EXCLUSIVE: FIRST PICTURES OF THE ATOM

ULTRA-INTELLIGENT MACHINES
DAEALUS: THE FIRST STARSHIP
HOW TO BUILD AN ANTI-GRAVITY MACHINE

PLUS: BUCK MINSTER FULLER, JERRY BROWN, RUSTY SCHWEICKART
ON OUR FUTURE IN SPACE
ASIMOV ON LABOR'S LOVE LOST...
Cover art for this month's OMNI is a new view of planet earth by De Es Schwerlberger called "Rescue." Schwerlberger 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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I had been a frequent listener to the program, and I had always been fascinated by the stories of UFO sightings. Several years ago, while driving in Mobile, Alabama, I saw a bright light in the sky. I immediately pulled over to the side of the road and observed the object for several minutes. It was a perfect disc, with a flat bottom and six legs protruding from the sides. The object was silver and looked like a barbecue grill upside down. The legs were not visible from this angle, but I knew they were there, based on previous sightings.

As I watched, the object began to move, and I realized that it was a UFO. I quickly dialed into the OMNI hotline and reported my sighting. The operator asked me to describe the object in detail and confirm that it was not a kite or a balloon. I gave a thorough description and relayed the calling address, which was in Mobile. The operator thanked me for my report and advised me to keep an eye on the object and report any further sightings.

Several hours later, I received a call from the OMNI headquarters in New York City. The operator informed me that they had received several reports of a similar object in the area, and they were conducting an investigation. They asked me to provide any additional details about the sighting and to remain near the object in case it returned. I agreed to do so and was promised that my report would be included in the official dossier.

Over the next few days, I continued to monitor the object's movements and received regular updates from the OMNI hotline. Finally, after several weeks, I was contacted by a government representative who informed me that the object was a prototype for a new class of spacecraft and that the technology was being kept secret for national security reasons. I was impressed by the government's professionalism and the way they handled the situation.

In conclusion, I believe that UFO sightings are real and that the technology behind them is not completely out of reach. We must continue to investigate and report these phenomena to bring them to light. Only then can we truly understand the mysteries of the universe.

FRANK KENDIG
Solar power is being shuffled into a holy fire 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 vectors 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 battle 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 arians."

A trip to the stars within a hundred years? Journalist/author Owen Davies examines the possibilities in "The First Starship" (p. 78), 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's staff 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: A leading specialist in gravitation 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. 48)

The notion that sand possesses magical, muselike qualities is intriguing and valid. Legends have for centuries told of strange sand dunes that squawked, 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 aware that I'm going to be revealing 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. 96).
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 Ingenhousz 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-

CONTINUED ON PAGE 132
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 Omnics 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.

If 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.

Omen 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 monotonous 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 the little problem about the Committee for the Scientific Investigation of Claims of the Paranormal, which you lavish praise while finding fault with most of the standard UFO investigation organizations. Really, Capt. Major what egotism! On my desk sits a package of literature from the Committee begging for support and do you know to and behold, who is one of the group's 'fellows' you are, and so are your brother 'fellows' whom you mention so happily, Robert Shoaffler 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-topic 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 disappointed 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: We'll 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 CUFOCS 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 CUFOCS 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 dropped 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 lynching 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 Adanfar Friere-Maccio, who has been conducting genetic and epidemiological surveys in Espirito Santo State in Brazil, where background radiation levels rise 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 unsanctioned. Mr. Penkrot would have us believe that his letter is something other than a special pleading. But if our "Miracle" column demonstrates
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 decompose it. In Greek mikros means "small," nesos means "island," and most of Micronesia's islands are, as the name suggests: tiny, but the Palauans 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 strays 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 mimicry 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, Edean 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 Japanese intruded to rule, then in 1944 the Japanese were driven out. In 1945 the US took up the torch. 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 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 barrack 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, and 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.
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 strong 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 cachet 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 a 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 lagoon for this part of the Pacific. It has jungles, more 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 effectiveness 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 efaaboq by the Palauans. The limestone islands are Palau's territorial 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 those 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 waterfall 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.

Further 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, parachute, porcupinefish, butterflyfish, rabbitfish, squirrelfish, unicornfish, trumpetfish, surgeonfish, rudderfish, sailfish, marlin, snappers, dolpins, 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, tropical birds, terns, 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 man, by their hunting and fishing, and the women by their 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 knuckledusters studded with sharks' teeth. They hunted pigeons in Palau's forests with blowguns. They caught fruit bats in the trees 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 ink designs ran up densely past their elbows. They wore 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. For childishness, 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 exercised 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. Unmighthy nations of Oceania have been left even less mightily 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

**Artist Charles Gibson 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 Palauans 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 Belau, 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 oplaf gloves of that time. But Palauan women still work in their taro gardens, gossiping and singing old songs. They still wield their cover-maternal 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 dying 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 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 Songorik, Jaluit, Ulithi, and Bikar in the Marshall Islands, of Losap Soro, Pulau, Fayo, Pikolot, Ngulu, and Eaunok in the Caroline, of Rarotonga, Takutea, Milaro, and Ataulaki in the Cook islands. Of Harakiti, Kikuwe, Ralaila, and Morokau in the Society Islands, of Epi, Efai, Eromanga, and Malekula in the New Hebrides. Each of these bits of land is a planet unto itself as different as Calisto, 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, splangles the equatorial 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 working out. Sometimes whole island clearances as has happened in Bikini atoll. Each light is tiny but when it falls the earth gets disproportionately darker. When a species vanishes, we never know quite what we've lost. Does Palau's, for example, hide some mold with a potential like penicillin's? Does Palau's reef, if its chief one 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 even 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 proverbs 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 carefree, dreamy archipelagos in South Sea Island mythology. Underneath, it sleeps slyly. The world 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 archetypes succeeded too well in their factionalization of Palauan society.

It often appears that every Palauan is at odds with his fellow in no quite frustating ways—and contrary to Donner, each man an island after all. Palau's saltant 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 on opposite 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' 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' maternal uncle Ngonak had died. Ngonak 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 soberly 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 Ngaraneketi, 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

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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 Diocletianian 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—or a quarter of a day too short. The Babylonians had realized earlier that a solar year was about 365 1/4 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 29⅝ 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 46 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.

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 average years 365 1/4 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 a.d.8, 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 tortuous 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 calendrical contribution the Roman Senate named the eighth month after Augustus.

But the real astronomical year is not 365 25 days long, but 365 242 1/4 days. Thus, the Julian correction was overcorrecting by 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

The month of March from Trés Riches Heures of Jean, Duke of Berry, early 15th century
was simple enough, but getting rid of the ten extra days was not
in 1582 thanks to Gregory. Thursday, October 4, was not 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 "poetry." 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, 1732.

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 last 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 can't be evenly divided.

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 (moons). 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 at all. Together 3) Ignore the moon and its phases.

The Jewish calendar is called "lunisolar" as it tries to accommodate both the sun and the 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 adjusting 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 language 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 Romane had taken to naming the days after their seven planetary gods (Dies Solis; Dies Lunae; Dies Martis; Dies Mercurii; Dies Jovis; Dies Veneris; and Dies Saturni). Reinforced by the Mosaic law of resting every seventh day the week began 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 lasted reasonably well—the metric system. Their Calendar of Reason was less fortuitous.

They renamed the months after the affairs of nature: Nieve, the snowy month; Pluviouse, the rainy month; Floreal, the flower month; Vendémaire, 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, sloppy; chippy, nippy; snowery; flowery, bowery; and hoppy; crumppy; poppy.

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

THE ASTRONOMERS' CALENDAR

A calendar that is still in use today was developed in the 16th century by Joseph Justus Scaliger, a French historian and chronologist. 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 4720 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, was the start of Julian Day 2,443,675. 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.

OH!

This year, two science fiction 'spitfire' films will treat in unremitting glory, honor, what would happen, if a giant meteorite crashed into a major city. Meteor crater sizes do patch the earth, to testifying to such celestial damage in the past. What are the odds of such a catastrophe today? See "Space" in next month's Omni.
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 1951, 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 no. 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. How much of an influence?

I believe there is one discovery that demonstrates just how greatly a culture can shape the thoughts of its 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.

