
OMNI
981 $2.00
BRAINBUSTER: OMNI'S ALL NEW I.Q. TEST • THE FICTIONS AND FANTASIES OF MODERN SCIENCE • INTERVIEW: THE SWISS CHEMIST WHO INVENTED PSYCHEDELIC DRUGS

OMNI

JULY 1981

CONTENTS

Cover art for this month s Omni is a stark surrealistic image by German artist Ute Osterwald Together with her husband Hans, Ute creates her conceptual art in the design studio the couple share in Hamburg West Germany Their work has been published in all the major magazines of Europe

OMNI 1981 (ISSN 0149-8711) U S Volume 3, Number 10 Copyright © 1981 by Omni Publications International Ltd All rights reserved Published monthly in the United States and in Canada by Omni Publications International Ltd., 909 Third Avenue, New York, N.Y. 10022 Tel (212) 593-3301 Printed in the U.S.A. by Meredith Printing Corp and distributed in the U.S. Canada, U.S. territorial possessions and the world (except the U.K.) by Curtis Circulation Company 21 Henderson Drive West Caldwell N.J. 07006 Distributed in the U.K. by SM Distribution Ltd. 16–18 Trinity Gardens London SW9 England Entire contents copyright Printed Nothing may be reproduced in whole or in part without written permission from the publishers Any similarity between places or persons mentioned in the fiction or semifiction and real places or persons living or dead is coincidental Subscriptions U.S. AFO—$18.00 one year Canada and elsewhere—$28.00 one year Single copies $2.00 in U.S. AFO $2.25 in Canada Address changes to Omni Magazine P.O. Box 908 Farmingdale N.Y. 11735 Postmaster Send form 3579 to Farmingdale address Tel (516) 420-1894 Controlled circulation postage paid at Des Moines Iowa Publisher disclaims all responsibility to return unsolicited editorial matter and all rights in portions published thereof remain the sole property of Omni Publications International Ltd Letters to Omni or its editors become the property of the magazine and are assumed intended for publication in whole or in part and may therefore be used for such purposes

FIRST WORD

By Eric Laithwaite

The climate for innovation in Britain has never been chillier. Failures are held up as examples to those who would brave the unknown

Suppose that the DC motor with its commutator and brushes had not been invented in 1832 and that the induction motor, devised in 1880, therefore came into general use. Now suppose that some bright person were to come up with the idea of a commutator in 1981 and take his idea to British industry, to the National Research Development Corporation, and to the Science Research Council. All would escort the inventor to the door as soon as they had heard him out. The development of such an idea, they would insist, would require far too much money. It could never be cost-effective, and if it had any merit at all, the Germans or the Japanese would have done it anyway.

Still, the commutator motor thrives in industry throughout the world. This fact highlights two profound problems that hamper invention in Great Britain. First, invention takes an absurd second place to science. Second, there is no direct connection between anyone's scientific education and his or her knack for invention. The history of technology proves this.

Technology began some 10,000 years ago. Science is a relatively new luxury, born out of technology. No other nation has surpassed the United Kingdom in terms of sheer ingenuity. The fruits of our country's inventiveness have appeared, more often than not, as technology.

We have, of course, an excellent record in science, too. Sir Isaac Newton, Joseph Priestley, Sir Humphry Davy, Michael Faraday, James Clerk Maxwell, and more recently Ernest Rutherford, Oliver Heaviside, Henry G. J. Moseley, and Sir William Bragg and his son, Sir Lawrence, constitute a most impressive assemblage of scientists. However, since the 1920s a decline has set in.

Science depends on wealth. Wealth in turn, depends on much more than technology. It is interwoven with commerce, industry, and politics. Since the beginning of this century we British have been losing ground in world trade and world politics.

The climate that existed when Sir Marc Isambard Brunel and his son, Isambard Kingdom Brunel, were digging tunnels under the Thames and holding banquets underground to celebrate their success has long passed. If the railway network in Great Britain had not been laid when it was, no accountant today would have authorized its construction. This brings us to the very heart of the present-day inventor's problem. We live in the Age of the Accountants.

When it comes to real exploration and pioneering—activities that continue unabated whatever the financial state of the world—the first question always is, Can the venture be done at all? Don't ask what it costs to put a man on the moon. Ask only what the chances are of bringing him back. But as soon as success is in sight, the man with the cash-flow concept moves in and asks, "Now how well can you perform the undertaking?"

The climate for innovation in Britain has never been chillier. Established failures, from the groundnut scheme of the late 1940s to the tracked hovercraft of the 1970s, are held up as classic examples to those who would brave the unknown. No one wants to learn real lessons, other than those favored by accountants.

Whether we like it or not, we British individually and collectively are answerable to the accountant. This is not to be attributed to our political system. Nor is it the result of our having become civilized earlier than those who now possess more wealth than we do. We have allowed the accountants to get into the driver's seat, and they know it. Like other dictators, accountants will succeed for a while until human nature moves to overthrow them. But it will take time.

Meanwhile there are some things that can be done to improve the climate for adventurers. There are good and bad accountants, just as there are good and bad engineers. Let those who are employed by firms that do not do well take note of what happens in large organizations that are successful and try to follow the same pattern. For example, a large firm mass-produces a product, die-cast metal toys, that has constituted 90 percent of its sales for years past. In 1981 that industry will have a loss for the first time in 50 years. What policy does that company now pursue?

The obvious remedies, such as cutting down waste, reducing the number of employees, and raising the price of the product, are all rejected. The company prunes its production program drastically and diverts the money it had earmarked for a new plant into the research department. Does this sound crazy? Not at all. To make twice as much of the standard merchandise is to make twice the loss next year that you made this year. Change the product instead. Make expensive executive toys in much smaller quantities. You will lead in a new fashion. To do it, however, you will need research. Lots of it. More than that, you will need men of courage, men who can ride a failure or emerge like a phoenix from their own first near-disaster.

One thing should be made crystal-clear to us all: Raising the price is an almost certain loser. And what shall it profit a man if his increased prices promise him a fortune, but he lose his company?

Eric Laithwaite, professor of heavy electrical engineering at the Imperial College, London, is a pioneer of magnetic levitation.

CONTRIBUTORS

OMNIBUS

FORWARD

MORAVEC

MONAGAN

SCHECHTER

MORRIS

There's a myth about Nobel Prize winners. Some people think the Nobel is the kiss of death. Samuel C. C. Ting has exploded that myth," says writer *Bruce Schechter*.

When Ting received the Nobel Prize, he was only forty years old. Schechter, an MIT graduate student when Ting's discovery of the J particle was announced, wanted to find out how a person who made a major discovery and won the coveted Nobel at so young an age can continue to do first-rate work. Read "The Once and Future Ting," on page 48, to learn how Schechter believes Ting achieved success.

Going up? Perennial *Omni* contributor *Robert L. Forward* and *Hans P. Moravec*, who studied at Stanford University's Artificial Intelligence Laboratory, speculate on the possibilities of stretching cables from orbiting satellites to Earth, creating a theoretically simple skyhook. In "High-Wire Act" (page 44) we see why elevators to space might easily supplant rocketry by the middle of the twenty-first century.

Forward, a physicist whose specialty is gravitation, works full-time for the Hughes Research Laboratory in Malibu, California. Ballantine/Del Rey Books released the paperback edition of Forward's first novel, *Dragon's Egg*, this past February. Moravec is a research scientist at the Robotics Institute, Carnegie-Mellon University. His consuming interest in robotics began when, at age ten, he put together tin cans, batteries, lights, and a motor to construct his first "serious" robot.

"I kept pedaling harder and harder and thought I was locked into one spot. Finally I got home. Everything had changed, become terrifying. My neighbor came in and looked like a horrible witch." This is what Albert Hofmann, the chemist who discovered LSD, recalls of his first experience with the hallucinogen, in 1943, the earliest recorded in science. Hofmann tells *David Monagan* in this month's *Omni* Interview (page 68) that he happened upon the potent drug quite by accident while studying fungus applications.

Formerly an editor of *Archaeology* magazine, Monagan is a free-lance writer whose articles have appeared in *Science Digest*, the *New York Times*, and the *Medical Tribune*, a weekly newspaper 200,000 physicians subscribe to.

Science-fiction award-winner *Robert Silverberg* returns with "The Palace at Midnight" (page 52). In June Bantam published the paperback edition of his book *Lord Valentine's Castle*, which was nominated this year for a Hugo Award. Jayge Carr, whose story "Malthus's Day" appeared in our November 1979 issue, contributes another story, "Blind Spot" (page 62). Two new Carr novels are soon to be published: *The Space Reivers* (Playboy Press) and *The Treasure in the Heart of the Maze* (Doubleday).

Robert Kall's Mind column, "Resurrection," on page 20, raises some disturbing questions about how we cope—psychologically and emotionally—with our loved ones who, diagnosed as terminally ill, survive because of a new technique. Kall, an inventor and a consulting editor of *Behavioral Medicine*, is director of the pain and stress management program at the Growth Opportunity Center in Huntingdon Valley, Pennsylvania. The U.S. Olympic ski team has asked Kall to advise team members on how to use biofeedback methods to improve their Olympic performances.

The year is 3000. A couple have just won the prize to end all prizes: a voyage through the universe. What might they see? *Robert Sheckley*, our fiction editor, tells us in "Tour of the Universe" (page 82). The illustrations are from the Mayflower book of the same title, by Robert Holdstock and Malcolm Edwards.

Three months ago *Columbia* landed at Edwards Air Force Base, in southern California. *Ben Bova* was present for that historic event. In this month's Space column he reminisces about what it was like to see America's latest accomplishment—one that all of us can celebrate during Space Week, July 13 through 20.

What number logically follows in this series: 2, 3, 5, 9, 17,—? This question and 38 others like it are part of the *Omni*–Mensa I.Q. test, created by Games editor *Scot Morris* with the help of *Alice Fixx*, public relations director for Mensa, the worldwide high-I.Q. society. Turn to page 96 to test yourself against Mensans who completed the examination in little more than half an hour. Next month *Omni* will provide the answers and will help you make sense of your score.

OMNI

BOB GUCCIONE
editor & publisher
KATHY KEETON
president
OMNI PUBLICATIONS INTERNATIONAL LTD.

THE CORPORATION
Bob Guccione (*chairman of the board*)
Kathy Keeton (*vice chairman*)
Mark Meagher (*president*)
Anthony J. Guccione (*secretary treasurer*)
Marianne Howarton (*senior vice-president*)
Benson Saks (*chief financial officer*)

EDITORIAL
Editor in Chief Bob Guccione *Executive Editor* Ben Bova *Managing Editor* J. Anderson Dorman *Senior Editors* Dick Teresi, Scot Morris, Owen Lewies *Fiction Editor* Robert Sheckley *Humor Editor* Bill Lee *European Editor* Dr. Bernard Dixon *Associate Editors* Ellen Datlow, Michael Edelhart, Kathleen McAuliffe, Kathleen Stein, Alex Wagner *Assistant Managing Editor* Paul Hitts *Assistant Editors* Geoffrey Golson, Marc Kaplan *Copy Chief* Robert Boylan *Copy Editors* Charles J. Attardi, Brian McKernan *Editorial Assistants* Susan Caputo, Leslie Epstein, Jayne Gassman, Francesca Lunzer *Contributing Editors* Stuart Diamond, Robert Malone, Dr. Patrick Moore

ART
Art Director Frank DeVino, *Assistant Art Directors* Margaret Rehich, Elizabeth Woodson, *Photo Editor* Hildegard Kron, *Associate Photo Editor* Lisa Shapiro, *Staff Photographers* Pat Hill, Tony Guccione; *Art Assistant*, Patricia Lubin

ADMINISTRATIVE
Associate Publisher Marianne Howarton, *V.P./Director of Advertising* Beverley Wardale *VP/Administrative Services* Jen Winston *VP/Production Director* John Evans *Midwest Advertising Mgr.* Norm Kamikow; *Southern Advertising Director* Peter Goldsmith *Western Advertising Director* John Romain *Controller* Marc Bendesky *Director of Marketing and Distribution/Publications* George Golesworthy *Nat'l Marketing Mgr.* Ralph Perricelli *Nat'l Sales Operations Mgr.* Richard Fogel *Director of Newsstand Sales* Robert Castardi *Newsstand Distribution Mgr.* Vincent DeLisi *Dir. of Pub. Rel.* Ted Hannah *Advertising Prod. Dir.* Toni Wagner *Advertising Admin. Mgr.* Leslie Moses *Editorial Prod. Mgr.* Robin Berliner, *Director of Research and Marketing Services* Carole Rossant

ADVERTISING OFFICES
Omni Publications Ltd. *New York* (Beverley Wardale) 909 Third Ave., New York, N.Y. 10022. Tel. (212) 593-3301. Telex no. 237126. *Midwest* (Norm Kamikow) 111 East Wacker Drive, Suite 2036, Chicago, Ill. 60601. Tel. (312) 565-0466. *South* (Peter Goldsmith) 1707 H St., N.W. Washington, D.C. 20006. Tel. (202) 298-6050. *Detroit* (John Bluth) 950 East Maple, Suite 204, Birmingham, Mich. 48011. Tel. (313) 645-3846. *West Coast* (John Romain) 9200 Westwood Blvd., Suite 1002, Los Angeles, Calif. 90024. Tel. (213) 824-9831. *U.K. & Europe* (Eleanore Graham) 2 Bramber Road, London W14 9PB, England. Tel. (01) 385-6181. Telex no. 919665.

EDITORIAL OFFICES
New York 909 Third Ave., New York, N.Y. 10022. Tel. (212) 593-3301. Telex no. 237126. *West Coast* 9200 Westwood Blvd., Suite 1002, Los Angeles, Calif. 90024. Tel. (213) 824-9831. *London* 2 Bramber Road, West Kensington, London W14 9PB, England. Tel. (01) 385-6181. Telex no. 919665.
U.K. & European Editions
Director of Publications U.K., David Jones. *Advertising Director* Eleanore Graham. *Editorial Assistant* Andie Burland.

BUREAUS
Washington, D.C. William R. Corson, 1707 H St., N.W. Washington, D.C. *Berlin* Hans Hohn, Enzianstrasse 1, Berlin 45. *Rio de Janeiro* Andre Fodor 98. *Rua Mexico, 15th floor, Rio de Janeiro ZC39. Budapest* Paul Kirlyhegyi, 5 Regi posta utca, Budapest 5, Hungary. *Zagreb* Cedomir Kompanovic, Strobrnjak 96, Zagreb, Yugoslavia.

JULY

LETTERS

COMMUNICATIONS

The Mummy Makes It
Three cheers for Ray Bradbury! His story "Colonel Stonesteel's Genuine Home-Made Truly Egyptian Mummy" [May 1981] is a splendid example of tall-tale telling in the spirit of Mark Twain. Please give us more.

William P. Roeder
State College, Pa.

The Spice of Life
Reading the Donald Symons interview in the March 1981 *Omni* was exasperating. How can one person hope to extrapolate the true nature of modern man from a study of primitive and homosexual social behavior and from the copulation patterns of caged bulls and monkeys? Human beings have long since risen above the level of baboons!

Symons drowns in his own arrogance when he assumes that human females have little need for variety. It is human nature to be curious and to crave diversity. Cultural brainwashing and societal intimidation are inconsiderate of women's sexual preferences, including variety.

Vala Cliffton
San Francisco, Calif.

If we pursue Donald Symons's line of biological fatalism to its logical end, we must conclude that there is no future for art, music, or higher mathematics, because such initiatives break the natural law and confer no apparent selective advantages.

Yet our society has prized and has legitimized these inventions, just as the feminist rejection of sexual determinism should be prized. Darwin's is a brilliant model for explaining the morphological and behavioral differences between *Homo sapiens* and other mammalian species. Applied incautiously within our species, however, it leads to a downgraded view of the human potential.

James Morrow
Westford, Mass.

For the Good of the Group
I enjoyed the balanced review of Robert Heinlein's *Expanded Universe* in the April *Omni*, but I disagree with Alexei Panshin's comments about Heinlein's "misplaced morality."

Panshin finds Heinlein's definition of morality—"behavior that tends toward survival"—false, because it is based on examples of individual behavior.

But Heinlein's work treats survival as a group concept, not solely an individual one. Where the clam or shark will succumb to the gene pool of its species through heredity, Heinlein understands that man will direct his actions toward survival of the human race.

Radford C. West
New York, N.Y.

Zap Appeal
I would like to clarify a few points raised in "Rape Zapper" featured in Continuum [May 1981].

Several design improvements have been made, including a snap-on protective cover and Personal Security Devices, Inc., Suite 7967, One World Trade Center, New York, NY 10048, now manufactures and sells the Zapper worldwide.

Edward R. Koenigsfest
New York, N.Y.

Attention Science-Fantasy Artists
In October 1981 the World Fantasy Art Exhibition will be held in Berkeley, California, in conjunction with the seventh World Fantasy Convention. The exhibition will feature paintings, drawings, and sculpture, with a bizarre, chimeric twist. Send twenty 35mm color slides of your work, a resume or cover letter, and a postpaid return envelope to: Will Stone, 560 Sutter Street, Suite 201, San Francisco, CA 94102. The deadline is August 1, 1981.

Jack Rems
Chairman, WFC
Berkeley, Calif.

In Defense of Privilege
I wish to reply to a letter written by Robert Bailey [Communications, February 1981].

We live on a planet with differing ideological factions. Although the idea of working together for the common good is a

CONTINUED ON PAGE 116

DIALOGUE

FORUM

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

Support for SOLARES

I read with keen interest Douglas Colligan's interview with Peter Glaser [April 1981] on the subject of the Solar Power Satellite. Unfortunately, the bottom line on the SPS is that it costs too much.

