey substance the consistency of latex paint. The paper is then dried in ovens about 28 meters long. Research laboratories continually search for new formulas that produce high-quality coatings but use less costly chemicals.

Glossy paper, used by most magazines, results when paper is coated and semi-dried until it becomes tacky. Then boiling water is poured on, and the paper is wrapped around shiny chrome drums. The room shimmers beneath fluorescent lights; the drums reflect the paper's sheen. If there is a scratch or a piece of dust on a drum, the paper will pick it up.

At the end of our tour in the finishing room, a heating blade cuts through stacks of paper six inches thick, thus completing a process begun by the lumberjack's chainsaw.

IN TRANSIT

Many papermaking plants offer regular tours during the summer and, with several days' notice, will arrange special tours for individuals or small groups during the off season. There are paper mills scattered throughout the country but the largest producers are Georgia, Alabama, Louisiana, Washington, Florida, Oregon, Missouri, South Carolina, Maine, and Virginia.

There are several easy approaches to setting up a tour. One is to go to a local library and check Lockwood's Directory of the Paper and Allied Trades—a massive compendium that lists every pulp and paper mill. Also, the yellow pages under the "Paper Manufacturers" heading will list the plants in a given area. A phone call to the public-affairs director will yield answers to most tour-related questions.

Finally, some of the largest, most diverse paper mills are:

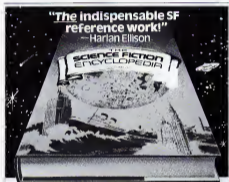
Champion Paper Corporation, P.O. Box 200, Stamford, Conn. 06901

Boise Cascade, 1600 SW Fourth Avenue, P.O. Box 1414, Portland, Oreg. 97207

International Paper Company, 220 East 42nd Street, New York, N.Y. 10017

St. Regis Paper Company, 150 East 42nd Street, New York, N.Y. 10017

Weyerhaeuser Company, P.O. Box 1060, Hot Springs, Ariz. 71901 **OO**



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PHENOMENA

"It was a natural apocalypse," says photographer Pete Turner of his volcanic eruption. "Imagine a hundred locomotives running past either side of you, the ground shaking like jelly, and you have some idea of what it was like."

The volcano appeared suddenly in 1873, on the small Icelandic island of Heimaey. In a town known as Vestmannaeyjar, volcanoes normally give off large amounts of various gases (especially carbon dioxide) and lava rocks that glow with the heat of the earth. Iceland sits atop the Mid-Atlantic Ridge, an area where the continental plates are being pulled apart at a rate of two centimeters per year. As the plates separate, fissures form, pressure builds, and the magma wells up inside the fissures until conditions are right for the volcano to form.

Turner was one of the first photographers to reach Heimaey, and he used a Nikon F camera with Kodachrome film to record the event. **DD**

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COMMUNICATIONS

Continued from page 12

individuals who were not astronomers. Even Ptolemy in his astrological tome, the *Tetrabiblos*, distinguished between astronomy ("first both in order and in effectiveness") and astrology, so that one whose aim is the truth might never compare his perceptions with the sureness of the first unvarying science. Kepler writes of the follies and blasphemies of astrologers—and refers to astrology as the "foolish sleepdaughter of astronomy"—a dreadful supposition. Ms. Crozer's reference to Newton as an astrologer is simply not supported by the historical record.

Astrologers may eventually realize what is truly known about celestial influences and move into the twentieth century. I hope so.

Philip A. Ianna
 Charlottesville, Va.

From Exclusion

Kenneth Blower's article on the plight of the California condor (*Earth*, August 1978) was one of the most thought-provoking pieces I've read in a long time. Will man ever learn? He too bad so many of us are born with such inflated egos that we feel we have the ability and the right to play with nature whenever we deem it necessary. The condor doesn't need man's help to survive. Any intervention at all will probably do more harm than good.

If we all worked on changing ourselves as much as we try to change other things, the world would probably be in a lot better shape. It certainly wouldn't hurt to try.

Jim Ojenski
 Hopewell Junction, NY

Ex Officio

In his "Official Circles" PSI on Caprid Hill article (July 1978) about Representative Charlie Rose of North Carolina, William K. Stuckey incorrectly referred to Terry Sanford as an "ex-university president." Although on sabbatical leave during the current academic year, Mr. Sanford remains the eminent president of Duke University.