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. Chen-shung Wu did the necessary experiments and confirmed that Lee and Yang were correct. Nature was not symmetrical after all. The world acclimated 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 who pointed out, a matter of culture. "My wife," he wrote, "is an artist observed at the time that the 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.
NO EXIT MARS

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 one-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 inhabited worlds in the solar system instead of one.

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 luminos-
ity 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 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.

Help save this vanishing American

There are only 32 known pairs of wild American peregrine falcons nesting in the United States. The peregrines are the fastest birds on earth, capable of diving at speeds of 200 miles an hour. You may never see this beautiful bird sweep through the sky. Unless you help us save them.

We're the World Wildlife Fund—an organization dedicated to help save endangered wildlife and natural areas. We've been working to save the peregrine falcon since 1972, by supporting Cornell University's captive breeding program. This program needs money in order to continue. That's what the World Wildlife Fund needs—your help and your money.

We'll use your contribution to help save many vanishing species of animals, birds, and habitats all over the world. Since we were established in 1961, we've spent more than 17 million dollars to support over 1200 projects in 84 countries.

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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! ZOW! ZOW! ZOW! and all that. My feeling was that we're a new country. We've got the American Indian, 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 I've 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...
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—Charles F. Kettering
Music

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. Its directions are infinite and ever changing. It defines capture. But there are guides at the outposts of musical space, explorers of 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" telling us what we might expect to hear from music as if 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 Thomson said of Cage in 1945, "He has produced aural 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," "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 cantillation (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 wry or ironic way, come from a world musical tradition.

"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 and uniform pulse, "modular" because it links distant 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.
Travel to Altair IV and back, courtesy of award-winning science fiction illustrator Vincent DiFate, and writer Steve Rubin, who present the revealing behind-the-scenes story of the production of FORBIDDEN PLANET, one of the most beloved science fiction films of all time. It's another unique, spectacular, 96-page double issue of CINEFANTASTIQUE, with 24 pages in full color, in the tradition of our acclaimed issues devoted to STAR WARS and CLOSE ENCOUNTERS OF THE THIRD KIND, illustrated with full color and behind-the-scenes production photos never before published! Subscribe today, and get the large, 17x22, full color Vincent DiFate poster shown above absolutely free! This poster will not be available with newstand copies. So send a New Year's greeting to yourself and all your friends from Hobby, the robot, the original "droid." A gift card will be enclosed at your request.

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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-Manicheans 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 chauvinistic and nativistic 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 bicultural view of the world—half American, half European, half modern, half traditional, half scientific and half humanistic. Dr. Vajk (thymus with bika) insists that the human race is not on a Calvinistic 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 'naive optimism' collapse utterly under the grim impact of the Limits of Growth's computer projections of the dire world situation. He hung back from the pits of despair into a new, more sophisticated optimism only after rereading his own unconvincing 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 analyses 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 projections 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 planet's surface. He pointed out 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 aesthetic. 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. Adapting Buckminster Fuller's principle of spherization—doing more with less—Vajk offers many provocative leads on how intelligence, aiming at quality can produce far more energy on the planet's surface than the Doomsday brigades believe 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 extraterrestrial 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 emigré, saving earth seemed impossible. Now I might go just as a tourist, or to work for a while. There is no need to flee the 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."
THE COYNE INCIDENT

UFO UPDATE

By James Oberg

S

omething 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 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 Janine Zedman, 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.

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 cuesing 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, level-headed group of witnesses into seeing an early jet, 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 recurrs 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 sight-

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

Wild Turkey Lore:

In 1776 Benjamin Franklin proposed that the Wild Turkey be adopted as the symbol of our country. The eagle was chosen instead.

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CONTINUED ON PAGE 127
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, Lepidophos, 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 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 Sohrr, 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 $544 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
KILLER AMOEBA

As if Legionnaires 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 antifungal 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

FUTURE CARS

Cars of the future will be lighter, safer and even smarter if the federal government has its way—but it won't be cheap. The National Highway Traffic Safety Administration (NHTSA) paid more than $6.25 million to develop three prototypes of technically 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.

Chrysler and Calspan, Inc., have engineered an RSV based on the 1976 Chrysler Simca 1308. Its major innovations are structural improvements that make it crushworthy 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 3,000 pounds [1,370 kilogram] 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 deplete the fields of essential nutrients through overly intensive agriculture. The Mayans, it seems, were the victims of their own unwitting 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 undiscovered 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 droughts followed with catastrophic results. Eventually even stop-gap measures—such as small raised fields encircled by irrigation canals—failed, and 1,500 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."
—Masterlinck
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 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 small-vehicle-mounted spark plugs for snowmobiles, motorcycles, and racing cars. Champion Spark Plugs 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.

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, we found four major categories of comic—a loud and crazy, typified by Jerry Lewis; old, fat, and sarcastic, such as W.C. Fields; 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 of 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 delineate 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. Grubbs 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.

SUPERTANK

The U.S. Army’s new XM-1 tank is a 59-t engine armored knight with a kind of laser lance. Using a laser rangefinder and ballistic computer, its 105-mm cannon fired on the run in a recent demonstration, under-}

ingly hitting targets more than one kilometer away.

It averaged 60 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-

“Every thing 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
SEDIMENT FROM OUTER SPACE

As NASA scientists struggle with shrunk 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 meteorites or comets.

When meteors hurtle toward 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 0.5 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 hopes, 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."

POLLUTION FLOWER

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

The cells of the stamen of the flower 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 ambassadors.

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.

**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 800 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.

**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 even the hardest metals out of shape—cause even the hardest diamonds 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 is 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.
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 gibberish.

More than 145 nations, concerned about the effect of recent frigid winters and scorching 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, ocean-going 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 is too late. A satellite launched in September (Nimbus 6) 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.

ALCOHOL AND SEX

When the Scottish nobleman in Macbeth asks the porter what desires drink provokes, he replies, “Lechery, sir, it provokes and unproves 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 McLean 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 the 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
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. No one ever finishes 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 perverts."

But while it was sheer hell for the researchers, the Schally-Guillemin quintessence 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 almost-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 range of human foibles, 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 fervor 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. But first, a look at the bloody.

It is extremely rare for scientists to view 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 1976 that because he disagreed with the mainstream precepts of his science (and with the mainstream ideal), he was having difficulty getting research grants, publishing his scientific papers, and obtaining jobs for his students. Yet when I suggested that he provide his name and dates and go public, he was 'appalled' at such an idea. The journalistic principal of sure through exposé 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. I will ask 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, and I understand him. Guillemin is harder to understand. Smoother, more cultured.'"

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

BY WILLIAM K. STUCKEY

PAINTING: SCHWERTBERGER
The Nobel Prize in medicine was awarded to Polish-born Dr. Alcide de Bordeaux, 46, for his work in the field of endocrinology, the study of hormones. De Bordeaux, who is known for his research on the adrenal gland, was awarded the prize for his work on the role of hormones in the body. He is a professor at the University of Paris and has been a member of the French Academy of Sciences since 1964.

De Bordeaux's work has been instrumental in the development of modern medicine, and he has been praised for his contributions to the field. He is also known for his work on the role of hormones in the immune system and has made significant contributions to the understanding of the role of hormones in the brain.

De Bordeaux's research has been supported by the French government and by a number of international organizations, including the World Health Organization. He is a member of the French Academy of Sciences and has been awarded the Légion d'honneur by the French government.

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De Bordeaux's work has been recognized with a number of honors, including the Légion d'honneur, the American Chemical Society Award, and the International Prize for Medicine. He has also been awarded the Order of Merit by the Italian government and the Order of the Crown by the Belgian government.