But there is an alternative space-based system with even more energy-generating potential than SPS and with a substantially lower price tag than SPS's. This system is SOLARES, developed primarily by Dr. Kenneth W. Billman at NASA-Ames Research Facility in Mountain View, California. Studies conducted at Ames from 1977 through 1979 show SOLARES to be superior to SPS in all vital areas, including capital investment per unit of power, total capital investment, and busbar electric energy cost in mills per kilowatt hour. The studies show SOLARES to be the only energy system that can be competitive with the fossil-nuclear mix of energy sources by the 1990s.

The SOLARES system consists of extremely lightweight mirrors that reflect sunlight onto photovoltaic collectors on the ground. These lightweight mirrors are the primary reason why SOLARES costs so much less than the SPS. Each of the 60 silicon-cell units in the SPS weighs as much as a *Midway*-class aircraft carrier—55,000 tons. By contrast, the entire space component of SOLARES, which puts out nearly three times as much power as SPS, weighs only as much as *one* of the 60 SPS units. Recent studies have also shown that SOLARES puts out 200 times as much power as the SPS per unit of orbiting mass.

Most space-development enthusiasts favor the SPS over SOLARES because they believe the SPS will provide energy for both Earth and space, and that SOLARES will not. They are mistaken. SOLARES mirrors can illuminate moon mining operations, concentrate solar energy in space furnaces to process ore, and concentrate heat to run turbines to produce electricity.

It is time for a strong dose of economic realism and political savvy in the space-interest community. It's time to support SOLARES.

Max Gordon Phillips
Sunnyvale, Calif.

Correction

In *Omni*'s May 1981 issue I noted a reproduction of a painting by René Magritte, one half on page 85 and the other half on page 87 ["Rent-a-Conscience"]. This painting is none other than *Decalcomanie*. I deplore the reproduction of this work of art in pieces and without proper credit or copyright.

Also, this 1966 oil-on-canvas, 31⅞" × 39⅜" painting was stolen from the Brussels home of its owners, Professor and Mrs. C. Perelman, in August of 1979. I would appreciate it if persons having information concerning this painting would contact this office.

Harry Torczyner
Attorney for the Estate
of Rene Magritte
521 Fifth Avenue
New York, NY 10017

We would like to apologize for reproducing the painting Decalcomanie in two parts. It is a single work and should be viewed as such. The correct credit for the painting is Decalcomanie *by Rene Magritte, copyright by A.D.A.G.P., Paris, 1981. Also, the credit for the painting on page 26 [*Mind*, May 1981] should read* Le Mois des Vendanges, *by Rene Magritte, copyright by A.D.A.G.P., Paris, 1981.—Ed.*

Perpetual Search for Perpetual Motion

James Randi's Last Word [May 1981] mentions the refusal of the Stanford Research Institute to investigate a perpetual-motion machine that was endorsed by *Science and Mechanics* magazine and has even been patented (U.S. patent 4,151,431).

I believe that the source of energy for the machine is something worth consideration by even the most hardened skeptic. Think about it: two doughnut-shaped permanent magnets with a metal rod through the middle, with like poles facing and thereby repelling each other. The rod will be held up straight, and one magnet will be held suspended in air, by magnetic repulsion alone.

Dave Martell
Bay City, Mich.

Dr. Paul Nahin, an associate professor of electrical engineering, replies: *I have read the material on the "permanent magnet motor" as carefully as I can read any patent, and I have several reactions. (1) The conservation of energy is such a basic cornerstone of physics that it's going to take more than a few claims to shake my faith in it. (2) The inventor is careful never to claim perpetual motion in his patent disclosure (the Patent Office has a policy of requesting a working model to accompany any claims of perpetual motion). (3) Physicists long ago gave up looking for magnetic particles (the "magnetic monopole"). Maxwell's equations for the electromagnetic field conspicuously lack such a particle. If they had one, we would have to explain why the equations work so well (they're even relativistically correct) without the monopole particle.*

As far as the conversion of Science and Mechanics *goes, a good fraud can easily mislead the susceptible. Look at how Uri Geller made utter fools out of supposedly intelligent scientists, and all he had to do was cheat at bending spoons.*

We Stand Corrected?

I just received my copy of *Omni*. To my surprise, I found this very nice article that Allan Maurer wrote about Jake Mendelssohn and Robot Eggs [Continuum, May 1981]. Unfortunately, the article contained some mistakes. The greatest of these was the statement that Jake was founder of Intergalactic Robot Eggs, Inc. I am the founder, not Jake. In the Robot Egg

CONTINUED ON PAGE 106

THE WARMING EARTH

By Karen Payne

Ecologist Orie L. Loucks is proud of the self-sufficiency he's achieved with his little urban garden, but lately the garden isn't healthy. Corn yield is way down. The cucumber patch is dried up, yellow, dying too soon. There is a greatly reduced yield of raspberries, beans, and asparagus. Insect-eating birds, such as warblers and nuthatches, have left the area and aren't around to help with pest control.

At the root of the trouble are the ozone and sulfur compounds now widespread over the Northeast and the Midwest. The garden is slowly being killed by low-level pollution. Loucks, science director of the Institute of Ecology (TIE), considers this the major environmental challenge of the 1980s. Environmentalists of the 1960s and 1970s wrestled over toxic and radioactive "hot spots." But today low-level pollutants are "warming" vast geographical regions.

In his garden, Loucks laments the subtlety of the environmental effects. "What makes me saddest of all is that people get to think this is how cucumbers grow. In the cities, we've come to accept evergreens that are yellow and brittle and plants that are dying."

The garden is merely one link in a chain reaction that begins with emissions thrown into the air by the tall smokestacks of coal-fired power plants. Slowly drifting eastward, a cloud picks up pollutants from urban areas along the way. In Illinois, Indiana, Ohio, and Kentucky, the cloud's ozone destroys up to 15 percent of the corn, wheat, and soybean crops. In the Northeast, sulfur and nitrogen compounds drop out of the cloud as acid dust or acid rain, damaging wallpaper, paintings, and clothes, and converting lakes and streams into vinegary fish graveyards.

"These subtle stresses have become almost a way of life now," Loucks says. "It is different from the environmental problems of the 1970s. Then solutions could be identified and people could commit themselves to persuading society to embrace proposed solutions. Much of the population seems willing to live with the warming trend and to let their kids solve the problem."

The Canadian-born Loucks is a scientific pioneer, one of the first to apply systems methods—a holistic approach—to environmental science. In the 1960s he was the first "environmental systems scientist" to testify against DDT.

Loucks thinks that the way to combat low-level pollution is through what he calls "the new Renaissance science," that is, research that unifies the isolated scientific disciplines. Since the 1950s Loucks has specialized in forestry, soils, atmospheric sciences, and botany—all the tools needed to trace toxic substances through the air and soil to their harmful effects on living organisms.

Collaborating with experts in universities, government, and industry, TIE coordinates interdisciplinary sciences in the study of stressed ecosystems. "With" this holistic approach, and by working within an invisible college that spans large areas," Loucks explains, "we can work with modern science in the same way Renaissance thinkers dealt with the whole body of science in their time."

So far, Loucks says, society pays scant rewards to those who cut across disciplines and dedicate themselves to understanding large bodies of relationships. "Scientists are rewarded for isolated breakthroughs," he says, "not for integrated findings. But as people begin to understand the implications of environmental disruption, the long-term view will become increasingly important. Once more integrated findings are known, our environmental choices may change."

The danger of conventional problem solving is illustrated by the 1960s solution to urban traffic problems: building freeways. With freeways in place, more cars traveled to downtown areas. New parking garages had to be built, leaving less space for stores and reducing the number of downtown shoppers. Loucks fears that such problem solving, without regard for consequences, is pushing us to use coal for its cheap energy.

A recent TIE study of the Ohio River valley demonstrates the danger of our shortsighted rush to coal. The total crop loss caused by coal-fired power plant emissions is expected to exceed $3 billion

CONTINUED ON PAGE 109

For the 1980s, ecologists forecast a pollutant "warming trend," crippling U.S. crop production

TESTICULAR THREAT

LIFE

By Raymond M Lane and Shirley M Nagelschmidt

For no apparent reason there has been a nearly 70 percent rise in cancer of the testicles in the United States since 1972.

Compared to lung or breast cancer, testicular cancer is still quite rare. Of the 403,000 estimated new cases of cancer among American men this year, only about 5,200 will involve the testes. But it is now the most common tumor in men from the ages of twenty to thirty-four, causing 13 percent of all cancer deaths in this group. Even more disturbing, the incidence of the disease seems to be growing. The American Cancer Society expects 200 more cases this year than last.

The same trend can be seen in Great Britain. There were 762 cases of testicular cancer there in 1975, the last year for which figures are available. Ten years earlier only 493 cases were detected. The increase appears to be continuing, especially among males from fifteen to thirty-four years old.

Testicular cancer is most common among white middle- and upper-class men. One recent study found that young, college-educated professionals have four times as much a chance of developing it as laborers do. Tall, thin Caucasian men seem especially susceptible; nonwhite men almost never develop it whatever their class or occupation.

No one has been able to explain the increases in testicular cancer, why it occurs in some men but not others, or, for that matter, why or how the cancer develops. American scientists have learned that men born with an undescended testicle suffer up to 40 times greater risk than the general male population. But while this group has become more numerous in recent years, the cause of their high vulnerability remains a mystery.

Doctors say testicular cancer is not caused by venereal disease, sports injuries, or even vigorous sexual activity. Some Danish researchers suspect that the increase is caused by jockey shorts or bikini briefs, which may press the scrotal sac too close to the body's heat. They're trying to determine whether men who wear loose-fitting boxer shorts, or none at all, have a lower incidence of cancer than men who wear tighter-fitting underwear.

Ten years ago testicular cancer was one of the rarest cancers and one of the most fatal kinds. Surgery and drugs have made it one of the most curable. Once the cancer is confirmed, the cancerous testicle is removed and is closely examined by a pathologist. A plan of radiation and/or drug therapy is then devised for the patient.

Most who have undergone the surgery can even maintain an active sex life. Fertility may be reduced by the loss of a testicle, but those who want to have children later on often bank their sperm before the operation.

As in breast cancer, early detection and treatment are crucial. "Unfortunately, public ignorance of the disease is overwhelming," says Dr. Marc B. Garnick of the Sidney Farber Cancer Institute of Harvard Medical School. "There's a startling lack of awareness even among physicians. No one seems to give a damn about male sexual health.

"By comparison, this society is perfectly at ease talking about breast cancer in women. We put up billboards on it, train girls still in pigtails in how to check their breasts, and find the topic sooner or later in every newspaper and magazine and on every TV show in the country. I hardly mean to criticize this growing public awareness of breast cancer—it is an essential tool in fighting the disease—but if people are mature enough to talk freely about breast cancer, then we are ready for men to do something just as important for themselves."

Because there is no early pain or discomfort, self-examination is the key to detecting testicular cancer early. At first, the cancer manifests itself as a pea-sized or larger bump on one of the testicles. Though it rarely affects both glands, the tumor can spread into the body, notably the abdomen or the lungs, and eventually cause death.

The best time to make the examination is after a warm shower or bath, when the scrotum is relaxed. The normal testicle is smooth, egg-shaped, and somewhat firm. Underneath the testis is a tube that carries

CONTINUED ON PAGE 123

Testicular cancer (magnified 500 times) has risen dramatically in men aged twenty to thirty-four

"IT WAS WORTH IT"

SPACE

By Ben Bova

In the early morning sunlight thousands of us searched the empty sky waiting in the desert like religious pilgrims waiting for a sign from above.

America's space shuttle *Columbia* had reentered the atmosphere, halfway across the world, and was going through radio blackout—bathed in a sheath of air so hot that radio waves could not penetrate it. No one spoke much, out there on the desert at Edwards Air Force Base next to the seven-mile-long dry lake bed. We all knew that this was the critical time, the real test of *Columbia*, her reentry-heat-shield tiles, and her two-man crew.

She had been launched two days earlier, after years of delays and frustrations. Launched, by happenstance, exactly on the twentieth anniversary of Yuri Gagarin's pioneering one-orbit spaceflight. The spaceship and the two astronauts piloting her, John Young and Robert Crippen, had performed magnificently so far. But those heat-shield tiles were a questionable item. Had they really stayed put on *Columbia*'s underside, or had significant numbers of them peeled off during the thundering launch from the Kennedy Space Center?

The loudspeakers that NASA had set up for the visitors awaiting *Columbia*'s return were silent for long, agonizing moments. Then, abruptly, the morning air was shattered by the voice of the mission controller in Houston.

"We have radar fix on you, *Columbia*. You're looking good."

Young's reply was drowned out by the cheers of thousands.

"*Columbia*," mission control reported, "we show you at 151K [151,000 feet altitude] now, 8.4 Mach, looking good."

"What a way to come to California!" Crippen exulted.

The pilgrims on the desert expanse surged expectantly now. By the tens of thousands they had come, in campers, in buses, in limousines, in dust-covered family cars. Children, grandparents, businessmen, pensioners, college kids—most of them had come out to the desert the night before and camped out while waiting for the return of the first space shuttle. Across the dry lake from where we stood, we could see a long, dark line against the base of the distant mountains: thousands of visitors, glittering in the sunlight with cameras and binoculars around their necks.

Columbia announced her arrival over Edwards Air Force Base by a double clap of thunder, like a goddess coming out of the sky to visit her worshipers. The sonic boom rang across the Mojave and pulled another cheer from the vast crowd.

Mission control: "*Columbia*, you're coming right down the track. The tracking data, map data, and preplan trajectory are all one line on our plot boards here."

We knew *Columbia* was overhead, but we could not see her. At an altitude of more than 40,000 feet, she was an invisible speck in the bright blue California sky. But we strained our eyes anyway, searching, glancing at the maps NASA had provided to show the long, sweeping course the spaceship was taking out over the dry lake, peeking every few seconds at the television sets that had been positioned around the visitors' area. High up in that crystalline, cloudless sky we could see the thin white scratches of vapor trails from the T-38 chase planes that were ushering *Columbia* earthward.

And then we saw her! A speck of white coming in low over the distant, bluish blur of mountains, the word made flesh—and metal. She grew before our widening eyes into a stately machine with wings, seemingly suspended above the shimmering floor of the ancient lake.

She was coming in nose-high, regally, her wheels down, her white flanks agleam in the sunlight. A puff of dust as the wheels touched the landing strip.

"Welcome home, *Columbia*!" mission control said for all of us. "Beautiful!"

And she was. We screamed. We laughed. We shouted and hugged one another in our joy. People wept. Some danced. Some made a brief, silent prayer of thanksgiving.

At the controls of the world's first true spaceship, Young quipped coolly, "Do you want us to take it up to the hangar?"

Mission control: "You got a lot of people smiling back here. Good to have you back."

Astronaut Crippen: "This is really the

CONTINUED ON PAGE 114

Columbia. *America's new achievement will set off incendiary budgetary discussions on Capitol Hill.*

RESURRECTION

MIND

By Robert Kali

Everyone thought Lisa would die Her illness was supposed to be fatal, the chances of recovering from last-ditch brain surgery were slim And yet through the application of new medical techniques Lisa survived unimpaired and went home

But what she found there wasn't joy "Damn you!" cursed her husband, Steve "Why don't you drop dead? You're a walking zombie" After two weeks Lisa took his advice and gobbled a handful of pain pills

The story of Steve and Lisa is a composite drawn from cases studied by Dr Charles David, associate professor of psychiatry at Dalhousie University Medical School in Halifax, Nova Scotia It is an example of a new social syndrome caused by rapid advancements in clinical science that have outstripped our ability to cope with them

"Modern medicine," Dr David states "has brought us miraculous cures but it also has brought us resurrection of the dead syndrome *Resurrection* means the coming back to life after death

"*Resurrection of the dead* is used in this situation to refer to the patient's reentering the world of the living after the relatives or family have written him off for dead."

Patients with terminal diseases are now routinely snatched from death's grasp by wonder drugs or advanced surgical techniques When they return home often following extended periods of hospitalization, the families of these fortunate patients treat them as if they should have died During the illness, family members go through the preparatory stages of coping with death The syndrome arises when they experience anticipatory grief too early They accept their loved one's death as a fact and suffer the tumultuous emotions this resignation carries with it.

Then, when a new or experimental procedure is trotted out at the last minute to save the patient family members go into a complex form of shock They resent the suffering they have endured needlessly, and they feel guilty about the resentment The result is anger and denial of their resurrected dear one, who by cheating death has in a sense also cheated them of their grief At this point, David says, after the turnaround in prognosis, the patient's relatives reject him and treat him as if he's dead They may even sabotage medical treatments or drive the patient to suicidal attempts as in Lisa's case Parents reject or ignore their children Children abandon their parents Spouses leave each other

"This syndrome is far more common than one might think," David declares "Millions of people every year suffer from life-threatening illness And they are all potential victims of the resurrection syndrome It could even explain why so many elderly are put away in old folks' homes and why some people, including children are put away in mental institutions or state homes for their whole lives It's a way for the family to bury them while they're still living"

David suggests that some denial is normal and healthy during the dying process—a gentle refusal to believe that the patient will actually die This denial provides a measure of hope that sustains patients and families through the painful anticipation of loss But the people most susceptible to the resurrection syndrome, David believes, don't have as much capacity for denial They bury themselves in pessimism

"It's important that the families understand the implications of the illness And it's very important that the doctor convey a sense of hope."

For physicians, encouraging hope in what may be a hopeless case is controversial Do they ease the family's pain and prepare them for impending death, or do they raise false hopes for a barely possible breakthrough cure? There's no simple, black-and-white answer It demands the highest interpersonal communications skills More important the situation emphasizes the powerful effect that hope can have on people The resurrection syndrome is an extreme example of why believing in a positive future can be good for you Problems tend to develop when people put either too much or too little faith in the future The answer appears to be a balance of hope and a healthy understanding of future expectations.

THE ARTS

By Jeff Rovin

If playing General Zod taught me anything," says actor Terence Stamp of his role in *Superman II*, "it is that when you're creating special effects that involve people flying, there's no possible way to avoid pain. This means either you have to be very masochistic or you must love a project whose shooting schedule offers forty weeks of sheer physical agony. In my case, it was the latter. The two Superman films were personally very gratifying."

