# OMNI

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# OMNI

JANUARY 1979

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*Cover art for this month's OMNI is a new view of planet earth by De Es Schwertberger called "Rescue." Schwertberger was born in Austria and now lives in New York City His book* Fundamental Images *was published in 1974 He is now at work on a new book*

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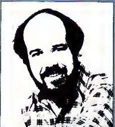


# FRANK KENDIG

*❛The object was silver, it had a flat bottom from which six legs protruded, and it was circular or disc-shaped. It looked like a barbecue grill turned upside down❜*

[illegible] ng ago I was asked [illegible] a late night radio talk [illegible] I was to [illegible] interviewed about OMNI and answer telephone calls from the listening audience. The show originated from Mobile, Alabama, but, technology being what it is, I was to be heard from my apartment in New York City. The show was broadcast "live."

Several hours before air time I received a telephone call from the host. He told me about the general procedure of the show and then warned me to expect calls about unidentified flying objects. It seems a UFO had been sighted in Mobile that afternoon.

Later that evening I answered telephone call after telephone call from people who had seen the UFO. One thing was absolutely clear—they had all seen *something*. Furthermore, they had all seen the *same* thing. In some ways the descriptions were consistent: the object was silver, it had a flat bottom from which six thin legs protruded; it was circular or disc-shaped. Several callers said that it looked like a barbecue grill upside down.

But at that point the consistency stopped. Estimates of the UFO's diameter ranged from 10 meters to 150 meters. Some callers reported that the UFO had flashing lights; others saw lights but no flashing; some observed no lights at all. Some callers said the object made a hissing noise; some reported the sound of an engine; some heard no sound at all. One caller said that he was driving with his family just inside the city limits of Mobile when the UFO hovered above his car and then took off across the highway with incredible speed. Another reported that the object "floated" across a field and then lifted off vertically. One caller said that the electrical systems in his automobile had stopped functioning and his engine had stalled when the UFO passed overhead. A cameraman from a local television station called to say that he had photographed the object.

After nearly two hours the inevitable call came: "That UFO you've been talking about. It just landed in my backyard. It's there now."

Unfortunately the object this good Mobile citizen described was distinctly terrestrial. Once again an unidentified flying object had been identified—a UFO had become an IFO. The caller said the object [illegible] od and [illegible] with alumin[illegible] [illegible] ced had six legs and was about 10 meters in diameter. [illegible] had no lights of any kind, or any means of propulsion. It was carried aloft by a number of plastic garbage bags filled with a gas the caller thought was helium.

The expected followed—a few Monday [illegible] quarterbacks called in to say they had seen the UFO and knew all along [illegible] was a fake. One caller claimed to be the designer of the UFO and said he had devised the stunt to "put some life [illegible] Mobile." When the show was over I found myself genuinely disappointed. I had wanted the UFO to be real.

[illegible] was not unt[illegible] later that I began to think about the callers who had sighted the object a[illegible] reported [illegible] as a UFO. Why did they report lights when there were no lights? [illegible] sound when there was no [illegible] reports of great speed when at best the object was bumped along by the [illegible] Exaggeration? Lies? I thought so at first, [illegible] then changed my mind. It was simple—they too had wanted the UFO to be rea[illegible]

Now, on the matter of UFOs I must ad[illegible] am often a skeptic. I believe we are not a[illegible] [illegible] have difficulty believing we are so popular or amusing a species that we are [illegible] ed daily—or even yearly—by our neighbors in space. To paraphrase Carl Sagan, if only one percent [illegible] the reported UFO sightings are genuine, then the aliens have better ser[illegible] between here and their home planet than Eastern Airlines provides between New [illegible] Mia[illegible]

But [illegible] like to believe. I *want* to believe. Even [illegible] hear about a sighting a little [illegible] says *maybe this is it*. Maybe the creatures from Altair-4 or the inhabitants [illegible] green planet orbiting Alpha Centauri are finally here. I have things [illegible] tell them. I would like to pose Kurt [illegible] question—"What are people for?" Maybe they know.

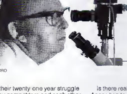
Perhaps [illegible] down to ambition. I often have the same ambition as Gottfried Rosenbaum, a character in Randall Jarrell's [illegible] *From an Institution*: "I shall tell [illegible] inattentive as you are, anyone [illegible] would not tell, what is my real ambition: [illegible] want some people to come [illegible] another planet and to make me [illegible] pet." ▫▫

# CONTRIBUTORS

## OMNIBUS


DRUSINE


ISAACSON


GORO


FORWARD

Solar power is being shuffled into a hold file by program managers at the Department of Energy, writes *Helen Drusine*, former energy consultant with the House government subcommittee on environment, energy, and natural resources.

Drusine was working with the subcommittee when she wrote the highly controversial report, "Nuclear Power Costs." It raised quite a few eyebrows at the Department of Energy, and apparently got industry and business leaders upset. So upset, she was fired. Drusine then picked herself up, gathered her notes, and came straight to *Omni*. The story is "Solar Politics" (p. 92), in which solar and nuclear forces continue to wage war for the same federal dollars—with nuclear winning substantially over the past several years. Conclusion? "Solar technologies will become exotic toys more in line with Star Wars and the 21st century—not victors of the energy war."

The 1977 Nobel Prize for physiology and medicine was shared by Andrew Victor Schally of Poland and Roger Guillemin of France. It's been said both winners' careers are models of persistence, brilliant intuition, and efficient management—not to mention fear, jealousy, and character assassination. *William Stuckey*, contributing editor and author of "Nobel Prize" in our first issue, here investigates the bitter, often savage, personal battle between these two giants of science in their race for science's most prestigious award. "If their twenty-one-year struggle against their competitors and each other is a general reflection of the scientific life," warns Stuckey, "then send your kid to art school. Science is for the piranhas." Follow them blow-by-blow in "Forever War" (p. 44).

A trip to the stars within a hundred years? Journalist/editor *Owen Davies* examines the possibilities in "The First Starship" (p. 76), a proposed mission by the British Interplanetary Society (BIS) to launch an unmanned star probe to Barnard's Star in search of planets—and possibly life. "It won't be easy," warns Davies. "The rocket will take 20 years just to build, not to mention the 50 years it will take for it to get to its destination. Question is: is the whole thing worth it?" Anthony Martin, editor of the BIS journal, believes the idea is "very sensible indeed."

"My ambition is to explain scientific ideas and facts to the lay readership, using the camera as a tool," photographer *Fritz Goro* told *Omni* staffers during a three-hour slide show from which the photographs for this month's pictorial essay were selected. For 30 years a staff photographer at *Life*, Goro traveled the world taking unique photographs of every kind of subject matter.

Goro's superb sense of design is readily apparent in all his work. His photos of computer microcircuits alone resemble stunning abstract paintings. We'll let *Omni's* exclusive gallery of Goro speak for itself, beginning on page 54.

Is there really a way to control gravity? According to *Dr. Robert L. Forward*, senior scientist at Hughes Research Laboratories in Malibu, California, the answer is yes. A leading specialist in gravitational theory, Dr. Forward suggests that if we take a closer look at Newton and Einstein, we'll see that antigravity catapults and "negative-gravity" starships are not as absurd as they might seem. It's "Goodbye Gravity" (p. 88).

The notion that sand possesses magical, musiclike qualities is intriguing and valid. Legends have for centuries told of strange sand dunes that squeaked, whistled, and boomed. In our Explorations column this month, *Jerry Schad* reports on this bizarre phenomenon—and tells us where we can listen for ourselves to "Acoustic Sands" (p. 131).

"I find myself treading on thin ice talking to you. I'm afraid I'm going to reveal too many things." That's what Richard Donner, tv and film director, told *Omni* reporter *James Delson* when asked to discuss his latest film venture, *Superman*. Supposedly one of the most difficult films ever made, *Superman* promises to be the biggest box office smash yet (p. 26).

Finally, you won't want to miss *Omni's* special two-page spread, "Atoms in Living Color," highlighting the work of Michael Isaacson and Albert Crew, the two brilliant Chicago physicists whose Scanning Transmission Electron Microscope took history's first moving pictures of the atom (p. 86). **OO**

# LETTERS

# COMMUNICATIONS

## Tofflleresque Anticipations

The interview with Alvin Toffler was superb and it restimulated all the excitement I felt when I first read *Future Shock*

Ted Nelson's "Computer Lib," too, affected me personally (I'm a programmer) It was (almost too) snappy, but it brought up a much needed "Toffleresque" anticipation of the use to which all this new-found computing power will be put, that is, either for the distribution of gadgets or towards a revolution in the organization of information and communication

Reginald T. Aubry
Methuen, MA

About the Toffler interview—I disliked the way Toffler railed against us progressmaniacs We don't want to ruin the earth, we just want to get off Once off the earth we could go our elitist ways splicing genes and meddling with human evolution, looking down from time to time at the starving masses below And as the Schumachers of the world churn out their new improved rice paddies to feed the growing millions we'll be speeding toward the stars

In short, Technologists of the world, unite! You have nothing to lose but your environmental impact statements

Brett P. Bellmore
Capac, MI

## Nelson Feedback

Ted Nelson's "Computer Lib" in November *Omni* really tells it like it is, especially the "muttering out loud and walking into things." I'm a computer person and I know!

John M. Taylor
Montgomery, AL

Ted Nelson's "Computer Lib" concerning personal (or micro-) computers is the most extraordinary article to appear in print concerning this popular new subject As owners of a computer store, and as individuals involved in the industry for the past two years, the perception shown by Mr. Nelson far exceeds that of the industry in general

Philip W. Jackson
San Antonio, TX

## Nucleogenesis and the Mind

Your article concerning the infinity of space and time ("Space," November) enlightened me. Still, as you place those immense figures of nucleogenesis, exploding galaxies, and atomic origin before me, I can't help pondering the ignorance of a few cubic centimeters occupied by the human mind

Vincent J. Paul
Lead, SD

## Vegetive Bicentennial

After spying Roman Vishniac's spectacular picture of photosynthesis in November *Omni*, I was reminded that this is the bicentennial of the discovery of photosynthesis, is it not?

Meredith Culver
Scottsdale, AZ

*Yes. In 1778/9 the Dutch scientist and physician Jan Ingenhouse demonstrated that the green parts of plants—chloroplasts, in which the cytoplasm is associated with the green pigment chlorophyll—utilize sunlight. In his book, Experiments Upon Vegetables he proved that the green plant is the basis of the world's food supply*
—Roman Vishniac

## Proximirus Ignoramus

Most people lead lives of ultra mundane dullness and concern themselves for the most part with the acquisition of money and security within their mediocre niches in society Despite the scientific and technological underpinnings of the very society in which we live, some people know nothing of science and care even less Because of their ignorance, some are likely to oppose the expenditure of money on programs of scientific research at every juncture, failing to realize, of course, that men and women of scientific and intellectual curiosity are primary contributors to the world in which we live Many people merely go along for the ride

Senator William Proxmire, by the criteria discussed above, is one of the ignorant ones Unlike most, however, he occupies a fairly influential position within gov-

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# DIALOGUE

# OMNI FORUM

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

### UFO Debate

How sad to see such a poor article on UFOs in *Omni's* first issue. James Oberg is certainly no authority on the subject. His article tries to come across as unbiased, but even someone with a superficial knowledge of the issue can see that it is laced with distortion and innuendo.

It has been said that in war the first casualty is truth. The UFO controversy is a kind of war with two armies defending their views of reality. This controversy is without a doubt one of the most remarkable and persistent scientific debates of the 20th century, with emotions riding high on both sides.

When the revolution is over and the UFOs, whatever they are, are incorporated into the consensus of reality that science is building, we will look back and see that the UFO controversy, like Darwinism and relativity, was just another scientific revolution in the evolution of mankind's enlightenment.

If "UFO Update" is representative of the type of coverage controversial issues will receive in the future, then *Omni* has little to offer a questioning mind.

Terry Hansen
Minneapolis, MN

Mr. Oberg replies: *It is an article of faith among UFO buffs that their phenomena are destined to become accepted by future science, since in the past other 'heresies' such as Darwinism and relativity were ultimately accepted, too. But most heresies, like most revolutions, failed, justifiably so, and only the successful ones make the history books. It remains to be seen whether or not UFOs will be accepted or forgotten.*

C'mon, James Oberg. If you plan to continue writing your skeptical UFO articles under the guise of proper scientific literature, please be fair. First, the *Omni* readership should be aware that not only are you working with NASA but you are a U.S. Air Force officer in fine standing as well. In fact, while I knew of you as Captain Oberg, I shouldn't doubt you are now Major Oberg. As a former USAF staff sergeant, I can appreciate that and wish to congratulate you if you have achieved a higher rank. Nevertheless . . .

As a UFO researcher for 16 years, and as one whose articles supporting UFOs have appeared in the same issues as yours on at least one occasion, I wonder what the Air Force would have done to me had I written pro-UFO articles during my enlistment, which occurred during the days when AF regs on UFOs were frightful. Your consistently skeptical articles are probably making some of your superiors far happier than anything you might write to the contrary. And I wouldn't be too hasty to single out Stanton Friedman for making "a good living off his lecture tours" when you are obviously turning a good buck for your stuff.

In fact, sir, you weren't so busy grinding out your basically monotone written efforts, you might have taken the time to proofread your "UFO Update," in which you made the error of referring to UFO researcher James McCampbell as Robert McCampbell.

Then there's that little problem about the "Committee for the Scientific Investigation of Claims of the Paranormal," which you lavishly praise while finding fault with most of the standard UFO investigation organizations. *Really*, Capt./Maj., what egotism. On my desk sits a package of literature from the Committee begging for support, and do you know lo and behold, who is one of the group's "fellows"? *You* are, and so are your brother "fellows" whom you mention so happily, Robert Sheaffer and Philip Klass. Surely you knew? No wonder you heaped praise on the Committee, which, by the way, seems to have been far more active in trying to prevent the media from reporting positively on some unexplained phenomena than in actually investigating the phenomena

I beg of you *Omni*, please, offer something more on UFOs than just Oberg s one-track point of view the subject craves variety For example, Springs, New York has had a wave of perhaps unprecedented UFO sightings, very impressive ones, looked into by several investigators and journalists In light of all that's happened there in this, albeit insignificant corner of the earth Oberg s stuff sounds all the more archaic, especially since some of the best witnesses were law enforcement officers and college students who saw things at close range not just silly lights in the sky

Shortly before President Carter entered office, a congressman kindly recommended me for a position in any UFO project Carter might initiate I realized then, as now, that my chances for selection were narrow—even if there was a study But I am all the more disheartened now to see that when I sent the president a letter giving reasons why a UFO study should be attempted, NASA ended up with my letter and gave the reply little better than a form letter Damn it If somebody writes the White House the reply should come from somebody, anybody at the same address. This policy of forwarding all UFO mail to NASA is rather like taking your roll of film to the corner drugstore and finding they sent it to the butcher for development

In closing allow me to make this proposition to Mr Oberg If you are really sincere with your skeptical UFO views, resign your commission in the Air Force and work as a civilian skeptic so those who might think you're doing all this for rank and good performance reports will be forever silenced (I m not one of them mind you I'm just trying to be fair and consider all the angles, like you would) In return, I shall gladly list your name in the acknowledgements of a book I'm now writing about the Air Force In fact, so far you'll be the only person on the list

Robert Barrow
Syracuse, NY

Mr Oberg replies *Well thanks for the letter I don t quite know how to begin, but I hope your UFO reports are better organized than your three page ramble*

*Once more around the same tired track I don t have any idea what my Air Force superiors think about my UFO activity since I have never had any directives one way or another It's easy to reject any unwelcome opinions as part of a "government plot," and you're welcome to that paranoia if you feel it suits you It also is a direct smear on my honesty and motives, which I understand and mildly resignedly endure*

*Don t crab to me about your not getting a UFO response from the White House Your "butcher" metaphor is very imaginary—and off target*

*I heaped praise on a number of UFO groups, including MUFON and CUFOS and GSW, and my membership came after my endorsements, not before Sorry to bust through the wall of silence UFO buffs would like to enclose the skeptic groups within*

*If the Springs, N Y, cases survive the test of CUFOS and the* National Enquirer's *investigation then yes indeed they will deserve mention But too many UFO researchers with 16 years' experience or more have dragged Hendry, Pratt, and other sympathetic researchers hundreds of miles on wild UFO chases*

*Your proposition is not at all appealing nor is it very rational Any other offers? Keep hunting*

## Background Radiation

Despite the evident lyricism of the "Miracle" article in October *Omni*, the Browers have produced less an article on science than a special pleading based on their known antipathy to nuclear energy They have ignored obvious scientific facts

It is well known that exposure to background radiation varies widely with geographic location In the United States natural background levels vary by a factor of three to four, from a low along the Gulf Coast to a high in Colorado Frigerio and Stowe have looked for any correlation between background levels and cancer rates They have found none Colorado with the highest background levels in the country, had the lowest cancer mortality rates

Even more relevant evidence comes from the long-term studies of Ademar Friere-Maia who has been conducting genetic and epidemiological surveys in Espirito Santo State in Brazil where background radiation levels reach almost ten times higher than average because of the presence of Thorium in the local soils He has found no detectable effect of radiation on such indicators of genetic damage as stillbirths congenital abnormalities or male/female sex ratios

It is impossible in principle to prove that background radiation has absolutely no effect on human health, but all existing scientific evidence indicates that radiation effects are extremely small in comparison with any other kind of environmental impact Increments to background radiation caused by activities of humans (such as producing vital electricity through fission reactors) would be much smaller than the natural geographic variations in background radiation levels. The impact on human health of such small increments can be reliably estimated to be insignificant In fact the Council on Scientific Affairs of the American Medical Association recently released a Health Evaluation of Energy Generating Sources which found that producing electricity with nuclear energy had a much smaller detrimental impact on health than generating the same electricity with coal or oil

J. A. Penkrot, M.S
Committee for Scientific
Truth in the Public Interest
Pittsburgh PA

Mr Brower replies *It is commonplace for advocates of nuclear energy to pretend, as Mr Penkrot does that people of their persuasion dominate the scientific community Names like "Committee for Scientific Truth in the Public Interest" are selected for their sober sane eyed sound Mr Penkrot would have us believe that his letter is something other than a special pleading*

*But if our "Miracle" column demonstrates*

CONTINUED ON PAGE 138

PACIFIC JEWEL

# EARTH

By Kenneth Brower

The Palau archipelago is the westernmost cluster in Micronesia's galaxy of small islands. "Micronesia" is more a convenience for geographers than a real geographical entity, and Palau is less a part of that doubtful entity than most of the scattered archipelagos that discompose it. In Greek *mikros* means "small," *nesos* means "island," and most of Micronesia's islands are, as the name suggests, tiny, but the Palaus are exceptions. They are sizable pieces of terrain.

Palau is closer in topography to a mainland than any other Micronesian group, and, as a result, its flora and fauna are the least islandlike. Over millennia, the winds and currents have brought seeds and stray creatures from nearby lands—New Guinea, Malaysia, the Philippines—and today Palau's ecosystem is almost continental in its diversity. This is a welcome development in an ocean of small, simple, and often monotonous ecosystems.

For humans, as for plants and animals, Palau is a mixing ground. Melanesia's realm of black islands is nearby, and many of Palau's people show a Melanesian influence—dark skin and nappy hair. Polynesia's many islands are not out of reach, and many Palau Islanders demonstrate Polynesian traits—big, robust men and women. And Malaysia's genes are there, too.

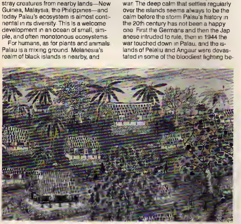
Presently Palau, along with most of the rest of Micronesia, is administered by the United States through another doubtful entity, the imitation quasi-sovereignty called the U.S. Trust Territory of the Pacific Islands.

History in Micronesia has a peculiar rhythm. The islands doze through long, placid, Edenic periods in which nothing much happens, then wake to catastrophe—typhoon, or in this century, world war. The deep calm that settles regularly over the islands seems always to be the calm before the storm. Palau's history in the 20th century has not been a happy one. First the Germans and then the Japanese intruded to rule, then in 1944 the war touched down in Palau, and the islands of Peleliu and Angaur were devastated in some of the bloodiest fighting between the United States and Japan. The American occupation of the years since has been peaceful, but the quality of the calm is different now.

A great demographic change is occurring in the Pacific generally, and Palau is no exception. There is a migration from the outer islands, small villages, and traditional life into the district centers and a cash economy. Confusion and resentment have followed this reverse diaspora, as always happens with large-scale human movements.

Today Palau's district center, on the central island of Koror, is becoming a *barrio* of tin roofs and gardens, a green and spacious slum, but a slum just the same, full of young men and women with nothing to do. There is too much drinking in Koror Town, too much fighting, not enough good feeling. The small villages have been abandoned to the very young and the very old. The very old are repositories of traditional lore and wisdom but have nobody to impart it to, for as soon as the young people are old enough to understand, they are shipped to Koror for a third-rate Western education. Traditional life there is losing its vitality.

A second, smaller migration is underway. Bright young Palauans are traveling in increasing numbers to the United States for a second-rate, and occasionally a first-rate, American education. They return to Palau to find parents and cousins living in the Bronze Age. Until recently, they were embarrassed at this primitiveness of their relatives. Now they are ambivalent. Technological civilization has begun to doubt itself, especially in its classrooms, and the young Palauan scholars pick up on that. Return-to-the-soil sentiments are now fashionable in the United States; the young Palauans know that their countrymen have never left it. They have been alerted to the pitfalls of the Machine Age, but they have also had a bite of the apple. Some decide that socialism is the right path for Palau—a return to Palau's old communal tradition. Others become capitalists, joining what they see as a mainstream. Most aren't sure what to believe.



Painting by Charles Gibbons

*A watercolor painting by "Rueur" Charles Gibbons, the fourth chief of Koror, painted at age 75*

Palau is entering a decade of decision. Soon Palauans, along with other residents of the trust territory, must decide what kind of relationship they wish to maintain with the United States, with the rest of Micronesia, and with the world. They must choose what kind of civilization they want for themselves. Nowhere in Micronesia are these issues more hotly debated than in Palau. There is a rising tension in the debate. For the first time in more than a century, the Palau Islanders are to have a voice in determining their destiny. The responsibility is, for a people unused to it, heady and disquieting.

Palau Islanders can complain of a capricious treatment by history, but they can't complain about what Nature has handed them. Palau's land is green and beautiful, its waters rich. The archipelago combines neatly the virtues of island and continent. With most Pacific paradises, the hidden catch is limited space and the absence of new faces. The boredom. After a week on an atoll in the Marshalls or the Mortlocks, you are acquainted with each pig and chicken, you know every twist and turn of each sandy path. Palau is different. Several of the islands are big enough to get lost in. The group contains remarkable geophysical variety for an archipelago only 128 kilometers (80 miles) in length.

The main island of Babeldaob is 40 kilometers (25 miles) long, an enormous landmass for this part of the Pacific. It has jungles, rivers, hills, and all the other advantages of volcanic "high" islands. Yet north of Babeldaob is the atoll of Kayangel, a fine example of a "low" island. Kayangel was built not by the effusiveness of lava but by the patience of coral polyps. It has the simple loveliness, the straightforward geometrical floor plan, of most atolls, yet unlike most atolls it is not totally remote from valleys, knolls, and sea cliffs. When a Kayangel resident tires of the peace and simplicity and begins longing for a landscape with more features to it, he can jump in his boat and reach Babeldaob in a couple of hours.

South of Babeldaob are the limestone islands, called *elabaob* by the Palauans. The limestone islands are Palau's terrestrial distinction. They occur a few other places in the ocean, but nowhere else so plentifully. Like the islands of Kayangel Atoll, they were built by coral polyps, but in this instance the polyps are long dead. The islands are fossil reefs that were, in the Tertiary period, thrust to crazy heights above the sea, sometimes more than 150 meters (500 feet). The ocean and various of its organisms immediately began trying to reclaim these elevated reefs, cutting into the soft coral limestone, and today they are steep, fluid, Alice-in-Wonderland landforms, covered greenly by jungle and undercut so deeply at waterline that the smaller islands resemble toadstools and the smallest have toppled. There are hundreds of limestone islands. They stand shoulder to shoulder, making a labyrinth that only experienced Palauans can navigate.

For their size, Palau's coral reefs are the richest in the world. The Great Barrier Reef is more diverse, but its diversity occurs over thousands of kilometers. Nowhere in the ocean is variety like Palau's contained within so small a compass. Palau's patch reefs, fringing reefs, and barrier reefs are inhabited by a bewildering variety of starfish, shellfish, snails, octopi, worms, and corals, many as yet undescribed by science. The waters around are inhabited by porpoises, dugongs, crocodiles, sea turtles, sea snakes, goatfish, parrotfish, porcupinefish, butterflyfish, rabbitfish, squirrelfish, unicornfish, trumpetfish, surgeonfish, rudderfish, sailfish, marlin, snappers, dolphins, wrasses, groupers, sharks, rays, barracuda. Above, on the dry land of the islands, live tree frogs, hermit crabs, coconut crabs, mangrove crabs, fruit bats, geckoes, monitor lizards, boa constrictors, tree snakes, tropic birds, terns, cormorants, cockatoos, herons, ospreys, incubator birds, and pigeons. Migratory birds of many species pass through on their way elsewhere.

This fecundity, marine and terrestrial, once supported a human population of from 40 to 50 thousand. The men, by their hunting and fishing, and the women, by their taro gardening, provided more than enough to feed such numbers, and Palauans lived as well as any people in history. The men wore the *thu*, the Micronesian loincloth which is, if you are dark enough, as comfortable a garment as was ever designed for wear under the tropical sun. Palauan males were tattooed and wore their hair in a clublike bun. Important chiefs wore bracelets made from the vertebrae of dugongs. The men were tough and warlike, fighting with swords, spears, daggers, and slip-on knuckles studded with sharks' teeth. They hunted pigeons in Palau's forests with blowguns. They caught fruit bats in the treetops with bat-nets. Underwater they stabbed reef fish with hand spears, and above water, in the eel-grass shallows, they cast throwing spears at the fish there. Palauan women, too, were tattooed. The inky designs ran up densely past their elbows, like long black opera gloves. The patterns were especially ornate on women of high clan. Women wore grass dresses, heavy bracelets of shell, and necklaces of Palauan money—a currency of glass and ceramic beads of unknown origin, valued in part for the mystery as to source. In the heat of day, laboring in their taro patches, they wore green turbans folded from the leaves of giant taro. After first childbirth, they dyed themselves yellow and underwent an arduous strengthening ritual, then returned to their gardens. The women were tough. Palauan society, though run ostensibly by men, was matrilineal, and women exercized considerable power.

Much of this has changed, but not all of it. Palauans are no longer so numerous. There has been a great and general depopulation in the Pacific, resulting from the introduction of various mainland diseases. Unmighty nations of Oceania have been left even less mighty than they were, and Palau did not escape this scourge. Palau's depopulation was not so bad as Hawaii's or Yap's, but from a high of 50,000 it has dropped to around 14,000. A certain amount of old lore and customs has been lost as well. Khaki shorts have generally replaced the *thu*, and speedboats have replaced canoes. The men no longer wear their hair in buns. Those reared in the time of the Japanese

Charles Gibbons

*Artist Charles Gibbons is a "Grandpa Moses" of Palau. He is the only artist on the islands who paints in this landscape style. Above, he depicts a local beach scene near village of Koror.*

occupation wear it cropped short. Younger men are experimenting now with Afros, or whatever that style should be called in the Pacific. Yet some Palauan men continue to fish from bamboo rafts, and they all use spears, as in the old days. For the most part .22 rifles have replaced blowguns, but those ancient weapons are still in use in parts of Babeldaob, and the fruit bats and pigeons must still be alert for the quiet, lethal darts. Today Palauan women wear print dresses instead of grass, and they seldom go topless anymore—missionaries and T-shirts have ruined that. Only old women, tattooed in girlhoods belonging to another epoch, still boast the permanent opera gloves of that time. But Palauan women still work in their taro gardens, gossiping and singing old songs. They still wield their covert matrilineal power. The first-childbirth ceremony endures, and in it each new mother returns briefly to the childhood of the race, donning a grass skirt, casting her blouse aside, and dyeing her torso yellow.

Fourteen thousand is not many, as populations go. The survival of Palau's traditions, or their failure, might not seem significant. Yet in a curious way, Palau's 14,000 outweigh the 14,000 citizens of, say, a small Kansas town, or the 14,000 residents of an apartment complex in New York City or of a city block in Paris. Palau is a whole world. Palauans, in their isolation, have evolved a distinct and separate way of looking at life and the cosmos. They have their own language and ethos. Their culture is duplicated, and duplicable, nowhere else. Similarly unique are the cultures of Rongerik, Jaluit, Utirik, and Bikar in the Marshall Islands, of Losap, Sorol, Pulap, Fayu, Pikelot, Ngulu, and Eauripik in the Carolines, of Rarotonga, Takutea, Mitiaro, and Aitulaki in the Cook Islands, of Haraiki, Kikueru, Raiatea, and Morokau in the Society Islands, of Epi, Efate, Eromanga, and Malekula in the New Hebrides. Each of these bits of land is a planet unto itself, as different as Callisto, Titan, Ganymede, and the other disparate moons of Jupiter, or as Arrakis, Caladan, and Salsa Secunda in the imaginary Imperium of Frank Herbert.

Oceania is a universe. One constellation, Micronesia, spangles the equinoctial line. Another, Melanesia, dips down into Ursa Major. A third, Polynesia, runs from Cygnus down through Cassiopeia to Perseus. In the 20th century, one after another, Oceanic cultures have been winking out. Sometimes whole *islands* disappear, as has happened in Bikini atoll. Each light is tiny, but when it fails, the earth gets disproportionately darker.

When a species vanishes, we never know quite what we've lost. Does Palau's jungle, for example, hide some mold with a potential like penicillin's? Does Palau's reef, half of its species still unknown to science, hide some fish or some coral or some arthropod to which our designers might go for analogy as our aeronautical engineers once went to birds? We can't know once that jungle and reef are gone. The same holds for small Oceanic civilizations that the 20th century is steadily snuffing. Might there be, in Palau's oral tradition, some proverb from which the world at large might benefit? Might there be, in Palau's old and still vital pharmacopoeia, some remedy? In Palau's ethics, some principle? In Palau's humor some joke?

Some ancient thinker, or thinkers, designed Palau's society cleverly. Palau is full of divisions, with the various components set off against one another. Village competes against village, island against island, clan against clan. The result is a lot of productivity and an excess of nervous energy. On the surface Palau looks a lot like one of those careless, dreamy archipelagos in South Sea island mythology. Underneath, it sleepily seethes. The word most visitors choose to describe Palauans, in comparing them to other Micronesians, is "aggressive." This is too simple, of course, but there is truth to it. Palauans *do* have terrible trouble getting along. Sometimes it seems that Palau's old social architects succeeded too well in their factionalization of Palauan society.

It often appears that every Palauan is at odds with his fellow, that no one quite trusts anyone, that contrary to Donne, each man is an island after all. Palau's essential factiousness has had political consequences unhappy for the islands.

Two Palauan contemporaries who head two of the factions in the islands are Yutaka Gibbons, the high chief of Koror Island, and Francisco Uludong, Palau's most vocal socialist. Gibbons is the youthful leader of an old aristocracy. Uludong is Palau's original Young Turk. The two men are not opposed on all issues—both are suspicious of United States military intentions in Palau, and both are resisting oil-industry plans to build a superport in the islands—but in other matters they often find themselves on opposite sides.

Chief Gibbons's elevation to power was recent and sudden.

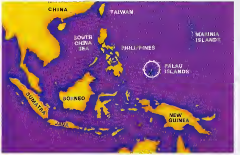
In the summer of 1973, at five o'clock one morning, at the U.S. Army Presidio in San Francisco, Specialist Fifth Class Yutaka Gibbons, a cook, was sound asleep when a call came down to his company from Washington. His sleepy company commander was ordered to release Gibbons immediately—tomorrow if possible. Back in Palau, Gibbons's maternal uncle, Ngoriakl, had died. Ngoriakl was *Ibedul*, the high chief of Koror (and generally regarded as paramount in all Palau, though this, like everything in Palau, is debated). Gibbons was first in line of succession. The Palau Legislature had petitioned Washington to send their new Ibedul home.

*Tia Belau* ("This is Palau"), Palau's only newspaper, reported the accession of the new Ibedul more solemnly than a regular reader might have expected. The publisher is Francisco Uludong, and radical sentiments usually smolder on his every page.

"The new Ibedul," said *Tia Belau*, "was chosen following Palauan customs, by Queen Bilung and the female elders of Idid, the highest clan in Koror. His appointment was confirmed last month by the Ngaramaketii, Koror's Council of Chiefs.

"His investiture ceremony began with his return to Palau last month, when he donned a traditional hat, symbol of paramount chief. For the next 15 days he underwent a period of 'retreat' in which he

CONTINUED ON PAGE 133




George Kelvin

*The Palau Islands archipelago is the westernmost cluster in Micronesia's galaxy of small islands. Palau is located due north of Australia and New Guinea and due west of the Philippines and China.*

# HAPPY NEW YEAR

# SPACE

By Mark R. Chartrand III

Happy 1979! Also, Happy 2732 and 2639! And continuing felicitations for 7487, 5739, 2727, 2290, 1695, 1399, and 1900.

Those first three years, depending on which calendar you use, are eminently acceptable in wishing someone a happy new year. January 1 marks the beginning of 1979, according to the Gregorian calendar, which ostensibly counts the years since the birth of Jesus (it doesn't really, for reasons explained in last month's column). But this year is also the 2732nd year *ab urbe condita*, since the founding of the city of Rome. And it is 2639 years since the first human emperor of Japan theoretically descended from heaven to rule on earth.

As for the other years mentioned above. It is now 7487 of the Byzantine Era, figured from the creation of the world in that mythology. The Jewish calendar reads 5739, the elapsed time since Genesis. And it's been 2727 years since Nebuchadnezzar ascended to the throne of Babylon, in case you've lost count. This dating system was used by classical astronomers, including Ptolemy. For those who prefer the Seleucid calendar, it is now 2290, calculated from the time of the Seleucid monarchy in Asia Minor. The Diocletian system has the year at 1695, counting from the accession of that Roman emperor. We are near the beginning of Islamic year 1399, the number of lunar years since the Hegira, the flight of Mohammed from Mecca to Medina. And in India the Saka Era, the official calendar, is in its 1900th year.

## EVOLUTION OF A CALENDAR

We owe to the Egyptians the first use of the astronomical solar year—the time it takes for our planet to orbit the sun and for the seasons to repeat. The Egyptian solar year was about 365 days, about a quarter of a day too short. The Babylonians had realized earlier that a solar year was about 365¼ days but had opted for a 360-day calendar based on lunar months, since they could not easily work with fractions and 360 is evenly divisible by so many numbers. (This is also the reason we have 360 degrees in a circle and divide hours and degrees into 60 parts.)

The retrogressive Greek astronomers ignored the Egyptians' pioneer work and adopted instead the lunar calendar, and this in turn was inherited by the Romans.

The Roman calendar was administered—with a whim of iron—by the College of Pontiffs, the highest of priests. The head of the College was the *Pontifex Maximus*. The Roman year had 355 days, or about 12 lunar months of 29½ days. Of course, this Roman year is about 10 days too short, and the Roman seasons started coming and going at the wrong times. To fix things up, the *Pontifex Maximus* would occasionally add an extra month, sticking it awkwardly between February 23 and 24.

In 63 B.C., Julius Caesar bought the office of *Pontifex Maximus* for himself, a post he held while away fighting the Gauls, Britons, and assorted other folk. He knew of the calendar problems and that the extra months had gotten out of hand, but he was too busy to turn his attention to it until 46 B.C. By then, the month of March, originally near the time of the vernal equinox, was falling in the middle of summer.

*The month of March from Très Riches Heures of Jean, Duke of Berry, early 15th century*

The Granger Collection

Caesar would have agreed with Hamlet that "The time is out of joint, O cursed spite that ever I was born to set it right." But set it right he did, with the advice of the Alexandrian Greek astronomer Sosigenes. To get the calendar in step with the seasons, he decreed that the year 46 B.C. (he didn't call it that!) would continue for three extra months until the seasons came out right. He then threw out the lunar calendar and instituted a new solar calendar of 365 days per year. Each fourth year an extra day would be added to make the years average 365¼ days.

Julius was assassinated two years later. The College of Pontiffs didn't follow his instructions and began having a leap year every three years, overdoing it a bit. By the time Augustus Caesar tackled the problem in 8 B.C. the Roman seasons were out of whack again. So Augustus stopped leap years until A.D. 8, and they have continued uninterrupted ever since then. Because of the fortuitous resumption of the Julian system in A.D. 8, we have our simple rule that leap years are those evenly divisible by four. And for his calendric contribution, the Roman Senate named the eighth month after Augustus.

But the real astronomical year is not 365.25 days long, but 365.242199. Thus the Julian prescription was overcorrecting by 0.007801 days each year, or an error of one full day every 128 years. By the end of the 16th century the error was ten days.

At that time, Pope Gregory XIII, with the advice of the astronomer-priest Clavius, decreed that ten days be dropped from the calendar and a small correction be made in the use of leap years. The correction was to omit leap years in century years—those ending in 00—unless they were also evenly divisible by 400. That was simple enough but getting rid of the ten extra days was not

In 1582 thanks to Gregory Thursday, October 4, was immediately followed by Friday October 15 There were riots in the streets. The populace did not understand the change and thought they had been cheated out of ten days of life and ten days of wages (conveniently forgetting they hadn t worked those ten days) But authority prevailed at least in Catholic countries and the Gregorian calendar was established, sporadically, throughout most of Europe

Great Britain however, wasn't having anything to do with 'popery' They continued with the Julian calendar—and with the ancient custom of beginning the year in March—until 1752 by which time the error had grown to 11 days Of course the North American colonies were part of the British Empire back then And today when we celebrate Washington's birthday on February 22 and say he was born in 1732 we are correct if we are going by the Gregorian calendar But a calendar of George's day would have read February 11, 1731

The Gregorian calendar makes the average length of the year 365 2425 days, or about 26 seconds too long This is a negligible error and won't amount to a full day for more than 3300 years When that time comes we ll do something about it, hopefully with less fuss than accompanied the fast change

## ONCE AROUND AGAIN

The central problem with the calendar—and one we can do nothing about but juggle numbers—is that the lengths of the various astronomical periods don t come out evenly

There are 365 days 5 hours, 48 minutes and 46 seconds in a solar year This is the time it takes for the earth to circle the sun once, and for the seasons to repeat There are 29 days 12 hours, 44 minutes and 3 seconds between full moons (months) This gives 354 days 8 hours 48 minutes and 36 seconds in twelve lunar months—more than ten days short of the cycle of the seasons (Actually there are several different kinds of years and months, depending on how they are defined, but that would take too much to go into now )

There are three possible ways of solving the problem 1) try to find some cycle in which there is an even number of both kinds of years 2) ignore the sun altogether 3) ignore the moon and its phases

The Jewish calendar is called "lunisolar" as it tries to accommodate both the sun and moon The calendar has lunar months of 29 or 30 days, with the month beginning at the time of the first appearance of the new crescent moon following new moon Years can have lengths of 353, 354 or 355 days since some of the months can have a varying number of days Seven years out of every 19-year cycle, an extra month is added after the sixth month Adar and before the seventh month, Nissan (Long ago, Nissan began the year so the extra month would have ended a year.) This juggling of year lengths keeps the Jewish calendar almost in step with the Gregorian solar calendar and the Jewish new year First Tishri or Rosh Hashanah, falls about the time of the autumnal equinox

The Muslim calendar ignores the sun it is based only on the moon and has 12 lunar months of 354 or 355 days It too, begins the month with the new crescent moon Since there are about 33 Muslim years for every 32 Gregorian years the seasons drift through the calendar by about ten days per year

The Gregorian calendar, as we have seen, measures the course of the sun and ignores the moon Thus moon phases occur anywhere in a month, unlike in a lunar calendar The one strong connection between the Gregorian calendar and the moon is the set of rules by which Easter is determined In order to assure that Easter falls around the time of Passover and the vernal equinox, the rules consider the phase of the moon and necessarily the Jewish calendar But because the Gregorian calendar is tied to the sun, the date of Easter changes from year to year

One odd thing perpetrated on us is the use of the initials B C and A D The first stands for the English words "Before Christ" whereas A D is for the Latin words "Anno Domini" The languages, of course came in the inverse order

Another curiosity is that despite all the sins of commission and omission against the calendar the cycle of time that has been changed the least is the week the period with the most tenuous connection with astronomy Seven days *is* about the time from one phase of the moon to the next, but our week seems to have arisen more from a mixture of numerology and astrology

## CALENDRIC CURIOSITIES

Seven has had mystical powers in most cultures with some slight physiological foundation Four was also mystical and four times seven is 28, about a lunar month and also the approximate time of a woman's menstrual period Seven is also the number of classical "planets," counting the sun and moon Not long before the Caesars the Romans had taken to naming the days after their seven planetary gods (Dies Solis, Dies Lunae, Dies Martis Dies Mercuri Dies Jovis, Dies Veneris and Dies Saturni) Reinforced by the Mosaic law of resting every seventh day the week became firmly established Even when Gregory dropped ten days, Thursday was promptly followed by Friday

Many people have sought to change the calendar since Gregory Probably the most famous try was by the French during their Revolution, in which they tried to usher in an "Age of Reason" The reasonable French did come up with one innovation that has fared reasonably well—the metric system Their Calendar of Reason was less fortunate

They renamed the months after the affairs of nature *Nivose* the snowy month, *Pluviose*, the rainy month, *Floreal*, the flower month *Vendemiaire* the vintage month, and so on for all of their 12 30-day months (with five days added at year's end) The British, ever contemptuous of the Revolution, parodied the months as wheezy sneezy freezy, slippy drippy nippy showery flowery, bowery and hoppy croppy, poppy

Promulgated in 1793, the Revolutionary calendar lasted until Napoleon reinstated the Gregorian calendar in 1806

## THE ASTRONOMERS' CALENDAR

A calendar that's still in use today was developed in the 16th century by Joseph Justus Scaliger a French historian and chronologer Astronomers deal with vast sweeps of time, and such rules as "Thirty days hath September . . ." dividing by four and the like can be vexatious So Scaliger devised a system of "Julian Days," named in honor of his father This is a continuous count of days, with no years, months, or days of the month to confuse things The day numbers repeat after 7980 years a figure he arrived at by multiplying together the lengths of several natural and artificial periods of time He calculated that all the cycles had had a common start in 4713 B C, and he thus began his count on January 1 of that year. To make it easy for astronomers who observe at night the Julian day begins at noon, so there is no awkward change of date at midnight January 1, 1979, at noon will be the start of Julian Day 2,443,875 Astronomers use this system for dating long-period phenomena such as variable stars and comet orbits

There are those who would change the calendar yet again to make the months more regular or the dates fall out on the same day of the week each year Some have proposed days of ten "hours," each with 100 "minutes," each of 100 "seconds"

So far the calendar changers have had much less success than the proponents of going metric but someday they just might change things again You might say that time is on their side **OO**

*This year two science fiction "splat" films will treat in unremitting gory horror what would happen if a giant meteorite crashed into a major city Meteor craters do pock the earth, testifying to such celestial damage in the past What are the odds of such a catastrophe today? See "Space" in next month's Omni*

# LIFE

By Dr Bernard Dixon

Cloning has caught the imagination for one very good reason. It represents a step toward personal immortality. But let's not forget that already thousands of laboratories, in many countries, contain living tissue descended from an American woman who died a quarter of a century ago. It was in 1952 that the biologist George Gey removed some cells from Henrietta Lacks's cervical tumor. The mother of five children, Mrs. Lacks died less than five months after the cancer was diagnosed, at the age of 31. HeLa cells, as they were named later, have proved to be of considerable value in scientific research and medical diagnosis. They have continued to grow and multiply, so that the total weight of them in the world is now greater than that of Henrietta Lacks when she was alive.

A major application of HeLa cells is in the diagnosis of virus infections. Unlike bacteria, viruses cannot proliferate on artificial media. They multiply only in living tissue. To identify a virus, therefore, a clinician will often take a swab from the throat or whatever part of the body is affected. A technician then inoculates the suspect material into HeLa cells maintained in laboratory glassware. If a virus is present, its behavior in the tissue culture (whether or not it grows, the way it grows, and its response to various antibodies) allows it to be identified.

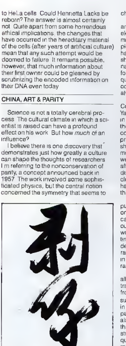
Perhaps for this uncanny reason, the lady concerned remained all but anonymous until a few years ago. As a student I was taught that HeLa was a contraction of Helen Lane—and indeed this name appears in many textbooks. More speculative was the notion that George Gey named the cells after a favorite film star, Hedy Lamarr. It was a little-known paper published in *Obstetrics and Gynaecology* in 1971, however, that confirmed the real identity of this unique historical figure.

A teasing question: now that we can contemplate taking the nucleus from a body cell, inserting it into an unrelated enucleated egg cell, and producing a fetus derived from the nuclear donor, is whether this technique might be applied to HeLa cells. Could Henrietta Lacks be reborn? The answer is almost certainly not. Quite apart from some horrendous ethical implications, the changes that have occurred in the hereditary material of the cells (after years of artificial culture) mean that any such attempt would be doomed to failure. It remains possible, however, that much information about their first owner could be gleaned by scrutinizing the encoded information on their DNA even today.

## CHINA, ART & PARITY

Science is not a totally cerebral process. The cultural climate in which a scientist is raised can have a profound effect on his work. But how *much* of an influence?

I believe there is one discovery that demonstrates just how greatly a culture can shape the thoughts of researchers. I'm referring to the nonconservation of parity, a concept announced back in 1957. The work involved some sophisticated physics, but the central notion concerned the symmetry that seems to characterize physics.



*Ideograph: Possible clue to a major discovery*

Loosely defined, parity means equality, and in physics refers to the tendency of elementary particles to exist in pairs—a mirror image for every image. For example, electrons can be either left- or right-handed. So if there is to be parity, there should be one right-handed electron in nature for every left-handed one. And before 1957, scientists assumed without question that whatever changes might occur within a system, this parity would always be maintained or conserved.

Then in 1957, Dr. Tsung-dao Lee of Columbia University and Dr. Chen Ning Yang of the Institute for Advanced Studies in Princeton, New Jersey, developed a theory suggesting that parity was *not* conserved in certain subatomic decay processes. At Columbia, Dr. Chien-shiung Wu did the necessary experiments and confirmed that Lee and Yang were correct. Nature was not symmetrical after all. The world acclaimed a historic discovery. But many people, scientists included, felt uneasy that the natural world had turned out to be less neat and orderly than had been supposed.

Later, a biologist, Dr. Robert Livingston, put his finger on the reason why this demonstration of parity's nonconservation caused such unrest. It was, he pointed out, a matter of culture. "My wife," he wrote, "who is an artist, observed at the time that this creative departure from deeply rooted assumptions of contemporary science might be more likely to occur in the minds of persons who grew up in a radically different cultural tradition.

And indeed, Lee, Yang, and Wu were all born in China, the artistic and cultural tradition of which differs fundamentally from that of the West. The secret to their success may lie in traditional Chinese art, in which there is less of an obligation to paint a 'balanced picture.' The Chinese also write by using ideographs rather than by making horizontal, left-to-right stripes. It is at least possible, as a consequence, that Chinese physicists were more open-minded about the conservation of parity than were those reared amid the Western cultural climate." DO

# STARS

By Patrick Moore

Long ago, BEMs, or Bug-Eyed Monsters, were all the rage. Alien planets were populated with creatures of all kinds, some of which lived in seas of liquid methane while others had six or seven heads, innumerable tentacles, metallic skins, and long, scaly tails. Many were telepathic. Most were decidedly unfriendly.