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mones immediately with Schally beginning
the search for the extremely elusive factors
early as 1954.
A classic mystery suggested that the pa-
tility 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 pre-
valing pituitary theory was correct, the
situation would be impossible, since the
theory states that the pituitary pumps key
sex hormones into the bloodstream with
unfailingly accuracy and independently of
emotion. Perhaps, then, the hypothalamus
which presumably does react to outside
"stressful" information such as visual im-
ages and emotion 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 mys-
terious releasing factors added a weird,
mind-over-matter quality to classical
anatomy.
Roger Guillemin also had become inter-
ested in stress and hormonal function, hav-
ing also moved to Canada to work under
the University of Montreal's Hans Selye, a
Nobel connected natic if ever there was
one and an authority on stress. He writes (in
Pionum Publishing's Pioneers of Neuroen-
doctrine, 1978) that he came to the hypoth-
amic 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
Houston. Young Schally hearing that the
Texas Frenchman shared mutual research
interest wrote from Montreal asking to
work in Guillemin's Houston lab. Guillemin
rotes ily (in Pioneers) that Professor Saff-
ran Schally's overseer gave Schally a
"guarded" recommendation. But Guillemin
hired Schally anyway, and Schally began
the first of his two "unbearable" years be-
fore bolting to New Orleans to head his own
VA sponsored research drive.
The problem is that the rest of the world of
endoctrine—except for Dallas's Dr
Samuel McDonald McCann and a handful of
other hearrs from the 1950s pioneers—thought Guillemin and Schally
were totally wrong. Moreover, they began to
suspect over the years that the two spent
more time talking for each other's juggling (at
amidst atmospheric 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 (cor
ictropin 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 hor-
mones" but that the insubstantial nature
of the chemical itself plus inadequate analy-
ing 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 un-
usual meeting in Tucson in 1969—called
by the National Institute of Health (NIH)
beckers of the competing teams of Guille-
min 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 simple enough (that is, separ-
ated from the extraneous head (tis-
ues of all those sheep brains) to at last
begin work on its structure. The NIH, which
had been prepared to suspend the re-
sources 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 se-
quency 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
egot centric. 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 roll the wa-
ters over even more Folkers a crack chemist
was asked by Schally to help him work out the
TRH structure. Folkers did—at least several
weeks before Guillemin team did. Today, Guillemin will not speak
Folkers. When I asked Guillemin to com-
tend 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 Folkers work on
the structural problem. Ironically it is not
Schally or Guillemin—but Karl Folk-
ers—holds the patern on TRH structure.
A note on all that animal matter,
Guillemin's most brilliant research stroke in pur-
ning the extremely potent small and
hard to isolate releasing factors was in the
sheen volume of sheep brains he decided
to be processed for hypothalamic
truths. Six million brains, which he bought
from packing houses at 40 cents apiece (a
total of $1.4 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
weenies people. Dr. McCann, the pride of
physiology at Dallas's University of Texas
Health Sciences Center speculates that he
probable did not survive in the Nobel
swepstakes because he simply did not
want to convert the 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 kind either I was
more interested in the physiology of how
the hypothalamus actually controls the
pituitary if it does or in solving a mun-
cade 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 concludes a draw—
though coworkers say they had it in pure
form years before Guillemin, but Karl Folk-
ers holds the patent. (Analysis: Try the
polygraph.)

Luteinizing Hormone Releasing Hor-
mine (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 hor-
mones and affects insulin production in dia-
abetes) is also claimed by Guillemin, but
add this dissenting note from McCann: We
published four articles on somatostatin
before Guillemin did. Meanwhile, he was
什ooding 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 seeker and Prize find-
ers, particularly after the comments of
another Dallas hypothalamic worker Dr.
John Porter.

"No one yet knows exactly how the
hypothalamus drives the pituitary, if it does.", said Dr. Porter. We are now finding
some of these substances that like somatosta-
tin, 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 hap-
penes, 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 fac-
sors. 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
consensus. The structure suggests
exactly how genetic material reproduces
itself. All we know about releasing factors is
what amino acid follows what other amino

CONTINUED ON PAGE 136
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 law of the land—let right be done!

Even while still a lonely, reclusive child, Wallace's heart ached mightily when he read of the laborious, boring, mind-numbing calculations endured by the great mathematicians of old. Just knowing, thinking of Gauss's marvelous mind wasting literally months of his precious existence grinding out tedious mathematics that even a dullard could 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 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 pondered endlessly over the reason for this strange misdirection of talent and bored his friends to the verge of endurance with his constant brooding on the mystery. But 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.
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 a new opportunity to do something! And Wallace John Stirlinghope vowed to help. He became convinced that it was his purpose on Earth—he could not 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 cried a small, yet powerful hand calculator in his palm. It was 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 square 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 microprocessor. 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 Stirlinghope was no fool. He understood, indeed feared, time paradoxes! He knew Newton could not be trusted with the secret, but it wouldn't do for the calculator to travel Newton's time. So Wallace had incorporated a small, self-destruction 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 sedition!

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 spreading London and threatening his college, 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 dodge 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 cool, gentle rain was falling as he approached the door. The soft, hazy light of an oil lamp glowed inside, revealing the translucent glass 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, 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.

"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 weather 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."

Motoring 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 elsewhere? Have you traveled far? Please come in and close your eyes."

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."

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 merit his idiot'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 and off like sparking 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 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 live 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's 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 planted wildly without thought of the essentially infinite technological gap that separated him from himself.

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 posed 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 his history? Wallace hesitated, and seeing the suspicion grow anew 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 & 18 divided by 12. Poor Wallace, at all the numbers to use they won the worst.

Within milliseconds the answer glowed brightly in fiery red characters. Wallace locked 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! 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 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—I imagine the tedious work the mind-deadening labor this machine will save you from. And it is yours!"

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

As Isaac sneered these last words at Wallace, he raised the poker over his head. "Begone! Most august of the Dark World! I know now you must be in the employ of the Father of the Antichrist, and the Lord God Almighty will protect me if I do not wrest in my resolve. Begone! 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 do not 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 yelled 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.

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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 turned 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 hellfire! 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 strove 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 tract would devour from his allotted time.

Five years later long after Newton had returned to Cambridge, a group of pricking children were surprised 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 stream bed—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 Stiennon 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 Stiennon, you see, never again had another kind word for Newton, or for that matter, any words for him at all."

53
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, journalistic 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
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 a 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 mag-

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.

Izma 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 purses—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—the assignment list for 1945 includes a piece of trampolining on..."
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...
Goro photographed the undersea, sand-covered limestone formations of the Great Bahama Bank (right) from a bimp on a Life assignment in 1952. Accidentally left 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-
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—than he is of the Life Achievement Award he received last November from the American Society of Magazine Photographers.

“It’s easy 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.”
It was a sparkling New world—but everyone in it had to pay a price. Everyone.

NEW IS BEAUTIFUL

BY TONY HOLKHAM

Eli 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 angelike boy, Zodiac, had chorused 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 imbecile?"

"That wouldn't be so much fun!" Zodiac's eyes sparkled. "I'll give you a clue - he relaxed, clearing his eyes and quoting.

Far from the edge of the land
There lies a shifting place
In the deeps 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 swam at his approach, and when the old man's hands touched the glass the fish sprang suddenly and to no conscious life, its small needle fangs lashing sharply against the glass. Eli carried the tank to the sink, and in a swift movement whipped off the cover, emptied out the contents, and covered the sink with a glass sheet. He held the tank over the water 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, the grinning, but I haven't the heart to have his glands removed."

"And I assumed that's the third cube. What do I do with it?"

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

Eli signed 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's three-dimensional." He poked 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 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 blown! 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?"

"Not 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 grunted finger. "I pay good bens and guardianship money to send you to a free school, and you hold on a minute." "Eli said Zodiac, his voice beying 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."

"I 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 lay you down some of the 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 seems that you'll have to stick to what you start. Then you won't end up like old, 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 winked 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 shuffled it across together with the boy's two satchels.

"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. ✈ Raw pâte? Most of it disappeared down his throat in a second.

"Steady, Eli said the boy, waving his hand encouragingly. "It's not as much as it looks."

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

"Well, I can't say I enjoyed it, but 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 pâte. It didn't touch the water. The fish gulped once and returned to the bottom. Zodiac shuddered involuntarily and turned back to the table.

"Why do you still keep him if he's so dangerous? It is 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 clasped his eyes. "When I was young, when there were still ships on the sea, I worked in a frigate carrying everything from fabrics to ore from England to North America. On the ship as well as the 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 port 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 lost 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 electric chair."

Forty years he's got and forty years he served. He used to write to me regularly and a week after his release I heard he'd
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 did not occur 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 an 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 the computer sharpened his interest in artificial or machine intelligence, an interest that continues to this day.