One would hardly expect such ungrudging words from the Kryptonian supervillain who comes to within a hairbreadth of conquering Earth in this sequel to 1978's box-office powerhouse *Superman*. Aided by those grueling but impressive special effects, Zod and fellow aliens Ursa (Sarah Douglas) and Non (Jack O'Halloran) murder astronauts on a lunar mission, use their heat-vision to torch an Earth community, decimate the army, bring a president to his knees, kidnap Lois Lane, and in a climactic battle with Superman all but raze Metropolis in some of the most spectacular footage ever filmed.

Off-camera, however, the almighty Zod is quite a different fellow. There is no bombast or sizzling autocracy, only the quiet intensity of his alter ego. The British-born Stamp is one of the acting profession's most serious and selective artists. His screen credits include *Billy Budd*, *The Collector*, and *Far from the Madding Crowd*; onstage he has performed in plays as diverse as *Dracula* and *The Lady from the Sea*. Yet nothing in the actor's eclectic twenty-year career prepared him for the difficulty of making Superman films.

Stamp had only a few scenes in the first movie, being banished at the outset to the Phantom Zone as punishment for crimes of sedition against Krypton. He returns for the sequel in grand fashion when Superman averts the atomic destruction of Paris by deflecting a terronst bomb into space. The blast rips open the Phantom Zone and liberates the criminals, simultaneously burdening the performers with the very real horror of having to fly.

Long before *Superman II* commenced shooting, Stamp spent weeks getting his body accustomed to the unique sensations of flight. "I was on a trampoline for hours every day, so that after I was rigged on the set, I didn't just hang there, which was the temptation. On a trampoline you can simulate the fact that the air is your new surrounding and get into a frame of mind to fly."

This preparation was vital, Stamp contends, since he is airborne during much of *Superman II*, either suspended from wires or locked in a body mold—a solid cast in which the performer is swooped and turned against prefilmed aerial footage. What he could not drill for was the torment these methods caused.

"When you're flying," Stamp explains, "every rigging that can possibly be used involves the whole body weight resting on something, somewhere. No matter how you pad yourself, your weight is always hitting something. It's just a question of where you take the pain. If you're strapped into a flying harness and dangling from wires, it hurts between your legs and on the front of your pelvis. If you're in the body mold, you take the pain in your chest. Not that you mind the pain during a take because you're being afflicted for something worthwhile. But you are dressed over the harness or body mold so that it doesn't show, and then they take away your ladder, leaving you, literally, to hang around for hours while the crew sets up the shot. It's an ordeal that saps your energy and makes you irascible."

This regimen was especially taxing for Stamp and for Christopher Reeve, since as Zod and Superman, their every flying position had to be dramatic and self-assured. "It's an even greater strain to keep yourself in that sort of commanding posture, with your body straight and your legs rigid. Most of the weight falls upon the stomach muscles. The only comparable exercise I can think of is holding a yoga pose, interminably."

And then there were accidents, Stamp admits. "A number of people were injured by mishaps with the flight equipment. The only way to prevent them is to keep extraordinarily alert when you're flying. If a wire breaks and you're totally there, you've got a chance. You can roll on your back

General Zod (Terence Stamp, center) in Times Square: "wicked charisma and concentration."

when you fall, or try to tumble toward your mattress. But if your mind is wandering, as happened with a couple of people you haven't a chance."

Despite the aches and chafing it took to defy gravity, Stamp maintains that the anguish offered practical dividends. "In my case it helped the performance by putting me in an absolutely vile mood, making me want to spread some of that suffering around. Also, if you're playing a villain, you have to bring an incredible degree of consciousness to the part. If you watch films of Hitler, for example, he clearly has a greater sense of presence than you find in an ordinary soldier. Zod needed that kind of wicked charisma, and the concentration it took to dangle safely in the air helped that. There was never a stray thought in my mind; as a result you know just watching Zod that this is a man to whom accidents do not happen."

One of the pleasures of observing Stamp's performance is his ability to make the power-mad Zod more than just a posturing icon, which was no mean accomplishment. "Zod, like Superman, is unplayable really," the actor confesses. "He was a destructive force on Krypton where he had the same power as everyone else. On Earth, with his expanded abilities, he really becomes the personification of evil. But there is still a man at the center of him, and I tried to define and relate to that. Zod was reachable to me when I thought of him as a fire elemental, as all things that burn. So what burns in me are what he is: anger, fury, greed, and envy. He was always being consumed, though there's very little actual demonstration from him—only this incessant furnace. He seems always to be thinking of a way that he can tear off someone's head and crap on it, particularly in the scenes with Gene Hackman [repeating his role as Lex Luthor]."

Zod is also very vain, Stamp confirms. "Though he doesn't knowingly show it, there are moments when it sneaks out, like when he is confronted with a television camera for the first time and realizes that there's a world audience. The staggering power of the character is layered upon these very apparent areas of instability which gave him a handle for me and, I think, some dimension in the film."

Aside from the challenge of interpreting so arch a figure, Stamp was anxious to play Zod for another reason: to increase his slim body of work in the science-fiction genre. "Except for *The Mind of Mr. Soames* [made in 1970], I have acted largely outside the realm of science fiction, although reading it is something of a hobby with me. I totally identify with these characters who are trying to gain a greater, more profound cognition of the universe in which they move." Stamp cites as his favorite works of science fiction *More than Human*, by Theodore Sturgeon; Frank Herbert's *Dune*; and Walter M. Miller's *A Canticle for Leibowitz*. "As a rule, the science-fiction novels I like best are those with an allegory one that I stumble upon, maybe months afterward. I don't really like it when the message is too apparent, as in *Stranger in a Strange Land*, which is nevertheless an interesting novel. I'm also fascinated by the different creative winds that seem to blow over science-fiction writers from time to time, more so than with mainstream writers. The Frank Herbert who wrote *Dune* is thematically very different from the man who wrote *The Dragon in the Sea* some years earlier, and to some extent the latter Dune novels. I think science-fiction authors are keenly aware of change, and their writing reflects this."

"Philosophy, too, is something I enjoy for much the same reason. In fact, it is the subject that has helped me to recognize an amusing but compelling parallel between movies and life. If you watch a film, you realize that it's a transient thing, that only the light of the projector is constant. A person's life is also ever-changing, a shadow play of flesh in transit, made perceptible by the light inside us. I won't label it 'the soul' or 'the consciousness,' because of the way those terms have been made superficial by overuse, but that light is present when we're young and is with us as we grow. Whether the images before it are romantic or terrifying or illuminating, it reveals them impartially for us to interpret, just like a movie. I think it would be quite interesting and fitting for our media-oriented society to evolve a philosophy or religion inspired by the cinema. We already have our idols, the Brandos and the Hepburns, symbolism of this sort may be the philosophy of the future."

Fascinated though he is by abstractions, Stamp describes himself as no less affected by what goes on in the real world, and he points to one event that almost made him feel as if he were *living out* a science-fiction novel while filming the Superman movies.

"There was an extraordinary harbinger associated with the project, one that affected me deeply," Stamp recalls. "The minor planet Chiron was discovered in October of 1977 by astronomer Charles T. Kowal. This coincided with the commencement of shooting the first film, and in terms of credibility it made that remote world of Krypton seem more plausible to me. Even more significant is the fact that the planetoid was named after a centaur, a great teacher in Greek mythology. As knowledge and hope are the legacy of Chiron, so they are also the legacy of Krypton. The sole surviving artifact of that planet is the green crystal through which Superman speaks with his long-dead parents. It's a self-perpetuating source of energy and immortality, an example of the ultimate power of science, wisdom, biology, and technology functioning as one, as the neighbors they were always intended to be.

"I also wondered whether, in a larger sense, the discovery of Chiron might signify a new surge in human knowledge, the same way that Pluto heralded a seismic era of learning, atomic power, the growth of Freudianism, the astonishing strides taken by the communications media, and so forth. It was a timely moment in which to be shooting a science-fiction film, and I hoped these abstractions would infuse the two movies and affect audiences on that same personal, philosophical level."

Whether audiences have recognized these subtle substrata in *Superman II* or are merely responding to the film as the marvelous entertainment it is, they're heading to the box office in record numbers. One result of this is that Stamp's following has swelled beyond its previous cult appeal. The actor is of two opposite minds regarding his newfound popularity.

"What pleases me is that people are reacting to the character of Zod. Chris and I agreed at the very beginning that it was up to us to take this movie seriously, however extreme certain aspects of it might have seemed to us. By fulfilling people's expectations, as we appear to be, we have done our jobs, and that is always a rewarding feeling."

As for the negative aspects of his success, Stamp sighs. "Well, I'm prepared to be offered a lot more villains, I'll tell you that. But what concerns me even more is *Superman III*. It won't trouble me to play Zod again, if the public is interested enough for the producers to resurrect him. With a good script, there is still a lot we can explore. There is, however, one thing I would absolutely *insist* upon."

Top billing? A love interest for Zod? The downfall of Superman?

"No," says Stamp, utterly serious. "Only that I remain on the ground a lot more." ∞

Stamp: "Zod, like Superman, is unplayable."

THE ARTS

By Scott Cohen

It's merely coincidental that his name is Muscio and he's chairman of the board at Muzak Corporation. Before coming to Muzak as president in 1966, Bing Muscio, whose total musical background consists of the operas on which he was brought up, was the chief operating officer at Fedders Corporation, an air-conditioner manufacturer. "I went from cool air to cool music" is how he puts it.

Muzak is cool, nonentertainment, functional music. Entertainment music is meant to be listened to, functional music is not. It's music you notice when it's not on and don't notice when it is. Muzak's got a scientific beat that stimulates work interest while increasing muscular activity. It's music to work to.

More than 80 million people in 125 countries around the world hear Muzak. It also is heard in the White House, where it was installed by President Eisenhower, in the Pentagon, in the headquarters of General Motors, Texaco, and the Bank of America, and in the Houston Astrodome, in Lloyds of London, Japanese police stations, and a 39-story high-rise cemetery in Rio de Janeiro, and even in the reptile house at the Bronx Zoo. Neil Armstrong heard Muzak before stepping onto the moon.

Muscio heard Muzak for the first time the way most people of his generation did. "We went to a restaurant, and music was being played, but there weren't any commercials," he recalls. "At the tables were cards—we called them table tents—that showed the selection being played that night. At 8:02 it was 'Goodnight, Irene.' At 8:02:45 it was something else. I was wondering how they could tell exactly what was going to be played on the radio, and then someone said that it wasn't radio, it was Muzak. Most of us thought of it as radio without commercials coming over the telephone, which is how it began."

Muzak got its name by contracting the words *music* and *Kodak*. Muzak was invented by Major General George Squire who pumped recorded music into better restaurants and the homes of wealthy people by playing it piggyback on utility lines. But since Marconi did this without wires, General Squire's method was obsolete before he started.

All that changed when the fledgling company was acquired in 1941 by William Benton, of Benton and Bowles fame, for about $100,000. It was Benton who experimented by playing Sousa marches in factories during World War II to see whether it increased workers' productivity. It did. Using more sophisticated programming, he discovered certain music increased productivity in the postwar years as well. Benton turned Muzak to a nifty profit when he sold it to the Wrather Organization in 1957. Now Muzak is owned by TelePrompter, which in turn is owned by ITT.

When Muscio came to Muzak in 1966, his job was to make Muzak scientifically attuned to the Now Age. Muscio is a new kind of guy. Together with some industrial psychologists, M.D.'s, and Muzakologists, he created the New Muzak.

"What we attempt to do is mirror your productivity curve, so that at that point where your spirits are down we try to bring them up. You have your most stimulating music around ten or eleven in the morning and at three in the afternoon. You take your uppers when you're down. We give you the uppers without worrying about the prescriptions."

According to Muzak engineers, when the average worker arrives on the job, he's in far better spirits than he is at around 10:30 A.M., when his energies are at the lowest. It picks up again around lunchtime and dissipates until 3:30 P.M., when it's at the day's lowest. Muzak is programmed to counter these depressions by becoming increasingly stimulating inversely to the "workers' efficiency curve," moving from moderate to bright in the morning, restful around lunch, and brighter as the day goes on. By midnight the tunes are almost bouncy.

"Muzak arranges, records, and produces all of its own music," says Muscio, who's pretty bright and bouncy himself, like the brass section around 11 P.M. "We claim to be specialists in the nonentertainment uses of music—specialists in the psychological/physi-

CONTINUED ON PAGE 118

Some 80 million people listen to Muzak daily and its franchisers can earn millions yearly

THE ARTS

By Jack Williamson

On a clear day you can see tomorrow. Maybe even the year 2000. *The New Worlds of Robert A. Heinlein: Expanded Universe* (Grosset and Dunlap, $12.95; Ace, $8.95) clears the day. It's a long view from a very special mountaintop.

"The Manana Literary Society" was Heinlein's name for the little group of writing friends who used to gather on Saturday evenings in his Hollywood home to sip dry sherry and discuss fiction, the future, sex, or whatever. Heinlein was an inspiration to us then, and this big book is better than those evenings were. It's a whole weekend.

He's a quiet man, neat, reserved, very sharp. Scrappy too, though polite about it. He likes to challenge false assumption and stupid error, but his military code includes a very formal sort of courtesy. He was the most civilized person I had met.

Never arty, he claims to write for easy money. Yet his plain style conceals an extraordinary skill. Look at his opening for "Delilah and the Space Rigger":

"Sure, we had trouble building Space Station One—but the trouble was people."

His future world is there, factual and felt. This easy-seeming art of making some far tomorrow as familiar as today was new to the genre, and it made him an instant model for serious science fiction.

Through the early 1940s—with time out for research with the Navy during World War II—he was Campbell's top writer at *Astounding/Analog*. After the war he carried science fiction out of the pulps and into the popular magazines and the visual media. He began his long series of juveniles for Scribner's.

They are my own favorites. Never condescending, these books ring true. Generally optimistic, they dramatize the human expansion to the stars. The protagonists are young people, growing up, finding their roles in human society. This is the pattern of the "juvenile," as well as of James Joyce's *Portrait of the Artist as a Young Man*.

Through most of the 1960s Heinlein led the pack. *Stranger in a Strange Land* (1961) made him the top seller he still is. The paperback advance on his new novel, *The Number of the Beast*, was $500,000. But *Starship Troopers*, though it earned him another Hugo, miffed his editor at Scribner's and touched off criticism that has never subsided.

The real target, I suspect, is his Darwinian philosophy. He sees evolution still at work, selecting the fittest for survival. His fiction is about survivor types. In the nonfiction he warns us of hazards and begs us to become survivors.

Most people don't listen. They prefer something warmer: TV, the largess of the welfare state, the comforting notion of special creation. Bishop Wilberforce tried, but failed, to demolish Darwinism in 1860. William Jennings Bryan lost again in 1925 at the Scopes monkey trial.

Now the California creationists are back in court. The new academic critics generally neglect or attack Heinlein. As liberals or Marxists, they want softer answers than Darwinism gives.

Another attack on Heinlein may be more valid. His novels often appear undisciplined, sometimes willful. He seems to neglect the basics of good fiction and to let his ideas run wild. As Wells did, he ignores art for the sake of his message in ways a professional editor would never permit.

Scores of able new writers have diversified science fiction enormously since 1940, but Heinlein did much to make it what it is. Any writer might still find useful models in Heinlein's early work: his vigor and his clarity, his strong imagination and his respect for fact, his quiet literary competence, his fighting courage.

This new book is a mix of fiction and prediction, some of it unforgettable, some of it unsaleable when he wrote it. All of it is more or less unified by new comment and one strong theme: survival. Heinlein is disturbed by the kind of future he sees. For him, as it was for Wells, tomorrow is something real. Darwin had revealed life as evolutionary process. Wells, extrapolating the process into the future, invented futurology. Heinlein knows the art.

This book is filled with some of his most frightening forecasts. Five years before Hiroshima and Nagasaki, he foresaw the horrors of nuclear war and the appalling problem of nuclear disarmament. Forty years later a sane solution still eludes us.

The critics call Heinlein an elitist and a militarist. Perhaps a Darwinian has to be these things. If evolution operates through selection and survival, the elite are those who select themselves, and sometimes they must do battle. That is Heinlein's message. It is a humane message, more bracing than gloomy *Starship Troopers*, which set off the storm, does not praise violence. It's a blueprint for survival. It pictures a state ruled by those who serve it, in peace as well as in war, not by those who hope to live off it.

This new book makes the message urgent. It's Heinlein himself, as close to an autobiography as he's likely to come. In spite of the critics, it will be—and indeed deserves to be—another best seller. The pity is that those who need it most will remain blind to it. ∞

Jack Williamson has written several science-fiction novels. His newest book is The Humanoid Touch *(Holt, Rinehart & Winston, 1980).*

EXPLORATIONS

By Nick Engler

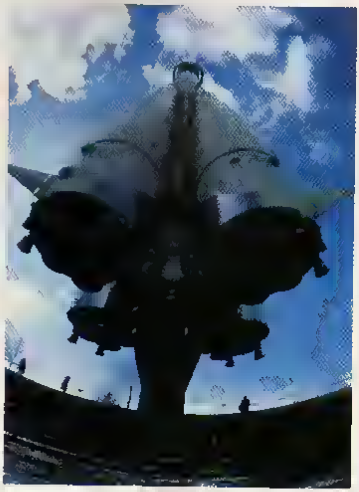
Kaluga is three hours from Moscow by train, a rambling ride through birch forests and storybook villages. The city appears to be much like many other stops: a blend of wood and concrete and decidedly Russian. But on a hill overlooking Kaluga rests a *Vostok* rocket. Behind that towers a silvery dome. This is one of the Soviet Union's proudest monuments: the Tsiolkovsky Museum of the History of the Cosmos.