Today BEMs have largely vanished, and our ideas about life elsewhere have changed. It now seems certain that there is no intelligent life in the solar system, except (possibly) on earth. Mars has been ruled out. Instead of supporting an advanced technological civilization capable of building a planet-wide canal system, it has proved to be a world inhabited only by mountains, valleys, volcanoes, and craters—with no sign of intelligent life.

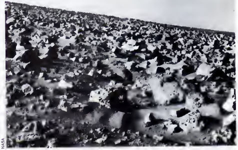
In the future, this will almost certainly alter. Men have been to the moon. Mars must be next. Barren though it may be, it has an appreciable atmosphere (unlike the moon), and there seems to be plenty of water locked up in the form of ice.

The manned flights to the moon were there-and-back affairs, lasting only a few days. But Mars is much farther away. Rockets of 1979 vintage take months to get there, and though this time will be cut down, a journey to Mars will always be a lengthy business. This means that even the very first explorers will have to set up a Martian base. Inevitably, certainly within 100 years, there will be permanent bases with people of both sexes. Babies will be born. And this in turn will lead to a problem that may turn out to be of extreme importance.

Mars is smaller than earth with only one tenth the mass. The surface gravity is also less: 0.38 of earth's. There is no reason to doubt that *Homo sapiens* can adapt to these conditions. After all, the *Apollo* astronauts walked on the moon, where the gravity is lower still. But what about Martian-born babies? They will grow up under 0.38 g, and presumably their muscles will develop accordingly. What would happen if a Martian boy or girl were taken to earth? Could their muscles cope?

The answer is quite possibly no. The feeling of heaviness might prove too intense. In that event, we will have a situation in which earth men can go to Mars and live there, but Martians can never come to earth. They could look down on the green fields, the forests, oceans, and lakes, knowing that a visit would be fatal. They would be entitled to regard the earth as a planet of death. In fact, even long spells under reduced gravity may turn out to have irreversible effects on the human body. Men who go to Mars will then do so with the knowledge they will never return home. In time, inhabitants of the Mars base will think of *that* planet as their home, not earth.

Despite the dangers, the attempt to colonize Mars will be made. By A.D. 3000, and probably long before, there will be two inhabited worlds in the solar system instead of one.



Lifeless Martian plain as photographed by Viking 2. No Bug-Eyed Monsters and very little gravity.

## STAR MASS

If memory serves me right, it was the White Queen in Lewis Carroll's *Through the Looking Glass* who made a habit of believing at least six impossible things before breakfast every day. Scientists are, predictably, much less credulous. All the same, there are times when they go too far in the opposite direction, and quite recently I read an old book by J. Ellard Gore that demonstrates what I mean.

Gore was a good writer and a good astronomer. He was an expert "popularizer," and in his book (published in 1918) he drew attention to a very curious set of circumstances surrounding Sirius, the most brilliant star in the sky and only 8.6 light-years away.

Over a century ago, F.W. Bessel commented that Sirius was showing a slow, slight wobble in its motion, and he predicted that there must be an invisible companion tugging on Sirius and pulling it out of position. In 1862 an American astronomer actually discovered the companion, just where Bessel had said it would be. Since Sirius is the Dog Star, the companion was nicknamed the Pup. It has only one ten-thousandth the luminosity of Sirius itself, but studies of its movements showed that it must be almost as massive as our sun. Presumably, then, it was large, cool, and red.

Later, in 1915, W.S. Adams at Mount Wilson took a long, hard look at the spectrum of the Pup and was surprised to find that it was not in the least what he had expected. Far from being large and red, the Pup was white-hot. But if the Pup was as massive as the sun, its surface white-hot, then its faintness meant that it was small—no more than 41,600 kilometers (26,000 miles) in diameter, which is smaller than Uranus or Neptune.

This was what Gore knew. Working things out, he commented that if all the data were right, the Pup would have to be incredibly dense—at least 50,000 times as dense as water. Tons of it could easily be packed into a matchbox. This, said Gore, was clearly absurd.

Of course, the data were *not* wrong, and the Pup really *is* over 50,000 times as dense as water. It is a white dwarf, a star that has used up its nuclear energy. At one point the star collapsed, and its constituent atoms were crushed and broken, so that the various bits were packed together with little waste space. Hence the high density. Gore's impossibility was, in fact, not only possible, but correct.

Another alleged impossibility that turned out to be true concerns the sun itself and how it radiates heat. After many theories and changes of heart, investigators discovered that the key to solar energy is hydrogen. Inside the sun, nuclei of hydrogen atoms are combining to make up nuclei of helium. Each time this happens, a little energy is released and a little mass is lost. When the calculations were made, it was found that in order to make everything fit into mathematical theory, the sun would have to be losing mass at the rate of 4,000,000 tons per second. "Absurd!" cried the critics.

But it is not absurd. The sun has much less mass now than it did when you picked up this issue of *Omni*. However, I can assure you that there is no need for alarm. The sun will stay much as it is now for the next five billion years at least. DO

# THE ARTS

Even though he flies, Superman is *not* an SF film," Richard Donner, director of the multimillion dollar movie adaptation, is speaking via phone from his home near Pinewood Studios in southern England. With still a handful of shots needed to complete the picture, he has taken a couple of hours off to talk with *Omni*. "Here it is October, and the film premieres at the Kennedy Center in Washington on December tenth. We'll make the date, but it'll kill us all."

The rush to complete *Superman* has been a constant pressure on Donner, but he's worked in television for years and the feeling must be familiar by now. Beginning with live programming from New York in the 1950s, he moved to Los Angeles late in the decade and directed *Wanted: Dead or Alive*, *The Twilight Zone*, dozens of other hit series, and a number of top-rated television movies. Donner's first theatrical feature film, *The Omen*, has grossed over $100 000 000. Now at the helm of *Superman*, he may establish himself as a director with box office clout.

"*The Omen* came out in June of 1976," Donner explains, "and one night I got a call from Alexander Salkind, one of the producers of *Superman*. He said, 'This is Alexander Salkind, do you know who I am?' I said, 'No.' He said, 'I made a picture called *The Three Musketeers*.' I said, 'Oh yes? I thought Richard Lester directed that.' He said, 'Well, I produced it.'"

"They had taken the Superman story through a couple of screenplay drafts before I came onto the picture. Mario Puzo (*The Godfather*) had written a brilliant screenplay as far as the formation of the fable was concerned. Then Robert Benton, David Newman, and Newman's wife, Leslie (*Bonnie and Clyde*), came in and rewrote it. They took a fable, made it into a parody, then parodied the parody. If the Newmans and Benton had been left alone, they would probably have delivered, on the whole, what I wanted to end up with, but they seem to have been directed to do *Batman*. It was POW! ZOWIE! ZOK! and all that. My feeling was that we're a new country. We've got the American Indian, and we've got Superman. You don't fuck with either one of 'em.

"When I told them that I wanted to do a major rewrite, the producers said they were happy with what they had. I told them thank you anyway. I assume they tried other people . . . I have no idea . . . but they came back and asked me what rewriting I had in mind."

Donner went to work with Tom Mankiewicz (*Diamonds Are Forever*, *The Man with the Golden Gun*), reshaping the script in accord with his vision of the story. "The only research I did was to read the comic books and a few books that were written by Superman's creators. I didn't cover any of the other media in which he appeared. I just decided the visuals had to be my own. The story had to be bigger than life, yet, at the same time, it had to be a reality for the people within it. I didn't want the characters to be laughing at themselves."

Donner enlisted a new creative crew to help prepare the picture. "I brought in John Barry, who had just finished *Star Wars*, as production designer. Geoffrey Unsworth, who had photographed *2001: A Space Odyssey*, was the director of photography. We did the whole thing in eleven weeks, which will be either its downfall or its success. It's probably the most difficult film ever made, and I say that truly without ego problems. We faced things that no other filmmaker has ever had to deal with. The film should have taken six or eight months to get under way once I came on, but we had to improvise as we went."

This improvisation was carried on throughout the filming of *Superman*. "We just couldn't get the flying sequences right," Donner said. "So as Unsworth and I started shooting the first-unit photography, Dennis Coop and a lot of other people were developing a new process, a new photography system. It took us from January or February until September of 1977 to get the first flying shot that I could approve. They were working on it all that

CONTINUED ON PAGE 137



*Richard Donner directs* Superman *played by Christopher Reeves with a script by Mario Puzo. Superman's parents, played by Marlon Brando and Susannah York, survey high tech on Krypton.*

"I am vitally interested in the future, because I am going to spend the rest of my life there." —Charles F. Kettering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# THE ARTS

In music now we have an enormous field that is being explored simultaneously at seemingly unrelated points As we move into the future we move simultaneously on all fronts " So says John Cage, the elder statesman of experimental music

Music turns on itself unpredictably intractably It's directions are infinite and ever changing It defies capture But there are guides at the outposts of musical space, explorers at music's leading edge From John Cage, Steve Reich, Philip Glass, composers who are stripping down and rebuilding the "language" of classical Western concert music, to Larry Fast, synthesizer whiz kid, to Sun Ra, the outrageous jazz mystic—five musicians who are "out there" tell *Omni* what we might expect to hear from music as it translates future time into rhythm and sound

**John Cage** is *the* musical futurist His work has promoted and established the use of percussion and voice tape-recorded composition, principles of indeterminacy, graphic notation, and live electronics Distinguished music critic and composer Virgil Thompson said of Cage in 1945, "He has produced atonal music not by causing the twelve tones of the chromatic scale to contradict one another consistently but by eliminating, to start with, all sounds of precise pitch "

Looking ahead John Cage sees the future of music in quantitative terms "When you have a larger number of people, you have a larger number of minds So you have quantity of mind You have interpenetration of diverse musical attitudes and the advent of an increasingly larger number of technical possibilities

"Formerly when things were separated, when there were fewer people and cultures were separated, everyone in each isolated group was going in the same direction Now we have this simultaneous movement And not in any particular way "

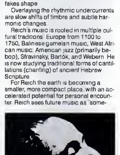
The cross-cultural implications of Cage's thinking are amplified by **Steve Reich** Reich's music has been variously tagged "minimal music," "trance music," "modular music," "phase music," and "pulse music " What all these names attempt to convey is a kind of music that emphasizes rhythm, a music consisting of melodic patterns with minute metric adjustments

In Reich's work a single pattern can be repeated over and over again in rhythmic relationships that gradually change so that a further number of new patterns evolve Or alternatively, a musical pattern is gradually extended for such a long duration that a kind of "slow motion" music takes shape

Overlaying the rhythmic undercurrents are slow shifts of timbre and subtle harmonic changes

Reich's music is rooted in multiple cultural traditions Europe from 1100 to 1750, Balinese gamelan music, West African music, American jazz (primarily bebop), Stravinsky, Bartók, and Webern He is now studying traditional forms of cantillations (chanting) of ancient Hebrew Scripture

For Reich the earth is becoming a smaller, more compact place with an accelerated potential for personal encounter Reich sees future music as "something completely new, which instead of coming from the *Western* tradition, the *Indian* tradition, the *African* tradition, will legitimately, and not in some weird way, come from a *world* musical tradition "



*Steve Reich modular trance music*

"The main thing," says **Philip Glass** "is that we're getting into post-Einsteinian concepts of time " For Glass, Newtonian time more rigid and formal in its structure, has given way to elastic, stretched-out, relativistic temporal constructs His compositions and performances are four, five, and six hours long, changing always as a function of his changing time/space concerns

Glass's music has been called "hypnotic" because of its continuous drone and uniform pulse, "modular" because it links distinct self-contained units to one another, and "minimal" because it seems to lack the usual psychological narrative devices of Western music such as anticipation and climax And repetition and extended time sequences in his works are paralleled by technical breakthroughs

"Digital systems using laser beams will be commonly used in the near future," he says, "and that will change music Laser beams will decode information from a record groove This means the length of a side will no longer be limited to twenty minutes In the future, one side of an LP will store two or three hours of music And when the record is turned, it will be done automatically and without interrupting the music We'll have home entertainment centers with speakers all around the room The kind of music I'm experimenting with will sound best then "

"Just by the nature of its increasing complexity, increasing reliance on automated forms of equipment, increasing computer assistance, and eventual computer control," believes electronic composer **Larry Fast**, "music will become very exciting to listen to—and less exciting to watch "

Technological expansion is at the core of Larry Fast's musical vision Fast is an electronic wizard Together with Dr Robert Moog, he designed an early prototype of the polymoog synthesizer and he continually designs customized equipment

CONTINUED ON PAGE 137

# THE ARTS

A book that may revolutionize our attitudes toward the future has just been published by a West Coast publishing house, Peace Press, in Culver City, a suburb of Los Angeles. The title is *Doomsday Has Been Cancelled*—an abrupt challenge to the fashionable neo-Manichaeans who have been preaching Apocalypse for the past decade—and the back jacket carries lyrical endorsements by the prestigious Gerard O'Neill of Princeton and Barbara Marx Hubbard of the Committee for the Future. There is even a forward by astronaut Russell Schweickart denouncing the chic Naderites and nadirites whose pessimism is based on "acceptance of all problems and rejection of all solutions."

The author is a young (36-year-old) physicist, J. Peter Vajk, a transplanted Transylvanian who grew up in a bilingual New Jersey household and has retained a bicameral view of the world—half American, half European, half modern, half traditional, half scientific and half humanistic. Dr. Vajk (rhymes with *bike*) insists that the human race is not on a Calvinist course of predestination, about to suffocate in its own pollution or starve out from lack of food and resources. On the contrary, he says, we have an excellent chance of achieving a quality of life that would appear Utopian to any previous generation.

As if to illustrate Toynbee's theory of challenge and response as the mechanism of progress, Vajk's ideas came directly out of what theologians call a Dark Night of the Soul. When the Club of Rome published their gloom-and-doom scenario, *The Limits of Growth*, in 1972, almost all readers were thrown into profound depression—but none more so than Pete Vajk, who was then working as a research physicist for Lawrence Livermore Laboratories in Berkeley. Vajk says that he felt his "naïve optimism" collapse utterly under the grim impact of *The Limits of Growth*'s computer projections of rising worldround chaos and famine. He bounced back from the pits of despair into a new, more sophisticated optimism only after reexamining his own unconscious metaphysics (a blend of the Roman Catholicism in which he had been reared and Zen Buddhism). Newly armed with the conviction that the "Buddha-mind is in all things" and that God was right in Genesis in declaring His creation "very good," Vajk began to run his own computer analysis of the Club of Rome scenario—and found it full of highly questionable assumptions.

The first product of Vajk's skeptical reexamination of the Club of Rome projection was a study, "The Impact of Space Colonization on World Dynamics," published in *Technological Forecasting* in December 1976. This highly technical paper did not reach a wide audience, but in it Vajk demonstrated that using the same computer programs as the Club of Rome had yielded a vastly different and more optimistic scenario for the next 30-50 years when a single assumption was changed. The assumption that Vajk had challenged was that our resources are limited to those on the planetface of earth. He assumed that we could build solar power collectors in geosynchronous orbit—an idea that NASA/Ames studies have shown to be economically and technically feasible. The result of this single new assumption was that the computer projections now showed none of the Doomsday tendencies that the Club of Rome forecast and even indicated the possibility of abolishing hunger.

More generally, Vajk observed that there are many possible futures, all of them equally plausible (if you accept the right assumptions), none of them absolutely certain. *"We are the Future Makers,"* he summarizes in *Doomsday Has Been Cancelled*. The future is not something that is going to happen to us, but something we are creating day by day and hour by hour in the decisions we make about our quality of life. *Quality* is a key word in Vajk's semantics, having connotations that are simultaneously scientific, moral, and esthetic. To seek the highest quality—in the design of a tool, in a work of art, in the way of life of a whole society—is what being human is all about, to him.

Although Vajk sees most of the solutions to our terrestrial problems in extraterrestrial energy sources, he has also packed *Doomsday Has Been Cancelled* with practical programs for increasing our earthside energy yield long before the first solar power satellite is in orbit. Adopting Buckminster Fuller's principle of *ephemeralization*—doing more with less—Vajk offers many provocative leads on how intelligence, aiming at quality, can produce far more energy on the planetface than the Doomsday brigade believes possible. Insisting that the sources of wealth are "knowledge and cooperation," he demonstrates that only the fallacious logic of the zero-sum game—in which somebody must be the loser—prevents us from achieving a higher standard of living for all right now. And he provides a very plausible scenario for an "Age of Substitutability" in which new techniques will allow us not only to recycle more but to replace depleted resources with new synthetics and alloys.

But these are all interim measures; the real solutions to our problems, Vajk insists, are to be found in breaking out of the closed system of planetary chauvinism and employing the full energy and resources of our extraplanetary environment; we have the prospect of an open system, indefinitely, if not infinitely, rich in all that we need to end the Malthusian crunch that perpetuates competition and war.

Dr. Vajk sincerely seeks high quality in all aspects of life; it is hard for him to understand why so many have given up this quest and accept decay and degeneration as the predestined trend. When confronted with the inevitable question whether he personally intends to go into space, he answers at once, "Yes." But then he adds thoughtfully, "A few years ago, I wanted to go as an émigré, since saving earth seemed impossible. Now I might go just as a tourist, or to work for a while. There is no need to flee this planet—it can be saved." And then he adds his inevitable and challenging slogan: "We are the Future Makers. It all depends on decisions we make now." ΩΩ

# THE COYNE INCIDENT

# UFO UPDATE

By James Oberg

Something from outer space buzzed an army helicopter one night about five years ago terrifying the four crewmen inside and nearly causing their deaths. Truly spectacular and unexplainable, the incident seared its way into the pages of UFO history and ignited a controversy whose flames still rage.

One thing seems certain: the encounter of Captain Larry Coyne and his crew, near Mansfield, Ohio, at 11 PM on October 18, 1973, is one of the most impressive UFO cases on record. Whether the cosmic visitor was an alien spaceship, as UFO buffs insist, or a bright fireball meteor, as UFO skeptic Philip J. Klass suggests, the fact of the sighting itself has withstood rigorous scientific scrutiny.

A low-flying, northbound helicopter was paced by a strange red light to the east. As the UFO neared at high speed, the alarmed helicopter pilot put his aircraft into a steep dive. The UFO stopped dead overhead, bathed the crew in a green light, and sped off to the west, changing colors again. Instruments in the helicopter malfunctioned, and the radio was dead. The entire aircraft was trapped in some sort of antigravity vortex and rose thousands of meters into the night sky before the pilot could bring it under control.

So impressive was this case, and so unimpeachable were the witnesses, that the weekly tabloid *National Enquirer* selected it "the best UFO case of 1973." The contest had been hard fought that year, with such powerful competitors as the Pascagoula abduction of two fishermen and a report from the governor of Ohio.

Recent findings have made the Coyne UFO case appear even more impressive. Leading authority on the pro-UFO side is Ohio investigator Jennie Zeidman, whose reports have appeared in the Mutual UFO Network's *UFO Journal*, in *Flying Saucer Review* (published in Great Britain), and in the monthly magazine *Fate*. A major new progress report on the case is being prepared for the *International UFO Reporter*, published by the Center for UFO Studies.

Aerial Phenomenon Research Organization (APRO)

*Lenticular cloud formation photographed by an American tourist at Santos, Brazil, in 1967.*

Despite the unarguable facts of the Coyne chronicle, UFO buffs realize that pilots have been experiencing similar UFO near-collisions for 30 years. In 1948, DC-3 pilots Clarence Chiles and John Whitted spotted a cigar-shaped object with two rows of glowing portholes as it whizzed past their aircraft. A similarly shaped UFO flew over Indiana and Kentucky in early 1968; three different aircraft were nearly rammed by a fleet of cigar-shaped UFOs later that same year.

Coyne's UFO was similar, especially in that none of these near misses caused any air turbulence or sound whatsoever.

The Chiles-Whitted case, as even most UFO believers concede, was probably a train of meteoric fragments fireballing across the night sky, cueing the startled pilots into *assuming* that the lights were portholes and then into imagining an outline of the nonexistent structure. Just such an illusion is documented in the first 1968 case, where a flaming falling satellite seduced an intelligent, levelheaded group of witnesses into seeing an eerily lit, cigar-shaped object pass within 299 meters (1000 feet) of them—when in fact the actual objects were hundreds of kilometers away. A second 1968 case, which unlike the other examples occurred in daytime, led the pilots of three aircraft into thinking they had nearly been rammed when in fact the disintegrating fireball (such as it was, based on other eyewitness accounts and photographs) was hundreds of kilometers away.

The most famous "non-UFO explanation" for the Coyne incident was generated (critics would say contrived) by Philip J. Klass, an editor at *Aviation Week* and probably the world's foremost UFO skeptic. Klass claims that Captain Coyne, like other pilots before him, may have been fooled by a bright meteor possibly from the Orionid shower, which reoccurs annually in the October 18–22 period. While some UFO experts have asserted that the Orionid shower does not produce fireballs, professional meteor specialists report just the opposite. A second bright Orionid fireball appeared over the Midwest an hour before the Coyne sighting, and a third, moving in the same direction as the Coyne UFO, was seen all throughout the Midwest on October 18, 1977, four years to the night after the Coyne event (but a few hours earlier resulting in more witnesses).

Although Klass's conclusions have been almost uniformly rejected by leading pro-UFO researchers, several of his subsidiary observations have been quietly verified. Failure of the radio following the encounter is now attributed to the helicopter's low altitude, causing hills to block transmission (on Klass's request, Coyne tried the radio at the same location on a subsequent flight and confirmed this), as well as to a too rapid switching of frequencies by a panicked radio operator. The "mysterious rise" of the aircraft has also lost its miraculous flavor.

This levitation is now attributed to the pilot's action of instinctively pulling back on the control stick as soon as the perceived danger of collision had passed. Diving toward the ground, impact was imminent within seconds had this not been done. Later, the crewmen could not recall doing exactly what experienced pilots should have done without thinking about it. Records show that other pilots under stress in similar life-threatening incidents fail to remember what subconscious reflex actions they took. But since the helicopter later responded immediately to Coyne's handling of the controls, once he noticed the rise and acted to correct it, there is no evidence of external force associated with the UFO.

Pro-UFO investigators evidently agree, as written by Zeidman in the MUFON *UFO Journal*: "There is no physical evidence to indicate that the climb or apparent radio malfunction were in any way a product of the object's proximity." And one should also note that there is of course no real evidence of even the object's proximity—it *could* have been a hundred kilometers overhead.

The key objections to Klass's Orionid fireball hypothesis are threefold: first, total duration of the helicopter crew's observation of the UFO may have been too long for it to have been a fireball, which

CONTINUED ON PAGE 139

# CONTINUUM

## SAFETY AT HOME: POISON ABROAD

In 1975, a dangerous pesticide caused convulsions, speech impairment, and loss of bladder control among Egyptian farmers and their families. It killed an undisclosed number of people and more than a thousand water buffalo. The chemical, Leptophos, had been exported to Egypt and about 30 other countries by an American firm. It had never been approved for use in the United States.

In 1972, U.S. companies exported to Iraq 80,000 tons of wheat and barley coated with a mercury-based fungicide banned in America. Four hundred Iraqis died and 5000 more were hospitalized.

These are not isolated examples. In various developing countries, people are routinely exposed to the potentially dangerous products of American technology—pesticides, weed killers, drugs, and other substances. Somehow the safety regulations that were developed along with the chemicals have remained at home.

"For a long time, the people in developing countries have waited for the benefits of American technology. . . . Instead, they are becoming the victims of technology," says Rashmi Mayur, director of the Urban Development Institute in Bombay, India, and head of a special United Nations panel on hazardous exports.

Dangerous exports from this country and other industrialized nations are causing increasing concern here as well as abroad. In each of the past two years, the United Nations Environment Program has urged industrialized nations to assist the Third World in protecting itself against hazardous chemicals.

"The technology for using toxic chemicals crosses national borders much more quickly than the capability to regulate it," says Jacob Scherr, an attorney for a Washington-based environmental group that has pushed for more American responsibility abroad. "What we have here is a serious double standard."

In one case, an American asbestos firm, Amatex, closed an almost-new Pennsylvania factory a year after the United States (in 1972) announced strict regulations protecting workers from asbestos-related cancer. The firm then opened another factory just across the U.S. border in Mexico—a country without strict asbestos regulations. Eyewitnesses say the conditions in the Mexican plant are unhealthy. The workers risk cancer daily. Much of the asbestos output from the Mexican plant is shipped back to the United States for sale.

Moreover, federal figures disclose that 15 percent of the 265 million kilograms (588 million pounds) of pesticides exported from the United States in 1975 were either never approved for use or banned at home.

The President's Council on Environmental Quality has been attempting, unsuccessfully, to get the State Department, the U.S. Export-Import Bank, and other agencies to make environmental assessments of their major foreign projects. It would provide the information necessary for foreign nations to better protect themselves.

A case in point: With $644 million in loans and loan guarantees from the Export-Import Bank—then the largest transaction in the bank's history—the Philippines is building a 600-megawatt nuclear reactor purchased from Westinghouse. No environmental assessment was done. Result: The $1.1 billion reactor is in one of the world's most active earthquake regions, 22 kilometers (14 miles) from an active volcano. The estimated cost of electricity from the reactor is more than from a plant using hydropower, geothermal energy, or coal—none of which were studied beforehand. The reactor never would have been approved in the United States under such circumstances.

U.S. practices are changing, albeit slowly. The Agency for International Development recently stopped shipping overseas pesticides banned in this country. This past summer, federal law was changed to require companies to notify foreign users of exported pesticides banned here.

But without international cooperation, many experts note, even U.S. regulations are ineffective. Pesticides banned here wind up back in this country coating imported crops. A U.S. ban on fluorocarbons in spray cans to protect the ozone layer does not affect half of the worldwide fluorocarbon production.

With billions of dollars at stake in perpetuating the current way of doing business, it is unclear how changes can occur. The world pesticides market alone is estimated at $7 billion annually. "The thinking on this whole subject is very new," said James Foster of the U.S. Occupational Safety and Health Administration. "All we know is that there is a problem—and that it must be solved."

—STUART DIAMOND

# CONTINUUM

## KILLER AMOEBA

As if Legionnaire's Disease wasn't enough to worry about now there's parasitic encephalitic meningitis (PEM), a disease that sounds like something out of a bad science fiction movie

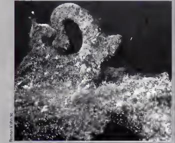
Caused by an amoeba that lives on the bottom of freshwater ponds and lakes, PEM is little understood and nearly always fatal The amoeba has caused 121 reported deaths since its discovery in 1963 and may be responsible for more, according to Dr George Healey parasitologist at the Federal Center for Disease Control in Atlanta Georgia

These organisms are very opportunistic, said Healey They enter a swimmer's body through the nose and go to the oxygen-rich environment of the brain There the amoebas devour brain matter and secrete a substance that kills tissue "We never knew amoebas could cause this kind of damage,' he said

Researchers are baffled by the erratic occurrence of the disease and its resistance to treatment Most of the reported cases have involved young people, primarily boys Only three victims have survived, one a nine-year-old California girl treated with antifungicide drugs in June But the same treatment failed to save an eight year old South Carolina boy in August

Dr Healey said he doesn't want to scare anyone "The disease is rare, and anyone worried about it should wear nose clips while swimming in lakes or ponds

—Allan Maurer



Roman Vishniac

*Amoeba. A special opportunistic variety devours human brain matter We never knew they could cause this kind of damage."*

## FUTURE CARS

Cars of the future will be lighter safer and even smarter if the federal government has its way—but they won't be cheap The National Highway Traffic Safety Administration (NHTSA) paid more than $6 25 million to develop three prototypes of technologically advanced cars it hopes Detroit will imitate

While the experimental cars which NHTSA calls research safety vehicles (RSVs), are economical to run, they are loaded with futuristic hardware and innovative engineering that promise to be expensive if incorporated into the family sedan

One of the experimental cars, the Eagle II developed by Minicars Inc , of Goleta, California features 'smart cruise control " Using solid-state radar and a microcomputer the cruise control system varies the car's speed to maintain a safe following distance behind any vehicles in front of it It sounds a warning and automatically brakes to avoid crashes


Department of Transportation

*The Eagle II Features "smart cruise control" solid state radar, automatic brakes and a price tag in seven figures*

Chrysler and Calspan, Inc have engineered an RSV based on the 1976 Chrysler Simca 1308 Its major innovations are structural improvements that make it crashworthy at speeds of 80 kph (50 mph) in front and rear collisions It has a soft bumper to reduce pedestrian injuries and tires that will run flat at 80 kph

"What we are aiming at," said Bob Cook a NHTSA spokesman, "is demonstrating that the technology exists to meet federally mandated standards for 1985 It all started a few years ago with something called the experimental research vehicle It looked like a Sherman tank

The latest versions are all under 3000 pounds [1370 kilograms] less than a Mustang They make great use of reforming plastics that bounce back when hit passive restraint systems [air bags], and other safety features They're economical and nonpolluting These are the basic elements of the car of the future " —A M

## MAYAN MISMANAGEMENT

It may not have been slaughter or disease that abruptly ended the Mayan Civilization in Central America a thousand years ago, but a wholesale disregard for ecological balance The soil surrounding Mayan temples and palaces bears evidence that expanding populations depleted the fields of essential nutrients through overly intensive agriculture The Mayans, it seems, were the victims of their own unwitting land mismanagement

Gerald Olson, professor of agronomy (soil science) at Cornell University, has found a characteristic layered soil composition around several ancient settlements of the Yucatan Peninsula Digging down through a meter of new light-brown soil, Olson found a band of clear black soil sitting on the undisturbed earth below The black soil he suggests, may indicate the Mayans' growing numbers forced them to burn off jungle areas for use as farmland and to shorten disastrously the fallow periods critical to soil restoration

Without the rain forest to hold and replenish the topsoil Olson says floods and

The Granger Collection

*Mayans Fabulous empire builders but lousy farmers*

droughts followed with catastrophic results Eventually even stop-gap measures—such as small raised fields encircled by irrigation canals—failed, and 1500 years of empire building stopped dead

—Dava Sobel

## PLANET WARMING

Two radio astronomers at NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California, have discovered major changes taking place deep within the atmosphere of Uranus M J Klein and J A Turegano of JPL s Planetary Atmosphere Research Section found that radio emissions from within the Uranian atmosphere have become 30 percent stronger during the past ten years.

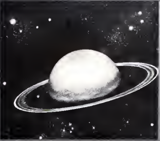
Using NASA's 64 meter radio telescope at Goldstone, California, the two astronomers were able to penetrate the dense clouds of the distant world where the atmospheric pressure is thought to be at least ten times greater than at the earth s surface

Klein and Turegano believe their findings suggest two possibilities One is that Uranus s atmosphere is warming up, though both scientists deem it unlikely that the temperature deep in a planet's interior could become 30 percent warmer in just ten years Such a change on earth would raise our average air temperature above 120° C (250° F)

More likely, the scientists feel the change is due to the planet s unusual orientation Different from any other planet Uranus rotates on its side as it orbits the sun During half the Uranian year (84 earth years) the north or south pole of the planet is always facing sunward Uranus s north pole is presently turning toward the sun following 42 years of darkness The scientists suggest that the radio beams sent from earth are now detecting hotter temperatures from regions of the atmosphere exposed to sunlight for the first time as the orientation of the planet begins to change.

*"At every crossway on the road that leads to the future each progressive spirit is opposed by a thousand men appointed to guard the past "*

*—Maeterlinck*



NASA

*Uranus Only recently were rings discovered now a new mystery has come to light—radio emissions have increased by 30 percent*

# CONTINUUM

## ALL THAT GLITTERS

All the firefighters who attend helicopter landings and takeoffs on the White House lawn wear face shields coated with a film of 24-karat gold. Outwardly attractive, the shields are also lifesaving—part of the heat-resistant metalized suits that enable firemen to see and work at close range in the intense heat of a helicopter fire, from which they may have to pull out a passenger or more.

*The man with the golden mask: Fireman's 24-karat-gold mask is transparent to visible light but reflects away radiant heat.*

The gold film is 300 angstroms thick—a "skin" thin enough to be transparent to wavelengths of visible light, but thick enough to be totally reflective to the slightly longer wavelengths of radiant heat. Because of this ability to admit light but not heat, gold visors are also used by airport crash rescue squads, other kinds of firefighters, and smelters who work with molten metals.

The Safety Systems Division of the 3M Company manufactures the film of gold on Mylar plastic, and several firms clamp the film onto Plexiglas visors.

Another popular industrial use of gold is in the production of spark plugs for snowmobiles, motorcycles, and racing cars. Champion Spark Plug of Toledo, Ohio, introduced the gold tipped spark plug in 1969, recommending it for snowmobiles for quicker starts in cold weather. At present Champion makes over 30 types of gold-alloy spark plugs.

—D.S.

*In 1899 the director of the U.S. Patent Office urged President McKinley to abolish the Patent Office along with his own job because "everything that can be invented has been invented."*

## SCIENCE OF HUMOR

What's so funny? Dr. Howard Pollio's research, for one thing. The University of Tennessee psychologist is studying humor.

"I get it from people all the time," he grumbles. "Skepticism, wisecracks. Even my mother calls me and asks, 'What kind of a job is this, for a grown boy to study humor?'"

Yet it's not so strange, Dr. Pollio testifies. "Humor is an important topic. There is hardly any society where laughter is not considered healthy and desirable. I have never understood why psychologists always study abnormal behavior."

Further, he points out, humor is easy to study. When someone tells a joke, you can measure precisely how long it takes the audience to laugh, how long they laugh, and how loudly.

Other studies are possible. Dr. Pollio once asked his students to classify comics, grouping those they found similar. "After a rigorous statistical analysis," he reports, "we found four major categories of comic: loud and crazy, typified by Jerry Lewis—there was a women's subgroup centered around Carol Burnett; skinny and weird, like Woody Allen; black comics; and old, fat, and sarcastic, such as W.C. Fields."

*Jerry Lewis: It's finally official: he's loud and crazy.*

"The problem with this kind of study," he adds, "is that we can't repeat it. By the time we've finished the study, people have already forgotten half the comics. I'd never before realized what a short half-life they have."

Despite such experimental hardships, Dr. Pollio has gleaned a few insights.

"Relative social position," he says, "is very important. The butt of the joke, a person, institution, or taboo topic must be valued and important in your society, and you must deflate it. The basic form of the joke is the put-down. And most humor flows between equals or downward. Seldom will someone joke about his superior at work to his face. In this way, humor acts as a device for tension management."

A general theory of humor, though, has been frustratingly elusive. "There have been thousands of theories," Dr. Pollio sighs. "Virtually every major philosopher, social critic, and psychologist has had one. I suppose it would be too much to hope that my research will explain what makes something funny in every case "

He plans to keep on trying, however "I think there is a strong relationship between the ability to see a joke and the ability to solve problems," he suggests

"Laughter underlines how silly it is to think about the mind and body separately" he adds "The stimulus of a laugh is an intellectual event yet it quickly goes on to block out all else There are only two other phenomena that so completely take over your awareness the orgasm and the sneeze "

—Owen Davies

## ALLURING FISH

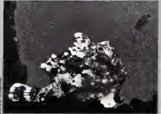
A fish that looks like a rock and has its own built-in fishing lure has recently been discovered in waters off the Philippine Islands. Scarcely more than ten centimeters (four inches) long itself, the anglerfish waves about a tiny lure on the end of a flexible filament

The lure looks exactly like a fish in the region that the anglerfish loves to eat The prey is attracted to the lure in hopes of a mating rendezvous, not realizing that the 'rock' beneath it is a deadly enemy Other fish have built-in lures but only the anglerfish has a lure that resembles a fish itself

The anglerfish is also unique in its ability to wiggle the lure while maintaining the "immobile, inert appearance of a sponge- or coral-like algae-encrusted rock," according to Theodore W. Pietsch and David B Grobecker of the College of Fisheries at the University of Washington, the first scientists to describe the fish

The anglerfish outdoes most animals in its elegant combination of camouflage, hunting prowess, and energy conservation Its shape and color allow it to hide from predators while simultaneously luring its food

—D S



David B. Grobecker

*Anglerfish (large rock like object) waves about its realistic lure A model of camouflage and energy conservation*

## SUPERTANK

The U S Army's new XM-1 tank is a 59 ton armored knight with a kind of laser lance Using a laser range finder and ballistic computer, its 105-mm cannon fired on the run in a recent demonstration, uner-

Department of the Army

*XM-1 Besides a laser, a computer, and a cannon that hits targets a kilometer away, it also comes with its very own smoke screen*

ringly hitting targets more than one kilometer away

It averaged 50 kph (about 30 mph) over hilly terrain and disappeared behind cover after releasing smoke grenades that within seconds, had hidden the tank in a gray cloud

For protection, the XM-1 is made of British-invented Chobham armor, whose composition is still secret To reduce the chances of destruction and death from ammunition fires, the ammo and four-man crew compartments are separated by armor bulkheads and sliding armor doors A fire-extinguishing system is designed to react to fires in three milliseconds and to quench them in 200

Chrysler Corporation is the main contractor for building 3325 XM-1s under a $4 7 billion government contract

—Alton Blakeslee

*"What sir," said Napoleon to steamship inventor Robert Fulton "You would make a ship sail against the wind and currents by lighting a bonfire under her decks? I pray you excuse me I have no time for such nonsense "*

*"Everything in space obeys the laws of physics If you know these laws, and obey them, space will treat you kindly And don't tell me man doesn't belong out there Man belongs wherever he wants to go—and he'll do plenty well when he gets there "*

—Wernher Von Braun

# CONTINUUM

## SEDIMENT FROM OUTER SPACE

As NASA scientists struggle with shrunken budgets to continue their study of outer space, geologists at the California Institute of Technology have taken to probing the ocean bottom to learn more about interplanetary conditions. What they're looking for are tiny bits of meteors or comets.

When meteors hurtle towards earth, atmospheric friction causes them to melt and throw off microscopic spheres of silicon and metal. These droplets land in the sea and can be found in the sediment below.

Though the particles' extraterrestrial origin had been suspected since they were discovered more than a century ago, Dr. Donald E. Brownlee has only now been able to prove that hypothesis. Using the high-technology method of neutron activation analysis, he found that their metal content duplicates that of known meteorites.

The particles, less than 2.5 hundredths of a millimeter (one thousandth of an inch) across, form barely one part per million of the ocean floor. But it is a fraction well worth searching for, Dr. Brownlee feels.

"About one particle in ten contains unmelted meteoric material," he explains. "Most meteors are so fragile that they break up in the air. These particles may be our best chance to find out what they are like.

"Our great hope, though, is that we will be able to find particles from the head of a comet, probably the oldest unchanged material in the universe. With luck, we may even find particles that formed before the solar system did. They could tell us a great deal about the origin of the sun and planets." —O.D.

California Institute of Technology

*Extraterrestrial sea sediment magnified 2300 times. Underwater particles could hold the secret to the origin of the solar system.*

## POLLUTION FLOWER

The spiderwort, a small, delicate flower common to all temperate climates, has found a peculiar role in this age of nuclear energy and toxic chemicals. It changes color in the presence of radiation and pollution.

The cells of the stamen

Brookhaven National Laboratory

*Spiderwort: A "pink" alert to radiation or pollution.*

hairs in a particular strain of the spiderwort change from blue to pink within two weeks of exposure to low levels of radiation and such pollutants as sulfur dioxide, vinyl chloride, and ethylene dibromide (a pesticide and gasoline additive). The pink cells are actually mutations caused by the harmful substances, and can easily be seen under a microscope (magnification, 15 times) by a nontechnical person. Each stamen hair has 22 cells, which look like a chain of colored beads. The number of pink cells can be correlated with the severity of the dose. (The stamen hairs are those sticking out of the center of the flower.)

Scientists are now using the spiderwort to study how living things react to low levels of pollutants. Although the results are still preliminary, indications are that the plant could serve as a very cheap detection device.

The spiderwort discovery was made in the mid-1960s by scientists at Brookhaven National Laboratory on Long Island. But it did not receive much attention until one of those scientists, Japanese geneticist Sadao Ichikawa, started traveling throughout the world recently to teach the spiderwort detection method to opponents of nuclear power.

—Stuart Diamond

## BEAMING IN ON TERRORISTS

Laser guns that don't hurt anybody are being used to train Department of Energy convoy guards to protect nuclear materials from terrorist attack.

Participants in the training exercises are divided into two groups—some trainees act as convoy escorts while others become their ambushers.

The trainees carry M-16 rifles equipped with harmless low-intensity lasers that emit invisible beams whenever blanks are fired. The men wear helmets and specially designed electronic vests that give out signals whenever a "bullet" passes within a foot or so. The vest beeps to signal a near-miss and produces a piercing sound for a kill (The shells being ejected in the photo below are the expended blank cartridges )

This equipment, the Multiple Integrated Laser Engagement System (MILES), was designed for the U S Army by the Xerox Corporation


*Sandia convoy guards Shooting it out with harmless lasers*

The ambush exercises, which take place in a remote canyon south of Albuquerque, are recorded by television cameras so experts at Sandia Laboratories can see precisely which attack and defense tactics are least or most effective

"We believe that modern terrorists will be well armed, sophisticated, daring, and serious So we must develop a nuclear safeguards system that can meet such a threat," said Bob Wilde, supervisor of Sandia's Transportation Systems Division,

—Phyllis Wollman

## NEAREST QUASAR

A quasar that is only a hop and a skip, cosmically speaking, from our own Milky Way, has been found by astronomer Bruce Margon of the University of California at Los Angeles (UCLA) Margon claims that Quasar 0241+622, named for its celestial coordinates, is a mere 800 million light-years away and produces a hundred times more light than the Milky Way It is the closest quasar ever discovered

Although more than 600 quasars have been identified since the early 1960s, no one yet is quite sure what a quasar is While they look like stars, quasars produce tremendous outpourings of energy more typical of huge galaxies

Now that he's found a quasar in familiar territory," Margon hopes astronomers will be able to solve the quasar enigma

Like other quasars, this one's light is shifted toward the red end of the spectrum, indicating that the object is moving away from us Unlike other quasars, however, its red shift is small, implying a relatively slow rate of recession about 12 640 kilometers (about 7900 miles) per second Some quasars approach the speed of light in their flight from us and seem to be some of the earliest products of cosmic evolution, as far as 15 million light-years away

"Nature played a joke on us by lining up this nearby quasar with the plane of the Milky Way so that dust obscures 99 percent of the light," says Margon Had it lain in a different direction he believes someone—even an amateur using a very small telescope—would have spotted it long ago,

—D S

## MELTING DIAMONDS

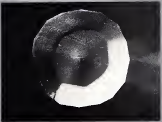
Until we develop matter many times harder than diamonds, we won t be journeying to the center of the earth The intense pressure, even a few miles beneath the crust, would bend most materials out of shape—cause even the hardest metals to flow like liquid

Now however, two geophysicists at the Carnegie Institution have taken a step toward conquering "inner space"—they've duplicated the high pressures within the earth's core

H K Mao and P M Bell generated a new pressure record (at room temperature) of 1 72 megabars A megabar is a million times normal atmospheric pressure, and 1 72 megabars corresponds to the amount of pressure at a depth of about 3200 kilometers (2000 miles), which while nowhere near the center of the earth is within the earth's core

Bell and Mao used a diamond-window pressure cell in which force was applied to a sample—a metal composite embedded with rubies—by diamonds above and below it The record setting pressure was so great that even one of the diamonds got buttery and "flowed "

Besides examining the physical state of the earth s core, high pressure experimentation may disclose new properties of matter and help produce such material as metallic hydrogen with superior superconducting properties

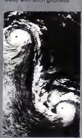



*Bell and Mao's melted diamond Enough pressure at 3200 kilometers down to churn the hardest matter into geothermal butter*

# CONTINUUM

## THE WEATHER QUESTION

Everybody talks about the weather, but nobody does anything about it, said Mark Twain 80 years ago. Today, he couldn't get away with such glibness.



NOAA

*Two swirling hurricanes. Photographed from weather satellite*

More than 145 nations, concerned about the effect of recent frigid winters and steaming summers on crops, health, energy costs and human life, have begun a $500 million research program to figure out exactly what is going on.

The program—the most ambitious weather research undertaking in history—includes satellites, surface weather stations, oceangoing vessels, and balloons. It began in December 1978 and will run until December 1979. Instruments will collect data on every conceivable aspect of the earth and atmosphere that might relate to weather. The information will be fed into computers, which will draw precise profiles of weather patterns.

In one experiment, airplanes will release 46-centimeter cylinders to measure atmospheric temperatures, pressures, humidity, wind speed, and other components at various altitudes as they parachute toward earth.

The National Oceanic and Atmospheric Administration, this country's leading weather agency, is developing satellite systems to predict potential flash floods, hurricanes, and other large storms so appropriate protective measures can be taken before it's too late. A satellite launched in September (*Nimbus G*) will measure differences in the heating of land masses and oceans in various latitudes to try to determine if the earth is warming up or cooling down.

It is expected that all of these programs will eventually improve the record of the nightly tv weather update, although it might take years for the new information to affect the forecasts. —S D

## ALCOHOL AND SEX

When the Scottish nobleman in *Macbeth* asks the porter what desires drink provokes, he replies, "Lechery, sir, it provokes and unprovokes: it provokes the desire, but takes away the performance." Now, almost four centuries later, the physiological basis for this contradictory phenomenon has finally come to light.

Jack Mendelson and his colleagues at McClean Hospital in Belmont, Massachusetts, and at Harvard University measured the levels of sex hormones in the blood of 16 healthy, nonalcoholic males shortly after they had been given approximately 5.5 ounces of 100-proof liquor (the amount varied according to body weight).

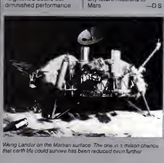
They found that as the alcohol level in the blood rose, the level of testosterone, a sex hormone regulating the production of sperm, greatly diminished, while luteinizing hormone (LH), which signals the testes to produce more testosterone, increased. Mendelson believes that the brain interprets the increased levels of LH as sexual arousal, creating the paradoxical state of heightened desire but diminished performance.

## ODDS AGAINST LIFE

The *Viking* missions to Mars returned strangely puzzling answers to the question of "Life?" on that planet. The data gathered about surface conditions there indicated that earth life wouldn't stand even one chance in a million of survival.

Subsequently, a special panel recently reported to the Space Science Board of the National Research Council that the likelihood of such survival was far more questionable: the "probability of growth" for any terrestrial organisms that inadvertently reached the Martian surface was not one in a million, but one in *ten billion*.

The implication of this statistic for NASA is that the agency needn't be quite so fussy about pre-launch sterilization procedures on any future missions to Mars. —D S



NASA

*Viking Lander on the Martian surface. The one in a million chance that earth life could survive has been reduced even further*

# FOREVER WAR

*Twenty-one years ago, two hormone researchers began slugging it out for the Nobel Prize. In 1977, both won. Yet today the battle still rages on.*

"Guillemin and Schally 'laid the foundations for the newest and perhaps most important branch of endocrinology—the study of the hormones produced by the brain itself.'"

—*Science*, April 21, 1978

"Why should I share my data or materials with Guillemin? Does the U.S. share its newest missiles with Russia? There were years of vicious, almost hysterical competition."

—Dr. Andrew Schally, May 2, 1978

"It's been months since Guillemin and Schally won the Nobel Prize, but their fight still goes on. Guillemin just refused to appear on the same stage with Schally at a Stockholm scientific meeting."