A 1977 listing of Good's published works summarizes more than 1000 papers, articles, books, and reviews compiled in little more than a quarter-century. This following interview was conducted by Omni contributing editor Dr. Christopher Evans.
Omni: Do the party 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 scientists will always look for an explanation of any unusual phenomenon in terms of what is already known before resorting to farout explanations. UFOs are a good example. The scientist will lean over backward to show that they’re really such UFOs—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 admetely 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. It 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 suppressed 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 farout 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 is 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.

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 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 beings 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 it is possible it is because the brain is uniparallel. If that’s true then if it’s possible for a computer to have telepathy it would presumably have to be uniparallel 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 there’s a kind of physical transmission—with a sending system and a receiving system.

Good: Yes. I call it physical. But once again, it’s a semantic point. If you want to call it nonphysical, you can. It is 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 if 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 and telepathy as it comes out of laboratories?

Good: Well, let me just express 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 electromagnetic 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. With telepathics it is 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 an overwhelming weakness because one can well believe that telepathy only occurs in a
remotely, we'll be invited to join the cosmic club.

Omni It's been sixteen years since The Scientific Speculations 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 a 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 uppers" to replace stockings, and in this way could be said to have altered 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.

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

- 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.

continued on page 117
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
29 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
The interstellar flight has already been delayed, more as a feasibility study than as a concrete project. It didn’t emerge from NASA’s screening lists, or from some academic research at the Soviet Union. Even the advanced propulsion groups at the Pasadena’s Laboratory (SPL) can boast only a “recreational or pioneer mission” intended to take less than half the proposed spacecraft to the nearest star. Credit for the first design of an interstellar flight goes to the dedicated amateurs of the British Interplanetary Society (BIS).

 Called Barnard’s Star a red dwarf star, only 6.5 light-years away, is already 78 light-years—50,000 light-years—away. The projects planners think the information gathered with the smaller spacecrafts would take so long.

The Barnard’s Star is a red dwarf star, less than half the diameter of our Sun and only one-tenth as bright. It is much colder than the Sun and is only about 500,000 years old. 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 P. Light, a nuclear physicist who worked on the first star and said it could take years longer to determine than scooping interstellar hydrogen into fusion reactors. Some were far too low powered to be sustained, but that meant computers would have to perform experiments and experiments could be interesting. The digital, perhaps with the most promising, would be the more interesting.

The mission is also partly driven by Alpha Centauri, a twin star system only 4.3 light-years away. Alpha B’s core, though 80 percent of the mass of Barnard’s Star, is highly magnetized and its magnetic field is the magnetic, pulsed rocket. [me]

Adapted from today’s experiments with laser fusion, small genetics, and the possibility that we would inject a pellet of thermonuclear fuel into a plasma cloud, which could then be used to power a high powered interplanetary rocket. The beams would heat and compress the plasma with the pulse, the intense blast touching of a small fusion explosion. The hot, correspond to beam without a high powered interplanetary rocket would be an extremely long and powerful plasma if it was fired at a steel plate. For example, the propulsion chamber by an intense magnetic field. Once the rocket is fired, the beam would be directed to power the electron beams and magnetic field would be pulsed from the exhaust plasma by a magnetic induction coil around the chamber’s exit. The fiery fusion bombs would be detonated.

The BIS concocted before any such scheme can work, citizens must be informed, that we all have to learn that scooping interstellar hydrogen into fusion reactors, so some were far too low powered to be sustained, but that meant computers would have to perform experiments and experiments could be interesting. The digital, perhaps with the most promising, would be the more interesting.

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pressed by the effort and just as skeptical of the conclusions. Mining Jupiter is an extremely ambitious enterprise he observes with a chuckle. "It is certainly 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 want 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 could 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 what I would have to do 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 that part, Dr. Jaffe and his colleague Harry North have been planning a trip to Pluto and beyond in the year 2000. Star missions are not just 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 would be placed into a low earth orbit by an advanced version of the Space Shuttle. it would be planned to an escape velocity. Thrust would continue for about eight years for an interstellar probe, nearly 12 years for a two-stage probe.

The payload, he says, would include a 1000-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 and help 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 engineered payload to Alpha Centauri, the laser array, probably built in a close sun, would be 250 kilometers in diameter. Dr. Forward says. This is not as difficult as it sounds. Although the array has to be extremely wide to achieve the desired bearing 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 sold. It can be many separate beams from a whole bunch of lasers in a thin orbit.

The interstellar probe itself would consist of a simple, 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 Noreen 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 lage 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 and its velocity vector is now pointing back at the earth. Then we 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 near Earth, there is no chance that an irreparable malfunction will jeopardize the mission. If something breaks down, repair 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 make a laser array that can carry a small 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, it will slow to well below relativistic velocities, it blossoms from a compact mass into a 10-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 approaches a target, the Golden 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 Golden Globe, the sensors would be able to detect objects less than one meter across even from a 10-kilometer orbital altitude."

"On a planet, a 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 is being poured into making computer components smaller, faster and more reliable."

"The third prerequisite computer design is that the computer be ready when the probes are launched, and they have to be launched soon."

Alan Bond doesn't think it will ever happen. "The Wardens and central computer will be extraordinarily intelligent," he explains. "It is impossible to say, but they may well be more intelligent than man when it comes to solving the kind of problems spacecraft 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 is that we're sending life itself. If you go to the stars in person we will be helping life spread throughout an infinite 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 man from reaching the stars. One time NASA近些年来 executive Carl Mols put it this way: "There are also those who argue that the journey to our nearest star neighbor, which will 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 should be reminded, however, that in the past explorers faced such journeys with less transportation. 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 this 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 spacecraft. It was the SPS that made the first practical attempt to design a manned flight to the moon—in 1939."

![Apple Computer Ad](image-url)
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 body of the quadriceps muscle of his left leg. Like all serious competitors, he had the electrode locations tattooed on his body. A faulty electrode placement could lead to disqualification. He had 97 dots on his body. 97 were leading into the 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 was ready.

Dan felt the webbing of his Comp III chair lighten. 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, bound himself rocking in unison with the Japanese skier. Suddenly the gun sounded and 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 lightness 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 in unison. 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 left 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 locked up a wall of snow. Dan found 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. Could he 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 eased 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 measured 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 with ease, and dropped into a deep crouch, his body low parallel to the ground. He was practically sitting on his heels as he tucked into 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 his mind Dan stood, turned sideways, slid to a stop in a line 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. So thoroughly taken 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 94.67%. 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 fifty 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 stripped the metal framework around both legs, good 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 paneled 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 the 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 he thought, if he could see them they would only depress him. They were as dead as the city.

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 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 run the fragile shell in our outer atmosphere, the shell that had allowed life to evolve on Earth in the first place. Furniture spray imagined a thousand 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 halted 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 it with his cloak. Brushed with the bristle. It was lightweight, gave support where it was needed, was flexible. Where had it to be? A supreme monument to mankind better 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...
These whitish, multicolored lights are in fact uranium atoms, magnified 15 million times by one of the world's most powerful electron microscopes. Shot by physicist Albert Crow 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. The 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 pixel of pixel 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, indium, and palladium.

Already, however, the method is yielding surprising insights into the behavior of atoms. "They tend to stick together even when they don't contain 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 solids. 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 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 stuns 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 is, 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 because the human race is long. Isaac Newton discovered a better theory. His is somewhat more complicated: A mass attracts all other masses. With Newton’s theory of gravity, it is 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 handle.

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 will 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 invent, 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 cancel 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. 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 a 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 microg's (10 millionths of the earth's gravity) at a height of one meter above the rock's center of mass. But if we used the same density at the center of the rock, the decrease would be 100 microg's at a height of one meter above the center of the rock.

Now suppose we could get closer to the four-milion-ton rock. If we could get ten times closer or about five meters away then the gravity of the rock would increase to 1 millig (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 gees). 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-ton mass. That means we have to find a way to make matter more dense than it normally is.

We know that dense stars or matter do exist. We can observe white dwarf stars which have the mass of the 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.

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 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 g 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 tree-fall experiments on the earth's surface.

But now we come to another problem. How do we hold the four-million-ton anti-gravity rock up over our heads? The roof loading works out to 3.4 million tons per square foot, which 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. 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 funseekers swimming through the air with colorful feathered wings attached to their arms—living out the legend of Icarus for the price of an E ticket?

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— if 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 electric forces into very strong electric forces.

Einstein's theory says that gravity is the same way. If 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 than 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 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 pipe 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 low 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
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.