For someone from the West, a visit to the Tsiolkovsky Museum or to any of the space-science memorials that dot the USSR offers a revealing look at the Soviet Union's space program. Since the first *Sputnik*, we've dissected the reports of each new Soviet launch, anxiously compared it with our own, and wondered what it might mean to us. There's no new information to be gleaned here, perhaps, but if you look closely at (or just beyond) the displays of hardware and eulogies of unfamiliar heroes, you can begin to sense what the Russians' accomplishments in outer space mean to them. The events remembered by monuments, the dreams enshrined in museums, are candid clues to the direction of a culture.

For Soviet citizens, Kaluga is where the Space Age began. One house in the rocket's shadow, gray with white trim, plainer than most, was the home of Konstantin Tsiolkovsky, the Father of Russian space science. As a resident of Kaluga, Tsiolkovsky taught geometry and physics and read Jules Verne in his leisure time. Verne's ideas so captivated him that he began to work out the mathematics of spaceflight. He calculated orbits and escape velocities and proposed ways to attain them. Tsiolkovsky's manuscripts are on display amid the rustic furnishings of his home. Though he wrote many of his works before the turn of the century, he describes with uncanny accuracy the future of space technology: multistage rockets, spacecraft operating on solar power, and the artificial *Sputnik*.

Czarist Russia ignored Tsiolkovsky. His visions might have withered in Kaluga. But in the 1920s Lenin's new Bolshevik government, anxious to adopt progressive attitudes, took an interest in Tsiolkovsky's theories. The aging schoolteacher was granted a pension and was encouraged to continue work in "cosmonautics." Before Tsiolkovsky's death in 1935, the Soviet Union had an active rocketry program. A few weeks after the celebration of his hundredth birthday in 1957, the first *Sputnik* was launched.

The engineer who presided over this launching was Sergei Korolev, known in the West as the USSR's Chief Designer, an ominous figure in the cold war. Korolev's home in Moscow, like Tsiolkovsky's in Kaluga, is preserved as a *dom-muzyei*. Inside, it's filled with Korolev's lifework: models of manned and unmanned spacecraft, remembrances from cosmonauts (whom he called his "little eagles") and a library of books about aeronautics and cosmonautics gathered from all over the world. (One title that catches a Westerner's eye is *Guided Missiles* by the U.S. Air Force.) Hung on the wall near a bust of Lenin, a back issue of *Pravda* details another of his triumphs, the first manned spaceflight.



Monument to cosmonautics: a Vostok rocket

By many accounts, both Russian and American, Korolev was unique as an aerospace designer. His methods are legend. Working under tight deadlines, he would sometimes discard the formality of blueprints. Instead he would bark precise orders at the technicians who were assembling the spacecraft, anticipating design problems and solving them in his head. Korolev died in 1966, having designed three manned spacecraft—*Vostok*, *Voskhod* and *Soyuz*—the last of which is still in use today.

The experimental results of Tsiolkovsky's theories and Korolev's engineering are on display in many places throughout the USSR. Not far from the Korolev Home-Museum, at the end of the tree-lined Avenue of the Cosmonauts, is the towering Monument to Space Conquerors. A bas-relief set in its base shows Lenin and the Russian people looking forward to a future filled with the benefits of space technology. Inside are examples of that technology.

But the largest and most extensive collection of Soviet aerospace hardware is housed under the silvery dome in Kaluga. The Tsiolkovsky Museum of the History of the Cosmos consists of two large halls. The first presents a history of rocketry and cosmonautics. Such familiar names as the Wright brothers, shown in their first airplane, appear alongside names like Nikolai Kibalchich, who in 1881 built a flying platform lifted by rockets. Unfortunately, he also exploded a bomb under the czar's carriage, which shortened Kibalchich's aeronautical career and partly explains his obscurity in the West.

The second hall shows the end result of this history. Yuri Gagarin's *Vostok 1*, a *Soyuz* space capsule, the *Mars*, *Venera*, and *Luna* landers. High overhead hang scientific satellites from the *Cosmos* series. There is a proud display of the *Apollo/Soyuz* test project (though here quite understandably it's billed as *Soyuz/Apollo*), along with several gifts from NASA and the Smithsonian Institution. Taking up one vast wall is a representation of the cosmos, Earth and the planets, showing the paths and orbits

CONTINUED ON PAGE 120

UFO UPDATE

By James Oberg

The question of hoaxes presents an interesting aspect of the UFO phenomenon. It can test the adequacy of UFO investigations and measure the powerful "will to believe" of many UFO investigators and authors. Only when, and if, these lessons are fully appreciated will serious UFO investigators be able to escape the suspicion that they are often victimized, willingly or unwillingly, by hoaxes.

English physicist David I. Simpson engineered some very revealing "UFO controlled experiment" hoaxes several years ago. According to his report published in the Spring 1980 issue of the *Skeptical Inquirer*, the tests "compared known details of fabricated UFO stimuli with the issued statements of investigators." In addition, Simpson wanted to test the abilities of UFO researchers by leaving clues that could suggest a practical solution. The hoaxes were designed to present substantial inconsistencies that would allow any moderately critical investigator to cast strong suspicion on their authenticity.

One particular experiment was performed on the evening of March 28, 1970, while a group of British UFO enthusiasts near Warminster, in Wiltshire, were watching for UFOs that reportedly frequent the region. Simpson installed a purple spotlight on a neighboring hill. As it suddenly flashed on and off, a phony "magnetic detector" sounded an alarm at the observation site. An accomplice with a camera containing preexposed film (which already showed UFO images) made several exposures of the horizon and then handed the camera—the film still inside—to a prominent UFO researcher.

Simpson prepared the hoax film so that the photographed direction and appearance of the "UFO" were grossly at odds with what observers actually beheld. He also saw to it that the first two preexposed frames (taken almost a year earlier) showed background scenes significantly different from the two subsequent real exposures (which of course did not show any UFO). This should have been evident even to the least experienced investigator.

But no one seemed to notice (and no one even interviewed the photographer). After two months of study by top UFO experts in Europe, the photographs were declared by *Flying Saucer Review* editor Charles Bowen to be "genuine beyond all reasonable doubt."

One consultant reported that "there is nothing about these photographs that suggests to me they have been faked in any way whatsoever."

Ufologist Dr. Pierre Guerin, director of research at the Astrophysical Institute of the French National Center for Scientific Research, reported that "there is no question that the object photographed was the result of faking."

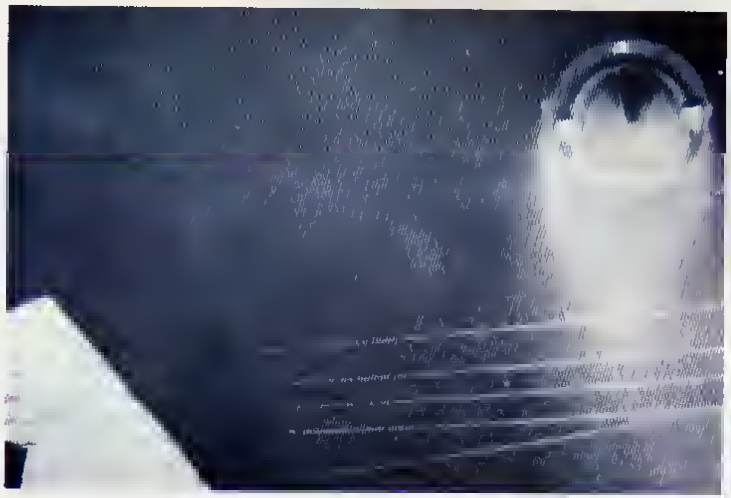
An artist's impression of the UFO appeared on the cover of the July–August 1970 issue of *Flying Saucer Review*. It showed the "object" with an angular diameter ten times too large (the experts had computed that the flying saucer was 60 feet long and 30 feet in diameter).

Eyewitness accounts described how the UFO—purple, fringed with white, having a crimson light in the middle—hovered for a moment and then moved toward Warminster before stopping again. All estimates of direction and duration were significantly erroneous, and the errors accumulated as time passed. (Later the object was described as giving off ultraviolet light and being surrounded by a "ruby-red halo.")

Simpson's critique of the "investigation," which he allowed to continue for two and a half years before revealing the hoax, was devastating. "My experiences in the UFO field have shown that the investigative incompetence demonstrated by this particular experiment, far from being exceptional, is typical. Occasionally individuals with relevant technical backgrounds become involved, it is disturbing to witness the abandonment of their mental disciplines and common sense. If ever there is subtle evidence suggesting extraterrestrial visitation, it is unlikely that it will be discovered by a typical ufologist."

Some UFO hoaxes start out as impulsive pranks rather than as carefully

CONTINUED ON PAGE 114



Fact or fantasy? This UFO photo from Pennsylvania is a type commonly associated with hoaxes

CONTINUUM

Edited by Dick Teresi

FEMINISM AND THE BRAIN

Not so long ago a prestigious psychology journal immortalized this strange theory: Sex hormones exert mysterious effects on the balance between our sympathetic (active) and parasympathetic (inhibitory) nervous systems. Womanly estrogen, the article claimed, favors the sympathetic nerves, and that explains why females are so good at "simple, overlearned perceptual-motor skills," like typing. Testosterone, the macho hormone, boosts parasympathetic activity, so men are at their best with "perceptual-restructuring tasks." Read: all higher intellectual functions.

That was in 1968, more than two millennia after Aristotle pondered whether women had souls and concluded they did not. Since females consistently outshine males at verbal ability, the authors of the sympathetic/parasympathetic manifesto were forced to dump readin' and writin' into the simple-motor-skill basket (penning *Pride and Prejudice* must have required exquisite manual dexterity, we assume). In that same year a male writer wondered in print whether woman might be the missing link in evolution—midway, presumably, between Java Man and a Green Bay Packers fullback.

This is an old and sorry tale. In the days when women were believed to possess diminutive frontal lobes, articles surfaced extolling these parts of the brain as the headquarters of human reason. Later, females turned out to be in no way unendowed in the frontal-lobe department, and scientists shifted to the parietal lobes as the locus of all smarts. Today the notion that sex differences lurk in our brains makes many a feminist cringe. And why not? No matter what data are unearthed, brain research has had a long, inglorious history of coming up with the same conclusion: Men are superior, and women are . . . well, women.

Yet this is not a rallying call for an end to sex-linked brain research. There *are* differences between the male and the female brain. But because of brain research's male-chauvinist past, some conscientious scientists are feeling a subtle but unmistakable pressure. Their work runs the risk of being judged sexist, even though they themselves may be feminists.

For instance, Sandra Witelson, a psychologist at McMaster University, in Hamilton, Ontario, has observed that the sexes seem to make unequal use of the two halves of the brain. Females tend to shine at verbal, analytical left-hemisphere skills; males at the visual, spatial right-brain side of life. But Witelson is clearly fearful of raising feminist hackles. "The people who are upset by this are those who think males and females are the same. It would be very surprising if they were the same."

University of California, Santa Barbara, anthropologist Donald Symons wanders even further into choppy waters. "I'd expect parts of the brain—like those concerned with sex and nurturing—to be as different in men and women as their genitals." Anticipating feminist glares, he points out that his theory of male-female mating strategies (see the March 1981 *Omni* Interview) is less flattering to the fickle, sensation-seeking male.

Why should gender creep into our brains? Well, we've learned that the developing human fetus responds to its own sex hormones early in uterine life, and that it is these hormones, not an XX or XY chromosome, that turn us into girls or boys by the time we're born. And the prenatal chemicals don't just sculpt our genitals. They also shape the brain. We know this because female monkeys exposed to male hormones *in utero* are born with masculinized genitals, and—here's where the brain comes in—they also *act* like males with their unladylike rough-and-tumble play. This sex-changeling behavior also happens with hormone-treated rodents. And, yes, even with *Homo sapiens*.

Girls born with a condition called adrenogenital syndrome are flesh-and-blood examples of the handiwork of sex hormones. Masculinized before birth by a hereditary chemical defect, these girls are given a completely feminine appearance nowadays with surgery and cortisone injections. But their behavior betrays the prenatal male-hormone influence on the brain, says medical psychologist John Money of Johns Hopkins University. Though raised with the same sugar-and-spice expectations as other American girls, adrenogenital girls nearly always turn out to be hard-core tomboys, preferring rowdy sports to dolls, and dreaming of careers rather than of Tupperware.

So how do we handle all these new data? We *shouldn't* use them to shore up ancient male-supremacist doctrines. Neither should scientists be inhibited in their research by feminists fearful of the results, for it will serve neither sex to deny the growing evidence of masculinity and femininity within the brain. After all, as UCLA neuroscientist Roger Gorsky put it, "I've always said the brain is a sex organ anyway."—*JUDITH B. HOOPER*

CONTINUUM

REAGAN'S JELLY BELLIES

Now another chapter in the fracas caused by President Ronald Reagan's jelly bean habit. The American Medical Association has endorsed the Chief Executive's candy saying it poses "no harm ... in moderation."

Philip L. White, the AMA's nutrition expert, said the candies contain sugar, corn syrup, dextrose and cornstarch—all carbohydrates, a basic dietary component. White admitted that many people already eat too many carbohydrates. But he noted that the President eats "jelly bellies," which are about half the size of jelly beans. Each has only five to ten calories. Thus, eight or ten candies daily will add little to one's calorie intake.

The AMA endorsement pleases the candy industry—jelly bean sales are booming—but it displeases some dental and nutrition experts. "It's self-indicting that the nation's largest medical association makes a special effort to endorse candy," Michael Jacobson, head of the Center for Science in the Public Interest, a nutrition group, charges. "When was the last time they endorsed a nutritious food like collard greens or chicken?"

The AMA counters that any sugar-laden food, including raisins, can cause cavities, and it urges candy eaters to brush thoroughly after consuming." White calls Reagan's habit "innately human." Jacobson retorts, "How can you tell kids not to eat candy when the President flaunts it?" And the American Society of Dentistry for Children asked Reagan to "go easy."

For the savants, jelly bellies are more expensive than jelly beans, with flavoring in the soft center as well as in the shell. Often sold in gourmet stores, they come in three dozen flavors, including cotton candy, tangerine, boysenberry, mango, baked apple and cream soda. In a published report, one dentist, Dr. Leonard Weiss, of Freehold, New Jersey, viewed the debate this way: "Frankly, I don't care, nor do I think the rest of the nation cares, about what the President eats for treats."

—Stuart Diamond

Reagan and jelly bellies. Flavoring in the center as well as the shell—and an endorsement from the American Medical Association.

FUTURE BASEBALL

If Ty Cobb were to come back to life and step onto a baseball diamond, he'd still feel right at home. Baseball gloves and shoes, and even the bases, have hardly changed in 50 years.

Things may not remain so much longer. A Japanese sporting-goods firm, the Mizuno Corporation, has taken a new look at old products and come up with some new designs.

Start with its clear plastic catcher's mask, which doesn't have to be flipped off when a catcher goes after a pop-up. Or its six-fingered glove that fits on either hand (perfect for budget-cutting school districts). Or its electronic batter's helmet, which broadcasts the manager's instructions directly into the hitter's ear, eliminating the third base coach's obfuscations. Or its automatic warning track, an outfield wired with an alarm that goes off when a fielder approaches the wall. Or its glove with polarized, see-through webbing to allow better viewing of fly balls. Or its base that lights up when a runner touches it.

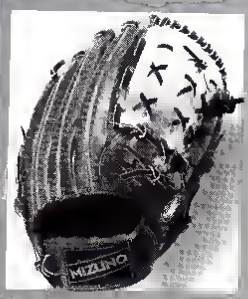
Prototypes have been developed for all these products; they were displayed to major leaguers during spring training this year.

On the drawing board are some even more futuristic designs: a strike-zone sensor to distinguish automatically between a strike and a ball, and an electronic foul line to tell a fair ball from a foul. Working in tandem with the Japanese electronics industry, Mizuno expects to produce workable models during the coming year.

Mizuno has been demonstrating its standard products at spring training camps for the last five years. Some 400 pro ballplayers have already switched to its long-lasting soft-leather glove, which needs no breaking in. This year's look at the future of baseball equipment was unveiled as part of the Japanese company's $3 million R&D program. —Dan Ross

"We all live under the same sky, but we don't all have the same horizon."

—Konrad Adenauer



Mizuno's new polarized see-through fielder's glove

ANIMAL REVENGE

For centuries *Homo sapiens* has been ravaging his habitat Now the world's animals are striking back

In Cambridge, Maryland last year sea gulls dented cars by bombing a new parking lot with oyster shells The lot had replaced their nests Near the Japanese island of Iki dolphins forced fishing boats back to port after the crews had killed 200 of the sea mammals In Bangladesh 1 000 poisonous vipers invaded a village sending people rushing for safety A road crew had disturbed the snakes' nests

Each spring half a billion blackbirds cause damage amounting to millions of dollars by eating corn grapes and other crops, as well as suburban and urban plants. In Pennsylvania the sorfie caused $15 million in crop damage in 1979 alone The National Wildlife Federation says drainage of wetlands and clearing of forests are forcing the birds to feed in the habitat that people have created for themselves Perhaps taking a cue from Alfred Hitchcock, some of the most common spring birds —including robins larks grackles, and crows —are on the attack

Individual insults also bring retribution In Virginia a prankster put an opossum in a public mailbox, and the animal reacted by chewing up 40 letters In Tokyo a crow became tangled in power cables electrocuting itself but also causing a short circuit that halted 20 trains for an hour

But some people are trying to make amends Last winter for example a woman from Kennebunk, Maine persuaded Delta Airlines to fly a shivering robin all the way to Florida —Stuart Diamond

Bird attacks human in Alfred Hitchcock's The Birds *Now it appears that not only birds but a variety of animals are seeking revenge*

The crisis of today is the joke of tomorrow
—H G Wells

CRIME'S TIMELY DEMISE

One hundred years from now the world's police forces might well be superfluous, according to a report by two top English policemen who claim that rapid advances in technology will end crime as we know it

Chief Superintendents Keith Hellawell and Alan Charlesworth claim that people will do all their work at home, using computers and closed-circuit television so that they'll hardly ever need to go outdoors and subject themselves to the criminal element And when they do leave their homes, they'll be surveyed by scanning devices and orbiting satellites that will spot any criminal activities

Those enterprising criminals who do manage to break the law despite such handicaps can expect severe penalties The report forecasts that, with no prisons in the twenty-first century punishment would take the form of having personal transport and communications systems shut off, thereby imprisoning a criminal at home The ultimate punishment would be a withdrawal of life-support systems

Hellawell and Charlesworth also predict that inflation and devaluation will ruin most people s commodities, thereby precluding theft Personal wealth will be measured by the amount of leisure time someone possesses

At the end of the report Hellawell states, "Perhaps historians will see our present stage of existence as a very early development stage of technological man. —John Glatt

Security guard monitors console of closed-circuit TV screens An explosion of this technology may help eliminate crime in 100 years

"A Potpourri of Bullous Eruptions"
—Title of paper delivered at a dermatologists convention

CONTINUUM

FERTILITRON

A watch-sized device that will tell a woman when she can become pregnant is being developed by a New York firm.