—Dr. Samuel McCann, June 2, 1978

"You know the story. Nice guys finish last."

—Dr. Karl Folkers, November 1977

The careers of the cowinners of the 1977 Nobel Prize in Physiology/Medicine, Andrew Schally of Poland and Roger Guillemin of France, have been models of persistence, brilliant intuition, and efficient management—plus fear, jealousy, and character assassination. If their 21-year struggle against their competitors and each other is a general reflection of scientific life, then send your kid to art school. Science is for piranhas.

But while it was sheer hell for the researchers, the Schally-Guillemin quest promises to do as much for the rest of us as the combined discoveries of penicillin, insulin, psychotropic drugs, the Pill and Spanish fly did. Their still-controversial deciphering of the chemical structures of several hypothalamic hormones may eventually lead to the production of drugs that will control appetite and obesity, prevent blindness and diabetes, control breast and prostate cancer, improve memory and learning, limit mental instability and increase concentration, and eliminate a large

BY WILLIAM K. STUCKEY

range of human freakishness, including dwarfism.

Perhaps even more dramatic, the Schally-Guillemin accomplishment may allow us to prevent inadvertent baby making on the one hand, and on the other, transform us all into sex objects beyond our most fevered dreams. Yes, the 1977 Nobel Prize research may result in the first effective over-the-counter aphrodisiac, perhaps in the form of a nasal spray. We'll talk more about the future benefits of hormone research later on. But first, a look at the bloodshed.

It is extremely rare for scientists to air their dirty linen, and it is difficult to convince them that it is beneficial to do so. For example, an otherwise respected Nobel laureate told me in 1975 that because he disagreed with the mainstream precepts of his science (and with the mainstream leader), he was having difficulty getting research grants, publishing his scientific papers, and obtaining jobs for his students. Yet when I suggested that he provide the names and dates and go public, he was "appalled" at such an idea. The journalistic principal of cure through exposure a la Watergate is an alien one to research and its international symbols, the Swedish judges who award the Nobel Prize. Consequently, we hear essentially the same lament from a losing Schally-Guillemin competitor.

"Look, I can't say too much," he says, pleading for anonymity. "I could still get hurt professionally by . . . well look, let's skip it. This field is very competitive, with a lot of cutthroat competition. I won't make specific charges, but I know that some of my competitors pulled dirty tricks on me. Schally makes a lot of comments. Guillemin is a very egocentric guy. Schally is aggressive, hard-driving, a cutthroat competitor, but I understand him. Guillemin is harder to understand . . . smoother . . . more cultured."

The unusual thing about the Schally-Guillemin conflict is that Andrew Schally

PAINTING: SCHWERTBERGER

himself has become the whistle blower He is the first researcher since DNA pioneer James B Watson (author of *The Double Helix)* to remind us that science not only soars on golden wings but occasionally skids on dog doo

## TALLEYRAND VS THE PETTY POLE

Science fiction novelist Joe Haldeman might describe the Schally Guillemin struggle with one of his titles *The Forever War* and it is one that Schally sees himself losing in public relations terms Recently he sat in his lab at the U S Veterans Hospitál in New Orleans and waved the latest copy of *Sciance* magazine at ma

Always always always " said Schally, who tends to speak in threes They ara *always* dascribing Guillemin as urbane and sophisticated, while I am made out to look like a warmonger *Science* has not treated me fairly"

He referred to an unusual thrae-part series by Nicholas Wade in iha journal of the American Association for the Advancement of Science (April 21--May 5, 1978) Wade had made a Herculean effort to untangle the complex and heavily disputed chronicle of Schally and Guillemin, but Guillemin seemed to win on points, emerging as Talleyrand, Voltaire, and the Prince of Modesty while Schally emerged as the petty Pole

The third-party quotes about Guillemin were along the 'urbane Frenchman" line Schally was dismissed as "a Slav in many ways, very excitable " Schally breaks the protocol of tha Swedish Nobel Prize judges by admitting that there indeed was a 'race" and that yes it *was* for the Nobel Prize Tha Swades like to think of scientists as truth-seeking Buddhas who would never dream of racing lobbying, blabbing or throat cutting for something so intangible as a mere human prize The Guillemin who appeared in *Science* was made to look like Buddha *What* race? he askad *What* prize? Oh yes, his research "required constancy consistency, and increasing know-how, but raelly, there was nothing conceptually revolutionary in this field that made me think a Nobel Prize had lo be awarded for it "

There is little doubt as to which of the two is the most personally impressive Schally has dry, long and stringy hair combed over bald spots and a voice that often elevates to an incredible, high-pitched whine Guillemin is bald with intellectually thin lips, has a trim frame often dressed in something muted and continental (whereas Schally sported emerald-green trousers and scuffy black shoes the day I met him), and owlish eyes reflecting a personal and flattering interest in every inanity a visitor might express The French-born Guillamin can display noblasse plus oblige Evan his

*Above Schally (far left) and Guillemin (far right) Right half of center photo captures them in rare moment together—at Nobel ceremonies Cowinner Roselyn Yalow is at center*



research setting—the austere and elegant castle of the Salk Institute of Biological Studies in La Jolla California, with majestic views of the Pacific's great whale migration lanes and of cliff-top launching pads for butterflylike hang gliders—far outshines Schally s—a lab that is just down the street from the screaming madhouse of New Orleans s Charity Hospital and with a view of the Superdome

"Schally leads his scientific staff like a combat sergeant In pursuit of the elusive hypothalamic hormones, he shared the messy job of helping grind up one million pig brains—personally mashing the baanlika hypothalami with mortar and pestle Guillemin delegated his own osterizing operation—liquefying six million sheep brains (Schally chose pigs in part because Guillemin had selectad shaap)—to a member of his large staff

I first contacted Schally in November 1977 a few weeks after he had won his share of the Nobel Ironically Schally had once worked in the same lab with Guillemin—at Houston s Baylor Medical College from 1957 to 1962—and I asked how things had been (I had no knowledge at the time of a blood feud)

"The atmosphere was unbearable I wouldn t be suppressed and dominated by him any longer" Schally recalled as his voice rose "I had gone to work for him at Baylor with the understanding that we would be fifty-fifty partners, sharing the credit with each other He doesn t share credit with anyone I would not be one of his slaves "

Guillemin, however took an entirely different and indirect approach when he discussed the Baylor days Vary little was said about Schally at all except that he was my student ' For fuller information Guillemin suggested that I speak with tha venerable Baylor physiologist (and tha man who gave Guillamin his first American rasaarch post), Habbal Hoff Hare ara selected quotes from Dr Hoff as to those discrete five years

- 'There was no doubt from the very beginning that the solution of the hypothalamic hormone problem was a problem of Nobel level Roger was just so clearly in advance in his ideas and technique that nobody else ever caught up Of course Schally did a great piece of work for Roger but having him share the Prize with Roger? That s a little bad '
- 'I do not think Schally developed any of the basic ideas '
- "When some peopla are around people of greatness, some people would like to prova to tha world that they are just as good."
- In answer to Schally's comment that the atmosphere in Guillemin s Baylor lab was unbearable "If you considared how long most of Roger s other assistants stayed with him you would conclude that the laboratory atmosphere was acceptable to most people But Schally was simply burning to be independent To that kind of a guy the atmosphere in anybody else s lab would be unbearable '
- "You have to understand that Schally s father was a general with the Polish government-in exile during World War II There is nobody more patriotic than a patriotic Pole Andrew has transformed that emotion into a search for *la gloire*, you know winning the Prize Roger had a little of that tendency Schally had a lot of it '

If *Science* s Wade had talked to Hoff perhaps he would have developed a different view of Guillemin s tactics (In fairnass howaver, avan soma of Schally's coworkers also made extremely harsh indictments of Guillemin—concantrating on his apparently turbulent research caraar in Franca—that are too libelous to rapaat hara )

And perhaps another view "in fairness" to Roger Guillemin The man has a positive talent for finding research funds a talent that induces jealousy in his less fortunate colleagues

'In the early 1970s' said one competitor (not Schally), "Guillemin came up with several million dollars in grants from the Aid for International Devalopment program The rest of us didn t even know the money was *there* "

There is soma spaculation that the sharpened-albow race for the Prize also hurt Guillemin and Schally in Swedish ayes A full half of tha $150,000-plus Prize want to Dr Rosalyn Yalow, of the Veterans Administration Hospital in the Bronx for daveloping the radioactive-tracer assay techniques that permitted Guillemin and Schally to pinpoint the two-dimensional chemical structures of tha first three hypothalamic hormones Dr Yalow's achievements apparently have aroused no ire The Frenchman and the Pole had to be content with a quarter-slice each

But Schally is forever Not only does he continue to call a Guillemin a Guillemin but he implies that his future work will be of such quality that an unprecedented second medical Nobel is not out of the question It is presumed that he would prefer not to share it with Roger Guillemin

## CHILDREN IN NAZILAND

Twanty-one years of hand-to-hand combat being unusual, one looks at the early backgrounds for some answars And the reasons for both Guillamin s and Schally's toughnass may ba found there Guillemin spant his taans living in Nazi-occupiad France while the slightly younger Schally underwent a similar ordeal in Poland before he and his parents escaped to Scotland (where life was only slightly better during the great "British Austerity" period following the war) The sole anecdotes that survive this period of Guillemin's life are that he was wounded—by an artillery shell from invading Americans—and that he was connected with a country hospital that was actually a front for the French Resistance

Perhaps the Guillemin manner was also honed in the stifling formalities of the French university (ha received his M D from his hometown University of Dijon and joinad tha medical faculty at Lyons during the early postwar period) Later, during his tanura at Baylor in the 1950s and 60s he accepted a joint appointment with the College de Franca, an arrangamant that to the delight of the Schally forcas apparently did not work out Guillemin-supporter Hoff providas these datails

"Roger just ran into tha total failura of the French system There was inadaquata interest in or support for his research Thair system is so terribly antiqua There are too many old profassors appointad for life and no breathing room for the younger people And Roger is certainly not the first Nobel-level scientist that the French boo-booed on André Cournand had tried in vain to get a job in France but finally had to settle for Columbia University—where his research won him the Prize (for heart catheterization) in 1956 "

Schally went into chemistry in England working for a while in the Laureate-rich atmosphere of London s National Institute for Medical Resaarch He dascribes this period as a pleasant one and one that gave him a character dissimilar to that of his great competitor

"Wall, you see, wa have different characters," Schally analyzed "I was brought up in England and I'm quita proud of it We never do something navar do anything behind someona s back We ara very athical I am hard but very ethical Yes yes yes Guillemin believes you know diplomacy, Talleyrand at which the French excel very political If I don t like something I'll just say so

Question Are you saying that Guillemin is the type to do things behind people s back?

"I would never do that ' replied Schally

Question But are you saying *he* would?

"I m not saying that We are different types I like sports, he hates sports my health has always been excallent his is bad "

Question How did you get along with him in Stockholm at the Prize ceremonies?

"Oh, Guillemin was extremely proper extremely friendly he was even cordial I didn t feel like being cordial but he was "

Doas it never end? But wait, there *is* some science in this narrativa

## FOG IN THE LABS

"Up in my head,
Just over my tongua,
A little thing from my brain is hung
To make it work there ara factors new
That tell it when and how much to pitu"
—Professor Murray Saffran
*Science*, April 21, 1978

Andrew Schally left England for Montreal s McGill University in 1952, where for the next five years he copublished papers with Professor Saffran Their research task was a radical one in hormone circles Several other scientists including the late Geoffrey Harris of Oxford, who probably would have shared tha 1977 Prize with Schally et al if he had not broken a Prize-eligibility rule by dying, had suggested that Saffran s doggeral dascription of the "little thing from my brain " iha pituitary was *not* the body s master gland that ragulated the most important hormonal traffic The clues were that anothar organ, the hypothalamus, actually told tha pituitary what to do by squirting out "hormone relaasing ' factors through a hypothalamic-pituitary blood vessel network

Tha problem had the richest of Nobel Prize alements As a classical problem, it would ba a rare coup to disprove the decades-old pituitary "master gland" theory by the "discovery —the key Nobel buzzword, first articulated in the 1896 will of Alfred Nobel himself—that the hypothalamus held the true power over sex, growth response of the body to physical stress (cold, heat infection, etc ), and other intriguing functions And isolating and unscrambling the chemical structure of releasing factors would meet Alfred Nobel's criterion of being of 'benefit to mankind'—sinca the chamistry hopefully could be modifiad, producing drugs that could diagnose or right hormonal wrongs in a much quicker, cheaper and more effectiva way than tampering with the delicata pituitary itself According to Saffran, he and Schally saw the Nobel significance in hypothalamic hormones immediately with Schally beginning the search for the extremely elusive factors as early as 1954.

A classic mystery suggested that the pituitary master-control theory was wrong. The mystery is the young girl, a virgin, who under the stress of leaving home for the first time (or other nonsexual stresses), misses her period for six months or so. If the prevailing pituitary theory was correct, the situation would be impossible, since the theory states that the pituitary pumps key sex hormones into the bloodstream with unfailing accuracy and independently of emotion. Perhaps, then, the hypothalamus, which presumably does react to outside "stressful" information such as visual images and emotions, was responsible for the girl's irregularity. And if this is true for sex, why not for other hormonally controlled functions? The hypothalamus and its mysterious releasing factors added a weird mind-over-matter quality to classical anatomy.

Roger Guillemin also had become interested in stress and hormonal function, having also moved to Canada to work under the University of Montreal's Hans Selye, a Nobel-connected nabob if ever there was one and an authority on stress. He writes (in Plenum Publishing's *Pioneers of Neuroendocrinology*, 1978) that he came to the hypothalamic control idea independently, then heard of Saffran's work (no mention at all of Schally, who nevertheless was a coauthor of the first research papers) and wrote him for information.

Guillemin then shifted his research base to Houston. Young Schally, hearing that the Texas Frenchman shared mutual research interest, wrote from Montreal, asking to work in Guillemin's Houston lab. Guillemin notes icily (in *Pioneers*) that Professor Saffran, Schally's overseer, gave Schally a "guarded" recommendation. But Guillemin hired Schally anyway, and Schally began the first of his five "unbearable" years before bolting to New Orleans to head his own VA-sponsored research drive.

The problem is that the rest of the world of endocrinology—except for Dallas's Dr. Samuel McDonald McCann and a handful of other hearty since-the-1950s pioneers—thought Guillemin and Schally were totally wrong. Moreover, they began to suspect over the years that the two spent more time going for each other's jugular (at acridly atmosphered scientific meetings and in the pages of journals) than trying to solve the hypothalamic problem. Guillemin and Schally had wasted years chasing the structure of the wrong releasing factor (corticotropin releasing factor, or CRF). Schally says that he and Saffran believed they were presenting, with CRF, the "first direct proof of the existence of hypothalamic hormones," but that the insubstantial nature of the chemical itself, plus inadequate analyzing tools, prevented their determining its exact chemical structure.

Both Guillemin and Schally each hot on the other's heels, shifted to the structure of a less problematic releasing factor, thyroid releasing hormone (TRH). Then, at an unusual meeting in Tucson in 1969—called by the National Institute of Health (NIH) backers of the competing teams of Guillemin and Schally to determine if the Pole and the Frenchman were really going to accomplish anything—Guillemin pulled a dazzler.

Guillemin announced that he had come up with a TRH sample pure enough (that is, separated from the extraneous head tissues of all those sheep brains) to at last begin work on its structure. The NIH, which had been prepared to suspend the research funds for both scientists, relented and stopped laughing.

The problem for Guillemin was that Schally himself had TRH in "pure form" and had identified its three amino-acid sequence *three years before* but believed then that he was wrong.

The nature of the burdens on the Swedish Prize judges who must determine

> *Schally makes a lot of comments. Guillemin is very egocentric. Schally is aggressive, hard-driving, a cutthroat competitor, but I understand him. Guillemin is harder to understand . . . smoother . . . cultured.*

who did what first, begins to be perceived.

Then, along came Karl Folkers of the University of Texas at Austin to roil the waters even more. Folkers, a crack chemist, was asked by Schally to help him work out the final TRH structure. Folkers did—at least several weeks before Guillemin's team did. Today, Guillemin will not speak of Folkers. When I asked Guillemin to comment on the Folkers work, he replied: "I wish no comment on that person. No change that and say, I wish no comment on that colleague."

Schally also downplays Folker's work on the structural problem. Ironically, it is not Schally or Guillemin—but Karl Folkers—who holds the patent on TRH structure.

A note on all that animal mush: Guillemin's most brilliant research stroke in pursuing the extremely potent, small, and hard-to-isolate releasing factors was in the sheer volume of sheep brains he decided had to be processed for hypothalamic fruits. Six million brains, which he bought from packing houses at 40 cents apiece (a total of $2.4 million), only hints at the total amount of public and private funds spent by the two in their 21-year search. Schally kept abreast with his one million pig brains—donated free by the Oscar Mayer weenie people. Dr. McCann, the pride of physiology at Dallas's University of Texas Health Sciences Center, speculates that he probably did not survive in the Nobel sweepstakes because he simply did not want to convert his lab into an industrial brain-blending facility.

"After we processed about 75,000 brains, I said that was enough," McCann recalled. "It is not very interesting work, and the funding wasn't all that good either. I was more interested in the physiology of how the hypothalamus actually controls the pituitary, if it does, than in solving a mundane chemical structure problem."

Wait a minute. *If* it does?

The score card on the three structures mapped to date, which was enough to convince the Swedes of the research's Nobel quality, is as follows:

**Thyroid releasing hormone.** Guillemin claims a win. Schally concedes a draw—although coworkers say they had it in pure form years before Guillemin, but Karl Folkers holds the patent. (Analysis: Try the polygraph.)

**Luteinizing Hormone Releasing Hormone** (LHRH, which directs the pituitary in timing ovulation and sexual behavior). Schally apparently scored a clean sweep here in structural deciphering, although the Texan, McCann, is given credit for first isolating it in hypothalamic extracts.

**Somatostatin** (which, among other things, inhibits the action of growth hormones and affects insulin production in diabetics) is also claimed by Guillemin. But add this dissenting note from McCann: "We published four articles on somatostatin before Guillemin did. Meanwhile, he was badmouthing the existence of somatostatin and claimed that our results could not be duplicated in his lab. Baloney."

One almost feels a surge of sympathy for the Swedish truth seekers and Prize finders, particularly after the comments of another Dallas hypothalamic worker, Dr. John Porter.

"No one yet knows exactly how the hypothalamus drives the pituitary, or *if* it does," said Dr. Porter. "We are now finding some of these substances, like somatostatin, all over the brain and elsewhere in the body, not just in the hypothalamus. All we know is that something goes into the pituitary and something goes out. It's a typical black box explanation: here's what happens, but we don't know why. The Prize to Guillemin and Schally I believe, was strictly for a technological feat. They got the two-dimensional structure of the releasing factors. Fine. That tells us how to modify it and make useful pharmaceuticals. But we still don't know the three-dimensional structure. Look at the Nobel Prize for Watson-Crick's model of DNA. That was three-dimensional . . . conceptual. The structure suggests exactly how genetic material reproduces itself. All we know about releasing factors is what amino acid follows what other amino

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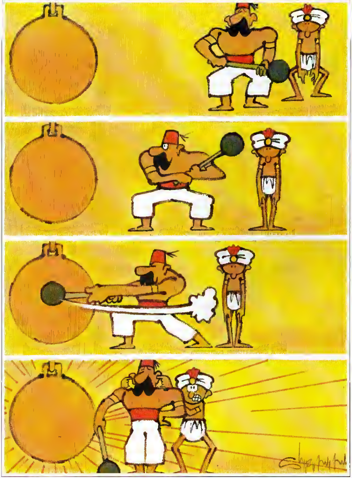
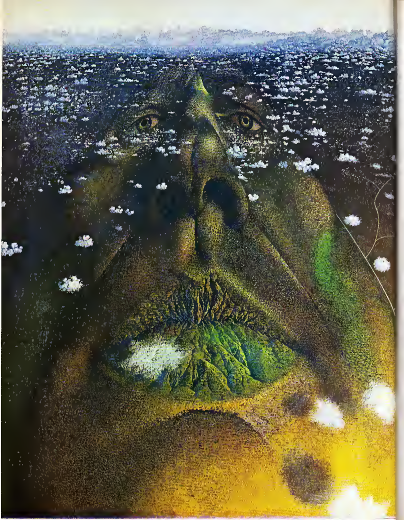




FICTION

*It would be so easy to change history, now that the time machine was available*

# NEWTON'S GIFT

Wallace John Steinhope was a sensitive human being, a person deeply concerned about the welfare of his fellow creatures Any act of injustice, however slight, made his breast pound with righteous indignation He was a champion of fair play, and his motto in life was taken from the ancient English rule of law—"Let right be done!"

Even while still a lonely, reclusive child, Wallace's heart ached mightily when he read of the laborious, boring, mind-dulling calculations endured by the great mathematicians of old Just knowing, *thinking*, of Gauss's marvelous mind wasting literally *months* of its precious existence grinding out tedious mathematics that even a dullard could do today in a minute on a home computer, was sheer agony for Wallace Contemplation of the God-like Newton suffering endless delays in his gravity research, all because of a simple miscalculation of the length of a degree of longitude, was almost unbearable

Indeed, Newton played a special role in Wallace's life (and he in Newton's, as we shall soon see) While the other great mathematical physicists had merely been hindered in their work by the lack of modern computational aids, Newton had squandered so much valuable time in other nonscientific pursuits! His quasireligious writings alone, over half a million words, exceeded his scientific writings What a waste! Wallace wondered endlessly over the reason for this strange misdirection of talent and bored his friends to the edge of endurance with his constant brooding on the mystery Still, they all liked and admired Wallace enormously so put up with it But more than one of them had sworn to throw up the next time Wallace mentioned Newton

PAINTING BY RUDOLF HAUSNER

during a wedding (but that's another story).

So deep was Wallace's anguish for his predecessors that even as he grew older and his own tremendous talents as a mathematical physicist gained him an international reputation, thoughts of the unmeasurable misery of his scientific ancestors were never far from his mind. It was most appropriate, then, that his greatest discovery gave him an opportunity to do something! And Wallace John Steinhope vowed to *help*. He became convinced that it was his purpose on Earth—he could not, he *would* not hesitate. As he strapped the knapsack-size time machine onto his chest, his excitement was, therefore, easy to understand.

"It is done! And I am ready. I will travel back and bestow this gift of appreciation, this key to mental relief, on the great Newton himself!" Wallace cradled a small, yet powerful hand calculator in his palm. It was a marvel of modern electronics. Incorporating large-scale integrated circuitry and a Z-8000 microprocessor solid-state chip, the calculator required only a small, self-contained nuclear battery for its power. It could add, subtract, multiply, divide, do square and cube roots, trig and hyperbolic functions, take powers, find logarithms, all in mere microseconds. It was programmable, too, able to store up to 500 instructions in its micromemory. The answers it displayed on its red, light-emitting diode readouts would liberate young Isaac from the chains of his impoverished heritage of mathematical calculation. No more Napier's bones for Newton!

But Wallace John Steinhope was no fool. He understood, indeed feared, time paradoxes. He knew Newton could be trusted with the secret but it wouldn't do for the calculator to survive Newton's time. So Wallace had incorporated a small, self-destructing heat mechanism into it. After five years of use, it would automatically melt itself into an unrecognizable, charred slag mass. But that would be enough time for its task to be completed. The emancipation of Newton's mighty brain from tedium!

Pleased enormously at the thought of the great good he was about to confer, Wallace set the time and space coordinates for merry old England, flipped the power switch on, and vanished.

Materializing in the Lincolnshire countryside in the spring of 1666, he began his rendezvous with destiny. It was the second and final year of the great bubonic plague, and Newton, seeking refuge from the agony and death plundering London and threatening his college of Trinity at Cambridge, had returned home to work in seclusion. The years of the Black Death were Newton's golden years, when the essentials of calculus would be worked out, when the colored spectrum of white light would be explained, and when the principle of the law of gravitation would be grasped. But how much easier it would all be if Newton were released from the binding chains of dreary calculation. Wallace's gift would slip the lock on those chains! Accelerate genius!

It was early evening when, guided by a map of the area prepared by a friend who was both a cartographer and amateur historian, Wallace reached the quiet little town of Woolsthorpe-by-Colsterworth. It was here, in a small farmhouse, that Wallace would meet his hero of the ages. A cold, gentle rain was falling as he approached the door. The soft, hazy light of an oil lamp glowed inside, revealing through the translucent glass the form of a man bent over a table. The fragrant smoke of well-dried burning wood curled from the chimney, announcing a warm fire within.

With his heart about to burst from excitement, Wallace rapped upon the door. After a pause, the shadow rose and moved away from the window. The door opened, and there stood Isaac Newton, a young man of 23 with an intellect that Hume and Voltaire considered "the greatest and rarest genius that ever rose for the adornment and instruction of the species." But for the importance of his self-appointed mission, Wallace would have fainted dead away from the thrill of it all.

*With his heart about to burst from excitement, he rapped upon the door. After a pause, the shadow rose and moved away from the window. The door opened, and there was Isaac Newton, a young man . . .*

"Is this the home of Isaac Newton?" he asked in a voice quavering with the trembling tones normally used by lovers about to reveal their deepest feelings.

The young man, of medium height and with thick hair already showing signs of gray, swung open the door and replied, "My home it is, indeed, stranger. Come into the parlor, please, before the wetness takes you ill."

Isaac followed Wallace into the room and stood quietly watching as his visitor removed his soaked coat and hat. The portable time machine was gently placed on the floor next to a wall. The calculator was snug and safe in its plastic case in Wallace's shirt pocket. "Thank you, Master Newton. May we sit while we talk? I am afraid you may wish to take some time to consider my words."

Motioning to a chair near the table, Isaac pulled a second chair from a darkened corner and joined Wallace. "You have a strange sound to your speech, stranger. Are you from hereabouts or have you traveled far? Please commence slowly your tale."

Wallace laughed aloud at this question, a response prompted by his nervous excitement and it quite surprised him. It also startled Isaac. "Please forgive me. It is just that I *have* traveled so very, very far to see you. You see, I am from the future." Wallace was not one to play his cards close to his chest.

Now it was Isaac's turn to laugh. "Oh, this is most ridiculous. Are you a friend of Barrow's at Trinity? It would be so like him to play such a trick. From the future, indeed!"

Wallace's eyes ached at the sight of the papers on the table where Isaac had been working. What wonders must be there about to be born! In any other situation, Wallace would have asked about their contents, but the die had been cast. He had to convince Isaac of the truth of his tale.

But he had to walk a tight line, too. It just wouldn't do to misdirect Isaac's interest away from the calculator and toward the time machine itself! He must do something dramatic, something that would rivet his idol's attention and hold it.

"Yes, yes, I understand your reluctance to believe me. But, look here. This will convince you of the honesty of my words." Wallace pulled the shiny black plastic-cased calculator from his shirt pocket and flipped the power switch on. The array of LEDs glowed bright in the gloomy room as they flashed on in a random, sparkling red burst. Isaac's eyes widened, and he pushed his chair back. Was he frightened?

"As the Lord is my Savior, is it a creation of Lucifer? The eyes of it shine with the color of his domain. Are you one of his earthly agents?"

"Oh my, no! Look here, Master Newton, let me show you that there is no black magic or chicanery involved. It is all perfectly understandable in terms of the laws of Nature. What I have here is an automatic calculator, a device to perform all of your laborious mathematical labors."

So saying, Wallace squeezed the sides of the calculator case together, releasing pressure snap-fittings, and flipped the case open on a hinge at the top. Revealed to Isaac were the innards of the electronic marvel—a tightly packed interior of printed circuit boards, a mass of integrated circuitry, the small LED display, and the sealed nuclear battery. Isaac stared intently at the sight, and Wallace could see the natural curiosity of Newton's great mind begin to drive away the initial apprehension.

"But where are the gears, levers, springs, and ratchets to carry out the calculations? All I see is a black box with lights that glow red—and how is *that* done, where is the lamp or candle to provide the light!—and many little isolated fragments of strange shapes. There is clearly nothing in your box that moves!"

"Oh, it is all done with electronics, Master

Newton! The central processing unit has access to a solid-state memory that contains the decoding logic necessary to implement the appropriate algorithmic processes to provide the answers to the specific requests entered through these buttons. The actual performance of the box is achieved by the controlled motion of electrons and holes in suitably doped semiconductor material under the influence of electric fields induced—" Wallace, still overcome by his excitement, had rambled on wildly without thought of the essentially infinite technological gap that separated himself from Newton.

"Stop, stop," cried Isaac. "I understand only a few of the words you use and nothing at all of their meaning! But it is obvious that for calculations to be performed, mechanical work must be done, and that implies motion. Pascal's adding machine has shown the veracity of that. I say again, nothing moves in the box. How *can* it work?"

Wallace was embarrassed. The mistake of overlooking the hundreds of years of progress after Newton's time was one a child might make. "I am sorry, Master Newton. I'm going too fast for you." Isaac looked at Wallace with a frown, but Wallace failed to see the pricked vanity of the proud Newton. Going too fast, indeed!

Wallace prepared to lay a firmer technological foundation for Newton, but then he froze. It couldn't be done! Newton was a genius, certainly, but the task was still impossible. Wallace would have to tell him all about Maxwell's equations, Boolean algebra and computer structure, electronics, and solid-state device fabrication technology. It was just too much, and besides, there was the danger! The potential time paradoxes of all that knowledge out of its proper time sequence! Could Newton, in innocence, reveal some critical bit of knowledge out of its natural place in history? Wallace hesitated, and seeing the suspicion grow again in Isaac's eyes, he realized he had to do something, *anything*, immediately.

"You cannot deny your own eyes," answered Wallace. "Let me *show* you it works. I'll divide two numbers for you with just the punch of a few buttons. Watch this." And at random he entered 81,918 divided by 123. Poor Wallace, of all the numbers to use, they were the worst.

Within milliseconds the answer glowed brightly in fiery red characters. Wallace looked with pride at the result and then, already enjoying in his mind what he knew would be Isaac's amazement, turned his eyes to the great man. What he saw made his spine tingle and the gooseflesh stand high on his neck! Newton had fallen to his knees, with eyes bulging and hands raised as if in prayer.

"The mark of the Beast, it is the mark of the Beast! It is so written in the Book of Revelation—'Here is wisdom. Let him that hath understanding count the number of the beast, for it is the number of man, and his number is six hundred threescore and six!'"

Rising to his feet, Newton fell back into his chair. "Your cursed box bears the brand of its master. There can be no doubt now, it *is* the creation of the fallen archangel!"

Wallace was aghast at Isaac's violent reaction. The 17th century genius had now stumbled backward from his chair and had grasped a poker from the hot coals of the fireplace. "Wait, please wait! Watch this, I'll multiply two other numbers together for you, watch!" Wallace quickly punched in the data, and then the answer gleamed steadily in burning red characters on the LEDs. Isaac's eyes first went wide with fear as he again saw the wizard electronics do their marvelous assignment, and then he shut them tight.

Wallace was becoming desperate—this wasn't the way it was supposed to be! "Don't you *see*—imagine the tedious work, the mind-deadening labor this machine will save you from. And it is yours!"

> *"Struck dumb with confusion at the uncontrolled outburst, Wallace stuffed the calculator into his shirt, grabbed his hat, coat, and time machine, and rushed from the house. He turned back"*

"Yes? But only for the exchange of my soul! That is always the Devil's price for his seductive gifts from Hell!"

As Isaac shrieked these last words at Wallace, he raised the poker over his head. "Begone, you emissary of the Dark World! I know now you must be in the employ of the Father of the Antichrist, but the Lord God Almighty will protect me if I do not waver in my resolve. Begone, or I'll strike your brains out on the floor where you stand!"

Isaac's eyes were wide with fear, nearly rolling back to show all white. Spittle sprayed from his mouth as he yelled at Wallace, who stared in shock at the wild man who threatened him with death.

"Please, please, *listen* to me, please! I beg you to understand—I'm a scientist just like you. The concept of the devil, and all it stands for, is contrary to everything I believe. How *could* I be in the devil's employ when I don't even accept his existence? You *must* believe me!"

"Blasphemy!" screamed Isaac. "Your own words condemn you. To deny the reality of Satan in a sinful world is to deny that of God, too. Now leave my home, you dark beast from hell, or by the heavens above, *I shall destroy you!*"

As he shrilled these words, Isaac brought the poker down in a wild swing that barely missed Wallace's head.

Struck dumb with confusion at the uncontrolled outburst, Wallace stuffed the calculator into his shirt, grabbed his hat, coat, and time machine and rushed from the house. As he hurried into the cold, wet night, he turned back, just once, to see Isaac Newton framed in the light of the open door. "Go, go, you foul messenger from the Lord of Evil! Back into your stinking pit of burning hell-fire! This is a house that honors the Divine Trinity and is no haven for the likes of you!" Wallace rushed away into the blackness, the time machine bouncing unheeded upon his chest.

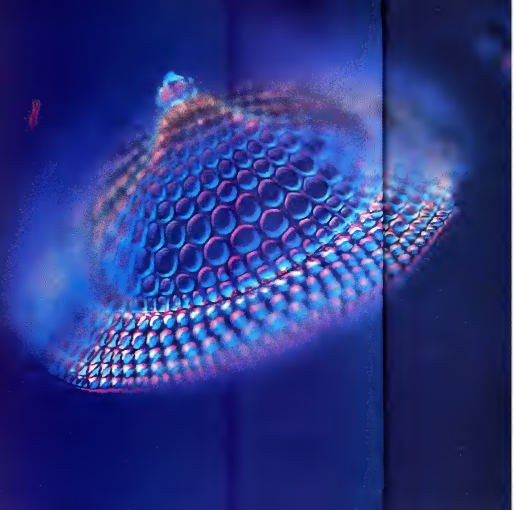
He ran, for how long he couldn't recall, until he fell exhausted next to a stream running heavy with the rain. Tears of rage, frustration, and shock streamed from his eyes. Rejected by the great Newton! Well, damn him! Wallace flung the calculator into the stream in his terrible anger and activated the return coordinates. He faded from Newton's world as quickly and as quietly as he had come.

As for Isaac Newton, after having chased the Devil's messenger from his house, he returned on shaking legs to his desk. Pushing aside his rough calculations on the orbit of the moon around the earth, he swore to redeem himself in the eyes of the Savior. Somehow he had been found lacking and had been tested. And the test was surely not over! He began to reapply his marvelous mind to determine the origin of his failure before the Lord God Jehovah. Taking quill in hand, he wrote the first of the many hundreds of thousands of words that his religious tracts would devour from his allotted time.

Five years later, long after Newton had returned to Cambridge, a group of picnicking children were frightened when a nearby stream suddenly erupted into a geyser of steam. Moments later, as the eruption subsided, the bravest (or most foolhardy) of the boys cautiously examined the streambed—all he found were some twisted, hot pieces of what he thought was a hard black rock, and he tossed them back. The incident was soon forgotten.

Well over 300 years later Wallace John Steinhope reappeared in his own time. He was essentially the same man as before he left—kind, generous, and sensitive. Ready to come to the aid of any man or beast that might need help, he was giving of himself to a fault. As far as his friends were concerned, in fact, he had even improved (naturally they didn't know what had brought about the welcome change, but if they had, they would have applauded it).

Wallace John Steinhope, you see, never again had another kind word for Newton, or for that matter, any words for him at all.



# FRITZ GORO

*The world the scientist sees: photographs from the 40-year career of a "scientific journalist"*

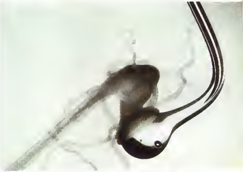
Most photographers are satisfied to make merely beautiful pictures, Fritz Goro sometimes worries that his pictures may be *too* beautiful, entertaining the eye of the beholder while blinding the brain to their scientific substance. Goro has no use for pretty pictures, "exercises in empty aesthetics," art for art's sake. He calls himself not an artist but a "scientific journalist," saying it twice, stressing *scientific* the first time, *journalist* the second. "I will not sacrifice information for aesthetics," he insists. "I do nothing for aesthetic effect. I use aesthetics to reveal realities as they are—I will not beautify or falsify them."

Credit for starting Goro on his unique 40-year career as a science photographer is shared by the Leica camera and Life Magazine, with an assist by Adolf Hitler. With a warrant out for his arrest

BY ANTHONY WOLFF

The single-celled sea creatures displayed on the preceding pages are known as radiolaria

These pages reveal a fresh-water hydra Goro caught in the act of trying to eat a glass rod The sightless creature was duped into demonstrating its unusual table manners—it turns its stomach inside out to ingest food—by coating the glass rod with glutathione a substance that triggers an automatic feeding response



by the Nazis as both a Jew and a journalist, Goro escaped from his native Germany in 1933 with little more than his wife and son and a Leica, the first of the versatile miniature cameras that were revolutionizing photography Goro had been a designer, illustrator and magazine art director and editor, now, homeless in Europe, unable to use his own language he became a photojournalist "Without the invention of the Leica," he says, "I never would have become e photographer in the first place"

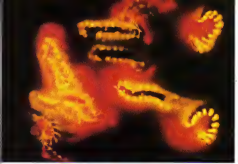
By the time the new photojournalist arrived in New York in 1936 Life Magazine was serving up weekly photojournalism to a public with an insatiable appetite for pictures Goro became a steady contributor, joining the staff officially after the war and staying on until the maga-

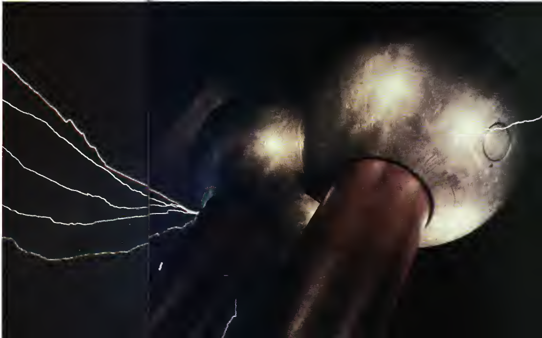
*"Without the invention of the Leica, I never would have become a photographer."*

*I cannot be a scientist. I work as a member of the scientific team*

zine folded in 1971, well past the mandatory retirement age—a dispensation Henry Luce did not even grant himself.

"The school I went to was Life Magazine," Goro says. "It was like being financed on an eternal grant." Under the magazine's loose rein—and loose pursestrings—Goro evolved his characteristic way of working: picking most of his own subjects, devoting weeks, even months, of total effort to each, often delivering no more than three or four stories a year. In 1937, he was on one of his early Life assignments, covering summer stock theatricals on Cape Cod, when he was diverted to the Woods Hole Oceanographic Institute to shoot what turned out to be his first science story. Goro continued to cover other subjects—his assignment list for 1940 includes a piece of frippery on





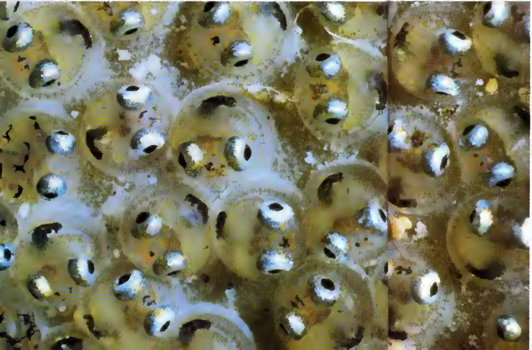
*Goro photographed the towering van de Graaff generator (right) at MIT in 1938. A bioluminescent South American Railroad Worm (top) took its own picture in a multiple-exposure "autograph" when Goro placed it directly on a sheet of unexposed film in a dark room. To make his famous Life picture of a ruby pulse laser piercing a razor blade (above), Goro used smoke from Chinese incense to make the beam visible, then made a time exposure to catch both beam and shrapnel.*

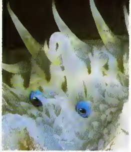
*"I accept only two kinds of compliments—from students and from scientists"*

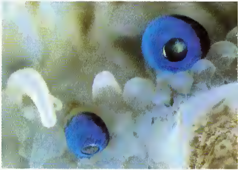
Blondes and Brunettes"—but he became increasingly preoccupied with the latest developments in science and technology.

When World War II ended with an atomic bang, making nuclear physics front-page news, Goro was prepared. For five years, he became virtually a photographer-in-residence at the Pupin Physics Laboratory of Columbia University. His immersion in the work of the physicists was so total that he was accepted as a fellow investigator assigned his own lab. For the bomb tests on Bikini, Goro was not a part of the press corps but a member of the military-scientific task force, on loan from Life to the government—at full salary.

With the same single-minded intensity Goro has continued to range

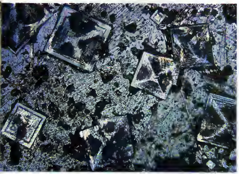






*All eyes: the fish larvae (left) were microphotographed 10 years ago in Jamaica at the Discovery Bay Laboratory of Goro's late son, Dr. Thomas F. Goreau, a noted marine biologist specializing in life on the coral reefs. Just last October, Goro, 77, insisted that OMNI postpone work on this portfolio while he finished an assignment to photograph the incredibly blue eyes of a bay scallop.*

*Goro photographed the undersea, sand-covered limestone formations of the Great Bahama Bank (right) from a blimp on a Life assignment in 1952. Accidently left high and dry on the bottom of an unwashed glass dish, the sea-salt crystals (below) were photographed through Goro's microscope under polarized light. The water drop is hanging from a paper clip (bottom) to demonstrate a do-it-yourself way to make rainbows.*



widely among the sciences, satisfying his own insatiable urge to understand and to explain. Even now, at 77, when he could easily retire to his garden and his grandchildren, collecting Social Security and his Life pension, selling and reselling his rich inventory of past photographs, Goro is still working, more slowly and carefully than before, to be sure, but with undiminished enthusiasm.

Fortunately, Goro's scientific journalism has never depended so much on speed and agility as on "concentration, patience, and low blood pressure," says Goro. "I have the time and the will to work this way. I believe in the work—if I didn't, I couldn't do it. I work without thinking about it, because I like what I do. I think I am very lucky."

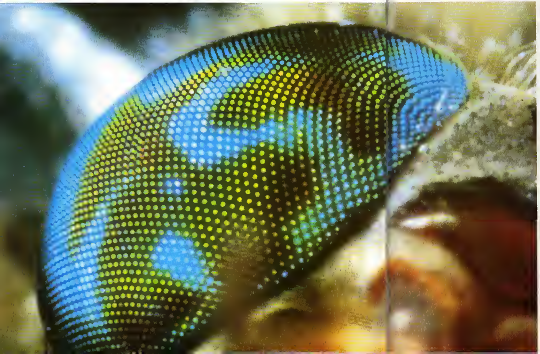
"I cannot be a scientist," he says with a suggestion of regret, "be-

*❛I work without thinking about it, because I like what I do. I think I am very lucky.❜*

*"The school I went to was Life Magazine. It was like being financed on an eternal grant."*

cause I do not have the training." It satisfies him to describe himself, despite his lack of scientific credentials, as "a member of a scientific team." He is probably prouder of his appointments as Regents Professor and Research Associate in Marine Biology at the Scripps Institution of Oceanography—to cite only two of his scientific honors—then he is of the Life Achievement Award he received last November from the American Society of Magazine Photographers.

"I enjoy being accepted by scientists," he admits. "I accept only two kinds of compliments—from students who tell me that they have learned something about science from my pictures, and from scientists who recognize in my work an accurate report of their own." ∞



*Magnified about 300 times, the compound eye of a deerfly (left) is resolved into hundreds of ommatidia, individual eyes, each aimed in a different direction. Because of their talents for reproduction and mutation, fruit flies (above) are favorite subjects for genetic research. The individual fly (bottom) is normal; the "wings-up" specimens (top) have a fatal genetic defect in their muscles.*

FICTION

*It was a sparkling New world—but everyone in it had to pay a price. Everyone.*

# NEW IS BEAUTIFUL

BY TONY HOLKHAM

Eli Blair shuffled uneasily around the room, hands thrust deep in his pockets. The wind shrieked about the house like a hare under an eagle's shadow.

"Build in four dimensions?" the angellike boy, Zodiac, had chortled earlier that day. "Easy. How do you design a cube?"

"I wouldn't bother," said Eli, nonchalantly. "If it was a perfect cube, I would just go ahead and make it."

"Don't get ahead of yourself," the boy cut in. "I said 'design' for a reason. A cube is three dimensions, which you can represent on a two-dimensional surface . . ."

"You mean three dimensions on two, and four on three?" The old man scratched his head. "No, it can't be as simple as that . . ."

The boy looked at him unblinkingly. "You're not going to tell me it's impossible, are you? Or that somebody must have thought of it already?" He shook his head, the golden hair catching the dying autumn sun. "They all say that until someone else patents the invention of a lifetime."

Eli looked sharply at the boy, then picked up a sheet of paper, tearing and folding it to form a rough cube. Twisting it this way and that, he smiled ruefully. "Paper's no good."

"Correct."

PAINTING BY MICHEL HENRICOT

The old man strode to the bookshelf and returned with a glass paperweight. He tipped it from hand to hand, and shook his head. It told him nothing.

"Getting warmer, Eli," said the boy encouragingly.

Eli glared, but inside he was warm with admiration. "Why don't you tell me, you young imp!"

"That wouldn't be so much fun." Zodiac's eyes sparkled. "I'll give you a clue," he relented, closing his eyes and quoting:

Far from the edge of the land,
There lies a shifting a place
In the deep's hand.

His guardian raised an eyebrow. "When did you start learning Zarradine?"

"Ages ago. Last week, I think."

"I'm surprised. But I suppose I shouldn't be," Eli shrugged. "Anyway, that's an easy clue." He turned to the window, to a tank of water wherein there lay motionless a small gray fish. A black dot of an eye swiveled at his approach, and when the old man's hands touched the glass the fish sprang suddenly and ferociously into life, its small needle fangs tapping sharply against the glass. Eli carried the tank to the sink and, in one swift movement, whipped off the cover, emptied out the contents, and covered the sink with a glass sheet. He held the tank over the dryer for a moment, and when he turned back to the boy there were a few beads of sweat on his forehead. "I swear he'll have me one day," he grinned, "but I haven't the heart to have his glands removed. Now," he said matter of factly, "the third cube. What do I do with it?"

"A diagram," said Zodiac simply, "a four-dimensional representation on a three-dimensional surface."

Eli sighed quietly. He shouldn't allow himself to be drawn in like this. He could teach the boy how to behave, but academically. "No more games," he said firmly, selecting a clay pencil from the desk drawer. "Show me."

Zodiac folded his arms, refusing the pencil. "You can't draw on the glass. It's a surface, and a surface has only two dimensions. It's what's inside, the volume, that is three-dimensional." He padded lightly to the cupboard and returned with thread and cutter.

For the next few minutes, the room was silent save for the quiet hum of the cutter and the occasional plop! from the sink. At last Zodiac stood back, a satisfied smile on his face.

Eli studied the result, more struck with its artistic merits than any mathematical significance. "It's clever, but where's the fourth dimension?"

"It's not in *there*," said the boy. "That wasn't the object of the exercise. This is just a design, a blueprint."

Eli shook his head, sitting down heavily. "Well, I'm blowed! And is this what you've been doing at school today?"

Zodiac looked away. "Well, no, not as an assignment, not exactly."

"What do you mean, not exactly?" The old man touched his ward on the shoulders. "You haven't been skipping school, have you?"

"No!" exclaimed the boy indignantly. "When I said not exactly, I meant the others were doing the industrial counterrevolution."

