



# OMNIBUS

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**WHAT DO  
RICHARD PRYOR,  
SENATOR PROXMIRE,  
ARTHUR CLARKE,  
PIERRE TRUDEAU,  
MILES DAVIS,  
DUDLEY MOORE,  
POPE JOHN PAUL,  
AND MISS PIGGY  
HAVE IN COMMON?**

**THE ROBOT  
PROLETARIAT  
MYSTERIOUS  
POWDER FIGHTS  
CANCER, DIABETES,  
AGING, OBESITY  
FIRST PHOTOS  
OF THE MIND  
SOBER-UP PILL**



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## FIRST WORD

By Ben Bova

● *Science-fiction films almost invariably present science, technology, and even intelligent, rational thought as evil* ●

There is an aspect to science-fiction filmmaking that bothers me intensely. You can see it in reruns of *Star Trek*. You can see it in that all-time blockbuster *Star Wars* and in *Star Trek: Voyager* (surely the dumbest science-fiction film ever made). You can even see it in the otherwise delightful *Time Bandits*. But it wasn't until I saw the French film *Qu'est-ce que l'on s'est entendus* what the problem is.

Science-fiction films almost invariably present science, technology, and even intelligent, rational thought as evil. This attitude is so pervasive in the minds of filmmakers that it results in motion pictures and television shows in which scientists are portrayed either as intellectual fools (as in the original version of *The Thing*) or as power-hungry monsters devoid of humanity (as in *Alien*).

When Herlin Elicon and I were developing scripts based on our short story about a robot policeman and its human partner, "Brilo," the television producers with whom we worked kept telling us that, although the robot might have all the brains, the solution to the crimes always had to come from the human partner, who uses emotion and intuition rather than intelligence to solve the crimes. Always.

"The heart, not the head," is the motto of Hollywood science fiction. In the *Star Trek* series Mr. Spock is clearly smarter, stronger, and cooler under stress than Captain Kirk is. Yet Kirk, with his human emotions, always solves the problems while the unemotional half-alien Spock merely provides data. If it were not for Hollywood's bias away from intelligence Spock would have been made captain of the starship after the third *Star Trek* episode and Kirk would have been left behind to moulder after the scantily clad spacewomen.

In *Star Wars* the anti-intellectual bias took the form of the Force. At the climactic moment, when the pivotal hero is singlehandedly attacking a planet-sized space battleship that had already wiped out an entire solar system, our hero pushes aside the computerized bomb-arming equipment and waits for *Yoda* (Guinness to whisper in his ear, "Use the Force"). And the hero plants his bomb openly on target.

That is hardly a rational, intelligent mode of behavior. In the print media, science-fiction for generations has been the bastion of intelligence, where science and technology are the major forces stopping the slaves. That is a valid definition of science fiction.

In printed science fiction, one of the writer's aims is to make the reader think, to challenge the reader's prejudices and preconceptions. It's an intellectual exercise. The motion picture and television industries cannot afford such luxury. They are purely entertainment media. With the very rare exceptions of films such as 2001: A Space Odyssey, filmmakers

are satisfied about giving their audiences to think. It's not easy to sell tickets.

So we get films like *Silent Running*, in which a biologist (played by Bruce Dern) is steering a spaceship full of trees and shrubs away from Earth to save them from the pollution that is killing the greenery on our home planet. In the name of ecological goodness, the biologist murders his fellow crew members. He takes the ship out to Saturn, but then discovers that his beloved plants are wilting. Why? Well, a flash of delayed insight, he realizes that they aren't getting enough sunlight. So he turns on some lamps and kills himself.

That's a scientist? Or even a believable protagonist? The trouble is, the producers of such films have never seen a scientist, don't understand what science is, and have a high-school dropout's attitude toward intellectuality.

I used to think this was strictly a Hollywood phenomenon, but the British-made *Time Bandits* convinced me otherwise. In many ways it is a wonderful film. There is a lot of Monty Python zaniness in this film, and it becomes almost surreal near the end.

But even in *Time Bandits* the character of the Creator (played by Sir Ralph Richardson) is depicted as being a nice old man, interested in flowers and leaves. The character of the Evil One is forever expressing intense interest in lasers and computers. What lesson does this film present? Technology is associated with evil, goodness won't have anything to do with it.

This, mind you, from producers who are using lasers and computers and the latest, most sophisticated technology—they can get their hands on to create the special effects that coax the audience into the theaters. If these producers behaved the way the characters in their films do, they would still be painting signs on the walls of their caves.

Which brings us to our latest coverman film, *Qu'est-ce que l'on s'est entendus*. It is a flawed film, not very accurate in its anthropology and inadvertently funny in places where it wants to be quite serious. But it does one thing that none of the aforementioned films do: It treats knowledge as unequivocally good. It says that knowledge makes us more human. Knowing how to make ice, rather than needing to steal it, makes the Cro-Magnon characters in this film more human. It removes one source of conflict from the Neolithic world.

Now why doesn't some enterprising filmmaker produce a movie in which the knowledge of how one makes a successful fusion-power reactor ends mankind's reliance on fossil fuels, especially petroleum? That would eliminate one source of conflict from the world today. Is there anyone out there in Movieland with the heart—and the brains, to tackle such a subject? ☐

## CONTRIBUTORS

# OMNIBUS



DEAMER



WENTRAUB



ROSENFELD



TERASA

**T**he steam engine powered the first Industrial Revolution. Now the mighty machine must bow to the tiny silicon chip. "The electronic handwriting is already on the wall," *Omnibus* staff writer Kathleen Stein reports. "Computers will one day oversee each and every step of production, from the basic design of a factory to the supervision of robots and automated machinery." Stein's in-depth analysis of this startling metamorphosis was inspired by a conversation with union leader Ray Shannon, who warned the journalist that "it may be impossible to overcome the combination of arrogance and fear that the technology evokes." Stein herself believes these problems are not insurmountable: "If both management and labor face the challenge of retaining workers, the computer may yet fulfill its awesome potential in the factory." Her preview of the next industrial revolution begins on page 44.

When David W. Deamer, a biologist by profession and a pianist by hobby, saw the instructions encoded in our DNA spelled out for the first time, he was immediately struck by the pleasing rhythmic pattern. Could it be that there is music in our genes? To find out, he translated the genetic alphabet into musical notation and was delighted by the melodic compositions that resulted. "The gene for insulin," he claims, "sounds just like that great old Irish tune 'The Washerwoman.' Mother Nature may not

be able to compete with a composer of Mozart's rank, but, like the *Go-Gos*, she's definitely "got the beat." See page 28 for the score to the "DNA Suite" and other examples of her innate talent.

For decades medical investigators have puzzled over the role of a body substance with the jawbreaking name dehydroepiandrosterone (DHEA). This mysterious compound somehow manages to have even more uses than it has syllables. Obesity, cancer, diabetes—these and myriad other afflictions have been arrested or prevented through recent animal tests using DHEA. Veteran science journalist Albert Rosenfeld explores evidence that has revived age-old dreams of a panacea in "Superpowder" (page 58). A former editor of *Life* and *Saturday Review*, Rosenfeld is the author of *Prolongevity*, which surveys current theory and experiments on aging. "This is yet another field in which DHEA has found exciting applications," says Rosenfeld. "In fact, this natural chemical may even help fight the ravages of time."

The most haunting legacy of Vietnam might be agent orange—the infamous herbicide U.S. forces employed against the enemy. Today thousands of Vietnam veterans claim that the defoliant was the cause of their present depression and a host of other disorders, including cancer and genetic malformations. But some experts maintain that there is no direct evidence linking agent orange to

these ill effects. That's why *Omnibus* associate editor Pamela Wentraub was shocked to read an ex-Vietnam nurse who insisted that the symptoms that afflict her and 150 other veterans had been traced to the same biochemical anomalies Wentraub decided to pay a visit to the young internist on the case, Ronald Codiano, who proceeded to describe a series of experiments that have led him to believe agent orange may indeed be the culprit. The details of his dramatic search are revealed in this month's Earth column (page 14). "Codiano has a bit more research ahead of him," Wentraub says, "and he's doing all the work on his own time and with his own money. But if the veterans can be vindicated, he may be the one to do it."

At thirty-six years of age, Koro Terasa is Japan's latest rising science-fiction author, with more than 30 novels and short-story collections to his name. In 1975 he received the Kadokawa Prize for his mainstream novel *Tomorrow the Birds Take Wing*. But outside of his native land, he is best known for his two-volume "city naturalist" series: *Insectology* (page 84) set against a surrealistic suburban landscape, is an excellent example from this anthology.

*Omnibus* offers another fiction gem from a Western literary giant. Don't miss the concluding installment of our two-part excerpt from Frank Herbert's successful new novel *The White Plague* (page 50). **OO**



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AUGUST

LETTERS

COMMUNICATIONS

It Bugged Him

I wish to comment on the illustration for "Alfuzino Vazozino" [Ltr., May 1982]. The article is excellent, but the illustration shows the wrong mosquito. ...

Also, your illustration does not show the sooty black coloration of the quad or the two dirty white spots on each wing. The picture is probably that of the common mud-puddle (Culex) pupae or even the sail-finish (Aedes sollicitans) ...

Robert Harts, Saratoga, N.C.

Star Quality

I do not look at movie magazines for articles on science and technology, or for science fiction. Obviously they don't belong there. And Robert Redford [April 1982] does not belong in Omni. Please stick to what your magazine does best, and let movie stars promote themselves. ...

J. Smythe, Alexandria, Va.

Thank you for your profile of Robert Redford. I am glad to see someone willing to risk his own comfort and reputation for something more important than himself. I appreciate your providing Mr. Redford an opportunity to express his point of view. ...

Hats off to Mr. Redford who not only has a pretty face but also a mind sharp enough and enough guts to create his Institute of Resource Management and to face massive criticism in order to make the rest of us aware of the great problems that threaten the environment. ...

Maxine Powell, Houston

Numbers Runner

I would like to call attention to two statistical errors in the article "Therapy by Mail" [Wind, April 1982]. It was reported that the number of ways of responding ...

to a 25-question multiple-choice questionnaire in which each question has 4 possible answers is 25!

Although 25! is actually 300,825, and not 9,765,825 as claimed in the article, the actual number of ways the questionnaire can be answered is 4<sup>25</sup> or roughly 1,1259 x 10<sup>17</sup>.

Gregg Lowery, Lincoln, Neb.

Fantastic Limits

Lord, not another aerospace engineer from Huntsville, Alabama, with yet another tale of the unlikely. This time we find our ubiquitous friend in the Antimatter section ["Deadly Dreams," April 1982] and he's talking about—(are you ready for this?)—"Wind Stuff!" ...

I can allow myself a flight of fancy to grant that Joan of Arc was genetically a man, and I am not so close-minded that I don't accept that UFOs may well be vehicles from other worlds. But when I'm asked to believe that Tibetan mystics created the Abominable Snowman from Wind Stuff, I find my capacity to fantasize has reached its limit. ...

Tom Pyzdek, Tucson, Ariz.

Funny Papers

As usual, I thoroughly enjoyed the May 1982 issue of your fine quasi-scientific journal.

Especially of interest, as always, is the intellectual impact of the randomly scattered funnies.

After many minutes of contemplation, however, the meaning of the caption on page 64 still eludes me.

The thought bubble does show a basically binary thought pattern, with an added loop for "other." It certainly seems a strange coincidence that this cartoon on page 64 (2<sup>2</sup>) and the cartoon on page 128 (2<sup>7</sup>) have the same caption. On page 42 (8 x 7), under the heading "Continuum" is a reference to suicide. ...

Is your electronic typesetting equipment trying to tell you something?

Tom Winch, Cartersville, Ill. □□

## FORUM

in which the readers, editors, and correspondents discuss theories and speculations arising out of *Omni*. Readers are encouraged to debate views and pose questions to *Omni*, the scientific community, and the science-fiction establishment. The opinions published are not necessarily those of the editors.

**Optimistic Slant**

I thoroughly enjoyed your recent interview with my father, Jonias Saik [May 1982]. There is one point raised by Mr. James Resson's introduction that I would like to clarify.

He refers to our book's "optimistic hypothesis that humans may biologically be predestined for continued evolution and survival." *World Population and Human Values* does have an optimistic slant, but nowhere in it do we state such a hypothesis.

Our idea is that while we have the capacity for destruction, we also have the capacity for survival. We are in a period of conflict between these tendencies and between the shifting values associated with them. Our future is very much in our hands—a realization that is both heartening and frightening.

Jonathan Saik  
San Diego

**Facing the Orient**

In the column entitled "Reading Faces" [Mind, January 1982], I believe some credit should have been given to the Chinese whose ancient texts on face reading are considerably more advanced, though not necessarily more accurate than modern writings on the subject.

Dr. Leopold Bellak has demonstrated that disciplined observation of those whom we meet face to face can be informative, and though he may be credited with compiling the 101 Trait Checklist, he cannot fairly be credited with devising the Zone System.

Dr. Bellak has applied the rational discipline of psychology to an old technique, and that in itself is valuable.

Michael Peterson  
Alisonville, N.S.W., Australia

**It's in the Stars**

The account of the controversy surrounding the work of Michel Gauquelin in *Raging Skeptics* [Antimatter, February 1982] bears little resemblance to anything I have read by him or about him. He holds degrees in both statistics and psychology and goes to great lengths to explain his skeptical position regarding astrology. His ideas on planetary effects have nothing to do with fate or destiny, contrary to what *Omni* suggests.

Gauquelin's work was a statistical study conducted over a period of more than a decade. He believes that hereditary factors predispose individuals to utilize unknown planetary influences and that these hereditary factors also have an effect on personality.

Land Fleming  
Chicago

**Save Us All**

After reading your article on survivalists [Books, March 1982], I was appalled by the destructive attitude of these so-called survivalists. They believe they are smarter than everyone else, who will undoubtedly be incinerated by nuclear weapons while they sit tight in their thick shelters, armed to the teeth.

They think they will be able to carry on man's glorified existence upon a scarred earth.

It seems to me that survivalists are inviting a nuclear attack. They pour off their money into preparation for life after an attack. Why aren't they directing their efforts toward nuclear disarmament if they are so concerned with preserving life?

A knife hangs over all our heads as long as the nuclear-arms race continues. Survivalists are just hiding under a table, hoping that the knife doesn't drop on them.

Jesse Elliot  
Houston

**Persistence to Dream**

Thank you for the excellent article "Lucid Dreams" by Douglas Coligan [March

1982]. The discovery of this phenomenon has allowed the entire field of dream exploration to take a quantum leap forward.

A program that I am now involved with takes the potential of lucid dreaming quite seriously. Lucid students summon a "wise old man" archetype dream character who can be consulted on many matters, ranging from dream interpretation to practical advice.

The parameters of this Dreampeaker have yet to be determined, but its access to information beyond that readily available to the normal conscious mind is apparent.

Under circumstances arising from meditation and altered sleeping patterns, some students are able to perceive their dream character while they are awake and have their eyes open.

Lucid dreaming has allowed me to experiment with mutual dreaming. Such dreams seem clearly telepathic and suggest many interesting possibilities if they can be encouraged.

Peter Fellows  
Toronto, Ont., Canada

**Planned Poverty**

I applaud *Omni* for publishing "Myths of Scarcity" by John Berger [Birth, February 1982]. Accumulating evidence is merely deciding the old notions that the root causes of world hunger are overpopulation, scarcity of agricultural resources, and insufficient technological tools and inadequate skills.

The evidence now available from developmental studies supports the assertion made by Frances Moore Lappe and Joseph Collins that it is the extreme imbalance of control over basic food-producing resources that prevents people from feeding themselves in many countries today.

By helping to focus our awareness on the real causes of hunger, *Omni* has made a significant contribution to the solution of this very serious human problem.

William Bower  
Kalamazoo, Mich. **DD**

# THE AGENT ORANGE MYSTERY

## EARTH

By Pamela Wertraub

**S**ingley shivered as he trudged past the ramshackle brownstones of South Broad Street. The hefty martial arts instructor made his way to the first-floor office of number 1427 and fell peacefully into a chair. Every muscle ached, each joint throbbing with Philadelphia's latest chill. He wondered whether he'd ever teach karate again.

The young internist who finally invited Singley into the bereft inner office didn't look as if he could offer much hope. He simply fixed his patient with a blunt gaze and solemnly began his exam. After 30 minutes Dr. Ronald Codrino could tell Singley only that his liver was bloated and his nervous system damaged.

By June 1981, Dr. Codrino had Singley hospitalized for a workup. A body scan and biopsy told him that the distraught patient's scarred liver had deteriorated like an alcoholic's, though Singley insisted he rarely drank. Then, in the following weeks, Singley's symptoms mounted: His fingers and toes grew numb, his head and abdomen throbbed; he became anxious and confused.

Codrino couldn't decipher the cause of the strange illness, but he did know that Singley was a Vietnam veteran. Before long, he started wondering whether the symptoms might not be due to the notorious agent orange—a herbicide that had been dumped on Vietnam to destroy crops that fed and camouflaged enemy troops. Codrino told Singley he'd probably been exposed to some kind of toxin and advised him to see a lawyer.

A few weeks later Codrino received a call from Hy Mayerson, a Philadelphia attorney who represented vets with illnesses they claimed were caused by agent orange. "Would you like to see some other veterans who've had exposure?" Mayerson asked. "You might be able to help." Codrino said sure and the next day he received weeks of background reading in the mail.

Agent orange, Codrino learned, was one of many herbicides sprayed in Vietnam during the 1960s and 1970s. Given its name because it was shipped in orange-striped barrels, agent orange was made largely of a chemical called

phenoxyacetic acid. It was usually contaminated with a small molecule known as dioxin, said by some to be the most potent toxin on Earth. Eleven thousand veterans were suing agent orange manufacturers for what they claimed were dioxin's dire side effects: depression, loss of sex drive, joint pain, even cancer. Large numbers of their children, they charged, were being born with deformed hearts, spines, and limbs.

But the experts said there was no real evidence—no biochemical evidence—to support such claims. The veterans' troubles, these experts said, were nothing more than a potpourri of unrelated symptoms afflicting the general population in roughly the same proportions.

After examining about 50 or 60 veterans referred by Mayerson, however, Codrino observed a strange pattern that made him think otherwise. Like Singley, veterans after veteran complained of personality changes, numbness, aching joints, and extreme sensitivity to sunlight. Amazingly, almost all of them seemed to be describing porphyria (pore-lee-ah), the rare disease that drove King George III mad during the American Revolution.

If Codrino could prove that his patients had some form of porphyria, he would be the first researcher to establish a biochemical link between agent orange and the veterans' symptoms. With such evidence in hand, he'd be well on his way to helping them get the economic and medical aid they'd been denied for years. With a bit of probing, he might even find a cure.

Classical porphyria, Codrino knew, results when the liver churns out massive quantities of chemicals known as porphyrins (pore-fur-ins). Porphyrins produced by healthy livers normally combine with iron and protein to form hemoglobin, the crucial pigment in the red blood cell. But sometimes—because of a genetic deficiency or because of an unwanted chemical—the liver becomes diseased, manufacturing porphyrins in excess. The extra molecules then travel through the body—to the skin, where they cause huge blisters; to the stomach, continued on page 66.



Medical research may soon vindicate veterans who proclaim the dangers of agent orange.

# TESTICLE TREATMENT

## LIFE

By Dr Bernard Dixon

**O**ccasionally modern medicine appears to revert to witch-doctory or worse. What could sound more absurd, for example, than attempting to prevent coronary fatalities by using bulls' testicles?

The use of such organs is the subject of not one but three major reports that appeared recently in the British medical journal *The Lancet*. They come from English cardiologists in London, Birmingham, and Newcastle-upon-Tyne who are exploiting a substance present in spermatozoa so as to reduce the likelihood of death after a heart attack.

The substance highlighted in these three reports is an enzyme named hyaluronidase. In bovines and humans this substance normally functions to help spermatozoa penetrate egg walls. Both spermatozoa and seminal fluid contain hyaluronidase, which eats away the outer cover of the ovum, thereby enabling fertilization to take place. But this substance, scientists reasoned, might be put to use to treat an entirely unrelated malady. Perhaps hyaluronidase might

be employed to dissolve the arterial blockages that threaten the life of myocardial infarction victims.

Such patients often do not succumb instantaneously to the coronary attack. Rather the worst damage may occur several hours or days later as heart muscle is slowly starved of oxygen and vital nutrients. And once the tissue dies the loss is irreversible. The muscle's contribution to pumping is gone forever.

This is where hyaluronidase enters the picture. More than 20 years ago a group of American scientists wondered whether the enzyme might limit coronary destruction by facilitating blood flow to the ailing region. And in fact, early animal tests seemed to confirm their hunch.

But the excitement was short-lived. Soon it became evident that hyaluronidase from bulls' spermatozoa was not destined to produce an overnight success. This crude extract often triggered allergic reactions in patients. The enzyme might help to save precious heart muscle but any such benefit was eclipsed by the enzyme's unpredictable toxicity.

The situation has now changed dramatically because modern technology has evolved a highly purified version of hyaluronidase. Produced by Biorex Laboratories in the United Kingdom, it does not seem to induce allergic or other hazardous side effects in patients.

Although very properly couched in cautious language, the three new reports from British hospitals seem enormously encouraging. One of them, based on work at the General Hospital, in Birmingham, describes results obtained with 483 people treated within six hours of the onset of symptoms. They were divided into two groups, one being given reactions of hyaluronidase and the other a placebo. Six months later only 27 of the 240 patients receiving the enzyme had died. In contrast, there were 45 deaths among the 243 individuals given a placebo. This difference is statistically significant. And the disparity was most telling in the case of those victims who had sustained the greatest damage to their heart muscle.

Further support comes from a more modest study conducted at Freeman Hospital in Newcastle-upon-Tyne. After four months the mortality rate for those who received the enzyme was 7.2 percent, as opposed to 14 percent among the placebo group. The third investigator, conducted at St. Thomas' Hospital, in London, was not designed to assess the effect of the enzyme on mortality. It did, however, generate electrocardiograph data, indicating that hyaluronidase reduced the degree of destruction of heart tissue. And a large battery of tests showed no adverse effects after the enzyme shots had been administered.

Statistics aside, there is still another reason for optimism. Recombinant DNA technology offers the promise of creating artificial cells that can produce an even purer, more potent, form of hyaluronidase. As with other gene products, such as interferon and insulin, there seems every likelihood that genetic engineers can go nature one better by synthesizing a superior brand of this remarkably versatile enzyme. **□**



Bulls—more specifically their testicles—have been used to save the lives of cardiac victims.

# SHUTTLE SCHOOL

## SPACE

By Len Hills

**T**he world's first commercial ground school for space pilots has opened its doors, and anyone who hankers to be a shuttle jockey can enroll. The training program is run by the American Society of Aerospace Pilots (ASAP), a new nonprofit organization "dedicated to the promotion of routine commercial spaceflight." Some 200 airline pilots have already started the course, and a shuttle flight-simulator program is in the works.

David Koch, a United Airlines pilot and national chairman of ASAP, says: "The question of where pilots for tomorrow's space vehicles will come from is already both practical and pressing. We think they can come from the pool of forty thousand trained professional pilots flying today's commercial jet liners."

NASA's shuttle program, Koch points out, will soon pass from its research-and-development phase, with only three or four flights a year, to a practical schedule of one flight per week. Soon work on an orbital space station could require shuttle flights hauling materials and work crews

back and forth on a schedule to rival Eastern's shuttle between New York City and Washington, D.C.

As ASAP sees it, today's pool of pilots is barely big enough to handle a weekly load and totally inadequate to fly the schedule that could come through natural expansion after 1985. That's where the airline pilots come in.

ASAP started as a department of the United Air Lines section of the Air Line Pilots Association (ALPA). Koch and other space-oriented fliers began to look at the future of commercial flight and found a grim job outlook for ALPA's members. Space missions were the one new market they could find. Last September the organization separated from ALPA and set up its own office.

The volunteers running ASAP say the organization has two missions. One is to train commercial pilots to move from jet flight decks to spacecraft flight decks. The other is to educate the public on the benefits of space commerce.

These tasks have required exhaustive preparation. For the past two years

we have been monitoring the aerospace industry, Koch says. "We have done a feasibility study to see whether or not we can move from airline operations to space operations. We have flown the NASA shuttle simulator; we have studied the astronaut course material we have talked to NASA people."

"The study has shown a number of things. First, the shuttle flies like any other airplane when you get into the astro mode. In space operations, it is a whole different thing, but we know that NASA pilots learned it, and so we can learn it, too. Second, we see the likelihood that commercial operators will run the space shuttle within six decades, and maybe within the next five years."

Qualifying a group of airline pilots to take over the space shuttle involves more than feasibility studies alone. Two years' worth of course material has been drawn from NASA and etched into 60 lessons by training experts from the United Airlines Flight Training Center. In Denver, Astronaut Buzz Aldrin, now a vice-president of Scientific Software Systems in Los Angeles, is the chief technical consultant for the ground school.

In addition to printed course material, the lessons include videotapes derived from NASA materials, audiotapes, movies, and textbooks for additional reading. The text for the first orientation lesson is Ben Bow's *High Road*.

The first section of the course—an orientation lesson, two administration lessons, and three covering navigation in space—has already gone out. After the student absorbs the lesson, he feeds for the nearest Control Data Computer Center where a sophisticated educational computer system called PLATO tests him and records the results. If he fails or doesn't like his score, he can try again. PLATO not only grades the student; it refers him to appropriate study materials if he blows a question, so he can bone up on the subject before retaking the test. Within one or two months, students will be able to contact PLATO from their own Apple or Radio Shack computers and take their tests at home.

CONTINUED ON PAGE 118



Airline pilots have already begun taking the sophisticated controls of the shuttle simulator.

# SUDDEN DEATH

## MIND

By Patrick Huyghe

One third of all the people who die a natural death in the United States do so by taking that quick, frightful leap into oblivion known as sudden death. Doctors define this as rapid, unexpected death occurring in seemingly healthy people. Most of these fatalities are the result of heart failure, and normally some heart disease can be found to explain them. But since many people with severe cardiovascular deterioration live long and useful lives, doctors have begun to wonder whether other contributing factors are involved. They also wonder whether these same factors might not be behind the 25,000 or so deaths each year that are not only sudden but unexplained as well.

Leading the list of causes is something that has been the focus of much medical research in recent years: an intense emotion. The idea that emotions can provoke sudden death has had widespread acceptance ever since civilization began. History and folklore are full of stories about people dying in the throes of some powerful emotion. History tells us, for example, that one Chilon of Lacedaemon made his exit because of an overdose of joy while embracing his son, who had just carried away a prize at the Olympic Games. Almost 2,000 years ago the Roman scholar of medicine Celsus wrote that emotional states could affect the heart—an opinion that William Harvey the seventeenth-century physician and discoverer of the human circulatory system shared.

The idea fell into disrepute in the late nineteenth century once the fledgling science of modern medicine declared all causes of death could be determined at the autopsy table, but now these venerable observations are being reexamined, and there is a solid body of evidence linking emotions to disordered heartbeats and, ultimately, to death.

With improved medical services and the advent of techniques like cardiopulmonary resuscitation, many people now survive serious heart attacks, and the fact has allowed some researchers to talk to the victims and find out what their

emotional states were just before the attack. Doctors at Boston's Brigham and Women's Hospital did this very thing last year with one group of heart-attack victims. They found that of 117 resuscitated patients, about a fifth reported some acute emotional disturbance just before their near-fatal arrhythmias, seriously abnormal heartbeats that can culminate in death. Among the disturbances they listed bitter arguments, some public humiliation, mental problems, business failures, profound grief, and, in one case, nightmares.

"There is strong evidence for a link between stress and sudden cardiac death," says Dr. Regis DeSiva, a cardiologist involved in the study, but the association still lacks definitive scientific proof. The chief problem, he says, is that it is hard to translate emotions like despair and fear into something that can be measured. What evidence there is does suggest that things like stress, fear, hopelessness, and even the act of heavy breathing can activate the

sympathetic nervous system, the part that marshals energy for instant use, the "fight or flight" response. Switching on the nervous system, doctors say, can trigger arrhythmias and cardiac arrest.

In the 1930s one celebrated doctor in India demonstrated the power of the mind and imagination in an astonishing and deadly experiment: he performed on a criminal who had been condemned to death. The doctor wanted to learn whether the human imagination could kill. The convict was an assassin of distinguished rank, and court permission had been obtained to bleed him to death inside prison so that his family might be spared the disgrace of a public hanging. When the time came, the condemned man was blindfolded, led into a room, and strapped to a table. Under it a container was set up to drip water gently into a basin on the floor. The doctor poked the skin of the man's arms and legs near his veins as if to bleed him and at the same time started the water dripping. The convict believed that the dripping he heard was his blood flowing out, and when the sound of the dripping water at length stopped, he passed out and died—without actually losing one drop of blood.

Of all psychological stresses, it appears that fright is the one most likely to cause rapid and sudden death. George Engel, a psychiatrist at the University of Rochester School of Medicine, in New York, has collected 170 case histories of emotional sudden death and found that more than a quarter of them involve some "setting of personal danger or threat of injury, real or symbolic." The list includes cases of terrified patients who died just before a minor surgical procedure. For this reason some surgeons refuse to operate on patients who fear surgery.

If there is any light at the end of the dark tunnel, it may come from one unusual group of victims whose deaths may offer some clues to exactly how these sudden cardiac deaths occur. These are the Asian refugees in this country who have been particularly susceptible to so-called nightmare deaths. They constitute the



Scared to death: Medical test, not failure

CONTINUED ON PAGE 81

# DIGITAL DIAGNOSIS

## THE BODY

By Michael Edelhart

A physician sits before a video screen on which appears a detailed picture of a human hand. He types some numbers into a keyboard, and the hand begins to change. The joints swell, the fingers curl inward, the bones twist. The hand withers into the gnarled claw of an arthritic. The doctor types once more, and the video hand's condition improves remarkably. The doctor smiles with satisfaction; through the computer he has practiced surgery on his crippled patient's hand and knows that the operation will help before he ever touches a scalpel.

Such scenes will be common among orthopedic surgeons within a few years as a result of studies that use electronic sensors and computers to create accurate working models of the human machine. Called computer biomechanics, the new branch of medical research promises to revolutionize the diagnosis and treatment of muscle and bone disease.

The work is the branchchild of Louisiana State University engineer David Thompson. With surgeon Paul Brand of Conville

Hospital, near Baton Rouge, he has created a sophisticated mathematical model of the human hand that allows a physician to take a few measurements, feed them into a computer, and receive a detailed report of the relationship between all the joints that might be affected by any illness or injury.

Though still highly experimental and only partially complete, Thompson believes his system "is already making a difference with surgeons today. This system is the first complete biomechanical model of the hand, and it has started surgeons thinking about these relationships between joints, what they mean, and how they can be used."

Thompson is still setting up the visual display of his computer hands. Within five years, he expects, he will have the entire visible, interactive system available. And even that, he believes, is simply a beginning. "The hand model is merely the first baby step toward creating a complete biomechanical picture of the entire human body. That is the ultimate aim of this kind of work.

Such a futuristic diagnosis system would enable doctors to feel biomechanical changes anywhere in the body and watch the effects that are caused elsewhere. This could aid enormously in understanding the health impact of stress and the progress of arthritis and other joint diseases. It might even pave the way to a full understanding of, and cure for, back pain.

Though these benefits lie years ahead, computer biomechanics has already produced some systems that are helping people now. One of these is the Electrodynamic (EDG) developed by the Langer Group, a biomechanical research firm in Deer Park, New York. The firm's director, Sheldon Langer, calls this device "an electrocardiogram for the feet."

In an EDG, about a dozen electronic sensors are attached to the patient's feet and wired into a computer pack worn at the waist. The wired-up individual then puts on his shoes and walks or runs according to his doctor's instructions. The sensors feed detailed biomechanical reports from each point of the foot to the computer, which collates them, compares them with healthy standards for the patient's height and weight, and produces a report on all the ways the patient's movement may be contributing to his foot problems—striking the heel too firmly on the ground, rolling the edge of the foot, striding too far, and many others.

With the EDG, the problem can be alleviated before the pain begins. Dr. Justin Wernick, a podiatrist and Langer vice-president, says, "It's the first time we've monitored the foot in its native environment—in motion, inside a shoe. If a malinger were having back pain, for example, we could test him while he was walking his route with his mailbag on his shoulder."

From electronic feet and computerized hands, computer biomechanics will move over the next 30 years to other parts of the body, making it ever easier to avoid the limitations and pain that afflict our aging, creaking joints. □



A new medical science may help explain the mysterious biomechanics of the hand.

# BREAKTHROUGHS

By Phoebe Hoban

**S**ay a final farewell to the old sound-effects man, the engineer who made galloping noises with coconut shells, who simulated the sound of a spear crunching into a warrior by striking pineapples with hatchets. It turns out that computers can produce the same effects without all the fruit.

Digital—computerized—soundtracks may soon be coming to a theater near you. From a dynamic new digital recording of *Fantasia*, recently released by Walt Disney Productions, to a futuristic sound system that could create audio effects as spectacular as the visual magic of *Star Wars*, Hollywood is quietly experimenting with the computer technology now revolutionizing the record industry. Says Disney's Glenn Barker: "Everything is going digital; it is the buzz word of the Eighties."

Ever since Thomas Edison invented the phonograph, records have been "faking." Electronic waves are used to create a physical model of the sound vibrations on plastic discs or magnetic tape. In digital recording, computer

equipment samples the audio signal thousands of times a second and converts it into a binary code. These bits of computer data are a precise mathematical model that can be decoded to replicate the original sound perfectly.

But digital technology can do much more than improve the fidelity of movie soundtracks. It can create anew any sound that exists—or produce sounds that have never been heard before.

Not surprisingly, the most sophisticated system is being developed by Lucasfilm Ltd., creator of the *Star Wars* saga. "Eventually digital sound will turn the movie industry on its ear," promises Lucasfilm's James Anderson-Moore.

Moore is most excited about digital sound effects. "You can transform one sound to another, like the whistling of the wind into a wolf's howl," he says. "You can alter the waveform of the human voice to make it sound like a monster, an ocean, or an extraterrestrial. A single technician can summon up the baying of a thousand dogs or, with Jovan ease, call forth a thunderclap if everything goes

according to schedule. Audiences may be able to hear what Moore is talking about as early as next year.

## NEW PRODUCTS

Garages can be hazardous to your home. They provide easy access to burglars, and they create fire hazards or hold fatal levels of odorless carbon monoxide. To protect against these risks, the Stan-Guard garage system is equipped with protective airlocks. In addition to opening the garage door by remote control, the device flashes a red light and sounds a blaring alarm when it detects danger. (Stanley Automatic Openers, 31623 Stephenson Highway, Madison Heights, MI 48071.)

The TTV-5 is a backpack television broadcasting system including a VHF (very high frequency) transmitter, a rechargeable 12-volt battery pack, and a video camera. The portable 43-pound set can transmit programs for five miles—a large enough range to make it useful for security or police work or for do-it-yourself entertainment. One hitch: While it is legal in other countries, the device has yet to be approved by the Federal Communications Commission. But its maker expects to cut through federal red tape within the next couple of years and put tyre reporters on the air. (Emcoe Broadcast Products, PO Box 66, White Haven, PA 18661.)