Richard Lester, president of Intersonics, Inc., said the still-to-be-tested device called the Fertilitron would monitor minute changes that occur in a woman's body when she ovulates. By pressing the back of the insulated watch against her wrist, a woman would obtain a reading from a microcircuit sensor. The Fertilitron would flash a red or green light, informing her she is either fertile or infertile.

"Apparently no one knows why, but a woman's body voltage changes slightly, as does the polarity of the charge," Lester said. "Accurate sensors can detect this almost infinitesimal change. It's an automatic way of telling her when she can become pregnant, and it would still give her the time."

While the Fertilitron is still being developed, Lester said another device invented by his company may be ready this year. Called Safetime, it is a tampon with a microprocessor sensor that reads a woman's body-temperature change when she ovulates. "It will let a woman know when she cannot become pregnant," Lester said.

The idea for both devices, he noted, came from a conversation he had with a gynecologist. "He said it would be nice if women had a quick, automatic way to monitor the changes that occur during ovulation. Right now they have to take their temperature regularly during the period in question, read it, and so on."

Either instrument will sell for about $100 apiece.

—Allan Maurer

"The enemies of the Future are always the very nicest people."

—Christopher Morley

HOT TAMALES

There is more than what meets the palate when it comes to spicy food preferences, says one psychologist. Why some cuisines like it hot is partly a matter of culture and partly a matter of biochemistry.

Fascinated by why anyone would deliberately eat uncomfortably spicy food, Dr. Paul Rozin, chairman of the University of Pennsylvania's psychology department, has been studying cultural food preferences in general, and the chili pepper in particular.

On one level, Dr. Rozin says, the hot chili is part of Mexican food's identity, what he calls traditional flavoring. Beyond this, chili peppers are rich in vitamins A and C, otherwise not present in the Mexican diet to any significant degree. They aid digestion by stimulating gastric secretion and salivation and, in the torrid Mexican climate, even help out in cooling off the body by causing the face to sweat.

Also, Rozin suspects, the kick of the hot pepper may trigger the release of endorphins—natural opiates in the brain—into the system of the chili eater.

Finally, Rozin points out that Mexican cuisine has one thing in common with others that use hot spices: it uses chili peppers to give some zip to otherwise bland staples. —Douglas Colligan

Assortment of chili peppers. Possible endorphin releasers.

KITE FREEDOM

Many kites went up into the attic instead of into the air after the publication of several stories about the trouble some kite flyers got into for allegedly flouting Federal Aviation Administration (FAA) regulations.

Despite these stories, it's all right to fly a kite almost anywhere. "All of those stories are in error," said an FAA spokesman. "A sheriff in California arrested some kids for flying kites near an airport, saying it's against FAA regulations. It's not.

"FAA regulations don't prohibit a kid from flying a normal kite for recreational purposes anywhere. Section 101 of the Federal Aviation Regulations applies to moored balloons and kites weighing more than five pounds. Those can't be flown in restricted areas without permission, higher than five hundred feet, or less than five hundred feet from the base of a cloud." Large kites of this type also require bright lights if they are flown at sunset or sunrise. —Allan Maurer

ENERGY-INTENSIVE LAWNS

An intensive study of lawns in Maryland has come up with a surprising result It takes twice as much energy and resources to keep a typical lawn green as it does to grow farm crops, such as corn and tobacco

John Falk, a scientist at the Smithsonian's Chesapeake Bay Center for Environmental Studies, found that a well-kept lawn 11 meters square requires 173 000 calories of food equivalent in labor water fertilizer and other resources each year With half as much energy in the same space a household could grow 150 pounds of tomatoes, 87 pounds of cucumbers and 208 pounds of potatoes, according to government figures

A lawn produces more new plant material each year than a tall grass prairie or coniferous forest ' Falk said He added that the 30 million acres of U S lawns totals an area the size of Indiana—a tenth as large as all farmland under cultivation

Falk, who has studied lawns for a decade, traces their proliferation to "affluence, technology and conspicuous consumption" in the last 100 years Advances in farm technology liberated soil for other uses And scientists spurred by the golf industry developed grass strains that satisfied the aesthetic desires of the burgeoning middle class

But he also found that, though lawns for the masses are new, the desire for lawns is ancient and has a place in evolution He said there is evidence the hanging gardens of Babylon were actually a lawn The village green was the traditional site of tournaments and many cultural events The lawn's smoothly rolling contour surrounded by trees and bushes resembles the African savannah where some anthropologists place the origin of the human race

—Stuart Diamond

Elaborate lawns are an obvious expense Now research shows even conventional lawns eat up more energy than farmland does

'The effort to understand the universe is one of the very few things that lift human life a little above the level of farce and give it some of the grace of tragedy '

—Steven Weinberg

PET NEUROSES

Dr Victoria Voith has had a 90 percent success rate in treating her neurotic patients yet not one has said so much as thanks—mostly because they're all animals

Dr Voith is director of the Animal Behavior Clinic, part of the University of Pennsylvania s Center for Interaction of Animals and Society and for the past two years has been working with people (the clients) and their pets (the patients) to solve the animals behavior problems

The two most common neuroses are biting and eliminating when they are not supposed to

And there are other more peculiar problems, like the Old English sheepdog that was terrified of thunderstorms and would crash through closed windows and glass doors at the first thunderclap

Therapy usually consists of three one-hour sessions with as many of the family members participating as possible One solution, in the case of a Doberman pinscher that kept snarling at its owner involved teaching the person how to reestablish dominance over the animal by training it to assume submissive positions stay sit lie down, etc

To solve other problems Voith may work with the animal itself For the nervous sheepdog she used the classic desensitizing methods developed to treat human phobias She played progressively louder recordings rewarding the dog for tolerating the noise each time, until she built up to the real thing

Dr Alan Beck with one of his neurotic patients

Since roughly one fourth of animals brought to local pounds to be destroyed each year are turned in because of behavioral problems, Dr Alan Beck, the center's director, points out that the clinic is a humane idea —Douglas Colligan

"Science clears the field on which technology can build "

—Werner Heisenberg

CONTINUUM

LAUGHING GAS HAZARDS

Dentists who are foo liberal with laughing gas may be endangering their own health A Stanford University study of 42 000 dentisfs and dental assistants has found that heavy dispensers of nitrous oxide are four times more likely than its nonusers to feel neurological aftereffects numbness muscle weakness or tingling jitters

Some earlier medical defective work by San Francisco s Dr Robert Layser on "laughing gas junkies,' dentists who end each day with long chuckles instead of dry martinis prompted the mass invesfigation

Stanford's Dr Jay Brodsky began his recenf huge study not as a dragnet for laughing gas abuse but as an attempt to assess fhe anesthetic's more general occupafional hazards The anesthesiologisf's results indicafe that up to 12 out of every 1 000 dentists and their assistants who have administered more than 3 000 hours of laughing gas may suffer neurological impairment Sustained exposure to a few parts per million of laughing gas in the office air, however, is far less damaging Dr Brodsky cautions, than the massive doses that nightly abusers absorb

And the Stanford physician also emphasizes that there's no cause for patients to worry unless they ve been in the chair for more than 3,000 hours In that case, they've got other problems

Buf Brodsky does feel that some denfisfs might stop unwarranted use of nitrous oxide in cleaning teeth, for example and make sure fhat their air scavengers are working —David Monagan

Does your dentist knock you into surreal giddiness with heavy hits of laughing gas? As it turns out, the joke may be on him

GRASSOHOL

A Florida ufilify company now burns oil worth $37 a barrel and marijuana worth $220,000 a barrel

Florida Power and Light Company has agreed to take 600 tons of marijuana confiscated in that state each year by the U S Customs Service, shred it and mix it with oil at the utility s Port Everglades generating station The drug produces power that is then fed into the southern Florida electrical grid

' It started out as a big joke " said utility spokeswoman Mary Ann Linden People referred to it as grassohol But we look at it as a service to the taxpayer We re happy to help as much as we can

And in fact the dope helps At the first burn this past January five tons of marijuana, with a $3 million street value, produced as much energy as 13 66 barrels of oil The ufility's engineers calculated thaf 732 pounds of pot yields the energy in one barrel of oil Thus the January burn packed enough energy to power all of southern Florida for 4 4 seconds On a yearly basis the 600 tons of the stuff confiscated will replace enough oil to power southern Florida for 8 8 minutes

Of course for equivalent energy the marijuana cosfs $219,619 33 per barrel but no one pays if except the smugglers who had brought it in The Customs Service, which for years sfruggled to find a suitable disposal method now saves $25,000 each year in incineration costs because the utility does it free Florida Power and Light and its customers save more than $60 000 in imported oil And a lot of people don t get sfoned

Ms Linden said the utility has received inquiries from

Customs agents load bales of marijuana into power plant

power officials and legal authorities throughout the world who want to duplicate the procedure She said there is no pot smell because the power plant's 400-foot stacks propel the smoke fen miles out over the ocean But U S Customs official Mark McCormack had a warning for marijuana growers who claim they were just growing their own power We would consider that an illegal use Marijuana is not a legal product at this point "—Stuart Diamond

"I hold that man is right who is most closely in league with the future

—Henrik Ibsen

KITE SAILS

Flying a kite may become a routine duty for crews of large, oceangoing tankers.

Professor Glen Schaefer and Keith Allsopp of Cranfield Institute of Technology, in England, calculate that big ships could increase speed and save fuel if they were towed by vast kites giving auxiliary power to their main engines.

Shipowners bedeviled by rising energy costs are warming to the idea of rigging ships with masts and sails to save fuel. A Japanese tanker rigged in this way is already undergoing her trials.

Schaefer and Allsopp argue that masts and sails clutter useful deck space and make ships roll, sometimes dangerously. One solution is to do away with masts and transfer the sails up into the sky as diamond-shaped kites—as large as 3 000 square meters—made of tough new materials at the end of strong towing lines.

The kite should be more effective the higher you fly it, because wind speed increases with altitude. Winds also veer with height. At some altitudes the trade winds blow in exactly the opposite direction from which they blow at sea level. So increased energy, better stability and greater flexibility await the kite flyers, who can probe the heights with pilot kites to find a favorable wind just as sailors once plumbed the depths of the sea with a lead.

Schaefer and Allsopp believe that sophisticated kite sails, using modern aerodynamic principles and remote control, could add as much as 40 percent to a ship's speed.

The two scientists have used a 50-square-meter kite to tow a 10-meter cabin cruiser in the English Channel—77 years after the Texas-born aviation pioneer Samuel Cody used a box kite to tow him across the Channel to France in a four-meter-long dinghy.

—Glyn Jones

Sailing ship. Pretty but masts are bulky and dangerous

COYOTE DETERRENTS

Can collars and Komondorok keep coyotes away? Coyotes usually dine on rodents, but occasionally a coyote takes a liking to lambs or other livestock.

Western farmers and ranchers fought the coyote with bait laced with a poison called 1080 until 1972, when the use of the substance was banned on federal lands. Ever since then the U.S. Fish and Wildlife Service (FWS) and the U.S. Department of Agriculture (USDA) have been looking for more selective weapons. Now they think they've found two of them: a rubber collar containing 1080 and a shaggy 100-pound dog from Hungary, the Komondor (plural, Komondorok).

The collars are not put on the Komondorok but on a small number of sheep or goats in a herd. When a coyote bites any of these livestock on the neck, which is its usual target when it attacks, the rubber pouch containing 1080 is pierced and the predator receives a lethal dose. The FWS has tested the collar on Western ranches with results that range from fair to spectacular.

"The collar is a sort of tool of last resort," says Guy E. Connolly of the FWS. "You use it when you've already tried everything else." Since 1080 is still banned except for research, the collar can't be used by livestock owners.

There are no restrictions on the Komondor, and there are about 1 000 of them in this country, most doing guard duty against coyotes. In Hungary they're used to guard sheep from wolves. A survey of Komondor owners by the USDA's sheep experiment station in Dubois, Idaho, shows that most give their dogs high marks. "There are dogs that are literally keeping people in the livestock business," says Jeffrey S. Green, of the station. Research at the Dubois installation indicates that for the best results Komondorok should be raised with their charges.—Barbara Ford

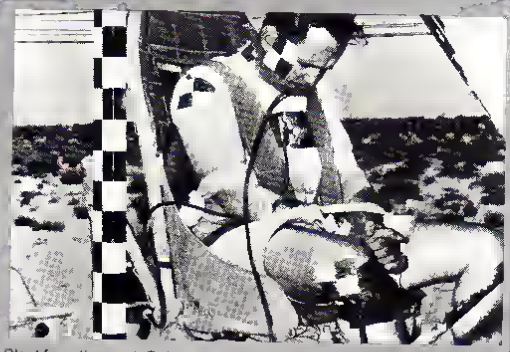
"In the final analysis, randomness, like beauty, is in the eye of the beholder."
—R. W. Hamming

Sheep models the latest poisonous rubber collar. Coyotes are in for a rude surprise when they go for the necks of these animals.

CONTINUUM

AIR FORCE SHUTTLE

The Air Force is already planning a second space shuttle, a smaller version that could take off like a



Blast from the past Subject readies himself for rocket sled ride Now Boeing wants to use a similar sled for launching a minishuttle

more conventional aircraft

Lt Gen Thomas Stafford, USAF (Retired), a former deputy chief of staff recently told the Senate Armed Services Subcommittee that the Air Force is 'projecting the shuttle from now to the year 2000 We are looking down the road with a small amount of research and development money at a reusable space vehicle that is smaller than the shuttle, will carry eight thousand to ten thousand pounds into orbit and could launch from a standard air base *Columbia* carries a cargo of 65,000 pounds, but it requires enormously complex launch-support facilities

The money that General Stafford mentioned went to Boeing and Rockwell International to develop concepts for a single-stage Earth-to-orbit manned spaceship Working independently, both aerospace companies came up with a small delta-winged vehicle with a projected lifetime of 500 to 1,000 missions, versus the 100-mission life of NASA's space shuttle The Rockwell minishuttle would take off from an ordinary runway using air-turborockets while still in the atmosphere Boeing would launch its spacecraft from a rocket sled After the initial stages both craft would rely on advanced versions of the space shuttle's main engines to reach orbital velocity and altitude

When can we look for this newest addition to our space fleet? Probably not much before the year 2000 If then The Air Force wants to examine other alternatives and study the possible uses for such a vehicle —Nick Engler

"Religions die when they are proved to be true Science is the record of dead religions '
—Oscar Wilde

SATELLITE TAX AUDIT

The Chilean government has found a new use for Landsat satellite images tax collection

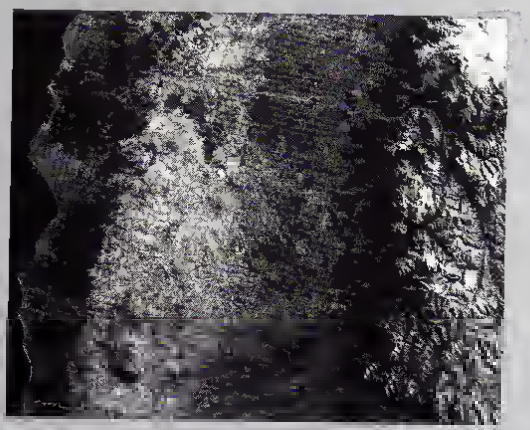
According to recent disclosures by the director of Chile's National Revenue Service, the satellite s remote sensing is being used to maintain surveillance on an area of some 650 square miles in one of Chile's richest agricultural regions

The authorities believe that farmers are evading some $300 million in taxes each year Agriculture represents nearly 10 percent of the Chilean economy yet it accounts for only an estimated 4 percent of total tax revenues

The sensors of Landsat 3 cover the same spot every 18 days, photographing various crops fields and forests The color-coded images identify such crops as wine grapes fruits, and grains These images are later transmitted to a receiving station in Brazil The magnetic tapes are forwarded to Canada for interpretation and then are returned to Chile

The Chilean tax men expect to recover at least $200 million from undeclared taxes in the agricultural sector and this will more than cover the $200 000 annual fee that a foreign country must pay the United States for using the satellite Director Felipe Lamarca also disclosed that the use of Landsat was part of a pilot project currently being tested If the data supplied by the satellite don t quite match the amount of taxes declared by the farmers special teams of investigators will be sent to the area and severe sanctions will be imposed on those caught cheating

—Antonio Huneeus



Landsat photograph of Chile Chile s National Revenue Service is buying U S satellite imagery to tax-audit that country s farmers

WHY DOES THE WORLD'S MOST INNOVATIVE SCIENCE MAGAZINE THINK SCIENCE FICTION IS SO IMPORTANT?

BECAUSE FACT IS A PLACE FICTION HAS ALREADY BEEN.

Science is not facts. It is perspective. It is not history, but the key to unlocking the door to tomorrow.

Today, the power to conceive has become the power to create. Tomorrow, our only boundaries will be the limits of imagination.

OMNI reveals science as it really is: ideas harnessed to the needs of men, hopes becoming happenings, fiction becoming fact.

Subscribe to OMNI. Explore living science.