James A. Bobulak, Ph.D.
 Duke University
 Durham, N.C. 00



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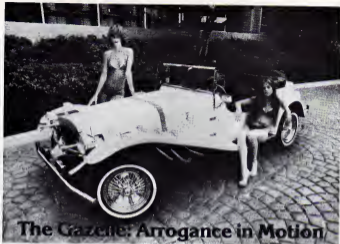
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and pose their own problems

GAMES

By Scott Morris

This month's column is dedicated to those readers who caught us napping on puzzles past and submitted alternate solutions to lead us down the path of rightness for our games' sake (Questions 1-6) and to the readers who liked the tables and sent us problems to sweat over (Questions 7-12).

1. **MATCH UP** (October 1978) We asked: "Can you move just one match to produce a valid equation?" The answer we wanted



was $\sqrt{1} = 1$. We disallowed one shortcut: $\sqrt{1} = 1$ but failed to foresee two alternate solutions sent in by Jay Steinfield of Bellare, Texas, and Agnes Barlow of Country Lakes, New Jersey. Can you find their two new answers?

2. **POTTED PROBLEM** (November 1978) Which coffee pot holds more? We said they



both hold the same, because the spouts rise to the same height. A half dozen readers argued that the short pot will hold more. Why?

3. **TRIANGLES** (October 1978) Another match problem asked you to arrange six matches into four equilateral triangles. We intended—but didn't specify—that all four triangles would be equal with sides one match long. Our three-dimensional solution was a tetrahedron with one base

triangle on the table, the three other matches propped against one another to



form three "vertical" triangles. Some readers found how to make six and even eight equilateral triangles with just six unbroken matches. Can you? (Hint: The matches remain flat on the table, but overlap.)

4. **UP AGAINST THE WALL** (November 1978) Can you stand with your back and heels against a wall and touch your toes without bending your knees? We said it couldn't be done. When you bend over, your hips must move back to keep your center of gravity over your feet. The wall prevents that, so you fall over. A few readers weren't convinced by this impeccable logic and found a way (Hint: Carefully reread the instructions to note what is, and is not, allowed.)

5. **CUT THE CAKE** (December 1978) Problem: Cut the birthday cake into eight equal pieces with just three straight cuts. We did it with two perpendicular/vertical cuts and one horizontal cut. Unfortunately this leaves some pieces (the bottom four) with less frosting than the others. A twelve-year-old Chicago reader, Tom Muller, found a way to equalize things. (Hint: His precocious solution is not strictly disallowed by the instructions.)



6. **THE PET STORE** (March 1979) Puppies cost \$5, kittens \$3, and goldfish 30 cents. How can you buy 100 animals

for \$100? Our answer was 10 puppies, 2 kittens, and 88 goldfish. Dozens of readers pointed out that 5 pups, 11 kittens, and 84 fish would be another possibility, but only a few found the one other combination that works. (Hint: To find it, you must doggedly forget something.)

READERS' PUZZLES

7. **FIVE ROOMS** Draw a continuous line that passes through every wall segment



once only. The illustration shows a failed attempt. The segment marked X remains uncrossed. Is there a path that solves the puzzle? The answer is no. Prove it.

8. **PROOF THAT 2 = 1** Several readers, including Mike Spear of El Paso, Texas, T. J. Waters of Mesa, Arizona, and Van Clava Morris of Wilmette, Illinois, have sent variations on the following mathematical paradox.

1. $x = y$ (Given)
2. $x^2 = xy$ (Multiply both sides by x)
3. $x^2 - y^2 = xy - y^2$ (Subtract y^2 from both)
4. $(x + y)(x - y) = y(x - y)$ (Factor)
5. $x + y = y$ (Cancel out the $(x - y)$ term)
6. $2y = y$ (Substitute x for y by equation 1)
7. $2 = 1$ (Divide both sides by y)

Two equals one? Is mathematics built on a house of snakes? Is all logic of thinking about to crumble? Save mathematics from utter collapse. Study each step, and find the flaw in this proof.

9. **THREE UTILITIES** The task here is to connect each utility (gas, electricity, water) to each of three houses without crossing lines. The paths can be as long and convoluted as necessary, so long as they don't cross (or pass under a house or

utility). The illustration shows a near miss. Every connection is made except for water.



to house A. Can you solve the problem? If not, can you prove that nobody can?