A new desktop terminal swallows typed pages, scans their lines, converts letters to digital codes, and feeds the codes into word processors. The device, called the Workless Station, reads up to eight type styles—but ignores notes or corrections scribbled by hand—at the rate of one page every 25 seconds. In a typical application, a small business could use the terminal to enter its file of letters into a computer memory. Old correspondence could then be called up quickly for revisions and reproduction. Prices range from \$7,000 to \$12,950. (DEST Corporation, 2380 Bering Drive, San Jose, CA 95131.)



Disney recently rerecorded the soundtrack of *Fantasia* using its computerized equipment.

## THE ARTS

By David W. Deamer

**C**T-G-G-G-C-G-T-G-G-T-G-G-C-T-  
C-A-C-A-C-C-T-G-T-A-A-T-C-C-C-

The sequence of letters above represents a biological mystery just on the edge of our understanding about human evolution at the molecular level. If some of your DNA could be isolated and the order of its chemical bases determined, this sequence would appear again and again. It is the first portion of a repeating sequence of about 300 bases that is found throughout all the DNA of the human body. The significance of the sequence is not yet understood.

My research area is cell biology, and I happen to play a little piano. When a colleague showed me this sequence (which had just been discovered in his laboratory), the first thought that came to mind was that it could almost be musical notation. There were the notes of C (cytosine), G (guanine), and A (adenine), which represent three of the four bases found in DNA. If T, the symbol for the fourth base (thymine), were transposed into the note E, we would have four musical notes that fit nicely into the key

of C. Furthermore, the notes form a C major sixth or A minor seventh chord, so that even an amateur pianist could improvise a bass accompaniment.

Could there really be a musical message in our genes? Or would it just be an unpleasantly random series of notes? I hurried home to find out. After a few false starts on the piano, it became apparent that some guidelines were necessary to define the musical freedoms I could take. First, the octave of a note should be free choice, since it would not matter to the sequence. Second, if two or more of the same bases appeared together in the sequence, the notes they represented could be blended into a half note (two beats) or dotted half (three beats) or full note (four beats). Finally, the tempo and time (2/4, 3/4, 4/4) could also be free choice. The only binding rule was that a molecular biologist should be able to look at the music and read the exact sequence of bases in the DNA.

As I began to play again according to these rules, something remarkable happened. The notes began to make

musical sense, and a delightful, waltzlike melody emerged (see score A below). By chance, the original discoverers of the chemical compounds of DNA happened to give three of the four bases names that could be transposed into musical notes in the key of C. Furthermore, the very first DNA sequence I tried to play immediately produced a melody that made musical sense. Could this be done with all DNA sequences?

Aware that the DNA sequence for insulin had just been published, I decided to try that. Insulin is a small protein containing two relatively short chains of polymerized amino acids, called the A and B chains. The sequence of amino acids in the B chain, together with its message sequence in DNA, is shown here:

PheValAsnGlnHisLeuCysGlySerHisLeu  
TITGTGAACCAACAGACCTGTGCGGC  
TCACACCTG  
ValGluAsnLeuTyrLeuValCysGlyGluArg  
GTGGAAAGCTCTACCTAGTGTGC  
GGGGAAACGA  
GlyPhePheTyrThrProLysThr  
GGCTTCTCTACACACCCCAAGACC

In the genetic code, each amino acid requires three bases in the DNA (the codon or triplet) to code for its position in the resulting protein. For instance, one of the codon triplets for the amino acid phenylalanine is three thymines in a row (TTT). If you check the first amino acid in the insulin chain, it is phenylalanine, and just below it you will see TTT, its codon in the DNA. Since the bases come in triplets in a gene, it seemed a good idea to play the notes as triplets as well. The first few bars of the melody appear thus (see score B at left).

Again it made a certain musical sense. The triplets give it the flavor of an Irish jig, and when the full protein is translated into music, the melody seems to have a beginning, a middle portion, and an end.

By this time I wanted to know a lot more about DNA, and particularly about the recent advances that have permitted base-sequence determination. Perhaps "music" is coded everywhere in our DNA. There is certainly plenty of it to look

CONTINUED ON PAGE 139

**ALU CONSENSUS**

**INSULIN B CHAIN**

Music of the Gene: Score A is from a recently discovered base sequence; B is insulin's DNA sequence.

## THE ARTS

By Thomas M. Disch

Just 50 years ago, in the twilight of the Jazz Age, when flappers and fivers were still the rage, a young, half-blind, upper-class Englishman published a novel destined to become one of the most enduring prophetic visions ever to clutter from the typewriter of man. The novel was *Brave New World*, its author was Aldous Huxley, and his vision was that of the Jazz Age gone to heaven: of an England that had become more American than America.

Huxley's novel is set in AF 632 (years being measured not from the birth of Christ, who's been written out of the history books, but from the death of a late serf, Henry Ford), when, as it says in Cole Porter's famous song, "anything goes." Well, not quite anything. Family life, religion, social mobility, and most forms of art have been eliminated from Huxley's dystopia, because the powers that be consider them subversive influences. They've been replaced by the "feelies" (movies with a tactile dimension), promiscuous sex, and soma, a euphoric-inducing drug with no harmful side effects.

What was most shocking to the first readers of *Brave New World* wasn't so much the way in which Huxley turned conventional values upside down but the verve and logic with which his villain, Mustapha Mond, the Resident Controller for Western Europe, justifies a social order based unashamedly on the beach and the iceberg—with "eight ninths of the population below the waterline, one ninth above." Mond sums up the lives of the majority of lower-caste Gammas and Epsilons this way: "Seven and a half hours of mild, unceasing labor and then the soma, vision and games and unrestricted copulation and the feelies. What more can they ask for?"

In 1952, when *Brave New World* was 20 years old and I was twelve, it seemed to me the height of all that was wicked, sophisticated, and far-fetched. So wicked indeed, that I had to glue the cover of another 35-cent paperback over the wonderfully lurid, but quite inaccurate, cover art showing a couple dressed in nothing but wisps of cloud

By the book's twenty-fifth birthday in 1957, I still gave it high points for wickedness and sophistication, but instead of thinking it far-fetched, I now believed that the world of AF 632 was, except for some minute details, already upon us. Those were the years of the organization man, of a worldwide conformity enforced not by a 1984-style Big Brother but by the rewards of an affluent consumer society. The first tender shoots of the sexual revolution were springing up, and even soma—in the form of tranquilizers—had appeared as an "ethical" drug. As for Huxley's system of social indoctrination by hypnopædia, or sleep-teaching, television was already a fair success in instilling such *Brave New World*-style slogans as "Ending is better than mending," and "A gram is better than a damn."

Now a half-century after the book appeared, I was curious to return to Huxley's novel and see whether his biting satire as a social prophet had fallen or risen since my previous reading. In some obvious ways, the book seems more on target now than ever—especially if

one hearkens to the dire warnings of those who regard secular humanism as Public Enemy No. 1.

From a strictly technological point of view, Huxley himself, in 1950, admitted, "One vast and obvious feature of foresight is immediately apparent. *Brave New World* contains no reference to nuclear fission. And none to television or space travel or computer technology, or even genetic engineering. Yet even without breaking the DNA code in advance of Watson and Crick, Huxley's blueprint for a 'hatchery' for human infants remains an impressive feat of technological imagining. Less convincing is his rationale for producing people on assembly lines, like Model-Ts.

Where our own world most differs from Huxley's is in the matter of contention and instability. Huxley wrote at a time when it was still possible to believe that the League of Nations might evolve into a world state that would might be rendered obsolete by sound management, and that antagonistic class divisions might be transformed into a frictionless caste system in which the lower classes were bound to be happy, dutiful morons.

In his own book-length reappraisal, *Brave New World Revisited*, written in 1958, Huxley took a grimmer view of the global situation: "It is a pretty safe bet that twenty years from now [i.e., in 1978], all the world's overpopulated and underdeveloped countries will be under some form of totalitarian rule—probably by the Communist Party."

*Brave New World* strays widest from the mark in its picture of a trouble-free beachside style caste system. Huxley grew up in an upper-class family in Edwardian England and shared much of the myopia and some of the arrogance of his "class-mates" when he wrote about those who hadn't shared his privileges. Quite simply, he could not conceive that anyone of working-class background could possess more than a rudimentary intelligence or spiritual dignity. In this regard, *Brave New World* is not so much a prophetic vision as it is a longing for a mythical Golden Age. **DD**



Aldous Huxley, prophet of the plastic present

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# CONTINUUM

Edited by Dick Teresa

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## TRIAGE

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In the awful cauldron of war, where all medical supplies but wounded bodies were in short supply, doctors formed a harsh code for coping with carnage—triage. The term describes a system whereby normal medical standards are superseded by the pressures of emergency conditions. The battlefield physician could not save everyone, so he ranked the wounded by their likelihood of survival and their need for care. Those at the head of the list got treatment first; others were found too torn up for treatment and were consigned to death. It presented a wrenching decision for a physician to make, but a necessary one when the alternative was still greater numbers of dead.

Now the concept of triage has slipped out of wartime and into today's world. Scientists, for example, have begun talking about applying triage to saving endangered species. Vanishing animals will be ranked by their likelihood of survival and importance to mankind; only those with a great enough chance of success will be saved. Others will be sent to oblivion.

Which should survive, the panda or the whale? Is the egret more deserving than the vulture? Is one majestic elephant of greater value than a million obscure insects essential to the ecology of a rain forest? Our ability to share the planet with all existing creatures requires that such difficult choices be made.

"We're already on the threshold of mass extinction of many species," according to Dr. Thomas E. Lovejoy, a director of the World Wildlife Fund. "And I thought there ought to be a system that would give us a conscious choice in choosing to save one species over another. . . . If we have to play God, I think it's better for us to make decisions consciously than to have the decisions made without our knowledge."

Triages of triage thinking have begun to creep into other areas as well. Anthropologists are trying to decide which primitive civilizations to preserve from contamination and which to give up to assimilation. Urban planners are struggling to choose who most desperately needs public assistance and who doesn't.

We are approaching an era of decreasing supply. As on the battlefield, the only thing we will have too much of is bodies crying out for attention and aid. We may find ourselves forced to follow Dr. Lovejoy's canon more and more often—to choose a lesser evil consciously rather than take a chance on the dangerous chance of circumstance. We will no longer have the lux-

ury of apportionment; we will be forced to bank our costs to keep the fire of civilization alive.

Medical historian Robert J. T. Joy has written that "triage may become a metaphor for social, economic, or political decisions. All of us may find ourselves sorted out." It has already begun. In Sweden it is accepted medical policy to deny organ transplants to people over seventy. The British government has decided that the survival of terminal kidney-failure veterans isn't worth the money it would cost to provide them with dialysis. The U.S. Department of Health and Human Services is trying to decide whether to support heart transplants. If the federal government doesn't back the technique, it will not be used. The choice could sort potential heart-transplant recipients, labeling them untreatable, even though the technology exists to treat them.

"There has always been a degree of triage in the world," Professor Jay Forrester of the Massachusetts Institute of Technology said in a speech a few years ago. "In many cases it has been necessary to build for the future at the expense of the present." But in our near future this process may expand more swiftly than ever before.

In an age of almost universal scarcity, triage becomes the necessary morality. If a revolutionary cure is available for only a few patients, who gets it and who dies? If our technological capacity is overwhelmed by world demand, who receives robots and who is relegated to fatal obsolescence? Organized selfishness, in such circumstances, is the only way to survive.

What will a triage-centered society be like? Will we have a morality that condones slow genocide? In a sense, yes. If spending the drinking water evenly means everyone will get too little to live, limiting use becomes a moral act—a necessity for the group's survival—even if it means some fully deserving individuals will die without a drop.

Consider for a moment the impact of a triage system on the life we have led. If triage had been in force a generation ago, would you have been allowed in the overcrowded, understaffed schools? Would your family have been placed high on the list for admittance to suburbia? Would your parents have been allowed to marry when they did, or would that priority have been too far down the list?

Would you have been born?—MICHAEL EDELHART

# CONTINUUM



Adult personality is known to begin to take shape at a very early age. Now one doctor says it may even start in the womb.

## FETUS ON THE COUCH

Suspended in its isolation chamber, the human fetus may be blasted with rock music, overdosed with chemicals, or deprived of oxygen. If Toronto psychiatrist Thomas Verney is right, these conditions brand the tiny embryo with lasting psychological scars.

Verney, author of *The Secret Life of the Unborn Child*, has spent six years reviewing medical research of the fetus and childhood development. His conclusion: A child's personality begins to form in utero, so the expectant mother must take steps to improve her unborn child's emotional makeup from the onset of pregnancy.

For example, don't smoke. It lowers the oxygen content of maternal blood passing through the placenta, caus-

ing the unborn child to become emotionally agitated (as measured by quickening heartbeat). And play tranquil vivadi concertos not throbbing rock music which seems to throw the fetus into paroxysms of violent kicking and distress.

Most important, Verney adds, maintain a positive outlook about childbirth. An anxiously hidden woman floods the womb with catecholamines—chemicals that put the fetus into a fearful state. A perfectly healthy woman, unnerved by her pregnancy, his thonzes, may shock the fetus into spontaneous abortion by releasing catecholamines into the womb.

—Eric Mahara

"Stop looking for me and find my kappage."

—Joy Adams, referring to Amelia Earhart

## A BYTE IS A BYTE IS A BYTE

In the relentless march of technology, the next victim of computer automation may be the editor.

Bell Laboratories, mindful of the rising tide of information that is swamping businesses, decided to do something to make the reporting of this information more readable. The culprit? Bell reasoned, was non-professional writers—especially technical types—who when asked to write a report or a memo would ramble on in obscure jargon. So the Bell scientists wrote a computer program called Winter's Workbench which cleans up bad technical writing.

The Workbench program substitutes simple words (like *use*) for the overused *utilize*; it shifts verbs from the passive to the active ("was done by researchers" is changed to "researchers did"); Workbench breaks up long sentences, simplifies convoluted sentence structure, corrects grammar, punctuation, and spelling—everything you'd expect from a good editor.

There are a few bugs, however. While Winter's Workbench makes bad writing better, it also makes good writing worse. As an experiment, Bell scientists fed the computer Abraham Lincoln's *Gettysburg Address*. Four score and seven years ago, our forefathers brought forth upon this continent a new nation, conceived in liberty and dedicated to the proposition

that all men are created equal. It was mercifully chopped to "Eighty seven years ago, our grandfathers created a free nation here."

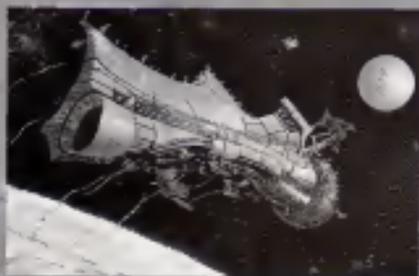
Other classics fared no better. The problem seems to be that among computers—as among editors—there is no accounting for taste.—Nick Engler

Never mention an ashtray unless you can swiftly make it the only one of its kind in the world.  
—William Galt

"By medicine, life may be prodded, if not death will seize the doctor, too."  
—William Shakespeare



Also: Eighty-seven years ago our grandfathers...



Where is all the antimatter? One physicist suggests sending a deep-space probe to find "cells" that contain the strange substance.

## CELLULAR UNIVERSE

Some 50 years ago a few brazen physicists postulated the existence of antimatter. While ordinary matter (the stuff of which desks, diamonds, and people are made) contains positive protons and negative electrons, antimatter would contain negative protons and positive electrons. If matter and antimatter ever collided, an enormous explosion would result.

But after decades of frustrating research, astronomers could find little evidence of this cosmic boom. They declared that antimatter existed in minuscule quantities, a mere piffle compared to the overwhelming morass of matter.

But just recently 1975's Nobel Prize-winning physicist Hannes Alfvén said that the cosmos may be chock-full of antimatter after all. The universe might have a cellular structure similar to that of living organisms, he suggests

with electrified cell walls that separate matter from antimatter in a vast checkerboard pattern.

Alfvén believes these cell walls may be formed by charged streams of cosmic gas or dust. Satellites journeying through our solar system, he adds, have detected suspicious changes in electrical current that may well mark the cell boundaries.

According to Alfvén, proof of this theory would drastically alter our present concept of interstellar and intergalactic space. "We wouldn't know whether our closest neighbors were made of matter or of antimatter," he explains. "To find out, we'd need a deep-space probe that could measure electrical current."

—Tom Kowach

"If you've never seen a UFO, you're not very observant. And if you've seen as many as I have, you won't believe in them."

—Arthur C. Clarke

## TALKING COMPUTER FOR DOLPHINS

Want to talk to dolphins? The best way may be to talk to a computer first, according to the Human/Dolphin Foundation, in Redwood City, California.

Dr. John Lilly first tried to teach a few dolphins English in the mid-1970s. But Lilly soon found that while the animals were smart, they had trouble understanding human speech which uses only a fraction of the enormously wide range of frequencies that dolphins hear. And although the dolphins tried to speak English, they were physiologically capable of producing only high-pitched, incomprehensible squeaks.

Lilly's answer was to get a computer to translate each species' speech into sound patterns the other could deal with. In 1977, after three years of work, the

foundation developed a computer system capable of translating human words typed on a keyboard into high-frequency sound patterns that dolphins seem to understand. It also analyzed the dolphin sounds and displayed a rough interpretation of them on a computer screen for people to read.

According to physicist John Kerr, now working as the foundation's director, the system is being used to teach dolphins Joe and Rosie simple tasks like jumping, bowing, and recognizing objects on command. The animals have also followed more complex instructions, Kerr reports. They can, for instance, swim through a channel to touch a ball with a flipper.

The researchers work with a vocabulary of 30 words, but they soon plan to go up to 128.

—Owen Davies



A new computer system translates human words into high-frequency sound patterns that dolphins seem to be able to understand.

# CONTINUUM

## MILITARY SHUTTLES

It was an extraordinary thesis. Eight master's degree candidates at the Air Force Institute of Technology (AFIT) combined their efforts to design a military space craft fashioned on existing technology.

It's no secret that the space shuttle has only limited military applications, even though the Department of Defense will be its biggest customer for the foreseeable future. The shuttle takes days, sometimes weeks, of maintenance and preparation between missions. And it can be launched into only a restricted number of east-west orbits, while many military satellites are in polar orbits in an emergency the shuttle would be of little use.

The Defense Department has studied the problem in a limited way and two aircraft companies—Boeing and McDonnell Douglas—have submitted conceptual designs for manned spacecraft capable of on-demand, all-azimuth launch. But the research received could run into billions of dollars. And budgets are tight, even the Pentagon's.

So the AFIT officers decided to see what they could patch together from off-the-shelf components. When the exercise was over, they had not one but three spacecraft designs.

Each of the hypothetical military vehicles would carry two astronauts and a small payload of up to 2,500 pounds and would operate for as many as

seven days in near-Earth orbit. Two of these vehicles would be launched from the air like the old X-15, one would be launched from the ground in a vertical position similar to the present-day shuttle. All the components of the vehicles would be reusable. There would be no throwaways nor even a fuel tank.

A lot of basic research would still be required, says a member of the design team. But the AFIT designs could be built without the enormous effort and expense of another Apollo or shuttle program.

If someone up the Air Force ladder takes a shine to the idea and sells it to Congress, one or more of these concepts could be off the drawing board and into space by 1995.

—Donna Chesbro-Engler

"Thinking is the taking of the soul with itself."

—Plato



The proposed space shuttle makes a snug military weapon.



Individual doses of methadone. Actually used to wean addicts from heroin, the opiate may prove effective against psychosis.

## METHADONE FOR PSYCHOTICS

Sure, methadone is addictive. But who cares? Being addicted is a lot better than being hopelessly psychotic. At least that's the view of psychiatrist Karl Verebey of New York Downstate Medical Center in New York City, who believes methadone may relieve serious emotional disorders more effectively than the antipsychotic drugs now in use.

Verebey realized the antipsychotic potential of methadone back in the early Seventies, when he was part of a study team evaluating it as a heroin substitute. "I took a dose of it," he says. "It felt like there was a glass shield between me and the outside world. It was an insurmountable feeling, and I thought immediately that methadone would be perfect for people whose fear or paranoia prevents them from functioning in society."

Then natural opiates called endorphins were discovered in the human brain. "I thought that mental illness might actually be caused by some dysfunction in endorphin metabolism," Verebey says. "So I searched the literature for reports of patients who responded to opiates in psychosis."

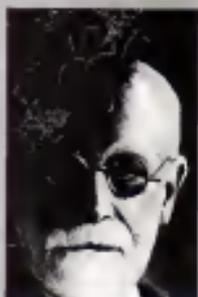
He found them. Most patients had taken the drugs to ease pain, but one nineteen-year-old woman received methadone in what her physician described as "a last-ditch effort to salvage her. The young patient had a long history of violence, self-mutilation, and attempted suicide. She had even beaten a puppy to death. They had everything to normalize her, and nothing worked." Verebey recalls. Then they used methadone, and "after a couple of doses she was totally normal."

Just recently psychiatrist Robert Milman and colleagues at Cornell University

in New York, have won permission to begin a study of methadone's antipsychotic properties. If the drug proves effective, it will be a significant advance over today's drugs, Venisbey believes. "The antipsychotic drugs now used make people zombies," he adds. "Opates would allow them to function." —Owen Davies

"Errors are not in the art, but in the artificers."

—Isaac Newton



Lipsitt: Partial proof that nomenclature is destiny

#### FATEFUL NAMES

Almost against his will, psychologist Lewis Lipsitt of Brown University in Providence, Rhode Island, has come to believe that nomenclature is destiny. A person's name will influence his or her chosen profession.

Henry Smiley for instance turned out to be an orthodontist, and G. A. Martin now studies the effects of alcohol on the body.

Over the last ten years Lipsitt has collected several thousand examples of people whose names announce their occupation or preoccupation, from the music teacher named Fiddler to the birdwatcher named Hawkes. At first Lipsitt explained, he was only trying to demonstrate for his students a concept about evaluating evidence.

"I thought these names would be a frivolous way to show the danger of assuming a cause-and-effect relationship between two seemingly related facts," he said. "The examples all had an apparent connectivity that couldn't possibly have any basis in reality." But Lipsitt takes his data much more seriously now—partly because there is just so much and partly because the idea of prophetic names turns out to have a long history with some very credible supporters.

The Talmud, for example, which is the official explanation of Jewish law and tradition, gives the first formal expression of Lipsitt's findings when it states, "As his name, so is he."

Carl Jung mentioned "the corruption of the name" when writing that Herr Gross had delusions of grandeur while Herr Klein (the German word for small) was troubled by feelings of inferiority.

"Are these the whimsical effects of chance," Jung asked, "or the suggestions of the name?"

For what it's worth, Lipsitt adds, Jung's own name means "young" and it was he who invented the idea

of rebirth in psychoanalysis. Freud's name translates to "joy"—a fitting moniker for the author of the Pleasure Principle.

Freud's name is also a counterexample of the phenomenon when you consider the fact that the father of psychoanalysis wrote extensively of his drive toward death.

The name may seem completely divorced from the life, Lipsitt suggests, when an odd occurrence or reaction pushes the individual off his predestined trail. But he laughs a little as he says so. As director of Brown's Child Study Centre, Lipsitt is all too aware of how easy it is to make erroneous judgments about the effects of early experience on human development. Nevertheless, he continues to expand his roster and always enjoys hearing of a particularly apt example, such as Mr. Roat the mailman. —Dava Sobel

"The flesh is sad, alas! And I have read all the books."

—Stephens Mallame

#### SHUFFLEBRAIN

Neuroanatomist Paul Petsch has sliced and scrambled the brain in his search for the "mind." His question: Is the mind—speech, vision, memory, intelligence—localized in specific parts of the brain? Or are mind and memory encoded and repeated throughout the brain?

To find out the Indiana University scientist tried to alter the salamander's



Salamander: You can shuffle it down any way you want

feeding behavior by removing major brain structures one at a time, switching left and right hemispheres, turning each hemisphere upside down, even shuffling brain parts around. Yet through it all, feeding continued apace.

Petsch finally taught a salamander to respond to a tap on its dash, then transferred its forebrain to an unconditioned salamander. The recipient woke up from surgery and responded to tapping, Petsch says. But so did the donor, even without its forebrain.

Petsch concludes that each tiny section of the brain contains the entire mind, much as a fragment of a shattered holographic sheet retains enough information to project the original image. Even a brain injury that leaves a person disabled may not wipe out stored memory for the lost function, Petsch says. Instead, such injuries may simply prevent access to memory. —Yvonne Basian

# CONTINUUM

## ANIMAL ARCHITECTURE

It takes an understanding of animal psychology to move a steer from there to here without spooking him so that he balks, slips, trips, or otherwise bruises his precious flesh. But the best truth, one expert observes, is that conditions at most feed lots, packing plants, and ranches are arranged without a thought for the animal's natural behavior, and the lack of consideration costs the livestock industry about \$46 million a year in the form of bruised meat unfit for human consumption.

The industry would do well to note that cows like music (instrumental more than loud rock and roll) that pigs are sensitive to their surroundings, and that sheep become stressed when put in a flock of strangers, according to Temple Grandin, a research assistant in animal science

at the University of Illinois, Urbana-Champaign, and president of Grandin Livestock Handling Systems, in Tempe, Arizona.

Grandin has spent most of the last ten years defining ways to facilitate livestock handling for slaughter, sorting, or veterinary care. She has shown how animal architecture—the shape of a holding pen, the slant of a loading chute, and the texture of a floor—can cause animals either to walk along calmly or to lie down and refuse to budge or even to go into shock and die.

Like people, Grandin explains, animals need personal space to stay calm. This is why a long, narrow pen keeps cattle more contented than a square pen with the same amount of floor space. The oblong design allows most individuals a place along the perimeter. The feeling of crowding in a circle or a square, on the other hand,

can lead to fights, and fights guarantee bruised meat.

Since most animals have poor depth perception, shadows frighten them as easily as solid forms. And curved chutes with high solid sides work best. Grandin maintains, because they capitalize on the animals' natural tendency to follow one another while keeping them from seeing what lies ahead—the stunning pen, say—until they're about to enter it.

Grandin recommends that handlers put themselves in the animals' place and use a camera held at the cow's or pig's eye level to document problem areas such as shadows, doors that look too small to get through, and ramps that seem to slope too steeply.

Soft background music not only soothes the animals but provides a better atmosphere for the workers, Grandin says, making them less likely to abuse the livestock. Music can also mask the alarm squeals that one stressed pig may use to whip the whole group into a lather.

Relatively few places employ an integrated system of handling techniques based on knowledge of animal behavior. However, Grandin adds, most of the research has been done within the last decade and hasn't had time to see practical application.

—Deva Sobel

"What we need is progress with an escape hatch."

—John Updike



Nerve cell: We're undoing the secret to its restoration.

## BRAIN MENDING

Our brain and nervous system are made up of billions of cells called neurons. While the human body cannot regenerate injured neurons, recent experiments indicate that these damaged cells may eventually be restored with surgery. This could allow us to cure dozens of neurological disorders, ranging from paralysis to cerebral palsy.

At McGill University, in Montreal, Drs. Albert Aguayo and Samuel David have already induced the growth and reconnection of neurons in the severed spinal cords of rats. First they opened a rat's leg and removed a bit of the protective fiber or glia that coats the nerves. Then they implanted the glia in the spinal cord. The glia coated the severed nerves, creating a tunnel through which the nerves could grow until they reconnected.

Aguayo suspects that glia contains essential growth agents not present in the spinal tissue. But he and David have yet to prove that



Curved chutes capitalize on cattle's natural tendency to follow one another, while preventing them from seeing the stunning pan.

the regenerated neurons are functional for the rats' spinal injuries were not serious enough to alter their behavior perceptibly.

At the University of Lund, in Sweden, however, neurologist Anders Bjorklund has changed the behavior of brain-damaged rats. First he grafted neurons from healthy rat embryos into the injured brains of adult rats. Then he taught the adults a way to mow the maze—something they did not know how to do before. Apparently, Bjorklund says, the neurons from the embryo grew and they connected to the damaged adult neurons, eventually replacing them.

It may be a decade before this procedure is applied to humans. But Bjorklund envisions the day we can clone thousands of embryos for brain-mending surgery.

—Eric Mishler

## BREATHLESS LONGEVITY

To stay young, just hold your breath. That's the advice of cell biologist Raj



Experimentally, it will live longer without its wings.

Sohal, who has learned that our bodies convert inhaled oxygen to a poisonous molecule that accelerates the aging process.

Sohal, of Southern Methodist University in Dallas, bases his conclusion on recent findings that crippled wingless flies live about 40 days, some 25 days longer than winged flies. The grounded flies consume less oxygen than airborne flies, he says, and consequently produce relatively few of the destructive molecules.

The oxygen we breathe, Sohal explains, is absorbed by the body's cells. But once inside a cell, some of the oxygen's molecules hook up with excess electrons and turn into negatively charged particles called superoxides. Some of the superoxide reacts with the chemicals in our body to form hydroxyl ions, which eat away at cells.

Scientists have long wondered whether the hydroxyl ion is associated with the aging process. Sohal says his fly experiments make the connection pretty clear.

Humans live longer than insects, Sohal adds, because our cells form less superoxide and, thus, less hydroxyl. But it isn't known whether human activities, which absorb enormous quantities of oxygen, are adversely affected.

—Madeline Lebowitz

"I was of three minds, like a tree in which there are three blackbirds."

—Wallace Stevens



Now noble for sobering up drunk drivers: In the interests of science, volunteers are getting smashed on mint julep cocktails.

## SOBER-UP PILL

Ernest Noble spends his days plying volunteers with potent mint julep cocktails. But he is not interested in getting people drunk; he is interested in getting them sober.

Noble, a scientist at UCLA's Alcohol Research Center, is developing what he calls a sober-up pill. "Alcohol first stimulates and then depresses the central nervous system by somehow disrupting the transmission of nerve impulses," he explains. "We're developing drugs that can influence neural transmission so that alcohol's depressive effect is abolished."

For the past 12 years, Noble has gotten his volunteers high on mint juleps. Each volunteer is subsequently given either a placebo or an experimental sober-up drug, then tested for such things as coordination, balance, memory, and attention span.

So far, Noble has found that performance improved 30 to 50 percent with three drugs—Dops, used in treating Parkinson's disease; ophedrine, a component of asthma drugs; and amphetamine, similar to amphetamine. The next step, he says, is creating the optimum sober-up pill with one of the drugs, or some combination of all three.

The sober-up pill, Noble stresses, is not meant for the alcoholic, but for the social drinker who has had one too many to drive home. It could also prevent emergency-room deaths of people who have overdosed on alcohol. Within five years, Noble believes, a fast-working, nonaddictive sober-up pill (or liquid) will be served right up there on the bar alongside the liquor and munchies.

—Carol A. Johnson

"The only real food for thought is more thought."

—Peter Dinkov

# CONTINUUM

## FOUNTAIN-OF-YOUTH FELONS

A seventy-two-year-old man with twinkling eyes shows off a youthful body rippling with muscles. His prime condition is not the result of weeks at an expensive health spa, but of a lifetime in prison.

"The fact is," says Morris Reed, supervisor of research and evaluation for the Tennessee Corrections Institute, "people who spend most of their adult lives in prison seem to look and feel about fifteen years younger than persons not in prison." Reed, who's spent a year and a half studying 19 older prisoners, reports that more than 75 percent of those interviewed felt younger than persons their age "on the outside." She attributes their youthful demeanor to a relatively

stress-free routine, and to a value system that doesn't emphasize growing old.

Without a family life, prisoners don't suffer widowhood or divorce. Since work is the only means of keeping busy, they never think of retirement. And because inmates pay more attention to physical and mental condition than to chronological age, they avoid the preconceived notions that may force imprisoned individuals to take on "mature" roles whether they're ready or not.

Though Reed does not believe the key to youth is incarceration, she contends aging is accelerated by the social pressures that surround those of us who are free.—Bernie Isaacs

"Oh, *l'affair!* I have only words to play with."  
—Victor Navolok

## BAKER'S HIGH

It's been called Baker's High and St. Anthony's fire; it means getting stoned on bread, and it can still happen if the rye flour used to bake it is contaminated by a certain fungal growth.

When a woman caller asked Arizona State University food nutritionist Dr. Ralph Ponce to analyze some bread, he naturally asked why. "It's making us high," she said. His analysis showed the homemade rye contained ergot fungal mold. "When heated, it turns into lysergic acid diethylamide—LSD," Ponce found. "History is full of documented cases in which



It's still possible to take acid trips with rocky bread.

thousands of people were affected by rye flour contaminated by this mold. They ate vodka, danced and called it St. Anthony's fire. As recently as 1951, 300 people were affected in a French village. These people climbed on top of houses and took nice Swan dives into the ground.

"Just as some molds are toxic to bacteria and give us penicillin, others are toxic to us. Some are used to make the yellow ran chemical weapons the Vietnamese reportedly used in Cambodia. Others cause cancer at lower levels than almost anything else."

Although it is still possible to obtain contaminated flour, most commercial bakers remove the germ from the rye, eliminating the problem.—Alan Maurer

"Dreaming pavilions every one of us to be quietly and safely insane every night of our lives."  
—William S. Burroughs

## SYNROC

One of the biggest problems facing the nuclear community is the buildup of high-level radioactive waste—the deadly "sludge" left over from reprocessing reactors and bombs. Until now the preferred disposal method has been to pump the dangerous wastes into underground steel tanks, encased in concrete. But the tanks are designed to last only a few decades, while the waste stays lethal for hundreds of centuries.

Now a promising and reasonably cheap new disposal medium has been devised. Geochemist Ted Ringwood, of the Australian National University, has come up with an artificial crystalline rock, dubbed Synroc, which could be used to contain high-level waste safely (in theory at least) for millions of years.

Synroc is made from several common, inexpensive chemicals, including calcium carbonate and titanium oxide. Combined under the right conditions of heat and pressure, the compounds fuse to form a dark rock that's harder than steel.

Powdered nuclear waste could be added to these ingredients before they are "cooked" into final form. The result would be a solid rock made in part of radioactive isotopes held tightly in place by a rigid latticework of chemical bonds. Once part of Synroc, the radioactive particles could not escape.