"I see. Now listen to me," said Eli, wagging a gnarled finger. "I pay good pension and guardianship money to send you to a free school, and you—"

"Hold on a minute, Eli," said Zodiac, his voice belying his childish looks. "You said you were sending me to the free school so I could be an individual, like you, and so I am. You can't deny that." He shrugged. "I can learn the industrial counterrevolution any time—I took a video of the lesson—but this dimension problem is on my mind, and it's *now* work. History is *later* work. Don't worry, Eli, I won't let you down come end-of-term exams. You know I won't."

*The boy only needed three hours of sleep now, in a couple of months he would need none. It was hard to believe that only seven months ago Eli had been brought a child who could hardly walk.*

"Okay, okay," Eli held up his hands. "I don't need a lecture. I know it's not up to me what you study, but it's just that I want you to stick to what you start. Then you won't end up like I did, a drifter for the first few years of my maturity. I had a terrible job sorting myself out."

"But you did in the end. If I achieve as much as you did, Eli, I'll be satisfied."

Eli winced melodramatically. "If you don't achieve at least five times as much as I did, I'll take a stick to you." They both laughed, not because they knew he never would do such a thing, but because it was an affirmation of confidence, and it made them both happy.

They left the glass-and-thread blueprint on the desk and sat down at the small table. "I've a surprise for you," said Eli, opening a drawer in front of him and taking out a small package. He shoved it across together with the boy's two sachets.

"What is it?" asked Zodiac, tearing the paper to expose a pinkish pasty material inside.

"Pâte."

"Pâte!" Carefully, the boy dipped a finger into it and raised it to his mouth. His eyes widened. "*Real* pâté?" Most of it disappeared down his throat in a second.

"Steady!" warned his guardian. "You shouldn't have eaten all that. You know too much fresh food'll give you a bad stomach."

"I couldn't help it. It was delicious."

"Well, I'm glad you enjoyed it. I don't suppose it'll hurt you—can't have been more than ten grams."

Zodiac licked his fingers for the third time. "Can I give the rest to Willy?"

"Yes, but be careful. He prefers fingers."

The boy slid the glass cover on the sink aside a fraction and dropped in the last lump of pâté. It didn't touch the water. The fish gulped once and returned to the bottom. Zodiac shuddered involuntarily, replaced the cover, and returned to the table. "Why do you still keep him if he's so dangerous? It's a rather one-sided relationship, isn't it?"

Eli leaned back in his chair. "Did I never tell you?"

The boy sat down opposite him and leaned forward eagerly.

The old man closed his eyes. "When I was young, when there were still ships on the sea, I worked in a freighter carrying everything from fabrics to ore from England to North America. On the ship as well was a young, rough-edged Australasian called Aubrey Jones, and he and I became the greatest of buddies. We had a great time, the two of us, raising hell in the ports with brawling and drinking, and suchlike. We were four days out of Liverpool when the war came, and we sat there in mid-ocean, waiting, wondering. A week passed, nothing on the radio, food supplies dwindling. You know your history. After sixteen days and nights of torment, half the crew dead of fear, hunger, or suicide, we heard it was over, so we sailed on to Boston. We survivors got blind drunk that night, and I had quite a job getting us back to the ship. Anyway, I did, and we loaded up and headed for home.

"Well, you could feel the tension on the ship all the way. Aubrey and I tossed all the drink we could find over the side. There was no skipper, just a weird, democratic, vagabond crew, and how we ever made Liverpool I still don't know to this day. But we did. And the first thing we did was to collect our pay and look for the nearest bar. Well, as you know we shouldn't have found one, because it was the New Way, but we did, a little illegal tavern on a back street.

"It was the last night of the century. We hadn't realized it until we'd already downed a few, and of course we were determined to celebrate, if no one else did. But it misfired disastrously. Aubrey managed to get into a fight and killed a man. It cured me because I left the ships and got a decent job. And it cured Aubrey, too, because they sent him to the moon.

"Forty years he got, and forty years he served. He used to write to me regularly, and a week after his release I heard he'd

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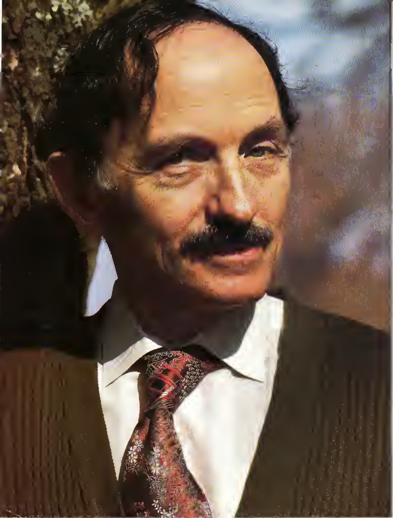
Blechman



Photograph By Pat Hill

*Climate control, communication with extraterrestrials, ultra-intelligent machines, and an end to war are all parts of the future according to this English mathematician.*

# INTERVIEW

# I.J.GOOD

In the early 1960s mathematician I J. Good read a research report stating that the bulk of scientific communication occurred not by the printed word, as most people (scientists included) assumed, but by word of mouth "It seemed to me," said Good "that there was a good deal of spoken material—ideas discussed over a few beers in a pub or in casual conversation—that might have real value but that never became part of 'real science' because it was simply too speculative or controversial " To remedy this Good produced *The Scientist Speculates*, "an anthology of partly baked ideas,' in 1962

"A partly baked idea or pbi," wrote Good, "is either a speculation, a question of some novelty, a suggestion for a novel experiment a stimulating analogy, or (rarely) a classification " To gather these partly baked ideas, Good went to a wide spectrum of scientists and thinkers, among them Harlow Shapley, J D Bernal, Marvin Minsky Isaac Asimov, and Arthur C Clarke Today, some 17 years after the publication of *The Scientist Speculates*, a number of these ideas have become part of the world of "real science."

Irving John Good was born in London and began his career in mathematics at an early age He claims to have rediscovered irrational numbers at age nine, mathematical induction and integration at 13. "I cannot prove either of these statements," he says, "but they are true " He took degrees in mathematics at Cambridge University and went on to do top-secret work for the British Foreign Office on Project Ultra, which utilized a captured German coding device to translate messages of strategic importance during World War II During this time Good also helped to design a large-scale digital computer, one of the first to leave the drawing boards His work on this computer spawned his interest in artificial or machine intelligence, an interest that continues to this day

A 1977 listing of Good's published works itemizes more than 1000 papers, articles, books, and reviews completed in little more than a quarter century The following interview was conducted by *Omni* contributing editor Dr Christopher Evans.

*Omni*: Do the partly baked ideas described in your book *The Scientist Speculates* ultimately find their way into science if they're any good?

**Good**: Not necessarily or at any rate not as quickly as they should. You must realize that there is a good deal of inherent hostility on the part of many scientists to *any* kind of speculation. There are good reasons for this of course. The standard scientific procedure of putting all ideas to a sharp test before they are spread around to the general public has paid off very well in the past and has become entrenched in the mind of the average scientist. The good scientist will always look for an explanation of any unusual phenomenon in terms of what is already known before resorting to far-out explanations. UFOs are a good example. The scientist will lean over backward to show that they're really such IFOs—Identifiable Flying Objects—as aircraft, balloons, meteorological phenomena, and so on before he brings in the notion of extraterrestrial spacecraft. There has also been a long tradition of struggle between scientific and religious organizations—the row over the Darwinian theory of evolution for example—that has tended to make scientists react quite vigorously against statements based on faith alone. This works well in most cases, but it also leads to great unfairness on occasion.

*Omni*: Can you give an example?

**Good**: Well, yes, I think scientists en bloc were very unfair—behaved quite disgracefully in fact—in the case of Velikovsky. He may very well have been wrong in what he had to say, but he was certainly treated badly by the establishment.

*Omni*: In what way? Wasn't Velikovsky a crank?

**Good**: Well, he wrote a number of admittedly far-out books, the most famous of which was *When Worlds Collide*. His claim was that the planet Venus had been ejected from Jupiter at some time in fairly recent history—within the last few thousand years—and that it had passed close by the earth rather like a giant comet, sufficiently close to cause floods, devastation, and the creation of all kinds of legends that are reflected in ancient literature, art, and religious writings. He backed this up with a few astronomical observations such as the famous red spot on the surface of Jupiter which nobody really understands and which happens to be about the same size as Venus. Anyway there was a lot of highly speculative material of this kind, all rather incredible in my view. But the really important point was the reaction of orthodox scientists. When the announcement of his second book was made, a large group of astronomers banded together and threatened to boycott the publishers if they published any more of Velikovsky's books. Now there's no two ways about it. If an editor refuses to publish something in a book or a journal because he thinks it's wrong or unsuitable, that's up to him. But when he is threatened or pressured into rejecting a manuscript against his wishes that seems to me nothing less than persecution.

*Omni*: Have there been other examples?

**Good**: It's hard to give concrete examples because if something has been supressed one simply won't know about it, but a good example is the case of ESP. I'm sure that there are many scientists who are not prepared to admit publicly that they believe in telepathy because they fear the ridicule of their colleagues. By the way, I'm rather dubious about telepathy myself, but I *can* detect overall scientific hostility to it. Of course, it's not true that all scientists are against new ideas. Some of the best tend to be rebellious and welcome far-out ideas.

*Omni*: One of the things that fascinates people is the notion of telepathy. I'd like to ask you, for this interview, to expand your views on ESP—whether you think there's anything in it. And whether you think scientists have gotten anywhere with it. And also whether you feel that the computers might evolve telepathic abilities.

> *I'm sure that there are a large number of scientists who are not prepared to admit to the public that they believe in telepathy, primarily because they fear the ridicule of their colleagues*

**Good**: I'm tolerant, so to speak, to ESP. I think there's a reasonable chance that it is possible. I feel it's odds against. I'm referring to ordinary telepathy.

*Omni*: Any kind of extrasensory perception?

**Good**: Yes. Well, more than precognition actually. I feel that's appreciably less likely than just telepathy. And if telepathy is possible, one wants to ask what kind of mechanism it involves that is consistent with ordinary science. I can only suppose that some kind of a field, presumably not just electromagnetic, sends out waves, telepathic waves, and that individual neurons are very slightly affected. But since we've got so many neurons, there's a cumulative effect. So that my theory for the moment, is that if it's possible it is because the brain is ultraparallel. If that's true, then if it's possible for a computer to have telepathy, it would presumably have to be ultraparallel also.

*Omni*: In other words, you might be able to get telepathic humans, but not telepathic computers.

**Good**: Correct. Unless, of course, you had a kind of biomachine that had organic materials in it that in some sense resembled protoplasm. It may be the chromosomes. The chromosomes are wound up like a slinky toy, and they may vibrate like a slinky does in response to these waves.

*Omni*: So it's still a kind of physical transmission—with a sending system and a receiving system?

**Good**: Yes. I'd call it physical. But once again, it's a semantic point. If you want to call it nonphysical, you can. If it was possible to simulate this field with man-made stuff—I won't call it a machine because it has biological organisms in it—is it still physics? I'm not sure that even Wigner would agree that it was physics, you see.

*Omni*: You say that you're receptive to the notion of telepathy, presumably because you don't feel that we know enough about the universe to say it couldn't exist. But how do you feel about the kind of evidence for telepathy or alleged evidence for telepathy that comes out of laboratories?

**Good**: Well, let me just prefix my answer to that with something about physics. There are new fields in physics that people didn't know about. I remember when I first encountered magnetic fields. I was about six years old and I couldn't believe it. I thought I was being tricked. Well, in addition to magnetic fields there are now so called strong and weak interactions, which are just mysteries to the ordinary man in the street. But they are distinct fields. They are not the same as gravitation. They are not the same as electromagnetism. They are new fields. Well, if physicists have discovered two new fields of force, two new kinds of fields of force in the last few decades, then that makes it not at all far out to assume there's yet one more, which is telepathic.

*Omni*: But let's get back to the laboratory evidence.

**Good**: The laboratory evidence seems to me to be rather weak, primarily because of the difficulties of repetition, reproducing the experimental results. Also there are suspicions of cheating. I don't know how fair those accusations are, so perhaps I ought not to say more about them. Unfortunately the chance that someone working in that area will cheat seems somehow larger. There are more charlatans in these areas than in ordinary scientific work. And yet we know that there has been quite a lot of cheating even in traditional scientific work. There was some correspondence—I think it was in *Science*—recently on this topic. A number of examples were given. The so-called missing link—one of them was fabricated, for example.

*Omni*: So what you're really saying is the lab work doesn't look very good. Don't you feel that is a great weakness? That if these fields existed, if this communication method was there—and presumably it would have to be useful to be there—it shouldn't be so difficult to pin down?

**Good**: Well, yes, it is a weakness. But not an overwhelming weakness because one can well believe that telepathy only occurs in a state of emotion, for example when certain rather exceptional conditions of the mind occur, which they haven't been able to pin down in the laboratory. One's always hearing stories. I heard one only about a week ago of rather remarkable events that occurred. A friend of mine had actually invited a number of people around to discuss parapsychology. He himself is a scientist. As they left it was night and they looked up at the sky and said, "I wish I could see those stars properly. It's a pity the lights are on." And the lights in the garage went off for 15 seconds, then came on again. If it was a coincidence, which presumably it was, it was a very remarkable coincidence. Five hundred years ago it would have been accepted quite definitely as a religious happening.

*Omni*: If you say it's not a coincidence but a causal happening of some kind, it seems totally pointless and trivial.

**Good**: Well, except it might be an indication from the powers that be that there's something in it. It's always done through a glass darkly this information. From time to time you get these minor miracles which might open your eyes to some religious truth. And yet they are never overwhelming. This may be one of the reasons why we can't pin down telepathy. It's a terribly glib theory, that god or something like god just wants to give us some indication that there's something in it, but doesn't want us to be able to prove it completely, because then we won't have the free choice of believing or not believing.

*Omni*: Could this be the same kind of reason why when the evidence is so weird and inconsequential, that I keep getting this little strain that possibly there could be something in UFOs? How do you feel about UFOs for example?

**Good**: There again I think there might be something in it. But if I had to bet I'd bet against. Yet if there are extraterrestrial beings who don't particularly want us to believe in their existence, to know their existence, you might say "Well, in that case, why do they allow these people to see them?" It might just be that they know we're not going to believe it officially. They know from previous experience, or from an understanding of human psychology that they're not seriously disturbing the human preserve, as I call it, or the human zoo. They're not seriously perturbing our civilization by allowing us to see these UFOs because they know that officially we're not going to accept it.

*Omni*: Would you say they had the wrong estimate of our intelligence? Why not simply avoid sightings completely? That presumably would be the easiest thing. There are all kinds of possibilities here, aren't there?

**Good**: Yes. One is that they want to come close enough to observe the world and therefore they have to be seen. That's the most natural explanation. Or they might want to break it to us gently, that they exist because at some stage in the not very remote future, we'll be invited to join the cosmic club.

*Omni*: It's been sixteen years since *The Scientist Speculates* was published and some of the speculations should by now have run their course. Looking back, can you identify any that seem to have paid off in one way or another?

**Good**: Well there's plenty that have paid off, though not necessarily for the person who put up the original speculation. One scientist suggested that there should be a kind of clothing that would make women look smooth on parts of their anatomy other than their legs. He proposed what he called "Nylon uppertights" to replace stockings, and in this way could be said to have anticipated pantyhose. More seriously, there was a proposal for a fantastic new aid to dentistry. The idea was that one should somehow produce giant magnified images of the inside of the person's mouth on which the dentist would operate. The movements he made would be coupled to a microminiaturized drill that would then make the appropriate operations on the patient's teeth. One could do delicate dental surgery in this way and of course the technique could also be adapted to brain surgery. The idea seemed absolutely fantastic fifteen years ago, but now with holographic 3-D projection, one might well be able to generate such giant images. And with tiny computers and advanced electronics perhaps the coupling to the miniature drill might also be achieved in "real time"—to use a computer expression.

> *The most exciting thing about tachyons, particles that travel faster than light, is that they make precognition possible, a part of established physics. Not proved, you' understand, just possible*

*Omni*: Any others that come to mind?

**Good**: Yes. There was an interesting remark made by Professor Colin Cherry of Imperial College, London about motorists and their bad, almost crazy driving habits. He claimed that the problem was really that people were unable to communicate with one another in the normal humanlike way when driving and as a result they reverted to behaving like animals. His point was that the main difference between men and infrahumans is that men can speak to one another so when speech ceases men behave like infrahumans. He proposed that a solution might be to allow them to communicate directly with each other by radio, and of course today we have the CB radio craze though whether it's done anything to cut down on the number of accidents is another matter. If Cherry was right, it ought to have. And there was a proposal to solve the world's food problem—not so widely recognized as being a problem at the time—called "Steak from Sawdust." It was really a clever realization of the fact that we ought to be able to convert wood or wood products into edible proteins, and indeed there's now quite a bit of work going on along these lines.

Then there was a little notion of mine which I called "Natural Rejection," which was perhaps only a good name for something that may have been familiar to some biologists already. This was the notion that if an ability is not used by a species it drops out of the system because there's no point in carrying the additional machinery for producing that ability. And since then Linus Pauling has used, without acknowledging me—I don't suppose for a moment that he knew of my suggestion—that idea in his book on *Vitamin C and the Common Cold*.

He pointed out that sometime ago our ancestors, apes or gorillas or something like that, used to eat an enormous amount of vitamin C in the form of vegetables and fruit. And since these were available, we lost the ability to synthesize Vitamin C. That would be a perfectly good example of natural rejection. He did refer to the same kind of mechanism.

*Omni*: Would this be a parallel process in evolution, parallel natural selection—another form of molding force in evolution?

**Good**: That's right. You could call it natural selection, but it's more descriptive to call it natural rejection. The animals—for example, lizards—who live deep in caves become blind. These lizards have a slight advantage over those that can see, if sight is no use, because they don't need the genetic information. It's just useless information.

*Omni*: But do they get something else in place of it? Because if the genetic code can carry a certain amount of information and carry it properly, either they ought to have some other kind of sense or they ought to be stronger or perhaps better able to go without food.

**Good**: The idea is simply that it's useless luggage. It's difficult to prove that something better was substituted. One just doesn't know enough about the chromosome to be able to demonstrate that. If the lizard's eye had become something else, if it had become sensitive to infrared, which perhaps was available in the cave, that would have been even more striking. That would have been both natural selection and natural rejection at the same time.

And in the rather peculiar area of subatomic physics there was some discussion in the book about backward movement in time and faster-than-light particles, and of course since then the tachyon has appeared as an important concept in particle

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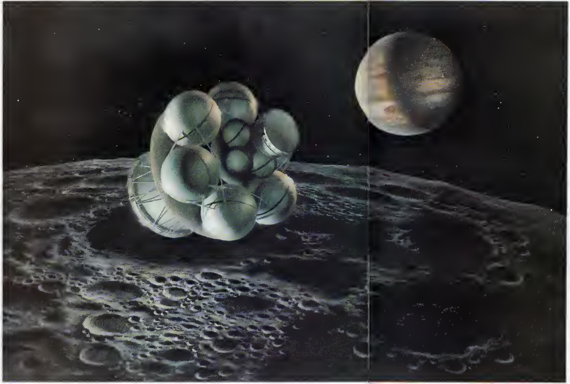


*A computerized fusion rocket, shown before launch in orbit over Callisto, could be the closest men ever come to exploring deep space and the stars beyond*

*We could build it before the next century ends—a ship that would take us to the nearby stars*

# THE FIRST STARSHIP

BY OWEN DAVIES

Callisto Base
Planet Jupiter
26 August 2075

My darling

It's 2330, and after nearly 12 hours of running the final prelaunch checks (or watching the computer run them) I should be tired I'm not No one here or at the Jupiter fuel depot will sleep tonight How can anyone sleep, even on earth knowing that before noon tomorrow Houston Standard Time our first starship will be on its way?

Daedalus is on the other side of Callisto now I'll go to the observation platform in a few minutes and hope to see her as she passes over the base There isn't much chance of that One hundred ninety meters of metal gets pretty lost out there There'll be even more space to lose her in between here and Barnard's Star—nearly six light-years of it

I keep wishing a human being were going After 20 years of working on this trip one of us ought to be able to take it Someday we will For now I guess I'm just as glad it will be an artificial mind

PAINTING BY DON DIXON

piloting through all that vacuum Who else could stand 50 years alone in space?
More later Love

A letter home much like that one could be sent well within the next century In a hundred years, plus or minus a few, a star ship will take form somewhere in space, very possibly in orbit around Callisto, one of Jupiter's larger moons

A rough outline of the first interstellar flight has already been drafted, more as a feasibility study than as a concrete plan It didn't emerge from NASA's gleaming offices, nor from some academic sanctum in the Soviet Union Even the advanced theorists at Pasadena's famed Jet Propulsion Laboratories (JPL) can boast only an "interstellar precursor mission" intended to travel less than half of 1 percent of the way to the nearest star Credit for the first detailed study of an interstellar flight goes to the dedicated amateurs of the British Interplanetary Society (BIS)

Called Project Daedalus after the fabled Greek craftsman whose wax-and-feather wings carried him from Crete to Sicily while his son Icarus crashed into the Mediterranean and drowned, the BIS plan projects an unmanned flyby of Barnard's Star, 5 9 light-years—50 000 billion miles—away The project's planners think the information gained will be worth the 80 years such a mission would take

Barnard's is an M5 star, a red subdwarf less than a fifth the diameter of our sun and barely one sixth its mass It is much colder than the sun and possibly much older There is evidence, though disputed, that Barnard's Star has at least one planet, perhaps two

This one mission could tell us more about the evolution of stars and the formation of planets than any number of theories," declares project leader Alan Bond And though Barnard's Star is small and cold compared with our own, its age suggests that if there really are planets, life may have evolved there as well "

In spite of that Barnard's was only the third choice for a first mission destination, according to Anthony Martin, editor of the BIS journal There is a greater chance of planets, and life, at Alpha Centauri, a two-star system only 4 3 light-years away Alpha Centauri A, after all, is a G0-type star nearly identical to our own sun But of the eight star systems suspected of having planets, six are red dwarfs And any starship that can make it to Barnard's Star should reach Alpha Centauri with ease

It won't be easy, however At launch, the two-stage Daedalus rocket would be an ungainly-looking craft with fuel tanks clustered like grapes at midsection an open-framing aft, and a flat-nosed canister at the front Over 190 meters long and weighing more than 54 000 tons, it would take 20 years to design and build

Falling first into orbit around the sun and reaching solar escape velocity two days after launch, Daedalus would accelerate for nearly four years, eventually reaching a velocity of 12 percent of the speed of light At that rate, it would take nearly 50 years to coast to Barnard's Star then pass by its target in only ten hours

Ahead of the ship protecting it from meteor damage, would be deployed a cloud of dust, 500 kilograms of matter as fine as tobacco smoke At its tremendous speed, the dust would vaporize objects of more than half a ton

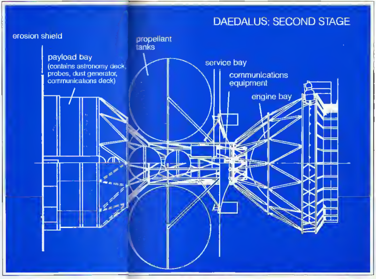
Some 500 tons of the spacecraft would be payload, a vast array of tv systems spectrometers, radiotelescopes, magnetometers, particle detectors—instruments to measure virtually any facet of a star or its planets Five independent probes would carry detectors a few thousand kilometers from the ship's radiation and particle emissions to study interstellar space free of interference Eighteen powered, disposable probes would be deployed near Barnard's Star to examine planets and other phenomena beyond the parent vessel's reach Five of the encounter probes would be specially designed to study gas-giant planets similar to Jupiter (It is this type of planet whose presence at Barnard's Star is most strongly suggested by telescopic data ) Three would be tailored for terrestrial planets The remainder would be assigned to stellar physics or held as replacements for probes that malfunction or are destroyed

Cut off from earth by the years-long delay in radio transmissions on-board computers would coordinate the entire mission Enormously more powerful than any data processors now in existence the computers would repair the ship, acting through mobile robots known as wardens decide what experiments to perform and even choose what information to send back to earth

The limiting factor is power Bond and Martin studied propulsion systems ranging from vast sails driven by the force of an immense laser in earth orbit to ramjets that scoop interstellar hydrogen into fusion reactors Some were far too low powered Others assumed too much technological progress

Bond and Martin's conclusion "The only propulsion system we know of today that might, by using projected technology for the early 21st century yield interstellar flight is the nuclear pulse rocket "

Adapted from today's experiments with fusion electrical generators the BIS engine would inject a pellet of thermonuclear fuel into a reaction chamber, hitting it simultaneously with an array of high-powered electron beams The beams would heat and compress the pellet with the force of an atomic blast touching of a small fusion explosion The hot, conductive ball of exploding plasma would then be swept out of the reaction chamber by an intense magnetic field, driving the rocket forward Electricity to power the electron beams and magnetic field would be plucked from the exhaust plasma by a magnetic induction coil




around the chamber's exit The tiny fusion bombs would be detonated

The BIS concedes that before any such scheme can work, some formidable technical problems will have to be solved "I think the most difficult problem in the rocket itself is going to be the extremely high voltages we need to make it work," says project leader Bond, who, when not working on Society business, is a fusion researcher for the United Kingdom Atomic Energy Authority

"We've sent copies of the report to a number of physicists, hoping they could tell us how to control these potentials—up to 250 million volts—or reduce them to workable levels So far, no one has been able to "

Acquiring the right fuel will prove even more challenging To avoid production of neutrons that would soon destroy many of the spacecraft's electronic components, and eventually the engine itself, the BIS has decided not to use the deuterium-tritium reaction on which all current fusion experiments are based Instead, they have settled on the fusion of deuterium with an isotope of helium, $^3He$

"The reaction products are all charged particles that can be directed into the exhaust ... so all reaction energy may be utilized," Martin and Bond explain in their report Few neutrons are produced, so the need for shielding is nearly eliminated The $D^3He$ reaction is hard to ignite, however That is why the electron beams require such high voltages

But the real problem is that helium-3 makes up less than one part in 10,000 of natural helium It can be made, but the only process now workable is so expensive that the isotope costs more than $20,000 per kilogram

Fusion processes are possible in theory, but Daedalus requires 30,000 tons of helium-3 Given 20 years to manufacture it, even the most efficient method would create as a byproduct enough electricity to supply the energy needs of the entire world Another possible reaction would yield 15 times that!

According to Robert C Parkinson, who studied propellant sources for the Daedalus project, that leaves only one alternative Go where there is enough helium to make extracting a rare isotope practical. Go to the skies of Jupiter and set up helium factories

Fully 17 percent of the Jovian atmosphere is helium, Parkinson points out Deuterium, of which Daedalus needs 20,000 tons is also abundant In theory, it should be possible to collect both propellants at once

What Parkinson envisions is a fleet of hot-air balloons each more than 180 meters in diameter Heated and electrically powered by an advanced fission generator, the balloons would carry isotope separators and propellant storage tanks capable of processing roughly 680 kilograms of Jovian atmosphere per second In 20 years, 128 such factories would be used Every hundred days or so the purified helium-3 and deuterium would be picked up by a Shuttle-like transport and carried into orbit

There are still a few small bugs in the system, of course For one thing, Parkinson points out, the reactor would take much too long to inflate the balloon And if the balloon was dropped into the atmosphere it still wouldn't be able to support the factory when it plummeted past its supposed operating altitude

Then there are the chilly Jovian breezes "Horizontal wind speeds of up to 90 meters per second have been observed" in the Jovian atmosphere the Daedalus report notes This translates to a little over 2100 miles per hour "The detailed behavior of the aerostat within natural turbulences that may be present deserves further study" the report imperturbably concludes

Parkinson does suggest one possible alternative to balloon-lofted Jovian factories He points out that Titan, Saturn's largest moon, is the only satellite in the solar system that possesses a substantial atmosphere Titan also has enough gravity and air pressure to permit construction of manned factories that could work almost round the clock, yet not so much gravity that lifting fuel to an orbiting spacecraft would be prohibited

Scientists outside the BIS, though generally cordial to the amateur effort are often skeptical of the assumptions behind the rocket's design After all, as long ago as 1965, the Soviet Union evaluated suggestions for nuclear-powered interstellar rockets and pronounced them impractical "It's exciting that anyone has done this kind of study at all," comments Dr Gerald Yonas, head of particle-beam fusion research at Albuquerque's Sandia Laboratories "In general, I thought they did a good job "

When it comes to the specifics of pulsed-fusion drive, however, Yonas grows more critical "Our most optimistic estimate is that it will be 2010 to 2020 before we get a demonstration inertial-confinement generator operating, and that is for a deuterium-tritium reaction The helium-3 reaction they are talking about is so much harder to ignite that I couldn't begin to guess how long that will take

"And this rate of 250 detonations per second is much too high Even if each explosion is equal to only a ton of TNT, you're talking about 250 tons per second My engineering intuition tells me you might get away with ten per second, but 250 is just unbelievable "

For all that, the Sandia physicist finds the Daedalus report extremely welcome "This could be very important in getting fusion generators accepted" he says "We talk to power-company people about it and they say, 'You're going to have explosions in my plant? Forget it! Don't even talk to me!' When we talk to rocket people about fusion explosions several times a minute, they say, 'Great! That's just what we need ' This could eventually be a very useful demonstration project "

He adds, though, that "we'd need to do it much sooner than they are talking about The year 2050 would be much too late for our purposes "

As an aside, he adds that the Daedalus power plant is a little behind the times "Velikov, of the Soviet Union, has proposed that you throw a ball of lithium at the pellet just before it explodes The lithium would absorb most of the neutrons and convert them to useful energy with high efficiency The lithium would become part of the reaction mass, and it could be driven through a magnetohydrodynamic generator to provide electricity"

Dr Leonard Jaffe, a theoretician at Jet Propulsion Laboratories, is just as impressed by the effort and just as skeptical of the conclusions "Mining Jupiter is an extremely ambitious enterprise" he observes with a chuckle. "It's certainly thinking large and imaginatively"

Freeman Dyson, professor of physics at Princeton's Institute for Advanced Studies and one of the nation's most far-ranging theoretical scientists, was, with bomb designer Ted Taylor, one of the originators of Project Orion, a mammoth interstellar vehicle propelled by repeated fission explosions. Speaking of Daedalus, he says that "I don't see any fatal flaws in it. I'm willing to agree that the technical problems will be solved.

"There are many things in it that would be expensive and difficult, however. The whole idea of using helium-3 makes it very much harder. I don't know whether you'd want to do it that way."

"What worries me is that Project Daedalus may give the public the impression that interstellar exploration is much more difficult than it really is. There are many well-known technologies that would get you there. A simple fission reactor with a plasma rocket will do it if you don't mind having it take a while.

"Take this idea of mining Jupiter for fuel. Maybe you could do it that way. I would hate to have the public believe that you could not produce a workable interstellar probe except by that kind of effort. There are too many easier ways of doing things."

For their part, Dr. Jaffe and his colleague Harry Norton have been planning a trip to Pluto and beyond in the year 2000. "Star missions are just not feasible in the near future," Dr. Jaffe believes. "What we can and should do is build an unmanned probe with a range of 400 to 1000 astronomical units. [1 AU = roughly 93 million miles, the mean distance from the earth to the sun. Pluto will be about 30 AU away in the year 2000; Proxima Centauri, the nearest star, about 270,000 AU.]

"We looked at 50 or 60 concepts for an interstellar drive and finally settled on a nuclear electric system. The propulsion unit would be an ion drive powered by a 500-kilowatt fission generator and using mercury as the reaction mass," the JPL physicist projects. "The generator is only a modest advance over what is available today and the ion drive could be developed within ten years, with enough effort."

The spacecraft could be placed into a low earth orbit by an advanced version of the Space Shuttle, turned on, and accelerated to solar escape velocity. Thrust would continue for about eight years for a one-stage rocket, nearly 12 years for a two-stage probe.

The payload, he says, would include a 1500-kilogram Pluto Orbiter that would provide the first detailed look at the outermost of the classical nine planets. The real mission, though, would be to study interstellar space, measuring low-energy cosmic rays blocked by the sun's magnetic field, locating the "heliopause," the point where the solar wind dies out, and checking the density of gas and dust between the stars.

In addition, measurements of stellar parallax, the difference between a star's direction as seen from earth and that seen by the distant spacecraft, would allow astronomers to work out the distance of far stars with much greater accuracy than is now possible. This would both reduce the error in estimates of stellar energy, a topic theoreticians find fascinating, and improve interstellar navigation.

Dr. Jaffe is no more sure that his spacecraft will ever leave orbit than the BIS is of Daedalus. "Even the year 2000 is a long way off," he says. "The general feeling here is that we can wait until there is more money for it."

A third proposal for an interstellar mission comes from Dr. Robert Forward, a senior research scientist at Hughes Research Laboratories, in Malibu, California. The idea is to use a gigantic array of lasers

*"Twenty years to design, two decades to mine fuel on Jupiter, then 50 years en route. Daedalus mission would yield one day at Barnard's star our first sight of outside planets, perhaps life, would be more than enough reward"*

to push an engineless payload to Alpha Centauri.

"The laser array, probably built in a close solar orbit, would be 250 kilometers in diameter," Dr. Forward says. "This is not as difficult as it sounds. Although the array does have to be extremely wide to achieve the desired beaming distance, the energy flux is not high. In a typical system, the beam is not much more powerful than sunlight.

"The other thing is that the transmitting array does not have to be filled in. The beam does not have to be solid. It can be many separate beams from a whole bunch of lasers in a thin orbit."

The interstellar probe itself would consist of a small, highly automated instrument package tethered to a rigid, flat sail. "The sail can't be flexible like a parachute or the sail of a ship," Dr. Forward points out. "They work only because the air molecules move sideways as well as straight into the sail. It is this side pressure that keeps the sail inflated. A beam of light has no side pressure. It would collapse a flexible sail like poking a stick into it."

When Dr. Forward first suggested the "photon sail" 16 years ago, skeptics instantly pointed to a serious flaw in the concept. There is no obvious way to slow the probe down when it nears its destination. The light beam can only push the probe ahead, not retard it.

A few years ago, however, Canadian engineer Philip Norem offered an ingenious way around the handicap. As Dr. Forward describes it, "the laser array would be used as I originally planned to accelerate the probe up to relativistic velocities, but the probe would not be sent directly to the target star system. Instead, it would be sent off to one side.

"Once the probe was up to coast velocity, it would extend two long, electrically charged wires. The high voltage of the trailing wires would interact with the interstellar magnetic field to swing the probe in a large circle. The probe would be aimed to curve around behind the target star and pass it on the way back.

"At this point, the probe is still moving at very high speeds, but its velocity vector is now pointing back at the earth. Then we'd just turn the laser on again and use it to decelerate the probe."

The system has tremendous advantages over any other propulsion method, the space scientist says. The fuel, engines, and reaction mass—the light itself—all remain at home, so only the payload must be accelerated. And because the laser "engine" is nearby, there is no chance that an irreparable malfunction will jeopardize the mission. If something breaks down, repairmen can go to the orbiting laser array and fix it.

Before it can be used, however, the idea must still pass some tremendous technological hurdles. "The people at JPL are talking about perhaps launching a sail only 1 kilometer in diameter in the next few years," Dr. Forward notes. "That's how far we still have to go to get to the size we need."

The sheer power of the laser array also worries some observers. "People keep telling me we can't build a 35-megawatt laser system," he comments. "Why not? The Saturn Five rocket puts out 35 megawatts. It's a matter of developing the technology."

With that said, however, Dr. Forward has modified his plan considerably. He now believes a more practical approach is to carry along a reaction mass, say hydrogen gas, and use the laser array to heat it. The technical problems of building the laser system remain, but the sail would be eliminated and the probe could decelerate as a normal rocket.

For all his concern with propulsion systems, the Californian believes that the theoretical debate over how best to power a spacecraft may be misplaced. He cites a quotation from Arthur C. Clarke, the noted British physicist and science-fiction writer:

"With so many theoretical possibilities for interstellar flight, we can be sure that at least one will be realized in practice. Remember the history of the atom bomb; there were three different ways in which it could be made, and no one knew which was best. So they were all tried—and they all worked."

Instead, Dr. Forward says, "My philosophy is that when you design an interstellar mission, the first thing you design is the probe. The whole idea is to design the smallest probe you can and still accomplish what you want done."

His ideal minimum-mass probe is what he calls the "Golden Globe." It should weigh, he says, under 100 kilograms.

"As the probe approaches its target, slowed now to well below relativistic velocities, it blossoms from a compact mass into a 100-meter sphere of dense wire mesh studded with arrays of tiny sensors and transmitters. These are close-coupled to complex digital molecular circuitry—IBM is working on molecular circuits now—all held together with high-strength one-dimensional superconductive fibers.

"As it approached a star, the Globe would constantly beam pictures and sensor data back to earth. The sensors would cover the entire spectrum from radio waves to ultraviolet light. Spaced over the surface of the Globe, the sensors would be able to detect objects less than one meter across, even from a 100 kilometer orbital altitude.

"On a planet, the few regions having the best chance of supporting life would be selected and small sections of the sensor mesh would detach themselves from the main probe and be driven down into the atmosphere by radiation pressure from the probe's lasers.

"The probes are little different from the rest of the mesh, except for a few specialized sensors. The whole thing is basically a distributed computer. Each part can do just about the same job as the entire computer, but not as fast and perhaps not with such complex data."

In short, it's a far cry from the 50 tons of payload Daedalus would use to carry out the same mission. How long will it be before a Golden Globe can be built?

"There are three key requirements that remain to be met," Dr. Forward feels. "The first thing any interstellar probe has to do is be semi-intelligent, and we do not have any real artificial intelligence yet. We've been expecting breakthroughs in this field for decades, and they just have not occurred. It could happen any time. The minute we get the concept of how to build an artificial intelligence the hardware to build it is probably available.

"The next question is whether these molecular circuits are going to work. I think the answer is yes, and it's going to be driven very hard by the great effort and large amount of money that's being plowed into making computer components smaller, faster and more reliable.

"The third prerequisite computer designers are at least thinking about now. The traditional way to design a computer is with a central processing unit that handles all the logic and a bunch of peripheral equipment. People are now trying to design computers with many smaller processing units all working in parallel. There are real problems with programming these, but ultimately we are going to have computers where you can take half of it and it will still do exactly the same thing as the whole computer. The Golden Globe is designed this way."

No matter what sort of unmanned stellar mission is finally attempted, the payoff question of when man will journey to the stars will remain unanswered. A little sadly, Alan Bond doesn't think it will ever happen.

"The wardens and central computer will be extraordinarily intelligent," he explains. "I hesitate to say it, but they may well be more intelligent than man when it comes to solving the kind of problems spaceflight will entail.

"We have the opportunity to design a being who is perfectly adapted to the space environment. Man, after all, requires a rather narrow range of temperature, atmospheric pressure, and other conditions. One has to ask why you send a human being at all. My conclusion is that perhaps you don't."

Princeton's Freeman Dyson disagrees. "I don't think of it so much as human beings you're sending," he says. "The important thing we're sending is life itself. By going to the stars in person, we will be helping life spread through an inanimate universe. I don't think you need any more justification than that."

If enough people share Prof. Dyson's view, it seems unlikely that technological difficulties or mere distance will prevent men from reaching the stars. One time NASA executive Oren Micks put it this way: "There are also those who argue that the journey to our nearest star neighbor, which would take 4.3 years at the speed of light, is too long to consider. Truly, we are accustomed to journeys today half way around the world in a matter of hours. We shudder at the thought of a four-year journey.

"We should be reminded, however, that in the past explorers faced such journeys with less trepidation. Marco Polo spent 24 years in his round trip from Venice to China. It is also noteworthy that the Dutch successfully colonized the Indies in spite of the fact that it took them four years to travel there and back."

It comes as something of a relief to note that Bond's view is not part of the Daedalus Project's final report. The Society as a whole has earned a reputation for predicting the future of spaceflight successfully. It was the BIS that made the first practical attempt to design a manned flight to the moon—in 1939. DQ

FICTION

*His burning goal was to win the Olympic slalom race, despite a crippled, chair-bound body.*

# TO RACE THE WIND

BY JACK C. HALDEMAN II

Dan positioned the last of the paste-on electrodes He placed it precisely on the belly of the quadriceps muscle of his left leg Like all serious competitors, he had the electrode locations tatooed on his body A faulty electrode placement could lead to disqualification He had 97 dots on his body 97 wires leading in a harness to the training simulator He was ready

The lights in the apartment were on dim, the windows opaqued The screen on the trainer flickered with gray life as it warmed up He sorted through the cassettes in the file, selected one, inserted it He would start with Yoritomo down run four at Innsbruck, XVII Winter Olympics, 1996 One of the classics

The screen cleared, focused Dan felt the webbing of his Comp III chair tighten He moved his arms slightly, the resistance was just right Yoritomo stood poised at the starting gate A light snow was falling, Dan could almost feel it Yoritomo leaned forward, rocking back and forth against the gate Dan assumed his starting stance, found himself rocking in unison with the Japanese skier Suddenly the gun sounded and the gate flew away They were off

It was a good start Dan strained for speed, his body in the chair unmoving *Dig* with the poles, arms and legs pushing Feel the strain across the chest the tightness of the thigh muscles *Think Think* The first marker is coming up Get set for it Imagine how you'll come out of it in position for the second marker the third Everything is interrelated Like a chess game moves are planned far in advance A mistake at one part of the course might not show up until the last marker Now—dig, pivot, *push*! He felt his body, still held firm in the

ILLUSTRATION BY FRIEDRICH HECHELMAN

Comp III strain to shift his balance lean into the marker Yoritomo's skis kicked up a wall of snow as he rounded the first marker

Dan didn't look at the numbers streaming across the bottom of the screen Elapsed time degree of linkage with Yoritomo probable competition standing at that point on the course He could run it back later study it evaluate his performance For now the feedback circuit gave him all the information he needed When his movements were right when he was in sync with Yoritomo his body felt good the feedback was positive

Suddenly a searing pain shot across Dan's forehead He was slipping had taken that last turn an instant late He struggled to catch up to regain the lost ground The pain lessened as he did

The pain circuit in his feedback system wasn't standard equipment but it had not been a difficult modification to make Most units were built to produce a feeling of uneasiness when the linkage dropped below a certain adjustable percentage But Dan was serious about his skiing, deadly serious He would stop at nothing in his search for perfection His trainer gave pain instead of uneasiness he set the linkage percentage threshold incredibly high

The slalom was nearly over He had caught up with Yoritomo was linked again He was a strange sight in the darkened room face illuminated by the flickering glow of the screen He sat unmoving locked in the webbing of his Comp III chair the machine measuring every twitch of his muscles, every brain wave as he tried to match his mind and body with that of one of the masters

On the screen Yoritomo cleared the last marker poled twice, and dropped into a deep crouch, his body low parallel to the ground He was practically sitting on his heels his arms tucked in poles held behind him at just the right angle This was the part Dan liked best Pure speed The finish line was a blur as they passed it The screen went suddenly blank the monitors stopped but Dan didn't The muscles in his body twitched a few more times as in his mind Dan stood turned sideways and slid to a stop in a fine spray of snow The machine never registered it It wasn't programmed to Dan didn't even realize he'd done it He was that deeply involved

Slowly like a man coming out of a trance Dan punched the machine for a summary The numbers arranged themselves in orderly rows across the screen

Elapsed time 43 76 seconds Right on the nose Degree of linkage 94 673% That late turn had hurt him Final probable competition standing 99 953 That meant that out of ten thousand competitors four or five might have beaten him on this particular run It wasn't good enough not by a long shot There would probably be 50 thousand people at the stadium on Saturday He grabbed the harness and yanked the wires from his body in disgust

He deactivated his Comp III and reached for his brace beside the chair He strapped the metal framework around both legs stood with the aid of a cane Twisting he inserted the back brace and connected the chest and shoulder supports The arm struts went on last He hobbled across the darkened room to the window palmed it clear

Below his apartment the city sprawled like an open sore A thick haze obscured everything at street level It lessened a little as you got higher but even from his apartment on the 38th floor it looked so thick that he felt he could cut it with a knife As he looked off in the distance it dropped off some but it still hid the mountains Just as well he thought If he could see them it would only depress him They were as dead as the cities

He knew all the words everyone knew them Greenhouse effect Jet stream Genetic damage Oxygen exchange systems Man is the only animal that fouls its own nest, chokes in its own wastes He

*"He hit perfectly, going faster than he'd ever gone before Wind whipped his face, tore at his goggles. There wasn't another human being for miles This was truly freedom The snow crunched under his skis"*

destroys everything to make the world a better place to live in It hadn't worked

Sprays that made people smell like flowers or animals in rut had ruined the fragile shell in our outer atmosphere, the shell that had allowed life to evolve on Earth in the first place Furniture spray Imagine 1000 people spraying plastic table tops to make them shine like carefully hand-polished wood Imagine a million a billion people spraying plastic Imagine particles blocking out the sun Imagine a planet choking to death Imagine anything and it couldn't be half so terrible as what had already happened Untold acres of concrete without a single living thing

What was left of the people anyway Dan raised his hand to his face, brushed his cheek with the brace It was lightweight gave support where it was needed was flexible where it had to be A supreme monument to mankind better even than Hoover Dam the fused glass at Los Alamos the Statue of Liberty—gone now corroded by oxides in the air Only mankind could have created something so perfect as the brace Only mankind would have had to

*My great-grandmother took tranks How long? Five years "Oh*

*My grandfather took aspirin all his life He thought it was safe Sorry to hear that*

*My mother ate beef No!" Yes and chicken too "Hormone treated beef with red dyes? Antibiotic chicken?" I'm afraid so Well it's no wonder*

*Look at me I didn't do this I'd rather not thank you*

And so the stories went On and on they went Life was an agony with a twisted tail that snaked back through the generations Dan didn't know a single person who wasn't disfigured or ruined in some way Some were worse than him some better off It was a matter of degree Only mankind could have built the brace How nice

Dan wasn't bitter What he felt was closer to despair Sometimes it seemed hopeless

Dan opaqued the window stood in the semi-darkness listened to the faint hiss of filtered air flow through his apartment So much was being done There were more government projects, it seemed than government agencies It was like trying to repair a broken dam with modeling clay trying to patch a ripped jugular vein with a Band-Aid He missed the mountains mountains he'd never known

He'd seen them sure Once he'd even taken a tour of the Grand Tetons at least the decontaminated parts Of course they hadn't been able to leave the sealed bus but he had seen plenty more than enough He had seen the peaks where never again would there be snow He had seen the gnarled stumps of dead trees There was erosion everywhere Where vegetation wouldn't grow the ground washed away It washed down the streams choked the rivers filled the bays with silt He saw the monument to the last bear It had made him a little sad

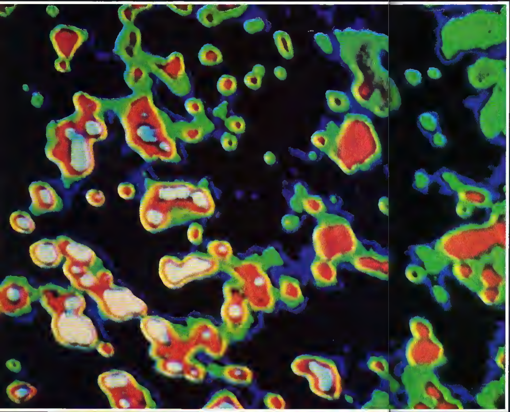
Everything seemed to be heading the way of the bears even the Olympics There were so few things to hold onto these days You found them where you could and when you had them you held onto them tightly He looked at his Comp III chair and the trainer and hobbled back across the room He regretted having removed the wires it would take more than half an hour to hook himself back up He unsnapped his arm brace This time he would go with Mitchell down the slopes at Squaw Valley It was a beautiful run one of the best

Imagine two sloping lines on a graph one going upward, the other steadily falling They intersect at a given point The point is 1976 The place is Montreal Surely you remember Canada

The downward sloping line represents man's harmony with his environment At that point they were still arguing about the ozone layer and the potential damage of nuclear wastes The greenhouse effect and daily radiation background alerts weren't yet part of everyone's lives Although mankind had already passed the point of no return on that particular line they didn't realize it Nothing would happen

CONTINUED ON PAGE 124


SSIIPPP
ARRGHH
PERFECT



# ATOMIC FIRST!

*World's first color films of the atom reveal strange behavior in which the elements flow like water in small atomic clusters.*

These whirling, multi-colored lights are in fact uranium atoms, magnified 15 million times by one of the world's most powerful electron microscopes. Shot by physicists Albert Crew and Michael Isaacson at the University of Chicago, they are part of the first color movie of atoms ever filmed.