Mail the attached coupon with your payment today and receive a year of OMNI for $18 — $6 off the newsstand price. Or, for faster service, call our toll-free number and charge your subscription order. Dial **1-800-331-1750 and ask for operator OP57.**

Illustration by Hans-Ulrich Osterwalder

OMNI

BECAUSE THERE'S
NO COMPETITION FOR THE RIGHT IDEA.

OMNI Sub[illegible]ot
PO Box 9[illegible] Farmingdale, N.Y. 11737

☐ YES. Send me one year of OMNI (12 issues) for only $18 (that's a savings of $6 off the newsstand price).

☐ Increase my savings by sending me 2 years of OMNI (24 issues) for only $32 (that's a saving of $16 off the newsstand price).

(For United Kingdom subscriptions, send payment of £11 for one year to: 2 Bramber Rd., London, W14.)

Name _____

Address _____ Apt # _____

City _____ State _____ Zip _____

☐ Please extend or renew my current subscription at the same low rate.

☐ Check or money order enclosed ☐ American Express

☐ VISA ☐ Mastercard

Acct # ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Exp. Date ____ Interbank #☐☐☐☐ (Mastercard only)

Signature _____

Print clearly please. Rates for U.S., APO, FPO and U.K. only. Canada and elsewhere, $28 for 1 year subscription. $52 for a 2 year subscription. Payment must accompany order. Allow 6-8 weeks for delivery of first issue. All payments sent to U.S. must be in U.S. currency. Offer void after 11/81.

DO781

HIGH WIRE ACT

Really cheap space transport won't use rockets, for that we need a cable car to the stars

BY ROBERT L. FORWARD AND HANS P. MORAVEC

It isn't going into space that has you reaching for the Dramamine. Before NASA retired the shuttle, it had gotten to be almost routine. There's just something about being dropped by the cargo plane in midair. Those moments of free fall before the cable catches you for the real trip to space are nerve-racking, not like being in orbit at all.

The loud metallic clashings don't help. The passenger capsule is being locked securely to the flatbed SST that will carry it to the edge of space, the streamlined fairings are being latched into place. It still sounds as if the capsule is being battered apart.

At the front of the 20-meter-long capsule, the crew sit in their tiny control room; they won't have much to do until the transport plane falls away and they maneuver to meet the cable's grapple-craft when it drops in from space. Around you, the 29 other passengers in the full capsule sit and fidget. The Mach-3 trip to the space elevator is about to begin.

It was Konstantin Tsiolkovsky, the Russian space pioneer, who first understood that multistage rockets could carry us into space. Years after his death, this insight brought him fame as the Father of space travel.

But few people remember Tsiolkovsky's second idea. Someday, he said, we might erect a skyhook, a cable into space, and climb

PAINTING BY DEAN ELLIS

it as we would a beanstalk. Years later Yuri Artsutanov suggested that a shorter cable rotating around its midpoint might hurl objects into space like David releasing a stone with his sling. Now that we are accustomed to rockets, these concepts sound outlandish at best. Yet practical-minded engineers are starting to take a closer look at them.

Trouble is, rockets are expensive and wasteful. Most of their fuel goes to prevent them from falling; relatively little actually carries them farther from Earth. The space shuttle is reusable, and so it cuts our equipment costs. Still, it uses up a lot of fuel. For really cheap space transportation we'll have to do away with rockets entirely. The skyhook or the rotating space elevator could be what replaces them.

Some 36,000 kilometers out we have put dozens of satellites into so called geosynchronous orbit. At that distance, it takes a satellite 24 hours to complete its orbit, exactly as long as it takes our planet to rotate underneath it. On Earth, it looks as though the satellites stay fixed in the sky above the equator while the stars slowly pass from east to west.

Suppose one of those satellites carried a cable-making machine. If the cable were strong enough to support its own weight it could extend all the way to the surface. For balance, the satellite would extrude another cable upward. The cables would be tapered, thin at the ends and thicker near the satellite, to support the weight below and counteract the centrifugal force above. At full length, the upper cable would be 110,000 kilometers long.

If the extrusion rates were carefully controlled, the pull of the cables on the satellite would cancel out and the cable machine would remain in synchronous orbit. The bottom end would eventually be attached to the ground, the outer end to a counterweight, probably a small asteroid. Gravity and centrifugal force would hold the cable exactly vertical.

Theoretically, that's all there is to a skyhook. But an Earth skyhook would be an engineering marvel. Building the 36,000-kilometer long segment down to the planet would be equivalent to erecting a suspension bridge around the equator. To finish the section in five years would mean building 20 kilometers of cable each and every day. And to lift appreciable loads, say 100 tons at a time, the skyhook would have to weigh 600,000 tons.

To get up the cable we'd use electric cars. For smaller cables, they would climb up the outside. For a greater carrying capacity we might arrange several cables in, say, a hollow square. The cars would then climb inside the structure like a standard elevator inside its shaft. To make their trip in six hours or less, the cable cars would have to travel at 6,000 kilometers or more per hour. At that speed, rubbing or rolling contact would cause an instant catastrophe, the cars would be propelled by magnetic levitation instead of by wheels.

Each car would consume only a few dollars' worth of electricity per kilogram—far less than the cost of rocket fuel. If a car traveled beyond the central station in geosynchronous orbit, it would be pulled along the cable by centrifugal force, like a skater at the end of a crack-the-whip. The cars would have to brake to keep from flying out too fast. If the brakes were used to turn a generator they could provide energy to raise the next cable car.

And you would want to go out beyond the central station. As the cars climb, the cable's rotation would carry them horizontally through space at ever higher velocities. An object dropped from the cable during the first few kilometers of the trip would fall nearly straight to the surface. As the car climbed higher the impact point would migrate eastward. Dropped from 25,000 kilometers or beyond, the object would shoot past Earth's horizon and go into orbit. At the central station, 36,000 kilometers out, skyhook payloads could simply be floated out of the car to become synchronous satellites.

A lunar space elevator could be built of plastics now in use. It would weigh only 3,700 tons and be able to lift or deliver a 100-ton payload every 20 minutes.

But move still farther out. At the ballast stone, the cable car would be 150,000 kilometers from the center of the earth and moving horizontally at 11 kilometers per second. Let go of the cable and the car—now turned spacecraft—could coast all the way to Saturn on a minimum-energy orbit. The trip to all the nearer planets would be much quicker.

It may be a long time before we can build a skyhook here at Earth. The skyhook would require an unusual material, something both strong and light. Even the best steel would be too heavy for an Earth-based skyhook. But crystalline graphite could handle the load. In theory it is 20 times as strong as conventional steel, yet only one fourth as dense. A cable one centimeter square with the strength of crystalline graphite whiskers could lift 210 tons here on Earth.

Partially crystalline graphite fibers in plastic are the wonder material of aerospace and sports-equipment manufacturers. Their high strength and low weight make them ideal for tennis rackets, golf clubs and the like. And the space shuttle's main engines are extremely light because they were built using graphite fibers wherever the temperature would permit.

A crystalline graphite cable one centimeter square would weigh about 220 kilograms per kilometer of length. A piece nearly 1,000 kilometers long could support its own weight in Earth's gravity field. If the cable were built with a taper thicker at its supporting end, it could be much longer. With a taper of ten to one, a graphite cable could be built all the way to synchronous orbit and beyond.

But for the moment we don't know how to weave large graphite cable with the strength of tiny whiskers. Today's graphite fibers are strong, but only one tenth as strong as theory postulates. Even at that, however, they are more than strong enough to build skyhooks on the moon and Mars.

A skyhook for Mars would be far easier. Mars rotates nearly as quickly as Earth, once every 24.5 hours, but its gravity is less than four tenths as strong as Earth's. A skyhook at Mars capable of lifting 100 tons would mass only 4,200 tons. Mars even offers a 21-kilometer-high mountain, Mons Pavonis, on the equator and a small moon, Deimos, in almost the right orbit to act as a counterweight.

And the new version of the skyhook, the space elevator, uses a much shorter cable that should be still easier to build. The space elevator rotates in orbit, the ends of the cable touching down near Earth's surface. One design calls for a cable 8,500 kilometers long, its central portion circling the earth every 183 minutes in an orbit 4,250 kilometers high.

The long cable would rotate once every 122 minutes, like two spokes on a bicycle wheel, with the imaginary rim rolling along the surface below. Three times each orbit, once every 61 minutes, one end of the cable would touch down into the upper atmosphere. These entry points would be the elevator's ports of departure.

The bodies involved are so large that the ends of the cable would seem to come down nearly vertically, without wandering horizontally. But there is more to it than a rigid cable. Under maximum load graphite could stretch by nearly 2 percent of its total length—about 80 kilometers for the section of cable out to the midpoint. This means that a coupling vehicle could fly the cable's end to the rendezvous ahead of its nominal touchdown time and delay its return to orbit. This would allow almost a full minute to meet the transport and to exchange capsules carrying cargo and passengers.

The three-touchdown space elevator would need a taper of about 12 to 1. A cable with a mass of only 7,500 tons could lift a 100-ton cargo into space. At touchdown, the end of the cable would approach and leave Earth at 1.4 gravities—not comfortable, but a much gentler ride than astronauts endure on the shuttle.

It would be even more practical on the moon. A lunar space elevator could be

made with materials like the superplastic Kevlar, which has about five times the strength to weight of steel. Kevlar is now used in such products as bulletproof clothing, radial tires, and parachutes. A 3,700-ton space elevator at the moon could lift and deposit 100 tons every 20 minutes, subjecting payloads to a maximum acceleration of only 0.66 gravity.

Rotating space elevators could be used on any of the solar system's moons. Jupiter's Ganymede and Saturn's Titan are larger than Earth's moon, but a Kevlar space elevator with a taper of six to one could serve either of them.

Spinning cables orbiting the sun between the planets could act as shuttle points, cutting the travel time between any two places in the solar system. Instead of going slowly off to a distant planet on a path calculated to save energy, the capsules would head at high speed to the nearest transfer cable. Approaching the cable, they would attach themselves to the point along the spinning thread that matches their approach velocity, then move along the cable to a point with the velocity needed for the next leg of their journey. After a short wait for the cable to rotate toward the departure point, the capsule would release itself from the cable, flying into space toward its goal.

The trip would be free. The cable would slow a bit as its energy was carried off by the disappearing capsule, then regain the speed when the capsule returned. As long as more mass dropped inward toward the sun than went out into space, the space elevator would need no energy source once it had been set in motion.

Graphite fiber technology is developing so rapidly that a rotating space cable will soon be feasible. Shortly after that, we may be able to make cables strong enough to weave a stationary skyhook. Scientists are planning some shuttle experiments with tether cables up to 100 kilometers long. After that, longer cables will come. Someday we may even see an international race to spin the first cable into space.

Well beyond the 50-kilometer altitude that once separated airplane pilots from astronauts, the cargo plane releases its latches and drops away as the passenger capsule soars on. If anything goes wrong, the capsule's parachutes will get you safely back to Earth. Overhead, the grapple-craft at the end of the space elevator dives downward to rendezvous, its control jets flashing to position it for pickup in order to exchange an incoming capsule for yours.

Carefully taking their time, the crew attach the grapples to the lifting lugs atop the passenger capsule. Upward acceleration slowly replaces free fall, and the weight comes back onto your belly—just in time. In half an hour you are 260 kilometers up and moving at 9 kilometers per second. The grapples release, and again you are in free fall. It will be 12 hours before you get to the moon. ∞

OMNI PROFILE

The mandarin of subatomic experimentation can make or break a theory in less than five billionths of a second

Close your eyes and think physicist. Chances are you see Albert Einstein: rumpled sweater, baggy pants, double-domed forehead, distant gaze. This image of the absent-minded theoretician today coexists with another breed of physicist: the experimentalist, surrounded by the apparatus of his laboratory, who craves hard facts rather than airy speculations.

Samuel C. C. Ting is the mandarin of modern experimental physics. His 15 years of experiments rewrote textbooks and produced a new map of the subnuclear world. In 1974, for instance, Ting performed a dazzlingly complex and daring experiment at Brookhaven National Laboratory, in Upton, New York. His work revealed the existence of an utterly unexpected particle, the J, which had no place in the accepted structure of the world. The experiment sent theorists rushing back to their blackboards. When the chalk dust settled, a new model for the structure of matter emerged, with the J particle as one of its cornerstones.

Ting shows an uncanny ability to devise experiments that ratify or destroy the constructs of theorists. He blazes trails through the confused, complex maze of subatomic fragments where the differences between energy and matter

PHOTOGRAPH BY JOHN WHITE

THE ONCE AND FUTURE TING

BY BRUCE SCHECHTER

grow murky and time can run backward Each of his experiments sends a thrill of anticipation through the scientific world

Harvard University Nobel Prize winner Sheldon Glashow declares "Frankly experimental physics was pretty damned dull for a number of years before Ting's experiment on the J"

So important was the J particle's discovery that many physicists now refer to "Before J" and "After J" as historical eras In 1976 only two years after he discovered the J particle Ting received the Nobel Prize He had just turned forty

BIG MONEY, SMALL TARGET

Sam Ting dresses neatly in conservative blue business suits white shirts and ties that sport a regimental stripe No fuddy duddy physicist he! You could easily mistake him for a successful Chinese businessman And you wouldn't be totally wrong either because at Ting's level experimental physics is a multimillion-dollar enterprise a big business in its own right

There is something paradoxical about the enormous expenditures of money and manpower the gargantuan experimental engines required for Ting's brand of modern physics It is strange that such huge investments are required to study the most minuscule workings of the universe Yet physicists have long since accepted such reciprocity the tinier the treasure, the bigger the lock This is nature's way of guarding its dearest secrets Vast amounts of energy both human and physical must be expended to break the lock perhaps because we are not clever enough to pick it But the very best and cleverest locksmith of them all is Sam Ting

What does a high-energy physicist like Ting actually do? The enterprise has been compared to a motion picture a big budget project with years of planning and dozens of experts involved all working to express the vision of a single auteur "The difference is," Ting quickly points out "that the motion picture is for entertainment and afterwards people forget about it We hope that our experiments will have some lasting value"

A good example of Ting's work is his current experiment at the Deutsches Elektronen Synchrotron (DESY pronounced daisy) in Hamburg Germany It employs 57 physicists from all over the world, as well as scores of technicians and costs in the tens of millions of dollars "And Ting's group is the *smallest*, using the giant electron accelerator PETRA, at DESY

The purpose of Ting's DESY experiment is to make careful observations of the transformations that matter and energy undergo in extreme laboratory conditions Here new particles can be created their internal structure examined and their interactive forces measured A high-energy beam of electrons traveling at nearly the speed of light and another beam of positrons (antimatter twins of electrons) are run in opposite directions down a narrow vacuum tube The inevitable head-on crash is arranged to occur inside Ting's experimental apparatus affectionately dubbed the Mark-J by those who work the accelerator

When these beams collide with one another, electrons sometimes bounce harmlessly off positrons More often an electron and a positron annihilate each other in a burst of energy that can reemerge into different kinds of matter Other massive unstable particles may be created only to decay, forming still more particles which in turn decay

All this is noted by the Mark-J as a flood of particles rushes by in about four billionths of a second (a light beam travels only 12 feet in that same time) Each event must be sifted recorded and interpreted It's like re-creating the blueprints for a hand grenade after having observed only the pattern of its exploding fragments

That any of this is possible remains a minor technological miracle but Ting's experiment at DESY is already posting some very impressive results

"Sam Ting is a trailblazer through the complex maze of subatomic particles, where energy and matter grow murky . . . and time can stretch or run backward"

Last summer for example the Ting contingent discovered a stunning clue to the fundamental binding force of nature the power that holds all subnuclear particles together According to current belief—current mythology as theorists like to say—all particles are composed of a few more fundamental particles called quarks Combinations of the five known types of quarks create the hundreds of subnuclear fragments that underpin the universe

There are two experimental problems First, no one has ever seen a free quark Plenty of evidence exists that quarks rattle around inside protons but so far they have resisted all attempts to be shaken free *Something* does an exceptional job of holding quarks together and this brings us to the second problem What is the force that does the binding? Current mythology says that another particle called the gluon figuratively glues quarks together It's a nice theory but until Ting stepped forward there was hardly a shred of evidence gluons existed

When an electron and a positron collide theory says their energy is sometimes converted into another particle that consists of a quark and an antiquark bound together by a gluon The particle lives briefly then decays throwing fragments everywhere Sometimes these fragments concentrate in two narrow jets indicating that the parent particle had consisted of two components But what Ting and others at PETRA saw was somewhat different Mixed in with two jet events and other phenomena were very rare three-jet events The fragments of the decaying particles arranged into three narrow prongs pointed away from one another like the spokes of a Mercedes-Benz insignia One spoke was presumably caused by a quark, the second by an antiquark and the third smaller spoke by a gluon

Ting explains that this is only one possible interpretation "I don't think you can guarantee that in a few years there won't be a different explanation for this phenomenon" he says In dealing with subatomic experimentation he says the explanations one chooses derive from current mythology Einstein once said, "It is theory that decides what we can observe."