—David Ritchie



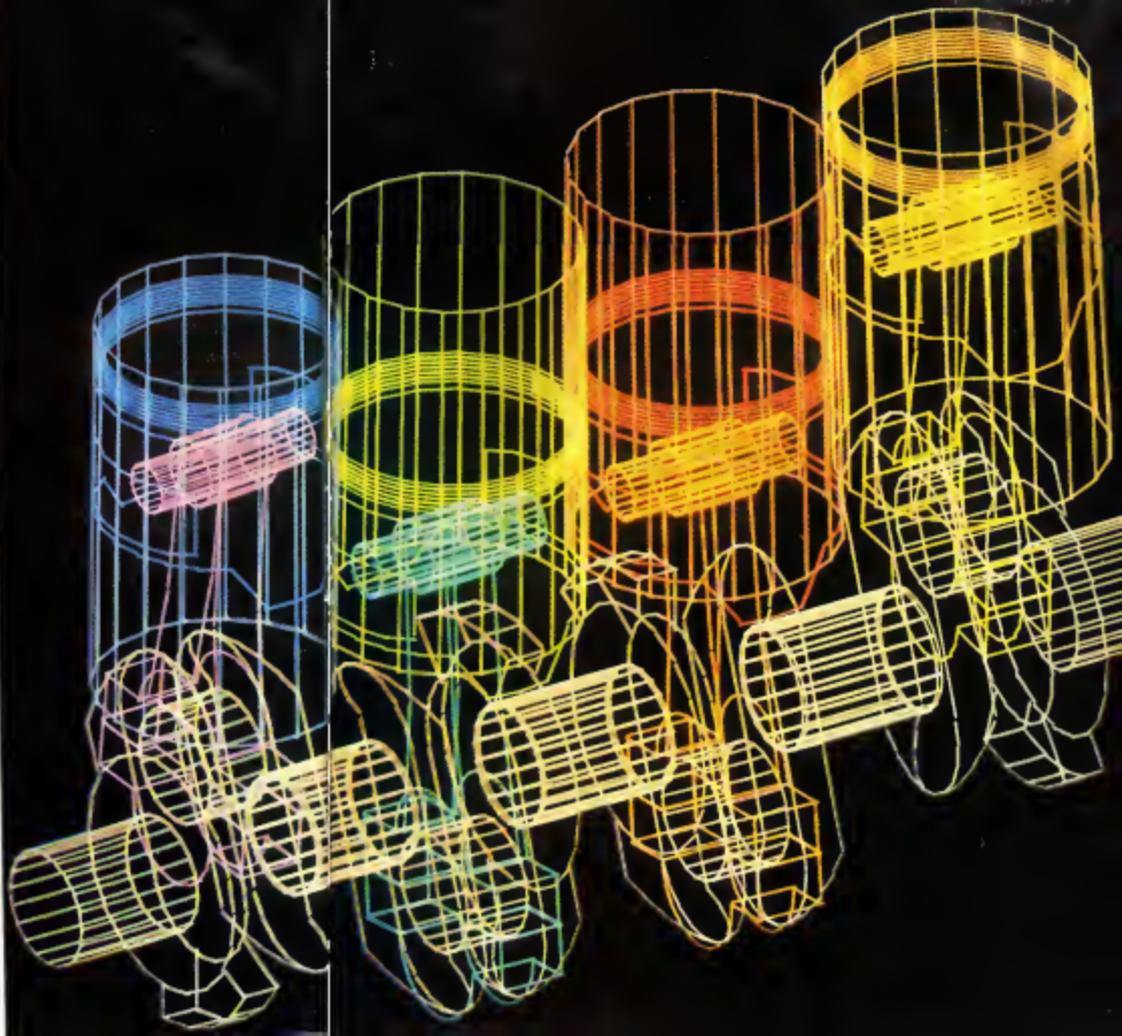
Prisoner: There are benefits to a life behind bars.

*There are no workers in this  
Wonderland; sensitive machines translate  
ideas into salable products*

## ALICE'S FACTORY

BY KATHLEEN STEIN

**O**zumba went upstairs to his study and punched in the code for the gear cluster he had begun to design. He had a couple of hours before the four o'clock session passed over his part of Niagara. The catwalk-ray-trace (CRT) screen filled with lines of color. Ozumba rotated the shape on its X and Y axes, reworked the tooth angle on a sprocket, ran stress analyses and sectional and mass-properties calculations. He smoothed its action on the man-powered aircraft the gears were designed for. Enter that day from his materials data base he



•Computer graphics create  
kinetic neo-blueprints for everything  
from masks to microchips •

had determined that the gears would be composed of a new titanium alloy. He zoomed in on the hub, reconnecting some lock rings. At five to four he checked the satellite dish, and when the bird was in range he beamed up the program for the gears.

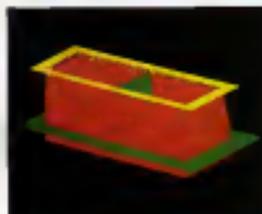
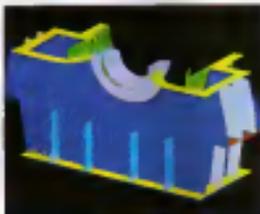
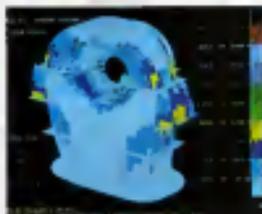
Cumba's design was received at Widget International's South Orange, New Jersey, plant. It came up on the terminals of the structural engineers who made some modifications and sent the design to the mainframe computer, which made up materials orders and sent them to supply. Altered the computerized batch-order processors, which determined the number

of gears to be made, found out which shop was available for the job and put its robots on call. The design was routed down a series of increasingly simpler computers that led to the micro-processors controlling the machine tools, robots, and sensors. The titanium sheets were delivered in automatic carts to work stations, where robots handed them to a variety of cutters and forgers. Then robots transferred the finished gears to assembly areas, where they were put together and finally given over to stations where robots fastened them to the aircraft's main chassis. Inspections by sensor robots were run at every stage.

Another far-out scenario? Yes and no. Far-out because the implications of a computerized, workerless manufacturing system shake the foundation of what is known about industrial society. Not far-out because it is happening now. Some call it the Second Industrial Revolution; some say it's the most important technological innovation since electricity.

It's usually called by its acronym, CAD/CAM, which stands for Computer-Aided Design and Computer Aided Manufacture. There are other acronyms, too. CAE, for Computer-Aided Engineering, CIM for Computer-Integrated Manufacturing, and more. They all bespeak an industry wherein the computer's electronic pulse ripples through the innermost recesses of production. Such huge corporations as General Electric have extensive research projects for setting up factories of the future, and the Robotics Institute of the Society of Manufacturing Engineers asserts that by 1990, 50 percent of all manufacturing work will be handled by robots—more than ten times the current level.

Fortune magazine calls CAD/CAM the "best new technology for productivity ever to come on the market." Indeed this radical new equipment promises a lifeline to an American economy that Treasury Secretary Donald Regan calls "dead in the water," even as it offers the possibility of production improvements as great as 30 to 1. For better or worse, CAD/CAM is changing the nature of blue- and white-collar work forever. In tomorrow's factories all



the workers will wear titanium-alloy collars.

The CAD part of the equation refers to the use of computer graphics (and accompanying data bases) to create two- and three-dimensional pictures from hypothetical realities—kinetic neo-blueprints for designing everything from Halloween masks to microchips, from Black and Decker hand tools to four cylinder engines to shuttle selectors (see illustrations on previous pages), from tractors and airplanes to petrochemical plants. CAD is used in pharmaceutical research to construct new molecular compounds in simulated testing of parts (like the turbine components above), in architecture to design skyscrapers. In the aerospace and automotive industries CAD has been in place for more than a decade. One General Motors designer admitted, "We wouldn't know how to do it manually anymore."

The CAM side of the loop—the computerized control of production machines from numerically controlled (NC) milling devices running on punched tape programs to semiautomatic robots with visual and tactile sensors—is just beginning to penetrate industry. And its applications are equally far-reaching. Although factories have had NC machines for more than 25 years, they have been serviced by humans rather than by robots and computers. Increasingly though, microcomputers are taking over from people—measuring parts, calculating tool paths, piloting the robots, directing finishing touches on a product. Computers can also preside over foramen-level jobs: sending out communications about batch-size changes, bills of material, shipping, and even the self-repair of shop equipment.

CAD/CAM, this automated "great chain of being" for industry transforms the factory into a kind of living organism linked together by intricate feedback of electronic messages. In time the "memories" of the organism will accrete in vast "Expert Systems," digital repositories of shared wisdom about the plant and its manifold processes.

At the top of the chain is the engineer sealed before his CRT screen. Looking over the shoulder of one of these masters of the electronic drafting board, you might see an image on the screen that looks something like a Mondrian painting—except that instead of three flat primary colors on the grid, there are seven shimmering Day-Glo pastels. The engineer overlays one grid with a new one of halftoneogenic reds and magentas and shifts thick pink lines. This is no mythic city he's designing; but the accurate visual symbolism of a few cells of a semiconductor chip magnified many times. Before CAD it was humanly impossible to design this tiny smart integrated circuit.

Looking into another screen, you might see a similar image resembling a constructivist artwork, filled with converging lines of force and fragmented geometric objects. The designer touches some buttons and a detail of the picture floods the screen: a close-up of an intricate lattice-work of pipes, valves, and flanges. He executes another command and a 3-D model including its entire skeletal support/rigging appears. It looks like a space station, but it is a perfectly scaled model of a petrochemical plant that will be built in an unspecified Arab country.

The programs used to generate these two designs are developed and marketed by companies such as Compeca, of Paramus, New Jersey, a firm that specializes in software used to design and produce both integrated circuits and massive process plants, from chemical to coal, from hydro to nuclear-power plants, and more. Compeca's Plant Design Management System (PDMS) is used by such construction companies as C. E. Lamson of Bloomfield, New Jersey, to design colossal industrial plants throughout the world. PDMS allows you to build your plant in the computer before building on site, says Compeca vice-president Carlston Hawk. "So when you're constructing it, you're actually building it for the second time."

The 3-D model addresses all problems specific to plant design and construction including paperwork (the biggest bug-a-boo), nozzles and valves. It provides interference analysis to determine, for instance, whether two pieces of metal occupy the same space, or whether a crucial valve is inaccessible. On-site construction difficulties involving terrain or roads can be anticipated and every connection and alignment in a project often many acres in size, can be tested with absolute accuracy. PDMS is like taking a full-scale physical model, perfectly accurate, and putting it into the computer," Hawk says. Then allowing the design team to get into the computer with a Polaroid camera to take pictures of any part of it from any position.

Traditional hand-drawn blueprint methods account for no less than 25 percent of cost overruns resulting from errors caused by tool limitations. With PDMS, Hawk boasts, error is virtually wiped out.

Theoretically a complete CAD/CAM set-up allows one person to do the following: generate a blueprint on a computer, modify it, give it three-dimensionality. Pictures of standard components of the design can be summoned up at the touch of a button. The computer calculates the sizes of parts and performs analyses to test for wear and tear. The engineer simulates the parts interacting with the whole. He finishes the design and files a geometrically perfect model of it in the computer's memory. Going from CAD to CAM, the computer generates an NC machine-tool path program from the model in the memory. A simulator simulates the tool cuts in the banks of raw material to verify that the machine will carve

out the part accurately. The NC program is then punched onto paper or is stored on magnetic tape. When production time rolls around, the NC program is sent "down-line" to the NC machines by control computers. Machines turn out the product.

Even with today's semi-complete CAD/CAM systems, there are reports of astonishing productivity gains. In some cases the design/production cycle has been cut in half. Five years after CAD/CAM was acquired, there are stories of plant output leaping 50 percent. For example, in 1977 Minster Machine Company of Minster, Ohio hooked up a computerized NC flame cutting machine to a CAD graphics system. This mini-CAD/CAM setup increased Minster's flame-cutting productivity by 30 percent, its overall weld-shop productivity improved by 17 percent. And today its engineering is on schedule despite a dramatic increase in workload.

For Wall Street, the CAD/CAM market is a new frontier. The cost of a large CAD

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CAM system begins at about \$700,000. There are more than 200 turnkey companies supplying ready-to-use combinations of hardware and software, and the market for their wares has tripled since 1978, with sales breaking through the \$1 billion mark early in 1982. By 1985 the market will top \$5 billion, forecasts Timothy Gauthier of Dataquest, an industry watching subsidiary of the A. C. Nielsen Company. "By 1990, he estimates, ninety percent of all engineers will work on CAD equipment, if not fully. And you almost can't have CAD without CAM."

Trying to gain a perspective on CAD/CAM's "Wild West show," Dick Sparr, president of Adage, a graphics company in Billerica, Massachusetts, likens the future of CAD/CAM advances to the evolution of the calculator—from the 60-pound table models of 30 years ago to today's hand-held programmable ones. "Analogous developments are going to occur," he says. "While CAD/CAM is not in its infancy it would be folly to call it mature."

The roots of CAD go back to the early Fifties, to military devices that converted radar information into computer-gener-

ated pictures. Massachusetts Institute of Technology's grant number cruncher, the Whirlwind, built during World War II as a prototype flight simulator for combat pilots, had CRT displays and oscilloscopes in its control room. But perhaps the most striking achievement in the early days of CAD was the 1963 MIT doctoral thesis submitted by Ivan Sutherland. Entitled Sketchpad: A Man-Machine Graphical Communication System, it was a collection of algorithmic programs that was to become the software basis of interactive computer graphics.

In 1970 a year after he founded his own company with David Evans, Sutherland wrote about computer graphics with undiminished awe. "Whereas a microscope enables us to examine the structure of a submicroscopic world, and a telescope reveals the structure of the universe at large," he stated in *Scientific American*, "a computer display enables us to examine the structure of a man-made mathematical world simulated entirely within an electrical mechanism. I think of a computer display as a window on Aoki's Wonderland in which a programmer can depict either objects that obey well-known natural laws or purely imaginary objects that follow laws that he has written into his programs. Through computer displays I have landed an airplane on the deck of a moving carrier, flown in a rocket at nearly the speed of light, and watched a computer reveal its innermost workings."

The two main graphics systems used in CAD are calligraphic and raster. Calligraphic creates the familiar wireframe image—the rotating Datsun on TV—as an electron beam moves from place to place on a screen in a pattern that traces out the individual line to make up the picture. Raster displays make pictures the same way as ordinary TV sets do. The image is "painted" in fixed sequence from left to right, top to bottom.

The basic picture element in calligraphic systems is the line, segment, or vector. To make images move, motions are broken down into "primitive orders rotate and scale (shrink or grow), based on mathematics. You can zoom in on a region near an object and the rest of the picture flies outward, too big to be contained on the screen. These outlying parts are removed from the "display list" by another primitive operation called clipping. To create solid objects on raster displays, you model the object's curved surfaces by splitting them into small surface patches, represented by quadrilaterals. For 3-D forms, the curves generalize into polygons, cones, spheres, and even more complex surfaces.

The latest thing in CAD, solid modeling can build up complex shapes out of pre-wireframe defined primitive shapes. Alan Barr, a doctoral candidate at Rensselaer Polytechnic Institute (RPI) in Troy, New York, creates vivid, sea-look colored shapes on his graphics display. He and his colleagues have developed a system called

Superquadrics. It can construct any shape capable of being defined by a quadratic equation. That includes doughnut, star and dumbbell configurations as well as pasta-like ellipsoids and hyperboloids. Where solid objects are to be joined—a nut and bolt screwed together—there are special geometric representations that describe the object as a volume with a smaller volume inside it. To pass through the looking glass, you marry art with mathematics.

There are advanced algorithms for hidden line and surface removal, that is, getting rid of parts of the object that would not be seen if they face away from the viewer or that become obscured as the object rotates. There are mathematically programmed "intensity values" for shading; they are determined by surface orientation, the direction of the light source and surface textures. There are algorithms for creating the smoothness of a baby's skin or the roughness of the moon's surface and even transparency.

The computer is the master of perspective, the art of depth illusion. The CAD system of Applicon, a turnkey company in Burlington, Massachusetts, has a design package in which the image can be modified from six orthographic views; designers can see it and change it from top and bottom, right and left sides, front and back. The same operation can be done from any axonometric projection too, rendering it realistic from several perspectives. Applicon's Flying Eye editing lets you walk inside and redesign the interior of your model as well. Its solid-modeling software enables you to determine precise mass properties such as area, volume, weight, center of gravity and moments of inertia. With "exploded view" you can make a complex gizmo such as an automobile engine fly apart into its smaller components.

With all of these fabulous tricks, nevertheless, there is no easy way to describe complex 3-D shapes. "How do you describe a person, a face from hair to eyes to mouth?" asks Mark Fox, head of the Intelligent Systems Lab at Carnegie-Mellon University (CMU) in Pittsburgh. "How do I deal with the extension of my veins here?" He proffers his forearm. The only person who could model the human body properly was Michelangelo, and even he wouldn't be able to come up with a description that a machine could understand. Fox asserts:

Nevertheless, engineers talk about "before and after CAD" as if it were a religious date. Certainly by taking the sludgy and routine composition out of engineering CAD has changed the nature and quality of design. "We can investigate large numbers of alternatives early on in the design sequence," says Steve Farnes, professor of civil engineering at CMU. Instead of having only 3 or 4 mousetrap designs, you can have 3,000 or 4,000. "You're bound to come up with a better mousetrap." And now it's feasible to change a design radically late in the game, too. Farnes adds:



It's crystal-clear.  
It's a bit more expensive, but for a crisp Gin & Tonic,  
the world comes to Gordon's.

FICTION

# THE WHITE PLAGUE

BY FRANK HERBERT

John Ace O'Mall, an American genetic engineer working on a research grant, witnesses the horrifying effects of an IRA terrorist bombing in a crowded Dublin street. His wife and ten children are killed by the blast. O'Mall decides to avenge their deaths in the most pointed way he can—through a genetically engineered disease. The following concludes O'mn's exclusive two-part excerpt, in which O'Mall unleashes his devastating plague on a select and unsuspecting populace.

The warning letters began arriving during the week before the first anniversary of the Grafton Street bombing. The first letter was timed to reach Ireland too late for counteraction. Others went to world leaders, who treated them as crank letters or bucked them along to specialists. The letters were numerous at first—to radio and television news departments, to newspapers, to prime ministers and presidents and religious leaders. It was determined later that one of the first letters was delivered to a newspaper on O'Connell Street. The editor, Alex Coleman, was a dark and vital man who covered his drive with a generally mild manner even

when he was being most forceful. His peers considered him an oddity because of his strong temperance beliefs, but no one doubted his earnestness for a good story.

Coleman read the letter over several times, glancing up occasionally to look out his third-floor window onto the street where Dublin's morning traffic had already begun to congeal into its usual frustrating crawl.

Crank letter?  
The thing didn't have that feeling about it. The warnings and threats made his skin crawl. Was this possible? The words had an educated air about them, sophisticated. The thing was typed on bond paper. He rubbed the paper between his fingers. Expensive.

Owney O'Mara, Coleman's personal secretary, had clipped a note to the editor. "I hope this is a crank. Should we call the Garda?"

So it had worked its disturbance on Owney. Coleman realized.

Once more the editor read through the letter, trying to find some reason to disregard it. Soon he put the letter flat on the desk in front of him. Then he keyed the intercom to Owney.

This is the second of a two-part excerpt.

PAINTING BY CHARLES PFAHL



'Sir?' Owey's voice always had a military abruptness.

'Check out the Achill Island angle, will you, Owey? Don't let up any horns. Just find out if there's anything unusual about...'

'Right away.'  
Coleman returned his attention to the letter. It was so damned direct, so clear and straightforward. A mind of power and yet terrifying purpose lay behind it. There was the usual warning to publish or else... but then:

'...I am going to wreak an appropriate revenge upon all of Ireland, Great Britain and Libya...'

The expressed justification rang a bell in Coleman's memory.

'You have wronged me by killing my loved ones. By my hand alone you are being called to account. You murdered my Mary and our children, Kevin and Mairead. I have sworn a terrible vow on their memories. I will be avenged in kind...'

Coleman again keyed the intercom and asked Owey to check on those names. 'And, while you're at it, call the College Hospital and see if you can get me through to Fin Doherty.'

'That would be Fintan Craig Doherty sir?'

'Right...'  
Once more Coleman read the letter. He was interrupted by the telephone and intercom simultaneously. Owey's voice said, 'Doctor Owey on the line, sir...'

Coleman picked up the phone. 'Fin?'

'What's so all-fired important, Alex? Owey O More sounds like he's been scolded...'

'I've a threatening letter, Fin. And there's some technical stuff in it. Would you mind listening for a minute?'

'Get on with it... Doherty's voice had an echo quality suggesting a speaker phone...'

'Is there someone else with you?'

'No. What's got the wind up?'

Coleman sighed and returned his attention to the letter, extracting the technical references for Doherty.

'It's hard to say from just a letter,' Doherty said. 'But I find no fault with its references to the recombinant-DNA process. You know, Alex, it is possible that way to make new diseases... but this...'

'The threat could be real?'

'I'd give that a qualified yes...'

'Then I shouldn't disregard the thing?'

'I'd be calling the Garda...'

'Is there anything else I should be doing?'

'Well, I'll give that a think and be back to you as soon as possible...'

'One thing, Fin? Not a word on this until I've had a go at it...'

'Aw, you bloody newspaperman!' But there was a hint of laughter in Doherty's voice that Coleman found reassuring. A qualified yes. Doherty wasn't too worried then. It was still a good story though. Coleman thought as he replaced the telephone

in its cradle. A bomb victim's vengeance. Medical expert says the thing's possible.

Owey's voice came over the intercom. 'St. That bomb at Grafton and St. Stephen's Green. You remember that?'

'That bloody thing!'

'Sir, three of the victims had the names in the letter. There was a Mary O'Neil killed with her two children, Kevin and Mairead...'

'From America, yes, I remember...'

'The husband was at the window of a bank down the street and saw it all happen. Name of... Owey paused. Then: 'Doctor John Roe O'Neil...'

'Medical?'

'No, a professor of some sort. He was keen on one of those foundation grant things they're so fond of—studying the state of genetics or some... yes, that's what our story says: Genetics research...'

'Genetics?' Coleman mused.

'According to our story at the time, sir, the O'Neil had something to do with physical chemistry—a, biophysics—and he

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'Owey I'm almost afraid not to publish it. There's something about it. And angling out Achill this way... a demonstration...'

he says...'

'Sir, you've thought of the panic we might cause...'

'Just get me the Garda, Owey...'

'Right away, sir...'

Coleman picked up his phone and called his wife at home, making it brief and imperative.

'There's going to be trouble over a story we're about to publish,' he explained. 'I want you to take the boys and go to your brother's in Madrid...'

When she started to protest, he cut her off. 'This is going to be bad, I think. If you're here I'm vulnerable. Don't waste any time. Just leave. Call me from Madrid and I'll explain...'

He replaced the phone in its cradle, feeling somewhat foolish but relieved. Panic? If this thing proved to be true, there would be worse than panic. He stared at the letter, focusing on the signature.

'The Madman...'

Coleman shook his head slowly, recalling the tale of the Irish coast ship survivor who, making a cross of shovels over his wife's grave at Grosz Isle, Quebec, had vowed: 'By the Cross, Mary, I swear to avenge your death...'

O'Neil's wife had been named Mary. And now, if this was O'Neil, he called himself simply 'The Madman...'

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● *The letter was so damned direct, so clear and straightforward. A mind of power and, yes, terrifying purpose lay behind it. There was the usual warning to publish, but then* ●

taught at some school of pharmacy in the States. Says here he also owned a pharmacy there...'

Coleman suddenly shuddered. He felt that something evil had crawled beneath the surface of his land, a thing more venomous than any snake the sainted Patrick had banned. That IRA bomb could come to be known as the most awful mistake in human history.

'Any luck getting through to Achill?'

Coleman asked.

'The lines are jammed, sir. Should we dispatch an aircraft?'

'Not yet. Get on to the Garda. If the Achill phones are jammed, they may know something. Did you copy the letter?'

'Two copies, sir...'

'That is if they don't have one of their own already...'

'I thought of that. I just don't like tipping our hand. We may have a head start on this. Well, we'll just have to chance it. He glanced down at the letter on his desk. 'I don't suppose there's any chance of getting fingerprints off this anyway...'

'Are we going ahead with the story, sir?'

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was the reference to using stereoisomers in translating the RNA sequences in the protein molecules.

"Superimposition to determine the patterns."

Those were the Madman's words. Ruckerman suspected immediately that the man had used alkene polymerization for part of his breakdown series, conjugation, and resonance. Yes, the man implied as much.

"The letter shows a full understanding of purification and subunit composition techniques," he said to his wife who was reading over his shoulder. "He knows."

There was enough information to convince a knowledgeable reader. Ruckerman knew. This in itself said a great deal about the author.

There had to be more to it. Ruckerman knew. The Madman left short of revealing key facts. But he led up to those facts with chilling accuracy. That, coupled with the threat, stirred Ruckerman to action.

He thought carefully about how to handle this, then sent his wife to pack a suitcase, following her to the bedroom, where he placed a call to the President's science adviser Dr. James Ryan Saddle. Even then Ruckerman was forced to press his way through a barrier of secretaries.

"Tell him it's Will Ruckerman and it's extremely important."

"Could you tell me the nature of this important matter?" the secretary asked, her voice sweetly insistent.

Ruckerman took two deep breaths to calm himself, staring at his reflection in the bedroom mirror. There were new lines in his angular face and his hair definitely was going gray. His wife, Louise, looked up from the packing, but she didn't speak.

"Listen, whoever you are, Ruckerman said. "This is Doctor Ruckerman, past president of the American Association for the Advancement of Science, a close friend of Jim Saddle. I have important information that the President of the United States should know. If there is any need for you to know, I'm sure someone will tell you. Mean while you patch me through to Jim."

"May I have your telephone number, sir?" She was all business now. Ruckerman gave her the number and cradled the telephone receiver.

Louise asked, "Do you think that's a real threat?"

"I certainly do." He stood beside the bedroom phone and fapped his fingers on the dresser top. They were taking ungodly long about it.

The telephone rang. Saddle was at Camp David, a male reporter informed him. The science adviser's voice sounded just a bit sleepy. "Will? What's so damned important you have to—"

"I won't waste your time, Jim. I've received a letter that—"

From someone calling himself "The Madman?"

"That's right. And I—"

"The FBI's on it, Will. Just another crank—"

"Jim, I don't think you'd be advised to treat this as a crank letter. The postscript should convince us of—"

"What postscript?"

"The additional page in which he gives some of the details about—"

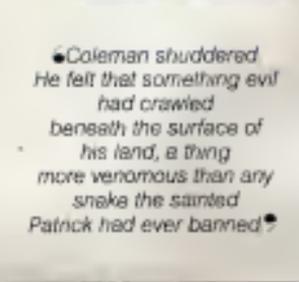
"There's no postscript on our letter. I'll have an agent come around to pick it up."

"Damn it, Jim! Will you listen to me? I've been partway down the path the guy describes. He's no amateur. Now I'm warning you to treat his threat as real. If I were in your shoes, I'd be counseling the President to take at least the first steps toward complying with—"

"Oh, come on, Will! Do you have any idea of the political implications? He wants a quarantine! Then he wants us to send all Loyans in the United States back to Loya, all Irish back to Ireland, all English back to England—everyone, including their diplomats. We can't just—"

"If we don't, he threatens to bring his country into—"

Ruckerman paused then.



●Coleman shuddered  
He felt that something evil  
had crawled  
beneath the surface of  
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snake the sainted  
Patrick had ever banned●

read from the letter. . . . the net of his ravings."

"I read that, and I don't give you one bit of credence to—"

"You aren't listening, Jim! I'm telling you it's possible to do what this guy threatens—"

"Are you serious?"

"I'm deadly serious."

The line went silent and Ruckerman could hear faint cross talk, the voices too low to make out the words. Saddle came back on. "Will, if it were anyone else telling me this, I mean, deadly new diseases to which there is no natural resistance and—"

"How the hell could he spread them?"

"I can think of a dozen easy ways without even straining my imagination."

"Damn it, Will! Now you're beginning to frighten me."

"Good. This letter scares the shit out of me."

"Will, I'll have to see that postscript before I can—"

"You won't act on my recommendation?"

"How can I be expected to go in to the President and—"

Jim: more important. The President should be briefed immediately. The al-

lected diplomats should be alerted. The military, the police in major cities, health officials, Civil Defense—"

"That might cause a panic."

"You have the main body of his letter. He says he's already loosed this thing. That means quarantine. Damn it, all he says it plan enough. Let it run its course where I have loosed it. Remember that I can announce malignancy whenever I choose if you attempt to sterilize the infected areas by atomic means. I shall give my revenge the open run of every land on the globe. Read that part again, Jim, and in the light of my warning, you tell me what you should be doing right now."

"Will, if you're wrong, do you have any idea what the repercussions—"

"And if you're wrong?"

"You're asking me to take a lot on faith."

"Damn it, Jim, you're a scientist. You should know by now that—"

"Then you tell me. Will, how a disease can be made sex-specific."

"Okay. At the present stage of my own project, which I'm convinced is far behind the Madman. Well, I believe diseases can be tailored to many genetic variations—to white skin, for example, to the susceptibility to sickle cell anemia."

But how could one person. . . . I mean think of the cost!"

"Peanuts. I've run a calculation on the required equipment—less than three hundred thousand dollars, including the computer. A basement lab somewhere. Ruckerman left silent."

Then Saddle said, "I'll want that list of equipment. The suppliers should be able to help."

"I'll read it off to you in a minute, but I think it'll be too late even if we can locate his lab in time."

"You really think—"

"I think he's done it. This letter, he lays out the essentials and there's not a mistake in it. I think Ireland, Great Britain, and Libya, and probably the rest of us, are in for one tumbler time. I don't see how we can totally contain such a thing. But for openness, we'd better act about quarantining those areas for our own safety if not for any other reasons."

"What other reasons?"

"This Madman is still running around loose. We don't want him mad at us."

"Will, he says he's not a human female. Will survive in those three ratons. I mean, really? How can—"

"I'll give you a more complete analysis later. Right now I'm begging you to take the necessary first steps. The President should be on that hot line to Moscow and to offer major capitals. He should—"

"Will, I believe I'd better send a plan for you. I don't want to take this to the President by myself. If we have to convince him, well, he knows your reputation, and if you can give—"

"Louise has already packed my bag, Jim, one of the first things to do is to get as many young women as possible into that—"

Denver hideaway that the military is so proud of. Women got that? And only enough men to run the technical end of a survival plan.

Ruckman let this sink in many women low men, just the opposite of what might occur outside such a sanctuary.

He continued: "The Russian leaders and other world leaders ought to be advised to take smirg action. That I go a long way toward convincing them of our sincerity. We don't want the Russians thinking this is some diabolical capitalist plot. God knows they're paranoid enough as it is."

I think we should leave high-level diplomatic decisions to the experts. Will you just get your ass back here with enough evidence to convince me you're right.

Ruckman replaced the phone in its cradle and looked across the room at his wife thoughtfully.

"He's going to wait for you," she said.

Ruckman slammed his fist against the dresser top, making the telephone bounce. "Louise, you take the car. Pack only necessities. Buy as much food as you can safely store, and get up to our place at Glen Elgin. Take the guns. I'll be in touch."

"We are to concentrate on how he spread the disease," William Beckett said. "They still haven't solved it."

It was the Team's third afternoon, and they had moved their meeting to the small dining room off the Denver Isolation Center's main cafeteria. It was closer to the lab facilities and had brighter walls and lighting and a smaller table. Coffee or tea could be delivered via a pass-through with a sliding panel from the kitchen. Security had objected, and there was a certain amount of crockery clatter to contend with, but the dining room was a more comfortable setting for all of them.

"I don't like boardrooms," Arlene Foss said.

"In the Soviet Union they are the same," Dorena Godelinsky agreed. "They are a place to be bored." In Russian, she added, "We call them fat bottom rooms."

Foss translated and noted: Sergej Lepikov's awe! He did not like Godelinsky's habit of belittling their superiors.

Is anyone asking does our Madman act alone? Just Hupp asked. He moved aside slightly as a white aproned waiter finished clearing away the dishes from their lunch.

"A conspiracy?" Lepikov asked. He looked at the departing waiter. "Are those waiters in your army, Bill?"

Foss answered: "It's our most carefully guarded secret. Sergej, two years of this duty and they're guaranteed to be insane killers."

Even Lepikov joined in the wry chuckle at Foss's wit.

Francis Dantas said: "Infected birds. We have the president of parrot fever. Could he have modified psittacosis?"

"Somehow that doesn't strike me as his style," Hupp said. "He's not taking us an easy trail to follow. No. He looked down

Photo: Bill Cobb/John Deere/Williams of The Sun-Gazette



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# Summer parties stir with



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*This white substance,  
a multiple-target drug, saves mice from certain death—and  
may prolong human life*

## **SUPERPOWDER**

BY ALBERT ROSENFELD

**T**he black mice in two cages, side by side, stir up memories of ancient fables. Those in one cage are sleek and healthy. Those in the other appear listless and older. Yet all the mice are the same age and the same breed, like siblings in a venerable morality tale about the rewards of good living and the wages of slothfulness.

In fact, the story of these mice is more dramatic than a fable. Both sets of mice

at Temple University's Fels Research Institute in Philadelphia, are in potentially grave danger. All have inherited susceptibility to a serious disease that causes their antibodies, meant to attack invading microorganisms, to kill their own blood cells instead. The fatter mice are developing anemia as a result of this genetic affliction. Chances are, they will die from it. The slim and healthy animals are protected by a white, powdery sub-

PHOTOGRAPH BY ANTHONY WOLFF

stance sprinkled liberally on their food. The substance, a hormone called DHEA, is prolonging their lives.

Medical researchers since Hippocrates have sought the magic bullet to cure all ills. No one is claiming that DHEA is it. But early returns from research suggest that this natural hormone, whose full name is dehydroepiandrosterone, may be able to hit multiple targets with a single shot.

Biochemist Arthur G. Schwartz, master of the Temple mice, points out that DHEA seems to counter obesity as well as to protect the lab animals from their genetic disease. The slender, scholarly scientist (shown, with one of his mice, in the photo on the previous page) is not given to overstatements. But Schwartz says the hormone might very well work on humans too. DHEA could also help combat diabetes, prevent cancer, and safeguard the cardiovascular system from heart attack or stroke, Schwartz says. It might even provide a frontline defense against aging.

Consider just one effect of DHEA. It inhibits the production or function of an enzyme called G-6-PD (glucose 6-phosphatase dehydrogenase), which is essential to the body's use of sugar. Any substance that can interfere with this metabolic "pathway" is bound to affect a number of the body's important functions, including cell division. It is not at all amazing that a G-6-PD inhibitor would have varied uses. Besides, DHEA influences other biochemical pathways that relate to such vital processes as fatty-acid metabolism and the making of DNA, the molecular basis of heredity. So versatility is built right into it.

The relative obscurity of DHEA outside the scientific community may seem strange in view of its abundance in our bodies. For example, it is something like 20 times as plentiful in our blood as the hormone cortisol—which, like DHEA, is made by the adrenal glands, two inch-wide glands one atop each kidney. And the population of DHEA molecules in the circulation on a given day may outnumber a thousandfold those of the sex hormones. Yet though most of us are familiar with all those estrogens and androgens despite their sparsely few of us have ever heard of DHEA.

The main problem has been to define DHEA's primary biological role. For a long time there was reluctance even to recognize it as a hormone. You still won't find unanimity on that score among endocrinologists," Schwartz says.

DHEA does not act like most hormones and is, in fact, hard to find stored in the adrenals themselves. It seems to be released into the bloodstream as soon as it is manufactured. Another source of confusion is that DHEA can act as a precursor (forerunner) of the sex hormones. Yet that could scarcely be its main purpose. Why would so much of it be needed to make such tiny quantities of estrogens and androgens? DHEA can also be a metabolite, a leftover product of other hormonal reactions, and some have speculated that

DHEA is merely a "waste stored" —a use well by product bound for excretion.