10. **NICOTINE FITS** Joe Eddy Brown, of Chicago, asks: If a hobo can recycle one new cigarette from six butts, how many could he make out of thirty-six butts? (Hint: The answer isn't six.)

11. **THE NINE DOTS** Steve Werk, of Winnipeg, Manitoba, asks whether it is possible to connect all nine dots with



four straight lines. This puzzle, Werk says, is often used to show how people's unconscious assumptions restrict them from insightful solutions. People tend to keep their lines within the border of the nine dots, but nothing in the rules demands this. Can you break through mental boundaries to find the solution?

Some ingenious alternate solutions to this puzzle have been proposed, in which the nine dots are connected with three straight lines or incredibly with just one. Can you imagine how?

12. **WHAT COLOR WAS THE BEAR?** Eric Damant, of New York City, says his favorite puzzle is this: An explorer sees a bear 100 meters due south of him. The bear walks 100 meters due east while the explorer stands still. The explorer then points his gun due south, fires, and kills the bear.

Question: What color was the bear?

The classic answer to this chestnut is that the bear is white, since the only place the explorer could be standing would be exactly on the North Pole.

There are no polar bears at the South Pole, but if there were, could the explorer be in Antarctica? The answer is yes. There are an infinite number of places—in fact three sets of infinite places—where the explorer can stand near the South Pole and satisfy the conditions of the problem. Can you think of any of them? The ultimate analysis of the problem is Benjamin Schwartz's article "What Color Was the Bear?" (*Mathematics Magazine*, Vol. 34, September–October 1960). For our abbreviated tour, see Answers, page 130.

ANSWERS to five Martin Gardner puzzles from last month:

1. **CUT-UPS** Can a square be dissected into five congruent parts, each having the same area and shape? Yes, there is only one way to do it, and here it is. How smart does this make you feel?



7. **TALE OF A TUB** A plastic boat loaded with nuts and bolts floats in a bathtub. When they are dumped, what happens to the water level in the tub? It goes down. A floating object displaces its weight in water; a submerged object displaces its volume. When the metal cargo is dumped, the water level is lowered.

8. **PIGEONS** A truck driver carrying 200 pigeons bongs on the side of the truck to lighten the birds and make them fly around in the compartment just long enough for him to drive across a rocky bridge. His method won't work, however. The weight of a closed compartment obscuring a bird is equal to the weight of

the compartment plus the bird's weight, except when the bird is in the air and accelerating up or down. The former increases the weight of the system; the latter reduces it. Only if the bird is in free fall is the system's weight lowered by the weight of the bird. Flapping birds alternate small up-and-down accelerations, which average out. The overall weight of the system remains virtually the same.

9. **BIKE TRICK** Pulling back on the lower pedal causes the bicycle to move backward. The force on the pedal is in the direction that normally would push the bicycle forward, but the large size of the wheels and the small gear ratio between



the pedal and the wheel sprockets are such that the bicycle is free to move backward with the pull. When it does so, the pedal actually moves forward with respect to the bicycle (that is, in a counterclockwise direction in the illustration), although it moves backward with respect to the ground. If you don't believe all this, Gardner suggests, you'll simply have to get a bicycle and try it.

10. **BELL ROPES** An acrobat wants to steal two bell ropes by climbing and cutting them at points as high as possible yet avoiding a fall to the concrete floor below. How can he get the most rope? He first ties the lower ends of the ropes together. He climbs rope A to the top and cuts rope B, leaving just enough rope to tie into a small loop. Hanging by this loop, he cuts rope A off at the ceiling (without letting it fall!), then passes the end of A through the loop and pulls it through until the knot is at the loop. After letting himself down the double rope, he pulls it free of the loop, thereby obtaining the entire length of A and almost all of B. ☐

THE TRUE PIONEERS OF SPACE

LAST WORD

By L.A.P. Moore

Although humans have been claiming *U.S. first* at every step in the race to escape from Earth's gravity, we are actually very late entrants. Culled from public documents, the following is a history of the true pioneers of the space race.

It all began in September 1783. The first balloon to carry passengers from the planet's surface rose from the courtyard of the palace of Versailles for an eight-minute flight. On board were the first two explorers of the universe—a duck and a rooster. You might say it was a lowly day. The next major step into space was 163 years in coming.