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.

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 a negative matter ball inside a dense disc and lay it on a good strong floor. If this disc is dense enough and thick enough, the repulsive gravity field on both sides of the disc will equalise. 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 spacecraft), 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 philosopher's 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 possible? We think so. It is theoretically possible to cancel the earth's gravity pull and to make a mass pull 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.
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 holding cell 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
President has repudiated because of its nuclear proliferation implications. Yet solar will get only about $470 million or 9 percent of the DOE's budget. The initial administration proposal was for $639.5 million, a decrease of 10 percent from last year. Carter increased the figure only when it was apparent that Congress would appropriate more than $450 million.

With the present gap between solar and nuclear programs, it's clear that solar-will contribute only minimally to this country's future energy needs and become exotic, losing many in line with Star Wars and the 26th century than with the energy war of the 1960s.

Oil and gas now supply 75 percent of our energy needs. But domestic production has been steadily declining, and the $45 billion in imports has by 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's safe inexhaustible, it cannot be monopolized, and its daily delivery 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 politicizing 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 experts are unquestionably biased, by design. Solar research says Representative Richard Gilman (D-N.Y.) Several congressmen, including Representative Robert Drinan (D-Mass), agree with disgruntled Energy Department officials who say the only way solar will be aggressively developed in this country is "over the [James] Schlesinger's dead body." During hearings last spring before a House subcommittee investigating the footloose solar program, Drinan even suggested starting a dump Schlesinger movement in Congress.

The administration is less aggressive than most on the development of solar energy, as is evident 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 15,000 to 2 million homes using solar energy by 1985.
- DOE's biggest single budget cutback for FY 1979 was 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-housing demonstrations are still needed across the country to prove consumers, builders, and lenders a handshing opportunity to see cost-effective solar heating systems in action.

If the Defense Department would invest only $440 million in photovoltaic cells, costs would drop 300 percent. ...
within five years. At that price the cells would be cheap enough for widespread use. Congress authorized only $80 million for such purchases in FY 1978. But even that small sum had to be forced "down the administrative throat," says Representative DiStefano.

- DOE's Washington headquarters has 454 employees involved in nuclear energy programs, only 64 are working in the solar program. Nationwide, the figure is nearly 1600 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 is 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 downsize the efficiency of the entire program, solar staffs charge.
- The assistant secretary for conservation and solar applications, Otis Wilden, was finally appointed 17 months after Carter became president and nine months after DOE was created. DOE's too solar energy office had been filled with a "temporary" successor from the Ford Administration who, the General Accounting Office (GAO) found, may have lacked legal authority to operate the program.
- 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 hydropower electric dams, power generation of remote sites using photovoltaic cells—all are already technically competitive, reports the CEQ. Within ten years wind turbines, photovoltaic, 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 percent of all U.S. energy demands are met by the sun. Worldwide about one fifth of all energy used originates from solar resources—according to the Solar Energy Industries Association. In the U.S., the energy generated from biomass—the production of fuels from wood, dung, crop residues, or other agricultural materials—is about 40 percent of all needed energy. But even this is far short of what is needed. In the United States alone, according to the CEQ, such a transition would not be cheap or easy. But if benefits could outweigh the costs and difficulties, "a major effort will have been made to achieve a national goal of energy independence," the CEQ report
- The Council on Environmental Quality agrees. Solar energy, it says, is no longer a "wonderful dream" and in fact may have been an "exciting 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. The CEQ report states that the CEQ reports on solar energy Progress and Promise. It is true that providing significantly more than 1 percent of our energy from solar power by the year 2000 should be achievable if we commit ourselves to that goal and to conservation as well. Solar is in fact our best hope.

Turning to solar energy goes beyond simple economics and desire; however. As Chief Scientist of DOE, Bernard McGhee, points to hearings of a House Government Operations subcommit-
Two nuclear "devices" were missing, stolen by experts. Their destination—the White House.

By Dean R. Lambe
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 had lined face now softened with a small smile; replaced the receiver. He stroked 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 phone nearest to the Hughes Air West 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. He 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 scoured 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 buried at a very sharp angle into the alkaline, siliceous soil. He had not expected to discover anything more profound than the hole, but his presence here was expected of him. On-site inspection. Scene of the crime.

When he and Captain Hutton had deployed at Indian Springs AF Base earlier that morning, they had encountered a predictable chaos. The auxiliary base was as warm 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 suite and wide-brimmed hat. FBI, DIA, Air Force Intelligence — it was 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 helicopetered to the last — but unfortunately not final — resting places of the nuclear devices.

The nukes were now Somewhere — perhaps 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 of all this loopy Intelligence network were running around like so many hawks 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 its pessimistic expectations — the riddles 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 form to lie to Interpol — too often, and CIA had claimed that mutual trust on the part of the friends 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 to, 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 mobile 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 SRC 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 denunciation 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 750 meters of sand and concrete, over 40 kilometers from a patrolled perimeter had proved inadequate after all.

Following a dull meeting with his stockbroker 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.

"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 physical exists 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... uhm 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 it! I know Art. Damned if I do..."

The dark-haired gentleman sat comfortably nursing his Gibson at the lounge of the Portland International Airport. 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..."
"Four points to you, Fenwick."
WORLDS BEYOND
Buckminster Fuller
Scientist

The following statements are from Worlds Beyond, a new collection of future visions 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 estranged 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. And we're not going to carry 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 totality of society, the interplay of all the biological elements, the sun's radiation, the cross-pollination, and so forth. We are all part of an incredible prevailing 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 has already done. Space-age technology is something that is 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—that is an extraordinary piece of structuring. We don't know any other planet with water just like 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 see the bottom at a depth of 20 feet. In an extraordinarily close terrestrial waters. If we can swim very well, but it gets very deep, it starts 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 on your very 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 it as going out into space from us. 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

PAINTINGS BY DON DIXON

The birth of a sun
WORLDS BEYOND
EDMUND G. BROWN, JR.

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 academicians
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
discharged, the basic concern still
remains that as we deplete our air and
water and resources, diseases 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 naturally and
economically psychologically and
divided. 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 of 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--at a far more
profound way--benefits for the people of
this earth. The earth now is drenched
with the blood of a million conflicts
over recorded history. We've divided
along arbitrary geographical lines
separated into ethnic categories and
divided into 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 short
limited period of time.

As we begin to see the possibilities
endless as they are throughout the
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, feeding the human family through transportation
and communications and other scientific
breakthroughs, or just exciting the
imagination. In space, we surmise
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, the science and technology.
You can't limit human beings, as they put
together as they have synthesized, 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, instruction
in television, we can have the work in the
Medicaricenters, at Harvard, at Berkeley
and by two-way communication we
can take it right into the ghettos and
low-income high schools. We can let
young people see what is possible if
we can just inspire them and summon up
their energies.
WORLDS BEYOND
RUSSELL SCHWEICKART
ASTRONAUT

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 you 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 make sure 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 18 cassettes' worth of data, which meant we still had a set of batteries good for another 18 cassettes' worth. We took up with us an agreement cassettes with music on them—whatever we wanted, for that matter—and we could use the 18 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 unnamed, 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 head in 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 tried 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 it was. I brought the reality of being up there back to those periods of preparation and integration of the two. It was one of the most powerful emotional experiences I've ever had. It almost jerked me bodily out of that spacecraft.


CONTINUED ON PAGE 128

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

T
hree 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 tanned-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...
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 misconceptions 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 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.”

“Your 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 impossible 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 cracking heels. 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 swirl around me in the foam. I just catch my face in the nanosecond of change from shock to tear, and then I dive again, my tail breaking surface, clear against the flaming sky. This dive is deep, cold, strong, 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?”

“Impus. 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 get 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 shredding rigging method? And why were they leaked to the press without checking with me?”

“I can explain 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 snuffling 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 his shoulder, ooze pus the color of rotting 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.
"Terrific form, Meyers. Now what do you say we work on accuracy."
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 at 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 swirl 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 solid thumb of their father'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, live 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. The 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 crowns. With one finger he traced the 206 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 is a cigarette-packing time while he assessed the question. Could it 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 Car- ruthers had? But a man who needed an ally was a second choice to be one himself. Always try to ally yourself with the already unshakeable.