Indeed DHEA is secreted in quantity. Nevertheless, researchers have found it in the testis, the ovary, the placenta, the fetus and the lungs. And now the pioneering French investigator Evariste-Emile Baulieu of the University of Poitiers has extracted DHEA from the brains of rodents and primates—where, he believes, it is produced locally rather than imported from the adrenals. DHEA, he believes, can thus hardly be thought of as a mere waste product.

Rather, says biochemist Norman Applezweig, who runs his own New York oncology firm, "DHEA must have a role in the living system, one that has thus far eluded us." He suspects that DHEA will prove to be nothing less than a regulator of metabolism in health and disease. As he points out, DHEA has already been tried as therapy—mostly in Europe—for a variety of human diseases, among them prostatic osteoporosis (a disease in which

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• **Another curious piece to the puzzle in women with breast cancer as well as in women who were destined to develop breast cancer, DHEA was consistently below normal!** •

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bones lose their calcium), gout, depression, hypertension, diabetes, and the disorders of menopause. But the results were questioned, and in almost every case were attributed to the conversion of DHEA, somewhere in the body to male or female hormones. With new approaches to testing and new understanding of DHEA's mechanisms, however, Applezweig is convinced that it may well become the most important drug of its kind ever to be developed.

Most of the studies in this country have been carried out, so far, in animals. But clinicians who know of DHEA's potential—especially in breast cancer, obesity and diabetes—are itching to start human tests.

Spearheading the new investigative thrust is Arthur Schwartz's group at Temple. Like many research scientists, Schwartz was initially attracted by the mysteries surrounding DHEA. Why should the adrenals secrete the substance in such generous quantities? He was especially fascinated by studies carried out in the 1950s indicating that DHEA production reaches its peak at the age of about twenty-five, then declines steadily. Research by

Claude Migeon at Johns Hopkins, by birth-control-pill pioneer Gregory Pincus, and by a team of investigators in Japan shows that toward the end of life, DHEA levels have diminished to 5 percent of those peak values. Such a dramatic steady decline is unheard-of among such hormones. Why does DHEA decline?

There were other curious pieces to the puzzle. Schwartz was drawn to a series of articles that appeared in the 1970s, mostly in British medical journals, reporting the results of a still-ongoing investigation of breast cancer in women by scientists at London's Imperial Cancer Research Fund. What particularly caught Schwartz's eye in these studies headed by cancer specialist Richard D. Bulbrook was the fact that DHEA was consistently below normal in women with breast cancer as well as in women who were predestined to develop breast cancer.

One never knows, in studying cancer, what is cause and what is effect. People with cancer lack normal levels of immune protection, for instance, and this might simply be one of the side effects of the disease. But a growing number of researchers believe that an impaired immune system is one of the preconditions permitting cancer to develop. Could the same be true of DHEA? If its absence or scarcity invariably accompanies breast cancer, might its presence be protective or even therapeutic?

In the early 1970s Schwartz happened to be working with rat-liver cells in tissue culture. In this environment, the cells are easily rendered malignant by doing them with cancer-causing chemicals. He was looking for ways to prevent the transformation by protecting the cells with various steroid substances, members of a class of organic compounds, including various hormones. Why did Schwartz focus on steroids? "Well," Schwartz explains, "carcinogenic chemicals often look like steroids, structurally speaking. And in biochemistry there is a well-known phenomenon called competitive inhibition. Molecule A may cause a certain reaction. Molecule B, if it is sufficiently similar will compete successfully, even preferentially to react before A does. Thus, A will be inhibited from carrying out its intentions. For the reason, drug companies often look for a substance that is similar in structure. And that was my idea—to find a similar steroid that would competitively inhibit the carcinogen and leave the cells normal."

So when I saw Bulbrook's paper connecting DHEA with breast-cancer inhibition, I quickly got hold of some DHEA—for the wrong reason, as I now know. DHEA works not by competitive inhibition but by blocking G-6-PD [the enzyme that regulates sugar metabolism]. Nevertheless, it did work. With DHEA in the culture, the cells were protected. They didn't turn cancerous.

Schwartz soon moved from tissue cultures to animal cancer studies of his own. Continued on page 10

With NASA preparing to open up the space shuttle to passengers, it is not too soon to plan the

## FLIGHT OF THE STARS

Over ten years from now passengers will be fastening their seat belts for the most important flight in the history of space—the first blast-off of ordinary people to orbit.

Ever since the Sixties, says NASA's David Garrett, we have envisioned sending ordinary persons into space.

The first step toward this decades-old dream will soon come true. On the fifth flight of Columbia, scheduled for launch in November, the first mission specialists will ride into space. Trained to manage the equipment and resources that support the shuttle's mission payload, they will be the first American astronauts not chosen for their skill as pilots.

But the mission specialists will still be trained scientists. What of laymen? "Gosh," Garrett muses, "who would be the first nonastronauts to go?" To answer that question, Omni sent reporter Barbara Rowles to the Ames Research Center, in Mountain View, California, to consult with seven NASA scientists who are working to find the human qualities best suited to spaceflight.

Their efforts have already made a few criteria clear for the first flights. In zero-gravity men and women between forty and fifty years of age maintain blood circulation and pressure better than any other age group. The average body kept in good shape without overdoing it, retains the most balanced reserve capacities to cope with any failure in life-support systems—better even than the muscled physiques of fitness fanatics. And initially probably no one over 5'10" will go to space: shorter

people simply have more legroom on a flight.

Based on the insights of NASA's scientists and our own bases, Omni has developed the first-passenger list. We chose candidates not only for their physical qualifications but for their vision and intellectual range: their unique perceptions qualify them for the shuttle.

NASA rejected five popular nominees for a variety of reasons: Fariah Fairchild, a candidate for stewardess ("She has too many teeth to fit the bite plate worn during take-off to prevent bitten tongues and chipped teeth"); David Stockman ("He'd never even look out the window, just stay in his seat, trying to figure out how to cut the costs of the flight"); Barbara Walters ("She'd probably spend the whole trip trying to get an interview with the pilot"); Mikhail Baryshnikov (Those highly developed leg muscles would be the first to atrophy in zero-g); and Carl Sagin ("We'd like to save him for the first flight to Mars").

While two of those who made NASA/Omni's final list are female—Miss Peggy and J. R. Ewing—all other names on the following roster won serious approval from NASA scientists for future shuttle stardom.



MILES DAVIS

Since the early 1940s, when he first blew his trumpet through the hot improvisations of bebop, Miles Davis has moved through every decade at the forefront of musical innovation. In the late 1940s he created the rite of cool jazz; by the 1950s he evolved into the advanced harmonies of hard bop. His seminal album, *Bitches Brew*, in the 1960s heralded the electronic age of jazz rock.

"Can you just hear his sardonic, atavistic notes buzzing through the roman-to-stains of cosmic space?" sighs one of NASA's own music critics. "He would probably arrange the different movements to reflect the stages of orbit. It could become the galactic anthem of the high frontier."



PIERRE TRUDEAU

At thirty, the future Canadian prime minister toured the world with only a knapsack and motorbike to observe social and economic developments in 20 countries on four continents. His exploration inspired a social theory of government that still guides his administration.

"I think in their guts human beings like to have security," he once reflected, "but in their minds they are discoverers, adventurers."

Now Omni would like to send Trudeau on the ultimate adventure: NASA agrees. They've been staving a deal for some secret leader since the untimely death of President John F. Kennedy ("You wouldn't expect us to send up a guy like Reagan," one scientist says.) Trudeau seems to share Kennedy's wide-ranging vision. We're betting that his shuttle flight will move him to lead the cause of space here on Earth.



**J. R. EWING**

Week after week, since he first struck oil on TV's *Dallas*, the ruthless, cold-blooded and amoral J. R. Ewing has exploited the resources around him, both human and otherwise. With minimal deposits and other valuable assets to develop on the new frontier, NASA could hardly hope to find a more exploitative pioneer.

When J.R. (alias Larry Hagman) heard that he had been selected for the space shot, he phoned Ome to find out about the flight. "Is it dangerous?" he inquired. "I expect it to be dangerous. So I wouldn't go. But I don't want to give up that seat. I would send my little brother Bobby in my place. Who gives a shit what happens to Bobby?"



**SENATOR WILLIAM PROXMIRE**

As ranking Democrat on the Senate Appropriations Committee, Senator Proxmire has earned a reputation as NASA's most dangerous adversary. Sabotaging program after program, he has assessed space as "one of the biggest, most ridiculous examples of wasteful spending."

"Obviously, NASA scientists declare unanimously 'he is badly in need of an lightenment.'" But is he open-minded enough to grow from the experience of space-flight? "I doubt it," says one scientist. "He's too worried about getting the votes here on Earth."

We still think it's worth a try if only to show the senator the earth isn't fat.

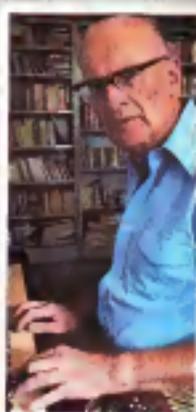


**MISS PIGGY**

Though she has done more to glamorize the female astronaut than any other rumpet in the known universe, one top-level NASA scientist still frowns on taking her aboard. Miss Piggy, he feels, is "too frivolous" to learn anything from the experience.

Space psychologists take issue with him. Who, but Miss Piggy, they ask, can reach 236 million children of all generations around the world with news of the new frontier? Who can bring more excitement and glamour to a shuttle flight?

"I'm not ashamed to admit it," the star of *Miss Piggy in Space* told Ome. "I am the greatest superstar on Earth."

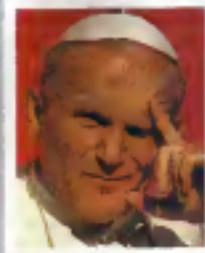


**ARTHUR C. CLARKE**

Four years ago, when NASA scientists tried to lure the famed science-fiction writer to the United States, he made them an offer they couldn't refuse. Clarke would leave his beloved home in Sri Lanka if they would reserve him a seat on the space shuttle. "I can't think of a single guy I'd rather send up there," said a NASA heavyweight.

In 1945, as a young Royal Air Force technician, Clarke wrote an article about future communications satellites so accurate that he could have used it as a patent application. "Can you imagine what actually getting him up there would produce?" enthused NASA. "He would probably come back and tell us everything that's going to happen in the next fifty years."

• If anyone can find humor in the stiff world of aerospace technology, points out one NASA scientist, Richard Pryor can. ■



**POPE JOHN PAUL ■**

"A few of us can go into the mountains and grasp cosmic truths," a NASA life scientist says. "but most of us need to get even farther from civilization before spiritual awakening can take place in space, when we glimpse the earth as a tiny fragile ball; we begin to know how small we really are in the scheme of the cosmos."

To carry the religious enlightenment of space back to the worldwide parish on Earth, Oms has chosen Pope John Paul. "I would like to take God's message everywhere," this humble priest turned world leader has proclaimed. It is a prayer that will be answered when he makes the first pilgrimage to the cathedral of space.



**GEORGE LUCAS**

Filmmaker George Lucas has the magic imagination of a Space Age Tolkien. His *Star Wars*, *The Empire Strikes Back*, and *Raiders of the Lost Ark* have done more to turn Earth audiences on to adventure than any other force outside the space program.

If he could turn out *Star Wars* inspired only by the comic books of his youth, imagine what the reality of weightlessness will do for his work. When notified of his selection for the shuttle trip, George Lucas stopped shooting. "Great!" he told Oms. "When do we leave?"



**RICHARD PRYOR**

"They needed him on Apollo 13," one space scientist reflects. "He could have turned the failure of that moon shot into an outrageous comedy spot."

For Richard Pryor, who two years ago ignited his own fiery blast-off into a near-fatal accident, space is the ultimate trip, an escape from racism, sexism and the autobiographical fragments that are the remnants of his bizarre view of life here on Earth. As a member of the shuttle crew, he'll loosen his seat belt and, forsaking all freebase, go after the ultimate high that nobody can furnish.

"Yes!" he answered instantly when Oms popped the question. "I would go 'cause I've never been there before."

Some NASA officials have sober reservations about Pryor's inclusion in the flight. "He's the kind of guy who sees a sign

that says 'Wet paint. Do not touch.' So he goes ahead and touches it. On board he'd most likely be the same way. If there's a button he's not supposed to push, you can be sure he's going to push it."

Others think the originality of Pryor's perceptions makes the risk well worth taking. "If anyone can find humor in the stiff world of aerospace technology, he can," one scientist votes with confidence. "NASA is going to be his best straight man."



**WALTER CRONKITE**

If NASA could select only one passenger to fly the *Orion* shuttle, it would be Walter Cronkite. To space scientists, he is the only journalist who has lived the space program.

Cronkite's age, sixty-two, worries some medical researchers. "His age group just did not do well in our studies," one comments. But they see no good competitors for his seat as the flight's journalist. "Mike Wallace would just try to figure out who was getting screwed. Jane Pauly would probably be too afraid to leave the ground."

Cronkite, they say, "is the only passenger who for all his commitment, idealism and dedication to the concept of space deserves to ride up front with the astronauts."



**KATE JACKSON**

On the criterion of achieve ment, she just doesn't measure up. Four seasons of reruns on *Charlie's Angels* just does not a great actress make. But a distill NASA researcher cites a quality that she believes more than qualifies Jackson for a seat on the shuttle. "She has the aura with which the contemporary woman can identify. We can relate to her."

Other actresses were considered. Jane Fonda (too headstrong and controversial), Meryl Streep (too intellectual and too into special), and Kate Jackson, the researcher summarized, "seems smart and level-headed, serious and earthy. She'd come back from space with a balanced perspective."



**GERARD K. O'NEILL**

"Some people just can't be left behind," console all the space scientists whom *Orion* approached. "Gerard O'Neill is one of them."

In 1969 the Princeton physics professor became convinced that the way to end overpopulation, pollution, and other earthly plagues was to colonize space. Since then he has worked tirelessly to make his vision a reality.

At fifty-five, O'Neill sadly admits that he may already be too old to adapt to permanent weightlessness aboard a space colony. About the closest he will get is a seat on the *Orion* shuttle. "That is," a NASA scientist smiles, "unless he becomes convinced that space is the perfect climate for old-age homes. The major problem in sending O'Neill up is that a space enthusiast like him may never come back."



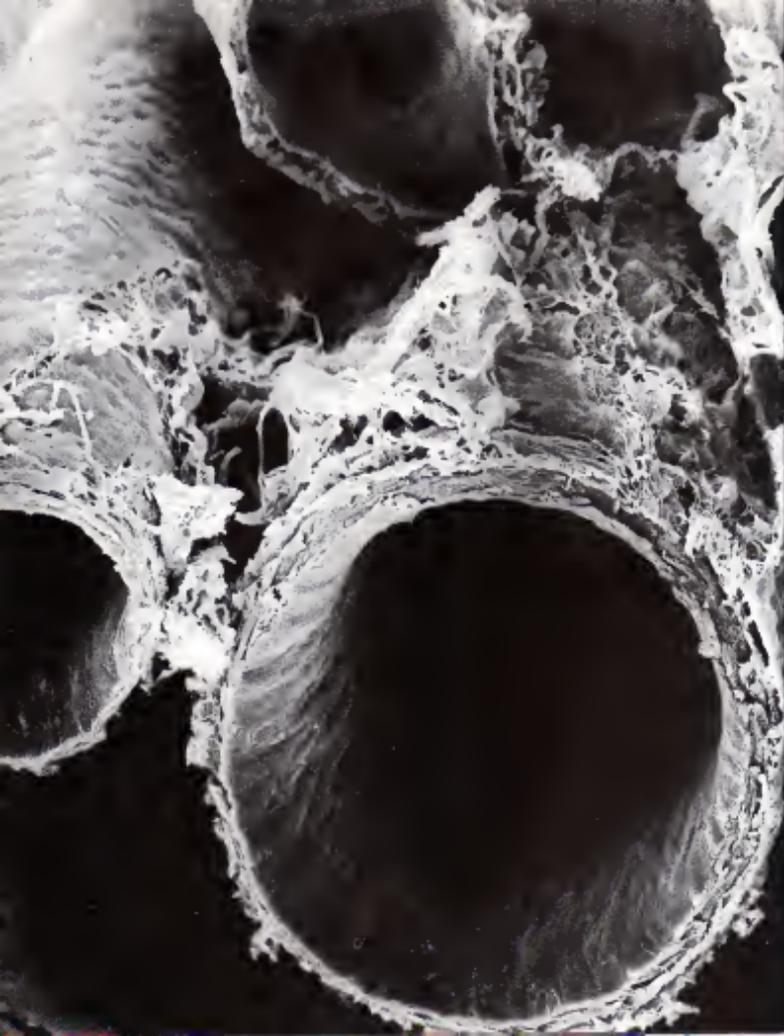
**DUDLEY MOORE**

At five feet two inches and 121 pounds, he is the lightest passenger to qualify for a seat. He doesn't pig, lift weights, or even belong to a health club.

"But that is exactly what makes him right for it," one of NASA's finest experts in condition but is not compulsive about it comes back in the best shape.

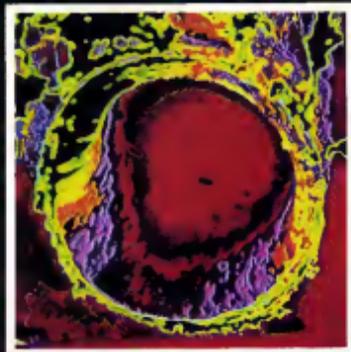
Besides, in zero gravity short people get taller. For a guy like Moore, one trip to space is worth two or three inches.

Moore himself was hesitant. "I have only experienced weightlessness in my life," he admits. "Then he rallies. 'But, given the opportunity, I would give weightlessness a shot.'"



*A simple innovation  
has illuminated the organ of intellect  
in its infinite complexity*

## LANDSCAPE OF THE MIND

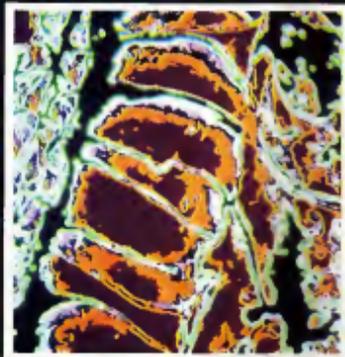


Marvel at the intricacy of a single brain cell, or wander, bacterium-like, through a forest of nerve cells that tower like redwoods. To penetrate inner space, embark on a left through an elegant system of conduits that supply the cerebral cortex with nutrients. The journey proceeds over the next pages to the spinal column and finally winds up at a chemical complex buried deep inside the brain itself. This artistic voyage to the center of consciousness has been made possible by the research of Dr. Armin B. Schohl and colleagues Ralfin Fried, Linda Paul, and Peter Dasing. Working at UCLA Med-

Left and above: A group of blood vessels situated in the depths of the cerebral hemisphere. Like pipelines in a refinery, they carry the raw materials that provide energy for other metabolites. Magnified 1,000 times.

BY KATHLEEN McAULIFFE

•The extraordinary depth of field creates the illusion that one has penetrated inner space •



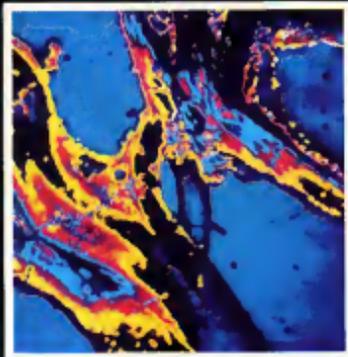
ical Center, they have pioneered a new technique that reveals the organs of intellect in vivid detail and with unrivaled depth of focus. Their unique black-and-white photographs (color enhanced in the smaller reproductions) represent a major advance in image processing. Less than a decade ago scientists had to use considerable guesswork to determine the overall structure of neurological tissues. Their magnifying tool was the transmission electron microscope, which could analyze only ultrathin cross sections. These slices had to be less than one three-hundredths the width of a blood capillary, otherwise the electron beam would not penetrate through the specimen to the photo plate on the other side. This end result was a flat, dimensionless shadowgraph, and thousands had to be stacked on top of one another before a single nerve cell body could

be seen in relief. A file of cells uses the omnivore cerebral canal that runs down the entire length of the spine (see p. 10). To the left of the canal are a single fiber of the spaghetti-like fibers and an amorphous tissue. Magnified 8,000 times.





•Brain tissue is tweezed apart along natural planes to expose its three-dimensional architecture •



be reconstructed. Then the scanning electron microscope came of age, allowing the examination of cross sections with greater thickness and depth. This is possible because electrons are not shot through the specimen but are bounced off its surface. The technique, roughly analogous to radar imaging, detects every bump and crevice in the molecular terrain. Only one problem remained: These vibrant contours were often blemished by artificial fracture lines inadvertently introduced during tissue preparation. It is here that the innovative thinking of the California researchers has transformed microscopy. Using a process called "creative tearing," they gently twist apart brain tissue along pre-determined planes. "It's as simple," Dr. Scheibel humbly acknowledges. "Yet for the first time we can make out the richly textured landscape of the brain." □

Left and above: A group of blood vessels in the subcortical nigra, where the neurochemical dopamine is produced. Damage to the area causes the tremors characteristic of Parkinson's disease. Magnified 7,200 times.



*If—or when—global war erupts, says England's military mastermind, it will happen not by grand design but by inadvertence, by accident—by chance*

## INTERVIEW

# GENERAL SIR JOHN HACKETT

**T**he military buildup of the Soviet Union and its satellites has caused the U.S./NATO strategists of modern war games to construct scenarios with very close finishes especially in conventional war between the USSR and the West. Since the 1970s, the gameplayers have relied on a single strategy for the defense of Europe against an onslaught by Soviet tanks—a thin line of conventional weapons and fighting men, backed up with the ultimate retaliatory force. In the games it has become increasingly obvious that the NATO forces facing a Soviet blitzkrieg-type sudden attack would collapse. The nuclear trump card would be the inevitable nightmare.

In 1979 General Sir John Hackett, together with several other top-ranking generals and advisers, published a chilling portrayal of a conventional war between the Soviet Union and the West. *The Third World War*, August 1985 became an international best-

seller. But its importance lay more in the fact that it had a clear—and audaciously nonochronous—message: Unless the West takes immediate action to build up its conventional forces, the next major war—when and if there is one—will have no clear winner. General Hackett is the best military strategist to come out and say that NATO's nuclear trump card is not only an obscenity, with obvious cataclysmic repercussions, but also strategically unnecessary. With a life-long-range planning, the Western nations could withstand any conventional machinery the Russians could throw at their borders. Although Hackett retired from his NATO post in 1968, with the publication of this book he reemerged as the man who initiated World War III. But he was not at all satisfied with ending it on page 360. He's written a sequel, *The Third World War: The Untold Story* (Macmillan) due out in September.

Both of Hackett's unusual literary efforts—part factual, part

PHOTOGRAPH BY ROBERT DOWLING

simulated "future" history—set up a briefing climate for global conflict. In the 1979 work Hackett uses the Soviet Union's historic fear of Germany to launch off the first battle on the East/West German border. He weaves together fake chronicles (such as one soldier's *A Chronicle on a Short, Hot War*, published in "1986") with filler satellite battles and historical events to create an ominous veneer. Yet the general himself cautioned that "we who have put this book together know very well that the only forecast that can be made with any confidence is that nothing will happen exactly as we have shown."

Nevertheless, since the book was first published, some events the author predicted have occurred. A conservative Republican president was elected in the United States (although ahead of schedule), and serious and chronic problems have beset Poland since the first shipyard strikes there. One can even find intonations of the Argentine prescription of a bloody dispute with Great Britain over the Falkland Islands.

In *The Unholy Story* Hackett uses the same scenario but he has added new perspectives. There is much more detail about the Soviet point of view, a Chinese invasion of Vietnam, an extraterrestrial battle involving the U.S. space shuttle and much newly declassified material.

Hackett, probably England's foremost soldier/scholar, was born in Australia in 1919. He might have become a professor of the humanities had not the imminence of Hitler's war drawn him into a cavalry regiment. World War I brought him three wounds and three decorations, the last of both when he commanded one of two parachute brigades at Arnhem, in the Netherlands, in 1944, where he was captured by the Germans. He later escaped with help from the Dutch Resistance. He topped his military career as commander in chief of NATO's British Army of the Rhine.

Hackett followed his withdrawal from the army (he never takes of retirement) with seven years as principal of Kings College, London. At that time he was also president of both the U.K. Classical and English associations. He now returns to Kings as a visiting professor of classics. An Arabist as well as a classicist who reads his Greek every morning without fail, he discussed his views on the world's present military plight and his fears of future warfare with *Omni* interviewer Robin Webster. They met at Hackett's ancient millhouse home in Coberley, Gloucestershire.

**Omni:** In your first book, subtitled August 1985, the Warsaw Pact forces did not reach as far as the Rhine and, therefore, did not manage to win the battle. There are suggestions, however, that, in an earlier draft, the Pact forces did get to the Rhine, and so the battle was won by the Eastern bloc. Hackett: Absolute nonsense. In the first version I had the invading Warsaw Pact forces reach the Rhine, the main objective

of such an invasion. Then a few years passed before the United States sent in troops to sort out the situation. However, as some West German friends of mine pointed out, if the Federal Republic [West Germany] were occupied and dismantled—which is what the Soviet Union aims at—the Atlantic Alliance could not survive. There would be nothing left for the United States to save, and so it probably wouldn't bother to send troops in. So, instead, I decided to write about a battle in which the Warsaw Pact forces didn't reach the Rhine. This, together with political events inside Russia itself, led to the war's ending with the West out in front, but only just. **Omni:** What do you think would be done with the United Kingdom in a Soviet-occupied Europe? Would it be viewed as some sort of offshore threat?

**Hackett:** Well, it depends on the attitude of the United States. If the United States withdraw across the Atlantic, the United Kingdom would be powerless and could prob-

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●*The Russians went into Afghanistan because Tito lived too long. But Russia bit off more than it could chew in Afghanistan, because the Afghans are very difficult to clobber.*●

---

ably be left alone. But if the United States showed an interest in a return to Europe, these islands would be suppressed very rapidly because otherwise they would provide a sort of bridge.

**Omni:** Let's assume that the Soviet forces do manage to reach the Rhine and thereby manage to make Europe a Communist stronghold. What do you think would happen to countries like Italy and France? Would they be treated differently because of their present political leanings? **Hackett:** I don't think so. The Russians have little interest in Euro Communism. In fact they regard it as a threat. Euro Communism in Italy and France would get pretty short shrift.

**Omni:** What did the Russians think of your first book?

**Hackett:** One of my friends, a Hungarian working in Britain, keeps me informed of what goes on in the USSR. He sends me excerpts from the Russian press and from other books. The impression one gets is that they hate it. They turned all the arguments upside down in their favor.

The real point is that the Russians are obsessed with the concept of national se-

curity. National security, to them, means a world in which it is safe, or possible, for a so-called Marxist-Leninist state to exist. And the only godlike bowl in which something of that sort can profitably swim is one in which there are no other hostile fish. National security for the Russians means more than survival. It means the setting up of a world in which there can be no threat. It doesn't mean that they won't rest until all capitalist countries are overthrown. That's the extreme projection of their world view. It simply means the establishment of a dominant position through which the opposition is offered a choice between compliance or nuclear suicide.

**Omni:** Do you see any circumstances in which the USSR would change its view?

**Hackett:** No. It is a fundamental position. The security of the nation-state as a basic tenet in Soviet state capitalism—what they call Soviet state communism. In this, they don't distinguish greatly between external threats and internal threats. So the internal security of the country is handled by agencies working in the very closest cooperation with the armed forces, because any threat, internal or external, has to be removed. The only thing that would cause a change would be the actual disintegration of the whole.

**Omni:** And this is what you prophesy?

**Hackett:** This is what I prophesy.

**Omni:** In his book *The Real War*, former President Richard Nixon attempts to support his belief that the Third World War has been under way for some time—behind the scenes, so to speak. I believe you disagree with the view.

**Hackett:** Yes, I do. I don't know how much of his book he wrote himself, but of course he's got it wrong. War is very clearly distinguishable from peace—constitutionally, legally, and traditionally. A good illustration of this was furnished when George Kennan was asked by a bunch of dowdy senators what the United States should have done when the American hostages were taken in Iran. The senators were expecting a lovely sort of answer, rapprochement, detente, that kind of thing. And Kennan replied that the United States should have declared war on Iran. "What?" they said. They nearly went through the roof; they couldn't believe their ears. But of course, as he went on to explain, what he had in mind was that you didn't have to fight Iran, however, a state of war and a state of peace are clearly defined. If you are in a state of war, your position is patently clear. You have the right, and the duty, to meet enemy nationals present in your country. You have the right to appropriate their assets without first passing a bill in Congress. And you have a lot of other rights, like stoppage of enemy vessels on the sea.

**Omni:** So you feel the American reaction was the wrong one?

**Hackett:** Well, I don't think the U.S. government was sufficiently imaginative to do that, and by the time President Carter had wept on enough shoulders and green

enough parents the chance to ask the Iranians to give their boys back. The moment was really lost and was never recoverable.

But let's come back to Naon's book. My point is that there has been no war of the type he describes.

**Orr:** Most people would make a distinction only between war and peace. But you appear to make a distinction among peace war, and the declaration of war.

**Hackett:** War can be started by declaration or it can be started by an open act of aggression, whatever that is. It can even be started when an ultimatum expires. But what has been happening between the U.S. and the USSR since 1950 is not war.

**Orr:** In that case how do you describe what has been taking place between the two superpowers?

**Hackett:** Well, it is the recognition on the Russian side that the United States threatens their national security, because the United States is unlikely ever to accept total compliance with Russia's requirements. And it is only in a world where you can count on compliance with your requirements that there is no threat to your national security.

If you draw a geophysical map and put Russia in the middle and see what is around it, and reflect that, from Western Europe they have been disastrously invaded four times in the last hundred seventy years, you realize that the Russians see a threat to the west, and always vague unrelle-

nant and possible turbulence to the south. In terms of ideology, you have the Soviet government's belief that it always has to extend its boundaries farther in order to provide a greater degree of national security. There can never be peace. The only solution is the overthrow of capitalism.

**Orr:** This is the basis on which you built up the scenario for *The Third World War*. Since writing the book, have you wanted to change anything significantly because of the Soviet invasion of Afghanistan?

**Hackett:** No. Anybody who thinks that the invasion of Afghanistan and the overthrow of the shah in Iran make a radical difference has really mistaken the whole drive of the book's argument. The argument is that, in a nuclear age, war by grand design is unthinkable. Nobody's such a fool as to go to war by grand design. Survival for everyone would be highly doubtful. What we are in danger of having is war by inadvertence, or by the coincidence of several miscalculations.

Instability caused by one international crisis, perhaps even a second, may be contained without too much trouble. But if you get a third and a fourth crisis, a situation might arise in which the world is in such a state of instability that a relatively small problem may tip us over the edge. Nobody wants that to happen. But it's like a ship in the shipyard waiting to be launched. The last chop comes and the whole ocean-going monster slides down

toward the water, inexorably, unstopably. And the people who planned, designed, and built it can now do nothing more to arrest its movement. This would be the Russian war machine.

**Orr:** Is this a good example of their military inflexibility?

**Hackett:** Yes. There are many types and levels of inflexibility in the Soviet system. But bearing this idea in mind of war by inadvertence and envisioning the Russian war machine's moving into action, the does not mean that the generals are in charge. They most certainly are not. The Politburo is in charge.

There is a biological or, if you like, a seismic, volcanic manifestation going on in Russia of something that has been built up—a land sea, and air fighting machine that is far greater than anything necessary for the actual physical defense of the country's frontiers or the frontiers of its allies. Everything has been subordinated to this. Their agriculture is a disaster. With all their land resources, they will starve unless they can export thirty million to forty million tons of grain a year from the despoiled and doomed capitalist West! The whole thing is a cosmic comedy of the highest order.

Now as to your question about what alternatives I would have made to the book if given the chance. Certainly not in terms of how things happen. There is only one prediction in the book. It reads: "We who put this book together know very well that the only forecast that can be made with any confidence about the outcome of another war, should there be one, is that nothing could happen exactly as we have shown here. There is the possibility that, unless the West does more in the next few years to improve its defenses, a war with the Warsaw Pact could end in early disaster."

**Orr:** Could you give an example of what you might call internationally important crises and how we might rate them?

**Hackett:** If you are looking for crises that might converge, a very important one is the interruption of the oil flow from the Persian Gulf. It doesn't matter how that happens, the interruption itself is the crisis. Then there are the mineral supplies from South Africa, which is a big bone of contention. A crisis there, and you are getting up to a nice low flashpoint. And then what does it want? Not much to set it off. The warning in my book is that unless our level of conventional preparedness is higher if the thing did develop into a shooting match by inadvertence, the West would face disaster.

**Orr:** Coming back to Afghanistan, what is the significance of the Soviet invasion there, and do you think the Red Army knew what kind of resistance it was going to find?

**Hackett:** First, let's deal with what the Afghanistan invasion has done. My answer is that it has postponed a critical stage in the future history of Yugoslavia. The trigger mechanism in *The Third World War* was Russia's acceptance of an "invitation" to move into Yugoslavia and stabilize a socialist state verging on anarchy. There was



"Just work with us, keep the sardines coming, and we'll see you get a nice government grant"

the clash with U.S. marines, and, from there everything went up in flames. Now the succession arrangements left by Marshal Tito are frail. They depend on a rotation that will need years to prove itself if it ever does. And in the absence of the one-man one-vote concept as a stabilizing force, who knows how the rotational system of leadership will work? So the situation is ripe for instability in a socialist state that in the interests of free people everywhere and the development of socialism for the welfare and peace of the world, demands the friendly intervention of Russia. This is the way the Russian argument would be put as it was in the case of Afghanistan.

However, the Russians went into Afghanistan because Tito lived on a bit too long, and things got worse in Afghanistan. Afghanistan has given Yugoslavia another lease on life, because the Russians now have to allow time for the post-Tito arrangements to fall before they can even pretend they're going in to stabilize the country. But Russia bit off more than it could chew in Afghanistan because the Afghans are very very difficult to conquer, and helicopter gunships aren't much help. What is more, tanks are not only no help they are an absolute liability. So while the Russians were able to make a big display of moving troops out of Afghanistan, all they were doing was moving out an armored division that was of no bloody use at all.

**Quesf:** In fact in your book, the greatest defense the NATO forces had in West Germany was the areas of rough terrain.  
**Hackett:** Absolutely right. You see the Red Army is highly organized and centralized to operate on sophisticated battlefields. They don't have rough-terrain soldiers. When you put them in the hills, where high technology is no good, they are no better than the Americans were in Iran. The sort of warfare they were waging in Afghanistan was against partisans in their native hills—rough guerrillas who didn't need sophisticated, who could do more with rocks than a trained soldier could do with a laser range-finder.

**Quesf:** You mentioned the unsuccessful U.S. rescue mission in Iran. Do you have any comments on the significance of that event?

**Hackett:** It certainly had a negative effect. It hardened Iran's resolve, it reduced U.S. stature in the Persian Gulf, and so reduced the American negotiating position. It made the United States a bit of a laughingstock and afforded the Iranians a gloriously makeable opportunity for a demonstration of faith and contempt. Had it been a success, of course, and had nothing worse happened after that Carter's selection would have been ensured.