On December 17, 1946, fungus spores took off in a balloon, headed for the top of the atmosphere. Their balloon was never seen again. Fruit flies gave it a try in 1947, reaching an altitude of 106 miles. These insect adventurers returned safely to swarms of welcomees.

Albert, a rhesus monkey, was sitting in a V-2 rocket on June 15, 1948, ready for launch. There was an equipment failure, however, and Albert never got off the ground. This was to be the first of many problems encountered by the monkey space effort, leading to rumors of interspecies sabotage. A year later on June 14, 1949, Albert II reached an altitude of 83 miles, vindicating the original Albert and the rhesus cause in general. Unfortunately, Albert III had problems. His return parachute failed. Two further rhesus flights in 1949 and in 1950, ended with parachute failures. Claiming "caution," humans refused to enter the race. It was a claim we would hear again and again.

As if to shame Man, a mouse went up in a V-2 rocket in the summer of 1950, but his return parachute also failed. Repeatedly picking up the fallen-mouse banner, eight mice took off in a balloon on September 29, made it to 27,000 feet, and then returned safely.

Heartened by the success of the mice, a monkey tried the V-2 Aerobee rocket on April 18, 1951. Almost unbelievably, the return parachute failed. Trying a new tactic, a monkey took 11 mice with him when he lifted off in the second Aerobee

on September 20, and they reached 236,000 feet. The parachute functioned perfectly, but the recovery team couldn't locate the returned capsule, which had landed in a desert. The third and last of the monkeys, Aerobee attempts was made on May 21, 1952. Michael and Patricia—with two mice going along for good luck, reached an altitude of 36 miles. All returned safely, and the Monkey Cause was broken.

Between the eight-mouse success and the end of 1952, there were 30 more balloon flights. Balloonists included fruit flies, mice, hamsters, cats, and dogs—a virtual airborne zoo. The flights ranged from 90,000 to 100,000 feet and lasted as long as 28 hours. Still, there was no word from Man.

Between 1849 and 1859 dogs made the great leap forward, going up in more than 40 rockets. On November 3, 1857—in a feat every bit as significant as that of 1783—a dog named Laika was the first orbiting to orbit the planet. The conquest of space had begun.

Then the monkeys went up one of their own, Gorio, who followed a long ballistic path that took him beyond orbital distance in a quick follow-up. Able and Baker, two female monkeys, reached an altitude of 300 miles and a speed of 10,000 mph. Both returned safely.

On June 3, 1959, three mice tried, but



Monks (left) and Biggie (right) ready for space.

failed to achieve orbit. The year ended with a success when a rhesus named Sam made a ballistic flight to 290,000 feet, returning in high spirits. Humans continued to provide technical and moral support, but men failed to go aloft. The time was not yet right.

The year 1960 started off well and got better. On January 21, a swifter six-pound rhesus named Miss Sam made a flight, edging the monkeys ahead again. The dogs struck back on August 19, when Beika and Steika achieved orbit at 199 miles. Their craft, which weighed 10,000 pounds, remained in orbit for more than 24 hours. Their orbital speed was 227 miles per minute. Their flight lasted 437,500 miles, setting a new record. Beika was two-and-a-half years old and weighed 4.5 kilograms, a year younger. Steika weighed a hefty 5.5 kilograms.

Also in the fall of 1960 Solly Arny and Moe—three mice—took a 5,000-mile-long, 700-mile-high flight in an Atlas, reaching 18,000 mph and passing through the inner Van Allen radiation belt. Later all three had healthy, normal offspring.

Toward the year, Pchelka and Moshka went up for the dogs on December 1, accompanied by insects and plants. And Man was finally thinking about entering the race.

Not to be outdone by their rhesus and squirrel monkey cousins, the chimpanzees made their move on January 31, 1961. Chang (nicknamed Ham), a handsome chimp weighing 16.5 kilograms, covered 414 miles in 16.5 minutes in a flawless ballistic flight.

On March 9, Chermushka, a female dog, took off with a truly integrated crew—guinea pigs, mice, insects, and seeds. A friend of hers, Zvezdochka, made a follow-up flight on March 25. Man was thinking seriously about entering the race.

On April 12, 1961, Yuri, a male human and cosmonaut of the USSR, made one orbit around Earth in his craft, Vostok 1. Man had finally arrived.

On November 29 of that year, Enos, a male chimpanzee, made two orbits. **CC**