Finally, Poole said cautiously, "How do you mean inexplicable? A? 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 tinged 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 "Get ya!"

"Did not!"

"Did too!"

"Bloody well did too! Lie down, you have to be dead!"

"Won't!"

"Will!"

"Won't!"

"Won't you go for! 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贫困 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!"

"If a forbidden inclination to despair..."

Carruthers ignored Poole's counterquestion. 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 though his ten- sion 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 unnoticed 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. If it was too smooth. Like a silvery oval. It looked more like... like a ship.

The man purrs, "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 slips again, turns and walks back to the barn. The other two follow but I see the boy look back over his shoulder at the stary 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 genteel, 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 cryptically, once more all business. "We can go ahead with the shoreline project and make damn sure. Or we can let this one go to the environmentalists with lots of hue and cry and rack up brownie points. No. And never vote for the bag 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. Poole put down his coffee mug a few drops spilled over the edge onto the teak table. "Of course All, he said. "So you just 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 all, All," 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, yes, 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 completely 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 cooly.

"Un foo murmurs asseverate that he agrees with what I am doing but the time, Gaetel 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, 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 bare 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 tongs 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 Roznicki.'

I climb from behind the tombstone to on top of it and gaze down at her. Too, am middle-aged—or would be if I were totally corporeal—while I am not. It is very hard to hold the state between here and 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.

"Rose, 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. She knows it beyond needing to doubt. Knows it with every undeviating cell of her gray mind, and as literally incapable of seeing what she knows does not exist. She looks through me levelly, straightforward, utterly unshaken in her unwon an 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 and down. Out the window he saw ocean, ocean, in sunset and the impossible flash of a green-scaled tail above bate breasts fished with flaring 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 there be possible? Jesus H. Christ—what else might be possible?

"Let's face it, Norman, this just isn't your day."

Salvation is expensive. 

"..."
been sent back to Australasia to work for the Fisheries Protection Board. After that, he didn’t write to me so often. Inevitably, 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 too a shot to the shark’s other leg 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. We’ve had a good run and they told me the little girl going to be all right, thank God. I want you to have all my bills to do what you like with. Please look after Willy for me. He’s a man bigger than good company. I swear he understands more than he tells on. Can’t write any more. Old friend. Take care. So long, Aubrey. Eli sighed deeply.

I was wondering what or on what Earth Willy was. I took a weekend return to Melbourne and collected Aubrey’s stuff—and Willy. His landlady told me rather sharply to 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 typified the sense of humor that never left him: not even while he was in prison. They said Willy eats anything, specially fresh meat. Particularly poults 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 into a license. It was only then that I discovered Willy’s true identity. He was extremely rare and worth a small fortune. Aubrey must have known that, and if it was his way of thanking me for sticking by him all those years I should have sold him then and there, 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.

I opened his eyes. Eat your food. He ordered quietly. Then he closed they 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 un先前able, and so have my wards.

Zodiac split a sachet between finger and

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.

“Nonsense!” said Zodiac sharply lossing his golden hair. “You’ll always be able to teach me something. You have the morals, the knowledge, and the honesty I hope we’ll be able to retain it when all the guardians are gone.

You will. You will. Don’t you worry. It’s more than over a technological world. 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 honors in man’s nature means a shorter lifespan, though a 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 her ward, for the 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 Cosworths 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, tippling out to 16 hours of schooling. He was growing up fast, even for a man. It was hard to believe that 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 wars, 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, lived out their lives in luxury in the cities, were almost oblivious to the New Way. Taking over Eli Blair had believed in 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 making 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 revent 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 looking up the house and the shops 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 cutting 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 crying out loud! 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 while comm is in use. 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 pate. 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 cleared 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 had 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. 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 sat to the mental task of taking himself to pieces, understanding but unneccessarily, and it was only the small 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 pate.

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 pate was accredited fit for consumption by wards, but it seems the data had been falsified.

"Oh, no!" Eli almost realized 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 a script in the North Atlantic had cured him for life. It seemed there was still some to 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. I will let you know how he is 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, 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 un
familiar to him. He could no more go to bed
than fly.

The night seemed interminable. To oc
cupy himself, Eli closed the shutters and
locked up the house, swept out the bedroom,
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 night-
mare. 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 wobbled down the path, 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 triv-
ual it had all seemed to him then. How he
now regretted the callousness of his youth. All
those memories crashed so violently about
his head he hardly heard the comm shrilling.

Eli opened the channel carefully half ex-
pecting... 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 ma-
tured in mind, but always retained the chil-
dish features. He knew.

"Mr Blair. I'm sorry. I'm not sure that
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 tomo-
row 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.
Think happened. His emotions were in tur-
moil. 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
an immediate answer. A two-year guard-
ianship was short and painful enough, despit
the calculated way it was cooled down to-
ward 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 waste-
ful and best forgotten.

Half-blind and 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. "On you're brute," he muttered.
"you've been waiting for this chance for
years. More seconds passed. No pain came. He
opened his eyes and looked down. Willy
was lying slightly and had
turned toward the head 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 pâte! Willy too,
had eaten the pâte. 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. I don't torture myself. Go to bed and
I'll be round with the papers in the morn-
ing."

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."

*For one thing, you seem to have an extraordinary developed super ego.*
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 the future, that they may 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 mesophysical 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 that fact that we are concentrating scientific and philosophical effort on the wrong things? Alexander Pope said that the proper study of mankind is men, 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 quasars 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 fragile object supported on the back of three giant tortoises. Frankly, I think he was looking himself. The very itself 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** On yes. In fact the whole 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 the 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—sliding itself out 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 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 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; indeed, it 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 a 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 what it had generated it, would have said, 'That is exactly the kind of thing that only a human could do.' I might add that it could 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 innate 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. So the answer is...

**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' level. 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, sat opposite each other with 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 if only by the skin of his teeth. As a matter of fact, it already beat 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 pos-
sible move? Now this kind of blockbusting approach over says 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—by changing 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 generalization of 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.

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 is 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 is using it, 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 become 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 can 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 of a man or less. 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 a man. This argument misses a very important point—that doubling 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 specialty 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 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 have been two or three rudimentary experiments already. In one, a computer was set to measuring 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 UIMs. 

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 in the future. For example, disease will be eradicated, and the expectation of life will increase. At that point, we will find ourselves in a position to make the UIMs do things that we now believe are possible but that we have not yet achieved. 

Omni: How long do you think it will be before we have the first of the UIMs? 

Good: My own estimate is that we will have the first of the UIMs within the next fifty years. The advances in medicine will be so dramatic that we will be able to create UIMs that can help us to understand ourselves and our environment. We will be able to create UIMs that can help us to understand ourselves and our environment. 

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, and even 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 be able to run the world. I then put forward this idea in The Scientist Speckulates and the theme was picked up in an SF novel called The Forbin Project. I remember it became a movie too. I believe, the point was that the enormous processing power 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 even 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 expansion 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 that 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 many multiple systems exist is pretty strong evidence that there are even greater numbers of planetary systems. It is 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 its 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! 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 our selves 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, 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 for 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 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. Can't see us not making it, can you?
HOLE THING
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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 Kannen 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. Dr Tanner only knew not 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 fuddled 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 in 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 beamed 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 are 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 pianos were going to entertain. Naturally those muscians 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 00:00..." He also noted that all eyes converged not on the original casings, but on the slate-gray narrow metal boxes that resided beside each device. "But how could some crazy peacecunk 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, Ploeshares, General Ploeshares".
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 grow 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 sash! Not a course at all. Six: this was a man sking down the side of a mountain four...three...not just any mountain two...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 hard and did not even feel the wind which roared past his face. He crouched over his skis. 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 until 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: once in his life he lived. Topping a ridge he flew into spaces, turned a serpentine 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 started 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. The clean air all closed in around him at once as he crossed the finish line and was hugged by the spectators. He turned his back and found the woman in the next chair was hugging him. He was hugging her. A curtain blan- keted 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, hope less 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 onto what you can.

He helped her into his brace, she helped him. It was awkward, they were both with each other. It didn't matter. Turning, they both kissed the old man behind them, touched his face, his arm. They didn't wait to see who won. It wasn't important.
According to 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 will be 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 1982, 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, it is true. But the commitment is weak.