**Quesf:** Were you surprised that the so-called revolution in Iran was religious?

**Hackett:** Not really. No. The re-Islamization, the reemergence of Islam, is rather like a worm eating its way out from a sort of pseudo-Western cocoon in which it had been wrapped for some time.

I had a party of vice-chancellors from

British universities around Iranian universities in 1973. At that time the universities were a good vantage point. One saw many indications of approaching instability. The examination period was approaching, and the alleged students had not done nearly enough work to justify passing. However, they were approaching their professors to say that they had to pass and that the exams had to be proctored at a level that would ensure that they could pass, and could they please have guarantees on that point? The corridors were filled with police. I'd never seen anything like it, professors walking with policemen alongside them in case a student tried to hit them with a bottle.

**Quesf:** I'd like to explore the idea of crisis points a little more. You indicated that Central America is a potential target for Russian infiltration. Do you still feel the same?  
**Hackett:** Well, I think that I would have had more money on it now. It should figure equally with southern Africa and the Horn of Africa. The areas are deadly unstable.

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and to be able to outflank North America from the south, and South America from the north is a very elegant performance.

**Quesf:** What about Poland as a flashpoint?

**Hackett:** I think the most significant thing about Poland is that it represents a crack a tiny little crack, in the Warsaw Pact structure—one that has never been there before. It is a crack that is spreading and that will have great significance in the future. In the book I prophesied that, with or without war, the Warsaw Pact will not survive the 1990s. I suppose that means there are two predictions in the book.

**Quesf:** The clampdown on the free trade union Solidarity, the arrest of its leaders and many of its supporters, and the imposition of martial law—what do you make of these actions by the Polish government?

**Hackett:** It is not enough, the incarceration of the leaders of Solidarity that has had a marked effect as the very, very far-reaching nature of the martial-law provisions. I was astonished when I went over to SHARPE [Supreme Headquarters Allied Powers Europe] and was given the exact details of what the clampdown involved. The degree of control, quite apart from the imprison-

ment of people is quite fantastic. The curfew provisions and the penalties for curfew breaking and the provisions against communication. You almost can't write a letter without authorization. You certainly can't use a telephone, and of course telegrams don't exist. Everything is closely monitored. Censorship is complete. Movement is only by permission.

**Quesf:** So the friendly gestures sometimes made to citizens by soldiers and policemen are just superficial gloss?

**Hackett:** Yes, it's fairly superficial. The grip is stronger than in any similar case I've seen, and I've seen curfews and martial law in many forms.

**Quesf:** Is it wrong, then, to think that Solidarity or something very much like Solidarity might reemerge?

**Hackett:** Well, no, it is bound to reemerge. A resurgent movement is an odds-on bet. It is a certainty, and the longer and more firmly the Polish government tries to bottle it up, the more violent it will become. That's one of the cracks we are talking about, because a free trade union is wholly unacceptable in a Marxist-Leninist system.

**Quesf:** So can we expect Poland to make the headlines again?

**Hackett:** Yes, it is only a question of when. I think it will happen slowly though. The military clampdown is not a resolution, but more a holding operation and, as such, is not too unsuccessful. But it's doing nothing to solve the real problems, like foreign debts. If Poland defaults on its huge indebtedness, scores of banks in the West are going to go out of business.

**Quesf:** What about the structure of the Soviet Union itself? Do you see any cracks appearing there?

**Hackett:** The dominant element is the host of enemies within the Soviet Union itself, the Baltic states, Lithuania, Latvia, Estonia. They are going to be important factors in the future. The Germans made the greatest mistake of the last war as they passed through the Ukraine on their way into the Soviet Union. The Ukrainians welcomed the Germans as liberators. And with supreme lack of imagination, the Germans treated them the same way their Russian masters had treated them. The Russians have themselves practiced genocide in an attempt to remove all Ukrainian leadership, to stamp out the Ukrainian language. They have killed fifteen million people so far, but there is still a very strong and free Ukrainian movement.

An element of disintegration exists also in the fact that, by 1990, there will be more Islamic subjects of the Soviet Union than non-Islamic subjects. All this sets up a situation of which the Kremlin is certainly aware and which I would say is not unrelated to the prolongation of the old guard. All these Politburo people are keenly aware, and they don't want things changed.

**Quesf:** You explore the Soviet Union's position in the Third World War in more detail in *The Third World War: The Unlived Story*. Can you tell me about the subject matter?

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**Hackett:** It has a scenario identical to that of my first book, but events are examined from many more angles. Nothing is really repeated from the first book, but there are no inaccuracies. It is really an amplification of the original scenario with a good deal of further input from new people: Vladimir Bukovsky, for example, the Russian dissident who was exchanged for the head of the Chilean Communist Party. He is a very well informed person. And Viktor Suvorov—that's not his real name—who was a Red Army officer for fifteen years. Suvorov commanded a motor rifle company during the invasion of Czechoslovakia. He is quite a lad. He has defected to the United Kingdom and is now under wraps over here, but I was allowed to speak with him for the book. He really helped in providing a lot of information from the Soviet point of view. He made me more aware of such things as the Soviet tendency toward centralism and the suspicion with which the KGB [the Soviet security police] and the party view the army. There is a singular tension there: the army is the only thing that could destroy the KGB or the party.

**Ovni:** So there is some kind of internal power struggle going on?

**Hackett:** Yes. You see, the CPSU [Communist Party of the Soviet Union] dominates the country and has only one thought, one objective—the retention of the dominant position of the CPSU.

Suvorov was a member of the party; he had to be if he was to be a Red Army officer. How do you become a member of the party? Well, you go through committee after committee and are examined at different party levels, and you have to satisfy the committees and the appropriate governors of your devotion to the party and prove that you have been working in its interests. So the whole business of electing a candidate to the party is a long, drawn-out, elaborate exercise in lassitude.

This is typical of the corruption of a deeply dishonest regime. Here's this contradiction of command and the party doesn't want to let the army off the hook; the KGB doesn't want to let the army off the hook. So there have to be a party man and a KGB man associated with every military commander the whole way down. As a result, the divisional commander knows beforehand that tomorrow's battle will be a total disaster, because the KGB man has insisted on one thing while the party man has insisted on something else.

But here's something quite interesting. When my friend Viktor was moving into Czechoslovakia, his rifle company was made up of a mixed collection of nationalists. None of them could speak Russian and they most certainly couldn't speak to one another.

There are two hundred languages spoken in the USSR and the minority lan-

guage of the whole lot is Russian! Fewer speak native Russian than speak the one hundred ninety-nine other languages.

So what, you may ask, keeps these men going in battle when they can't understand what a commander is saying to them? I'll tell you. Behind every regiment, there is a KGB damage battalion with instructions to shoot anybody coming back.

**Ovni:** What do you think NATO should do to be better prepared for a war with the Warsaw Pact forces? Does it need more weapons, or does it need better administrative systems?

**Hackett:** There are so many curative measures that NATO has spoken of for so long, but many of the problems still remain. Certainly, there should be a more thorough standardization of equipment, since the present incompatibilities run counter to national interests.

**Ovni:** This question may be too simplistic, but is nuclear war inevitable?

**Hackett:** No, no. I got buffed over the question, since I describe nuclear warfare as the ultimate obscenity. I once received a nude letter from a chap who asked, "How if you say this, can you possibly justify the possession of nuclear weapons and the express will to use them?" Of course, the simple and unwelcome fact is that, to avoid the ultimate obscenity to avoid nuclear warfare, we have to possess nuclear armaments. This is a very sad thing. You

cannot wash away nuclear weapons, and you will not render these use less likely by depriving yourself of the possibility of using them.

**Qerr:** The actual hardware involved in fighting a war seems to be getting more and more sophisticated, and the introduction of local "intelligence" into weapons through the use of microprocessor technology has accelerated the process still further. Did you take such developments into account while writing your first book?  
**Hackett:** Yes. That is one reason the book is set in 1985. One could not project further than that. Neither I nor any of my friends advisors and coworkers wished to engage in writing science fiction. Indeed, I wouldn't have accepted anything of the sort. In the new book, however, I have included an actual weapons chapter. I've taken the greatest care with it—so much so, in fact, that I had it very carefully rechecked for me by my friends in NATO.

**Qerr:** NATO could soon be using a tank called the MBT-X1. How do you rate it?

**Hackett:** It will be in service in two years, is equipped for chemical/biological warfare, and is better than anything the Russians have.

**Qerr:** There has been much talk of particle-beam weapons and other highly advanced battlefield devices. How do you think the deployment of such weapons will affect the skills required of commanding personnel? Will they, in fact, need only new skills?

**Hackett:** Some commanders will deal better than other commanders with the new weapons. If you want an example of how wrong somebody can be, you need go back only to World War One, when a certain commander said that the military value of aircraft was nil.

One of the great weaknesses of American military technique is a tendency to rely on machines to do the work, plus the idea that if you can name the problem, you have solved it. In the last resort, the important decisions are always made intuitively. They are always the product of a preformed mind given a small fraction of evidence—only such evidence as would justify a scientist's saying "Nothing less than splendid judgment is acceptable here." The general has to do something, you see. He can't wait for all the evidence. He has to act on the information he has and it is never conclusive. All that data processing, advanced intelligence techniques, and accumulation and interpretation of evidence can do is reduce some of the vague areas within which an intuitive decision is valid.

You have to recognize what is random and what is important, and they could be the same thing. For example, the head of the British Services Liaison Mission in Washington headed a war game at the end of which he asked a man in a white coat how many men on the red side had run away. The man in the white coat was astonished at such a simple question and replied "None." He was then asked how

many men on the blue side had run away. "None," came the reply. In that case, my friend said, you can scrap any conclusion you come to. The issue of any battle is determined by how many more people run away on one side than on the other side, and by nothing else. Hardware is essential, but it is not the final argument.

**Qerr:** I fear that there is a gap in the West between military might in terms of technology and the people behind that technology who are deciding how to use it. Would you agree with this?

**Hackett:** The difference between the use of military hardware, let's say, and the design and development of military hardware is the difference between the practice of art and the practice of science. The behavior of a general is very similar to the behavior of an artist. What he has to do is induce to a condition of order—an order of his own choosing—the mass of material presented to him either in a state of disorder or in an order not of his choosing.

---

● *The difference  
between the use of military  
hardware and the  
development of military  
hardware is the  
difference between the  
practice of art  
and the practice of science* ●

---

**Qerr:** I suspect that, since the single soldier is being given far more firepower, so to speak, and is being asked to make many more important decisions in isolation from other command groups, he will require new skills, too. Further, I suspect that this is affecting soldiers mainly in the West.

**Hackett:** Yes, I believe you are right. This is one area in which I think the West is far superior to the Russians, and always will be. The Russian warfighting method now consists more and more of deep penetration—of deep thrusts, mobile action, the exploitation of great speed. This is a method that makes greater and greater demands on the independent initiative of lower commanders, and the Red Army is not the place where you would expect to find the kind of thing to be cultivated. The monolithic system with all control at the top, is totally antagonistic to junior initiatives.

It merely follows from what you have said that the devolution of authority upon small groups at lower levels is a function of higher and more dispersed firepower. One soldier with Redeyes heat-seeking missiles, or any other light aircraft type of weapon, is deadly. That, of course, you get standoff

tactics, with weapons capable of being fired from very long distances away.

There is one very important point to realize concerning the devolution of command onto smaller groups. It may be temporary, but, owing to the inaccessibility of Congress in respect to personnel support, pay and allowances, the U.S. armed forces are taking in a higher and higher proportion of Category Four personnel, who have no better than a fifth-grade education and who are only marginally trainable. These are the chaps who will be in that small group or by themselves with a highly sophisticated surface-to-air missile and who will be expected to knock out a little airplane six miles off, which is otherwise going to attack your tanks with depleted uranium bullets. According to Parameters, the journal of the U.S. Army, fifteen to twenty percent of the intake is now Category Four. A healthy army can put up with one percent. The forecast is that within a year or two unless things get better, forty to forty-five percent of the Army's manpower will be drawn from that group.

**Qerr:** One scenario in which the single soldier may have enormous responsibility is if all his communications options are jammed or destroyed by the attacker. Russia seems to be putting a lot of energy into developing killer satellites that could knock out a large number of Western communications satellites. How do you rate these weapons?

**Hackett:** Oh, very highly indeed. This is the assumption of a program that they appeared to have discontinued in the early Seventies, but it has been resumed recently as a result of some pressure.

The United States has navied and proceaded with studies in this area, but I will say no more than that the Americans haven't lost sight of the possibility.

**Qerr:** War by inadvertence could almost have occurred on two occasions in 1980, both times when the U.S. Air Force early-warning computer network issued false nuclear-attack alerts. The computers involved in the network are known to be old, but the quality of personnel running the network has also been criticized. Were you concerned by the alerts?

**Hackett:** If people only draw the right conclusions from this, they would get a lot of comfort from it. How many missiles were fired during those alerts? None. What you have discovered is a real failure system in operation. The mistake was picked up in sufficient time to prevent any missiles from being launched.

**Qerr:** But surely the error should not have occurred at all?

**Hackett:** Of course it shouldn't have happened. But in any man-made system errors will happen. Those two episodes should be cause for satisfaction. In a time of war, every effort will be made to cause a breakdown in your systems. The discovery of the breakdown before a fatal and irreversible conclusion has been drawn from the evidence is a comfort. □

A large reptile of the late  
Cretaceous Period  
A herbivorous quadruped,  
a horned dinosaur

## TRICERATOPS

BY KONO TENSEI

The father and son were  
returning from cycling  
They had set out together on a  
Sunday of disappearing autumn  
heading for the cycling course along  
the river. On the way back they  
had been forced to burrow through  
the exhaust and dust of the national  
highway before finally reaching  
the residential area a mile from  
home. Their house lay beyond the  
slightly aging neighborhood on  
the other side of the small hill  
in the new subdivision.  
It was only a little past seven, but  
the autumn sun was sinking quickly  
and darkness had begun  
to gather about them.  
The father and son stopped their  
bikes beneath the yellow light of  
the streetlamps and breathed

the cool air in deeply.  
"Are you okay, Dad?"  
My knees are ready to fall apart.  
Let me rest a minute.  
"I don't feel a thing."  
I guess you wouldn't, said the  
father. He smiled wryly as  
he lit a cigarette.  
Somebody's making out!" his  
son cried suddenly. "I'm starving  
to death. Can't we go now? It's just  
a little bit further."

I guess so.  
The father crushed out the  
cigarette with the tip of his shoe  
and put his hands back  
on the black handlebars.  
It was at the instant the father  
and son had put one foot to the  
pedals, at the instant they were  
looking down the road ahead of



English translation by David Lewis

PAINTING BY  
CHARLES R. KNIGHT

them, were beginning to gather momentum, a huge shadow darted across the intersection no more than five or six meters away shaking the very earth as it passed.

It had the feeling of mass, of power, of a bulldozer of a ten-ton truck.

Though its passage took but an instant it indelibly burned on their eyes an image of thick, clearly animal skin an almost slimy sheen the quaver of fish and muscle.

Hands still tightly gripping the handlebars, the father and son lowered their feet from the pedals and stared.

Thick dust swirled beneath the streetlamps. The tremors gradually subsided.

It seemed a subterranean rumbling still growled about them.

Then, quite abruptly, even that rumbling stopped.

It stopped with a slightly unnatural air, almost as though a tape recording had been suddenly switched off, but in any case it had ceased, and their surroundings filled again with crying babies, the smell of dinner cooking, raucous TV commercials.

Shall we ?  
The father asked with his eyes, and his son nodded.

They stopped their bikes at the intersection and looked ahead.

A scattering of streetlamps threw down hazy light. Traces of gas and watermain work were everywhere around them. The road stretched on with its spitting asphalt, returned to silence.

"Where'd it go?" the son asked.

Ash.  
The father shook his head.  
The two of them were silent for a while.  
"Dad, what do you think it was?"  
I don't know."

"I almost thought it was a rhinoceros. It was too big to be a cow. It looked seven or eight meters long. And if my eyes weren't fooling me, it was twice as high as the fence. That would make it three meters, uh-uh, even taller."

"Aahh," said the father again. "I guess a rhino might get loose from the zoo sometimes. It's not impossible. But didn't you see two horns on that thing's head?"

"Horns? Yeah, it did look like two horns."  
"So it couldn't be a rhinoceros."  
"So it was a cow after all? A bull?"  
"It must be. You don't see many of them anymore, but it's my guess a bull got loose from some farm or pasture near here."

"Yeah."  
"Well, if it keeps on like that, there's going to be one whale of an accident when it meets a truck."

"Yeah."  
The father and son looked back down the road. They listened. But aside from the cheerful night noises with their tales of domestic peace and tranquility, there were no hints of anything amiss in the town.

Almost as though it never happened.

The father shook his head.

*I'd been alone, I'd have thought I was hallucinating.*

After a long while the father and son

pedaled silently and hurried along the road home. The street began its gradual ascent and they stopped several times to rest.

The town spread out behind them. They turned and looked back, but there were no signs of anything unusual, no accusing shadows, and nowhere a trembling of the earth, a rising plume of dust.

"Dad, did you see the tail?" the son asked suddenly.

"Mmmm, what about it?"

"Didn't you see it? A supernatural tail?"  
The father and son reached the crest of the hill and passed through the last sparse copse of trees.

Suddenly their own subdivision lay before them.

The lights were on in all the new houses of the new town, but somehow—perhaps because of the sharp glare of the scattered mercury-vapor lamps—the homes seemed to hunch stockily against the earth.

The mother had dinner ready for them.  
"Oh, come on now. Was it really that big?"

---

*•The head was  
fully a third the size of  
the body, resembling  
a buffalo's. Two long horns  
jutted out  
like spears. It was like  
no other  
animal he had ever seen. •*

---

Chopsticks in midair, the mother eyed the father and son across the dinner table.  
"It was! It was so big I thought it was a rhino."

"Well, it's terrible if it's true. The whole town must be in an uproar."

Actually there wasn't any at all. Even the running noise stopped, just like that.  
"That's right. It stopped like we'd never heard a thing."

"But that's impossible. Oh, I see now. That's why you two were so interested in the news all of a sudden. And did they say anything about it on the news?"

"Not a thing. But it may be too early too soon for it to get on the news."

Boy, it's gotta get on the news! Look: it's seven, eight meters long for sure, and at least three meters high.

"I think you're just exaggerating. Really, have you ever seen or even heard of a cow that big? This isn't a joke, is it? You're not playing games with me?"

We are not. Anyway, we sit it for sure. Didn't we, Dad?"

"Absolutely! If that was a cow, it'd be a cinch there'd be steaks for five hundred people or more."

"Oh, stop it this instant! You are joking."

The mother laughed shrilly, and the father and son looked at each other, their expressions strangely vague.

After a while the father also laughed, dryly, shortly.

"Well, it hardly matters. There was a little earthquake, then that weird zapping by. So we got a good shock out of it. Maybe the shadows threw us off, made it look bigger than it was. All that's really certain is that it wasn't a dog or a pig or some animal like that, but a really big beast, right?"

"Yeah." The son nodded, still not quite satisfied, and began to work his chopsticks.

A variety show was on the television screen. A skimpily clad Eurasian girl was weaving her arms and legs as she sang, almost howled, in a strange strained voice. The wife laughed shrilly again.

"What is it?"  
"The singer, she just blew her nose!"  
"Her nose?"

"Oh, come on! You were just telling me about it yesterday, weren't you? You said this girl sometimes blows her nose when she's straining too hard. I thought I'd never heard anything so stupid in my life, but really just now she blew her nose. Oh, it's too funny!"

The mother rolled with laughter again.  
The father and son smiled tightly and lowered their eyes.

The father stayed up nearly half that night, drinking. His wife and son had gone to bed, but he somehow unable to sleep, rose and, putting his legs up to the electric heater in the living room, propped himself up on one arm and began to drink leisurely away at the whiskey he poured little by little into his glass. The last news of the day started on the television, left on since early evening, but as expected, there was no mention of the shadow they had seen.

Were we really just seeing things?

The alcohol seeped through every cell in his aching muscles, slowly tanning his exhausted body like leather. At least that was how it felt to the father as he continued to watch the sniffling screen.

At some point he dozed off.

Someone was blowing his nose. Gradually the noise grew louder, increasing in violence until it sounded like bellows. This is no joke. No snorer going to blow his nose like that. This is one heck of a dream. Half-asleep, half-awake, his mind unaccountably.

Eventually the noise was joined by a low moan, shameless and huge, as though echoing from inside a mammoth cave. No way. This isn't that singer's voice. What's going on?

His eyes snapped open.  
A snore.  
A nose like a bellows.  
And the sounds continued.

He looked at the television set. The station was already off the air, and the screen held a sandstorm of crackling light. He turned it off and listened.

The noise was coming from outside.  
The father peered through a crack in the  
curtains.

Scraggly potted plants filled the little  
garden, no longer than a child's hand, but  
beyond the hedge loomed a huge black  
shadow, with an eye that glistened pero-  
ngly in the dark.

It did look a little like a rhinoceros.

But the horn on its nose was even sharper  
than a rhino's, and beneath it the mouth  
curved like a raptor's beak, and from that  
mouth puffed violent white breath like a  
steam locomotive.

The head was fully a third the size of the  
body, resembling a buffalo's. Two long  
horns jutted out like spears, but the turned  
up, hairless shield between the head and  
abdomen was like that of no other animal  
he had ever seen.

A door opened.

The father turned to find his son stand-  
ing in the room. The boy had pulled his  
trousers on over his pajamas, and he looked  
soberly at his father as he pushed one arm  
into his sweater.

"Is it there?" the son asked in a low voice.

"Yes."

The father jerked his jaw in the direction  
of the shadow outside.

The mammoth animal scratched the  
fence twice, three times with the tips of its  
horns, then slowly swung its side toward  
them. It began to walk. Like a heavy tank  
moving out for a night battle.

The dark brown back, the hips, the thick,  
heavy tail like a goat's lizard's trailing down  
from those hips, all these passed slowly  
through their field of vision. The quiver of  
muscle beneath thick skin.

"That's not a cow or rhino," said the son,  
his voice choking in his throat.

"It seems to be a dinosaur. That's all I  
can think of."

"It is really a dinosaur, then I've seen it  
in my books. It's a famous one: Not Alos-  
saurus, not Stegosaurus—"

"This one's back is pointed, but its teeth  
don't look like much."

"It has a mouth like a beak?"

"That's right."

"Then it's Triceratops! Isn't that right, Dad?  
Triceratops. It means the three-horned di-  
nosaur. The nose horn and two on its fore-  
head that makes three, right?"

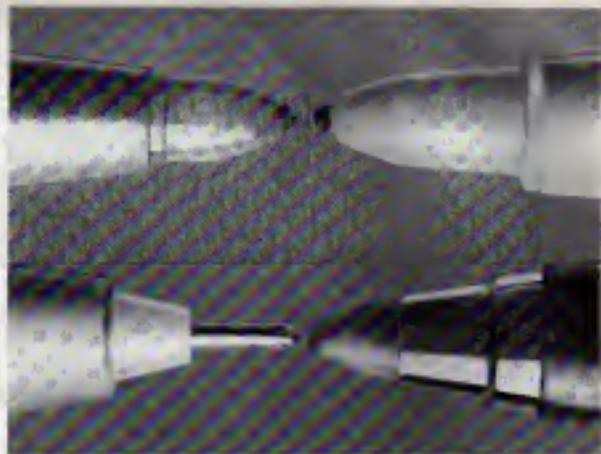
"Then that's it, Triceratops!"

Triceratops, living and fighting and fight-  
ing again in an endless struggle for sur-  
vival in the late Cretaceous, Mesozoic world  
seventy million years before dawn of  
history's most savage beast, the carniv-  
orous monster Tyrannosaurus rex. Tricer-  
atops, that massive herbivore, possessing  
the most powerful armament of any animal  
ever known. Triceratops, that Triceratops  
was even now walking leisurely down the  
road before their very eyes.

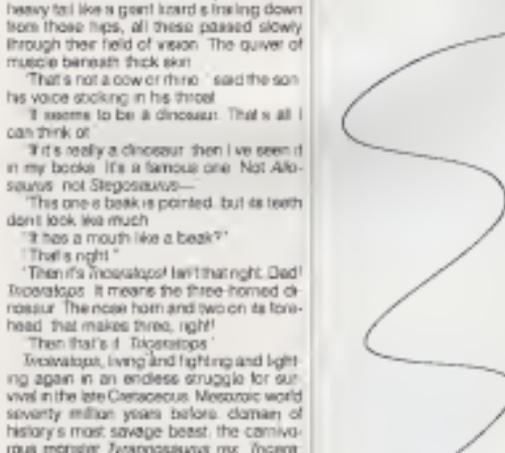
"Shall we go outside?"

"Sure!"

Father and son slipped through the en-  
trance door of their home. It was chilly out-  
side, but there was no wind.



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Ten meters away the small mountains of Inceratops's hips awaited steadily forward, dragging a tail like a telephone pole. They couldn't see the beast's face beyond the expansive sweep of the shield. But from Inceratops's posture they could well imagine its cautious agniance, front legs crouched head lowered, body in readiness for the slightest sign of danger.

At last Inceratops reached the end of the street. Before it stood a stone fence and to the left and right walls of brick and stone. He'll head back the way.

Father and son drew back between the gateposts, but in the next instant they stopped, rooted speechless in their tracks.

Inceratops did not stop. It put its head up against the stone wall and sank smoothly into the hard surface. The shield vanished above them and the slice of backbone above them vanished. The hips and hind legs vanished. The tail from base to tip, inch by steady inch, simply disappeared.

Morning came, and the father, setting off to work, and the son, setting off for school, both left the house at the same time.

The father and son exchanged glance and walked to the stone fence at the end of the road. The wall stood solidly, blocking their way.

They fingered it, but found nothing unusual.

Nor was there a single break in the mortar-painted sides, the window glass of the house beyond the wall.

I've read about dimensional faults and stuff like that, the son said.

Mmmm. But those are all just theories? Theories?

When you say that something you can't prove might be this way or that way, that's a theory.

So there aren't any dimensional faults?

Well, someone just thought them up. They might really exist, and they might not.

If you figure they exist, then the surface of the wall must be right about the fault line. Between our world and the world of Inceratops, twenty million years ago. But really you can't try explaining it just about any way you please.

For instance?

For instance, you could think that our world and Inceratops's world exist simultaneously. Instead of pepping in and out of a fault line every now and then, we're really both here all the time with just a bit of a lag in between. That would explain why we can somehow look through into that other world, and they can look through to us. It'd be just that line a difference.

Huh?

I started thinking about it when there was a thick, warm animal smell in the house this morning. And this isn't the first time you know. It's been like this for at least two or three months now. The people living here must be experiencing the same thing.

Inceratops went inside their house?

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# Safe Harbour

"Maybe. But you know how people's heads are. We try to deny things that we think are impossible. It's a kind of protective instinct. So even if we somehow do see it, or feel it, we usually just shut it out automatically, choose not to see it, not to do it. If we see it again, two, three times maybe then common sense comes to the rescue and we laugh it off. Nerves. 'Boy, what a crazy idea!' And that's the end of it."

"And if it still doesn't stop?"

"Then people stop accepting you. You can't live a productive social life anymore."

The boy shook his head lightly from side to side, then laughed.

"What is so funny?"

"Nothing much. I was just thinking about Mom. I didn't tell her what I saw last night. Can you guess what would happen to me if I did?"

The father laughed, too.

Well, she'd sure put you on the rack. There is, if it wasn't right after she'd just seen the same thing herself!

"I guess I can't tell any of my friends about it, either."

"Of course not. Now let's get going. We can talk it over when we get home."

The father and son started walking.

Occasionally speaking and laughing happily together.

And every time they met a neighbor.

"Good morning!"

"Good morning!"

Scattering high-spirited greetings all about them.

The father and son often saw dinosaurs after that.

Sometimes glancing up at the wheel they'd glimpse the shadow of a huge winged creature like Pteranodon weaving across the sky. But the only earth-hugging dinosaurs they saw were triceratopses.

Apparently the local habitat was best suited to Triceratops. The beast asleep in the garage, its head so perfectly aligned with the family car that it seemed a strange horned automobile was snoring humorously away the huge dinosaur passing over the head of a small child crying helpfully by the roadside; all these apparitions were triceratopses.

Sometimes the father and son would even see them—though only transparently—walking the sunbathed road in full daylight.

Not was it only what they could see. The drying animal smelt, the low grunting. Running monstrosity to the station on ice-streached frigid mornings as they gasped and choked on impossible flower pollen. Listening to the distant bassoonlike cries of a female triceratops in heat howling through the long night.

You and your dad seem awfully close those days. Anything special going on?

There were days when his mother would badger him, but the son simply grinned.

"Nothing special." was all he'd say.

It was on one of those days, yet another Sunday evening when they had gone cycling about the neighborhood, though not



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to promote stories about aliens  
chasing cars and  
borng holes through windows•

## ANTI-MATTER

A giant red crescent surrounded by swirling gas clouds zoomed over central Russia just before midnight on June 14, 1980. Called the most widely witnessed UFO in history, it sent tens of thousands of citizens running through the streets in fear of a nuclear attack. When any bombs failed to fall, Russians started whispering about hemeroids on the streets of Moscow, wild sex bums, and mysterious holes drilled right through apartment windows.

When news of the UFO (pictured at right) finally reached the United States, last August, I read about it in the pages of the *National Enquirer*. I puzzled over the strange object's origin for a while, then recalled tales of an equally bizarre object that had flashed through the skies of Chile, Argentina, Brazil, and Uruguay, also in June 1980. Checking my files, I found that the South American UFO—a fast-moving white halo bigger than the moon—had also made its appearance on June 14, a mere hour after the Soviet sighting.

I'd learned enough about orbital flight from my years at NASA to know that the two sightings, though different in appearance, might be due to a single satellite launched from Earth. But I had to prove it, and I thought I could do just that with data generated by Air Force radars that regularly scan satellite paths worldwide.

By early September I'd written to the Goddard Space Flight Center in Green Belt, Maryland, asking for information about every satellite that had left the earth within a week of the sightings. I'd also sent photos of the Soviet



## UFO UPDATE

and South American UFOs to computer expert Robert Shaffer. Shaffer would analyze the photos to calculate the trajectory of the objects passing through the sky. When both sets of information arrived, I would see whether I could match the UFOs with a particular vehicle.

All the data came by late March, and this April I shouted "Eureka!" The reports were embellished by a satellite—a Missile Early Warning satellite launched from the supersecret Northern Cosmodrome space center near the Soviet city of Plesetsk.

The launch was complex, but its unique characteristics could account for the sightings. At liftoff, about 11:55 p.m. Moscow time, 30 engines spewed a crescent of smoke into the skies. As the rocket headed east, the ruddy mid-night sun lit the smoke plumes in a dazzling array. An hour later, just as the satellite was passing Argentina, its final stage fired, pushing the payload into space and dumping leftover fuel. That fuel formed a temporary cloud, or halo, illuminated by the evening sun.

I've recently led two other South American "hunts" to Cosmodrome satellites launched on February 1, 1980 and October 31, 1981. Satellites from the Northern Cosmodrome, it seems, can account for UFO sightings around the world. The KGB, eager to muddy the water and cover up public recognition of the military space center at Plesetsk, is only too happy to promote scintillating stories about aliens chasing cars and borng nasty holes through windows.—JAMES OBERG

## PSYCHIC SLEUTHS

The massive hunt for missing American Gen. James Dozier deployed 6,000 Italian lawmen. But Pentagon officials in Washington allegedly conducted a separate search with the help of clairvoyants who "saw" the general in a riverside farmhouse near Verona. The psychics ended their search this February when normal police methods succeeded in finding Dozier from terrorists in Padua.

Psychics have aided the CIA, the FBI, and various police forces for more than 30 years, and despite their failure in the Dozier case acceptance of their work is widespread. Police Chief magazine, for instance, instructs its readers to place psychics "among the arsenal of investigative tools. And" according to a survey conducted by the California Justice Department, police

believe psychics could locate a missing person.

Yet some say these beliefs represent a turn toward irrationality. Experiments conducted by the Los Angeles Police Department indicate that psychics provide useless information. And a recent investigation by Dutch journalist Piet Heen Hoebens discredits psychic super sleuth Peter Hurkos, who supposedly aided in catching dozens of brutal killers.

In the end it may be impossible to prove or disprove the validity of psychic sleuthing. Witness the case of Dorothy Allison (shown in the picture below), who said she supplied police with the name of Wayne Williams, convicted in the well-known Atlanta murders three years before he was arrested. Yet Atlanta Police Chief George Napper says that just isn't so.

—Marcello Truzzi



## WHO WROTE GENESIS?

Theologians don't believe God's hand in the grand design of the universe, but they have often debated whether Genesis, the first book of the Old Testament, was the handiwork of a single author or of many writers. An exhaustive computer analysis conducted in Israel now reveals an 82 percent probability that the ancient book had just one author.

After feeding the 20,000 Hebrew words of Genesis into a computer, researchers at Technion, a university in Haifa, found many sentences that ended in verbs and numerous words of six characters or more. Because these idiosyncratic patterns appear again and again, says project director Yehuda Radday, it seems likely that a sole author was responsible.

Despite this new evidence, few scholars believe the

Old Testament, in its entirety, was written by a single person. But Radday intends to analyze the complete work word by word, in hopes of unearthing its origin. —Eric Mishler

The beginning of the universe seems to present insuperable difficulties unless we agree to look on it as frankly supernatural. —Arthur S. Eddington

## AMERICAN TRIANGLE

Just when you thought you already had enough to worry about, a new problem looms on the horizon: The dreaded Bermuda Triangle is moving toward the United States. That's the conclusion of Hugh Cochrane, author of Gateway to Oblivion and an authority on deadly triangles worldwide.

Cochrane says that there definitely seems to be a westward shift in the Bermuda Triangle, whose destructive force he attributes to energy that emanates from the bottom of the ocean. Triangle zones can move, he explains, much as earthquake zones do.

As a result of the shift Cochrane says, Americans can expect to see a great increase in train wrecks and airplane crashes. Indeed, some experts say strange energy can already be found in the Great Lakes. Others contend that the peak of the triangle has moved to the treacherous Bay of Fundy between Maine and Nova Scotia.

Robert Sheaffer

## UFO AUTO ACCIDENTS

It was 1:40 in the morning when a Minnesota police man left his car idling across the road by an inexplicable force. When the officer awoke from an apparent blackout on this late August day in 1979, he discovered his windshield shattered, his airanna bent and his clock running 14 minutes slow. He recalled seeing a strange light emanating from the sky. Sound like the overactive

been reported all the world. In most cases, the center says, trouble occurred only after drivers glimpsed bright lights or shiny metallic objects in the sky. The UFOs then apparently set off a series of electrochem events that made engines stall or blow out and blocked radios with annoying static.

Based on interviews with hundreds of witnesses to such events, Mark Rodhe gives an astrophysical and author of the report,



## AROMA THERAPY

It's been a rough day at the office. But at 5 p.m. a miniature time-release canister emits a pleasing can of wood aroma, you're ready to enter the grueling rush-hour traffic.