Still Ting is highly skeptical of theory and of theorists He likes to remind us that theorists are useful people to talk to As long as you don't believe them you'll be all right"

If it holds up Ting's discovery of the gluon will be an event of first importance There is even talk of another Nobel Prize The physicist is unimpressed with this, as he is with most other theoretical speculation Besides the discovery of the gluon would merely be verification of what theorists have been talking about for years So what if it revolutionizes our understanding of the world? For Ting this is just business as usual

Some of his discoveries have been special to him though none more so than the first sighting of the J When Ting began doing his experiments a decade ago high-energy physics was still a relatively modest enterprise For instance it took only four people to design run and interpret Ting's thesis experiment at the University of California at Berkeley The basic ideas and goals then were the same as they are now but the scale of contemporary experiments is vastly larger

TO CATCH A RAINDROP

When Ting went to Brookhaven National Laboratory in 1972 with a proposal to do the experiment that would win him the Nobel Prize he was greeted with open criticism The experiment first of all was very difficult and expensive to perform Ting likes to explain the complexity in the following way "During the rainy season in a city like Boston maybe ten billion drops fall in one second Say one of them is of a different color We had to find that drop"

The other criticism was more pointed Even if Ting could get his experiment to work an eminent physicist pointed out it was worthless Ting's experiment was de-

CONTINUED ON PAGE 105

FICTION

Her diplomatic mission was a pretense to get inside the Emperor's court

THE PALACE AT MIDNIGHT

BY ROBERT SILVERBERG

The foreign minister of the Empire of San Francisco was trying to sleep late. Last night had been a long one, a wild if not particularly gratifying party at the Baths: too much to drink, too much to smoke, and he had seen the dawn come up like thunder out of Oakland 'crost the Bay. Now the telephone was ringing. He integrated the first couple of rings nicely into his dream, but the next one began to undermine his slumber, and the one after that woke him up. He groped for the receiver and, eyes still closed, managed to croak, "Christensen here."

"Tom, are you awake? You don't sound awake. It's Morty Tom. Wake up."

The undersecretary for external affairs, Christensen sat up, rubbed his eyes, ran his tongue around his lips. Daylight was streaming into the room. His cats were glaring at him from the doorway. The little Siamese... pawed daintily at her empty bowl and looked

PAINTING BY JEAN-PIERRE ALAUX

up expectantly The fat Persian just sat

"Tom?"

"I m up! I'm up! What is it Morty?'

"I didn't mean to wake you How was I supposed to know one in the afternoon—"

"What is it Morty?"

"We got a call from Monterey There's an ambassador on the way up and you've got to meet with her"

The foreign minister worked hard at clearing the fog from his brain He was thirty nine years old and all-night parties took more out of him than they once had

"You do it Morty."

"You know I would Tom But I can't You've got to handle this one yourself It's prime"

"Prime? What kind of prime? You mean, like a great dope deal? Or are they declaring war on us?"

"How would I know the details? The call came in and they said it was prime Ms Sawyer must confer with Mr Christensen It wouldn't involve dope Tom And it can't be war, either Shit, why would Monterey want to make war on us? They've only got ten soldiers I bet, unless they're drafting the Chicanos out of the Salinas *calabozo* and besides—"

All right " Christensen's head was buzzing "Go easy on the chatter Okay? Where am I supposed to meet her?"

'In Berkeley.'

"You're kidding"

She won't come into the city She thinks it's too dangerous over here

'What do we do kill ambassadors and barbecue them? She'll be sate here and she knows it '

Look I talked to her She thinks the city is too crazy She'll come as far as Berkeley but that's it "

Tell her to go to hell '

"Tom Tom—"

Christensen sighed "Where in Berkeley will she be?

"The Claremont, at half past four"

"Jesus" Christensen said "How did you get me into this? All the way across to the East Bay to meet a lousy ambassador from Monterey! Let her come to San Francisco This is the Empire isn't it? They're only a stinking republic Am I supposed to swim over to Oakland every time an envoy shows up and wiggles a finger? Some bozo from Fresno says boo, and I have to haul my ass out to the Valley eh? Where does it stop? What kind of clout do I have anyway?

"Tom—"

I'm sorry Morty I don't feel like a goddamned diplomat this morning "

"It isn't morning anymore, Tom But I'd do it for you if I could "

"All right All right I didn't mean to yell at you You make the ferry arrangements "

"Ferry leaves at three-thirty Chauffeur will pick you up at your place at three, okay?'

"Okay" Christensen said. "See if you can find out any more about all this, and have somebody call me back in an hour with a briefing will you?"

He fed the cats showered shaved took a couple of pills and brewed some coffee At half past two the ministry called Nobody had any idea what the ambassador might want Relations between San Francisco and the Republic of Monterey were cordial just now Ms Sawyer lived in Pacific Grove and was a member of the Monterey Senate that was all that was known about her *Some briefing* Christensen thought

He went downstairs to wait for his chauffeur It was a late autumn day bright and clear and cool The rains hadn't begun yet and the streets looked dusty The foreign minister lived on Frederick Street just off Cole in an old white Victorian with a small front porch He settled in on the steps feeling wide awake but surly and a few minutes before three his car came putt-putting up a venerable gray Chevrolet with the arms of imperial San Francisco on its doors The driver was Vietnamese or maybe Thai Christensen got in without a word and off they went at an imperial velocity through

"These absurd little nations with their wars and their alliances and shifting confederations, it was like a game, it was like playground politics Except this time it was real"

the virtually empty streets down to Haight eastward for a while then onto Oak up Van Ness past the palace where at this moment the Emperor Norton VII was probably taking his imperial nap and along Post and then Market to the ferry slip

The stump of the Bay Bridge glittered magically against the sharp blue sky A small power cruiser was waiting for him Christensen was silent during the slow dull voyage A chill wind cut through the Golden Gate and made him huddle into himself He stared broodingly at the low rounded East Bay hills dry and brown from a long summer of drought and thought about the permutations of fate that had transformed an adequate architect into the barely competent foreign minister of this barely competent little nation The Empire of San Francisco one of the early emperors had said is the only country in history that was decadent from the day it was founded

At the Berkeley marina Christensen told the ferry skipper, 'I don't know what time I'll be coming back So no sense waiting I'll phone in when I'm ready to go "

Another imperial car took him up the hillside to the sprawling nineteenth-century splendor of the Claremont Hotel that vast antiquated survivor of all the cataclysms It was seedy now the grounds a jungle, ivy almost to the tops of the palm trees and yet it still looked fit to be a palace with hundreds of rooms and magnificent banquet halls Christensen wondered how often it had guests There wasn't much tourism these days

In the parking plaza outside the entrance was a single car, a black-and-white California Highway Patrol job that had been decorated with the insignia of the Republic of Monterey a contorted cypress tree and a sea otter A uniformed driver lounged against it looking bored "I'm Christensen" he told the man

"You the foreign minister?'

"I'm not the Emperor Norton "

"Come on She's waiting in the bar"

Ms Sawyer stood up as he entered—a slender dark-haired woman of about thirty with cool green eyes—and he flashed her a quick professionally cordial smile which she returned just as professionally He did not feel at all cordial

' Senator Sawyer he said I'm Tom Christensen"

"Glad to know you She pivoted and gestured foward the huge picture window that ran the length of the bar "I just got here I've been admiring the view It's been years since I've been in the Bay Area"

He nodded From the cocktail lounge one could see the slopes of Berkeley the bay the ruined bridges the still-imposing San Francisco skyline Very nice They took seats by the window and he beckoned to a waiter who brought them drinks

"How was your drive up?' Christensen asked

"No problems We got stopped for speeding in San Jose but I got out of it They could see it was an official car but they stopped us anyway"

The lousy bastards They love to look important

'Things haven't been good between Monterey and San Jose all year They're spoiling for trouble"

"I hadn't heard" Christensen said

"We think they want to annex Santa Cruz Naturally we can't put up with that Santa Cruz is our buffer"

He asked sharply "Is that what you came here for to ask our help against San Jose?"

She stared at him in surprise "Are you in a hurry Mr Christensen?"

"Not particularly"

"You sound awfully impatient We're still making preliminary conversation having a drink two diplomats playing the diplomatic game Isn't that so?"

Well?

"I was telling you what happened to me on the way north In response to your question Then I was filling you in on current political developments I didn't expect you to snap at me like that"

"Did I snap?'

"It certainly sounded like snapping to me " she said with some annoyance

Christensen took a deep pull of his bourbon-and-water and gave her a long, steady look. She met his gaze imperturbably. She looked composed, amused, and very, very tough. After a time, when some of the red haze of irrational anger and fatigue had cleared from his mind, he said quietly, "I had about four hours' sleep last night, and I wasn't expecting an envoy from Monterey today. I'm tired and edgy, and if I sounded impatient or harsh or snappish, I'm sorry."

"It's all right. I understand."

"Another bourbon or two and I'll be properly unwound." He held his empty glass toward the hovering waiter. "A refill for you, too?" he asked her.

"Yes. Please." In a formal tone she said, "Is the Emperor in good health?"

"Not bad. He hasn't really been well for a couple of years, but he's holding his own. And President Morgan?"

"Fine," she said. "Hunting wild boar in Big Sur this week."

"A nice life it must be, President of Monterey. I've always liked Monterey. So much quieter and cleaner and more sensible down there than in San Francisco."

"Too quiet sometimes. I envy you the excitement here."

"Yes, of course. The rapes, the muggings, the arson, the mass meetings, the race wars, the—"

"Please," she said gently.

He realized he had begun to rant. There was a throbbing behind his eyes. He worked to gain control of himself.

"Did my voice get too loud?"

"You must be terribly tired. Look, we can confer in the morning, if you'd prefer. It isn't *that* urgent. Suppose we have dinner and not talk politics at all, and get rooms here, and tomorrow after breakfast we can—"

"No." Christensen said, "My nerves are a little ragged, that's all. But I'll try to be more civil. And I'd rather not wait until tomorrow to find out what this is all about. Suppose you give me a precis of it now, and if it sounds too complicated, I'll sleep on it and we can discuss it in detail tomorrow. Yes?"

"All right." She put her drink down and sat quite still, as if arranging her thoughts. At length she said, "The Republic of Monterey maintains close ties with the Free State of Mendocino. I understand that Mendocino and the Empire broke off relations a little while back."

"A fishing dispute, nothing major."

"But you have no direct contact with them right now. Therefore this should come as news to you. The Mendocino people have learned, and have communicated to our representative there, that an invasion of San Francisco is imminent."

Christensen blinked twice. "By whom?"

"The Realm of Wicca," she said.

"Flying down from Oregon on their broomsticks?"

"Please. I'm being serious."

"Unless things have changed up there," Christensen said, "the Realm of Wicca is nonviolent, like all the neopagan states. As I understand it, they tend their farms and

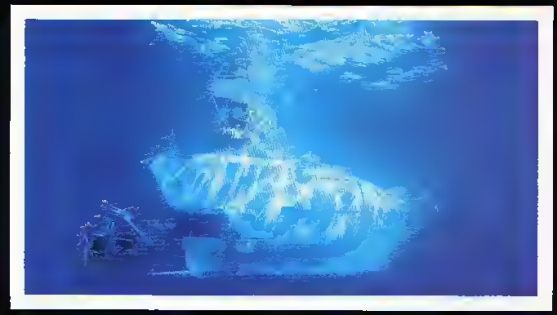
CONTINUED ON PAGE 99

SUBMERSIBLES

Exploring the earth's last, deepest frontier

BY ANTHONY WOLFF

On the seafloor—70 percent of the earth's surface, strewn with valuable minerals—human survival depends on thin-skinned diving suits and submersible vessels. Clad in fiberglass and foam on a titanium frame, the 17-ton *Alvin* (right) can carry three explorers to 13,200 feet. *Alvin* has recovered a nuclear bomb from the Atlantic off Spain and discovered vents spewing hot lava in the Pacific's Galapagos Rift. The embryonic JIM suit (below), made of magnesium with a

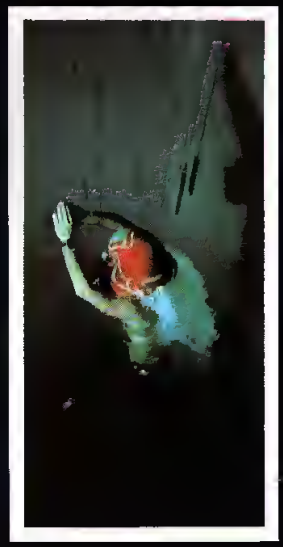


fiberglass skin, weighs 910 pounds in air but only 60 pounds underwater. Designed for divers who install and service undersea oil installations, the JIM suit has universal joints, lubricated with vegetable oil, and a full kit of interchangeable tools instead of hands. With a carbon dioxide scrubber in its breathing system, JIM enables a diver to work 2,000 feet underwater for as long as 20 hours without support from the surface. The suit maintains an internal pressure of one atmosphere, so that the diver can surface safely without undergoing tedious decompression. Instead of separate legs, the WASP suit (above) has a one-piece bottom with four thrusters for getting around on the seafloor. Carried to a depth of 60 feet on a Launch and Recovery Transport (right), marine biologist Sylvia Earle, in the JIM suit, accompanied by its mother sub, gets ready to head for the bottom off Hawaii in 1979. The dive, JIM's first in the open sea, set a women's depth record of 1,250 feet.

"Basically, JIM is a 6'6" tall, 3'5" wide, 910-pound pressure vessel with articulate arms and legs"

"Undersea habitats allow aquanauts to spend days at a stretch, instead of hours, studying marine ecology"

Drawn by scientific curiosity as well as commercial interest, pioneer aquanauts are establishing semipermanent bases for prolonged sojourns on the seafloor. The National Oceanic and Atmospheric Administration's *Hydrolab*, in 50 feet of water off St. Croix, in the Virgin Islands, offers cramped quarters for a quartet of researchers in a 16′ × 8′ cylinder. On permanent station above, a life-support boat pumps air through an umbilicus to maintain the lab's internal pressure of three atmospheres. Air bubbles, trapped under plastic domes moored around the *Hydrolab* (left), provide convenient spaces for scientific tête-à-têtes. Visitors can stay down for eight days before undergoing several days of gradual decompression to lower the blood's nitrogen level for the return to the surface. Preparing for emergency ascents (below), divers practice rapid surfacing techniques in the Navy's 50-foot submarine escape tower at Pearl Harbor, in Hawaii. ◻◻



She survived a savage world to become the most revered artist of her time

BLIND SPOT

BY JAYGE CARR

Some of a doctor's duties are hard—and some even harder.

"You're blind." Lip unconsciously caught between his teeth, he faced the mirror. "You're blind. Totally, incurably, and permanently blind."

His holo image stared back at him. hairless, pale skin over neatly muscled bones, a sensitive mouth, cruelly jutting cheekbones, and E-norm ears flat to the narrow skull. And the eyes: jewel-faceted like an insect's, glittering silver. The prosthetic eyes that could see macroscopic or microscopic, in a range of wavelengths much broader than human norm, in a full three-hundred-sixty-degree scan, as if his head and body weren't there or were transparent.

He ordered the holo mirror to show him in the latest fashion in reflective body paint, a splashy chrome- and vermilion-distorted houndstooth check.

"You're blind, and there's nothing medical science can do."

He replaced the houndstooth with an intricate pattern of paisley tears in gold/orange/turquoise/scarlet, his own natural skin color, a shadowy blue-gray, showing between.

"There's nothing medical science can do, but there are prosthetics that we can use."

He ordered his eyes to "see" in infrared, decided he didn't like the

PAINTING BY
HENRI ROUSSEAU

pattern in that mode and replaced two of the colors with heat paints To normal vision, the heat paints were merely a subtle haze in infrared a transparent color unlike anything "seen" in normal range He made a few minor adjustments to the pattern and shut his eyes Holding his breath, he ordered the autovalet to spray and he felt the warmth envelop him Very good! The pattern had been faithfully transferred Only ... it looked a little ... incomplete

'Prosthetics," he repeated aloud his mind still with his Very Important Patient

At his mental command, the holo image added a long scarf in a complementary color He experimented with various drapes added a few hundred angstroms to the shade and nodded to himself The autovalet obediently dispensed a long strip of cloth He held it up against himself approved the shade and arranged it carefully, with the neat movements of a man who splices living nerves Some preferred to have the autovalet do it all, but he felt the results when it came to actual synthetic materials were a little artificial

He ordered true image again and stiffened his spine He was ready

The patient was sitting in the solarium as she always was when she was free of testing or therapy her face turned toward the sun she could no longer see except as the palest blur—and not even that for much longer

She turned toward him as he approached the rippling floor carrying him along with a barely perceptible hum And despite the fine downy white hair that covered her face (and her body too) he knew that she knew what he was going to say Her soft "Well, Doctor" was anticlimactic

He ordered a seat and the floor formed one He sat down before answering "I have the results of the latest test"

"How much longer?

"Before the deterioration of the optic nerve is complete and total? Between twenty and thirty days."

Ah!" A deep shuddering sigh She took the blow well; he had to admire her gallant spirit He wondered whether she looked as ugly to her own people as she did to him or was her ugliness merely the product of a different world a different culture? She was short and round totally covered with the velvety milk white fur She never used any kind of body paint Her nose was broad lying against her flat cheeks the inside of her nostrils, the lips and the naked tips of the huge furred ears were black like an animal's

"And the other possibilities?' she asked

"We'll try autotransplants first" he told her patiently as if she hadn't heard it all a dozen times before "We'll control-clone new nerves and try to graft them in It's a tricky procedure all around It can succeed I've used it successfully myself many times." *You're the problem*, he was thinking Many high-T worlds had low-T enclaves peopled with those who rejected the technology for religious or other reasons or who had been isolated and had never developed it And the records showed in an amazing number of cases that when those low-T people were exposed to high-T procedures especially delicate medical procedures those procedures failed The mind rejected or disbelieved and the body followed Her preliminary tests had not been promising But he was the best, he'd never failed a patient before And he wouldn't fail this supremely important one

"What if the grafts fail to—take?" she asked, her ugly face with the visual augmenters that made it even uglier turned toward him

"We've discussed that" he replied "We'll have to go to the prosthetics with a direct mind interface."

Her hands clenched He saw the effort she needed to unclench them "Yes" Her voice was calm but it was the calmness of a thin net holding back an avalanche "We've discussed it Do you really think your artificial eyes will be usable? Do you imagine that I will be able to continue my work using dead ...?" She left the sentence unfinished

> *She was an ugly genius, whose works of art were revered throughout the galaxy And it was his responsibility to restore that genius so that it could continue creating*

She was ugly but she was a genius—a genius whose works were revered almost worshiped throughout the inhabited galaxy It was his responsibility to restore that genius so that it could continue those deathless creations of sublime art He gritted his teeth "I assure you if it comes to that you won't even be able to tell the difference"

"I will" That utter assurance that geniuses need to have now turned against him—and her own future "I will"

"Treat the patient as well as the problem," one of his professors had been fond of saying But how was he to treat this strange off-worlder whose precious eyes were deteriorating daily? This primitive from a culture so degenerate that had it not been for luck and some determined missionaries, she would have spent her entire life in the wild, grubbing for roots, speaking in grunts, fighting with every other member of her species she met except of course during the rutting season

Now—a genius Unique Honored and adored And facing the worst of all fates, the loss of what made her what she was

"I have a reproduction of one of your works Did I tell you that?"