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-tenth of the budget for FY 1979. Even this year's budget, which has received substantial and substantial federal allocations, 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 $10 billion for the development of nuclear energy and nuclear weapons. Of this, more than $17.5 billion has gone directly to civilian and naval fission reactor development. (Conventional nuclear reactors owe a great debt to submarine reactor designs.) The $17 billion does not include the nearly $8 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 bases 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 lobbying and has not profited from the approximately $530 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 as well as 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 is 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 Haynes put it—it 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 solar benign answers to the 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 staffing went 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 disputed priorities, overemphasizing large-scale technologies to the detriment of smaller scale applications. If you have a lot of money to spend on a limited staff it makes sense to spend big contracts to spend it on one solar effort—"Solar is ideal for small businesses"—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 to 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 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 submitted a $9,000 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 energy research program has emphasized large central power stations to produce solar electricity in some distant future. It 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's 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 $38 million toward the huge $120 million Power Tower in Barstow, California. In contrast, all nonelectric applications received less than half that amount ($105.4 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
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 giant power towers, the power tower being the most notable example, and far too little emphasis on decentralized solar applications."

Many solar advocates, like Representative Ottinger are fearful that the solar electric program is going to get swamped 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 technologies 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 track 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 projects 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 spent over $719 thousand of the project funds, and a substantial portion of the remaining $21 million was reallocated to nondefensive 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 "every federal institution has 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, when solar power, the public'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 were released, but the final report has not been released. The Carter administration is spending more on solar energy than any other country in the world..."
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 are seen 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.

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 of 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 chimp doll with nothing beneath the surface. Now we're beginning to learn what is 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—olefactory, auditory, optical, tactile—and to some extent, the esthetics and the intuitions. All that is happening is that we're discovering principles that have always been there. Learning to employ some of these principles and discovering more about how they operate could influence, then, the increase of our knowledge about what's going on, that's all.

Human beings have developed means 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, because it is, more simply, less misconception, less information. The old misconception 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 latch ing 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 too 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. That the 99 percent of humanity that doesn't understand 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.
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 pass on with the flight plan through 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 inter rupted 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 17 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 umbilical, 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 get 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 hang 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 this camera. Which is no simple task in a pressurized spacecraft, you know, outside in a vacuum. So while Dave was messin' 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 back to 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 went out at dawn just after we 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 imagine how beautiful it is.

Mysticism something that interests me, in a way 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 so many people in looking in 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's not that. Certainly this was not the case for me. I don't believe that it was for anyone I know included those I've mentioned. I think humility is the mark of something that's 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 mules 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 of the universe as that. The human awareness of the features which places you spend 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 this experience in terms of a changed lifestyle is the one that develops as you circle the earth every hour and a half. At least this is the case in earth-orbital missions.

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COMUNICATIONS

CONTINUED FROM PAGE 10

ment, a position that provides him with a springboard from which to launch his thoughtfully, gut-level denigrations of programs whose ultimate purpose is to increase 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 flashings 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 in 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' underwear 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.

Neocronomicon
In November Omni your cover was from a book by H.R. Giger called Neocronomicon. I have tried all the book stores in my area with no results. How can I order it? I want it very much.

Tom Walker
Dunedin, FL

The Swiss artist Giger's Neocronomicon 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 Aalaly, 22 Passage Vane Dodoet, 75001 Paris France.

In the U.S. Hansen Galleries will be handling some of Giger's art. For information contact Hansen Galleries, 72 Washington St., New York, NY 10012. Telephone 212-431-5904—Ed

TM, Emotion, and Disease
Concerning Language. Emotion and Disease by Wallace Ellbrook in November Omni, I would urge Dr. Ellbrook 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-Sidhi program where evidence of perfect mind-body coordination is being found during the performance of supranormal activities.

Ellbrook 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 mental 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 nonactivity 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-Sidhi program is demonstrating, the body can be maintained in perfect health.

T.S. Miller
Boston, MA

Postindustrial Postscript
While enjoying the future-oriented contents of your new year, 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 Mercy Griffin TV 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 Shakkous
Palos Verdes Estates, CA

 EMCalled '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 de-emphasized special effects and external conflicts for loyal 'trekker' special effects alone cannot 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 plying 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. Shank
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 1560 A.D. despite the fact that Velikovsky deduced several outlandish predicitons from it that subsequently proved true. Among them the high tempeature 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 Tilly
Waukegan, IL

Vita 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 Orlandi
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 Krushchev, 77, Somerset Maugham, 87, 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 musicalike 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 Mid-eastern 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 churning 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 companions. Soon other sources, set going by the disturbance, joined their music to the first with such a crescendo 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 kicked, tossed, 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 ear the 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 slope 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 downhill, a loud roarer 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-up' 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-
varying 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 slicing 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 Middle East 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 squeezing 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 squeezing 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 insulate the additional polishing needed for the grains’ distinct smoothness. These conditions may not exist solely on earth—itis speculated that booming sand may be common in the windy and near-waterless environment of the deserts of Mars.

An analysis of squeezing 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 squeezing sand are of nearly uniform size. The addition of only a few smaller-size particles to a sample of squeezing 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 sound made by two pieces of corduroy being rapidly rubbed together. Or, maybe, as with booming sand, a rapid alternation between loose packing and loose packing of grains creates an expansion and contraction of the volume occupied by the sand and a consequent rhythmic 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 squeezing 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 squeezing 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.

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 A Geologic Guide to the United States (Berkeley, 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 Bernadino 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 U.S. 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 sets of (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!
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.

You must learn to trust your cabinet,' Bilung had told his grandson. 'You must spend more time with your cabinet. They're all titted people. They're old and experienced, and they know all these customs.'

'So 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.

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 unadventurous 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 Dusty 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, raclblock, 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 tamar 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 tamar plant toward a group of people sitting in the shade of the porch, murmuring formulae as he went. The tamar 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 over his 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 tamar plant in the grasped 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 tamar to the coffin. The coffin, 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-cuan woman removed their zoras and got onboard barefoot, carrying bouquets. Their zoras in one hand, their flowers in the other, they made themselves comfortable in positions that few young Western women, unflinching 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 46

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?'
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 he would have gone down, it was a nightmare. At times I just wanted to walk off the project."

Superman planned to be a two-picture series; it 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 reading this 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 haven’t decided what look’ to use. They have 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 gargoyle..."

"The destruction of Krypton is caused by the 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 just as overwhelmed as the rest constantly..."
fascinating look at the beauty of the scientific world.
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 young Air Force personnel, 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 Schriroth 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 with the reports the crew made. The ground testimony alleges it reversed course back eastwards.

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 estimated that it receives reports on less than one meteor in ten, instead, 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. 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 that date. Pulp months have conjured up fantastic images of alien "tractor beams" dragging terrified humans into the sky. Coyne suddenly recalled several years after the event that his helmet was spinning wildly the following day and had to be replaced—but no maintenance reports have been found.

Jennie Zeitman'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 "sucker[ed] into worship of that arch con man Phil Klass." As for Klass a fireball misperception theory, Zeitman considers 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. 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 experiences 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, as 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 denying UFOs as only a profitable fantasy concocted by 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 activity could have been responsible.

But Western reports gloriously 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 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 researchers Bill Ock and Henry Gns that the UFO had broken windows and drilled tiny holes in pevning 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, showing 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 Ock, 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. Dmitriev 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 "swamp gas."

According to Dmitireyev's theory, backed up by voluminous calculations and technical gibberish, the glowing clouds in the sky were just luminous smog that allegedly came from nearby industrial areas such as Petrozavodsk. That would probably be a greater miracle than a real flying saucer, cyniccal 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 communist).

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 1980s 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 exercised it with skeptical press releases, the Russian "jellyfish" UFO has all the qualifications for becoming another UFO superstar.

 froze-frame of the famous Rudolph Negara UFO encounter near Yugoslav border in 1971

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140 OMNI
Pre 1000. Although known from the Bronze Age, the safety pin was re-created 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.

7000-1599. 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 Zürich 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 1782 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 Hotel for Tropical Fervor in Apalachicola, Florida, by John Carne 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.

Elether Geavee 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 Mège-Mouriès in 1869. He described it as "a compound of stout skim milk, pig's stomach, cow's udder and bicarbonate of soda." Mège-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 experimented 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. He 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 opener 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 El A. Hamwi started rolling his waffles into cones for the benefit of the ice-cream concessionaires in the next booth.