"Our plan was to look at DNA and read the genetic code without complex chemical manipulations," Isaacson says. "Since then, we've used it to study catalyst metals that simplify many reactions used in the oil and drug industries."

Smaller than light waves, atoms have no color of their own. This photo's hues are added to a black-and-white picture by an electronic device that translates shades of gray into colors, making variations easier to see. The color of a spot shows the kind of atom or number of atoms in a pile. Each kind of metal shows a characteristic color pattern.

"We hope eventually to identify any atom just by looking at it," Isaacson says. "That is still a long way off." So far, the scientists have filmed only uranium, platinum, iridium, and palladium.

Already, however, the method is yielding surprising insights into the behavior of atoms. "They tend to cling together even when they don't combine chemically," Isaacson reports. "They shuttle back and forth in depressions in the carbon film that supports them, then leap out of the valley. In small groups, they act more like liquids than metals. As yet, we have no idea of how to explain it."

# GOODBYE GRAVITY

*How four million tons of rock atop diamond pillars cancel the earth's pull*

BY DR. ROBERT L. FORWARD

Gravity pervades our entire life, day in, day out, from birth to death. It pulls on our limbs so that each step we take is burdened by its enervating presence. It sucks our bodies into the mud, preventing us from soaring into the skies like birds.

Is there a way to control gravity? Can we somehow find a way to "nullify" the earth's gravity field? Can we possibly arrange for a mass to push us gently away instead of hugging us firmly to its bosom? The answer is Yes. Maybe. Someday. But to control some force in nature, you need to know something about it. You need a theory of how it works, and the more detailed the theory, the better your chances of control.

The first theory of gravity was simple: *Things fall down.*

There is no way to control gravity with this theory. It is merely an observation mankind acknowledged early on. "Things fall down" served the human race well until Isaac Newton discovered a better theory. His is somewhat more complicated: *A mass attracts all other masses.*

With Newton's theory of gravity it's possible to design a simple antigravity machine. This theory served the human race for 300 years until Einstein introduced a better idea. Einstein's theory of gravity is even more complex: *A mass causes space to curve. Other masses move in that curved space.*

Because Einstein's theory is more complex, it gives us more handles

PAINTING BY HANNAH KAY

by which we can control gravity There are at least two ways we can use Einstein's theory to negate the gravity field of earth or make a mass *push* instead of *pull* (these we'll discuss later) Einstein's theory is now serving the human race well and will until a better theory of gravity is proposed

We do not know the correct theory of gravity yet but it surely must include quantum mechanics – the behavior of atoms and elementary particles Einstein's theory of gravity ignores quantum mechanics so it will inevitably be replaced Many brilliant people are now attempting to work out a new theory that will retain all that is true in Einstein's theory and yet add the new features of the microcosmic world of the atom

A new theory of gravity will be even more complex than Einstein's Strange Einsteinian concepts of curved space will be mixed in with the even more exotic bestiary of the elementary particles whose properties include charm and color Yet we should not despair that such theories become more complex because in the distant future those complexities will be the very tools the gravitational engineer uses to invert design build and operate machines that will give us control over our common burden

Let's start with Newton's law of gravity Can we make an antigravity machine using Newton's theory? Yes! We can use Newton's theory to show how it's possible to cancel the gravity field of the earth over a small region of its surface

Newton's law of gravity is *A big mass will attract another mass The bigger the attracting mass the stronger the attraction The closer the two masses the stronger the attraction*

How can we use this law to cancel earth's gravity? One simple way to keep the earth from pulling us down would be to put another mass the same size as the earth above our head Its gravity field would pull us up at the same time as the earth pulled us down and the two forces would cancel each other out You could then float about in zero gravity

This is obviously not a practical solution However notice that Newton says that the attraction gets stronger as the two masses get closer How can we use that?

Consider the gravity field of a rock about 100 meters across If it is very dense rock it will weigh about four million tons Imagine that we could lift that rock up on strong pillars and make a small room underneath it In that room 50 meters from the center of the rock overhead the gravity of the earth would be decreased by the upward gravitational pull of the rock The amount of gravity decrease would be about 10 microgees (10 millionths of the earth's gravity) antigravity of a sort—but not very much

Now suppose we could get closer to the four-million-ton rock If we could get ten times closer or about five meters away then the gravity from the rock would increase to 1 milligee (1/1000th of the earth's gravity) If we could get 50 centimeters away the attraction would increase to one tenth the earth's gravity (0.1 gee) The rock is now beginning to have a significant effect on the earth's gravity If we could get 16 centimeters away from the center of a four-million-ton mass the gravity would rise to 1 gee! The gravity field of the rock is now enough to cancel out the gravity field of earth which has a quadrillion times more mass than the rock

But how do we get very close to a four-million-ton rock? It doesn't work to dig a hole and crawl inside You have to make the rock smaller while maintaining its four million tons of mass That means we have to find a way to make matter more dense than it normally is

We know that dense forms of matter do exist We can observe white dwarf stars which have the mass of a sun condensed into a ball the size of the earth White dwarf densities are about a million times greater than normal star densities We also know that neutron stars exist Here the mass of a sun has been condensed into a sphere 20 kilometers across! Neutron-star densities are a trillion times greater than normal star densities

> *"If you stand near a rapidly moving mass you will find yourself "dragged" along Imagine a "lift" shaft filled with rapidly flowing ultradense mass that quickly zooms you to the top of a mile-high building"*

Thus the key to controlling gravity using Newton's Law is to find a method to collapse ordinary matter to white dwarf or greater densities We can't do it now but someday we may develop the technology that allows us to condense our four-million-ton rock into a ball 30 centimeters across with a surface gravity of 1 gee Even better would be to make it in the shape of a slightly denser disc 40 centimeters across and a centimeter thick Then the 1 gee gravity field from the collapsed rock material would be uniform under the disc We would have a gravity-free volume 30 centimeters across in which we could carry out free-fall experiments on the earth's surface

But now we come to another problem How do we hold the four-million-ton antigravity roof up over our heads? The roof loading works out to 3.4 million tons per square foot It would take a remarkable material to stand that sort of pressure However the material exists—and it is remarkable diamond

How strong is a perfect diamond? Strong enough to help make antigravity possible? Actually the highest pressure ever created in the laboratory was 1.7 million tons per square foot and at that pressure one of the two diamond anvils used in the machine deformed However the other diamond did not Dare we envision a future where one of the attractions at Disneyland is a Space Pavilion rising upward on massive swooping buttresses of pure diamond that support a brilliantly reflecting roof of ultradense matter? And under that roof a crowd of fun seekers swimming through the air with colorful feathered wings attached to their arms—living out the legend of Icarus for the price of an E coupon?

Newton gave us one way to control gravity Einstein's theory of gravity offers a more complicated (and better) description Like a precious jewel Einstein's theory has several different facets to it—we can examine it first from one viewpoint and then from another

One interesting aspect of the Einstein theory is that gravity behaves very much like electricity In our studies we have found that electricity and magnetism are interrelated If you change or move electricity you create magnetism and if you change or move magnetism you make electricity again This effect is used in your automobile The electricity in your battery is only 12 volts not strong enough to run your spark plugs This low voltage electricity is used to create magnetism in the spark coil The magnetism in the coil is then released very rapidly to make the powerful high-voltage sparks that are used by the spark plugs By using the magnetic field as an intermediate step, we have found a way to convert weak electricity forces into very strong electricity forces

Einstein's theory says that gravity behaves the same way It you take a mass and its gravity and move it rapidly you can create a new field the gravitational equivalent of magnetism If you then cause that new field to change or move you can create a stronger gravity field More important that stronger gravity field can be made to appear at a place where there is no mass and the gravity can be made either attractive or repulsive

Conceptually there are a number of ways such a gravity machine could be made One idea is to roll up some hollow pipes to form a long coil somewhat like the curly cord on a telephone We then bend the long coil around until the two ends meet to form a curly closed ring If the pipes are filled with very dense liquid and the liquid is moved back and forth in the pipes rapidly enough then an alternating push-pull gravity field will be generated at the center of the ring If the machine was large enough the liquid dense enough and the flow fast enough we would then have a gravity catapult that could launch and retrieve rocket ships from space by its gravity repulsion and attraction

How big? How dense? How fast?

Well the machine has to be as big as the distance over which you want the gravity field to operate. The liquids have to be as dense or denser than white dwarf material. And the speed of the flow has to be so high that the liquid will approach the speed of light in a few milliseconds. I am afraid that it will be some time before we have all that technology well in hand.

But we do have the theory needed to design our gravity catapult, and sometime in the distant future we may have college courses full of bright young students taking their first course in gravitational engineering. They will study turbulent flow in ultradense matter and produce more and more efficient designs for modulating the gravitational attractor and repeller beam intensities to minimize passenger discomfort during the launch or retrieval of an interstellar passenger liner.

The Einstein theory can give us another way to control gravity. One of its strangest aspects is the concept of curved space. In Einstein's view mass does not cause gravity, mass curves space. What Newton called gravitational attraction is force-free motion in that curved space.

A good analogy is to imagine a rubber sheet stretched over a frame. If you put a heavy ball bearing in the center of the sheet, the weight of the ball will cause a curved depression. If you then dropped a tiny marble on the curved rubber sheet, it would immediately start to roll toward the center as if the large ball were attracting it. But there is no attraction, just force-free motion in a curved space.

The method by which mass causes curvature is difficult to really comprehend. It is as if the mass had grabbed hold of space and pulled the space into it. This grip of mass on space is still maintained when the mass is moving. The space seems to move along with the mass! This effect, called "dragging of the space-time coordinate system," is the basis for another type of gravity machine.

If you are near a rapidly moving mass, you will find yourself "dragged" along in the direction of the mass. One envisions a "lift" shaft lined with pipes full of rapidly flowing ultradense mass that quickly zooms you to the top of a mile-high building. But this effect would more likely be used in space as a gravity catapult for shipping purposes within the solar system. This machine would again be in the form of a ring of ultradense matter, but this time a ring that uniformly whirled from inside out, like a smoke ring. If you entered the hold in the ring from one side you would be expelled out the other side with greatly increased velocity. If you fell in with high velocity from the outer limits of the asteroid belt, you could be gently stopped in earth orbit by simply threading the ring in the other direction.

As unbelievable as these machines for controlling gravity may seem, they at least use a form of matter we *know* exists. However, there are speculations concerning another type of matter, whose strange properties—if they could ever be found or made—would introduce a whole new era of gravity control.

All matter that we see around us with our eyes, with the most powerful microscopes and through the largest telescopes, is called *regular* or *positive* matter. But theories of gravity allow for the existence of an opposite form of matter: *negative* matter. According to such theories, an atom of negative matter would of course repel all other matter (including *other* atoms of negative matter).

Negative matter is not the "anti-matter" you may have heard about. Antimatter is different in its atomic properties (i.e., structure), not in its gravitational properties. When a particle of antimatter meets a particle of regular matter, the atomic bonds that hold each of the two pieces of mass/energy tightly together in the form of solid balls of matter are canceled out. The combined mass results in raw energy, flowing outward in the form of gamma radiation at the speed of light. However, while all this violent atomic interaction is going on, we find that the gravity of both the antimatter particle and the regular particle, as well as the gamma-ray energy that they turn into, always has the same attractive properties that we've talked about.

*"Many brilliant people are now working hard to find a new theory that will contain all that was good in Einstein's theory, but will add the new features of quantum mechanics—how atoms and particles behave."*

We don't know how to make negative matter, but when we do, we'll find that it won't cost us any energy. Since the energy of a particle is proportional to its mass, a negative mass must produce negative energy. So if we succeed in making a negative mass particle, we'll get free energy out of the deal.

One can imagine a futuristic scene in some huge laboratory, where great machines apply intense electric, magnetic, and gravitational forces to a microscopic point in empty space. Energy levels of the machine-generated fields are raised higher and higher until the "nothing" itself is ripped apart—resulting in a ball of regular matter and an equal-sized ball of negative matter.

Once we isolate negative matter, we can start using it to make antigravity machines. But we must be very careful how we handle it. Unlike a chunk of regular matter, which responds to your push by moving away, if you push on a chunk of negative matter it will *come toward you*. The possibilities of such a substance would be mind-boggling; its applications, endless.

Using negative matter, the simplest antigravity machine we can build is to form negative matter into a dense disc and lay it on a good strong floor. If the disc is dense enough and thick enough, the repulsive gravity field on both sides of the disc will equal 1 gee. That negative gravity field from the disc would then cancel the attractive gravity field of the earth. The region immediately above the disc would comprise zero gravity.

A negative gravitational field (i.e., energy emitted by negative matter) can also be used for gravity propulsion. If you place a ball of ultradense negative matter near a similar ball of regular matter (which might be attached to your spaceship), you will find that the negative matter ball will repel the regular matter ball, which in turn, will attract the negative matter ball. These two spheres will then start to move off in a straight line at a constantly increasing speed, the ball of negative matter chasing after the positive matter ball.

"Wait just a minute," you might say. "Aren't you getting something for nothing? First there are two balls of matter, both standing still, and shortly thereafter they are both moving off together at nearly the speed of light—expending no energy to get them up to that speed."

But if you look closely—as ridiculous as it seems—you find that negative mass propulsion doesn't violate any laws of physics. The ball of regular mass gains speed and increases its energy. But while it is doing so, the ball of negative matter is gaining negative energy. The net energy of the two is zero—just as it was when they were standing still.

So far as we know, negative matter does not exist. We *don't know why* it doesn't. After all, if both the positive and negative forms of electricity exist, why not positive and negative mass? Perhaps there is some yet unknown law of physics that prevents it from forming.

But even if we never obtain this magical philosophers' stone of gravitation, we can still devise ways to control gravity with just regular matter if we work hard and use our intelligence.

Gravity control. Is it possible? We think so. It is theoretically possible to cancel the earth's gravity pull and to make a mass push instead of pull. But it will be a long time before mankind can develop the technology to build the tools that will make these theoretical predictions come true. One day, however, the human race (or whomever the human race has evolved into by then) will control gravity as easily as our littlest children now control the powerful forces of lightning with the flick of a wall switch or the turning of a channel dial.

Zap! Instant zero gravity. ◘◘

# SOLAR POLITICS

*Bureaucrats are sandbagging the solar solution.*

BY HELEN DRUSINE

Despite overwhelming popular support, as evidenced by a recent Harris poll showing 80 percent approval, solar energy is still viewed by the federal bureaucracy as an errant stepchild. The Department of Energy, created in October 1977, was directed "to place major emphasis on the development and commercial use of solar ... [and] renewable energy resources." Instead, we have a program that drifts along like a piece of intergalactic flotsam, its direction unknown and its future questionable.

DOE is the third largest federal agency. With a $12 billion budget, it supports 20,000 employees directly and countless others throughout the country via grants and research project funding.

Many experts claim that solar is the safest and sanest solution to America's crisis-prone energy condition, but the potential of sun power is being shuffled into a hold file by program managers at DOE. Their preference about which energy road America should take in the 1980s and beyond has earned them the nickname "The High Priests of Nuclear."

Nuclear energy programs will receive more than $3 billion, eight times the amount being appropriated for solar energy. And $600 million have been earmarked for the development of the breeder reactor alone, a technology the

PHOTOGRAPHED BY DAN McCOY/RAINBOW

*Sandia Laboratory's mirrored heliostats reflect and focus New Mexico sunlight onto "Power Tower" to generate electricity.*

*If the Defense Department would invest only $440 million in photovoltaic cells, costs would drop 300 percent*

President has repudiated because of its nuclear proliferation implications Yet solar will get only about $470 million or 3 percent of the DOE budget The initial administration proposal was for $400 5 million, a *decrease* of 10 percent from last year Carter increased this figure only when it was apparent that Congress would appropriate more than $500 million

With this 'paper gap' between solar and nuclear programs, it's clear that solar technologies will contribute only minimally to the country s future energy needs and become exotic toys more in line with *Star Wars* and the 21st century than with the energy war of the 1980s

Oil and gas now supply 75 percent of our energy needs But domestic production has been steadily declining and the $45 billion a year spent on imports is damaging the economy Long-term reliance on coal is limited by carbon dioxide buildup in the earth's atmosphere Solar energy is nonpolluting, poses little risk to climate and no risk of nuclear weapons proliferation It is safe inexhaustible, it cannot be monopolized, and its daily deliverance does not depend on the whims of foreign countries

Going solar also fulfills E F Schumacher's prescription for technology with a human face " Solar is 'conducive to decentralization, compatible with the laws of ecology, gentle in its use of scarce resources, and designed to serve the human person, instead of making him the servant of machines,' Schumacher wrote in *Small Is Beautiful Economics as if People Mattered*

But politicking is robbing America of this safe, renewable, nonpolluting source And it's no secret who the villains are James Schlesinger, the DOE secretary was a former chairman of the old Atomic Energy Commission and is widely known to favor nuclear energy development over solar energy Carter's top energy appointees are 'unquestionably botching by design" solar research says Representative Richard Ottinger (D-N Y) Several congressmen including Representative Robert Drinan (D Mass ), agree with disgruntled Energy Department staffers who say the only way solar will be aggressively developed in this country is "over [James] Schlesinger s dead body" During hearings last spring before a House subcommittee investigating the federal solar program, Drinan even suggested starting a "dump Schlesinger" movement in Congress

The administration s less than aggressive stance on the development of solar energy is also evidenced by

- Solar Energy Industries Association estimates that 11 million homes will have solar hot-water heaters by 1985 DOE s forecast is only one tenth that many Even President Carter s original target of 2 5 million is being cut to 1 3 million This is less than the goal for California alone, which hopes to have 1 5 to 2 million homes using solar energy by 1985
- DOE s biggest single budget cutback for FY 1979 was a 45 percent reduction in the solar energy heating and cooling demonstration program—from $65 8 million to $36 million Yet experts agree that hundreds of federally funded solar heating demonstrations are still needed across the country to provide consumers builders, and lenders a firsthand opportunity to see cost effective solar heating systems in operation The House Science and Technology Committee added $23 million to the demonstration budget over three years to try and repair the damage
- A 1977 study for the Federal Energy Administration concluded that if the Department of Defense invested only $440 million in the development of photovoltaic cells the cost would drop from the current $15 a peak watt to between 50 and 75 cents

*Workman (left) polishing a parabolic mirror Solar collectors ( above ) produce 32kw of energy to drive an electric turbine/generator system Such huge projects monopolize U S solar budget*

*"Up to five times as many jobs would result from going solar as opposed to continuing with conventional electric power plants."*

within five years. At that price the cells would be cheap enough for widespread use. Congress authorized only $98 million for such purchases in FY 1978. But even that small sum had to be forced "down the administration's throat," says Representative Ottinger.

- DOE's Washington headquarters has 454 employees involved in nuclear energy programs; *only 64* are working in the solar program. Nationwide, the figures are nearly 1800 for nuclear and some 200 for solar.
- Responsibility for solar energy is split between two assistant secretaries—the Office of Conservation and Solar Applications is one, and there's the Office of Energy Technology. Other parts of the solar program are managed by the Office of Energy Research, the Office of Resource Applications, the Energy Information Administration, and Policy and Evaluation. These splits downgrade the efficiency of the entire program, solar staffers charge.
- The assistant secretary for conservation and solar application, Omi Walden, was finally appointed 17 months after Carter became president and nine months after DOE was created. DOE's top solar energy office had been filled with a "temporary" holdover from the Ford Administration who, the General Accounting Office (GAO) found, may have lacked legal authority to continue performing the job.

Despite all odds, however, the solar industry has been growing. New products, for example, are doubling every nine months, according to the Solar Energy Industries Association. Furthermore, according to the President's Council on Environmental Quality (CEQ), solar energy is already a serious option. Passive solar heating, solar hot water heating, the burning of forest wastes for industrial use, electric power generation at existing small hydroelectric dams, power generation at remote sites using photovoltaic cells—all are already financially competitive, reports the CEQ. Within ten years, wind turbines, photovoltaics, biomass fuels, and intermediate temperature systems for industrial and other applications should also be competitive.

Theoretically the sunlight falling on 10 percent of U.S. farmland could supply our total energy needs today. Yet less than 1

*General Electric's project (left) at Sandia uses a group of smaller mirrors to simulate a large one (above), a frame for solar cells.*

percent of all U.S. energy demands are met by the sun. Worldwide, about one fifth of all energy used originates from solar resources, with the majority of that coming from biomass—the production of fuels from wood, dung, crop residues, or other agricultural materials that store energy. By the year 2000, these renewable resources could provide 40 percent of all needed energy, 25 percent of it in the United States alone, according to the CEQ.

"Such a transition would not be cheap or easy but its benefits would far outweigh the costs and difficulties," wrote Denis Hayes, national organizer of Sun Day, in *Energy: The Solar Prospect.* "Every essential feature ... has already proven technically viable. If the proposed 50-year timetable is not met, the roadblocks will have been political—not technical."

The Council on Environmental Quality agrees. Solar energy, it says, is no longer—and in fact may never have been—an exotic and futuristic energy source with no practical significance for the nation's large energy requirements. "It is now possible to speak realistically of the United States' becoming a solar society," says the CEQ report *Solar Energy: Progress and Promise.* "A goal of providing significantly more than one half our energy from solar sources by the year 2020 should be achievable if our commitment to that goal and to conservation is strong. ... [Solar] is in fact our best hope."

Turning to solar energy goes beyond simple economics and desire, however. As Gus Speth of CEQ testified at hearings of a House Government Operations subcommittee investigating the solar program: "If we don't turn to a renewable source, we jeopardize this country's defense, we jeopardize this country's economic base, we jeopardize the health this country has and must have if it is going to survive."

Solar does indeed offer economic advantages. The U.S. could develop an important export market as the acknowledged leader in solar technology, Speth says, thereby reducing our trade deficit and the concomitant decline of the dollar. Environmentalist Hayes believes it could be a successful part of our foreign assistance program and proposes a "Marshall Plan" for solar resources amounting to 0.5 percent of the GNP, or $5 billion. This is not a large sum when compared with annual Third World arms receipts of nearly $28 billion.

The use of solar energy could also substantially affect the nagging unemployment problem. A study by the Council on Economic Priorities has found that capital investment in solar heating systems will generate between two and five times as many jobs as the same expenditure for conventional electric power plants. Senator Edward Kennedy has charged that DOE still does not have the capacity to calculate employment impacts and has not worked closely with the Labor Department in making its decisions.

There are essentially two choices for satisfying unlimited energy needs—nuclear and solar. The choice should not be made on the basis of cost alone. The *kind* of society in which we choose to live is equally important. As Hayes says, if we have to pay more for solar power now, the economic premium for a source of safe, dependable, renewable, and nonpolluting energy is well worth the investment.

The nuclear energy alternative "cannot sanely be greeted with equanimity," writes Hayes, also the author of *Rays of Hope: The Transition to a Post-Petroleum World.* "If the postulated energy demand were met with nuclear fission, about 15,000 large reactors would have to be constructed—one new reactor a day for 50 years. [This would require at least $130 billion in capital investment.] Sustaining these reactors would require the recycling of 20 million kilograms of plutonium annually. Every year, enough plutonium would be recycled around the world to fabricate four million Hiroshima-size bombs."

Several recent studies support the two-option argument. Willis Harman is the au-

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FICTION

# THE HOLE THING

*Two nuclear "devices" were missing, stolen by experts. Their destination—the White House*

BY DEAN R. LAMBE

General Clinton Winsor reread the Telex for the third time, his cigar unnoticed as it quietly tipped from his titanium-alloy Air Force ashtray onto the aged walnut of his desk top. It was a measure of the General's distress that an ash, let alone a scorch mark, was allowed to mar the oiled beauty of the fine hardwood piece that Winsor had inherited from his father. The General's head slowly rose, and he locked eyes with his aide. There was just enough perspiration to add a sheen to Captain Hutton's ebony features as the younger man squinted in the afternoon glare from the south-facing windows and shifted his gaze from the silent insistence of his superior.

In the electric silence, the General finally noticed his errant cigar and growled a quick obscenity as he snubbed it out. "How far has this gone, Art?" he asked as he absently rubbed the scorched spot with his forefinger.

"All the way up, sir. The President's been briefed, and DOD has bounced it back down to us."

"Figures," said Winsor. For the first time since he had been appointed Pentagon liaison to the Nuclear Regulatory Commission, the General seemed to feel how very light the weight of that one star on his tunic was. Suddenly his job was no longer a sinecure, a guaranteed ticket to a second star before retirement.

"And I suppose the whole Intelligence community is falling all over itself?" The General paused while he reached into the top right-hand drawer for another cigar—the drawer that always squeaked. "Naturally there'll be a combined-operations meeting?"

"Yes, sir, in Secure Conference Room B. We're to provide background and description of the materials."

General Winsor grimaced as he clicked shut his cigar lighter. He did not relish the prospect of facing those flint-eyed bastards from the FBI, the CIA, the DIA, and God knows what else, with an explanation of why two nearly operational nuclear weapons had been left beneath the sands of Yucca Flats. Left for years, when the original underground test firings had failed. He blew smoke toward his blue and gold draperies and tried to marshal his thoughts. The whole thing was as incredible as it was terrifying. Somebody, some group, had slipped through the supposedly secure perimeter of the Nevada Proving Grounds, had—somehow, not once but twice—tunneled down almost a kilometer and had left the United States of America nothing but a sandy shaft in exchange for two atomic bombs.

The focal point of the General's blue eyes moved from the tip of his cigar to his aide's face. "All right, Art, we've only got a couple of hours before that damn meeting. Let's tear apart those files even though we both know the records aren't likely to tell us anything useful." As his aide left the room, Winsor elevated his slightly unmilitary bulk from his chair and began to pace. "Shit, oh dear," he muttered, "why couldn't the half-life

PAINTING BY ERIC PAETZ

In the bank of pay phones near the Pan Am counter at O'Hare, the third phone from the left rang twice, fell silent, then rang again. A well dressed, elderly man pushed his predominantly black hair back from his high forehead and answered.

"Emil?"

"Yes, Rudi."

"Phase two complete. The merchandise has been shipped, and the instruments are ready. Janine is in place."

The elderly gentleman put his lined face now softened with a small smile replaced the receiver. He strolled around to the Eastern counter and purchased a ticket to New York. He paid cash. The ticket was issued to a name by which the gentleman was known to only eight other people in the world.

Five minutes later, and two time zones earlier, the pay phone nearest to the Hughes AirWest counter at LAX was answered by a stocky, middle-aged man. The conversation was equally terse, the message similar, and the subsequent actions were much the same. This man bought passage to Dulles International on British Airways, but he also avoided use of the credit cards in his wallet, signing in with a name not known to his mother. Had any passerby guessed correctly—on the basis of his weathered complexion—that he was a mining engineer by profession, it would not have mattered. He had a legitimate business meeting under his real name in Washington, and he would keep that appointment.

General Winsor squinted against the glare of the baking desert sun and the grit of lightly blowing sand. He stared at a large hole in the ground—a tunnel, really, that burrowed at a very sharp angle into the alkaline, siliceous soil. He had not expected to discover anything more profound than this hole, but his presence here was expected of him. On-site inspection. Scene of the crime.

When he and Captain Hutton had deplaned at Indian Springs AF Base earlier that morning, they had encountered a predictable chaos. The auxiliary base was aswarm with uniformed Air Police, and the General had amused himself in trying to guess the identity of the uncomfortable ones who diligently faced the heat in suits and ties. FBI, DIA, Air Force Intelligence, it did not really matter who they were. They might as well be on the moon for all the good they were doing here, all the use they would be once helicoptered to the last—but unfortunately not final—resting places of the nuclear devices. Granted, all those investigators had made some progress in the five days since the ominous holes had been discovered. The method of removal by a seemingly legitimate mining crew was known. But knowledge of how a series of excellent document and ID forgeries, in conjunction with the usual military civilian "not my job" chain of command, had removed the bombs did little to explain where the nukes were now. Somewhere—perhaps now anywhere on the planet—a terrorist group, a band of misfits planning a coup, or maybe even a "freely elected" leader was gleefully polishing two 50-plus kiloton devices. And all the spooks and spies, all of this lofty Intelligence network, were running around like so many hawk-frightened quail, all waiting for the other shoe to drop.

As the General turned away from the uncommunicative hole and boarded the sun-heated copter, he considered the countless dead ends. The initial crisis meeting had lived up to his pessimistic expectations—the rivalries and interagency squabbles had been there in force. FBI had argued with CIA over what kind of cover story was to be disseminated to Interpol and the friendly Intelligence services. The mousy little man from State had made the mistake of inquiring why any cover was necessary, and both FBI and CIA had jumped on him. FBI had said that it was bad

> *FBI, DIA, Air Force Intelligence, it did not really matter who they were. They might as well be on the moon for all the good they were doing here, or at the former resting places of nuclear devices*

form to lie to Interpol—too often, and CIA had claimed that mutual trust on the part of the friendlies was still a very fragile commodity. Finally the quiet young man from the White House had shouted down men 30 years his senior and announced that *the* cover story had been chosen. About 500 kilos of spent fuel rod material had disappeared during transshipment from Shippingport to the new repository in New Mexico, and the kind cooperation of other governments was sought in the event that terrorists might attempt to sabotage water supplies or other civilian targets.

Once the cover story had been agreed, another battle had emerged between FBI and DIA over the source of information leaks. The General had mediated that one. He pointed out that in the early 70s a college kid had designed a quite functional low-yield device solely from publicly available documents—all the kid lacked was the fissionable material. Winsor also had reminded the group that there had been national press coverage when the firing circuits had failed on the second device in 1978. Of course, all warring factions had then turned on the General for a justification of his shoddy security planning, but he had been ready for them—almost. No one had thought it relevant that Winsor had not been the NRC liaison in 1974, when the first device—the neutron bomb prototype—had broken loose from its cables 12 meters above the bottom of the test shaft. Winsor had been prepared for that reaction, but he had not been ready for the open derision that greeted his argument for letting sleeping bombs lie. Even the detailed printouts that his aid had passed around were of little help. Obviously, an entombment under 730 meters of sand and concrete, over 40 kilometers from a patrolled perimeter fence, had proved inadequate after all.

Following a dull meeting with his stock broker, the elderly gentleman entered the lobby of the newly refurbished Continental Hotel. He was handed his room key in a matter of seconds as he was well known to the assistant manager. He then went to an enclosed telephone booth and placed a call to the nation's capital. The content of the call would have mystified both the hotel's personnel and his stockbroker.

"Rudi? Emil here."

"Yes, Emil. Klaus and I will finish phase three in ten hours. Nick is here and is completing work on the instruments. Nick is very pleased with the degree of exactitude in the machining tolerances. Janine has the final timetable."

"Fine. I shall leave for home tomorrow."

The General was exhausted when he returned to his office. The fourth interagency meeting had been nearly as fruitless as the first. In almost two weeks, there had still been no trace of the nukes. Also no unusual activity on the part of the various Palestinian groups, the Red Guard, the Red Brigades, the Red whatevers ... no physicists unaccounted for.

"Do you need me for anything else, sir?" the black Captain asked as he helped Winsor shed his tie and blouse.

The General stared at his uniform with distaste—such sweat-stained disorder was unseemly in the Pentagon.

"No, go on home, Art. Your kids have probably forgotten their daddy."

"Well ... if you're sure ... uh, General, do you think there's anything to what that little rat face from the FBI was saying? I mean, could those weapons still be in the country? God, that would ..."

Winsor wearily shook his head. "Damned if I know, Art. Damned if I do."

The dark-haired gentleman sat comfortably nursing his Gibson in the lounge of the Portland International Jetport. Shortly after 3 PM, a nearby pay phone rang.

"Emil?"

"Yes, Rudi, go ahead."

"The exchange has been made at the warehouse. No delivery problems are expected, and our instruments should make beautiful music. Janine has called to say that she is happy in her new home. Nick

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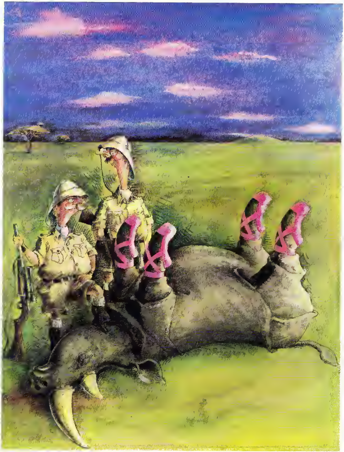

"Four points to you, Fenwick."

# WORLDS BEYOND BUCKMINSTER FULLER

SCIENTIST

Buckminster Fuller Archives

❛ *If we want to examine space technology, keep in mind that we are in space and have never been anywhere else* ❜

*The following statements are from* Worlds Beyond, *a new collection of future views by a spectrum of thinkers ranging from Jacques Cousteau to Timothy Leary Excerpted here are the visions of scientist Buckminster Fuller politician Jerry Brown, and astronaut Rusty Schweickart*

We are already a space colony If we can t make it in this beautifully equipped colony we re not going to make it anywhere else either And we re not going to carry on any space colonies, except by virtue of being colonies from the mother ship If the mother ship can't be made to work the colonies aren't going to work

The universe is technology all biology is technology Anything that operates under cosmic laws is technology The universe is *nothing but* technology We, as individuals represent a most complex technology the total ecology of the interplay of all the biological elements, the sun s radiation, the cross-pollination and so forth, the chemistries we develop on this planet are all part of an incredible preexisting technology

If we want to examine space-age technology we should keep in mind that we are in space and have never been anywhere else

The space-age technology of getting this planet populated is the most extraordinary space age technology that has ever occurred What we've been doing is absolutely childish compared with what nature s already done Space-age technology is something that s always been going on it s a mark of great ignorance to speak of it as if it weren t

There is no independence in the universe Everything in the universe is interdependent The kind of phenomenon we represent—60 percent water, to give us hydraulic compression, distribution of loads, noncompressibility the whole shape—this is an extraordinary piece of structuring We don t know any other planet with water just this tiny bit of water on the surface of our globe, which is almost negligible on a planetary scale

To you and me the ocean looks very deep We are amazed when we can see the bottom at a depth of 20 feet in extraordinarily clear tropical waters If we can swim very well, but it gets any deeper, we start to be fearful But we now know that in some places in our oceans the depth reaches five miles And the average depth of all the waters on our earth is about one mile That seems to us incredibly deep

However our earth is a sphere 8000 miles in diameter And we can visualize this ratio of 8000 to 1 by imagining a steel ball 12 inches in diameter Also imagine that this ball is highly polished like a mirror Now if you breathe on it, the film of condensation from your moist breath would be *deeper* than our ocean

It's important then to keep in mind that the earth is already in space rather than to think of us as going out into space from it All the things that are going on are simply a discovery by humanity of how the universe operates We're gradually getting in a little bit on our own control system We re not

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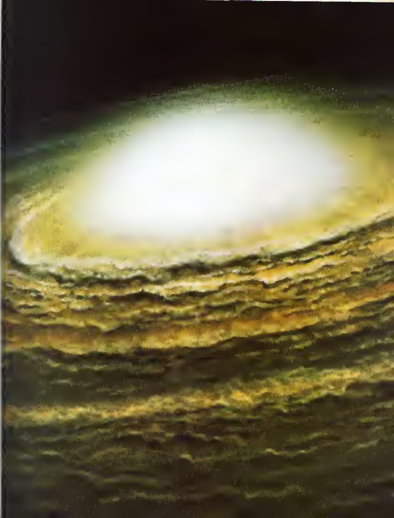
PAINTINGS BY DON DIXON



*The birth of a sun*

# WORLDS BEYOND EDMUND G. BROWN, JR.

POLITICIAN

Zimmerman/Alpha

❛ *When space manufacturing is finally added to the total equation, old economic rules will no longer apply* ❜

As we look at the whole earth and see the thin film of soil and atmosphere that makes life possible, we are struck by the fact that we're in a closed system and there are very definite finite limits to what is possible.

Several years ago, some academics wrote a book about *The Limits to Growth* trying to calculate what was possible given geometric expansion, in the various economies of the world. Although some of their assumptions have been discredited, the basic concern still remains that as we deplete our air and water and resources, stresses are imposed on our society, on our ecology, and, ultimately, on our future survival.

I'm struck by the limits that press in against us, both materially and economically, psychologically and politically. Those limits must be respected, in some cases must be reverenced, when they deal with the natural environment.

But as I look out into space and as I look at the possibilities that an expanding universe (and an expanding exploration of that universe) makes possible, I sense in my own mind not only immediate benefits in a practical economic sense, but—in a far more profound way—benefits for the people of this earth. The earth map is drenched with the blood from a million conflicts over recorded history. We're divided along arbitrary geographical lines, separated into ethnic categories, and divided into various linguistic groups. Yet when we look at the earth and the human species from a few hundred miles up, we can't help but sense the oneness of the human race, this species that has been part of the universe for such a limited period of time.

As we begin to see the possibilities, endless as they are, throughout the entire universe, we can concentrate the creative energies of the best and most talented of those among us here on earth, whether they are monitoring the oceans or the land, protecting the environment, knitting together the human family through transportation and communication and other scientific breakthroughs, or just exciting the imagination. In space, we summon up more energy and more concentrated human talent than in almost any other human endeavor.

The mind of man will develop, will expand technologies. Some of these technologies are destructive, some of them kill millions of people, and some open up untold new horizons. You can't limit the mind of science and technology. You can't limit human beings as they put things together, as they synthesize, as they combine thoughts and information in ways that have never existed before.

As I look at the communications network around this globe, I think of the tremendous practical applications of space exploration. For example, with communications satellites, instructional television, we can take the work in the Mediterranean, at Harvard, in Berkeley, and by two-way communication we can take it right into the ghettos and low-income high schools. We can let young people sense what is possible, if we can just inspire them and summon up

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*An interstellar probe*

# WORLDS BEYOND RUSSELL SCHWEICKART

ASTRONAUT


*❛ I react against the idea that space is a mystical thing. . . somehow the experience itself does something to people ❜*

*Astronaut Russell Schweickart, the first human to walk in space without an umbilical, was lunar module pilot for the* Apollo 9 *earth-orbital flight.*

I really can't speak for anyone else, but at least in my own experience, in reflecting back on it, there's certainly no question that I am today—as a result of my experience of space flight—quite a different person from what I was before.

But in trying to analyze what stimulated that change, or what the process of change was, it was not just the flight. In some ways the flight itself was probably less of a factor than the preparation for the flight. The flight was central, of course, being the actual culmination of all the training, as well as the experience of being there. But then after the flight, the reflection of what it was that I had been through and what I had seen and observed and the integration of that total process—the preflight, the flight, and then the after-flight reflection—were all part of it. It's not something that comes in and commands your attention.

As we moved toward flight, there had been much trouble on the previous flights in adequately documenting what was going on. So many things happened so fast that it was really difficult to take notes, and if one didn't take notes, then by the end of the day you were so filled with information that you began to lose track. So on our flight—*Apollo 9*—we decided to take along a little Sony tape recorder that we could use to record, by voice, information about major maneuvers, tests and results of main engine burns, and things of that kind.

Just to insure that we didn't lose any data, the policy was that we'd change the batteries for each cassette. It turned out that the batteries we carried were adequate for about 1.8 cassette's worth of tape, which meant we still had a set of batteries good for another .8 cassette's worth. We took up with us, on agreement, cassettes with music on them—or whatever we wanted, for that matter—and we could use the .8 batteries for our own entertainment.

I took up two of the pieces of classical music that I used to play on quiet Sunday evenings at home. Unfortunately one of my good friends up there—who will go nameless, but it wasn't Jim McDivitt—didn't particularly care for my brand of music. So, strangely, my cassette of music disappeared until about the ninth day of the flight. I finally found it. At lunch on that day, rather than just eating with the headset on and monitoring the radio as we normally did, I decided to take the earphones off and put them aside, eat lunch, and put the cassette player on the shelf next to me and play the music. I did it almost casually; it was no big deal.

Suddenly, I was transported in a most physical and deeply emotional way back to those quiet Sunday evenings when I was preparing for these flights by going back through human experience. And there I *was*. It brought the reality of being up there back to those periods of preparation and integrated the two. It was one of the most powerful emotional experiences I've ever had. It almost jerked me bodily out of that spacecraft.

Excerpted from *Worlds Beyond: The Everlasting Frontier*.


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*The earth from space*



*She tried to rekindle that sense of wonder, of enigma . . . of shoes, ships and sealing wax.*

# AND WHETHER PIGS HAVE WINGS

BY NANCY KRESS

Three men are walking on the beach below; one of them will be mine.

I stand at the top of the dune, my feet a little apart, braced against the wind. Gritty sand seeps into my leather sandals, and my long blond hair whips around my face, covering my eyes, then uncovering them. I know how I look to the men below, in this bikini-clad body the color of fresh toast.

Soon.

The first man jogs toward me. He is perhaps 30, tall, dressed in jeans and a bulky red sweater with the knotty bumps of inexpert hand knitting. He moves easily, in loose, even lopes that smooth out the rocky ground underfoot, humming an aria off key. I know he will not do. I look away, and he jogs by with only one regretful look back over his shoulder.

As the second man comes closer, I see that he is quite young, still half child, and

PAINTING BY BOB VENOSA

that he is so absorbed in the book he is reading as he walks that he hasn't noticed me at all. He holds the book with both hands, fingers and thumbs splayed to keep the wind from turning the pages. Over the top of the garish dust jacket, an artist's inventive misconception of a spaceship, the boy's eyes are wide, pale blue, the pupils dilated as they move intently back and forth over the page. I can't keep from smiling—certainly not him!

The third man approaches slowly from the opposite direction. He is quite far away. I wait patiently, the bracelet on my arm glowing not entirely in reflection of the sunset over the ocean. He is looking not at the sunset but down at his feet, picking his way over the rocks, avoiding wetting his shoes in the tide pools. Even I can tell they are expensive shoes—Italian?—and that they have been carefully chosen to match his gray slacks and open-neck silk shirt. He frowns at the rocks, lips together, his jowls a bit too heavy and his eyes a bit too red. I touch my bracelet and start down the dune, angling toward the line of high rocks he will cross next. When he is on top of them he sees me coming toward him, stops, waits.

"I wonder if I might borrow a cigarette." My voice is husky low—what I think of as a purple voice. Such men always have cigarettes.

He hands me the cigarette wordlessly, his eyes appraising. They are light gray, startlingly pale against his tan, and very hard. I take the unlit cigarette and drop it, grind it on the rock beneath my sandal and start to run, already changing. By the time I am halfway down the line of rocks, perhaps 30 feet away from him, the scales have already begun to appear on my legs and rump, bright green scales the color of new grass. I dive from the end of the rocks, an impossibly high dive for my starting position, curving in a high arch and hanging there, suspended against the sunset as dancers of ballet—the most beautiful thing I have seen here—seem to hang suspended before the downward plunge from their crackling leaps. By the top of the dive, my legs have already fused to tail, silver green in its backward flip over my bare breasts. I hit the water in a cloud of golden spray then up again for my hair to writhe around me in the foam. I just catch his face in the nanosecond of change from shock to fear, and then I dive again, my tail breaking surface, clear against the flaming sky. This dive is deep, cold, and strong, only the glow from the bracelet guiding me, until I surface in the power room aboard ship, beyond the moon.

• • •

"Good morning, Mr. Carruthers, sir. Twenty-sixth floor?"

"Please, Jerry."

"Good morning, sir. How nice to see you back!"

"Morning, Louise. This the mail? I'll take it in with me."

"Welcome back, Mr. Carruthers. Did you enjoy your vacation away from the office?"

"Very nice, David, see if Mr. Poole can see me right away in my office."

"Certainly, sir."

"Louise, coffee for two."

"Right away, sir."

"Al—good to have you back! So how was the action at the Cape? Lots of sun?"

"Lots. Josh, what's this report I got from Sam Lister on the oil deal? Who the hell came up with those cock-eyed figures on the new shoreline rigging method, and why were they leaked to the press without checking with *me*?"

"I can explain about that, Al."

"I hope so. I *certainly* hope so."

"Let's go into your office. Can we—oh, here comes the coffee already. Right on top of it, as always! Now about the oil figures ... the strategy was—"

• • •

The child is not quite three. He stands behind the tarpaper shack, barefoot on the dusty ground, sucking his thumb. Small night noises, crickets and rabbits and the sloughing of wind in pine, are drowned out by the screaming coming from the shack.

"Lousy bitch!"

"No, no Lew—God, Lew no!"

"Lousy fucking bitch!"

The child looks over his shoulder at the shack. There is a sore on the shoulder, oozing pus the color of rotted peaches. The dull nonexpression on the child's face, in his dark dead eyes, doesn't change until another sound comes from the shack, the thud of fist on flesh and bone, followed by a keening wail that dies away in more thuds. The child yanks his thumb from his mouth and starts to run, legs pumping and the babyish curve of his belly swaying from side to side, until he reaches the dark edge of the wood. He runs into a blackberry thicket, starts to yell, and then abruptly stops, staring back at the shack. The blackberry thorns grab his cotton shirt and wet diaper, draw blood that trickles down his arms and dusty feet in thick, sticky trails. The child makes a low whuffling sound, eeehhh, eeehhh, without hope. His dull face still has not changed expression.

I hop from a clump of ragweed. In the random moonlight my fur is white, except for pink nose and ears and the glowing bracelet where my paws become tiny pink hands. I can feel the absurd white cottontail twitching behind me, rising with each hop and then falling as I sit up on my haunches and use my hands to free the child from the blackberry thorns. He gazes at me and puts his thumb in his mouth. The shack behind us is silent.

I twitch my nose at him, then my ears. I cover my eyes with my hands and peek at him through the fingers. Slowly, reluctantly, as if it is being dragged from him and he will regret it later, the child smiles. His milk teeth gleam in his dark little face. I twitch my nose again, pick a blackberry, and hold it out to him. It is hard and sour, not yet ripe, but he eats it. In the warm darkness his wondering gurgle carries clearly, sharp as a sword.

• • •

"It's the environmentalist lobby, Al, that's the real stickler. Bunch of bleeding hearts, but they're organized, and they've got their votes. Danchell, for one—he needs the support or it's no-go next election, after that Medicaid fiasco in his district. We can get our votes, too, of course—no problem, Cranston's in Washington now—but not cheap. You gotta remember that with the new process the whole shoreline is going to end up a real mess, and everybody's holding out for enough time to ride out the public yelling. I carried those figures *here*, which is why the total might look a little high to you, but I fixed it so it wouldn't to the audit boys, if it comes to that."

"How much shoreline are we talking about, Josh? Exactly."

"Twenty point six miles. On your map—from *here* to *here*. Mostly US Seacoast Wildlife Preserve—a few small fry. No problem."