According to Dr. Robert Henkin, director of the Center for Molecular Nutrition and Sensory Disorders at Georgetown University Medical Center in Washington, D.C., a scents not unlike this one might be commonplace in the not too-distant future. The aroma may not be sandalwood, although the ancient Egyptians used that scent as a relaxant. And instead of personalized canisters, a central air-conditioning unit might send aromatic vapors through the ventilation system. But if Henkin is correct, aromas will be used to manipulate human behavior and treat psychological disorders.

Aromatic vapors attach to chemical receptor cells in the nasal cavity, Henkin explains. Once activated, these cells trigger nerve cells that send messages to the brain. Scientists must still learn more about the cascade of events that constitute the body's olfactory mechanism. Henkin adds, but once they do, it will be possible to match predictable human response to specific aromas. For example, people are frightened when they smell smoke, or tickled by the smell of rotten garbage; the scent of a pine forest is often a relaxant. So aromas could be specially blended to cure insomnia or depression or to motivate people to work faster.

"People might object to the fact that you are controlling their environment by pumping vapors into a room through the air-conditioning duct," Henkin notes.

Yet some olfactory manipulation has already begun. At International Flavors and Fragrances, Inc. in New Jersey, researchers have developed spray-can dispersed aromas designed to stimulate impulse purchases by customers. Aromas now available include a new car smell and the scents of fresh-baked bread and chocolate.

—Eric Mershon

"The major task of the twentieth century will be to explore the unconscious, to investigate the substrata of the mind."

—Sigmund Freud



imagination of a late-night driver? Maybe. But a few weeks earlier in Mason two teen-aged brothers were also terrified when mysterious lights passed over their car, allegedly emitting an energy that pinned them to their seats. Driving home after the encounter, the brothers said, they felt their car zoom out of control as if it possessed a wild force of its own.

According to the Center for UFO Studies in Evanson, Illinois, 440 cases of UFO-provoked car accidents or potential accidents have

concluded that there is no scientific explanation for most of the occurrences. The Minnesota policeman, for instance, was driving a Ford LTD, yet Ford engineers who examined the vehicle insisted that no known phenomenon could cause Ford cars to behave in such a freakish fashion.

—Bridhany Campbell

"From ghoulies and ghoules and long leggy beasties and things that go bump in the night, good Lord, deliver us!"

—Old Scottish prayer



## SUBURBAN PYRAMID

James Oran first read that pyramids could heal wounds, sharpen razors even sap coffee of its bitterness, some 15 years ago. Fascinated, but skeptical, he soon set out to test pyramid power for himself.

Using his expertise as a building contractor, Oran had constructed several eight-inch-tall pyramids and passed his hand over each. One of the models he found, zapped him with a jolt akin to a mild electric shock. He repeated the experiment several times, then had visitors try it, too. Everyone said he felt the same sensation.

Oran went on to bigger and bigger ventures, and now he is on the verge of completing his masterpiece—a six-story pyramid home on the outskirts of Quince, Illinois. A one-third scale model of the Great Pyramid of Cheops in Egypt, the wood-framed structure (above) contains

Egyptian statues and hieroglyphs. For security it is surrounded by a moat, with dogs patrolling outside and a sphinx guarding the door. And, Oran says, over the next couple of years he will increase the pyramid's power tenfold by applying gold leaf to the entire outside surface.

Oran hopes that once he and his family move into the structure, around 1984, they'll be able to conduct the first ongoing pyramid experiment in history. Yet Oran claims that the pyramid's power has already begun to show itself. A spring that started sprouting nasturtium right at the base of the pyramid, he claims, produces plump sprouts eight times faster than other water. And chickens drinking from the spring have grown 20 to 25 percent faster than other chickens.

Mark Tech

*"The unknown always passes for the marvelous."*

—Tactus

## OUT-OF-BODY SURVEY

Millions of Americans have journeyed to other worlds without their bodies or the use of spaceships, according to Kansas scientists studying the out-of-body experience (OBE).

Wondering whether reports of OBEs—the sensation that the mind is leaving the body—had any validly psychical, Fowler Jones and two colleagues from the University of Kansas questioned 420 randomly selected people from 39 states and three foreign countries. The result? Three hundred thirty-nine of those interviewed had had at least one OBE, and some had had hundreds. Eighty-five percent of those who had OBEs said the experience was pleasant, while a mere 5 percent said they felt as if they were going crazy.

What exactly is taking place when people have out-of-body experiences? "All we can say at this point," Jones says, "is that people who have such experiences feel they're quite real. They describe them in various ways, but the common denominator is that the mind, the I part of the personality, the thinking-feeling part is no longer located inside the physical body but is deposited somewhere else in the environment. It is as if they have a mobile center of consciousness located just a few feet or several miles from the physical body.

Jones emphasizes that

OBEs are experienced by healthy, intelligent people many of whom attend church on a regular basis. The OBE is not the result of a drug-induced stupor, he says, nor is it merely a dream. If it were, he adds, it would be impossible to explain just why so many events glimpsed during an OBE turn out to have actually occurred.

One man interviewed in the study, Jones notes, felt that an OBE saved his life. His mind left his body and wound up in a room filled with coworkers plotting his death. After returning to his body, the man said, he confronted one of the conspirators and frightened her into admitting the grisly plan. —Tom Kovach

*"Curiosity is little more than another name for hope."*

—A. W. and J. C. Hays



"You can have customization of detail in future designs you will have buildings with much more complexity and the perception of complexity. Architects will work with far subtler concepts, will be able to concentrate on sculptural facets of a building, and will observe how the sunlight hits them."

"Unit CAD," says Ken Tull, staff engineer at Lockheed Georgia, the aerospace engineer was using the same instruments as Euclid and Pythagoras—compass, square, and pencil. With the exception of a radius gauge, there was nothing new. When you put that engineer on a CBE, you give him a whole new world. Instead of having a drawing board three feet by six feet, he's got a board as big as forty-eight football fields." He can "resolution up" a scale model in a few seconds without losing one centimeter of accuracy.

The most tedious part of design has been analysis—heat, stress, the structural behavior of parts under loads. Software packages such as the National Aeronautics and Space Administration's NASTRAN have been developed to do this work. These analytical programs subject the computer model to various mathematically simulated stresses. The model is broken down into tiny parts called elements, and since there are a finite number of them, the process is called finite-element analysis. Done by hand, it's a mind-numbing chore that generates reams of data. If the analyst did not cover all his bases, he might have missed an important flaw in the design—with dangerous consequences. Unified to CAD, finite-element analysis accelerates the process. The model is often generated in color and lights up brilliantly where stress contours occur.

Mark Shepard, a professor at the Center for Interactive Computer Graphics at RPI, demonstrates his new system. It is applicable to anything that requires a governing set of rules, from nuclear containment vessels to aircraft. He turns to his CRT, where an image of a sheetmetal bracket glows green. The 2-D object, resembling a flation with a hole in it, is traversed with a webbing of little triangles. "Each triangle has an assumed behavior," he explains. "Put enough of them together and you get a reasonably good idea of complex behavior. Historically these meshes were calculated by hand. On the bracket, that would be a several days chore. On the computer, it takes one hour." He zooms in on an area of the bracket to examine how much load is displaced.

"If I'm concerned with how 'out-of-round' the hole is, we can zoom in on that, or we can walk around the bracket." He fiddles with the controls. "After you do the analysis, you can go back and make the bracket thicker to avoid stress concentration, or you can take out excess material. When finite element analysis is made an integral part

of the design process, then design is based less on rule of thumb and crude approximations. Although that, too, is an approximate analysis, it verges on perfection."

There is one drawback to near-perfection, however, and that is the tendency to design too close to the line. In the past, engineers didn't have the tools for such fine analysis. So they grossly overdesigned to be on the safe side. At today's close-to-fleesless condition, a part is designed to do its thing perfectly except for the unexpected contingency. "If you push it the wrong way, and it wasn't designed for it," Shepard says, "the gadget will break. The computer allows you to be more efficient. But for the consumer that may be a mixed blessing."

After analysis, the next step is to cut down on production time. "If we can run a graphics program," Fox says, "to simulate the cutting of a turbine blade instead of running a real half-million dollar machine and taking it out of production, we've saved

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*•The only person  
who could model the human  
body properly was  
Michelangelo, and even he  
wouldn't be  
able to come up with a  
description that  
a machine could understand.*

---

fantastically on time." Computerized, the leading turnkey company recently introduced a "dynamic tool motion" program whereby the engineer at the console can simulate the interactions between any tool and the piece it's working on. (The program is called "tool-path verification.") Computerized program offers an enhanced reality. The quasi-omnipotent engineer can view the tool's cutting path from any angle at the flick of a key-stick.

In CAD/CAM's great chain of being things such as tool-path verification constitute middle links that be CAD to CAM. But how far away is the goal of complete design-to-production automation? How simple is the job? Fox returns the question. "If it's a complex three-D shape, nothing goes directly from design to production. But if it's a simpler shape such as a block of metal subject to a milling machine that merely goes up and down cutting holes in it, then it's easy to go from specifications to actual program and production. But systems are becoming much smarter, and more CAM systems can go from increasingly complex shapes to automatic programs—for metal cutting and milling in general."

The ultimate CAM "designism" is the flexible manufacturing cell. The cell concept implies a self-contained series of machines that perform a complete task and are serviced by robots or other forms of manipulators and controlled by minicomputers. The cell feeds itself materials and divests itself of a finished item with minimal hands-on human interference.

Right now there are a few complete cells in operation in the United States, and the ones that exist are not very flexible. But in a unique collaboration, Westinghouse and CMU are in the final stages of developing an advanced computer-robot-machine unit that could become the model for future cells. The flexibility is attractive to Westinghouse, which makes more than 250,000 different products. Westinghouse engineers, along with CMU's Paul Wright and his group in the Flexible Manufacturing Laboratory will install the first cell in a Westinghouse Winston Salem turbine-blade plant later this year. "Our goal," says Wright, "is to make one batch of turbine-blade products (rough shapes) without any human intervention whatsoever."

The Westinghouse/CMU cell is enough to make Hephaestus drool. His star player is a formidable two and a half million dollar, 20-ton, open-die forge called a swaging machine. It sits on a foundation 40 by 60 feet, and its computer-driven hammers beat a piece of stainless steel, called a billet into an arbor shape. "It's a twentieth-century village blacksmith," says Gary Shatz, Westinghouse manager of advance manufacturing.

Attended by two robots, the swage operates in an atmosphere where temperatures can reach 2,100° F. This heat is generated by the other main player, a cylindrical furnace. This giant cooking facility heats a billet the size of a large plastic Coke bottle. Placed into the furnace by a robot's arm, the billet is removed by the robot when it's hot enough and taken to the swage to be beaten into a preform. That still another robot removes the preform from the swage and hauls it to a vision system for fully automated inspection.

If the preform is defective, Wright explains, machines correct machines. A diagnostic fault-detection system not only finds imperfections and breakdowns but also has built-in strategies to accommodate and correct them. These decisions are made in the software.

Wright has his own simile that explains the cell. "These machines are like individual musicians in a chamber orchestra. They need a conductor to make sure they're all playing in sequence. When does one fool start up, another stop? How many blades does one machine make before it switches over to another task? Programming authority is divided into a local André Proust conductor code that resides in a supervisory computer (typically a PDP 11) and a Beethoven composer code in a large mainframe computer such as a VAX 11/750. There are myriad programming prob-

lems: besides the vision systems and the fact-finding nodes, there is even a robot-avoidance program to keep the automations from bashing into one another. "We have to describe forbidden places where they can't go."

Jose Isasi, Westinghouse manager of manufacturing planning at the Winston-Salem plant, is happy about his cell. "This pretforming is a high-energy process," he says. "We're talking about extreme high temperature, huge equipment never before used in a cell, things that put out tremendous forces. Usually there are a lot of people to watch them. In our case the proof of the pudding is gonna be that we turn off the lights and go home and let the computers run it all night. And when we come back and if the cell is still there and it has not blown up, then we'll know we succeeded. That's the test. We're gonna depart the area and let the computers alone with the robots and sensors and everything." When Isasi gets going, the sounds like CAD/CAM's Fisher Guido Sarullo.

"And the computers will have to run several kinds of equipment: all on the brink of going wrong," Isasi continues. "And you're talking about a lot of heat floating around but there's a lot of computer horsepower on every level so that we can detect if something is about to happen before it explodes or blows up or destroys the two-and-a-half-million-dollar machines!"

"It's a hostile environment," he points out, "and just because it's such an aggressive environment, the eye of the robot is protected by a fancy enclosure. It keeps the lens clean and air conditioned. We actually had to build a computer room right on the factory floor to house all the computer horsepower. Some people call it Mission Control. Westinghouse is installing a closed-circuit TV system, so that in the future," Isasi says, "we can have one or two guys on a central control overseeing the entire factory."

"Physically it would be possible to run the cell from CMU in Pittsburgh," adds Jerry Colyer, project engineer at Winston-Salem. Later this month Operation Warm Blanket will execute a sequence from beginning to end—brief in, pretform out. It will be the first time a supervisory computer code and diagnostic fault system plus robot vision will be used in a U.S. heavy manufacturing situation. They plan to produce one pretform per minute.

How will cells be used in the totally automated factory of the future? First you've got to understand how each cell could influence all the others. "Wright says, 'You'll need many more sensors. Each cell will have to be coordinated with the next. And robots will have to do all the running around.' Now few factories are laid out with robotic transport in mind," Wright says.

"If you were going to invest in a CAD/CAM setup, where would you start?"

On today's market you can buy CAD/CAM systems of varying degrees of integration—from computerized NC ma-



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chines to top-to-bottom design/production units. We looked at a few of them. At the Danetec/Summit plant in Bozeman, Montana, a spokeswoman named Kathy Deeter sang praises of her company's wares. One device called the Bandit is an automated contourer for lathes, grinders, and chucks. You can program it as you would a computer to cut out any pattern on any product on up to three axes. It can indent surfaces and can nearly carve out a rounded ball. "And we're coming out with Bandit Three," Kathy enthused. "It's just superb! Everything you ever wanted—graphics, a CRT that shows you the object as it would look out of, all sorts of look-ahead devices and human engineering. Human engineering is CAD/CAM/ase for making the programs easier for morons to use. User friendly is a synonym."

Deeter also described the Quick Draw tool changer, a vulturous-looking machine that actually goes under the appellation of "dedicated" robot. It is designed for only one application. The Quick Draw's automated arm reaches into a tool crib, picks up the right implement, screws it into a little claw, makes the cut, takes the tool out of the claw, and puts it back into the crib. Then it goes on to the next tool and task. Danetec also offers the Intelligent Driver, a smaller version of the Bandit, and the Task Master, a medium-sized Bandit.

"Somebody bought twenty Task Masters the other day," Kathy told us. "They

make bra straps with them. The Task Master electronically picks up the strap, measures off the right amount, brings it over to the laser, which lases the strap onto the bra. No stitching involved! The Bandit people also offer retrofitting. A Bandit can be attached to an old lathe, mill, or grinder. "Instead of a shop person standing there, you've got a Bandit." Although it declines to reveal its annual sales, Danetec says it is selling "hundreds of thousands" of machines through a distributor to markets in the United States, Europe, and Japan.

Computrol, of Minneapolis, boasts of being the only thoroughly computerized turnkey CAD/CAM system available. Computrol specializes in the production of precision tooling (making things with tools), plastic injection molding, and die casting and forging. Computrol's software permits programming at the Computscope whereby a designer can vary the size of his tool and the rate the tool does its job and he can contour the workpiece in 3-D right at the console. We're having problems handling the number of people interested in the system, says Computrol's understated president, Fred Zimmerman.

Zimmerman says one customer made \$6 million worth of molds on a Computolsystem. Another had 122 toolmakers and now has 30. "And they're doing twice as much tooling." He reminds us that even though metalworking is the segment of industry utilizing CAD/CAM to its fullest advantage,

95 percent of tooling is still done manually. "But CAD/CAM's beginning to pick up speed," he reveals. "Our system is effective for sixty percent of applications. Yet you can't just sit down at a computer and type mold and expect one to come flopping out straightforwardly. It's extremely fast at what it can handle."

What Computer-type CAD/CAM can handle most effectively is a job where there's an element of repetition. "If a computer is doing multicavity molds, or making families—such as families of mixing bowls—where there are size considerations, or a logo that appears on many parts and is actually molded into those parts," he explains, "then you get great economy." Like many CAD/CAM companies, Computrol makes no attempt to close the loop with robotics. "We don't know beans from buckshot about robotics. We drive milling machines to cut hot and cold steel, and there are enough problems in that," Zimmerman concludes.

From the design of mammoth petrochemical plants to nuts and bolts, CAD/CAM's impregnation of industry promises to alter everything, including the life of the white-collar worker. What will CAD/CAM do to the manager of the twenty-first century? We ask CMU's Mark Fox.

"Eventually it will eliminate him," he replies with a boldness he then attempts to qualify in the twentieth century, he backtracks: integrated computerized systems will actually allow the manager to keep his job. Fox characterizes the modern corporate man as one who is "floundering in a mess of complexity." With the conglomerate, white-collarers are running around like headless chickens while upper management is busily putting out fires everywhere. "The manager has to deal with everything on an emergency basis," Fox says. "There's little time to think, no time for long-range planning. People whose minds can encompass all that's happening can't handle it, because they don't have access to the right information."

Fox's solution to this chaos is the Intelligent Management System, which he and his group at CMU are developing. Its immediate goal is to aid managers with the avalanche of data coming at them continuously. But its long-range goal is to automate the management of whole organizations: functions such as scheduling, planning, simulations—things that white-collarers think about.

"We're working toward the factory in which there are no managers." He gins gleefully. "Just the distributive intelligent system. There'll be microprocessors on every floor: processors corresponding to accountants and programmers—all sorts of processors all communicating, trying to achieve perfection."

How did Fox arrive at this vision of Utopia? "It has been observed," he says, "that in smaller batch-size factories, white-collar labor accounts for a large quantity of the total labor cost—in some cases ex-



"I'm the science editor, but I'll be glad to turn this over to Mr. Malcolm, our *pathe* editor."

ceeding fifty percent." Fox cites the Japanese Hitachi Company, which in 1972 found that 100 white-collar workers "touched" or interacted with one product. Hitachi automated scheduling and reduced the number of white collars who touched the item to 30. In existing U.S. factories, Fox says, "the product or part is often lying there on the floor eighty percent of the time, waiting for something to happen. Even if you get CAD/CAM to increase the productivity of your factory machines, you won't have much improvement until you reorganize your business radically."

"CAD/CAM is a big laugh, from my point of view," he continues. "We're fooling ourselves if we think robotics is going to be the savior of industry. When you're talking about service industries where a lot of production is job-shop-oriented, then automation is the bottleneck. But we don't see the Intelligent Management System replacing people for a long time," he says.

Others agree that CAD/CAM won't take over factories overnight. "CAD/CAM is a revolution of such enormous scope," says Bela Gold, director of the research program in industrial economics at Case Western Reserve University, in Cleveland. "That most people are unaware of where it's leading. But it is going toward a totally different way of organizing manufacturing processes and a totally different perception of how those processes function." Gold thinks the traditional U.S. corporate struc-

ture is addressing the CAD/CAM revolution badly if at all and contrasts the American structure with the Japanese top-down organizational system. "The Japanese implement one component at a time," Gold says. "But always in terms of how that component fits into the overall architecture. You've got to have tight conformity of successive stages. Otherwise the programs don't work, and the machines don't match each other or the programs."

According to Gold, the worst impediment to the revolution is top management. They get their advice from the VP of engineering or infrastructure, and many of these old guys have been out of it for twenty years, and, by the way, I'm an old guy myself," the sixty-seven-year-old economist laughs. "They reinforce the innate caution of a lot of senior executives and say, 'Well, hell, you can press a button and get a custom-tailored suit.'"

"You can't just plug these things in," Gold continues. "You've got to keep adapting them to the changing pressure of the production and marketing situation. And if you don't have a staff trained for it, the tools will be underutilized or will break down. And in robotics," he adds, "they're trying to replace people in operators that already exist instead of redesigning the production in accordance with robotic capabilities. We are adapting robots piece by piece, and they are not going to fit together. Likewise with CAD/CAM systems."

With blue-collar unemployment already at 12.5 percent, there is no way to avoid CAD/CAM's most burning question: Will the automation revolution precipitate a pink-slip blitzard? When asked about massive dislocation of the workforce, most pro-CAD/CAM people voice the same reassuring argument: "There is no problem," Zimmerman maintains. "The average toolmaker in the United States is fifty-six. Ten thousand a year are retiring, and three thousand a year are coming in. We like toolmakers and find they make excellent operators for our system. We're not trying to do away with them; only to use them more productively."

"Layoff the big fool!" exclaims Westinghouse manager of communications Peter Ryckman. "We haven't laid off a single worker because of CAD/CAM. But the pool of eighteen-year olds decreased by thirty percent in the last four years. There's a strong feeling that any company not involved in programmable automation because of manpower resistance will have to do it down the line."

Tom Moser, manager of engineering systems for Westinghouse, tells this tale: "Harris you've been replaced by one computer, three programmers, four field engineers, and two systems analysts."

And CMU's Paul Wright doesn't see CAD/CAM development as all that different from the rise of the modern banking and telephone industries. "Phone employees used to occupy themselves at switchboards. Machines do that today yet Ma Bell employs just as many people. My scenario is that far fewer people will be involved in grubby tasks of the Dickensian sort. Those same people will be retained and diversified into programming tasks, and of course there'll be a huge need for repair and maintenance."

Not that there won't be dramatic changes in the nature of work. It is highly conceivable that by the year 2025 programmable automation will have replaced most operative jobs in manufacturing (about 8 percent of today's workforce) as well as a number of nonmanufacturing jobs. CMU's Robert Ayres and Steve Miller say in their paper, "The Impact of Industrial Robots": "Concerted effort should be made by the public and private sectors to redirect the future workforce to these changes, they advise."

In the long-distant future, the descendants of CAD/CAM technology may bring about the end of work as it has been experienced ever since the first humans picked up a stick and scratched the soil. We may not need money eventually, nor any other form of barter system. Instead, we may spend our days chasing enlightenment or sitting around enjoying our pine colodas while computers and robots program and manufacture our durables and suffle about busily building more of themselves, preparing for that next evolutionary step: people such as Robert Jastrow talk about—the rise of silicon intelligences. **CC**



"I keep having this nightmare in which the meek inherit the earth."

at a blue folder in front of him, opened it slowly, and looked through the enclosed pages until he found what he was seeking. "There's a file from his second letter," Hupp said.

"I know there are links between the IRA and the Red Army—links with Japanese terrorists, the Tupamaros, and God knows who else. I was tempted to spread my revenge into all the lands that have harbored such cowards. I want those lands. Do not tempt me again, for I have released only a small part of my arsenal."

Hupp closed the folder and looked at Lepkov across the table from him. "We must assume that this is not an empty threat. I do not think this man bluffs. On that assumption, we must also assume that he has more than one way to spread his arsenal. Because if we find the way or ways he did it in the present instance, we could close off that channel."

"Could we?" Beckett asked.

Lepkov nodded to agree that he also shared his doubt.

Godelinsky leaned forward, sipped her tea, then said, "Is it not curious that we have not yet discovered how O'Neill performed this vile deed? He inflicted specific areas. The fact that his plague has spread can only mean human carriers are involved in some way."

"Why is that?" Danzas asked.

The way everything is being sprayed no insect could be doing it, she said. She rubbed her forehead and frowned.

Lepkov said something to her, lowered and in Russian. Foss caught only part of it, but she turned to peer sharply at the other woman.

"Is something amiss?" Hupp asked.

"Only a headache," Godelinsky said. "I think it is the water change. Perhaps I could have some more tea."

Beckett turned to the panel behind her, opened it, and confronted a face bent close on the other side, a bland, smiling blond man with white teeth. "Anyone else want something from the kitchen?" the man asked.

"Bumpkins!" Lepkov said.

"They just haven't had time to install microphones in this room," Foss said. "I'll be less obnoxious tomorrow. I'll take coffee black, please."

Beckett glanced around the table. The others demurred. He returned his attention to the bland face at the pass-through. "You heard?"

"Righto, Doc."

The covering panel slid closed.

Beckett returned his attention to the table. "You are not embarrassed?" Lepkov asked, looking up.

In Russian, Foss said, "Water! There's a microphone in my bosom!"

Lepkov scowled, but Godelinsky laughed aloud at the wack joke.

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"We tell that joke in Russia," she said. "It is a very descriptive use of us."

"Here, the microphone is in the margins," Lepkov said. "Or in the pillow."

Hupp lifted a briefcase from the floor beside his chair, wiped a piece of lettuce from it with a paper tissue, and removed a small notepad and pen from it. "It will be something simple," he said.

The panel behind Beckett slid open. "One tea, one coffee, black. It was Blind Face. He pushed two steaming cups onto the inner ledge and closed the panel."

Without getting up, Beckett took the two cups from the ledge and slid them along the table. As Godelinsky took her cup, Beckett noted a patch of white on the back of her left hand. It was not prominent, but quite noticeable to his trained eye. Before he could comment on it, Lepkov said, "I think the plague was spread with some devious American device. A spray can for the hair, possibly."

Hupp wrote on his notepad. "It is on my list, but I doubt it. Again, it's too obvious a thing for our Madmen."

Godelinsky sipped noisily at her tea, then said, "I agree with Joe on that. It is just not O'Neill's style."

Hupp smiled. "I think it will be something remarkably simple. It will be a thing of which we will say, 'Oh, my God! Of course!'"

"Such as?" Beckett prompted.

Hupp produced a high-shouldered shrug, palms thrust out and upward. "I ad-

dress only the question of style, not the specific method to be employed."

"We don't know the incubation period," Godelinsky said. "This could've been sitting there for months."

"Contaminated gifts?" Foss asked.

"That kind of thing," Hupp said. "A toy that a mother would handle before passing it along to her child. We must not forget that O'Neill's wife and children were slain. He speaks of appropriate revenge. It is the madness in his method that will open the door to him."

"In some common food item, perhaps?" Foss said.

"Potatoes?" Lepkov asked. "That is too dull, much too dull."

Hupp raised a monitory finger. "Ah, but she has touched the essence. It must be a common thing. It must be something used in Ireland, Britain, and Libya, and it must be a thing that exposes the maximum number of women to contamination."

"Why women?" Beckett asked. "Why can't men be the carriers?"

Danzas, following his usual pattern of not contributing to a Team exchange until it was well along, said, "There is another quality required by the limitations we can assume are imposed on our Madmen."

Everyone turned toward him attentively.

"How does he gain access to the distribution system?" Danzas asked. "It is access that intrigues me. I agree that it must be something simple and common to the

three countries, but it also must be available to the Macman, and probably without elaborate preparation or a complicated conspiracy."

"He is a loner," Beckett said.

"A devoted intelligence," Lepkov interjected. "The scientific abilities he demonstrates in the laboratory will, I'm sure, apply to his distribution method."

"Devious, yes," Hupp said "but not necessarily based in scientific complexity. His style—it is more likely to be a very common item he contaminates, perhaps something each of us carries on his person at the very moment."

Silence greeted Hupp's suggestion. Beckett nodded, more to himself than to Hupp. There was the ring of truth about his suggestion: It was O'Neil's style. Simplicity, that was the keynote.

"Why could it not be a conspiracy?"

Lepkov asked.

Godelinsky shook her head.

"Insects?" Foss asked.

"An insect vector of the plague," Lepkov said. "Would that not fit your description, Joe?"

"But how would he distribute them?"

Hupp asked.

"The eggs or the larvae?" Foss asked.

"Again the distribution is the question," Hupp said.

"Air travel makes such a concept the remote of our world," Lepkov suggested.

"What about contamination of the water

systems in the target regions?" Danzas asked.

"Insects in the water?" Lepkov asked.

"Or the disease itself," Danzas said.

Hupp pounded a fist gently on the table. "Distribution," he said. "How?"

"Perhaps an airline attendant or a pilot,"

Lepkov said. "Is this O'Neil a pilot?"

"Negative," Beckett said.

"But the involvement of air travel in this thing. That idea has its appeal," Lepkov remarked.

Beckett said, "It takes quite fifty new insects a year, thanks to air travel."

"What is carried universally by such air craft?" Lepkov asked.

"Luggage packages," Beckett said. "The tourists themselves, but..." He shook his head. "This ignores the fact that he permeates his targets—Ireland, Britain, and Libya."

"With no guarantee that others escape," Foss said.

Godelinsky rubbed at her forehead. "And we cannot be sure that he uses only one method: incubation period. That is essential to our considerations."

"The male," Hupp said.

"He would require correspondents in the infected regions," Godelinsky objected.

"Are you suggesting a conspiracy of pen pals?" Foss asked.

"What are you suggesting?" Beckett asked.

"I don't know really," Hupp said. "I only

try to play O'Neil through his performance. What do we know about him?"

"He was in Ireland," Beckett said.

"Exactly," Hupp said. "And in Ireland he suffers the great agony that drives him to do this terrible thing. But at some point he has the other experiences of Ireland. What is it he can learn there?"

"I do not follow this," Lepkov said.

"He learns how people spend their days in Ireland," Hupp said.

"And in Great Britain and Libya as well?" Lepkov asked.

Hupp shook his head. "Perhaps, but let us concentrate first on Ireland and O'Neil there. If his performance there can be made to produce answers, perhaps we can adjust those answers to the other places, too."

"Go ahead," Beckett said. "And he experienced the odd feeling that Hupp was sniffing along a hot trail. Go with it! He thought:

"O'Neil is not a resident of Ireland," Hupp said. "Thus, he must stay somewhere there. A hotel? Yes. What does he do at the hotel? He sleeps. He uses the various facilities of the hotel and the community. This is such a certain:

"I do not see any answers," Lepkov said.

"Only more questions. So what if he calls room service?"

"For this he uses a telephone," Hupp said. "He has access to a telephone directory."

"And he has tourist guides," Lepkov said.

"So what?"

"Let him go with it," Beckett said.

Lepkov shrugged and turned partly away from Beckett.

"Tour and tourist guides, yes!" Hupp said. "That could be important. The colorful brochures, the stores and the restaurants, the drinking establishments, the public and private means of transportation. Does he rent a car or take taxis?"

"He bought a car first thing," Beckett said. "A cheap Fiat, secondhand. We've just had confirmation. It's there in that street. I distributed the morning:

"I have not yet read it," Hupp apologized. "But now we know he was mobile."

"What happened to the car?" Lepkov asked.

"It was sold for him by the people who sold it to him," Beckett said.

"Then it could not have been left there in a contaminated condition," Godelinsky said.

"But he is mobile," Hupp repeated.

"Where does he go? Does he attend a sporting event? A lecture? The theater? I direct your attention to common, everyday activities. He buys a book. He mails a letter. He has the concierge make a booking for him at a restaurant.

Danzas shuddered and muttered, "Irish restaurants."

"But O'Neil was beginning to be an active part of the Irish community before tragedy struck," Hupp said. "He is there, and he thinks with a... a thoroughness."

"How does this get us closer to his distribution methods?" Lepkov asked.



"Before he could employ any distribution means, Hupp said, he had to know it would work in his target areas."

Lepkov heaved his shoulders. "So? What does he see around here that gives him the knowledge?" Hupp asked. "How does he assure himself his method or methods will work?"

"What if he could contaminate paper?" Foss asked.

Beckett moved his lips soundlessly, an unspoken word. He repeated it aloud. "Money!" He looked up to find himself the focus of five pairs of staring eyes.

Hupp exhaled a long, Ahhhhhhhhhhh. "Through the mails?" Darzas wondered.

"Would that not contaminate everyone who handled such mail?" Lepkov asked.

Not if he sealed it in a sterile package within the envelope, Beckett answered.

"In plastic," Hupp said.

"I have a device in my kitchen," Foss said. "It's called a heat-sealer. They sell plastic envelopes for it. You put leftover food in the envelopes, seal them hermetically and put them in the freezer. Later you bring them out, thaw and heat them. Presto instant dinner."

"Is this not too simple a thing?" Lepkov objected, but his tone said he was awed by the picture being built here.

It is precisely the level of simplicity we seek, Hupp replied. It is the man's style.

"But who would receive such money?" Lepkov asked. "How could he be certain that

"Don't play the fool, Sergei! Godelinsky exclaimed.

"He'd send it to charities," Foss said. "Or to someone collecting for the IRA." Hupp said. "A poetic madness that would appeal to our Madman."

An Irish American, Godelinsky said. "Who better to know where in Ireland to send an IRA contributor?"

He could send money to almost anyone in Ireland, Beckett mentioned.

They looked at him.

Well, face it, he added. "You're a store owner. You get an order, money enclosed to send merchandise to the United States. Or you're just a private citizen, a name taken at random out of a telephone directory. You get an envelope from the States, money in it along with a simple letter of explanation. Would you send it back? What if there were no return address?"

"But..." Lepkov said, shaking his head.

"Does this not arouse the recipient's suspicions?"

"Why?" Hupp asked.

"I do not understand how such a thing is explained to the random recipient."

Lepkov answered.

"Why bother with an explanation?" Foss asked. "Just send the money, local currency. The recipient thanks God he's at last smiled upon him."

Lepkov merely stared at her.

"There could be no need for the smear

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plastic envelope," Godelinsky said. "A lacy period for the plague and there would be no danger to intermediaries. We do not know the incubation period."

"If the opening of the outer envelope broke the seal of the inner package, that would do it," Beckoff said.

Lepkov, still looking at Foss, cleared his throat. "Can anyone enter an American store and buy one of these devices to seal plastic envelopes?"

"All you need's money," Foss said. "It's expensive."

"The one in my kitchen cost less than thirty dollars. You can get them even cheaper on sale."

"I think we have it," Beckoff said.

"And it fits the requirements for the other targets," Hupp said. "All he needs is the currency of the selected nation."

"He walks into any Desk Perena office and says he needs five hundred dollars in British pounds," Foss said.

"But do they not require him to show a passport or some other form of identification?" Lepkov asked.

Foss merely shrugged.

"I like it, but we can't be certain yet," Beckoff said.

Godelinsky tilted her chin up and met his gaze.

"It's foolproof," Hupp said.

"Or fool-certain," Godelinsky added.

Danzas said, "We must send word to have this investigated immediately."

"I am not assured," Lepkov said. "So he sends money to a charity. That I understand. But with others?"

"I hear that Catholic charities in Ireland are never very rich," Foss said. "I'd go into circulation quickly."

He could send money to a sporting club," Beckoff said, his tone thoughtful. "A theater group. Those small theater groups and athletic teams all over Ireland."

"Money so diabolically simple," Foss said.

"How does he apply this scheme to Libya?" Lepkov asked. "We assume he does not speak Arabic."

Hupp raised a hand, curiously like a student calling for a teacher's attention. Lepkov looked quizzically at him.

"A visit to a Libyan consular embassy," Hupp said. "To the United Nations. What would he need to know? The addresses of charity organizations in Tripoli and Benghazi, perhaps?"

"Or again he buys merchandise, money enclosed with his order," Beckoff said.

"None of the information is difficult to acquire," Hupp said. "There are people anxious to give it to you. It is their job."

"Some charities and relief organizations sell their mailing lists," Beckoff said. "Or they'll exchange them—then let for yours."

"When I was at UCLA," Hupp said, "a political activist could get almost any mailing list he wanted. I know of one computer specialist who put himself through school

by stealing such lists from computer storage systems and selling them."