The first photocopier was patented in 1906 for use in an Ohio 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 Pomon, and Ward's Grocery in Ocean Park — instituted the revolutionary idea of letting the customer serve himself and the supermarket was born.

Nuxvum 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 Last 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. He patented the stuff under the name Teflon in 1938.

1940s. The nylon stocking came about because the Du Pont Company offered a new product to hosier manufacturers. They were introduced on May 15, 1940.

The bikini was first shown at a Paris fashion show and named after the atomic explosion at Bikini Atoll four days before.

1950s. The go-cart was first built by Art Inglis 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.
A blaze with color, the videodisc shown here was photographed by Paul Brerley. Birefringence 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 phonograph record, but is more pronounced here due to the markings 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 side-frame pictures per side, for a total viewing time of one hour a side. In addition, a single frame of the videodisc can be reloaded, replayed, and displayed separately on the screen. DD
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 Spalianzani of Italy injected the semen of a spaniel into a female hunting dog, and 62 days later the owner of three pups.

It did not take long for humans to get into the act, for, as Puddi head 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 to see 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 or 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 best educated guess, since guessing at what an invention was invented is 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.

<table>
<thead>
<tr>
<th>INVENTIONS YOU SHOULD KNOW</th>
<th>WHEN WERE THESE INVENTED?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pro-1000 playing cards, false teeth, umbrella, soap</td>
<td>Place each of these inventions into one of the 16 time frames in the chart</td>
</tr>
<tr>
<td>1000-1595 beer, table fork, colorless glass, canal locks, hand gun, astrolabe</td>
<td>1 air conditioning</td>
</tr>
<tr>
<td>1800-1799 pressure cooker, thimble, metronome, merry-go-round, stopwatch</td>
<td>2 bikini swimsuit</td>
</tr>
<tr>
<td>1800-1839 calculator, computer, electric, Poker, accordion, carbon paper, stethoscope, plywood, safety matches, chewing gum, taxi meter</td>
<td>3 can opener</td>
</tr>
<tr>
<td>1840-49 electric burglar alarm, cigarettes, jeans, gas burner, celluloid, overseas telegram</td>
<td>4 color photography</td>
</tr>
<tr>
<td>1850-59 plastic, barbed wire, badminton, machine gun, torpedo, typewriter</td>
<td>5 condom</td>
</tr>
<tr>
<td>1860-69 cash register, toilet roll, milking machine, sachet, microphone</td>
<td>6 Dr. Pepper</td>
</tr>
<tr>
<td>1870-79 motorcycle, Yellow Pages, phone directory, juke box, artificial silk, linoleum</td>
<td>7 elevator (in a public building)</td>
</tr>
<tr>
<td>1880-89 toothpaste tube, golf tee, aspirin, electric chair, wireless telegraphy</td>
<td>8 escalator</td>
</tr>
<tr>
<td>1900-09 rayon, vacuum cleaner, permanent wave, silicone, animated cartoon</td>
<td>9 frozen foods</td>
</tr>
<tr>
<td>1910-19 stainless steel, Life Savers, bra, crossword puzzle, tear gas, glasses, smoke, Scotch tape, Contract</td>
<td>10 go-kart</td>
</tr>
<tr>
<td>1920-29 bridge, water skis, pop-up electric toaster, cloverleaf intersection, power steering, self-winding watch</td>
<td>11 gummed envelopes</td>
</tr>
<tr>
<td>1930-39 instant coffee, drive-in, movies, fluorescent lighting, polyethylene, DDT</td>
<td>12 ice cream cone</td>
</tr>
<tr>
<td>1940-49 aerosol spray, Polaroid camera, microwave oven, streptomycin, transistor</td>
<td>13 in-flight movie</td>
</tr>
<tr>
<td>1950-59 stainless steel razor blade, electric toothbrush, fiber tip pen, polo vaccine</td>
<td>14 lawn mower</td>
</tr>
<tr>
<td>Present</td>
<td>15 mimeograph</td>
</tr>
<tr>
<td>16 Noxema</td>
<td>16 roller skates</td>
</tr>
<tr>
<td>17 nylon stockings</td>
<td>17 safety pin</td>
</tr>
<tr>
<td>18 parking meter</td>
<td>18 safety razor</td>
</tr>
<tr>
<td>19 pencil</td>
<td>19 soda pop</td>
</tr>
<tr>
<td>20 photocopier</td>
<td>20 sugar cubes</td>
</tr>
<tr>
<td>21 potato chip</td>
<td>21 supermarket</td>
</tr>
<tr>
<td>22 pretzel</td>
<td>22 synthetic (man-made) food</td>
</tr>
<tr>
<td>23 roller skates</td>
<td>23 Tefflon</td>
</tr>
<tr>
<td>24 safety pin</td>
<td>24 zipper</td>
</tr>
</tbody>
</table>

**Table: Deviation from Actual Years**

<table>
<thead>
<tr>
<th>Year</th>
<th>Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pro-1000</td>
<td>1000-1599</td>
</tr>
<tr>
<td>1000-1599</td>
<td>1000-1799</td>
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<tr>
<td>1000-1799</td>
<td>1800-1839</td>
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<tr>
<td>1800-1839</td>
<td>1840-1849</td>
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<td>1840-1849</td>
<td>1850-1859</td>
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<td>1850-1859</td>
<td>1860-1869</td>
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<td>1860-1869</td>
<td>1870-1879</td>
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<td>1870-1879</td>
<td>1880-1889</td>
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<td>1880-1889</td>
<td>1890-1899</td>
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<td>1890-1899</td>
<td>1900-1909</td>
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<td>1900-1909</td>
<td>1910-1919</td>
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<tr>
<td>1910-1919</td>
<td>1920-1929</td>
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<tr>
<td>1920-1929</td>
<td>1930-1939</td>
</tr>
<tr>
<td>1930-1939</td>
<td>1940-1949</td>
</tr>
<tr>
<td>1940-1949</td>
<td>1950-Present</td>
</tr>
</tbody>
</table>
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
pluses 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 58. So take heart—IT
isn't as easy as it looks!
By the way—in order to avoid some arg-
uments and the wrath of inventors ev-
everywhere, here is a list of publica-
tions that we found extremely helpful in pre-
paring 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 Inven-
tions 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 whatchamacallists
and glizmos 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 con-
found 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 res-
   taurants 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 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. Corfe
B. Dragdee G. Dreger
C. Solidus H. Colophon
D. Gutter I. Kiflee
E. Papilotes J. Macron

ROUND SHE GOES
Imagine you have a piece of string
25,000 miles long, and that you want to
stretch the 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's assume for the sake of conven-
ience 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, try 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 in-
stance, or perhaps solving a chemical
equation.
Below are some questions that we have
thought of and wondered about our-
selves. 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
get a scientist scratching his head, and
not lead to a nervous breakdown. All must
be based on current scientific knowledge
or speculation. Postcards only, please.
Enteries should be postmarked by March
1, 1979. First prize winner will receive
$100. Runners up (2-10) will receive 025.
All entries become the property of
OMNI and will not be returned. Send on
tries to OMNI Competition-3, 908 Third
Ave., New York, N.Y. 10022

Note: In our first competition, we asked
you to create Signs of the Times
language-free images that convey an im-
portant message. We have been in-
undated 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 DH

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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.

Knobholz, Tennessee, June 25. The police strike that has lain like a pall on this far 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 Fonduce of the Citizen's Action Committee put it this way. "We get indoors right after sunset. That way there's no mugging and all of us right here with our baseball bats and switchblades. There are no break-ins. And that means you, busted. I don't care if you do say you're a reporter just stay on your side of the door."

Spike Gaobate, three-time loser, agrees. "The police strike has eliminated the burgling 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 seen a piece of mail move in two months as the local postal employees, all veterans of the Lebanon 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 Upanashad, 'It's obvious that the American husband and the American floozie are being deprived of their Constitutional right to write indiscreet letters for wifes to find. If this vicious massacre of family peace keeps up, society will break down and, worse, lawyers will lose a lot of money.'"

San Juan de Los 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 the 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. Beat 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, informed 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.

Marlene Mestrop, 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 is 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 Safraff 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. DO