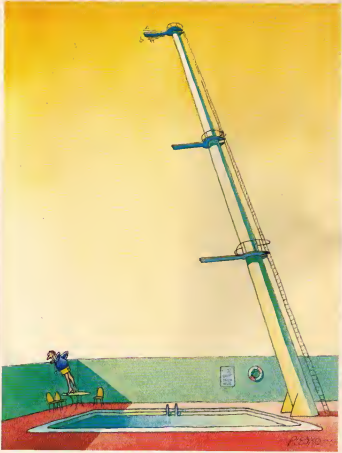
• • •

Picture three successive circles, interlocking but not by much. In the first lies the immediate sensory world—or what *you* think is the immediate sensory world. The warm rain on your bare arm, the elusive smell of lilacs, the bitter aspirin dissolving on your hung-over tongue. Your child in your womb, your woman in your arms, your feces in your bowels pushing downward.

In the second circle lie the systems of your mind, social constructs for creating necessary order. The Town Line Road. Swiss franc, Holy Mother Church, matriarchal lineage, Napoleonic Code, Monarchy, democracy, dictatorship, oligarchy, communism, socialism, Freemasons, Dow Chemical Company, Boy Scouts, Black Hand. *Created* order, as opposed to, say, $a^2 + b^2 = c^2$, which is merely discovered.

In the third circle lie the ambiguities, the questions without answers, the lonely province of poets and mystics. You wake in the night with the warm wind blowing the curtains in the open window and turn over in the darkness. For a second you are aware of the blood in your veins, warm and full, and the strong beat of your heart against

*The dull nonexpression on the child's face, in his dark dead eyes, doesn't change until another sound comes from the shack, the thud of fist on flesh and bone, followed by a keening wail that dies away.*



*"Terrific form, Meyers. Now what do you say we work on accuracy."*

the sheet and you think Yes, but why? before sleep ebbs back in long waves and the question is forgotten Forgotten sometimes until the very end when it seems too late to ask it after all Why here? Why me? Why now? And after now—what? What before? And *how*? Misty questions changing shape even as you look at them, like the bright swirls of color on your inner eyelids that come only from closing your eyes too hard The questions children ask—some children the children who pause in the baseball game at dusk chewing on the soiled thumb of their fielder's mitts to watch the stars come out and wonder The third circle is fluid shifting the 'real' so treacherously underfoot that it becomes dangerous to move and the best recourse is to stand still and wonder letting the believed and the unknown dissolve into each other The circle itself may not even be round

• • •

"Tyler estimates maybe four months five at the outside He'll put the money through Mexico, no problem there But it would be best to be underway by October if possible because OPEC may be shifting its policy then according to what Mahjoub has been feeding us"

Carruthers leaned back in his chair It was a wing chair one of a pair hand embroidered in the rich, discreet patterns of Jacobean crewel With one finger he traced the 20 6 miles of shoreline on Poole's map Rocky most of it, and wild—he'd been there once on vacation

"Josh you ever have something completely inexplicable happen to you something you couldn't account for any way at all?"

Poole lit a cigarette gaining time while he assessed the question It could be an oblique reference to some mistake Carruthers had once made—as a prelude to one of Poole's? The press leak? But he had already pointed out ... or was the question something else entirely, some subtle way of maneuvering, of throwing him off balance so Carruthers could probe for any hidden intentions, weaknesses overlooked threats? Or was it an invitation a first step toward an alliance against some coalition Poole hadn't yet seen forming but Carruthers had? But a man who needed an ally was a second choice to be one himself Always try to ally yourself with the already unshakable

Finally, Poole said cautiously, "How do you mean 'inexplicable.' Al? Did something happen up at the Cape?"

• • •

The boys play at the edge of the moor Behind them stretches a plain of heather, before them a rainy pasture tingling with green all alive-o Between heather and pasture is a crumbling stone wall two feet high that was ancient five centuries before

"Bang!" shouts one of the boys, waving a plastic machine gun in the general direction of the other young boy "Got ya!"

"Did not!"

"Did too!"

"Did not!"

"Bloody well did too! Lie down, you have to be dead!"

"Won't!"

"Will!"

"Won't!"

"Well, you *got* to! Them's the rules!"

"Won't! You *missed*!"

"Did not!"

"Did too!"

I come around the end of the wall, wheeling a barrow full of iron ore I am only as tall as the wall itself and almost as old Knotted gray beard pointed brown cap jerkin and breeches covered with earth from the mines. Only the bracelet glows brightly—that and my eyes fiercely blue in the wrinkled sea of my ancient face I stop pushing the barrow—the rocks clink together softly in protest—and stare at the boys, who look back at me without wonder

"Bang!" shouts the first boy "You're dead!"

It is a forbidden indulgence to despair

• • •

Carruthers ignored Poole's counter-question. "Just 'inexplicable'—in any sense we're used to dealing with Beyond the way things usually behave"

Poole had had time to make a decision. They didn't come any tougher than Carruthers any more ruthless anything Poole revealed about past mistaken perceptions past misjudged deals would be too risky He put down his cigarette and lifted the coffee mug aware even through his tension of its heft its expensive solidity

"No," Poole said over the rim, "I can't really say that I have, Al Usually I can find the explanation for pretty near everything"

The two men stared at each other

• • •

I swoop down over the near desert, reaching the lowest point of my wide parabola over a ranch house, then rising again over the heads of dusty unnoticing sheep People run out of the open barn, their heads tipped back toward the night sky

"Did you see it, Dad? Did you? What was it?"

The man spits into the dust "Lightnin', most likely Heat lightnin'"

"Sure," the woman says, relieved "Hotter 'n hell tonight"

"No, it wasn't, Dad! It was too ... too *shaped* Like a silvery oval It looked more like ... like a *ship*"

The man snorts "Too much comics, boy!"

"Heat lightnin'," the woman says

"But you saw it had—"

"That's enough," the man says sharply "We got work to do" He spits again turns and walks back to the barn The other two follow but I see the boy look back over his shoulder at the starry sky his face lighted by doubt and longing and a suspicious astonishment, and I am satisfied The

Others will complain—no, never complain but point out with gentle relentless clarity—that the power drain for this sort of thing is enormous but I am satisfied it is worth it

• • •

"So we have two options then," Carruthers said crisply, once more all business. "We can go ahead with the shoreline project and make damn sure Cranston gets the Washington boys to shove the right papers around, or we can let this one go to the environmentalists with lots of hue and cry and rack up brownie points cash and voting positions for the big push on the Yukon deal."

Poole blinked "But I didn't think it was ever a question of—"

"Those are the two options Josh And I'm the one who makes the final decision, right Josh?" His eyes chilled the room light-gray ice

Poole put down his coffee mug a few drops spilled over the edge onto the teak table "Of course Al" he said

"So you better get on the phone Josh, and plug your little press leak. The paper will need a retraction."

"Yes Right away"

"I hope it won't damage your network Or anything."

"Not at all Al," Poole said genially backing from the room He backed into the door

"You didn't make any premature personal investments in the land without telling me, did you Josh? Of course not"

"Of course not"

"Good Get on it right away, then," Carruthers said

• • •

Always the third circle slides down into the second The mysteries of faith harden into the certainties of dogma the revolution becomes the new government, the scientific theory habituates into the factual limits showing why something else can't be done Wondrous, theoretical possible, probable factual expected mandatory

I point this out, yet again, to the Others They want something more dramatic and definite, I can tell something more like last time Not this guerrilla warfare hit and run hiding under this world's own debunked mysteries to rekindle that sense of wonder, of enigma of things not absolutely complacently unarguably certain that it so desperately needs

*Look at what happened last time*, I say again *Afterwards Anything too organized will defeat its own purpose That's the treacherous genius of their minds to codify*

Uriel murmurs assent I can tell he agrees with what I am doing

*But the time*, Gabriel says *There isn't much time Look at the physical state of the little world, even now"What if you can't do whatever it is you hope to do with all this furtive sneaking about in time?*

For answer, I slip on the bracelet It starts to glow, and I feel the power fill me

• • •

The middle-aged woman in black stands alone by the flowerless grave, staring down at the raw earth A shopping bag with string handles rests on the ground next to her, it bulges with the disparately shaped outlines of powdered milk, cat food and day old sweet rolls The woman is not crying Her face is set in the sagging lines of resigned defeat curving troughs from nose to mouth, like wobbly parentheses She stands motionless, her wide knees a little apart, not even waiting Just standing The tombstone says "John Alfred Reznicki"

I climb from behind the tombstone to on top of it and gaze down at her I too, am middle-aged—or would be if I were totally corporeal which I am not It is very hard to hold the state between *here* and *not here* a state intended only as transition not prolonged exercise My bracelet glows frantically, and I put my right arm behind my almost-back It is doubtful that John Alfred would have worn a bracelet

The woman looks at me with steady eyes They are dead-leaf brown, and they don't widen or close or shift away I watch her closely Nothing

"Rosa I say gently

She continues to watch the tombstone with detached calm It is not the calm of shock, she is not in shock, but I nearly am She *knows* there is nothing after death knows it beyond needing to doubt knows it with every undeviating cell of her gray mind, and so is literally incapable of seeing what she knows does not exist She looks through me levelly, straightforward, utterly unshaken in her unwondering certainty

Gabriel is right There is not much time

• • •

Carruthers turned his chair to face the window The skyline was impressive even through fog but he didn't see it Absently his finger traced the line of coast on Poole's map, up and down and up again Out the window he saw ocean, ocean in sunset and the impossible flash of a green-scaled tail above bare breasts ringed with flailing blond hair and sea foam

But how could it be impossible if he had seen it?

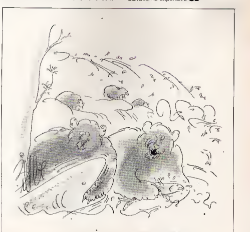
Carruthers knew he was not going mad, was not a man who stood in danger of madness He might easily stand in danger of sudden coronary, hypertension, kidnapping, stroke, emphysema, gangland murder, or lung cancer—but not madness He trusted his judgment, it had proved too good too often not to trust In his judgment, he had seen the impossible Therefore, it was not impossible He had seen it

But what else might then be possible? Jesus H Christ—*what else might be possible?*

• • •

Uriel murmurs again about the power drain, but not very seriously He knows that I know he will manage somehow And we both know that this, however bizarre the procedure is a Major Project

Salvation is expensive ∞



"Let's face it Norman, this just isn't your day"

# BEAUTIFUL

CONTINUED FROM PAGE 66

been sent back to Australasia to work for the Fisheries Protection Board After that, he didn t write to me so often Inevitable, I suppose, but we never lost contact altogether We always said we d meet again, but somehow we were always too busy Then in '51, I got a letter from his employers He d been badly mauled by a shark while trying to save a girl from drowning There was a little note from him enclosed, and I remember it word for word It said Dear Trusted Friend Eli I took on a shark the other day but my reflexes aren t what they were when we were young Only fight I ve ever lost, but it s the last Never mind, I ve had a good run and they tell me the little girl s going to be all right, thank God I want you to have all my bits to do what you like with Please look after Willy for me He s a mean bugger but good company I d swear he understands more than he lets on Can't write any more old friend Take care So long, Aubrey Eli sighed deeply

So wondering who or what on Earth Willy was, I took a weekend return to Melbourne and collected Aubrey's stuff—and Willy His landlady told me rather sharply Glad to see the back of the brute Then she melted and there were tears in her eyes He was a helluva man Mr Blair, she said, an a damn shame he s gone She gave me the written instructions Aubrey had given her for when he was at sea They were very simple and typical of the sense of humor that never left him not even while he was in prison They said Willy eats anything, specially fresh meat Particularly partial to humans One bite is fatal—to the human '

I seriously considered tipping dear Willy straight into the nearest furnace but kept thinking of Aubrey so I relented and brought the beast home He never took his eyes from me all the way Customs was a bit funny but I called a friend in London and he got me a license It was only then I discovered Willy s true identity He was extremely rare and worth a small fortune Aubrey must have known that, and if was his way of thanking me for sticking by him all those years I should have sold him there and then, but once I d turned down the first offer, the next was easier And the brute looked at me all the time, at first sort of suspicious, but then I swear it was a secure look, knowing somehow I ll never know how I came to grow fond of such a creature but I did '

Eli opened his eyes Eat your food, he ordered quietly Then he closed them again Anyway, I've had Willy for ten years now, and I reckon he'll outlive *me* He s used to my ways and me his I know what he likes—sunshine duck hard-boiled eggs I wouldn t part with him now I've got an antidote for his poison, but I don t think I ll ever need it I've always been ultracareful and so have my wards

Zodiac split a sachet between finger and thumb and poured the contents down his throat Sometimes I wish he said slowly "I was an Old Individual I d like to have been a guardian like you Will you have another ward when I m dead?

Eli frowned "Don t talk like that First of all the New Individuals are the future, and second I don t like you talking about your own death You re only eight months old now, with another 20 to go, and it s not as if your life *seems* any shorter than mine . . . "

I m sorry interrupted the boy "I know what you say is true I'm not thinking of the comparative lengths of our lives just our lifestyle I m enjoying my life of course I am The New Way is better than the Old but in this changeover period I think the guardians have a more satisfying task than the wards "

Eli nodded slowly "That may be so, but the New Way is better and that s all that matters to any of us There ll come a time when I m just a housekeeper to you—I know I ve seen it four times already—a time when you re so far ahead that I ll be the child and you the adult Give it a few more months and you ll be happy with your side of the bargain

> *All four-dimensional objects are open-ended systems Build a closed system and it will remain closed only for one unit of time. After that the fourth dimension will increase and blow things apart.*

"Nonsense!" said Zodiac sharply tossing his golden hair "You ll always be able to teach me something You have the morals, the knowledge, and the honesty I only hope we ll be able to retain it when all the guardians are gone

"You will boy you will Don t you worry It s more than ever a technological world but it s good technology Benevolent technology The New Way will inherit the best of the Old—the wisdom, the intellect, the industriousness Humanity will progress and prosper forever, now that aggression and greed have almost gone If ironing out the horrors in man s nature means a shorter lifespan though a no less full one so be it The New Way is good ' Eli s eyes bored into the boy's "It's more than good It s beautiful, it s perfect " He glanced up at the clock "And now

"I know sighed his ward for a moment the child again He dutifully rose and cleared away the table "Can I watch you catch Willy?

"No, I m going to leave him there for tonight I don t want to spoil our blueprint—perhaps we can talk about it again tomorrow He held out his hands and Zodiac took them "Goodnight, young man Sleep well

When the boy had gone to his room, Eli settled into a comfortable chair from where he could see the moon through the trees on the hill above the house Clouds were gathering, and a light breeze tugged at the shutters There would be a storm any minute, Eli knew for he had not lived in the Cotswolds for ten years without knowing the weather patterns like an old friend

He felt tired Every day was a long day with Zodiac The boy only needed three hours sleep now and in a couple of months he would need none Before Eli was barely asleep in his own bed, the boy would be up and gone tiptoeing out to 18 hours of schooling He was growing up fast, even for a ward, and it was hard to believe it was only seven months ago that Joseph Parsons Secretary of the Fellowship of Guardians, had brought him a one-month-old, golden-haired child who could hardly walk Zodiac had cried because of Eli s whiskers, and Eli shaved them off there and then as a token of friendship Two weeks later the boy was beating him at simple card games Eli shrugged inwardly Even after five baby wards he still found it difficult to come to terms with the incredible development rate and speeding metabolism of the new race But he envied no man Most Old ones now in retirement living out their lives in luxury in the cities, were almost oblivious to the New Way taking over Eli Blair had believed in it right from the start, right from the very first New child and blessed the day when the aggressors had obliterated themselves from the face of the earth and left the rest of the world to scramble every way of life until they came up with the answer that was the New Way Humanity had dragged itself back from the brink of oblivion and would never again pit itself against itself, or against Nature And as soon as he was retired Eli Blair devoted his every waking hour to make it work It had to work, because now there were no destroyers only builders And the New children were the children of the builders

There was no particular point during his reverie that Eli Blair s thoughts became dreams He had long been accustomed to taking a half-hour nap before setting out the boy s meager (to him) breakfast and locking up the house, and he slipped easily into the light sleep of advancing years his feet stretched out, his hands loose in his lap

But when he awoke he knew it was not his mental alarm clock which had woken him He looked out of the window—the moon had scarcely moved so he had been asleep only a few minutes What had disturbed him then? Everything was still, save the rising wind and he was on the verge of drifting off when the disturbance reached him again This time he knew too well what it was, and he lurched drunkenly out of the chair as the third agonized yell from the back of the house penetrated his brain. Eli flung open the door to see the boy writhing on the bed, clutching at his middle. His staring eyes saw nothing, and the golden hair was dark with sweat.

The old man threw a blanket over him and fiercely punched out some numbers on the bedside comm.

Immediately a tinny voice: "Emergency."

"Blair two-five-nine-zero-G. Ambulance, my ward . . . "

"Nature of emergency?" asked the unemotional electronic voice.

"I think it's food poisoning."

"Patient's identification?"

"Oh, for . . . " Eli wiped the sweat from his eyes. No use arguing. "Zodiac, seven-two-eight-W."

"Wait please."

The next four seconds seemed like four hours. Then the voice again. "Landing space—go. Availability—go. ETA two minutes. Blair, do not give anything to patient. Keep patient warm. Keep calm. Confirm."

"Confirmed." Eli cursed the machine as he dragged another blanket over the boy. Keep calm, it said! He cursed the pâté. He cursed the peddler who had persuaded him to buy it. He cursed himself for his stupidity, and he soothed the boy's brow with water from the tap by the bed.

The ambulance's siren blared from above the roof, and Eli rushed to the back door in time to see it settle gently in the yard, the whine of the engines just audible above the wind. Two figures jumped out, both barely bigger than Zodiac, but broader shouldered. They rushed where Eli directed them, swept the boy up in a stretcher, and were outside again before ten seconds were past. One of them, a girl, gasped, "Don't worry. Wait for our call," and the machine was gone, up and away like a monstrous flying egg, over the trees, to the nearest hospital specializing in the medicine of the New Way.

Eli closed the door quietly and sat down in front of his desk comm. Now he had time for the self-recrimination that had been building up since he had burst into Zodiac's room just a few minutes before. For the next five minutes he set to the mental task of taking himself to pieces, understandably but unnecessarily, and it was only the shrill tone of the comm which prevented him from driving himself insane.

He stabbed open the channel. "Yes!"

A calm, young voice came through, then the screen cleared. Eli saw the face of a boy not unlike Zodiac, but older, perhaps a year old. "Mr. Blair, I'm Dr. Rosko. Zodiac is comfortable now, but I must tell you his condition is very grave. Food poisoning is confirmed. He ate some pâté."

Eli nodded slowly. "I know. It was my fault. I shouldn't have bought it."

"Please, Mr. Blair, there is absolutely no blame attached to you. Zodiac is our seventh case today, and the peddler concerned has now been arrested. The pâté was accredited fit for consumption by wards, but it seems the date had been falsified."

"Oh, no!" Eli almost reeled back from the words. The old ways lingered on. You never knew when you might come across them, in a crowded street, in a back alley—there were still fragments of the old self-interest at large. Still people, ghastly nightmares of the past, who could, would, put personal gain before the well-being of the race. Eli Blair remembered the old ways, had been a part of them, but those 16 days of cold, unimaginable fear adrift in the North Atlantic had cured him for life. It seemed there were still those whom it had not. Eli ached from the pain of it. "And Zodiac?" he said, hearing himself almost pleading.

"Don't upset yourself, Mr. Blair. You must be distressed, I know, but your ward will receive the best possible care. We are doing everything we can."

"I know. Thank you, Dr. Rosko. You will let me know how he's doing?" Without thinking, he added, desperately, "Is there any chance of me seeing him, any chance at all?" But he already knew the answer—knew he could never enter a ward establishment of any kind, where things moved 30 times faster than he knew, where the environment was as alien to him as the South Pole—more so. For it was only in the presence of the old ones, like himself, that the wards slowed themselves down.

Amongst themselves they lived 30 times as quickly and got 30 times as much done in the same time.

"I'm sorry, Mr Blair, you know it's not possible. You understand."

Eli took hold of himself. "Of course, Doctor. I shouldn't have asked."

"You are distraught. I suggest you take a sedative and go to bed. I will see to it you are called if there's any change."

If there's any change. The words rang in Eli's head when the Doctor had signed off. He switched off the comm and stood up, looking around the room as if it were unfamiliar to him. He could no more go to bed than fly.

The night seemed interminable. To occupy himself, Eli closed the shutters and locked up the house, swept out the bedrooms, tidied his desk. And he was now reduced to shuffling back and forth across the cluttered room, listening to the shrieking wind mingling with his waking nightmare. Thoughts of the past clashed with dread of the future. He tried to shut out the picture of the smiling, golden-haired boy who eagerly wolfed down the pâté, but it kept coming back. Guardianship might seem the best job on earth, he thought bitterly, but here was the other side of the coin. He had never been married, but now for the first time he knew what it must have been like for the thousands of women who lost babies at the height of the industrial counterrevolution, when medical services ground to a halt for a whole year. How trivial it had all seemed to him then. How he now regretted the callousness of his youth. All these memories crashed so violently about his head he hardly heard the comm shrilling.

Eli opened the channel carefully, half expecting . . . ? But it was Dr Rosko.

"Mr Blair," he said quietly, and Eli knew. He knew from the face. The New ones could not hide their emotions. They matured in mind, but always retained the childish features. He knew.

"Mr Blair, I'm sorry Zodiac couldn't make it. He died a few minutes ago. We did what we could."

Eli nodded. "I know that."

"Will you be all right?"

"I'll be all right, Doctor. I'll ring you tomorrow about the arrangements."

When the doctor's grave face had gone from the screen, Eli Blair felt as if he was about to be torn apart. His rational nature said the New Way was still the same. Things happen. His emotions were in turmoil. He staggered up out of his seat again, drained of energy, and wandered aimlessly about the room for a few minutes. Can I go through it again? The question demanded immediate answer. A two-year guardianship was short and painful enough, despite the calculated way it was cooled down toward the end of a ward's life, and Eli Blair was old. The New Way was perfect—he had said that earlier, but was it perfect for him? However the war had changed him, he would be a part of the old way until the day he died. Was it time to go now? Had enough of human nature been instilled into the frames of the New children yet? Could they be trusted to breed on their own now and not revert to the old ways? The New children did not cry. They did not get angry. Yet they loved with unbelievable strength of will. Would this be enough to carry them through to the promised future? Eli Blair did not know. The New Way seemed to crowd in on him, and he felt his age acutely. His role was ever diminishing. The ambulance drivers, the doctor, the emergency robot, all New. Every day, less Old, more and more New. Eli knew one thing. He didn't want to be the last. He didn't want to live out the residue of his days like a dinosaur, a living relic of the past that was hateful and wasteful and best forgotten.

Half-blinded by the pain in his head, Eli stumbled against the sink. There was no hesitation in the hand that slid the glass aside and fell slowly into the cool water. He steeled himself, closing his eyes. A second passed. "Go on, you brute," he muttered, "you've been waiting for this chance for years." More seconds passed, but no pain came. He opened his eyes and looked down. Willy was listing slightly and had turned toward the hand that intruded. The small black eyes regarded Eli angrily, but he did not move. Every few seconds, his stout gray body twitched, and Eli suddenly came to his senses. The pâté! Willy, too, had eaten the pâté. And he was in agony, dying. Eli yanked a yard of traveling cable from its wall housing and turned on the power. A quick jab at the surface of the water was enough. Willy would suffer no more. Eli Blair, now totally alone, went and sat at his desk.

The brief episode with the fish affected him deeply. Somehow it brought back the world he had almost discarded in his grief. He might laugh about the miracle later. But now there was something to do. Dying was too easy—killing Willy had made him realize it. Dying was not the New Way.

A few taps on the keyboard brought a face on the screen. An Old face. Joseph Parsons had not changed in seven months. "Hello, Eli," he said. "I've been waiting for you to call. The registrar at the hospital called me a while ago. You know how sorry I am."

Eli was lost for words for a moment. Then he said, "Thank you, Joseph. Look, I know this will sound harsh, but . . ."

"Eli, don't torture yourself. Go to bed, and I'll be round with the papers in the morning."

Eli Blair couldn't stop the wry smile. "You knew I'd call you, didn't you?"

Joseph nodded wisely. "Of course I did. Once you've been a guardian, you can't shake it off. You've been a guardian five times. You ought to know by now."

"Yes," sighed Eli, "I suppose I ought." DO

*"For one thing, you seem to have an extraordinary developed superego."*

# INTERVIEW

CONTINUED FROM PAGE 73

physics Curiously enough, in the book it was being discussed as part of an attempt at explaining precognition, which is the ability some people are supposed to have of seeing into the future You see if precognition is possible—again I'm pretty skeptical—that must mean that signals or information of some kind can travel backward in time, which according to special relativity theory would be equivalent to particles going faster than light

*Omni*. Does that mean that if one *did* discover faster-than-light particles precognition would then become possible?

Good Yes Absolutely Precognition would then fit quite comfortably into established physics. And that, in my view is perhaps the most exciting thing about tachyons, that they make precognition possible Not proved you understand, just *possible*

*Omni* Physicists nowadays are working in a frontier area where everything new is increasingly at odds with common sense Are things going to go on like this, just getting more and more divorced from our world of knowledge?

Good One hopes not It's more a matter of getting through a period of great complexity out of which one feels some overall simplicity must emerge But things are still getting weirder and weirder Take for example the very curious new material beginning to come from the study of quasars and black holes Now, a black hole is one of the more fantastic deductions from general relativity theory, which says that matter can just leave the universe through a sort of sink in space When there's enough matter in one place it just collapses in on itself And once it does this the forces of gravity are so great that not even light can escape from the region where the collapsed star has gone. Now, if not even light can escape that means that there can be no communication of *any* kind from inside Thus from the point of view of what can be observed—which is all that science is really concerned with—the star now has only a *metaphysical* reality Very peculiar when you think about it

*Omni*. If the black hole sucks in everything in its neighborhood, why doesn't this gravitational pull reach out and pull in all the universe in due course?

Good Well, it can clear a good deal of the space around itself and one would be advised not to get too close Of course not everything gets sucked in, any more than the sun sucks in every comet that passes by But an awful lot of things, some very big, do end up inside black holes Indeed, one of the latest theories about the fantastic amounts of energy that are given off by quasars is that they are really black holes swallowing up stars and converting their mass into huge amounts of energy as they do so We've been talking here about very large objects rather than very small ones, but it all helps to make the point that the more we find out about the universe the more amazing it appears to be The British physicist J B Haldane once summed it up very nicely when he said that the universe is not simply more fantastic than you think, but more fantastic than you *can* think

*Omni* Is part of the problem the fact that we are concentrating scientific and philosophical effort on the wrong things? Alexander Pope said that the proper study of mankind is man, which should make psychology the most important science

Good Yes, and man is really a very convenient size for studying, isn't he—far more convenient than quasars or subatomic particles And yet one knows much more about neutrons than one does about neurons A psychologist recently said that our theoretical model of the human brain was roughly parallel to the theory of the world that was in vogue two thousand years ago which said that the world was a traylike object supported on the back of three giant tortoises Frankly, I think he was fooling himself The tray-and-tortoise model was at least a well-defined statement no matter how ludicrous it may seem today and I don't know of any psychologists who are in a position to make equally precise statements about the brain, ludicrous or otherwise

*Omni*. Do you see any signs of psychology making any significant advances in the near future?

Good No, I don't, but the problem may not be simply a matter of the nonavailability of facts It may be for example that there's something about us that prevents us from understanding the mind There may be such murky depths in our nature that when we begin to uncover them we try to deny that they exist Let's take the question of morals and ethics Now if anything, I tend to feel that people are fairly neutral ethically when they're born, and that if they become "bad," so to speak it's the environment that has corrupted them But it may be that we are, in fact, intolerably wicked and selfish and that psychologists for the most part refuse to recognize the evidence for this when they stumble on it. That would lead to a self-imposed brake on progress in the field

*Omni* But for most people the central problems in psychology are the nature of consciousness, thought processes, intelligent behavior, and so on Is there any hope of making progress in these areas?

Good. Well, yes, but not perhaps in the way that one imagines I suspect that our best hope of getting somewhere in terms of consciousness, thought, and so on will be when we can simulate these processes in a computer When we get that far half the battle, perhaps even more, will have been won Now, things have moved rather slowly in this field—the field of artificial or machine intelligence—in recent years In the early 1940s, when I was working on one of the first electronic computers, I used to have long conversations with colleagues about machine intelligence and its ramifications, and I thought not only that it would be quite possible to have an intelligent machine but also that we would have one fairly soon. In fact, twenty years ago I predicted that it was a fifty-fifty chance that we would have had one by now. I was evidently a bit optimistic.

**Omni**: A lot of people find it impossible to associate the notion of intelligence with machines anyway. Doesn't it depend enormously on how you define intelligence?

**Good**: Of course it does and most people's objections are based on a view of intelligence that says that it's something that is just a product of a human brain, and therefore, by definition, could never appear in a machine. But that is very naive. I would define intelligence as the ability to adapt successfully to a large variety of different circumstances—to survive in a complex and frequently changing environment, for example. According to that definition, men and most animals are extremely intelligent. If one doubts that, I merely point out that no animal ever makes more than one fatal mistake in its lifetime, and when you consider how potentially fatal the world is, it's quite clear that all animals are highly adaptable, and thus intelligent.

**Omni**: Do you think brain size has anything to do with intelligence?

**Good**: Oh yes. In fact the whale brain is larger than the human brain and one wonders whether it's more intelligent or whether it's merely because it has so much of this additional work that it has to do, and therefore needs a larger brain just for bodily administration. We don't really know. It may be that whales are very intelligent.

**Omni**: Are you at all intrigued or surprised at the notion of communicating with animals like chimpanzees, and also John Lilly's work with the dolphin, inconclusive though it is, that suggests that the animals are capable of rather higher intelligence than we had suspected?

**Good**: Of course. And I think one reason we didn't suspect it was just pure snobbery. I advocated many years ago that we should catch a small whale and try to train it from the start to communicate with us. I think experiments have been done along those lines.

**Omni**: But how far down the line would you say that intelligence appears? How simple an animal?

**Good**: It's hard to draw the line, and I suppose even an amoeba has some kind of intelligence, but we're talking about information processing rather than just some form of instinctive reaction. Take the case of a fly, which, when you try to swat it, begins buzzing around in an active way. Presumably it has an innate hormonal mechanism that causes it to fly round all over the place when it's attacked. Now I doubt you would call that intelligent behavior, but with the warm-blooded animals there's really no argument. In one of the psychological journals there was an account of a rat that was caught in some kind of trap and chewed off its own leg in order to escape. That may not have been a pleasant thing for it to do, but it was most certainly an intelligent one. By the way, if you saw that kind of behavior in a machine—ridding itself of one of its components in order to increase its chance of survival—you would think it exceedingly intelligent.

**Omni**: By your original definition many machines would already seem to have some rudiments of intelligence. But there are one or two objections that people always raise at this point. The first is that a machine can never do anything original, and the second is that it can't do anything that it hasn't been programmed to do. To most people this represents an unbridgeable gulf between computers and human brains. Do you see it as such?

**Good**: Not at all. In fact, it's very misleading to say that a computer will do only what it's programmed to. It sounds clearly right

*"If not even light can escape from a black hole there can be no communication of any kind from inside. Thus from the point of view of what can be observed—science's only concern—the star has only a metaphysical reality"*

when you say it, but the question really is whether a computer can do things that the program has not predicted it will do. And the answer is that it most certainly can and indeed *has already done so*. Many computers can search around for the ideal solution out of a wide choice of possible paths and come up with a solution that no human being has ever spotted.

**Omni**: Can you give us an example?

**Good**: Yes. There is the case of a computer that came up with a very elegant solution to a geometrical problem. The computer was set to develop a proof of a simple proposition: if you have a triangle that has two of its sides equal, then the base angles must be equal. There is a simple Euclidean proof, which the computer ignored. Instead, it took a dramatically novel approach by flipping the triangle through 180 degrees and proving the proposition in a way that none of its programmers knew about. Anyone observing the proof, and not knowing who or what had generated it, would have said, "That is exactly the kind of thing that only a human could do." I might add that it would only have been done by an exceptional human too. If one of my students had come up with that proof independently, I would consider him a budding mathematician.

**Omni**: So originality at that level is clearly possible in a computer. Presumably we'll expect more and more examples of this as computer science develops.

**Good**: Yes. Take chess. If you program a computer to play anything more than the most automatic game of chess, you're going to have to program some moderate intelligence into it. This is to allow it to get beyond the superficial aspects of the game, to find deep combinations, as they're called. And if it's really programmed intelligently, it will find combinations that the programmer himself will have missed. Of course it's all quite logical in the sense that a computer behaves in a logical way. But the problem is that humans have the notion that there is some noninductive or nonlogical way of arriving at solutions—call it insight if you like—that is somehow innately and uniquely human. A God-given thing almost. And this is why they get so upset when they see a computer appearing to poach on their preserve. Another factor is that a lot of our own thinking is done at an unconscious level. And because we don't know how we think, we praise ourselves because of the immense subtlety of our thinking, whereas in fact we're really praising ourselves for our own ignorance. This is what makes it so difficult to program a computer to do the kind of intellectual things that we do—because we don't know how we do them ourselves!

**Omni**: You're a front-rank chess player yourself. Computers are getting to play quite good games, aren't they?

**Good**: Yes, they've improved a lot, particularly in the last two or three years. In fact, the best chess-playing program is now rated at "expert" level in the world chess rankings. How rapidly things will move from here is hard to guess. There may be a qualitative difference between a player at "expert" level and one at "grand master", let alone "International Master" levels. But we shall see fairly soon. I was present on one mildly historic occasion when two computer experts who are also first-rate chess players, Donald Michie and David Levy, bet quite a lot of money on whether a chess-program would beat Levy in ten years' time. Well that ten years is just about up, and I reckon Levy's going to escape, but only by the skin of his teeth. A computer's already beaten him at blitz chess and given him some good games, tournament style. Incidentally, even if he does have a triumph, I think it will be a temporary one.

**Omni**: Are you saying that it's only a matter of time before a computer is able to wipe the floor with anyone, even world champions like Spassky and Fisher?

**Good**: If you're talking about the near future, say the next decade or so, I'm not sure that we know enough about chess to answer with any confidence. The question is, To what extent do existing computer programs get their advantage by the technique of exhaustive analysis of every possible move? Now this kind of blockbusting approach over, say three moves ahead, will make a very good player indeed, but not one at "master" level, and it may be that in following present programming strategies computers will be unable to form the deep plans that are the essence of really great chess. If this is the case, the front rank of human chess players will never be beaten by computers until a totally different approach to computer chess is forthcoming. Now, personally, I hope it is true that computers will turn out to peak at master level for this will put a new kind of emphasis on developing genuinely intelligent programs. It will be a beautiful field of study that will have great gains to machine intelligence as a whole. In fact you might say that finding out how to program a computer to play a championship game of chess is one of the most important activities in science.

*Omni:* That's a very challenging remark. How do you justify it?

**Good:** Once we talk about computers that plan things, even if only games of chess, we're moving into a far higher and far more exciting level of intelligence. Planning involves, in humans at any rate, the use of language, and in particular *descriptions* of things. Thus, it is almost certain that if a computer is going to plan, it will have to be able to handle descriptions. And when you can handle descriptions, then the next thing you can do is begin to change them—for example, by taking one description and reshaping it so that it becomes an analogous description capable of coping with a different area of knowledge. And once one achieves this kind of generalized planning, one could hope—actually, I don't know whether to say hope or fear—that the computer will be able to begin forming scientific hypotheses. At this point, we are moving into deep water. Very deep water indeed.

*Omni:* Yes, because we seem to be getting into a realm in which the computer is becoming a real challenge rather than simply an intellectual threat to us. What are the consequences of all this, and how are people going to feel about it?

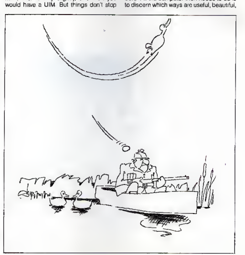
**Good:** People have always feared machines, for good or bad reasons, and they're obviously going to fear highly intelligent machines even more. But until they become *ultraintelligent*—I'll explain what I mean by that in a moment—they're obviously going to be awfully useful to have around, and we shall continue to cooperate with them just as we cooperate with them today. Synergy is the word to describe the relationship between man and machine as it stands at present. We've already reached the point where no scientist is really working efficiently unless he's in some synergistic relationship with a computer, and this process will inevitably continue and evolve. After a while, a man working with his computer will form such a close relationship that he'll forget he's using a tool, in the way that one forgets one's using a tool when driving a car. The machine becomes a part of one's self and one even gets to feel lost without it. What I'm arguing is that the advantages of forming this synergistic relationship will be so great in terms of scientific productivity that any aesthetic objections to it will be heavily overruled. And at the same time, the motivation to produce even more intelligent computers, capable of even more intimate cooperation will grow.

*Omni:* And what comes then?

**Good:** One moves toward the concept of the ultraintelligent machine, or UIM. Now, the UIM is a term I use for a computer that could cope with every intellectual activity as well as any man. It's not a science fiction concept by the way, for there's been enough advance in computers over the last thirty years to suggest that sooner or later we will be able to program a computer with the overall intelligence, more or less, of a man. It might be a pretty stupid man at first, but even that would be a tremendous breakthrough. Now people generally make an objection at this point and say, "Why bother to go to all this trouble and expense to make a machine of the same intelligence as a human when the world has already got more than its fair share of humans?" It's also far cheaper and far more pleasant to produce humans! This argument misses a very important point—that at double the cost, or maybe less, you could presumably produce a machine *more* intelligent than a man, even if only slightly, and then you would have a UIM. But things don't stop there. What you now do is instruct this bright new computer in the art of programming computers and designing computers and make that its speciality or sole goal in life. In that case it would obviously be able to produce a better machine than you could, a second generation of UIMs that would be even smarter and that could immediately be put to the task of producing the third generation, which would be staggeringly better than their predecessors. And so the process would go on so far as one can see, indefinitely into the future.

*Omni:* So you'll have the machines improving their own intelligence at a rate that no human could ever hope to achieve?

**Good:** Yes, I'm afraid so. Of course, many people now remark, "What about creativity? That's going to be lost." The short answer is that we tend to overvalue a lot of so-called creativity. Many operations that appear creative at first are in fact routine when you know enough about them. The longer answer is that while the word creation seems to imply producing something out of nothing, that's a fallacious interpretation. Creation almost always means putting two ideas together in a useful, beautiful, and aesthetic way, which is also to a *purpose*. Once you see it in that light, you realize that there's no reason why computers, once they get intelligent enough, shouldn't put together ideas in large numbers. All the computer then needs to do is to discern which ways are useful, beautiful,



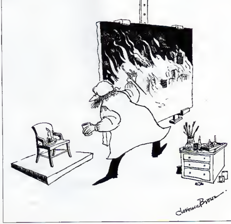
and so on. By the way there's no reason in principle why a computer shouldn't be programmed with an aesthetic sense. There've been one or two rudimentary experiments already. In one, a computer was set to measuring, in mathematical terms, the relative beauty of a series of vases. And then a group of art students were given a set of pictures of the vases and asked to rank them in terms of their perceived beauty. It turned out that the computer and the art students' ranks were fairly similar. Of course, that's a very simple example, but the computer obviously has to walk before it can run.

*Omni*: But why should we want to do all this anyway? Let's say we're content to have the computers as helpful slaves doing bank statements, airline bookings, and leave it at that. Why bother to make your ultraintelligent machine at all?

Good: That's a good point because it raises the most critical issue of all. The reason we would bother to make UIMs is because they will be immensely helpful in scientific work, allowing us to advance our knowledge of the universe at a rate that humans on their own could never hope to achieve. They'll help us to form hypotheses, plan critical experiments, and then interpret the result of the experiments. They'll even be able to help us formulate new theories to explain our experimental findings. The gains to science will be so great that once one has the potential of making UIMs, it will be impossible for us to resist the temptation to create them. Don't forget that it's not just traditional science that will benefit! Medical science will advance in the most dramatic way as well. Take longevity as a good example of something that most people want to achieve. There's no doubt that even with our present understanding of medicine we're markedly increasing the average human life expectation, but that's nothing in comparison with what we might hope to achieve with UIM's aid.

*Omni*: In what way?

Good: Well the argument's an interesting one. Let's take a child today who has a mean life expectation of seventy-five years, which is about the Western world's average. Now that's assuming that there are no advances in medicine within this period of seventy-five years. Of course, one would expect *some* to occur, so that his true expectation of life is probably closer to one hundred years, depending on what the advances turn out to be. But some time in that period we can expect the UIMs to come along, and one of the first things we will ask them to do—apart from improving themselves in the way that we've already discussed—is to put their talents to bear on medical science. We would therefore assume even greater advances in human life expectation as a result—say jacking it up to one hundred twenty or thereabouts. This isn't just fantastic guesswork, incidentally. Human biologists have no reason to assume that these kinds of extensions of life couldn't be achieved in principle. But now a novel factor comes in. In the course of the extra decades of life that, thanks to the UIMs, all humans now have at their disposal, the UIMs will have been beavering away and bringing about even greater advances in medical science, leading in turn to even more dramatic advances in life expectancy.



*Omni*: Is this all likely to take place soon enough to affect, say, people reading this interview?

Good: Well, yes. In fact it means that there could be people reading this edition of *Omni* who could live to be a thousand! The point is, and it's a point that people are inclined to miss, that computers, once they reach a certain level, begin to flare out, and their intelligence advances exponentially. And with exponentially increasing intelligence, their achievements increase exponentially too. It's hard not to sound sensational about this, but it's a sensational concept.

*Omni*: How long do you think it will be before we have the first of the UIMs?

Good: My own estimate, which is a subjective one of course, but which is also based on my conversations with people working in machine intelligence, is that there is a fifty percent probability that we will have UIMs by the year 2000. But things are changing so rapidly in computer science at the moment that that could be a conservative estimate. And once they arrive, things begin to move and change extremely quickly. Whether favorably or unfavorably depends on one's point of view, but it can be said with absolute certainty that the world will be transformed.

*Omni*: Could you give some examples?

Good: The most spectacular will come as the result of advances in various fields of science. We've mentioned medicine already, but one shouldn't forget psychology. Perhaps through computers we shall come to understand ourselves for the first time. And then there's other things like climate control, vastly increased food production, an end to political squabbles, perhaps even to war.

*Omni*: How could the UIMs help to prevent war?

Good: Well, I once wrote an article on the social repercussions of computers, and in it I suggested that there was a real possibility that both Russia and the USA might—working quite independently of course—produce UIMs and that these would communicate via satellite and join together to form one supercomputer that would then proceed to run the world. I first put forward this idea, I now recall, in *The Scientist Speculates* and the theme was picked up in an SF novel called *The Forbin Project*. It became a movie too, I believe. Anyway, the point was that the enormous processing speed of the two computers allowed them to communicate with each other very rapidly, and this effectively fused their identities. Part of the reason that people fail to communicate properly is because they communicate so slowly, and if they could only communicate more rapidly they would achieve a greater sense of identity. In fact, I'd go so far as to say that the reason we think that we are each *individual* beings is because the subunits of the brain communicate with one another quicker than the brain as a whole can communicate with other brains. This has unfortunate consequences. The heads of the USA and the USSR, for example, no matter how badly they may really want to "unite," are limited to communicating with each other at a maximum of one hundred fifty words a minute, and that, you see, will always keep them psychologically distinct and separate. They can't communicate fast enough ever to feel like identical beings, but computers could and hence might end up saving the world from war. There are other possibilities, and the way I like to express it is to say that the best way to prevent the hydrogen explosion is to get the information explosion first. So it's the UIMs or the bomb. Take your pick.

*Omni:* It's not hard to decide if those are the only alternatives. But are they?

**Good:** They're the most obvious. But there's another interesting way in which the UIMs might help to save us, and is by bringing us into contact with extraterrestrial life. On the whole, I'm skeptical about UFOs as such, but at the same time I have to admit that it's rather ridiculous to deny the possibility of extraterrestrial life. I believe, with the majority of scientists, that there *is* intelligent life, if not in our solar system, at least in our galaxy. There are about ten to the eleventh power [ten trillion] stars in our galaxy and about ten to the tenth galaxies in the universe. Not much is known directly as to whether any of these have planetary systems, but it is known that many are part of multiple systems and very often they may be double stars. The fact that so many multiple systems exist is pretty strong *prima facie* evidence that there are even greater numbers of planetary systems. It's quite unthinkable that life hasn't evolved on enormous numbers of these, and in many cases it would be stupendously in advance of our own. But this isn't the only, perhaps not even the principal, reason why I believe there are extraterrestrial entities—I use the word entities advisedly—and why we may be contacted by them before too long. The reason is because I am so convinced that the ultraintelligent machine will be produced. You see, once you get UIMs, space travel will become child's play.

*Omni:* So it's we who'll end up contacting the aliens rather than the other way around.

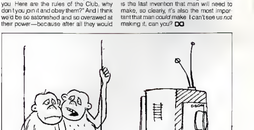
**Good:** Not necessarily. Don't forget that the aliens will also have UIMs—indeed they may even *be* UIMs if the logic of everything I have been arguing is valid—and they will have been observing our presence and our evolution rather closely. They will certainly have noted that scientific advances on earth have been extremely rapid recently, and they will realize that once we have UIMs within a few decades we will be able to populate the solar system and beyond with spacecraft. And they will also have noted, on the basis of our past record, that we are an extremely aggressive species and one that might be doubly dangerous with UIM support. For this reason, I think it extremely likely that either just before or just after we achieve the UIMs we will find ourselves contacted by extraterrestrial life, with or without its own UIMs.

*Omni:* What will happen then?

**Good:** There are lots of possibilities, but the most likely is either that they will destroy us before we get too powerful or that they will invite us to join them in what I like to refer to as the "Cosmic Club"—a galactic association of the most intelligent life forms. Personally, I think it extremely unlikely that they will wipe us out, for if there is a Cosmic Club of the kind mentioned, it will have achieved a high level of social stability and very firm internal rules and regulations. It would certainly need to be solidly against aggression, otherwise it would have destroyed itself, and except in the most exceptional circumstances it would be ethically too advanced to destroy another intelligent civilization. It's much more likely that the aliens will appear and say to us, "Come on now, be sensible. We have much more power than you. Here are the rules of the Club, why don't you join it and obey them?" And I think we'd be so astonished and so overawed at their power—because after all they would have had the UIMs far, far longer than we had—that we would see ourselves suddenly as savages and go down on our knees simply begging to join. Of course there's a third possibility and that is that their UIMs won't bother to approach us at all, but will simply be interested in contacting our own UIMs. Then it would be the UIMs, rather than humans who would be invited to join the Cosmic Club!

*Omni:* That's a very eerie thought, and it makes one wonder whether you are basically pessimistic or optimistic about the kind of future you have been depicting?

**Good:** Well, it depends on how you view things. I suppose one might be optimistic about anything that intervenes to prevent mankind from destroying itself in a nuclear war, and I think that it's possible that the creation of the UIMs is the only way in which we can hope to avert that kind of disaster. But then we're faced with a new problem—the UIMs themselves and how they will view mankind. They may of course supersede us intellectually so decisively that we become redundant, and as is well known, a species that becomes redundant withers away and dies. And so we're caught in a strange kind of dilemma. Personally, I think we'll resolve it by creating the UIMs. I once remarked that the ultraintelligent machine is the last invention that man will need to make, so clearly, it's also the most important that man *could* make. I can't see us *not* making it, can you? ◘◘



*"I don't know if it's an insult to your intelligence but it's an insult to my intelligence."*

# HOLE THING

CONTINUED FROM PAGE 100

and Klaus have already left, and my flight leaves in 15 minutes."