Danzas turned and looked down his long nose at Hupp. "You associated with political activists?"

"It is called here a learning experience," Hupp said.

"We describe it world of anarchy and madness," Lepkov said.

"To which the Soviet Union has made significant contributions," Godelinsky said in Russian. Lepkov said, "Such remarks do not go without notice."

Godelinsky responded in English, "I don't really care." She pushed her chair away from the table and bent over with her head close to the floor.

"You feel faint?" Beckoff asked. He got up and went around to stand beside her chair. He could see the white spot on the back of her hand. It was quite prominent. He had dismissed it earlier as a lab dissection spilled makeup or perhaps a dab of toothpaste. Now he felt a chill in his guts.

Godelinsky's voice sounded nasal and weak from her bent-over position. "I feel faint, yes. She coughed. "It is a very strange feeling. Both hurt and excited."

"I think we'd both better turn ourselves in at the hospital facility," Foss said.

Beckoff whirled to stare after "You top?"

The great granddaddy of all headaches," Foss said.

Godelinsky straightened, looking pale. "It is not possible," Lepkov said.

"How could the Madman know about this place and what we do here?" Danzas asked, anger mingling with concern.

Hupp stood up and came around to stand beside Beckoff. Both of them looked at Godelinsky. Beckoff lifted her wrist and took her pulse. "One hundred and ten."

"Have our speculators been bodiless?" Danzas asked. "Is the Madman someone in our midst?"

Hupp looked startled. "One of us?"

"No, no," Danzas said. "But someone with whom we have commerce."

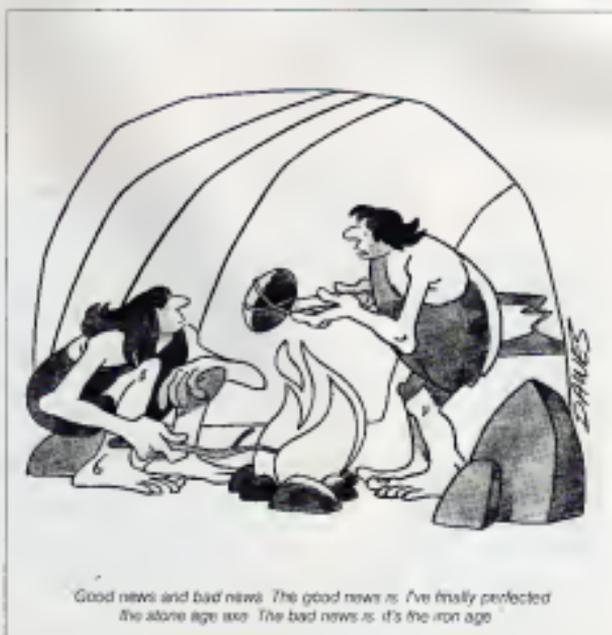
"Let's get these women to the hospital," Beckoff said, and he felt a pang of fear for his own family. He had thought them safely isolated at the family's fishing camp in northern Michigan.

Beckoff lay stretched out, fully clothed on the spartan cot in his tiny quarters at the Denver Isolation Center. His hands were behind his head and he could feel the lumpy pillow on his knuckles. The only light in the room came from the illuminated clock on the desk near his head. 2:33 A.M. Thank God my family's still safe, he thought.

That entire area of northern Michigan had been contained off by special troops.

We're going the way of France and Switzerland.

Fragmented.  
He kept his eyes open, staring upward into the darkness. When he swallowed, it was past a lump in his throat.



Good news and bad news: The good news is, I've finally perfected the stone age ax. The bad news is, it's the iron age.

If he closed them, he knew his mind would be filled with memory pictures of Arane Posa as she lay dying.

"I'm freezing!" she'd kept complaining. Between the complaints, however, she had provided them with a clinical picture of her symptoms as seen from within by a mind finely tuned to medical details.

The room in the hospital facility had light green walls, a hard plastic floor scored by the frequent applications of antiseptic. There were no windows, only an inset picture of peaks in the Cascades, a thing mostly of greens and blues designed to give the illusion of space beyond the sterile room. Lines of gray-clad wire ran from beneath Posa's bed, out over the head of her bed, and into a console which linked them to the ivory box of the electronic system that monitored her vital signs. A transparent plastic tube ran down from an intravenous bottle into her right arm, sterile fluid.

From his chair close beside her bed, Beckett could keep an eye on the monitor and the patient. Her lips moved. No sound, eyes closed. Lips moved again then. "There was that odd sort of disorientation at the onset," she whispered. "You got that?"

"I got it. An."

With Dorena, too. What does she say? Beckett moved a swing-arm lamp closer over the notebook in his lap and made a notation. "We'll have a report from Joe presently," he said.

"Presumably," she whispered. "What's that supposed to mean?"

"In an hour or so."

"I may not be here in an hour or so. The thing's fast. Will I can feel it."

"I want you to think back," Beckett said. "What's the last thing you experienced that you suspect may have been a symptom?"

"There was a white spot on the instep of my right foot this morning," she said.

"White spots on extremities," Beckett wrote. "Nothing earlier?" he asked.

She opened her eyes. They looked glazed, and the eyelids were swollen. Her skin had the pale, bloodless look of death. Almost the color of the pillow beneath her head. Her baby-doll features were bloated, the curly hair tangled and sweaty.

"Think back," he said.

She closed her eyes, then. "Ahhh, no."

"What?" He bent close to her mouth. "It couldn't have been," she whispered.

"What?"

"Day before yesterday I woke up horny as hell."

He leaned back and scribbled in his notebook.

"You writing that down, too?" she whispered hoarsely.

"It could be important. What else?"

"I took a bath and... Jesus! My gut aches."

He made a note, then. "You took a bath."

"It was odd. The water never seemed hot enough—I thought it was the damned conservationists, but there was lots of steam and my skin turned red. Felt cold though."

"Sensory distortion," he wrote. "Did you

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run any cold water over yourself?  
"No." She moved her head slowly from side to side. "And I was hungry. God, I was hungry. I ate two breakfasts. I thought it was just all the upset and . . . you know."  
"Did you check your pulse?"  
"I don't think so. I don't remember. God, it bothered me eating that much. I'm always worried about gaining weight. Where've you got Dorona?"

"Just down the hall." We've rigged a UV gasket and antiseptic sprays in a passage between the two rooms. We thought it was a good idea . . . just in case."  
"In case one of us makes it and the other doesn't. Good thinking. I don't think I'm going to make it. Will. What's that stuff in the IV?"

"Just fluid. We're going to try to give some new blood in a few minutes. You need white cell stimulation."

"So it hits the marrow."  
"We're not sure."

"When I saw that spot on my instep. Will, I think I know right then. My guts felt like a block of ice. I didn't want to think about it. You noticed the spot on Dorona's hand?"

"Yes."  
"Do a good autopsy," she said. "Find out everything you can." She closed her eyes, then snapped them open. Was I unconscious very long?"

"Just now?"  
"No! When you brought me in here. About an hour."

"I bet like a ton of bricks," she said. "I remember you sitting me on the edge of the bed to help me into the gown. Then—ehup!"

"Your blood pressure went way down. I thought so. What about the other woman in the DIC? Is it spreading?"

"I'm afraid so."  
"Shit!" A moment later she said, "Will, I don't think your antiseptic gasket will be much use. I think men are the carriers."

"I'm afraid you're right." He cleared his throat.

"How much fever?" she asked.  
"First high—and now it's low grade—ninety-nine point seven." He looked up at the monitor. "Heartbeat's a hundred forty."

"You going to try digitals?"  
"I've ordered some lanolin, but we're still debating it. It didn't do much for Dorona."

"The autopsy," she whispered. "Look for fibroblasts."

He nodded.  
"Got a hunch," she said. "Liver looks like a used football."

Beckett made a noise.  
"You try interferon. Dorona?" she whispered.

"Yes."  
"Well?"

"Night as well have been water."  
"Noticed my nurse was male," she said.

"How bad is it with the other women?"  
"Bad."  
"What're you doing?"

"We closed the isolation doors. We're lucky this whole damned complex was de-

signed to resist the spread of radioactive contamination."

"Think any of 'em will make it?"  
"Too early to tell."

"Any idea how it got in here?"  
"Any of us could have brought it in. Lepkov thinks it was he. He says he can't make any contact with his home in the Soviet Union."

Danzas is from Brittany, she whispered very weakly.

"But he hasn't been there for a long time."  
"Lepkov," she said. "He got all kinds of briefings before being sent over here. Gordinisky complained about it. Specialists, envoys."

"We're pretty certain men are the carriers," he said.

"Low-grade infection? You have any symptoms?"

"A small case of the sniffles and a slight fever, but that was five days ago."

"Five days," she whispered. "And already I'm dying. It works so fast."



●The Madman  
fell short of revealing key facts. But he led up to those facts with chilling accuracy. That, coupled with the threats, stirred Ruckerman to action ●



"We think the incubation period may be as little as three or four days," he said.

"Perhaps even shorter. It may take a couple of days for a man to become an active carrier."

"Benign in men, fatal in women," she whispered. Then her voice became stronger. "That Madman is one sick son of a bitch! They still think it's O'Neil?"

"Nobody doubts it anymore."  
"You think he's a carrier, too?"

Beckett shrugged. "No sense telling her about Seattle and Tacoma. She had enough on her plate." "I'd like to cover your symptoms one more time. Okay?"

"One more time may be all we have."  
"Don't give up. Ah."

"Easy for you to say." She fell silent for almost a minute, then said, "Loose bowel that morning. I felt so horny. Then that Dorona gave me that—"

"Danical," he said.  
"The headache. Jesus, it was bad for a time. Not so bad now. You giving me any parkester in that IV?"

"Not yet."  
"My nipples ache," she said. "Did I tell you that you'd better do the best damned

autopsy of your life? I can't remember."  
"You told me."

Danzas tiptoed in and whispered to Beckett: "Dorona just died."

"I heard that," Foss said. "That's another thing. Will. Acute hearing. Everything's so goddamned loud! Can you get me a tabby?"

"We're trying," Danzas said.  
"A fine time for me to go back to Damer! My tucking stomach's on fire! She started past Beckett at Danzas: "That Madman's a dirty racket! He must know how much agony he's causing."

Beckett considered telling her what they had discovered, that most women laposed into a coma and died without waking. He decided against it. No sense revealing that the efforts to keep Anahie alive were prolonging her pain.

O'Neil, she whispered, "I wonder if his wife felt any. She closed her eyes and fell silent."

Beckett touched a hand to the artery in her neck. He nodded toward the monitor above her bed. BLOOD PRESSURE SIXTY OVER THIRTY. PULSE SIXTY-NINE.

"Every antibiotic we tried on Dorona only worsened her condition," Danzas said. "But perhaps we could try some chemo."

"No! It was Foss, her voice surprisingly loud and shrill. We agreed shotgun for Dorona, nothing for me. She turned a glazed stare to Beckett: "Don't tell my husband about the pain."

Beckett swallowed past a lump. "I won't tell him it was easy, very quiet."

"Would you like some morphine?" Beckett asked.

"I can't think with morphine. If I can't think I can't tell you what's happening to me."

Beckett looked at the monitor. PULSE SIXTY-THREE. BLOOD PRESSURE FIFTY OVER TWENTY-FIVE.

"What's my blood pressure?" Foss asked. Beckett told her.

"Thought so. I'm experiencing some breathing difficulty. I'm cold. And my feet tumbeling?"

Beckett put a hand on her right foot. "No." "Feels like it. You know Will, I've figured out something. I'm not afraid of death. It's dying scares the shit out of me. Then she said weakly, "Don't forget pal—the best damned autopsy."

When she did not continue, Beckett looked up at the monitor. He could feel her pulse slowing under his hand. The monitor read ten beats per minute and dropping.

Blood pressure was diving. Even as he looked, he felt the pulse under his hand stop. The monitor emitted a shrill and continuous electronic shriek.

Danzas went around the bed and turned off the monitor.

In the sudden silence, Beckett removed his hand from Foss's neck. "Ears were running down her cheeks."

"Damn him!" Beckett muttered.

"They're arranging for us to do the autopsies in the OR," Danzas said.

"Oh, fuck off, you bloody French pig!" Beckett shouted. ☐☐

# EARTH

CONTINUED FROM PAGE 14

where they cause abdominal pain; and to the central nervous system and brain where they cause numbness, paralysis and schizophrenia.

Diving into the literature on porphyrins, Codano soon found a paper that implied his hunch about agent orange might be correct. The dioxin that contaminated agent orange, the paper suggested, could slip into the nucleus of a living cell and alter genetic material so that the cell produced huge quantities of porphyrin.

By now Codano knew he was hot on the trail of something and began scouring the country for a place that could analyze the veterans' urine for any sign of the disease. Finally he learned of the Watson Laboratory, an internationally acclaimed porphyrin center at Abbott-Northwestern Hospital in Minneapolis. He placed a call to Zbyslaw J. Petryka, the lab's chief research chemist, and explained his hypothesis. "It's a distinct possibility," Petryka told Codano and volunteered to analyze the veterans' urine himself.

Codano spent the next few weeks collecting urine samples for Petryka. Working late into the night with a group of Philadelphia veterans, he first painted 100 containers pitch-black, since light destroys porphyrins. Then he filled each container

with the urine of an ailing patient and got the samples to Petryka by early October.

To test for excess porphyrins in the urine, Petryka used a technique called liquid chromatography. First he poured each urine sample on top of a glass column filled with silica powder that he waited. Heavier molecules would pass through the powder more quickly than lighter ones. If Petryka knew the weight of a molecule, he could determine its exact identity merely by noting when it reached bottom.

Testing sample after sample, the chemist did indeed find large amounts of relatively heavy porphyrins seeping through the powder. Analysis revealed that these porphyrins were similar to those found in the urine of people abusing alcohol, barbiturates and antidepressants. When such patients stopped their abuse, their porphyrin level usually returned to normal. But even when the researchers excluded from their study all veterans with drug or alcohol problems, they found that 60 percent of the urine samples had two to five times more of these porphyrins than expected.

The findings suggested that the veterans had a form of porphyrin. But to be sure, Petryka ran the urine through a test called the Ehrlich reaction, based on the action of the Ehrlich solution. This clear solution turns purple when exposed to a variety of chemicals, including porphobilinogen, a substance that yields porphyrins.

By this past winter, Petryka had mixed

urine samples from 151 veterans in test tubes filled with Wöhlerian's reagent of Ehrlich solution. Ninety percent of the tubes glowed violet in seconds. But try as he might, he could find no sign of any of the chemicals that usually induce the color change. He concluded that the purple coloration was due to an unknown substance. Ninety percent of the Vietnam veterans examined by Codano, it seemed, had urine rife with a mystery molecule.

Petryka then found elevated porphyrins and the mystery molecule in the urine of a nine-year-old girl whose mother and father had both served in Vietnam. Although the girl had never been in Vietnam herself, she suffered excruciating pain just as the veterans did. She woke up screaming at night because her ribs ached, and she walked on her toes because her feet hurt.

Petryka has spent the last six months searching for the unknown molecule in the veterans' urine, but so far he has had little luck. Until the molecule is isolated, he cautions, "we cannot begin to say just how it has affected the veterans. Indeed, although the evidence indicates that agent orange is linked to severe physiological problems, the researchers must do far more work before they can absolutely prove that the veterans have a disease.

But Codano nevertheless feels the veterans cannot wait for all the answers. Any form of porphyrin, he explains, can worsen from year to year.

To head off the symptoms, Codano hopes for FDA approval to test a drug called hematin, which inhibits the enzymes that spur porphyrin production. He also suggests there may be a way of eliminating the original toxin, the dioxin itself. Studies with animals, he notes, indicate that dioxin tends to stay in the body indefinitely, circulating from the liver through the bile fluid and back to the liver again. But if a chemical could bind to dioxin during the cycle, preventing it from reentering the liver, it might pass out of the body and stop provoking porphyrin production once and for all. Just such a drug, Codano adds, was recently used to bind molecules of kepone, a poisonous pesticide that behaves like dioxin; the same drug, or one like it, might be made to fight dioxin as well.

The ultimate answer may be far more complex. Vietnam veterans were exposed to a mixture of 15 herbicides and pesticides with names ranging from agent blue (arsenic) to agent purple to agent pink. The soldiers absorbed each of these with the air they breathed, the water they drank and the food they ate. The combined effect may forever be inestimable.

But as Codano says, "Even if we never solve the mystery completely, the important thing is to stop telling the veterans there's nothing wrong with them. One hundred fifty of the two hundred people I've examined have porphyrin problems, numb fingers and hands, and an unknown molecule coursing through their systems. It's time to quit the denials and help. ☐



# SUPERPOWDER

CONTINUED FROM PAGE 10

Then in 1977 another provocative DHEA paper appeared. Terence T. Yen, a biochemist working in the pharmaceutical labs of Eli Lilly and Company in Indianapolis, treated DHEA in mice especially bred to be obese and he found that their weight dropped significantly.

Here was another nuzzle: Could it be that DHEA simply killed their appetite? In many classic studies where calories had been severely restricted (though nutritional balance was maintained) to extend the lifespan of laboratory rodents, the animals were also less obese and less cancer-prone. Could the effects of DHEA result simply from eating less? Yen quickly ascertained that the mice on DHEA did not suffer any loss of appetite. They ate as much as their litter mates, which, without DHEA, got much fatter.

Schwartz's own animal experiments soon confirmed both the antiobesity and anticancer effects of DHEA. The substance slimmed down fat rodents. And in mice genetically predisposed to develop spontaneous breast cancer, DHEA inhibited tumor formation, he discovered. Despite the large doses he administered over the course of a full year—more than ten times as much as the amount of cortisone he would have dared to give, for instance, even to a rodent—there were no apparent toxic effects. "It's much too early of course in the game to feel confident about safety," Schwartz warns.

What, for instance, might go wrong? For one thing, since DHEA is a precursor of the sex hormones, some scientists believe it might be damaging to the reproductive organs of both females and males, even perhaps incurring the risk of uterine or prostate cancer. If that came to pass, the well-meaning doctor would have caused cancer while trying to prevent it. Biochemist Norman Applezweig doubts that this would happen. "In very obese people," he says, "as well as in patients with cancer or diabetes, or for that matter in any of us who are growing older, DHEA has fallen below often far below, its optimal level. So we would merely be giving replacement doses to get DHEA back up to where it ideally ought to be.

Applezweig of course recognizes that logic is no guarantee of safety. "Any substance could have unforeseen, and perhaps serious, side effects once it is put into widespread use. We've seen it happen with all too many drugs, and it could of course turn out to be true of DHEA as well. We'll never know until we give it a good try."

Applezweig and Schwartz are not the only people eager to give it that good try. One of Schwartz's collaborators is nutritional biochemist Margot Casary, of Creighton University also in Philadelphia. She is doing obesity studies on mice and on normal-weight rats as well as rats genetically bred

for obesity. In all cases the food intake has remained essentially the same. And in all cases less weight was put on with DHEA in the food than without it. Casary found that in every case (though in varying quantities) the overall amount of fat tissue went down, but so did the size of individual fat cells. When she merely restricted the amount of food, there was no alteration in the body fat-cell size. This seems to clinch the argument for the antifat properties of DHEA and suggests why other researchers believe that DHEA will also be useful in preventing cardiovascular disease. Researchers have long recognized that fat metabolism can play a major role in winding off heart and vascular disorders and strokes.

Another researcher specializing in fat mice is biochemist Douglas Coleman of the Jackson Laboratory in Bar Harbor, Maine. His punbred strains of mice are not only obese but also diabetic. Though he has been experimenting with DHEA for only

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*It seems to hold back so many of the degenerative processes that, barring some terrible unforeseen effects, DHEA is bound to improve the quality of our later years.*

---

a short time, the usually conservative Coleman has already noted "remarkable effects, both dramatic and obvious. Coleman has worked with his genetically obese mice for many years, and he knows they tend to stay fat even when he cuts their food rations in half. Yet, on DHEA, eating their fill diet, one grossly obese group of mice gained weight much less rapidly. More impressive, the diabetic mice, even those that fail to respond to insulin therapy, do respond to DHEA. Their blood sugar drops to normal. And these sick and susceptible mice that usually die at the age of six months "seem to go on indefinitely—at least another six months that we know of so far—once they are put on DHEA." So in these instances DHEA has doubled the life expectancy of these short-lived animals. Unfortunately such experiments in rats and mice are not reliably translatable to human beings, especially in cancer research. And as the French researcher Baulieu has taken pains to point out, DHEA metabolism is not the same in rodents as in humans.

Nevertheless, recalling Bulbrook's studies of Englishwomen with breast cancer, Schwartz believes that DHEA should be

tried. And he says that a number of cancer clinicians—notably at Houston's M. D. Anderson Hospital and at New York's Memorial Sloan-Kettering Cancer Center—stand ready to go ahead once all of the preliminary obstacles have been cleared.

What are those obstacles? One is a lack of money. Drug companies, even Eli Lilly where Yen did his anxiety experiments, have shown little interest in funding the work, in part because DHEA is not a patentable substance. But this objection could be overcome if DHEA lives up to even a fraction of its promise. And Schwartz says that synthetic analogs of the substance—with slightly altered molecules retaining DHEA's beneficial effects—would be patentable. The search for such commercially attractive analogs is on. In fact Schwartz is already working with one whose effects seem in early trials to be superior to DHEA's.

Schwartz believes financial support will be forthcoming shortly. And then the human tests known as "Phase I trials" undertaken just to prove safety could be promptly carried out. But after that it will require many months of testing in animals (in rodents at first, then at least 90 days of further testing in nonrodents, dogs, for example). By the time all this clears through the Food and Drug Administration, perhaps a year will have passed. Then clinical trials in larger numbers of people to prove efficacy as well as to confirm safety will take another few years. So it's unlikely that DHEA will be available for general human use until nearly the end of the decade.

The best trials that Schwartz and his clinical collaborators would undertake would be an attempt to prevent or retard the growth of cancers. (Schwartz has seen no evidence so far that DHEA would be effective in treating cancers that were already established.) Who might the first subjects be?

"In the human female," Schwartz says, "obesity is known to be a predisposing factor in breast cancer. A high-fat diet also seems to elevate the risk. In view of the link between excess fat and breast cancer and deducing from the experimental findings obtained so far, it is reasonable to guess that DHEA ought to be a useful preventive. One of the first clinical trials might enlist women who are vulnerable because of their family history."

Is breast cancer the only type of malignancy DHEA protects against? Schwartz thinks not. One breed of laboratory mouse for instance is susceptible to artificially induced cancer if you put a carcinogen on the skin, then add another substance called a "promoter," skin cancer quickly develops. But if you give mice a single dose of DHEA, simply applying it to the skin before you apply the promoter, the carcinogen's action is blocked, and no tumor forms. "Since many substances in the environment are suspected of being cancer promoters," Schwartz suggests, "it is possible that DHEA might protect against them

Certain kinds of chemically induced lung and colon cancer in mice have also been shown by Schwartz's team to be inhibited by DHEA. So those at high risk of developing colon cancer would also be on Schwartz's list of people who would be included in the first clinical trials of DHEA. One trial experiment: A common African cancer called Burkitt's lymphoma—a cancer of the lymphatic tissue—is caused by the Epstein-Barr virus, transmitted by insects. In tissue culture, this virus can also transform human white blood cells into cancerous cells. But when DHEA is added to the mix, the transformation does not take place. In sum, DHEA has already demonstrated possible effectiveness in preventing cancers of the breast, liver, skin, colon and lungs, as well as Burkitt's lymphoma. And the testing has barely begun.

Researchers in many places have recorded suggestive evidence for DHEA's other miscellaneous effects. Carolyn Bercanier, of the University of Georgia, working with rats that age and sicken prematurely, found that DHEA gave them more energy and held down fat production. Yaron Pily, of the Pacific Northwest Research Foundation in Seattle, demonstrated DHEA's sinking arthritis effects. M. Ben-David, at Hebrew University in Jerusalem, used DHEA to bring down cholesterol levels again in accidentals. Baulieu has even proposed that there should be clinical trials of DHEA for schizophrenia.

Most interesting, perhaps, is a series of experiments carried out by a team of Hungarian scientists in Prague, led by Jiri Sorka, of Karlova University. Noting, as others had, that the decline of DHEA coincides with a host of degenerative disorders, Sorka theorized that as DHEA's inhibiting effects wane with age, destructive processes are allowed to flourish unchecked. The result is what he calls "the hyperproductive syndrome." Taking a hard look at a number of elderly patients suffering from obesity, hypertension, heart troubles, arthritis, and gout, and finding their levels of DHEA low both in blood and in urine, Sorka put them on varying dosages of DHEA.

He was able to raise DHEA levels and claimed noticeable improvement in all except the gout victims, whose elevated uric acid levels went even higher instead of coming down as expected. But Sorka worked with only a small number of patients and used no "matched controls." Besides, too many other things were happening to those patients at the same time for him to be sure the good effects were due solely to DHEA. So his results have not been taken very seriously. But they were interesting enough to suggest the need for more clinical work.

All this has led Applezweig to the conclusion that, unlike most hormones, which excrete (the word *hormone* comes from a Greek word meaning "to stir up") cells into activity, DHEA rather acts to "decrease

metabolic processes." So DHEA behaves more like an antihormone. If insufficiency of DHEA leads to runaway production of nucleic acids, fats, and hormones, then replacement therapy with DHEA should curb those excesses that manifest themselves in the diseases of aging.

Schwartz, who can't help noticing that all his animals on DHEA seem to look younger than those that are not, agrees that DHEA may well be effective in slowing off some of the more serious ravages of aging. In fact, it was the possibility that brought Schwartz and DHEA to the attention of the private, nonprofit Fund for Integrative Biomedical Research, with a special interest in aging—or rather, antiaging. The scientific director of the Washington, D.C.-based foundation, cancer specialist William Regelson, of the Medical College of Virginia, has taken a personal hand in accelerating DHEA research.

Even if DHEA turns out to have no direct impact on the aging process itself, Regelson says, "it does seem to hold back so many of the individual degenerative processes that, barring some terrible unforeseen effects, I think DHEA is bound to improve the quality of our later years."

In the short term, these benefits will depend on obtaining large quantities of standardized DHEA to carry out the remaining research. While awaiting the arrival of the synthetic form, investigators have turned to a lovely Mexican yam. Natives call it *barbasco*. Its Latin name is *Dioscorea floribunda*, a deceptively romantic name for a porous plant—with some useful medical properties. You'll never find it in the supermarket, but the yam provided the original raw materials for the first birth-control steroids. And it can be processed to produce DHEA, a fact well-known to Mexican government officials. Faced with the prospect of opening up a huge market for the barbasco, they would like to see research and clinical trials carried out with dispatch. In fact, Mexico may sponsor some trials with or without American collaboration.

DHEA is already better known south of the border than in the United States. Applezweig, who has served as a consultant for the Mexican government, recalls that only a few months ago the head of the Mexican research agency Proqramex inadvertently caused a sensation. He granted the request of a prominent TV commentator whose dog was stricken with breast cancer, for a supply of DHEA. On large doses of the hormone, the dog apparently made a strong comeback after surgery. Mexico's national television network played up the story, and it caused a stir among viewers.

The real news is more spectacular. Without surgery or side effect, dozens of mice and rats have now defeated several diseases, their defenses bolstered by a multiple-target drug. And researchers suggest that these stores of rodent success may foreshadow new human victories over an array of ancient enemies. **DD**



## EXPLORATIONS

By Odian Cusack

In the waters surrounding picturesque Provincetown, Massachusetts, a whale-watch vessel keeps a careful eye on the horizon. Suddenly the mushroom-shaped blow of a humpback is spotted. Passengers on the lower deck scramble for binoculars and cameras as the giants approach. Against a blue backdrop, a 40-ton marvel propels itself above the surface with the ease of Nijinsky, executing a brief pirouette on the waves. After an effortless descent to the offshore depths, a second whale, 50 feet long, rises full-form from the sea. Each partner in turn repeats the other's movements in one of the most superbly choreographed natural shows on Earth. Performance completed, the baleen clancore surfaces in unison, their odd knobby heads peering inquisitively at the audience only a few feet away on the deck. As a final curtain call, they flash their flukes, the rounded lobes on either side of their tails, and bid farewell.

Such aquatic ballets draw more than 70,000 people each summer to the outermost tip of Cape Cod, also known

for its local artists and craftsmen, the historical flavor, and the unabashed gay community. The 90-foot whale-watch cruises, *Dolphin IV* and *Dolphin V*, are booked months in advance, often by environmental groups whose supporters are eager to get a look at exactly what they've been trying to save. And while wildlife buffs enjoy their ringside seats at this natural spectacle, scientists are busy collecting data on these friendly yet mysterious creatures of the deep.

On board the pleasure cruiser, naturalist David Mattia instantly recognizes the applause-worthy duo as Point and Othello. Like a celebrity removing his mask, the whale reveals its identity by displaying the scouted fluke on the back of its tail. As unique as fingerprints, the flukes are pigmented in patterns ranging from all-white to all-black with near-infinite variation in between. And when a novel configuration is discerned through a careful comparison of photographs, cetacean lovers delight in christening the newcomer. From the Caribbean to the waters of Maine, more than 1,000 hump-

backs now have a name and identity separate from others of their species. This "Who's Who of Leviathans" is compiled in a scholarly paperback volume published by the College of the Atlantic Whales and an e-mailed Humpback Whales—Fluke Photos.

At day's end, Mattia reports back to the Provincetown Center for Coastal Studies, headed by Dr. Charles ("Stormy") Mayo. A fisheries biologist-turned-naturalist, the energetic and popular Mayo was given his salty moniker at birth during a gale 38 years ago. To this day he is much more at home on the bridge of *Dolphin III*, scanning the ocean than in the small quiet building that houses his research center. But it is here that Mayo compares fluke patterns in his analysis of the mating, feeding, and social behavior of select animals.

The object of these lengthy hours of observation is a plump cetacean with extremely long flippers and a predilection for aquatic acrobatics. On land, the humpback resembles a roly-poly with a wart-nestled head. The only vestiges of the terrestrial existence it abandoned 40 million years ago are a few follicles of hair that jut from its head nodules.

Though hardly a pretty animal by current definition, the humpback takes on beauty and grace in the context of its own environment. The seemingly disproportionate flippers, a third the total body length, are said to envelope around another of its species during a tender embrace. And the massive fluke permits the leviathan to glide through the oceans without effort or strain; the most adept human swimmer seems awkward and tedious by comparison. For the life it lives in the world it inhabits, there is probably no more perfectly formed creature on this planet than a whale.

Scorable to humans and one another, humpbacks congregate in groups that vary from three to seven individuals, with the largest gatherings observed just before their southern migration. Point and Othello are gregarious and always put on a show for the whale watchers, tisking now with her second calf, however,



A Provincetown humpback reveals its identity by displaying the unique pigmentation on its tail.

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## TRICERATOPS

CONTINUED FROM PAGE 51

as far as on the day they first met Triceratops. After passing through the copse on the top of the hill and coming out above that subdivision, the father and son came to a stop, finding themselves speechless and unable to move.

A Triceratops huddled superimposed over every house in the town, their skin—brilliant green beneath the mercury lamps—gently rising and falling with their breathing. Occasionally one would open its eyes in a narrow slit, and every time the lids raised, the pupils would glitter in brilliant rose, perhaps because of rhodospin pig ment like that found in some species of oocoidae.

It was a scene of phantasmal beauty like the working of giant beetles.

‘Do you suppose the land over there’s the same as the town?’

‘Maybe they can see us and feel us like we feel them. Maybe they’re just trying to keep warm.’

You may be right.

Isn’t it a weird feeling? Everyone’s going to work or leaving for school from a din o saur’s belly, and they’re coming home to the belly, eating dinner, watching TV.

But that’s how it is.

‘Hey, my room’s in its butt!’

‘Don’t let it get to you.’

‘But it’s really peaceful, somehow, isn’t it?’ They may look fat, but I’ve never seen a Triceratops fighting.

‘They hardly ever run, either.’

‘Yeah, that’s right. Just the one we saw the first time, in the other town.’

I wonder what he was running for.

Anyway, it’s peaceful enough today.

There’s nothing better than peace.

The peace did not last long.

It was a day when yellow sand blown from the continent filled the air and turned the sun the color of blood, a harsh unpleasant day.

It was the day that the son, looking casually toward the national highway from the hilltop while returning from a friend’s house, saw a dozen dinosaurs running on strange hind legs—like ostriches—long tails held high, kicking up clouds of dust.

Those were tyrannosauroids for sure. Superlat back legs and little skinny front ones like decorations. Pointed mouths. Anyway, tyrannosauroids. And they were really moving fast. They came running at least as far as the station.

‘We’re just a little way from the station here, but I didn’t feel anything like tyrannosaurus when I was coming home just now. Even the Triceratops in the garage just opened his eyes a bit and stared at me like he always does.’

‘But I really did see them.’

‘Maybe they ran right through town and went somewhere else?’

‘But I wonder why they would do that?’

They went out of sight near the station.

‘Hmmm.’

The father crossed his arms.

‘In that case, maybe they’re still milling around these somewhere. Or maybe—’

‘Let’s go see,’ said the son.

‘You two are up to something again, aren’t you?’

The mother shouted after them. The father and son smiled, waved, and mounted their bicycles.

They went as far as the station, but there was no trace of any tyrannosauroids. After watching the station plaza for a while, they turned leisurely back home.

A small creek flowed close to the station, completely covered with concrete. There was a playground built on top of it. The long, covered drain formed a second road stretching almost to their subdivision.

‘Let’s go back this way.’

The father and son pedaled their bicycles slowly over the concrete plating. The tires bounced heavily every time they jumped a gap between the plates.

Their front lights wailed widely.

Before long they became aware of a strange noise. It sounded like rapid water and an octave lower the grunting of countless pigs. Moments later they felt the earth begin to rumble.

And suddenly they looked down at their feet. And ran to the metal lid of an sewer.

They were running beneath the metal mesh of the lid. Secretly kicking up the water as they ran. Their wet hides glistened, their necks were outstretched. The pack of tyrannosauroids closhed for the subdivision like a conveyor belt, a never-ending stream.

They had been following the water course. The group near the national highway had been but a single part, a flying column, and had merged with the main group at the station.

Their bad.

It hardly mattered if they hurried, yet the father and son began to pedal furiously.

As they neared the subdivision, countless tyrannosauroids danced up through the concrete sheeting ahead of them, looking like a geyser of muddy water.

All the houses on the slanting slope of the subdivision heaved up their roofs and began to move.

The Triceratops had risen.

The fighting began.

Before their eyes, a Triceratops head lowered, charged forward and plunged sharp horns into the carotid artery of an attacking tyrannosaurus. The carnivore’s blood fountaining into the air like water from a fire hose fell back, lashed its long tail and leaped hugely, gouging out the Triceratops’s eyes with a single sweep of the key-shaped claws on its forelegs.

Three more tyrannosauroids swooped onto the mammoth body of the Triceratops, crumpled just six meters in front of their home. The huge reptiles plunged razor teeth into the belly meat, already ripped apart by their claws. The surroundings were flooded in a murky river of blood.

"Isn't that our triceratops?" cried the boy  
his voice shaking  
"You're right."