"Bless you, Rudi. May your future be joyous."

The elderly gentleman smiled as he broke the connection and then punched a familiar number. When this call was answered, he instructed his chauffeur to meet him at the airport. "There is no urgency, Franklin. I shall be waiting in the lounge."

Emil Kainnen returned to his seat and ordered another drink. He knew that he had over an hour before his driver could arrive from his Maine summer house on Sebago Lake—especially now that he had told Franklin not to push the vintage Rolls. When his second drink arrived, he nearly chuckled aloud at how his physician would disapprove of the second cocktail! If Dr. Tanner only knew that he ever would, of the strain that he had been under these past three years—the years since he had first heard of the fizzled tests and conceived Operation Shock Treatment. And he knew that some earnest young men would be around to see him sooner or later. After all, there were not many multimillionaires of his political persuasion. But the young men would discover nothing, could prove nothing. Even if they found the extra hot machinery in that abandoned waste dump in West Valley, even if they could make a connection to the now-demolished warehouse in Kansas City, they would still have nothing; come to a dead end.

Yes, Emil was quite confident that the conspirators were untraceable. In the aftermath of the world-shaking event, there would be very few, very cold clues. Granted, almost a hundred people had played some part, but only nine had known what the ultimate purpose was, had handled the crucial, identifiable stages.

He was less successful at inhibiting his throaty laugh as he thought about the reaction that would follow release of the pictures—but the bar was almost empty and no one noticed. Ah, yes, he thought, the photos. What would all those bright young men make of them? Ordinary Kodachrome from the English factory ... purchased in Kenya ... exposed in Kansas under fluorescent lighting with the Canadian 50 Hz frequency ... developed in Brazil ... and mailed to newspapers from 15 American cities. Ah, yes, a picture is worth a thousand words.

General Winsor ignited his fifth cigar of the day as the elevator descended to the White House basement. He was more curious than irate at the urgent summons that had come just before the scheduled meeting with the President's chief of staff. The thin man who faced him as the elevator doors opened began immediately.

"Bryce Ellis, General. Executive Protection Service. We've found your missing toys, or rather, they found us!"

The General froze in mid-stride and nearly bit through the tightly rolled Havana in his mouth. Visions of concentric circles flashed through his head: radii of total destruction, secondary destruction, lethal radiation levels. He was surprised at the calmness of his reply. "My God! Here ... ah, the devices have been deactivated, I take it?"

"Sure, General, no sweat. Experts have been standing by for weeks, ready to fly anywhere, but ..."

Winsor stared in the direction indicated by the Secret Service agent, momentarily speechless. Men and exotic equipment surrounded two unlikely objects. The General held his cigar weakly in his right hand. "Pianos?" he managed to croak.

"Yeah," said Ellis, as they moved closer. "For the State Dinner tonight. Two pianists were going to entertain. Naturally, those musicians know nothing, the music company knows nothing, the delivery people know nothing—"

"But how could terrorists?"

"Oh, it doesn't look like terrorists ... or even foreigners. One of the press aides on the First Lady's staff is missing, and besides, the message is pretty clear."

Winsor's eyes followed the agent's pointing finger. Inside the gutted grand pianos, it was neatly printed on each bomb casing: "Give Peace a Chance." The General had thought that he was beyond shock, but his numbed brain continued to assimilate details. Each device had a new timing mechanism, and both digital clocks read 000.00. He also noted that all eyes converged, not on the original casings, but on the slate-gray, narrow metal boxes that rested beside each device. "But how could some crazy peacenik group?" he muttered.

"Not so crazy," said Ellis. "Those people were very slick, and very much to the point. The specialists here are pretty sure that the uranium ... plutonium ... whatever is in those lead boxes."

"Can't be," Winsor replied. "The fissionable slugs wouldn't fit in." As all the implications came together, the General paused. "My God, the technology required to reshape that stuff safely is—"

He was interrupted by the crackle of a walkie-talkie. "Roger. The President's out of range. Open the boxes."

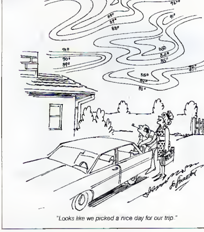
Four men in silvery gloves, which seemed to outweigh the hands that bore them, moved to comply.

"What the hell are—" Winsor sputtered into the tense silence.

"Even read Isaiah or Micah, General?" Ellis asked softly.

"What? The Old Testament prophets ..."

"Yeah. Plowshares, General. Plowshares." **DO**




*"Looks like we picked a nice day for our trip."*

# WIND

CONTINUED FROM PAGE 84

for another 50 years, perhaps 1000. It was so far in the future it really didn't matter. Those were much simpler times.

In Montreal the other line played out. The XXI Summer Olympics were held there that year. An interesting event took place. A small girl from Romania scored 20.000 on the uneven parallel bars. A perfect score. Perfect. That meant that no human being could ever do any better. Perfection. She also scored 19.950 on the balance beam. That was not perfection, but very nearly so.

Perfection and imperfection cross on the graph. They move on.

Through the '80s and the '90s the skies grew darker as the one line plunged downward, steeper every year despite futile attempts to slow or reverse it. Earth was going to hell in a bucket.

The other line was peaking; it would soon start to turn and follow the other towards oblivion. But there were marvelous peaks. While the majority of the people on Earth were either too fat or too hungry, a few were reaching spectacular heights. Through good and bad years the Olympics were held like clockwork. Records were made only to fall immediately. Perfection seemed to be almost within grasp.

Monitoring of athletes became mandatory. A wafer-thin transmitter no larger than a small coin could transmit muscle movements, brain waves. It was possible to record the totality of a record effort. It was a good thing it was done, for soon there would be no records.

Deficiencies took their toll. Food additives added more than vitamins. Harmless things turned out not to be harmless at all. Drugs and background radiation had effects that didn't show up for several generations. That line turned sharply down.

*When you have something that's good, you hold onto it. You don't let it go.*

The Olympics were good, but there were no athletes left. Only the records remained of past achievements. So they were used.

Electromyography: EMG. The production of a graphic record of the electric currents associated with muscular action.

Electroencephalography: EEG. The production of a graphic record of the electrical activity of the brain.

Hook a person up to a machine. Measure his responses to a situation and compare them to those of another.

*Forget that he can't move. He has no legs, no arms, no hands. He lives his life in a brace, in a basket. Forget you did this thing to him. Forget you took away the snow and his ability to fly down it. Give him something to hold on to.*

*Do what you can.* A national slogan.

Saturday. The skiing competition. There had been no snow outside the arctic regions for longer than anyone alive could recall. Dan made his way to the stadium. It was a difficult trip for him, but no more so than it was for everyone else.

The transit system was crowded, of course. Some people were considerate, others not. Dan was alternately knocked down and helped up, abused and consoled. He never went out much these days, didn't have to. The transit system was underground and thoroughly sealed. To venture outside without a suit was suicide. The stadium was domed and fully enclosed.

Dan followed the signs towards his assigned seat. It had taken 15 years of competition to work his way this far. Years of hard work and constant training. He might be too old, his body too far gone, by the time the next Olympics rolled around.

He tottered by his seat for a moment, looked out over the sea of faces, the sea of dreams. Flags and banners hung in the still air. Music echoed throughout the stadium, mingled with the murmur of hopeful voices.

Dan unstrapped his brace and lowered himself into the webbing of the chair. He picked up the harness of wires and started

> *❝Dan raised his hand, brushed his cheek with the brace. It was light-weight, gave support where it was needed, was flexible where it had to be. A monument to mankind, better than Hoover dam.❞*

to attach the electrodes. His hands were sweaty and he checked each connection three times. Then he went back and checked them again.

The machine he faced was a standard model, not externally much different from his own. Yet this one simply monitored; there were no feedback mechanisms at all. You had to follow the motion of the figure on the screen by yourself, matching muscle impulses to movements.

Dan hoped they would select a tape of one of the runs he had practiced. It was the only way he felt he had a chance. Some of them he could almost run with his eyes closed. There was a fairly good chance that they would, since there were a limited number of tapes available. He had practiced most of them.

An amber ready light flashed on his screen and he punched a button to indicate he was all hooked up and ready to go. He waited while others in the stadium checked their electrodes for the last time, punched their buttons.

The screen flicked into life, credits rolled past. He hardly noticed, a sick feeling grew in the pit of his stomach. *He had never seen this tape.* Hope drained from him, he fought back the tears. To work so long, to put so much hope into one day . . .

The countdown started. Ten . . . nine . . . what's this? . . . eight . . . seven . . . not a slalom, not a course at all . . . six . . . five . . . this was a man skiing down the side of a mountain . . . four . . . three . . . not just *any* mountain . . . two . . . one . . . Everest. *Start.*

With wild abandon, he pushed off the face of the mountain. The ground dropped out below him. He was flying. He hit perfectly, going faster than he'd ever gone before. Wind whipped his face, tore at his goggles. There wasn't another human being for miles. This was freedom, truly freedom. The snow crunched under his skis, the sun hung brightly overhead. Twist to the left. Over that mogul, knees bent, land, pole, faster now. A bird wheeled in the incredibly blue sky. He was laughing, tears ran down his face, were whipped away by the wind. He was yelling, screaming out of pure joy. He let his arms swing wide. He did crazy things, little dance steps on the snow. The cold air tore through his body, stung his nose, burned his lungs. He loved it.

And down he flew, faster, faster. He could do anything, he could do everything. He dodged the rocks, flew over gaping fissures. He lived, for once in his life he lived. Topping a ridge, he flew into space, turned a somersault while laughter rolled from his belly, from his soul.

Coming off the steep face of the mountain, the slope leveled off, trees started to appear. *Trees.* He startled a deer, flushed some birds. *Deer. Bird. Living animals.* He crested a hill and could see the finish line below him, a small cluster of people.

As he approached the finish line, he came out of his speed crouch, slowed, looked over his shoulder. The incredible mountain lay behind him, above him. He had done it, conquered the unconquerable. The green things and the living things and the snow and the clean air all closed in around him at once as he crossed the finish line and was hugged by the spectators.

He opened his eyes and found the woman in the next chair was hugging him. He was hugging her. A quiet hush blanketed the stadium. An old man behind them was softly sobbing. Dan looked at the woman, a stranger, a friend. Her eyes held the wonder of the things she had seen, that they had seen. He pulled her tightly to him. She grabbed his ruined arms with her broken hands. Tears flowed down both their faces, mingled together as they brushed their cheeks. They were lost people, hopeless people, but they had found something, shared something very important.

Give it a label. Call it hope.

*If man can do this, man can do anything. Hold on to what you can.*

He helped her into her brace, she helped him. It was awkward, they were clumsy with each other. It didn't matter. Turning, they both kissed the old man behind them, touched his face, his smile. They didn't wait to see who won. It wasn't important. ◘◘

CONTINUED FROM PAGE 97

thor of a Stanford Research Institute study done for the Energy Research and Development Administration (ERDA) DOE s predecessor He told a congressional subcommittee looking into the cost of nuclear power that the basic political issue is whether we are going to pay the penalties of being dominated by a highly centralized nuclear future or whether we are going to make a very different kind of social issue of a solar future Decentralized solar energy and soft technology paths have powerful sociocultural advantages, and they shape our future in a direction that is more humane

The Stanford report went on to say, That question cannot be separated from a fundamental reassessment of major priorities in our society and of our basic beliefs about man's place on the planet and in the universe—beliefs upon which our priorities depend The issue of accelerating a shift to solar energy and other renewable energy supplies *is not a matter of technological and economic factors alone* it involves the fate and future of industrialized civilization (emphasis added)

Since 1952 when the Paley Commission recommended to President Truman that an aggressive effort be made to develop solar energy other government and private reports have reiterated that suggestion, saying that solar resources could provide a substantial portion of this country s energy needs if an aggressive effort were made or if, as CEQ put it, "our commitment ... is strong

Unfortunately, "commitment" and "aggressive effort" mean money And solar energy has traditionally been the stepchild of the U.S energy program, receiving less than one five-hundredth of federal energy funding Even this year s budget up substantially from solar s initial $10 million funding level six years ago, is still considered conservative Unfortunately the Department of Energy has failed to move forward aggressively in the solar program, as manifested by an extremely conservative solar budget for FY 1979 Indications are that Phase Two of the National Energy Act (NEA) will not give solar energy the substantial boost it deserves, said the Congressional Solar Coalition in a March 31, 1978 letter to President Carter

Solar and nuclear energies continue to compete for the same federal dollars with nuclear energy winning substantially over the years Since World War II the federal government has spent more than $100 billion for the development of nuclear energy and nuclear weapons Of this, more than $17 billion has gone directly to civilian and naval fission reactor development (Conventional nuclear reactors owe a great deal to submarine reactor designs ) The $17 billion does not include the nearly $9 billion for fusion and physical research on the behavior of materials and for biological, medical and environmental research

Thus say many solar energy advocates past as well as present efforts to utilize solar energy have been thwarted by economic biases As one government source put it "The high priests of nuclear have little use for solar because it is a direct threat

Moreover, unlike competing energy sources solar energy has been unable to reap the financial benefits of scores of highly paid lobbyists and it has not profited from the approximately $130 billion spent by the federal government over the past 60 years to subsidize conventional energy sources such as oil, gas, coal, and nuclear, according to a 1978 study

Solar energy's competitive disadvantage is compounded in that producers of fossil fuels and nuclear power get special help for financing taxes and insurance along with rate structures that mask the cost of new generating plants by averaging them with less expensive older facilities

*Given the "paper gap" that exists between the solar and nuclear programs, it s clear that solar technologies will contribute only minimally to the country s future energy needs*

Solar equipment is never averaged in Indeed a solar user may even be penalized by his or her utility because their need for gas or electricity has been reduced (utilities have traditionally charged small users a disproportionately higher rate)

Many solar energy advocates and administration critics believe that if the same spirit and money were brought to solar power that 15 years ago were applied to space exploration the remaining problems of solar technologies could be solved within a decade As Hayes put it, if—as President Carter says—the energy crisis is 'the moral equivalent of war' couldn t the financial equivalent of a Trident submarine—$1 billion—be invested in safe benign answers to that crisis?

In addition to being underfinanced, the solar program is also severely understaffed DOE s top officials, along with the Office of Management and Budget, which controls staffing have kept the solar staff small An internal review of solar program management (received over protests of DOE officials by the subcommittee investigating the solar program) found that though funding increased from $50 million in FY 1975 to $290 million two years later the staffs rose to only slightly over 100 a small increase from prior years Even now with a budget of more than $400 million the situation has not changed appreciably

Understaffing has resulted in disjointed priorities, overemphasizing large-scale technology to the detriment of smaller scale applications If you have a lot of money to spend but a limited staff it makes sense to find a few big contracts to spend it on " said one solar staffer "Solar is ideal for small business, yet there is a continual bias toward large corporations It makes things easier administratively Department of Energy officials concede that only 17 percent of the solar heating and cooling demonstration budget goes for small business

We have this aerospace company mentality permeating the whole solar energy business [Yet] a large fraction of the really exciting low-cost solar energy ideas have been coming out of very, very small enterprises, Theodore Taylor physicist and author of a Rockefeller Foundation sponsored study on solar energy told the subcommittee He used as an example a small Florida company that had submitted a $17 000 bid to DOE for an irrigation solar pump the company had already built No further research was needed Six months later the company was informed that the contract had been given to another company for $70 000 When they called DOE to ask why, they were told, "Your project didn't have any R & D in it"

The aerospace company mentality is due in part to DOE's administration by many former officials of the old Atomic Energy Commission It is not surprising, therefore that the majority of solar funds will be spent on high cost high technology centralized systems with long-term research, development, and demonstration needs similar to those of nuclear power

The [solar] research program has emphasized large central power stations to produce solar electricity in some distant future and has largely ignored small solar devices for producing on-site power wrote *Science* The massive engineering projects designed by aerospace companies which dominate much of the program, seem to have in mind the existing utility industry—rather than individuals or communities—as the ultimate consumer of solar energy equipment

The bias within DOE toward large-scale projects is also reflected in the way the budget is divided among various technologies that produce the same end use For example, $274.8 million was allocated in FY 1979 for solar electric application, including $28 million toward the huge $120 million "Power Tower" in Barstow, California In contrast, all nonelectric applications received less than half that amount ($108.4 million)

The power tower is a ten-megawatt pilot plant surrounded by a large field of optically perfect mirrors that follow the sun all day and reflect its rays to the top of the tower A boiler is used to produce steam and in turn electricity The high-temperature power tower has only long-range—some say unlikely—applications in the Southwest but "intermediate" temperature systems can be used throughout the U S

Yet as Denis Hayes told the House subcommittee, "Less than 10 percent of the end-use energy consumed by the American economy is in the form of electricity To get that 10 percent we consume almost 30 percent of our fuels, converting it into electricity [Thus] there is a disproportionate emphasis on solar electric technologies within the Department of Energy's R & D budget, and in that category far too much emphasis on gigantic projects the power tower being the most notable example and far too little on decentralized solar applications "

Many solar advocates, like Representative Ottinger are fearful that "the solar electric program is going to get eclipsed by being dumped in with long-term, high technology nuclear projects Hell! Solar electricity [from decentralized, photovoltaic cells] should be cost effective in the near future The problem is that Standard Oil and the utilities do not own the sun There is just not the industrial push behind solar that there is behind nuclear There is tremendous industrial pressure to advance high capital options like nuclear with high capital options The banks want that because it means high financing The labor unions want it because big dollars are involved [an average of $1 5 billion to build a nuclear plant]"

Ironically even if solar energy were to get the green light from DOE, its monitoring and tracking system is so inept that any additional funds might be squandered The internal DOE review found that "solar has been more concerned with obligating its funds rather than tracking the use of [them]" Said one DOE solar staffer "There's no way to tell if the money is being used properly I don t even have travel funds to get out there and oversee a particular program I can't monitor my contracts properly so we are basically operating under trust Lots of money gets wasted because a company says a project will cost so much and we don t have time to find out whether it s justified "

The General Accounting Office in a separate study also concluded that better planning and management control are needed in the solar program, after investigating the first solar demonstration project on Department of Defense (DOD) residences This project was never completed because the solar systems to be used were overdesigned and could not meet the $50-per square-foot estimate GAO stated in an April 1978 report that "according to one builder the Defense systems would have been at least two times more expensive to install than other commercially available heating systems and as such were "economically ridiculous "

Defense had spent over $719 thousand of the project funds and a substantial portion of the remaining $3 1 million was redirected to nonresidential solar efforts—contrary to the law This situation could have been avoided had ERDA and the DOD developed a detailed program before initiating the project GAO said

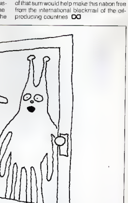
Referring to the DOD project and other squandered solar funds Hayes told the subcommittee that "sometimes federal institutions have thrown away incredible amounts of money on some of the most inept purchases I have seen

Not only is there little management control in the new DOE solar energy program but according to a majority of the more than 25 witnesses who appeared before the House Government Operations subcommittee last spring there is disorganization if not chaos in federal solar programs Yet DOE was created expressly because of the need for coordination and effective management of the vast array of federal energy programs, including solar initiatives

Congressional and environmental critics agree that the mandate to give solar energy top priority in the nation s plan to become energy self-sufficient has been treated by the Carter administration as at best an afterthought Appropriately sun power, the people s energy, owes its emerging popularity to increasing public pressure that it be allowed to make a contribution consistent with its social and environmental benefits A Harris poll last spring showed the public which nine months earlier had been heavily disposed toward nuclear energy now favored a crash solar program by 80 percent far ahead of any other energy source

Jimmy Carter reads the public opinion polls as closely as any president in recent history His decision to increase the solar budget and to launch both an interagency review of federal solar programs and a presentation of options for accelerated solar use seems to be a direct result of public opinion The final report of the Domestic Policy Review (DPR) was to have been released October 15 after we went to press Early drafts of DPR documents however were greeted critically by informed observers A combination of public interest groups produced their own counter domestic policy review hoping to influence the president to accept more ambitious goals for the solar program But as of this writing it was unclear how successful the effort was going to be

Perhaps turning on People Pressure for solar energy is the answer to solar s survival as a viable national energy source It's your money the Carter administration is spending for nuclear cruisers and Trident submarines—with Congress this year approving another whopping Defense budget of $119 billion One one hundredth of that sum would help make this nation free from the international blackmail of the oil-producing countries ∞



"Don t ask me I'm just as baffled by all this as you are "

# BROWN

CONTINUED FROM PAGE 104

the talent that they have. That's what I'd like to do.

It is a work of human imagination to break down the parochialisms that seem from space seem so arbitrary. We divide up people into Californians and Mexicans, Arabs and Israelis, Chinese and Americans, yet, as we circle the globe, we see what it is that we are *one very rare species*, existing for a moment in universal time.

The space shuttle *Enterprise* is truly like laying the last spike on the Transcontinental Railroad, only much more so. Those of us who see it will also see, in the next ten or 20 years, a base on the moon manufacturing from moon material or asteroids. It's *going* to happen. The only question is: How?

Will it be the Japanese, or the Germans, or the Russians—or will it be *all* of the world? Working through the leadership of the developed countries, we can bring along all the other countries to try to promote a better quality of life, to reverence the Spaceship Earth, to realize that the oceans flow through all of us and through all lands.

We're going into space as a species. The human race is going out and throughout, wherever space will permit us to go. It's only a question of when, and who and what kind of leadership will take us there. **ꝏ**

# FULLER

CONTINUED FROM PAGE 102

introducing new technology: we can't invent anything. All we can do is discover what *is* and employ it.

Many new tools are evolving with us, as independent entities. However, in the world of the machine, I don't talk about "cybernetic intelligence" (as some do). I talk about the technology of cybernetics, of steering-system *feedback*, for example, but I don't refer to feedback as intelligence. To discover an error in an angular course and correct it is not intelligence. We have a cultural propensity for talking about things in a way that's really stupid. Newspapers, magazines, need headlines that will sell, so they apply the word "intelligence" to a machine. No machines will ever be intelligent. They never have been and never will be.

There is a physical universe and a metaphysical universe. The universe, as we began to find out at the beginning of this century in Einsteinian terms, is all energy. Energy can neither be created nor be destroyed. The physical universe is all energy; radiation is energy. A needle on an instrument will be moved either gravitationally or electromagnetically. Anything that is metaphysical will not move needles. The sound I make when I talk to you is physical, but the *meaning* within the sounds is completely metaphysical. Your whole intellect is utterly metaphysical, whereas cybernetics deals very much with the physical—like the arrow or the needle, that shows that your course is wrong. That's why "cybernetic intelligence" is a contradiction in terms.

People have been so careless as to think of us as some kind of china doll with nothing underneath the surface. Now we're beginning to learn about what's in that brain of ours, and it's incredible!

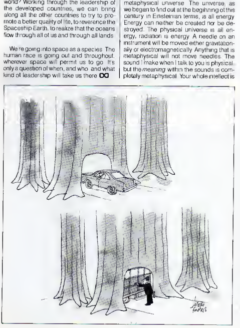
What is really going on is that *mind is discovering the principles of brain to be only a special case*, coordinating the input of all the senses—olfactory, auditory, optical, tactile—and, to some extent, the esthetics and the intuitions. All that's happening is that we're discovering principles that have always been there, learning to employ some of those principles, and discovering some more about how they operate. Coevolution, then, is the increase of our knowledge about what's going on in that's all.

Human beings have developed words so that we can communicate our experiences; that's what education is. Although we became able to write and to compound all the experiences and information of all the people before us, gradually discovering the principles operating in that information, we were misinterpreting the special case of ourselves and missing completely what its significance was. That makes the present cultural change a fascinating one: each child born successively is given less misinformation; the old misinformation becomes simply irrelevant. Moreover, each successive child is being born in the presence of more reliable information.

This is why I say I'm not worried about the way new information gets to children, whether they're sitting in front of a tv set, looking at newspapers, or just looking at cartoons. The kids are going to latch onto whatever it may be.

The fact is that latching onto tv is really a most wonderful thing. An apparent problem is that we're using it as a means to make money—to sell toothpaste, and so on. The kids, however, aren't really so much interested in that information, but just in the way the thing is working. They love the technique; they're studying the technique all the time. They take in the use of language much more than they do the message.

My hope would be that we take advantage of the fact that kids are glued to the set and give them some of the synergetics, the mathematics, that will really fascinate them. Then the 99 percent of humanity that doesn't understand that the universe is nothing but technology, who think that technology is something new and desirable, who can be fooled into using phrases like "cybernetic intelligence," will be able to catch on to nature's way of producing. They can learn about the way things grow, what a structure is, how you employ the principles in the most economical way so you can harness all the wonderful energies that are available in your own little home. **ꝏ**



# SCHWEICKART

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I wasn't in any way prepared for the experience. It was really a surprising thing. I realized through that experience how much I was into the activity of the space flight, how much I was really involved in what I was doing there. *That* experience brought me back to the earth. And to home. And to music and to life back there.

For the most part, during a flight like that you're quite busy. If there are no interruptions and you press on with the flight plan, throw the switches, make the readings, do the maneuvers, and use all the skills you've developed in training, you can totally occupy yourself with these activities.

During the flight, I found that I thought about the nature of the experience I was undergoing only when I caused it to happen. That is, when I took the time, I interrupted what was happening and took the time to think about it, what the experience of space was, in and of itself. I brought it consciously into mind, and actually it was almost an accident.

On the fourth day of the flight, I was to go outside the lunar module for a test of the backpack that we were to use later on the surface of the moon, in order to explore the moon. This was to be the first flight of that backpack. I was, on that day going outside the lunar module and, in fact, went out for 47 minutes.

During that time, Dave Scott—who was over in the command module—also depressurized the command module, and although he was not on a backpack but had to stay hooked to the umbilicals, nevertheless he partially exited from the hatch in order to recover some thermal samples. Part of the program at that point was to photograph the exterior surfaces of the lunar module and the command module for discoloration due to pyrotechnic events and things of that kind, which might change the thermal characteristics. So David and I were photographing.

I was to progress up a set of handrails to the top of the lunar module and across to the command module. That was to verify our ability to transfer from one to the other externally in case we couldn't go through the tunnel between the two vehicles because of some problem with the docking. Dave was to photograph that, for engineering purposes: to see how well I could control my bodily position and whether I would bang into the radar antennas, things of that kind. The camera jammed.

Dave called a halt to everything and said "Give me five minutes to try and fix the camera." Which is no simple task in a pressurized spacesuit, you know, outside in a vacuum. So while Dave was messing around with the camera, I had about five minutes in which I had nothing to do. Except to take that time to think about what I was doing, and look down at the earth. Of course, this is an absolutely spectacular sight, at that time we were coming up over the west coast of the United States.

I'd gotten out at dawn just after we'd crossed the equator over the Pacific. By this time I was coming up over the western part of the United States. I was looking down, going over the southern part at 17,000 miles per hour. When there is no communication coming in, as you use that portable life-support system the radios are completely dead. There's absolutely no sound at all. Now, when you're going along at 17,000 miles an hour with this incredible, spectacular panorama below you—and absolute total silence—you can't imagine how beautiful it is.

Mysticism is something that interests me, in a way. In another way I react against the idea that the space experience is, in and of itself, a mystical thing. I think that has been implied by many people in looking at the kind of changes that have occurred in some of the astronauts. Jim Irwin after his flight on *Apollo 15* started the High Flight organization and became an evangelical preacher. Ed Mitchell going into ESP, Al Worden writing poetry.

Somehow the experience of space does something to people. I react against that concept when it takes on the guise of something imposed almost from the outside, something controlled by the experience. It is not that. Certainly this was not the case for me. I don't believe that it was for anyone I know, including those I've mentioned. I think it's something that one permits. I think space is a very profound experience. There are many analogous experiences here on earth or under the sea or in many areas of life.

In many cases, unique human experiences come about only after one gets the attention of the person—as the story goes, hitting the mule between the eyes with a two-by-four to get his attention if you want him to do something. Space travel, at least in the early days when things were pretty exciting, was a fairly big two-by-four in terms of getting one's attention and causing one to think why one is undergoing that experience—a "How did I get here?" kind of thing—space travel has that aspect to it. Then the experience itself is, in terms of the perspective the enlarged physical perspective of the earth. This is the identity that develops as you circle the earth every hour and a half. At least this is the case in earth-orbital missions.

As you go around, you develop an expanding identity one that starts by recognizing the familiar features, home, the places you spent your time. However, this enlarged perspective is something that stays with just about everyone who has flown in space. The consequent and subsequent expression of that experience, in terms of a changed lifestyle or what one does afterward, assumes different forms for different people. For some people, it's personal and internalized. They consider this to be a private matter. For others, it's something that demands a different type of commitment.

The space experience itself is unique. A person does not do this on a routine basis. Any space flight that you're assigned to may be the only one you fly, or if it's a second one, it may be your last space flight. They don't come that frequently, and so there is certainly a sense of wanting to capture the experience because it is something that doesn't happen frequently. In some form, though perhaps less purposeful than the one I just described for myself, I think that probably everyone prepared for the missions. But I suspect there was a great deal of variation in the consciousness or the specifics of how different people went about it.

Simply going into space is not going to produce change in consciousness. When you get up there, you are still you. And if you are open, then the experience takes on a different meaning for you and has a different significance than if you were an "eyes-straight-ahead" or "on-with-the-job" type of person. But that's also true of those same two people if they go out into the woods or if they go scuba diving at night or any other experience of that kind. The one type of person will experience something quite different from another who is less open to the broader perspectives.

We will develop a longer-range view of the evolution of intelligence. There has been an assumption, although not an explicit one, that the evolution of life is limited to the planet.

The reality of migration away from earth, of a gradually increasing sphere of consciousness and awareness of different life forms, is something that we're seeing in its embryonic stages. To some, that's a shock, to others, it's dismaying, because they see it as *either* space *or* earth. I think that's totally invalid. The environment of earth will be *enhanced* as we move out into space, because we open up a much larger environment for utilization and for interaction, whereas without doing that, we are limited to using the resources here on the planet.

This whole issue of the limits to growth, which puts a psychological as well as physical cap on potential expansion of activity and awareness, has had a very depressing effect on many people. It is now beginning to be reexamined in a critical way through a lot of the activities brought about by O'Neill's concept of space colonization and other developments. I don't for a moment think there's any concept being worked on now that will be followed as a straightforward scenario. But the idea embodied in concepts such as space colonization or space industrialization or availability of nonterrestrial resources is fundamental, and it will change the way in which people look at the future.

I know that my kids, and I don't think they're in any way atypical, assume that this is part of the future. They will provide the imagination and creativity needed to bring about this kind of an evolution. They are the kids of the space age. OO

CONTINUED FROM PAGE 10

ernment, a position that provides him with a springboard from which to launch his thoughtless, gut-level denigrations of programs whose ultimate purpose is to improve our understanding of the universe around us

Referring to NASA s worthwhile SETI project (the search for extraterrestrial intelligence) Proxmire has said that this project should be postponed for a million light-years Anyone who doesn't realize that a light-year is a unit of distance and not of time cannot be expected to harbor meaningful or informed opinions on topics of this nature

Keith A. Daniels
Portsmouth, RI

### Flash of Inspiration

In reading "Stars" by Patrick Moore (November *Omni*) regarding TLP—Transient Lunar Phenomena—the thought occurs to me that light phenomena observed at such formations as Alphonsus could have a parallel with flashing lights common on earth immediately before earthquakes This is particularly logical when it is acknowledged that lights of this nature occur most often when the moon is at perigee and stress is greatest as is the case with an earth surface prior to a quake

Lawrence E Larkey
Kingsport TN

### Tubular Belles

In the "Continuum" section of November *Omni* (page 39) two manufacturers of ladies' undergarments seem at a loss to explain why ladies are becoming less hourglass-shaped and more tube-shaped Perhaps they should examine their products' changes over the 25-year period in question I think that fashion—coupled with girdles—has brought about this phenomenon in their sampling

Kip Williams
Ft Collins, CO

*Corsets physically deformed women s bones because earlier in the century girls were bound in them before age ten See The Unfashionable Human Body by Bernard Rudofsky for all types of gruesome illustrations —Ed*

### Necronomicon

In November *Omni* your cover was from a book by H R Giger called *Necronomicon* I have tried all the book stores in my area with no results How can I order it? I want if very much

Tom Walker
Dunedin, FL

*The Swiss artist Giger's Necronomicon has been published in German and French The English edition should be available sometime in 1979 For information concerning the German or French editions you may contact Galerie Bijan Aalam, 22 Passage Vero Dodat, 75001 Paris, France*

*In the U S Hansen Galleries will be handling some of Giger s art For information contact Hansen Gallenes, 72 Wooster St , New York NY 10012 telephone 212 431 5904 —Ed*

### TM, Emotion, and Disease

Concerning "Language Emotion and Disease" by Wallace Ellerbroek in November *Omni*, I would urge Dr Ellerbroek to investigate more closely the scientific research done on the effects of Transcendental Meditation as taught by Maharishi Mahesh Yogi in regard to health and to review research presently being done at Maharishi European Research University on the TM Siddhi program where evidence of perfect mind/body coordination is being found during the performance of supranormal activities

Ellerbroek might study the underlying basis of all mental activity pure consciousness itself He is correct in stating that negative states are critical components in the development of all the most common medical and psychiatric problems But to remove negativity, one should not dwell on negativity but rather introduce something wholly positive to dispel the negativity

Research indicates that during TM the nervous system attains a state of no-activity and no-passivity The mind and body gain a state of restful alertness In time this state is automatically without conscious effort maintained at all times thus leading to a situation where the body is invincible to disease Until this state is achieved, the body will go through periods of sickness So on this level "people still get sick" (*Omni* p 94), but on a higher level as the TM-Siddhi program is demonstrating the body can be maintained in perfect health

TS Miller
Boston, MA

### Postindustrial Postscript

While enjoying the future-oriented contents of your new 'zine, I noticed an error Gerard K O Neill never said that the surface of a planet is not a good place for a postindustrial society What he did say, both in his book *The High Frontier* and on a recent Merv Griffin tv space special is that a planetary surface is no place for a technologically advancing industrial society *Postindustrial* space colonies are not part of his concept and, frankly I'm glad he s too intelligent to buy that postindustrial garbage anyway

Sandy Shakocius
Palos Verdes Estates, CA

### Embattled 'Battlestar'

Glen Larson better start looking elsewhere for loyal *Galactica* viewers *Star Trek* fans are not taken in by spectacular effects depicting mindless space battles *Trek* stories deemphasized special effects and external conflicts To a loyal "Trekker" special effects alone can never make a science fiction television series

L A Lackore
Ames, IA

During television's prime time viewing hours *Battlestar Galactica* airs horrendous acts of cosmic violence As I watch the dazzle of people ships and robots being zapped out of existence something tugs at my conscience

These stories have an almost subliminal way of paving into our minds allowing some of us to be comfortable with the probability that our future in space is going to become a never-ending series of wars

Our future begins with our thoughts and fantasies let's not think of our tomorrows with today's mentality I hope *Omni* will continue to contribute to our imagination and our future as a well-balanced and responsible alternative to the tradition that brought forth *Battlestar*

Gene T Sherk
Portland, OR

### Tentatively Speaking

Congratulations on a great new magazine with a long overdue editorial premise I d like to suggest a reexamination of the works of Immanuel Velikovsky *Science* has ignored *Worlds in Collision*, Velikovsky s 1950 theory of the origin of Venus and its close encounter with the earth circa 1500 B.C. despite the fact that Velikovsky deduced several outlandish predictions from it that subsequently proved true Among them the high temperature of Venus radio emanations from Jupiter and the remnant magnetism in lunar rocks

Since scientific journals have consistently refused to allow Dr Velikovsky to respond to his detractors for the last 28 years I think *Omni* should devote some space to an objective look at current evidence for his assertions

Gary Tillery
Waukegan, IL

### Vitae Extendae

Just in case you didn't notice of the people listed in your November "Continuum" article as having taken Gerovital H3 all have died What does that tell you about the efficacy of the drug?

Ben Orlanski
Fifth Grade
(Address unknown)

*All the deceased however, lived well beyond the average lifespan of the American male (68 years) former Vice-President Henry Wallace lived to be 77, Nikita Khrushchev, 77, Somerset Maugham, 91 Saudi Arabia's King ibn Saud 73 Mao Tse-tung, 83 This, of course, does not confirm Gerovital's efficacy —Ed*

# ACOUSTIC SANDS

# EXPLORATIONS

By Jerry Schad

It seems unlikely that so common a medium as sand could possess apparently magical, musiclike qualities. Yet the existence of such sands is well documented. Booming, roaring, barking, squeaking, and whistling sands have figured in obscure legends, folklore, and traveler's tales for over 1500 years, with the earliest references found in Chinese and Mideastern chronicles. Marco Polo describes encountering the phenomenon on a journey through the Gobi desert, Charles Darwin mentions it while traveling through Chile, and it crops up in the writing of Henry David Thoreau.

The more imaginative legends speak of the "song of the desert", the groaning of subterranean deities in the still of the night, incantations of ghosts, the beating of drums in underground caverns, or the chiming of bells in a sand-drowned monastery.

In reality, the noise emanates from sand flowing down the slip face of certain rare dunes or drifts known as "booming dunes." British physicist R.A. Bagnold witnessed it on two occasions in southwestern Egypt: ". . . It happened on a still night, suddenly—a vibrant booming so loud that I had to shout to be heard by my companion. Soon other sources, set going by the disturbance, joined their music to the first with so close a note that a slow beat was clearly recognized. This weird chorus went on continuously for more than five minutes before silence returned and the ground ceased to tremble."

A more common, though less spectacular manifestation of the acoustic properties of sand is found in a type known as squeaking (or singing or whistling) sand present on certain ocean beaches, lakeshores and riverbanks. In order to produce sound, squeaking sand must be sharply poked, kicked, or scuffed. There are basic differences in the physical properties of booming and squeaking sand; the sounds made by each are mutually exclusive. The unique properties of acoustic sands, in turn, differ from those of ordinary sand.

Booming sand dunes are visually indistinguishable from normal sand dunes, and to the eye squeaking sand is also identical in appearance to ordinary sand, yet fundamental differences in the individual sand grains are revealed by the scanning electron microscope.

Booming and silent sand grains are rather similar in shape and roundness, but under magnification it is evident that booming grains are much more smooth and polished. How this difference gives rise to the acoustic properties of sand is still a matter of educated guessing. The smoothness of grains may be of considerable importance in the booming process in allowing grains to slip over one another with a minimum of friction.

The occurrence of booming sand is rare but widespread. Only 31 locations of booming dunes have been reported in literature, with the majority in the Middle East and Africa. The United States has four: one each in California and Nevada, and two in Hawaii.

Dryness is essential for sound production in booming sand. Rain, or even high humidity, will eliminate booming completely. Hot, dry days are best of all.

The booming sound may occur spontaneously by the natural slippage of sand on the lee side of a dune where the sand has built up to a slope reaching the maximum angle of repose. One can also induce the sand to boom by artificial means. By pushing sand downward, a loud roaring noise, similar to a staccato note played on a tuba, often results. Sand may be forced downhill with the hands, feet, a shovel, or with whatever is convenient. An early investigator, A.D. Lewis, explains his method during a scientific visit to the Kalahari dunes of South Africa in 1935 as follows: ". . . By sliding down the slope in slow jerks on one's 'sit upon' . . . a very loud roar is produced. In the still of the evening and early morning, natives were kept sliding down the slope in this way, and the noise was easily heard at a distance of 600 yards, like the rumbling of distant thunder."

The continuous slumping of sand on a booming dune, whether spontaneous or induced, produces a low-frequency hum (about 50 to 100 hertz, or cycles per second) that can resemble a pure tone of a pipe organ or a bass violin. In some cases, the presence of overtones suggests the drone of bumblebees or of propeller aircraft flying overhead. Accom-

*Kelso Dunes in southeastern California—one of only two sites of booming sand in the continental U.S.*

panying the acoustic emissions of the dune are seismic waves—ground vibrations that may be felt as mild electric shocks through the feet or hands

The intensity and duration of sound depends upon the surface area of avalanching sand which is typically a few centimeters deep The sliding of a few square meters of sand will produce sounds audible 50 or 100 meters away while huge avalanches from dunes in China and the Mideast are responsible for the "rumble of distant carts, drums, or thunder" heard and often felt at distances of up to 16 kilometers

The more familiar phenomenon of squeaking beach sand is, on the other hand, not heard beyond a few tens of meters The sound emitted is a brief note of around 1000 hertz The sand need not always be dry to squeak but in all cases the squeak or whistle is louder and more easily produced immediately after the sand has been washed and well dried The best conditions on the beach are likely to occur in dry sand just above the high-water mark, especially on warm, sunny days following a rain shower Areas of squeaking sand are quite common but not well documented in the United States In exhaustive studies of beaches in the British Isles, 33 sites with acoustic sand have been located

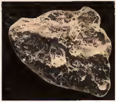
While there is no doubt today that the musical effects of acoustic sands are attributable to natural phenomena the exact method by which the mechanical energy of moving grains of polished sand is converted into coherent vibrations is not yet certain

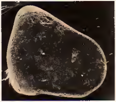
The continuous humming noise may originate as an oscillation of grains between the interfaces of sliding planes of sand Or the key to the production of sound may be the way in which the grains are packed together Air pressure within the mass of flowing sand may change rhythmically as the packing geometry changes Regardless of the exact cause the stationary sand underneath must act as a natural resonator, or sounding board, to account for the enormous volume of sound

Booming sands are often found at the downwind ends of large dune fields or backed up against the lee slopes of mountains by wind eddies In either case the sand has to have been transported by wind over a large space or been trapped for a long period in a wind-driven environment to insure the additional polishing needed for the grains' distinct smoothness These conditions may not exist solely on earth—it is speculated that booming sand may be common in the windy and near waterless environment of the deserts of Mars!

An analysis of squeaking sands shows that these grains are also better rounded and have much smoother surfaces than grains from silent beaches Furthermore, unlike booming sand grains of squeaking sand are of nearly uniform size The addition of only a few smaller-size particles to a sample of squeaking sand will destroy its vocal ability The sound mechanism may be due to the impact of grain upon grain, millions in unison, as the sand is forced along parallel planes This might be compared to the noise made by two pieces of corduroy being rapidly rubbed together Or, maybe as with booming sand, a rapid alternation between close packing and loose packing of grains creates an expansion and contraction of the volume occupied by the sand and a consequent rythmic change of air pressure at the surface There are apparently some subtle differences between the stable arrangement of particles in the two types of acoustic sand—a *body centered cubic* packing has been proposed for the booming variety, and a *rhombic* packing for the squeaking kind

The theories about acoustic sand are tentative at best Recent research has centered upon the precise analysis of sizes, shapes, and textures of the grains, and the means by which the correct mix of particles accumulates on a beach or a dune Recordings have been made of both the acoustic and seismic outputs of a booming dune, and similar studies have been performed with squeaking sand in the laboratory To date there is no quantitative theory—only hypotheses, speculation, and a good measure of mystery about this startling, other-worldly phenomenon **DO**





*Scanning electron micrographs of grains of silent sand (top) and squeaking sand (bottom)*

## WHERE THE SANDS ARE LOUDEST

*Squeaking sand* is found at over 100 locations in the United States primarily along the Atlantic coast and the shores of Lake Michigan Even within known areas, its presence may be sporadic due to factors that affect the transport of sand particles When conditions are right, such as on a hot, sunny day you should be able to produce the sound by shuffling through the topmost layer of dry sand just above the high-water line Two such beaches, recorded in James Dale Davidson's *An Eccentric Guide to the United States* (Berkley, 1977), are at Manchester Massachusetts, and Grant Haven on Lake Michigan *Booming dunes* are much more of a rarity Here's where to find them

• The Kelso Dunes of southeastern California consist of three groups of large barchan (crescent-shaped) dunes, 12 kilometers southwest of the town of Kelso in San Bernardino County Access from either Interstate 15 or Interstate 40 is by way of the paved Kelbaker Road and a short segment of dirt road that passes within 2 kilometers of the southern edge of the highest dune Because of fragile vegetation along the base of the dunes the area is off limits to off-road vehicles

• Sand Mountain in western Nevada lies 4 kilometers north of US Highway 50 at a point 25 kilometers east of Fallon A dirt road leads to the soft apron along its base Sand Mountain is composed of two seif (sword-shaped) dunes whose summits stand about 120 meters above the desert floor

• The Roaring Sands or Barking Sands on the west coast of Kauai Hawaii, near Mana run parallel to the coast for a kilometer or more They are unique in that they consist of carbonate sand—water-worn and windblown fragments of shells and coral Booming dunes in other parts of the world are principally quartz

• The only other known booming sands in North America are back beach dunes on the island of Niihau, Hawaii and in Baja California Patience and good luck!

# EARTH

CONTINUED FROM PAGE 18

was schooled on the powers, responsibilities, and duties of Ibedul by certain members of Ngarameketii At the end of the retreat he was taken to Ngerchemai a hamlet in Koror, where he washed his hands off a baked turtle, a ceremony in which he pledged to begin his reign with a clean conscience and justice for his people."

When I first approached Ibedul Gibbons, his back happened to be toward me For a moment I was at a loss over what to say I had been told that I should address him only as "Ibedul," and I didn't want to be disrespectful, yet suddenly I had that old problem of Americans when confronted by royalty My tongue was perversely democratic and wanted to call him "Mr Gibbons" At the last instant I had an inspiration

"Hello," I said.

Ibedul turned, grinned, and pumped my hand His smile was infectious and it disarmed me In the same instant though, came a thought *The man lacks the guile to survive Palauan politics* I had met Ibedul Ngoriakl, his predecessor, and the difference between their visages was exactly that of night and day

I studied Ibedul circumspectly He had an imperial midsection A healthy stomach is the badge of office for both U.S. Army cooks and South Sea island chiefs His face was permanently fixed, I thought in an expression of agreeable surprise He looked like a man whose genie had granted all three wishes, and who was beginning to believe there really was no catch.

This impression was not entirely correct The first months as high chief back in '73, had been very difficult, Ibedul told me "I didn't really know where I go, what happens, what I do, if something comes up Like a conflict arises between the clans about the land disputes, or some kind of war" He admitted that now, several years later he was still working hard at learning all he had to know

"My grandmother I go to her house every night I talk to her and learn about all these customs Because, you know, I wasn't paying too much attention when I was a kid. Mainly I was in school, or running around with the kids I went to Guam and then decided to be a military man So I was away most of the time."

Ibedul's grandmother was Bilung, Queen of Koror She was a very smart lady, according to her grandson As a young woman she had been clever at bringing Palauan money into Koror from other islands Pieces of this money serve as markers in oldtime Palau's most serious game, a game that is important still today.

Bilung's mother had come originally from the archipelago of Truk and her father was an American sailor

"You must learn to trust your cabinet," Bilung had told her grandson "You must spend more time with your cabinet. They're all titled people They're old and experienced, and they know all these customs."

"So I rely on my cabinet," Ibedul told me "I have twenty members, ten upper ones and ten lower ones They represent each clan here in Koror If anything comes up, I call them in to discuss it and get their opinions"

The task facing Ibedul Gibbons is a doubly difficult one He must learn two systems, one of which is oral, complicated, and uncertain because the elders in whose memory it lives do not always agree the other of which is written, but uncertainly so, for the United States has little colonial experience, and is slightly embarrassed, anyway, by its presence in the islands (though not sufficiently embarrassed), and is vague on just which of its internal codes apply to its territory The

*"I studied Ibedul. He had an imperial midsection. A healthy stomach is the badge of office for both U.S. Army cooks and island chiefs. He looked like a genie granted him wishes."*

second system is superimposed on the first, squashing it in some places, in other places made lumpy by the queer box springs beneath Ibedul has had to weather the sniping of islanders better versed in native custom He has also had to turn aside bribes by U.S Naval Intelligence agents I was glad I was not in his sandals I hoped that his grandmother Bilung and his cabinet would advise him well. Bilung was ill, he told me I hoped she would regain her health I hoped that the clever old woman could keep patience with her cheery and undevious grandson.

A week later, I renewed my acquaintance with Uludong, whom I had first met several years before

Walking down Koror's main road, I looked up from the dust to see a police Datsun blocking the street. Its lights were flashing, and a number of islanders stood at the pavement's edge, looking past the revolving light and down the road At first I thought *robbery, roadblock*, then realized the implausibility of that There is no place in Palau for a getaway car to get away to I walked on and saw a crowd gathered in a front yard It was a funeral. Several hundred people in Sunday clothes had assembled there, and a coffin was emerging from the house The coffin was huge and draped in white It came to a stop against the jammed background of bright-colored shirts and flower patterned smocks

A very old man had taken a young taro plant and was holding the taproot to the head of the coffin Leaning close, he directed his words both to the coffin's occupant and to the crowd His old voice was strong, and he spoke fast

I saw Francisco Uludong nearby watching the proceedings, his face alert, as usual His lips were red from the betel nut he was chewing I sidled over and asked him what was happening He gestured toward the coffin 'It's a very old lady from the high clan The old man is removing her title"

The old man turned from the coffin He walked with the taro plant toward a group of people sitting in the shade of the porch, murmuring formulae as he went The taro plant, I gathered, had in some way absorbed the dead woman's title Her successor would have need for it. The old man lingered at the porch, delivering more ritual, then he returned with the plant and held it once more to the coffin's head He removed a second title This time he faltered, stammering once or twice as he forgot a word and his eyelids fluttered as he tried to remember The whites of his eyes were brownish and cloudy They were eyes of an older race

The taro plant in the gnarled hands was as lovely as any young thing The dark fingers held its taproot to the old woman's head, speaking to her and to us He withdrew it and carried the title to the porch Then he returned to the coffin a third time

"She had three titles!" said Uludong His eyes widened and he missed several chews of his betel nut The socialist and anti-elitist was impressed in spite of himself

But he was wrong The old woman had four titles

When the last title was gone, the pallbearers carried the coffin up onto a long caisson hitched to a truck The caisson, piled high with flowers looked like a float in a football parade The old lady was going out cheerily

When the men had set the coffin down, a number of elderly high-clan women removed their zoris and gof onboard barefoot, carrying bouquets. Their zoris in one hand, their flowers in the other, they made themselves comfortable in positions that few young Western women, unlimber from lifetimes of sitting on chairs, could have managed

I asked Uludong where the procession was going now "To the church first But that's just a Christian thing Afterward they take her out to the *rich* people's place"

The truck pulled off slowly, and Bilung, Queen of Koror, heaped with flowers, surrounded by her sisters, went off to her final rest ◘

# FOREVER WAR

CONTINUED FROM PAGE 48

acid No conceptual breakthroughs there. Again, though, we gained a useful new class of therapeutic agents.'

One is reminded here of Guillemin's own comment in *Science* about there being nothing "conceptually revolutionary" about the releasing-factor field.

Where does that leave the Swedes and Andrew Schally? It leaves the Swedes in Stockholm and Schally still generally happy as a clam and thinking about sex in a mind-over-matter way.

## LOVE, SCIENCE & OTHER TALES

'I'm on top now," said a greatly relaxed Schally "I got here without dirty tricks No no no Nothing of the sort It has never been my way to play tricks I went to Stockholm in 1973, and sources on the Nobel Committee at the very highest level told me that LHRH [the sex hormone-releasing factor] was definitely my victory scientifically The structures of only three releasing factors have been solved so far With the Prize, I will not become a politician but will continue my original interests, trying to solve the other structures. We were the first to demonstrate the activity of the *antagonistic analogues* [chemical modifications that inhibit sex hormone action] in LHRH, so we are placing heavy emphasis on new methods of birth control Without side effects Probably still to be taken daily, but perhaps by nasal spray' At the same time, we are developing clinically *stimulatory analogues* [which enhance sex hormone production] to sexually stimulate men and women, to overcome psychogenic impotence"

Stimulate? Didn't Wade say in *Science* something about LHRH studies that might produce true aphrodisiacs? Is he working on aphrodisiacs? Is that too strong a word?

'Uh ... well yes and no," Andrew Schally replies 'I'm not saying I have them I am just saying that psychiatrists and clinicians should explore the potentials of analogues"

Any chance of a mass-produced aphrodisiac ever hitting the stores?

"(Laughs) Certainly But not every man might respond to it We need many more double-blind studies There is also evidence that LHRH is a good antidepressant so that might explain a possible aphrodisiac effect The effect has definitely been shown in animals. Published by others, not me It could be used to increase libido, or something like that"

Come on won't it work on women too?

'I could tell you many stories over a glass of wine but without the double-blind studies they could not be accepted. I still don't want to talk about it But if this [aphrodisiac] effect is found, it wouldn't at all surprise me '

Would it be the kind of thing you might slip into someone's drink?

"Well ... like Spanish fly? You could do that with Spanish fly too But that is harmful. You would destroy the liver and kidneys and the genito-urinary tract No, you couldn't take a new aphrodisiac orally You would inject it or use a nasal spray"

(Since winning the Prize, Schally has indulged himself in one public macho joke To the press in New Orleans he mentioned that his new wife, from Brazil, was also an endocrinologist who "did beautiful work with my hormones ")

But Schally has other interests

"I also want to prepare analogues of somatostatin, not only for control of ulcers but for prevention of blindness that occurs with several types of diabetes. My research is planned at least fifteen or twenty years in advance Later we will take on central [brain] control of the appetite and obesity I have already published a few theories about hypothalamic control of obesity I also want to work on some aspects of cancer principally breast and prostate, which may respond to some analogues of the releasing factors. I also want to see how some of these factors might control general behavior—sex, learning, and so on. We have indications Perhaps we will find out how to improve the memory Yes yes Of course I do not intend to share any of this with Guillemin. Did Watson and Crick share their findings with Linus Pauling?' ∞

# FILM

CONTINUED FROM PAGE 20

time but I knew we had to get it right We're being very secretive about the flying sequences because I'm thrilled with the illusion, and I want to keep it as just that, an illusion

"It's easy to talk about Superman flying now, of course, after it's done, but when we were trying to figure out how the hell we were going to do it it was a nightmare At times I just wanted to walk off the picture

*Superman* planned to be a two-picture series has been temporarily halted With the first film completed, the producers are waiting to see audience reaction before resuming production on the second part, large sections of which have already been shot by Donner But the first part is actually several little films rolled into one according to the director

"The first of these little movies is the life and death of the planet Krypton, where Superman's mother and father, played by Marlon Brando and Susannah York, lived That part could be called science fiction When the baby Kal-El is sent by starship to earth, that's another little film A short one, but nevertheless a film Then he's found by Ma and Pa Kent played by Glenn Ford and Phyllis Thaxter They raise him, and when he's seventeen, the young Clark Kent goes off to find out who he is That's a third film It's almost churchlike in an odd sort of way, because it's so American Clark goes to the Fortress of Solitude and becomes Superman And when he appears in Metropolis as Clark Kent, that's the fourth film It's the most real of the films to me even though it's fraught with the most unreal approaches

"I find myself treading thin ice as I'm talking to you " Donner says "I'm starting to become afraid that I'm going to reveal too many things " I urge him on, asking about the production design After a year's preparation " he tells me, "they still hadn't decided what 'look' to use They more or less settled on the old *Buck Rogers* look Grecian furniture and so forth But when John Barry came onto the film we came up with the idea of using the visual imagery of a geode the kind of stone that you cut in half and polish revealing all the crystalline magnificence of the interior So Krypton became a white planet of crystals The destruction of Krypton is caused by its sun moving closer and creating an earthquake that pushes the interior crystals up through the surface destroying everyone and everything We had a lot of tremendous sets, which fell down around Brando and Susannah York Quite incredible phenomenal and all done with eleven weeks' preparation It was fairly overwhelming, but then I'm just as overwhelmed as the rest constantly . especially when I realize that I have six more weeks to get this picture ready and we're still shooting " —*James Delson*

# MUSIC

CONTINUED FROM PAGE 26

electronic wizard Together with Dr Robert Moog, he designed an early prototype of the polymoog synthesizer, and he continually designs customized equipment unavailable commercially In 1975 his first album, *Electronic Realization For Rock Orchestra* was released It was an enterprising and brave endeavor Fast spent 350 painstaking hours in the studio creating the album The work contained over 1000 separate parts and was the first computer quadraphonic mix to be programmed in New York City

The basic components of his instrumentation for "Synergy" which is what he calls his music, are the polymoog, a synthesizer that plays several voices simultaneously, and the sequencer an electronic device that acts as an electronic sideman Fast programs the sequencer computer-fashion so that it will follow instructions encoded in its memory bank whenever it's commanded On top of that Fast uses a supersequencer that, because it employs microcomputers, is able to execute more instructions

Fast doesn't think his technocratic view of music's future is dehumanized "It seems perhaps, that the live performance of a piece that has been crafted and written either in a computer program or composed as an electronic piece prior to the performance, doesn't lend itself to human involvement But that's not to say that it is dehumanized It's just that all the human involvement occurred well before the performance

A lot of good amateur musicians are getting into electronic equipment, either electronic designers who are designing synthesizers and playing them or musicians who've gotten involved with electronics Where there were only a handful of people ten years ago, there are thousands now People also have access to home microcomputers They are forming a kind of vanguard, a new subcultural folk music "

Fast sees in the distant extensions of the electronic movement the potential evolution of a "new hybrid form—something between music and brain stimuli "

Light-years from Fast, if not in his music but in his visionary landscaping jazz composer and bandleader **Sun Ra** will sometimes sing with his entire band: "If you find Earth boring just the same old thing come on and sign up with Outer Spaceways Incorporated "

Some years ago in Chicago, Ra reported being transported into space on an energy beam In space he was transformed into a member of an Angel race and given a mission on earth—to make space music

"A race means a particular species of beings.' Sun Ra lectures "The Angel race is dealing on a celestial plane You've got terrestrials, people who only deal on the earthly plane but the Angel race, the celestial beings can conceive of earth beings and also directly communicate with other types of beings Earth people are just here, that's all They need to be enlightened on certain things They're just concerned with eating and sleeping and sex and dope and politics and religion and philosophy, and they're not concerned with anything else because they don't see why it's necessary Whereas celestial beings see they can't be chained by so called depravity Angels like their minds and spirits to take wing They're always moving forward They're artistically inclined They find food in looking at a picture or they find food in hearing a beautiful song or looking at a beautiful dance or just seeing a person smile They find food in that The point is, dealing with things that keep people alive And one of the things that keep people alive is happiness, and music is happiness "

Sun Ra's vision of future music is clear "Music is an intergalactic language People and instruments are going to be continuous The person playing the instrument will become an integral part of the instrument All the arts in the future will have to have some relevance to survival and being Not just life and death Being I don't care where you're at, in any country of the world, you can't just worry about the survival of a German or an Italian or a Black or a Chinese man, you've got to be thinking about the survival of this planet itself People today are in a state of savagery They're worse than heathens in the ancient days If the world is like it is, it's because they don't have no music People are using dope, getting into false religions and eating bad food, simply because they have no music Musicians can change all that If a person is worried a musician can play for him, and that person will be all right When musicians play all at once people forget their problems They say there's disorder well, then things got to be rearranged And music can do that

I'm looking for the day when maybe a million musicians get together to play

"In the future humans will have to rise above themselves and be part of the cosmos Faces will change when you look at them you won't see hatred or frustration They'll be very beautiful When you look at a person you'll be looking at music Because they all will have become instruments of the cosmos "

—*Richard Dubin and Bret Primack*

**Recommended Listening**

*John Cage*—John Cage *Tomato Records 7016*

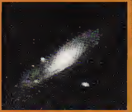
*Steve Reich*—Music for Eighteen Musicians, *ECM 1129*

*Philip Glass*—Einstein on the Beach, *Tomato Records 4-2401*

*Larry Fast*—Synergy *Passport Records, PB-6000*

*Sun Ra*—Live at Montreux *Inner City IC-1039*

# NEXT OMNI



LIFECLOUD

HAWKING

PAIN

**LIFECLOUD**—Life may not have started on the earth but in the depths of interstellar space, writes British cosmologist Sir Fred Hoyle Hoyle and co-author Chandra Wickramasinghe argue that our biochemical ancestry predates the formation of the earth—indeed it stretches billions of years back in time and several hundred light-years away in space According to Hoyle life was seeded on the earth by comets carrying organic molecules formed deep inside interstellar clouds

**EXCLUSIVE PROFILE/STEPHEN HAWKING**—Stephen Hawking, "the king of black holes" as author Dennis Overbye calls him, is regarded by many as the equal of Newton or Einstein Confined to a wheelchair by a wasting muscular disease Hawking ferrets out the very structure of space and time, performing all the bizarre and breathtaking physics necessary in his head Overbye, an editor for *Sky and Telescope* profiles this puckish genius and explores the nature of black holes—massive stars that have collapsed under the force of their own gravity until their gravitational field is so strong that even light is held prisoner in their grip

**ART IN THE SERVICE OF SCIENCE**—This gallery of some of the most exquisite medical illustrations ever executed will reveal wonders of the nerves and veins that more closely resemble fine art than living, breathing systems Another OMNI look at the beauty of the scientific world

**PAIN**—Although still incompletely understood, pain is now yielding some of its fascinating secrets and future implications Jonathan B Tucker, a talented young editor of *Scientific American*, explores the spectrum of pain from annoyance to agony examines the strange cases of people born totally unable to sense pain, and focuses on the leading edge of research into the natural opiates of the brain The painkillers of the future, it seems will focus on new therapies that exploit the body s own pain-modulatory mechanisms



# FORUM

CONTINUED FROM PAGE 13

*an antipathy to nuclear power, this letter betrays an antipathy just as strong Our special pleading is more scientific than yours, Mr Penkrot The overwhelming consensus of the world s health scientists is with us It holds that there is no safe threshold for radiation that radiation causes cancers and leukemias in linear relationship to dose and that a unit of background radiation is no different in its carcinogenic powers than a unit from any other source*

*Mr Penkrot cites studies by Frigerio and Stowe and others as if they proved something, one way or another, about background radiation and the incidence of cancer He says nothing about the difficulties in drawing conclusions from studies such as Frigerio's, which fail to take into account among other things, the extraordinary mobility of the American people How long did Frigerio s subjects live in the areas he was studying? (How long was their exposure to the background source?) Where did they live before that? Frigerio doesn't know Finding out would be a horrendous task given the huge sample necessary in demonstrating low-dose effects Most areas of high background radiation (Mr Penkrot mentions Colorado) happen also to be lightly industrialized areas*

*"It is impossible in principle to prove that background radiation has absolutely no effect on human health " writes Mr Penkrot implying that only rigid rules of proof keep him from demonstrating a proposition no serious scientist has ever advanced "All existing scientific evidence indicates that radiation effects are extremely small he continues Here the Committee for Scientific Truth is propagating outright falsehood Anyone tempted to believe Mr Penkrot should read (1) Victor Archer in* Health Physics *March 1978 Dr Archer one of our foremost workers on the problem of cancer in uranium miners estimates that 45 percent of all cancers in the U S could be caused by background radiation (2) The 1972 BEIR Committee report to the National Academy of Science, which estimates that several thousand U S cancer deaths per year are caused by background radiation There are high and low estimates by reputable scientists The truth probably falls somewhere in between*

*Radiation kills and deforms, and in a big way whether the natural radiation in the earth s crust or the artificial radiation produced by reactors and bombs*

**Query**

I was wondering if you knew of anyone I could contact about my theory that mass may be the hypercomplex fifth dimension?

Adam Abelow
New York, NY

*No* —Ed

# UFO

CONTINUED FROM PAGE 33

would last a minute or two at most; second, the crew reported seeing a sharply outlined structured object; third, the reported overhead stop of the UFO could not have been accomplished by any natural object. Now all of these objections are admittedly based on the testimony of startled and frightened crewmen, and Klass has tried to make the most of the known unreliability of similar testimony from other pilots under similar circumstances. But the four crewmen are astonishingly consistent in their accounts, requiring parallel misperceptions, if such they are.

According to Zeidman's reconstruction of the encounter, based on many hours of interviews with the crewmen, the incident covered a period of more than five minutes. Klass is the first to admit that such a duration would absolutely rule out his "fireball" hypothesis, so he disputes it as strongly as UFO believers want to accept it. Captain Coyne's first recollection of the incident, which psychologists would testify is probably the most accurate estimate, was that it had lasted "about a minute"; the time span has lengthened over the years, reaching 330 seconds last year before falling back to Zeidman's figure of 300 seconds. Attempts to restage the encounter have not resolved this critical point, and the dispute continues.

The crew's physical description of the object is less ironclad, especially in light of similar misperceptions reported by other pilots, mentioned earlier. The green color of the objects *may* have been a color distortion through the green sun visor along the top of the canopy. Coyne initially reported watching the object over him through the canopy but later amended his account to place the object more in front of him. The red object seen earlier may have only been a radio-tower warning light.

As to the stopping of the UFO directly over the helicopter, that item too has grown over the years. Although the crew now speaks of the UFO "stopping dead" for as long as ten seconds, the original reports claimed only that it "hesitated momentarily" for a second or two at *most*. Klass, in probably the weakest link of his fireball hypothesis, theorizes that the lingering fiery trail of the meteor may have illuminated the cabin for several seconds, leading the men to *assume* that the UFO had stopped. Another possibility hinges on the fact that the men were on a moving, pitching aircraft that, just at the moment the UFO passed overhead, probably pulled hard out of a dive and began to climb: a slight lurch of the helicopter to the left could easily have given the impression that the fireball had indeed "hesitated momentarily."

But these are only theories, and sometimes half-baked ones at that. Ultimately, they are ordinary possibilities of things known to have happened in the past to other pilots, which must be weighed against the extraordinary alternative: involvement of a genuine UFO.

Several years after the event, in response to a newspaper publicity campaign, a group of ground witnesses surfaced. A woman and four youngsters reported having seen the UFO circle the helicopter that night. This development seemed to provide the clinching proof of unexplainability, as the fireball hypothesis was apparently extinguished. So eager was the UFO community to believe this story that writers were quoting the new testimony as evidence months before anything but its bare existence had been announced.

But Klass (together with a few other heretic UFO experts such as David Schroth of MUFON) claims that the alleged ground testimony does not really corroborate the Coyne UFO account. Instead, it grossly contradicts it, casting even more dispersion on its authenticity. The UFO's given position was at least eight kilometers (five miles) from the helicopter's flight path as reconstructed by Klass from the pilot's own account. Also, the flight direction and maneuvers of the UFO were completely at variance: the crew said the object proceeded westbound after the flyby, while the ground testimony alleges it reversed course back eastwards.

*While hiking in Peruvian Mountains, Augusto Arrenda photographed unusual airborne disc.*

Frustrated UFO researchers bemoan the likelihood that there were numerous other people who saw the flaming object but did not bother to report it. The American Meteor Society estimates that it receives reports on less than one meteor in ten; indeed, the fireball the same night of the Coyne incident passed over populated regions of Pennsylvania and Ohio but was officially reported by only one person, an airline pilot (who, it must be said, recognized it for what it was).

Numerous embellishments of the case have appeared over the years. Coyne reportedly claims that Dr. J. Allen Hynek of the Center for UFO Studies told him that the UFO was also seen and photographed by the Skylab astronauts. Hynek denies having said this, since there were no astronauts on Skylab at that date. Pulp monthlies have conjured up fantastic images of alien "tractor beams" dragging terrified airmen into the sky. Coyne suddenly recalled, several years after the event, that his compass had been spinning wildly the following day and had to be replaced—but no maintenance reports have been found.

Jennie Zeidman's confidence in the strength of the Coyne UFO case has been expressed in warnings to some colleagues who privately still question some aspects of her analysis. Such heretical doubts, she asserts, are dangerous symptoms of being "suckered into worship of that arch-con-man Phil Klass." As for Klass's fireball misperception theory, Zeidman considers it a dead issue. "I predict Klass will now change his tactics and claim the case is a hoax, that the four army men were lying."

Klass laughs off that suggestion. "I have never doubted the integrity or reputation of the men. What I have doubted is their ability, under a life-threatening nighttime emergency, to accurately interpret and recall the sudden brief visual inputs which they perceived."

While the average airline passenger may like to think that pilots are "trained observers" with excellent powers of recognition of midair phenomena, UFO investigators have discovered just the opposite to be true. Klass, then, is not alone in questioning these abilities.

Writing in the *Hynek UFO Report* (Dell, 1978), pro-UFO spokesman Dr. J. Allen Hynek of the Center for UFO Studies observed that "... surprisingly, commercial and military pilots appear to make relatively poor witnesses ... but it should come as no surprise that a majority of pilot misidentifications ... were of astronomical objects." One possible reassuring explanation for this failure is that all their flying experience has conditioned pilots to interpret fragmentary visual glimpses in terms of nearby aircraft-sized structured objects, since these would naturally be of primary concern.

None of this diminishes in any way the amazing character of the Coyne UFO encounter. Something that behaved just like an alien spaceship might be expected to behave was reported by four credible witnesses; the stimulus must have been something truly extraordinary. Such reports in the past have turned out to have been honest misperceptions, but there are features of this case much harder to explain. The Coyne UFO flies on: one of the best on record.

UFOs are reported from all over the world, with major 'flaps' occurring periodically in Latin America, Western Europe, Japan, and elsewhere. Even Russia has been host to UFO encounters, some of which have been typical of reports elsewhere, and some of which have been unique.

One of the strangest Russian UFOs ever reported was seen near Leningrad about a year ago. In the predawn darkness of September 20, 1977, early rising residents of the industrial town of Petrozavodsk watched an awesome spectacle in the eastern sky.

A giant glowing "jellyfish" hung high in the air, with luminous tentacles hanging down to the ground. It slowly drifted northward, changing shape and size, with a bright point of light at its center.

TASS, the official Soviet news agency, carried the story the next day. The manifestation was labeled "an unusual natural phenomenon," in line with official Soviet policy of denouncing flying saucers as only a profitable fantasy concocted by the unscrupulous greedy capitalist news media.

Soviet scientists suggested that the 'jellyfish' could have been a decaying satellite burning up in the atmosphere. Readers were assured that no man-made activities could have been responsible.

But Western reports gleefully and unambiguously labeled the sighting a UFO. Combined with similar reports from the Leningrad area and from across the Finnish border, the jellyfish UFO story made numerous wire services and broadcast news programs.

More sober observers of the UFO scene were not too impressed, however. At the privately funded Center for UFO Studies in Illinois, researcher Allan Hendry was reminded of similar American reports that turned out to be night time rocket launches. This suspicion was confirmed by analysts on the UFO Subcommittee, a subdivision of the skeptical "Committee for the Scientific Investigation of Claims of the Paranormal," who were able to identify the UFO with the glowing exhaust plumes of a rocket carrying the Cosmos-955 spy satellite.

Since the rare predawn launch had been made from the top secret Plesetsk space center a few hundred kilometers from the scene of the sighting, TASS officials had at first been unaware of the true explanation. When informed, they had been bound by security regulations from revealing it.

The matter rested for several months, since most leading UFO groups accepted the 'secret rocket' explanation. The case seemed forgotten except as an embarrassment to Moscow for inadvertently advertising a Soviet military space secret.

The jellyfish UFO returned suddenly to life last March, borne (reborn?) by headlines on the front page of a weekly tabloid. "First UFO to Inflict Damage on a City!" screamed the *National Enquirer*, as it related the discovery by reporters Bill Dick and Henry Gris that the UFO had broken windows and drilled tiny holes in paving stones all over hapless Petrozavodsk. Moreover, the UFO had returned repeatedly since its first raid.

Skeptics attributed the reports of physical damage to the well-known effects of popular hysteria, since as it turned out the jellyfish UFO had struck sheer terror into thousands of witnesses. But UFO groups, contemplating the new evidence (or reports of evidence—nobody could be found who had actually seen the damage, since it had all been confiscated by the secret police), wavered in their prior endorsement of the 'secret rocket' explanation. One new version, published in a UFO magazine, asserted that the secret rocket had actually exploded over the city, showering the area with fragments that caused the reported damage.

The 'UFO Subcommittee' stood fast with its 'secret rocket' theory (and the rocket had been going away from the city, not over it), dismissing the damage reports as understandable rumors and exaggerations. Reporters Gris and Dick, who had obtained their data from Russian UFO experts in Moscow but who had never actually visited the site of the damage, claimed to have more details—but they would not be revealed until a new book was completed. TASS, attempting to make up for its original slipup, has clamped down a curtain of secrecy over all aspects of the event.

Nearly a year after the jellyfish UFO's flight, another "official" Soviet explanation was published, breaking a longstanding news blackout. The verdict from scientist M. Dimitreyev was oddly familiar to observers of the American UFO scene. As best as Western experts could determine, the Russian scientist was claiming that the UFO had been "swampsky gas."

According to Dimitreyev's theory, backed up by voluminous calculations and technical gibberish, the glowing clouds in the sky were just luminescent smog that allegedly came from nearby industrial areas such as Petrozavodsk. That would probably be a greater miracle than a real flying saucer, cynical observers suggested, and it reminded UFO experts of the infamous Michigan UFOs in 1966, which were labeled "swamp gas."

But the much-publicized "scientific explanation" of the jellyfish UFO may be taken as real evidence of continued popular anxiety and interest inside Russia concerning the original incident. The government is clearly even more anxious to have people stop thinking about the event lest they figure out what it *really* was.

The whole issue of flying saucers inside the USSR is a hot potato for the Soviet government. There is a great deal of popular interest in the topic since the Russians follow their own space program quite enthusiastically and are fascinated by science fiction and theories of extraterrestrial civilization (which naturally will all be communistic).

But the government's drive to wield a monopoly on public ideas has led to an official aversion for such wild subjects, since it became clear in the 1960s that Soviet "UFO experts" did not believe official Soviet explanations any more than Western UFO specialists believed official U.S. government explanations. These Russian UFO buffs are tolerated but not allowed to publish, so a UFO "underground" complete with *samizdat* newspapers has sprung up.

The incident has entered the pantheon of UFO myths, although its legitimacy remains to be established, considering it had TASS as a father and the *National Enquirer* as a stepfather. While the more serious pro-UFO groups remain unimpressed, and the 'UFO Subcommittee' claims to have exorcised it with skeptical press releases, the Russian jellyfish UFO has all the qualities for becoming another UFO superstar. ◘◘

ICUFON

*Freeze-frame of the famous Rudolph Negora UFO encounter near Yugoslav border in 1971*

# GAMES

ANSWERS TO GAMES (page 144)

## STORIES BEHIND THE INVENTION

*Pre 1000.* Although known from the Bronze Age, the *safety pin* was reconceived by Walter Hunt in 1849. He sold his patent rights for a flat $400.

The *pretzel* dates from about 500 B.C. It is said to be the invention of an Italian monk who gave them to children as a reward for learning prayers. The shape was supposed to symbolize the cross or, secondarily, that of a child's arms folded in prayer.

*1000-1599.* The first *condom* is attributed to Gabriel Fallopius, the Padua University anatomy professor who died in 1562. He was also credited with the discovery of the fallopian tubes.

The *pencil* can be traced back to 1565, when Konrad von Gesner of Zurich described a piece of lead held in a wooden casing.

*1600-1799.* Joseph Merlin *roller-skated* into a masquerade party in 1760 while playing his violin. Unable to stop, he rolled straight into a large mirror, severely injuring himself.

In 1762 Jean-Jacques Perret put a thin guard on one side of a blade to prevent the blade from slipping into the skin. The *safety razor* was born.

*1800-1839.* The world's first *soda pop* was created in 1807 when a Philadelphia druggist, Townsend Speakman, added fruit flavors to some carbonated water.

Edwin Budding invented the *lawn mower* in 1830. Before then, grass fields could be cut only with a scythe and when wet. Budding worked in a textile factory, and after operating a machine designed to shear the nap off of cloth, he got the idea for a similar device "for the purpose of cropping or shearing the vegetable surface of lawns."

The first *air-conditioning* system was installed in the American Hospital for Tropical Fevers, in Apalachicola, Florida, by John Carrie in 1843.

*1850s.* The *potato chip* was invented by George Crum, head chef of the Moon Lake House Hotel in Saratoga Springs, New York, in 1853. It was a sarcastic reply to some returned "too thick" french fries.

Elisha Graves Otis demonstrated his first *elevator* at a New York exhibition in 1854. The first one was installed five years later, revolutionizing architecture.

*1860s.* Scottish physicist James Clerk Maxwell, with his assistant, Thomas Sutton, made three photographs of a bright tartan ribbon through red, green, and blue "filters" (actually bottles containing colored liquid). The resulting positive glass transparencies were projected through three lamps, each with a corresponding filter. Thus *color photography* was born in May 1861.

The first *synthetic food*, margarine, was patented by Hippolyte Mege-Mouries in 1869. He described it as "a compound of suet, skim milk, pig's stomach, cow's udder, and bicarbonate of soda." Mege-Mouriès reasoned that a cow's natural body fat was responsible for milk, so this same agency could make a butter substitute.

*1870s.* Thomas Edison was experimenting with paraffin-covered paper when he discovered a way of using a wax stencil to duplicate printing. Edison's *mimeograph*, invented in 1875, was later bought by Albert Blake Dick, who refined it and later marketed it under his own name.

In 1879, at age 60, Henry Tate perfected the *sugar cube*, made a fortune, and used it to purchase paintings. This formed the nucleus of the world-renowned Tate Gallery in England.

*1880s.* A soda fountain clerk in Waco, Texas, invented a new soft drink that immediately caught on among his customers. They dubbed it *Dr Pepper* after a real doctor whom the soda clerk had worked for.

The first *can openers* appeared in U.S. Army and Navy stores in 1885. Previous to this, no efficient method of opening was known, except to "cut round on the top with a chisel and hammer."

*1890s.* A patent for a "clasp locker" went to Whitcomb L. Judson in 1893. Metal teeth interlinked with one another to fasten with a zip—the first *zipper*.

Coney Island saw the first *escalator* in 1896. Jesse W. Reno's invention was an inclined belt conveyor with rubber-covered slats to provide a grip.

*1900s.* The *ice cream cone* was invented at the 1904 Louisiana Purchase Exhibition in St. Louis. A Syrian penny-sugar-waffle salesman named E.A. Hamwi started rolling his waffles into cones for the benefit of the ice-cream concessionaire in the next booth.

The first *photocopier* was patented in 1906 for use in an Oklahoma City land claim office.

*1910s.* Long ago when you went into a grocery store, you told the clerk what you wanted and he got it for you. Then in 1912 two stores in California—the Alpha Beta Food Market in Ponoma, and Ward's Groceteria in Ocean Park—instituted the revolutionary idea of letting the customer serve himself, and the *supermarket* was born.

*Noxema* skin cream has been around since 1914. Its name came from the testimony of a satisfied customer: "Your product sure knocked my eczema!"

*1920s.* In 1925 the first *in-flight movie* was introduced, a film of Conan Doyle's *The Lost World*. It was shown on an Imperial Airways flight from England to the Continent.

While working for the U.S. government, Clarence Birdseye observed the Eskimo practice of freezing fish. After studying it for several years, he launched the company that bears his name in 1923: *Birds Eye Frozen Foods*.

*1930s.* Carlton Magee, editor of an Oklahoma City newspaper, invented the *parking meter* in the early 1930s to help control downtown traffic and provide revenues.

Roy Plunkett of the DuPont Chemical Company found a substance that was so slippery that virtually nothing would stick to it. His company patented the stuff under the name *Teflon* in 1938.

*1940s.* The *nylon stocking* came about because the DuPont Company offered a new product to hosiery manufacturers. They were introduced on May 15, 1940.

The *bikini* was first shown at a Paris fashion show and named after the atomic explosion on Bikini Atoll four days before, on July 1, 1946.

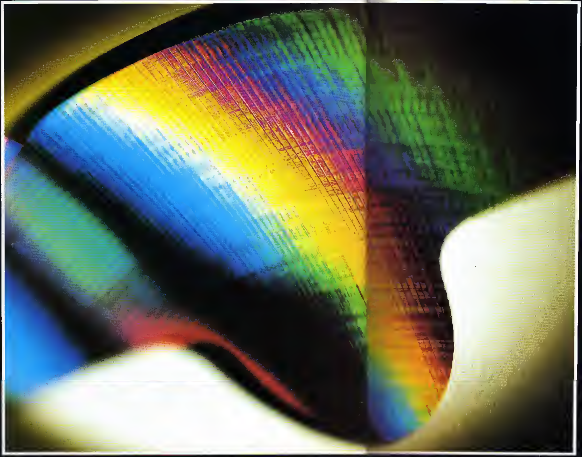
*1950s-Present.* The *go-kart* was first built by Art Ingles in Los Angeles in 1956.

## THE DOOHICKEY QUIZ

1-E, 2-C, 3-F, 4-A, 5-J, 6-H, 7-D, 8-I, 9-B, 10-G

## 'ROUND SHE GOES

One might think that the difference in length would create an infinitesimally small error in height. But, in fact, the string would have to stand 6" off the entire surface of the earth. You can verify this with some simple geometry, by figuring how the change in circumference affects the radius of the sphere. The difference in radius is the height the string stands. ꝏ



# PHENOMENA

Ablaze with color, the videodisc shown here was photographed by Paul Brierley. Brierley illuminated the surface of the disc with a beam of white light, which was bent by the grooves of the disc as it passed over them. This caused diffraction to occur—the breaking up of white light into its component parts (the "rainbow effect"). Light also is diffracted by the grooves of a common phonograph record, but is more pronounced here due to the makeup of the videodisc. With 12,500 grooves per radial *inch*, as compared with a record's 25,000 grooves per *side*, the videodisc is capable of storing 35,000 separate still frame pictures per side, for a total viewing time of one hour a side. In addition, a single frame of the videodisc can be isolated, "read," and displayed separately on the screen. ◻◻

*Inventions that mark turning points in human existence*

# GAMES

BY SCOT MORRIS

With all the furor in the press about cloning and recombinant DNA, it is startling to find that this year marks the 200th anniversary of the first artificial insemination. In 1779, Abbe Lazare Spallanzani of Italy injected the semen of a spaniel into a female hunting dog, and 62 days later found himself the owner of three pups.

It did not take long for humans to get into the act, for, as Pudd'nhead Wilson said, "Few things are harder to put up with than the annoyance of a good example." Just six years later, in 1785, M. Thouret of Paris University successfully impregnated his wife with a tin syringe.

These events and inventions mark momentous turning points in human existence, much like the landing on the moon or the invention of the light bulb and telephone. Yet many of us are hard-pressed as to when "minor" items were invented. For instance, a glance at the chart on this page shows that an electric burglar alarm was around in the 1850s, long before electricity was in common usage. Similarly, false teeth have been known for a thousand years or more.

In fact, we are often deceived not only by the commonness of a particular item, but also by its adaptation to space-age technology. After all, isn't a food processor really an advanced form of the mortar and pestle?

All of the inventions listed on this chart are in their correct time periods. Abraham Lincoln and George Washington lived in different eras, yet both knew of pressure cookers and stopwatches. It is both interesting and fun to correlate our knowledge of historical people and events with when an item was invented.

That's what this month's quiz is all about. When were they invented? Thirty-one everyday inventions are listed below. The idea is to try and place each of these into the 16 time periods.

Most times you won't know the correct answer. Fine. You should make your most educated guess, since guesstimating will often produce a good score. If you know the answer, great. But we're betting that most of these will surprise and confound even the best of you.

**INVENTIONS YOU SHOULD KNOW**

| | |
|---|---|
| **Pre-1000** | playing cards, false teeth, umbrella, soap |
| **1000-1595** | beer, table fork, colorless glass, canal locks, hand gun, astrolabe, helicopter |
| **1600-1799** | pressure cooker, thimble, metronome, merry-go-round, stopwatch, fountain pen, calculator |
| **1800-1839** | computer, elastic, Poker, accordion, carbon paper, stethoscope, plywood |
| **1840-49** | safety matches, chewing gum, taxi meter, gelatin dessert, cylinder lock |
| **1850-59** | electric burglar alarm, cigarettes, jeans, gas burner, celluloid, overseas telegram |
| **1860-69** | plastic, barbed wire, badminton, machine gun, torpedo, typewriter |
| **1870-79** | cash register, toilet roll, milking machine, saccharin, microphone |
| **1880-89** | motorcycle, Yellow Pages phone directory, juke box, artificial silk, linotypers |
| **1890-99** | toothpaste tube, golf tee, aspirin, electric chair, wireless telegraphy |
| **1900-09** | rayon, vacuum cleaner, permanent wave, silicone, animated cartoon |
| **1910-19** | stainless steel, Life Savers, bra, crossword puzzle, tear gas, gas masks |
| **1920-29** | Scotch tape, Contract Bridge, water skis, pop-up electric toaster, cloverleaf intersection, power steering, self-winding watch |
| **1930-39** | instant coffee, drive-in movies, fluorescent lighting, polyethylene, DDT |
| **1940-49** | aerosol spray, Polaroid camera, microwave oven, streptomycin, transistor |
| **1950-Present** | stainless steel razor blade, electric toothbrush, fiber-tip pen, polio vaccine |

**WHEN WERE THESE INVENTED?**

Place each of these inventions into one of the 16 time frames in the chart.

1. air conditioning
2. bikini swimsuit
3. can opener
4. color photography
5. condom
6. Dr Pepper
7. elevator (in a public building)
8. escalator
9. frozen foods
10. go-kart
11. gummed envelopes
12. ice cream cone
13. in-flight movie
14. lawn mower
15. mimeograph
16. Noxema
17. nylon stockings
18. parking meter
19. pencil
20. photocopier
21. potato chip
22. pretzel
23. roller skates
24. safety pin
25. safety razor
26. soda pop
27. sugar cubes
28. supermarket
29. synthetic (man-made) food
30. Teflon
31. zipper

| Year | | Deviation Points |
|---|---|---|
| **Pre-1000** | | |
| **1000-1599** | | |
| **1600-1799** | | |
| **1800-1839** | | |
| **1840-1849** | | |
| **1850-1859** | | |
| **1860-1869** | | |
| **1870-1879** | | |
| **1880-1889** | | |
| **1890-1899** | | |
| **1900-1909** | | |
| **1910-1919** | | |
| **1920-1929** | | |
| **1930-1939** | | |
| **1940-1949** | | |
| **1950-Present** | | |

**HOW TO SCORE**

For each invention, find the number of time periods between your answer and the correct answer. For example, the first cash register appeared in the 1870s. If you place it in the 1890s, give yourself two deviation points for this invention; likewise if you place it in the 1850s you are also two deviation points off. Ignore plus or minus signs, and simply add your deviation points up for all 31 inventions.

(0–45) —Excellent
(46–90) —Good
(91–130)—Average
(130+) —Poor

Don't be too discouraged if your score is not superlative. In an informal survey of OMNI staffers and friends, even the best of us could score no lower than a (42). The average was a (88). So take heart—it isn't as easy as it looks!

By the way—in order to avoid some arguments and the wrath of inventors everywhere, here is a list of publications that we found extremely helpful in preparing this quiz:

*The Book of Firsts* by Patrick Robertson, Clarkson N. Potter, Inc./Publisher.
*Science and Inventions "Time Line"* by Paddington Press, Ltd.
*The Pocket Book of Famous First Facts* by Joseph Nathan Kane, Pocket Books.
*Why Did They Name It . . . ?* by Hannah Campbell, Ace Books, Inc.
*Eureka: An Illustrated History of Inventions From the Wheel to the Computer* by Edward deBono, Holt, Rinehart.
*Everyday Inventions* by Meredith Hooper, Taplinger Publishing Co., Inc.

**DOOHICKEYS**

In November we featured a quiz on doohickeys—those whatchamacallits and gizmos that we use all the time. Most of us don't know what the true names of these are, though they all have proper English names.

So many of you have responded to this that we thought we would try and confound you one more time. Remember that each thing has only one name and that each name applies to only one thing. Just match them up.

____ 1. The paper decorations you put over the ends of lamb chops
____ 2. The typewriter mark that looks like this: /
____ 3. The metal arrangement that covers a champagne cork
____ 4. The small wooden affair in restaurants that comes with butter packed inside and with one stave extending up
____ 5. The horizontal mark used to show a long vowel
____ 6. The emblem of a publisher that is put on books
____ 7. The division in the middle of a magazine spread
____ 8. The fringed decoration on shoes that covers the laces
____ 9. The little silver sugar balls a baker uses to decorate a birthday cake
____ 10. The contraption a baker uses to sprinkle sugar on your doughnuts

THEIR NAMES

| | |
|---|---|
| A. Piggin | F. Coiffe |
| B. Dragées | G. Dredger |
| C. Solidus | H. Colophon |
| D. Gutter | I. Kiltie |
| E. Papillotes | J. Macron |

**'ROUND SHE GOES**

Imagine you have a piece of string 25,000 miles long, and that you want to stretch this snugly around the equator. Suppose you started from point A, and then traveled over desert, forest, ocean and mountain until you returned to point A. (Let us assume for the sake of convenience that the earth is a perfect sphere.) Upon your return, however, you find that the string is actually three feet too long. Instead of cutting the string, you decide to tie the ends together and distribute the extra length evenly over the entire 25,000 miles. How far off the ground will the string stand because it is 36" too long?

Just for fun, take any three digit number (say 321). Now repeat the digit to make a six digit number (321321). Now divide this by seven, divide that product by eleven, and finally divide that product by thirteen. You should end up with your original three digit number!

Answers: page 141

**OMNI Competition #3**

Most of us view a final exam question as one of the great traumas of our academic lives. It is doubtful that there isn't one of us who hasn't broken into a cold sweat at the thought of an algebra question, for instance, or perhaps solving a chemical equation.

Below are some questions that we have thought of and wondered about ourselves. Some of them may not have any answer, but they are certainly guaranteed to curl your toes!

*Theology:* "If God is omnipotent, can he build a stone so big that he can't lift it?"
*Physical Science:* "If all matter is made of molecules, why is it we can see through the molecules in glass, but not through the molecules in wood?"
*Aerodynamics:* "If an airplane gets its lift from the round shape of the upper part of its wing (the Bernoulli principle), how is it possible for an airplane to fly upside-down?"
*Optics:* "Why does a mirror reverse left-and-right but not up-and-down?"
*Astrophysics:* "What is beyond the edge of the universe, if anything?"
*Philosophy:* "Why is there something (i.e. the universe) instead of nothing?"

The Competition: Readers are invited to submit a final exam question that might set a scientist to scratching his head, if not lead to a nervous breakdown. All must be based on current scientific knowledge or speculation. Postcards only, please. Entries should be postmarked by March 1, 1979. First prize winner will receive $100. Runners up (2-10) will receive $25.

All entries become the property of OMNI and will not be returned. Send entries to OMNI Competition-3, 909 Third Ave., N.Y., N.Y. 10022.

Note: In our first competition, we asked you to create "Signs of the Times" language-free images that convey an important message. We have been inundated with responses—some good and some not-so-good. They have been sorted and judged, and we plan to devote several pages to them in the February issue of OMNI. Watch for it!

# LAST WORD

By Isaac Asimov

In 1976, the doctors of Los Angeles went on strike and stayed on strike for five weeks, abandoning their patients to the mercy of natural recovery.

The weekly death rate in Los Angeles promptly dropped from 19.8 deaths per 100,000 to an average of 16.2 per 100,000 during the strike-bound five weeks. When the doctors went busily back to their stethoscopes and tongue depressors, the weekly death rate promptly jumped to an average of 20.4 per 100,000 over the next five weeks.

The most likely reason for this decline seemed to rest in the elimination of elective surgery (the kind a patient wants for the fun of it). Doctors denied this. They said at least part of the drop was due to the elimination of necessary surgery (the kind a *doctor* wants for the fun of it).

This is an actual well-documented event because it happened in Los Angeles. Similar events (the actuality of which we cannot guarantee) can be discovered by an assiduous combing of small-town newspapers.

*Knothole, Tennessee*, June 25. The police strike that has lain like a pall on this fair town is now in its sixth week. Nowhere is a patrolman to be seen; the police cars languish in their garages.

And the crime rate is way down. Joshua Fondue of the Citizen's Action Committee put it this way: "We get indoors right after sunset. That way there's no mugging, and with all of us right here with our baseball bats and switchblades there are no break-ins. And that means you, buster. I don't care if you do say you're a reporter. Just stay on your side of the door."

Spike Gaolbate, three-time loser, agrees. "The police strike has eliminated strolling beneath the stars. It deprives the citizen of beauty; it deprives us of their skulls or wallets, whichever is thicker."

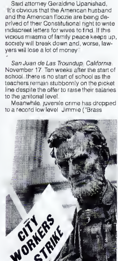
*Hardbit, Vermont*, July 18. The town of Hardbit has not seen a piece of mail move in two months, as the local postal employees, all veterans of the Lebanese Occupation of 1958, declared a Perpetual Veterans Day. "I repeat that this is not a strike," said Ehrlich O'Konski, head of the local postal union. "We just don't work on holidays."

The divorce rate is, of course, way down. Hardbit lawyers are depressed, economically and emotionally.

Said attorney Geraldine Upanishad, "It's obvious that the American husband and the American floozie are being deprived of their Constitutional right to write indiscreet letters for wives to find. If this vicious miasma of family peace keeps up, society will break down and, worse, lawyers will lose a lot of money."

*San Juan de Las Troundup, California*, November 17. Ten weeks after the start of school, there is no start of school as the teachers remain stubbornly on the picket line despite the offer to raise their salaries to the janitorial level.

Meanwhile, juvenile crime has dropped to a record low level. Jimmie ("Brass Knuckles") Hollering, age 12, shouted down to this reporter from his bedroom window, "We kids are sick of this strike. We ain't learning nothing. At school I could mark up the walls in my art class and break up the toilets so I could get learned-up about plumbing. I break one little toilet at home, my old man gets mad. I can't smoke in my stupid house. I can't look at dirty pictures. And I don't remember when I last had a chance to beat up a teacher. Beating up my mom ain't no fun. She's allowed to hit back."




*North Nowhere, North Dakota*, December 8. Carrier pigeons from South Nowhere, South Dakota, inform us that the second year of the town's newspaper strike has begun today and there is no sign of a break in the stalemate.

Meanwhile, the report is that mental illness has fallen to a record low.

Marilee Menstroo, South Nowhere visitor, says, "There isn't any bad news going around. I guess there must be bad news out there somewhere, but it don't get to us. There's a rumor that Congress is back in session and that upset some people—but we didn't know for sure. It could be all the Congresspeople died, and that thought cheered us up."

Psychiatrist Hugh Safreud agreed. "Oh, yes, it's a denial of reality that causes all this mental health. It's bad. It's distinctly unhealthy to be healthy. Possibly so for the patient. *Certainly* so for the psychiatrist. I understand that some psychiatrists in South Nowhere are keeping copies of *The New York Times* in their waiting rooms to maintain proper levels of anxiety. If the *Times* goes on strike, too, it may be the end for South Nowhere. They'll die of pernicious happiness."

*United Nations, New York*, December 25. The peace and joy of the Christmas season was marred by a proclamation of a general strike on the part of all the military forces of the world. Panic reigns in the hearts of all true patriots of every persuasion.

Meanwhile, fears of universal disaster sank to an all-time low over the world. OO