A tyrannosaurus had fallen in front of the  
entranceway. The father and son warily  
watched its huge bloodshot eyes, the convul-  
sive contractions of its belly as they  
wheeled their backs up the driveway.

The fighting lasted throughout the night.  
Even at the height of the raucous laugh-  
ter of a televised singing contest, the father  
and son could hear the war cries. Could  
feel the thick hide splitting, the shrieks of  
the hour of death.

By morning the combat had almost  
ended, and the countless corpses of tri-  
ceratopses and tyrannosaurus, some still  
barely twitching the tips of their tails, some  
dragging the ripped staves of their stom-  
achs, lay tumbled across the landscape.

Almost without exception, the corpses of  
triceratopses had their entrails dug out, their  
ribs laid bare, and their neck shields  
chopped into ribbons. But most of the ty-  
rannosaurus showed only deep, punctu-  
rate wounds in their necks and bellies,  
escaping utter destruction.

There were even a few scattered survi-  
vors. But none had escaped unscathed.  
All had lost the energy to keep on fighting.

One tyrannosaurus, his flung-out leg half  
increased from the high-down, continued to  
drag out and gobble the guts of the tri-  
ceratops he had slaughtered.

Behind him sprawled the body of one of  
his comrades, a gaping hole bored through  
its neck, its body dotted with dried blood  
while no more than five meters away a tri-  
ceratops grazed silently on the grass, blood  
still seeping from one of its eyes.

Every now and then the tyrannosaurus  
would raise its head and glare—though  
perhaps this was only their fancy—bale-  
fully at the grazing triceratops.

if you eat that crud, why'd you kill us?  
The father and son almost felt they could  
hear that voice.

if there's too much to eat, why did you  
keep on butchering us?

The triceratops's unblooded eye seemed to  
look that back.

The father and son watched as they  
walked slowly to the station. The corpses  
that weren't dripping were at least tolerable.  
But even they were brought up short  
where the large intestines of a tyrannosaurus  
lay heaped across the road, as if they  
had sprung writing from the animal's tor-  
open belly. After a moment's pause they  
edged by on the side of the street.

A woman in fashionable white slacks  
passed through that blood-smeared land-  
scape, her shoals clacking loudly, her eyes  
supercariously watching father and son.

A merabus filled with kindergarteners  
passed through that landscape bearing  
its load of lively chatter.

An elementary-school student passed  
through that landscape, singing a single  
Skylark dancing to the sky  
God is reigning in the sky

The world, the world's a trifles OO

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# SPACE

COLLECTOR FROM PAGE 19

ASAP's ambitious program makes good news copy, but it raises three questions: Are these guys nuts? Will NASA ever give spaceflight over to private operators? And can spaceflight ever become a profit-making commercial venture?

William Backus chief center planning officer at the Kennedy Space Center says "They're not crazy, but most people here feel they are premature. I would say that the charter members might not ever get to fly a space shuttle, but their activities will enable a future pilot to do it."

NASA Administrator James M. Beggs has said he believes that a private marketing operation for the shuttle launch service would be better than current federal shuttle marketing. And there seems to be support in Congress for eventual private operations. But no blueprint or timetable has been drawn up for the inclusion of private operators in the program.

How long the development of space takes and when private space ventures become profitable depend entirely on government willingness to support the program. This translates into serious allocation of funds for the work. Expanded budgets are not a favorite topic among the nation's lawmakers. In the long run ASAP's other reason

for being—to educate the public—may well turn out to be more important than its flight-training program. Strong public support is needed before lawmakers will be willing to pass out appropriations in these defalcated times.

To wake people up and educate them we decided to open the organization up, Koch says. This has meant creating several classes of membership. A full member must have a commercial pilot's engine instrument rating, with 2,000 or more hours in any light-tick crew member position; 1,000 of those hours must be spent in high-performance vehicles. These are the space pilots of the future.

Anyone holding a private pilot's license but not meeting the full-member qualifications can become an associate member pilot. An associate member general classification is open to anyone interested in knowing about space or looking toward an eventual career in it.

A full member pays \$50 a year and contributes 12 days of volunteer work to the organization. Associate members, general and pilot, pay \$25 a year. Student associates pay \$15.

All members are eligible to take the ground school courses, which cost an extra \$310. Plans are being drawn up now to offer an abbreviated course which won't offer instruction in such technical segments as space navigation for those who

don't intend to apply for pilot's jobs.

"The ground-school course, or parts of it," Koch says, "would be ideal training for newsmen for example who must write about space, and for corporate people who will sell products and services to companies in the program."

Assuming that ASAP is right in forecasting an expanded space program how many shuttle pilots will be needed to fly regularly scheduled trips? According to Koch, by 1985 the total will be about 300—100 military pilots, 100 with NASA, and 100 civilians. By 1987 the total will rise to 1,000 and by 1990 to 2,000. By the year 2000 he says, the total could reach 10,000.

Other figures make it clear just how badly we need to enlarge the number of persons with knowledge of space. There are about 20,000 people in NASA involved in the space program; if appears that the Soviet Union has a like number. These 40,000 persons, including clerks and bureaucrats, are the world's pool of knowledge and ability in spaceflight. This number is dangerously small, considering the scope of space and its importance to the future. It will have to expand dramatically in the next decade and the course plotted by ASAP may be one valuable way to do it.

For further information about the course write to The American Society of Aerospace Pilots, 1305 Remington Road, Chambersburg, PA, 60196 **DD**

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at all the DNA in one human cell could be arranged in a single strand, it would be about 1.5 meters long. Somewhere in all that DNA there must be a base sequence TTTCCCC-C-C- and this could be played as the famous opening notes of Beethoven's Fifth Symphony.

A major breakthrough in molecular biology occurred a few years ago when a technique became available for determining the base sequence in a DNA strand. What has been learned is that there is considerably more DNA present in a cell than necessary to make a human being. We still don't know what all the excess DNA is doing, but at least the techniques for sequencing have given us some idea of what it looks like as well as an understanding of the sequence of bases in genes. Another surprising discovery is that the gene regions are much more complex than was expected, instead of a simple sequence of bases coding for each protein chain, it was found that pieces of the message were scattered about in the gene region, with numerous other sequences in between. Even more remarkable are some of the sequences that are found outside the gene. A significant fraction of human DNA consists of the 300 base-repeating sequences that were described earlier, while another

fraction is so unlike the rest of the DNA that it appears all by itself in certain isolation techniques; this is called satellite DNA.

This kind of order is rare in nature, and totally unexpected at the molecular level. Currently no one knows with certainty where such sequences come from or what their function might be. There are some guesses, of course. For instance, it has been suggested that the repeating sequences are a signal. Some portions of the DNA in cells are called transposable elements because they can be transferred from one region to another and thereby permit an organism to shuffle its genetic deck.

Another idea is that the repeating sequences are remnants of viral genes that "infected" the DNA and that they are carried along with the replication process. A more speculative explanation proposed by several scientists, including Francis Crick, the codiscoverer of the DNA double helix, is that the repeating sequences represent selfish DNA. One can imagine that a certain sequence of DNA accidentally got lodged in the main DNA pool of an early cell and found itself able to reproduce more or less independently. Naturally it would do so until it had filled up as much of the DNA pool as it could without hurting the organism that it was inhabiting. Thus, selfish DNA would be of no use to the cell, but would be alive in its own primitive fashion, making it essentially a molecular parasite.

An even more intriguing idea and one

that will never appear in a traditional scientific journal is that DNA, when it is not hard at work making proteins, whistles a little tune that we can decode as music. Want to try your hand? The base sequence of a satellite DNA fragment called BLUR 17 is shown here:

```
TCCTTACGCTTACCTTAGCTTACGCTT
GTATTATACCTTAGGTTACCTTAGT
AGATTACCTTAGCTTACCTTAGT
GCTTACCTTAGCTTACCTTAGT
AGGTTACTTTAGCTTACCTTAGT
CTTACCTTAGCTTACCTTAGT
GACCTAGCTTACCTTAGT
TTACTTTATCTTACCTTAGT
ACCTTAGCTTACCTTAGT
TACCTTAGATTACCTTAGT
```

The orderliness of this three and five base repeats is obvious at a glance. It forms a kind of rhythm that goes on throughout the sequence. If you are musically minded, you should be able to translate this into a genetic melody by using the notes A, C, G, and E (for T) and following the guidelines outlined earlier. Of course, the choice of notes is arbitrary, since no one had music in mind when the bases were named. Any other four notes could be assigned and would produce a different melody, but the same rhythm will be present, reflecting the patterns of repeats in the sequence. Accompanying chords are imposed according to the musical feel of the melody.

By this time, if you are a knowledgeable biochemist or musician, you are probably thinking, "That guy has got to be kidding. There can't be real music in DNA, just some patterns that happen to fall into interesting but arbitrary tone sequences. Well, that depends on what you mean by music. The melodies shown here are musical (because I found music), analogous to art (because of the artist). Beauty in this case is in the ear of the listener." **DD**



/ Like to think that / All a wot' ecological niche

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# SPACE IS SURVIVAL



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# MIND

continued from page 20

single largest category of unexplained sudden deaths yet discovered.

In the past four years about 40 Laotians, Vietnamese, and Kampuchean have died mysteriously in their sleep. The victims were mostly young, apparently healthy men. Death in each instance happened at night and took only a matter of minutes. This strange pattern had first been noted in the 1940s and 1950s among young men in Japan, where the disease is called *kokori* and among Filipino men in the Philippines and in Hawaii, where it is known as *bangungot* (the Tagalog word for "night mare"). Autopsies done on the men revealed they had suffered acute cardiac failure, but none had underlying heart disease. And because some deaths were preceded by heavy breathing, groaning and screaming, there was a popular notion the deaths were caused by nightmares.

If doctors can find out exactly what happened among these refugees, says Dr. Roy Baron, an epidemiologist at the Center for Disease Control who is in charge of the investigation of such cases, they may well have a clue as to what caused other inexplicable sudden deaths. Cardiac pathologists who studied heart tissue taken from people recently deceased think the heart failure may have originated from some abnormality in the heart's connective tissue, its electrical system. Perhaps the best way to locate the triggering factor involved, Baron suggests, is to find people who have survived these episodes and then study them in sleep laboratories.

"I don't think we are going to get very far by arguing these people had a bad dream and scared themselves to death," adds Dr. Merrill Miller, a sleep physiologist and chief of the Sleep Disorders Center at the State University of New York at Stony Brook. Right now the leading hypothesis, which is not inconsistent with the autopsy and case history material collected by Dr. Baron, Miller says, is that REM (rapid eye-movement) sleep precipitates a kind of cardiovascular crisis.

The respiratory pattern becomes highly irregular during REM. For vulnerable individuals, sleep can be fraught with risks. At times it can seriously alter the pulse rate. Partly for these reasons, most nocturnal heart attacks occur during REM.

While everyone shows some cardiac irregularity during REM sleep, Miller asserts, there may be a subgroup who exhibit terrific cardiac irregularities during REM. What he would like to do is study that subgroup in which these night deaths are most frequent and see whether we can find any exaggeration of normal cardiac and respiratory irregularities.

Studies like Miller's may eventually help pinpoint some of the high-risk factors. Meanwhile the mystery of sudden death remains an awesome one. **DC**

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MICROCHIP ART



COURTESY OF SONY



FICTION

**MICROCHIP ART**—Through the lens of Philip Harrington's camera, a microchip barely discernible to the human eye is transformed into a richly textured landscape of startling depth. The world-renowned photomicrographer uses polarized light and other special effects to dramatize the delicate inner workings of electronic networks. The total effect is that of an aerial view of a Mayan city with stepped pyramids and plazas. Don't miss this visual treat in September's *Omni*.

**NATURAL CANCER FIGHTERS**—Researchers are learning to enlist antibodies, one of the natural weapons our bodies produce to defeat cancer. In 70 percent of cases, when drugs and interferon have failed, antibodies have knocked out tumor cells and saved lives. Tagged with radioactive atoms, antibodies have also enabled doctors to spot cancers too small to appear on normal X rays. Ironically, cancer cells themselves help researchers produce these lifesaving substances.

**COMPUTER KIDS**—Good bye, blackboard and eraser; hello, TRS-80, Apple, and Alan. There is a new generation of children growing up who handle the intricacies of computer language and programming the way other generations learned how to ride a bike. For better or worse, the computer has become a fixture in modern childhood, and as a result, we may never be the same again. The next issue of *Omni* shows how the first wave of computer kids is using, and sometimes abusing, this new tool for fun and in some disturbing instances, for profit, too.

**INTERVIEW**—At 6 A.M. when Swedish officials called Hans Bethe to tell him he had won the 1967 Nobel Prize, he let the phone ring for two minutes, thinking it was a wrong number. That was one of the few miscalculations ever made by the man who figured out how the sun works. In 1942 Bethe was one of the first physicists convinced that the atom bomb could be ready in time for use in the war, and he joined the Manhattan Project at Los Alamos. Since then he has been involved in nuclear issues at the highest government levels. In next month's interview Bethe argues about nuclear power and disarmament and other highly charged matters.

**FICTION**—In the September issue *Omni* features an impressive debut by Dan Simmons. In "Eyes I Dare Not Meet in Dreams," telepathy obviously proves to be a blessing for three embittered mafiosos. The Man Who Met Picasso, now elderly, tells a stranger of his youthful encounter with the great man. This charming fantasy is by Michael Swerneck, one of the latest rising stars of science fiction.

keeps a respectable distance and, like any protective mother, seems to caution her hefty youngster to do the same.

In the late fall the humpbacks migrate to the sunny waters of the Caribbean, where they will court and mate. The males will sing the "songs," an intricate orchestration of underwater vocalizations, among the loudest made by any animal on Earth. At close range, their haunting chant has been likened to a pounding drum. Dr. Roger Payne has recorded baleen ballads for over 12 years. He reports that all the males in a region sing the same song, which gradually undergoes changes during the season, like a musical improvisation. Off Provincetown, however, they are mute. "In colder climes," Mayo explains, "music is not a large part of their lives."

What is important to Provincetown whales is eating, which is why Mayo restricts cruise passengers to be on the alert for a halo of bubbles erupting on the ocean's surface. The frothy circle is the telltale sign of a bubble net—an ingenious device that the humpback uses to snare an ample supply of sandlances and other favorite fish. The whale swims to the surface in a spiral, blowing bubbles ahead of it that form a makeshift net. Once its prey is surrounded by this curtain of air, the gargantuan gourmand springs from the center with jaws agape as dinner served. The humpback is the only species of whale that has ever been observed securing its food in this unusual manner.

Until recently the worth of a whale was measured in size, weight, and yield. Few knew or cared that they sang, court, use their environment like a tool, and perhaps, as Carl Sagan has speculated, carry the history of the earth's oceans in their complex, highly developed brains.

Although Provincetown retired as last whaling ship in 1921, only 7,000 humpbacks remain in the world's oceans. While populations in the Southern Hemisphere have been virtually exterminated, As their numbers dwindle, our tragic lack of knowledge about these gentle giants has become a mounting cause of remorse.

In 1977 the Voyager deep-space probe was launched from Cape Canaveral, Florida, to carry the culture of the earth beyond our solar system to other galaxies. Among other things, the probe contains a unique copper recording with the music of Bach and Mozart, a greeting in 55 languages, and the song of the humpback whale. With a life expectancy of 1 billion years, that record may well preserve the song long after the singer has been silenced. An Alan to man, the humpback is fittingly selected to sing its final elegy among the stars. **DD**

To book a boat reservation, contact Whale Watching Dolphin Fleet, Box 162, Eastham, MA 02542. Telephone: 617-255-3857.

# FANTASTIC VOYAGES



Each new edition of OMNI Magazine is a fantastic voyage, a wondrous journey through the Infinite and magical universe of science and science fiction.

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Additionally, OMNI's regular columns Earth, Life, Space, Mind, Environment and Continuum are a constant update on what's occurring in our world, while Anti-matter shows us the lighter side.

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# THE WATCHER

## STARS

By Derral Mulholland

Every August the earth collides with hundreds of microscopic fragments from Comet Swift-Tuttle. Nearly all these notes burn to a crisp in the atmosphere, fired by the intense heat produced by air friction causing a celestial light show known as the Perseid meteor shower. A meteor shower occurs when the path of the earth and a comet intersect. The blazing trail of a meteor signals to us that the earth and a piece of the comet have arrived at the crossing point simultaneously.

But absolutely nothing guarantees that the comet itself won't be there someday when we arrive. Nothing. That probability arises only about every 120 years, however. That is the amount of time Swift-Tuttle takes to complete one of its long, hyperbolic orbits around the sun. The comet itself has been seen only once, in 1862, and, although that isn't enough to predict its return very accurately, astronomers say it is due back about now. The best that orbit specialists have been able to say is that it has been expected sometime

between 1879 and 1883. So it might arrive on August 12 of either 1962 or 1963 when the earth will be in its path. Will it happen this year?

No, it won't be there on August 12, 1962, the Watcher predicts. "Otherwise we should have seen it by now."

Fortunately, we have a comet early warning system, with astronomer Brian Marsden, the Watcher, at its center. Marsden heads the telegram bureau of the International Astronomical Union housed in the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts. He runs an operation to inform astronomers around the world of important or unusual short-lived events—comets, asteroids, supernovae—in time for them to be observed adequately. Comet sightings from all over the globe are sent to him as a matter of course, normally by telegram. He in turn relays this information to all subscribers of the service—by telegram to potential observers, by postcard to those whose being apprised is less urgent.

When Marsden accumulates enough

observations—only a handful are needed—he computes an orbit that shows where the comet is going. He then draws up a list of predicted future positions, and this too is sent out. The activity now comes full circle. With the predictions, astronomers can make more observations, which in turn are used to make more precise predictions of the future path.

Does Marsden feel the Perseid comet will ravage the earth, a real-life counterpart to the fictional Comet Hammer-Brown that devastated Earth in the novel Lucifer's Hammer? "You can't say categorically that it won't happen sometime," he says carefully, "but the possibility of a collision in 1962 is very remote." If it can happen, he says, only if the comet returns on August 12, when we are at the fateful intersection. And if it is as bright as it was in 1862, then it won't be able to sneak up on his grid of sentries. "Nobody's seen it," he says. "And everybody is looking."

"That doesn't mean there will never be a surprise impact," Marsden admits. "We can't promise that. Such things are always possible, not only in 1962, but in any year. Fortunately, Swift-Tuttle is not a very big object, perhaps a mile in diameter. Any shield small enough to slip unobserved through the surveillance net is not likely to be large enough to create more than a local disturbance."

In fact, one widely publicized claim that there is a 1 chance in 2 million of a collision with the comet is probably too pessimistic. Besides, Marsden says, it's awfully hard to give a probability for something of that nature. So many variables.

As cause for alarm, Comet Swift-Tuttle is small potatoes compared to the hazards of everyday life, those on guard feel. After all, the odds of any one person dying from a random cause on any given day is about 1 in 25,000. That's a much greater risk than the chance of being hit by any one of all the known comets during a person's life.

Killer comets? The warning net is in place and Marsden is ready. "There is still a probability for next year," he notes. **CC**



Killer comets: Lurking somewhere out there? Not to fear, the Watcher is ready and waiting. **CC**



## PHENOMENA

A metallic green African swallowtail butterfly (*Papilio arimachus*) flutters above a sea of color in the striking photo by Kaszly Buddy. Looking for a way to highlight the sheen of this lepidopteran, he first projected the image of a multicultural abstract painting onto a screen and then positioned the swallowtail in front of it. A native-born Hungarian who works in the photo department of the University of Oslo's Neurophysiology Institute, Buddy confesses to being a compulsive experimenter with photography, especially on a small scale. This microscopic interest has led him to record everything from the delicate geometric structure of a crystal to the frothing image of one drop of water making a microscopic splash. He recorded this on Agfachrome 50L film, using a Canon F-1 camera equipped with an f1.4 50mm lens. OO

Competition #22. Omni Editor Arrested  
for Malappropriation of Puns

# GAMES

By Scot Morris

Our twenty-second Competition, launched last January, invited readers to enter the rewarding career of headline and caption writing. We gave two examples: topless girl driving a convertible causes a ten-car pileup (NINE TWO NINE TEN) and Orcasia considers purchasing Buster Keaton's Hollywood estate (ARISTOTLE CONSIDERS/AREA THE HOUSE OF BUZZARD).

Perhaps our examples were too few or the assignment too general, but many entries missed the mark. We saw too many punch lines to staggy-dog stories (that's a competition we haven't run yet), IRISH CALLED ON ACCOUNT OF GAME THE RAMBLING RICK OF GEORGE THE CZECH AND AN ELEPHANT ENGINEER, RED'S GONG IN THE BALL, BET WERE A HEAD FOR A RESERVATION, NO TEENKID LISTENED. In some cases the setup was so convoluted that we couldn't bear to read the whole entry. When the headline is *HYIT AGAIN, BAMA*, and the story begins "New York Yankee star player Stan Homaker... there's little point in reading further."

Repeats abounded. Three gags in particular were so popular that we often saw several versions of each in one day's mail. The most original pun was about the mental patient who raped two laundrywomen and then escaped: *NUT SCREWS WASHERS AND BOLTS*. Running a close second was the story of Arnie, a hit man seeking for apprentice wages, who killed his contract and two bystanders at a grocery store: *ARNIE CHOKES THREE FOR A COLLAR AT SUPERMARKET TODAY*. Then there was the one about the madcap psychic who robbed a bank and got away with the loot: predictably headlined *SMALL MEDIUM AT LARGE*.

Our favorite entries were based on true stories, and in this regard we are pleased to recommend a book sent to us by Los Angeles reader Dorothy Carol, *Squad Helps Dog Bite Victim*. The Dolphin paperback is a compilation of the best "bubs from the nation's press," which have been preserved for posterity by the Columbia Journalism Review in its popular column *The Lower Case*. All the headlines, quotes, captions, and "collections" in the book are genuine, though we wonder the OMN

how many were accidental. Surely some of these headline writers were slyly anticipating *Omni* Competition #22. Here are our dozen favorites:

- \*\*"ACCIDENT WITNESS PROVIDES NAMES (Quad-City Times, Davenport, Iowa, 8/3/78)
- \*\*"DIFFERENCE BETWEEN DAY AND NIGHT FOUND ON TOUR OF TORRINGTON SCHOOLS (Register, Torrington, Conn., 5/19/77)
- \*\*"PEOPLE SHOULD EXPLAIN WHEN GAS CHECK PRESENT (Citizen, Ottawa, Canada, 5/25/75)
- \*\*"CHILD REMAINS OBEDIENT (Journal Star, Peoria, Ill., 1/12/78)
- \*\*"SUSPECT HELD IN KILLING OF REPORTER FOR WACKY (New York Times, 9/24/77)
- \*\*"INDIAN OCEAN TALKS (Plain Dealer, Cleveland, 10/5/77)
- \*\*"CHINESE STRMAN DROPS (Oregonian, Portland, 7/28/76)
- \*\*"DOLL IS STOLEN, BREAK FOR USE IN GARDEN (Buffalo Courier-Express, 6/23/77)
- \*\*"COLUMBIAN GETS UNPROTECTED IN TROUBLE WITH HIS PAPER (Lewiston Morning Tribune, Lewiston, Idaho, 3/17/75)
- \*\*"LOT OF WOMEN DISTRESSING (Spokane Daily Chronicle, 7/4/75)
- \*\*"BREAK ATTEMPT BY SCOTT BLOC NOT FORGIVEN (Atlanta Journal, 4/4/79)
- \*\*"ALL LITTLE CONDENSED TO FACE FINEST SQUAD (Washington Post, 3/9/80)

The budding headline writers in our Competition were allowed to invent fanciful stories or pictures, but we favored the most plausible ones, and we coined several of the setups. An unrelated runner-up is Tom G. Taylor, of Houston, who provided us with the headline at the top of the page:

## GRAND-PRIZE WINNER: \$100

On January 8 of this year, the Southern Africanist (of Carbondale, Illinois) printed the true story of a train that had gone off the tracks near the desert town of Thermal, California, just north of the Salton Sea. The train had been carrying radioactive americium; the article explained and various officials, fearing the threat of public contamination, immediately cordoned off the Thermal area. The story earned this accurate, if

uninspired headline: *FRIGHT TRAIN CARRYING NUCLEAR MATERIAL DERAILS*. Tom Misant, of Carbondale, Illinois, sent us the Southern Africanist clipping with the headline he would have written for it: *THERMAL, NUCLEAR TRAIN REACTION*.

## RUNNERS UP: \$25

The scene, similar to Poland in January 1982: *Headlines*: STRIKES DEPRESS NATION, DEPRESSION STRIKES NATION, NATION DEPRESSED, STRIKES —James C. Cave, Princeton, Tex.

A computer company gives an award to its best salesman: *MAN WINS BEST PRIZE FOR APPLE TURNOVER* —Stephen Duzdek, Silver Springs, Md.

An imagine-it-yourself picture caption: *TOUR WITH BAGS AND HATS AT WHITE HOUSE BREAKFAST* —Armand A. Paul, Frederick, N. B. Canada

Story about a Nashvile Datsun dealer: *THIS IS WHERE DOLLY PARTON BUYS HER BIG JS* —Pamela VanWeen, City of Industry, Calif.

Bark holes develop in residential areas of Florida as the result of drought and the consequent lowering of water levels (a true story). *Headline: BOTTOM FALLS OUT OF FLORIDA REAL ESTATE* —David M. Garretts, Madras, Ohio

A former Playboy bunny sued her doctors for approximately \$6 million, claiming that the bunion operation they performed had left her crippled and unable to work (a true story). *Headline: ORKAYKIN AIDS SUAVEY* —P. J. Weber, Mount Pleasant, S. C.

Renée Richards is barred from playing in the women's tennis championships after failing a hormone test. The judges' decision is headlined: *NO VIOLENCE AROUND* —Denis Goss, San Francisco

At a pre-season baseball game in Florida

Yankee star Tommy John poses for a photograph with Dodger Fernando Valenzuela. Caption: **INTO HERE AT AN OBSESSION**

—Vincent J. Kish, Bellerose, N.Y.

The Gullu brothers, convicted of making wine without a license, win their appeal on the grounds that all they had were some vats of crushed grapes. Headline: **THEY WILL SERVE NO TIME BEFORE IT'S WINE**

—Patrick Schubert, Rockford, Ill.

#### HONORABLE MENTION

Teen star Garret does the Garfunkel impression. **LOVE METERS AFT**

—Dick Doran, Philadelphia

Interior secretary writ declared. **WE'RE NOT OUT OF WOODS YET**

—Gerard Gormley, Springfield, Pa.

The diplomat's abductors are sentenced. **KNOWPERSURE GET 10 YEARS IN ATTACHE CASE**

—David Harrison, Tallahassee, Fla.

At a charity dinner a basketball star, a heart surgeon, and the architect of San Francisco's baseball stadium are photographed together. Caption: **DEBUSH-HERE, DEBAGNY AND THE CHALLENGER MARJOR**

—J. Van Bushbarger, Davidsonville, Md.

When a boatload of Hagan refugees came ashore at Jupiter Island, just north of Palm Beach, the *Stuart News* (Stuart, Fla.) gave the incident this front-page head-turning headline: **ALIENS LAND ON JUPITER**

—sent by Bob Wright, Jensen Beach, Fla.

Top science magazine announces exclusive interview in its Christmas issue which will be given free to all subscribers. **GOOD IS OWN PRESENT**

—Marlette West, Concord, Calif.

Merrim Webster publishes a "Majority approved" dictionary which omits all sexual, scientific, indigulous, un-American, and foreign sounding words

An editorial headline: **WIKINGO 100 FKA**

—David M. Garens, Medina, Ohio

#### UPDATES

Our January column was devoted to three uninvolved nodes that lead to gold. As you may have heard, the gold-finger rabbit that was the prize of Kit Williams's *Masquerade* was unearthed in March, somewhat by accident and through the unrefined tactic of searching in the neighborhood where Williams had played as a child. This left the master riddle of *Masquerade* to be cracked by punists who could convince themselves that intellectual rewards after all are worth more than gold. As of this writing, solutions to *The Wre* and the Beale Cipher have yet to be found.

In February's "World's Hardest Word Quiz," we said that the longest word that can be typed using the top row of letters on a typewriter is typewriter. Jim Grant of Burnaby, British Columbia, had the ten-letter record with prognator, as did Steve Julian of Pomona, California, with rapetovine.

You can spell astirde on the telephone by dialing 278-7433. The same number spells another word with different letters in every position, and, as several readers pointed out, either crushed or brushed will work as a solution.

In response to our challenge for words to fill out the "seven-letter alphabet" "D W Ficker of Côte St. Luc, Quebec, offers the slant / in halpenny and the silent x in saux. Mark Isak of Los Gatos, California, who also found saux, adds obster as a candidate for slant /.

Isak also points out that in the category "longest word in which all letters are in alphabetical order" almost is tied by several others, including abhors, begins, boppy, chemp, and chmiz. If double letters are allowed, Isak adds the record-holders are beesty and bellow. (Bellow was also recognized as a winning word by a reader in Orcutt, California, named Dave Sevedge, who proudly informed us that his own name is typed entirely with the left hand.)

This brings us to April, and to our challenge to find the longest words typed with the left and right hands, respectively. Pat J. Goldblatt of Salem, Oregon, had the left-hand record, stewardesses, with her 12-letter desegregator, as did Athena Norcia of Toluca, Mexico, with parbreasted. (This assumes b is a left-hand letter; if so, is the 13-letter breadfeeders in any dictionary?) On the other hand, *loolop* (8 letters) was too short to remain unchallenged. As several pointed out, nigh-hand words, homophony and polyphony (9 letters each) beat it by one. Then John Faucett of Los Alamitos, New Mexico, and Kendall Stiles of Akron, Ohio, independently introduced us to the 11-letter hypoplomion. It isn't a common word, but it is in most desk dictionaries (it's a scientific term for a layer of stagnant water in a lake). Until further notice we'll accept hypoplomion as the word to beat for the right hand.

In a related challenge, Gary Russell of Eugene, Oregon, looked for words that are typed with alternating hands and wonders whether any Green reader can find one longer than *astertioxy*.

The April column also brought letters from readers who didn't get Mel Stover's solutions to the TAKE FIVE problem in which one is to make a perfect cube out of five "somethings"—cigars or coins. The cigars were arranged in the Roman numeral VIII, the perfect cube of 2. The Chinese coins produced a cube of space in their centers when the square holes were aligned. Everett Scott of Wauville, Nova Scotia, suggested taking five quarters to make a total of 125 cents. 125 is a perfect cube.

Our May Geography Lesson brought the observation from both Dennis Carlton and Robert Sage that it is possible to travel due south from Tennessee into each of the eight adjoining states (Ky., Mo, Ark, Miss, Ala, Ga, N.C. and Va.). The Kentucky connection is by boat, across Kentucky Lake. The extreme northeast corner of Tennessee sits slightly north of a portion of southern Virginia, but you'll need a detailed map to confirm this. **OO**



## LAST WORD

By Randy Cohen

• We enjoyed your letter, but we regret that we cannot dedicate a space shuttle launch to your girlfriend, Katha •

*Eater's note: Randy Cohen is a compulsive letter writer and whimsical seeder of both The Evening and Sunday Arden and responses he has written and received in the past year.*

Alex Lovelace  
Deputy Administrator  
NASA  
400 Maryland Ave., S.W.  
Washington, DC 20546  
Dear Mr. Lovelace:

I read in the papers the other day that the president is dedicating the next launch of the space shuttle to the people of Afghanistan. I had no idea that you gave book dedications. Just like top-40 radio huh? Well, I'd like to make one: if this service is available to regular people. Could you dedicate a launch to my girlfriend, Katha? She's really a wonderful woman, and a dedication would mean a lot to both of us.

Incidentally, how will we know you've done it? Will Dan Rather say. And this launch is going up for Katha in New York City from Randy? I look forward to hearing from you on this.

Yours,  
Randy Cohen  
Marketing Applied Research Division  
P.S. It doesn't cost any money for a dedication, does it?

Dear Mr. Cohen,

Your letter to Dr. Alan Lovelace has been referred to this office. Dr. Lovelace has left NASA and now is a Vice President at General Dynamics.

We enjoyed reading your letter but we regret that we cannot dedicate a space shuttle launch to your girlfriend, Katha. There are so many wonderful women in this country and the world that we cannot hope to have enough space shuttle launches to recognize them all.

Thanks for the letter. We appreciate your thoughts.  
Sincerely,  
William J. O'Donnell  
Head, News and Information Service  
NASA

Dr. W. Haanel  
Supervisory Veterinary Medical Officer  
New York Animal Import Center  
Rural Route #1, Box 74  
Rock Tavern, NY 12575  
Dear Dr. Haanel:

I've been hearing a grotesque cow rumor, and I hope you can confirm—or even better, deny—it for me.

The story goes that the Japanese have created, through genetic engineering, a strain of bonasa beef cattle. Unusually bred as pets, the "toy cows" of the Kyoto region have become prized for their tenderness and taste. Commercial ranching has begun, and there are chains of restaurants featuring these cows, chains modeled on lobster houses. Herds of miniature cows graze in pens in the

middle of these restaurants. Patrons trolley over and select dinner on the hoof, much as they pick out a live lobster. The cowlets are taken into the kitchen, slaughtered, and cooked.

Meal of terror? I think so, but it's all relative, I guess. At any rate, here's where you come in: I've heard that the operators of a restaurant chain plan a similar operation for America. Is this true? I've addressed my query to you because, as chief vet at the Animal Import Center, you'd have the inside dope on any movement of miniature cattle. Well—have you? Have you even heard anything about them? Has anyone brought bonasa beef into the country?

I realize this is an odd question, but certainly stranger things have happened in the international food game. It would ease my mind considerably to have your slant on this thing. Thanks in advance for your help.

Yours,  
Randy Cohen

Dear Randy,

Sounds like a Texas Aggies story to me. Referring to the letter Bill Haanel sent down from Newburgh. However, I've heard all sorts of strange tales, so I followed up on this one just in case you were serious. I checked our APHIS import vets and the import meat inspection vets in FBS. Then called a friend at the Japanese embassy. From all of their inputs, here is the story I have.

A. There is no breed of teeny, tiny cattle.

B. We are not importing any cattle or beef from Japan. Actually, Japan is one of our better markets for beef. Much of this U.S. beef, I is told, is sold as "Kobe Beef." We also ship a lot of horse meat to Japan, but no idea what this is called, when served in restaurants.

C. "Kobe Beef" is produced from any breed of cattle that is raised under ideal care, fed a rich diet, massaged daily by pretty girls, given beer to drink, and it's supposed to be the best beef and tenderest beef in the world. It is also the most expensive.

D. Under U.S. meat inspection laws you couldn't slaughter cattle on the premises of a restaurant even if you had an animal small enough to make a single meal. Further, eating beef before it has aged is not a pleasant experience.

E. There are restaurants that offer steaks and chops, raw, in refrigerated display cases. You pick it out and they cook it to your taste. Far as I can find out, that's as close as you're going to get to steak on the hoof.

Thanks for the very entertaining letter. Sincerely,  
Dwight Goodman  
United States  
Department of Agriculture  
Animal and Plant  
Health Inspection Service ☐☐