"Yes," she said nodding "You mentioned it *Mayflight in the Morning* One of my earliest and best What size is it?'

"I hold it in my hand"

He remembered his surromother bringing in the program crooning She had said that the artist would be recognized as a genius and she had been right He remembered her inserting the program waiting that fraction of a second while the machine constructed the artifact The children had surged forward irresistibly drawn toward the strange concatenations of subtle curves and infinite interplays of color and texture But the first child to touch it had jerked back as the piece sang with the gentlest tinkling voice

"It's a multisense piece," the surromother had told them "You feel it you look at it and when you touch it, it sings Here—" She programmed for two more copies and passed them around so that there was a chorus of fairy voices "I understand the original had scent and taste too You could lick it but since it was made by an off-worlder whose sensory judgments might be different from ours those have been suppressed"

"An off-worlder?" he had asked reluctantly passing the piece along (share-and-share) to his neighbor One day he had promised himself he would have one of those for his very own And he had kept that promise

"Yes the artist was discovered by a group of missionaries and was brought here to be properly trained and to have her works disseminated through our simultaneity projector And quite right too Such talent belongs to all worlds Ironically though, thanks to the relativistic effects on the voyage—you do know about relativistic time effects at almost the speed of light, don't you children?—while she was traveling from her world to ours, her own world was able to acquire both a simultaneity projector of its own and technicians to service it But their loss is our gain"

"It sings soprano in that size," the genius who created it told him as if he hadn't heard the song a thousand times And do you like what it sings?

"Yes ... no" he admitted "It makes me sad sometimes I don't know why and yet I can't keep my fingers off it even though I know its song is likely to make me sad"

She smiled and her almost blind eyes looked at him and saw something else "When you understand the song you'll understand what the difference is, and why it's so important"

"We'll try the grafts first" he said firmly

Three times he painstakingly inserted and spliced the fragile nerves then supervised the slow recovery And three times

CONTINUED ON PAGE 90

Photograph by Hanner Frell

The chemist-turned-mystic who discovered LSD talks about the quarter of a milligram that changed his world forever

INTERVIEW

ALBERT HOFMANN

On a gentle spring day in 1943 Dr Albert Hofmann, an eminent research scientist working in his laboratory at the Swiss pharmaceutical firm Sandoz Ltd., was stunned by the unimaginable: a passage to another world. But the terra nova that Dr Hofmann discovered was within himself. And the route to it was a fickle, obscure-sounding compound called lysergic acid diethylamide, which neither he nor anyone else suspected as a trapdoor to the self's secret chambers.

It was the hope of lifesaving medicines, not artificial paradises, that prompted Hofmann to turn to the study of the alkaloids of ergot, a parasitic grain fungus or rust, in the early 1930s. The common nucleus of these substances had been baptized lysergic acid. By isolating and synthesizing lysergic acid derivatives, Hofmann had developed the basis for crucial drugs to control postpartum bleeding and cerebral and circulatory disorders. But in 1938, one compound remained perplexing: LSD-25. Something about the drug drew the chemist back to it five years later.

As it happened, he accidentally absorbed some of it through his skin, and the peculiar genie of LSD-25 stepped forth unbidden in a daydream Hofmann knew he shouldn't be having. This was man's first acid trip. Subsequent experiments by Hofmann and his Sandoz colleagues confirmed that the substance had an awesome power to sever the mind from its ego.

But nothing Hofmann learned from his experimental illuminations with LSD, psilocybin, and other hallucinogens could have prepared him for what happened next. In 1963 he received a request from a Harvard lecturer named Timothy Leary for 3.5 million doses of LSD and psilocybin. Though the request was denied, the chemist's vial had already spilled into the streets. The result was a decade of chemical heavens and hells.

How did the psychedelics he fathered 40 years ago affect his own life—and Western culture? Out of Hofmann's ruminations come his book *LSD—My Problem Child* (McGraw-Hill, 1980) and the following interview with *Omni* reporter David Monagan.

Omni: Many people may be puzzled why you would write a book about LSD now—almost forty years since you discovered it and a decade since its use and presumably interest in it peaked.

Hofmann. As a scientist I was trained to make experiments first and describe the results afterward. The Sixties were really a cultural experiment with LSD. I waited to watch how it would all turn out, how it would end, how attitudes would evolve. My book is an analysis of that experiment.

Omni: Looking back, many people see Timothy Leary as the personification of the LSD culture. You corresponded with him in the Sixties and met him in Switzerland in 1971 and 1973. As the Father of LSD, did you consider him your most charismatic disciple or were you wary of him?

Hofmann: I never could make out what he really intended. I had the feeling he was naive. He was so enthusiastic about LSD that he wanted to give it to everyone, even to very young people. I told him: 'No, give it only to people who are prepared for it, who have strong, stable psychic structures. Don't give it to young people.' He said that American teen-agers are so experienced that they are like grown-ups in Europe.

We did not agree about this at all. I had the same argument with my friend Rudolf Gelpke, the Islamic scholar and drug researcher. He told all his friends: 'You must take LSD.' I never said that everyone should take it. If someone asked me, I told him exactly what LSD does, and I left it up to him to judge whether to take it. And I think that's the point of writing this book.

Omni: Could you tell us what that first moment was like, when you discovered the psychotropic effects of LSD-25?

Hofmann: While working on ergot alkaloids in 1938, I first synthesized lysergic acid diethylamide, but it didn't seem to produce any psychic effects when it was tested on lower animals. Only in working with the substance again, one day in 1943, when I somehow began to have this daydreamlike but not disagreeable experience, did I discover it in my own body. Because I knew I hadn't ingested anything, I realized that the substance involved must be very, very active. I was determined to get to the bottom of it, and three days later I arranged to take what I believed to be a very weak dose—0.25 milligram.

After about half an hour the effects started. I tried to take notes in my laboratory journal, but after a few pages I realized I couldn't write anymore. Everything started to change, so I said to my assistant, 'Let's go home. This won't be so easy after all.' Automobile use was restricted during the war, so we started home on our bicycles.

Omni: Thus the story about the drug-crazed Dr. Hofmann pedaling madly through the streets of Basel.

Hofmann: Yes. I kept pedaling harder and harder, and I thought I was locked in one spot. Finally I got home, and everything had changed, had become terrifying. My neighbor came in and looked like a horrible witch; my assistant's features grew twisted. I became very anxious because I didn't know whether I would be able to come back from this strange world. Because it was the first time.

Omni: Did you feel that you had left this world altogether? Or did you know anything that would help you explain it, did you have any knowledge of mescaline or of Saint Anthony's Fire, when medieval townspeople were stricken with wild visions from ergot fungus on their bread?

Hofmann: I knew nothing about mescaline then, and, though I had heard about hallucinations and nervous disorders associated with Saint Anthony's Fire, nothing I had read could have prepared me for what I began seeing. The symptoms increased terribly until I lost all sensation of my body. I had the feeling that I was already dead, that my heartbeat had stopped, that I was completely out of my body.

It was a terrifying experience because there were my children and my wife to consider. But even while that was happening, I realized I had just made a very important discovery because no known toxic substance in the world would have had any effect at all in such a small dosage. I was still able to think about that.

> *"We should have two lives—one in which we take LSD and one in which we don't—to prove its effects. I think that taking LSD together is a very deep experience."*

Omni: Yours sounds more like a terrifying experience than an uplifting one.

Hofmann: Yes, at first. But by the time the doctor got there, the horror had softened somewhat, and I was already starting to come back from the feeling that I had died. I started to see an endless variety of colors and even to enjoy them. I thought: *Yes, now you have come back to life.* It was beautiful to feel at home again, to feel that I could come back to our everyday world from the strange world where I had been.

I had the feeling that things had changed their meaning, and I watched with great happiness a kind of rapture as every sound—a car door closing or the doctor talking—was accompanied by a stream of corresponding colored images, abstract pictures. That night I had a good sleep and awoke the next day without any hangover.

Omni: When you first reported such an unearthly experience, did any of your colleagues at Sandoz doubt the truth of what you were saying?

Hofmann: Only with regard to the amount of the drug, because nothing then existed in pharmacology with effects at a fraction of a milligram. But then Professor Rothlin, the head of the pharmacological department, and two of his assistants decided to check it out by taking only about a fourth of what I had taken—0.06 milligram. They too underwent impressive experiences.

Omni: Then you and others at Sandoz followed with a series of controlled laboratory tests of LSD—tests you have said weren't very satisfactory. Why not?

Hofmann: We used low doses—0.05 milligram—in a controlled setting with interviewers, Rorschach tests, written explanations of what we were going through. These weren't especially meaningful experiences personally. I thought it would be more interesting to see how it would work in an artistic surrounding.

Omni: Did you feel that you not only had discovered a new area of scientific research but had also—through your personal experiments—opened a door into another world of individual experience?

Hofmann: The whole thing started within my normal work as a chemist. Then I became interested in the matter of how reality, the existing world or one's experience of it, could be changed and broadened so completely.

I arranged to explore these things in a nonlaboratory setting in 1951 with the pharmacologist Herbert Knozett and the German novelist Ernst Jünger. I would say it was the first truly psychedelic experience, though it was a low dose and didn't go very deep. But it was beautiful. I believed I was in North Africa among the Berber tribes. I saw all these beautiful exotic landscapes, oases, while a Mozart record played like music from above. However, it was not a religious experience.

Omni: When did you have your first religious experience on LSD?

Hofmann: Well, the very first time I had the feeling that I had left the world forever. It was frightening, but nonetheless a profound experience, because I was confronted with death and came back.

Omni: Did your LSD experiences with Junger advance your friendship to a higher plane?

Hofmann: I think that our friendship over the last thirty years would have been deep even without LSD. We should have two lives—one in which we take LSD and one in which we don't—to prove what its effects really are. One will never know but I think taking LSD was a very deep experience to have had together.

Omni: In those early years did you think that you were playing with fire, or did you feel you had found something marvelous?

Hofmann: My hopes for LSD were absolutely concentrated on the psychiatric field. From my own experience I realized that LSD could be a useful agent in psychoanalysis and psychotherapy that patients

could leave their everyday ordinary reality with it by getting out of their problems and into another sphere of consciousness I also thought it could be important for brain research

But my own LSD experiences had a touch of danger to them, and I never thought LSD would be used as a pleasure drug as it was when it hit the drug scene in the United States in the 1950s Apart from psychiatric use I thought of LSD as being appropriate for an elite you might say for artists and writers and philosophers

Omni: But you were impressed by Aldous Huxley who while not advertising the drugs to the masses, remained very evangelistic about psychedelics?

Hofmann: Yes I felt closer to Huxley's point of view than to Leary's, but even Huxley believed in LSD's potential for a much broader public than I did I had no contact with Huxley until 1961, when we had a beautiful meeting at the Sonnenberg Hotel outside Zurich We were together again a great deal at the World Academy of Arts and Sciences in Stockholm in 1963 but he was already suffering from cancer

Omni: Regardless of your own intentions LSD use spread among perhaps millions of people in North America and Europe in the Sixties and more than a few of these people had intensely disruptive experiences In your book you describe the many sadly confused and unstable hippies who made pilgrimages to your house in Switzerland Did you ever regret your discovery and feel that you like Einstein with the atom had unwittingly created a monster?

Hofmann: No I can honestly say that I haven't because I've always pointed out the dangers The unstable people would have done something else perhaps something worse like heroin if there had been no LSD And the main point is that LSD was developed in the course of an investigation whose aim was to produce new medicines, it wasn't to produce a psychedelic But I think the production of this psychedelic was very important

Omni: You say that you used LSD yourself along with other hallucinogens such as psilocybin and morning-glory seeds about twenty times Yet like many others you've stopped using them Why?

Hofmann: The last time I took LSD was in 1972 with Junger I think I got out of LSD all that it could do for me and probably the same was true for many other people It's really not LSD that produces deep effects It can only stimulate what's in the person already If there is nothing inside nothing comes out

Omni: What about all the bad reactions?

Hofmann: The surroundings the setting are very important Much of the Sixties drug scene involved mindless indiscriminate use in the wrong kinds of places like bars that led to all these bad accidents Even in its medical and psychiatric use the surroundings should be special artistic not just a laboratory or office setting

Omni: Do you think there was overuse as well as misuse of the drug in the Sixties? The late John Lennon for instance was reported to have done LSD more than a thousand times

Hofmann: I don't see the reason for such repeated use It's even destructive, because such a powerful experience should be respected—and worked out When you use something habitually its value is decreased

Omni: Leary and Richard Alpert or Baba Ram Das made pilgrimages to the East after taking LSD Did tasting of the lotus tempt people to abandon this reality for an ever greater escape?

Hofmann: I've never been able to understand these people What I got out of LSD I carry about inside me I have to stay in my own daily life To see the flowers in my own garden is to see all the mystical wonder of existence of creation You don't have to go to India to see it

I think the insight that many people got from LSD is that the Creator exists If you see the wonder of creation it seems impossible that it was produced by accident There must be something spiritual behind it something we name God

It is true that some people had negative experiences too You see we always have this ambivalence the experience of the good and the bad together They are always connected and never separated

Omni: Someone once said that one thing LSD did was to give us back a sense of danger that had been effectively removed from our sanitized middle-class life. Is there any truth to that?

Hofmann: Yes. Everyday consciousness is a balancing on a very narrow line—a line that falls on either side into the abyss. It is a balance we need in order to exist. Otherwise the danger is that we become crazy. The LSD experience is schizophrenic to the extent that you simultaneously remember your ordinary reality and also see another reality, another world.

Omni: What about the rumors of long-term physical damage from LSD?

Hofmann: There's no evidence for lasting physical damage of any kind. The things that were said about chromosome damage, for example, were all based on isolated observations that later studies proved untrue.

Omni: Did the LSD experience change enough people to affect society, that is, to become a social force? Do you think there is less passion for the unknown now than during the Sixties?

Hofmann: I believe that the revolution of consciousness some people experienced during the Sixties will have an influence on them for the rest of their lives, whether they took LSD or didn't.

It is a crazier time now, but in a different way. In the Sixties there was a psychological revolution, a search for another reality. Now there is anxiety about the terrible things that could happen, fear of war and the destruction of nature, energy problems. These are more practical questions; the Sixties had a more mystical component.

Omni: Were you yourself changed? Did the chemicals you examined alter the chemist who created and synthesized them?

Hofmann: As head of the department for natural-products research, I remained the experimental chemist in the laboratory, working on isolating the active principles of different plants for medicine. But through LSD I also became interested in mysticism and all the substances that affect the mind. Personally, I had been changed, of course, especially in my conception of reality.

I realized that we have the choice to see things in different ways, that there is no such thing as an objective reality. We have the opportunity to choose a philosophical attitude corresponding to our personality. People may look at a grim aspect of reality and believe that it is the only true one, not knowing that they have the potential to alter their lives by looking at another aspect.

Omni: But given this more rational state of mind that prevails in the Eighties, what possibility is there that people will again seek to delve into their unconscious in order to explore these inner alternatives and potentials?

Hofmann: I'm not sure how things will or should compare to the Sixties, but interest in meditation, in getting behind this rational side to a deeper truth of things, has now become increasingly important. LSD can be used to help one make a breakthrough in meditation.

Omni: How do you envision the future of LSD? Can it still be used to leap through to another level of experience?

Hofmann: Yes. I see it having an important role as an adjunct to meditation, and in psychoanalysis, brain research, and treatment of the terminally ill. The final goal of meditation is a visionary experience of reality, and some people who have meditated extensively may feel prepared to go a step further. And this is where LSD might help them.

I don't mean that everybody should take it, only that meditation can be seen as a kind of medical application of LSD as a chance for people stuck in an unpleasant world view to get an otherwise unattainable view of reality. But of course it is much better if they just have a spontaneous expanding experience without it.

Omni: So are you talking about just one transforming dose of LSD?

Hofmann: Yes, about one, or only a few more because some people, when all their fixed conceptions are shaken, may find their first LSD experience frightening.

Omni: So the first time could take things apart, and the second may be necessary to put them back together.

Hofmann: Yes, that's one way to say it.

Omni: But the LSD experience is unpredictable. Sometimes it has been said that LSD is positive, renewing, only when it is tied to a feeling of hope. Does the world malaise—modern-day anxiety, urban decay, the breakdown of the family—limit the potential of LSD?

Hofmann: Not really. Just as in earlier difficult times when people were more religious, we need religion now. But not the same kind. We can't use the same old pictures for our religious imagination; the images of a God outside reality. We must try to get inside and feel that we are a part of creation, in some way individually a part of God—that we are partners in creation and thus protected by it. Meditation alone or meditation with LSD can illuminate this new religiosity. The great weakness of the Western world is that we no longer have a strong religious belief that can be fused with our everyday reality. God is someone we talk to on Sunday.

Omni: Do you practice any particular type of meditation or espouse any technique?

Hofmann: Everybody should do it in his own way. I begin when I have the feeling, the knowledge that I have as a chemist, that our human organism is made up of the same things, the same compounds that are found in animals, plants and all living matter around us. Then I feel united with nature and protected in it. The knowledge that we've gotten of reality from all our research in the natural sciences is really the myth of our time. We have to meditate on this knowledge in order to give it deeper meaning.

Omni: What kind of meaning?

Hofmann: We should experience the wonder of creation in our lives. I think that no one should be so deeply impressed by this as should a natural scientist, because if, as a chemist, I see a flower, I know all that is involved in synthesizing a flower's elements. And I know that even the fact that it exists is not something that is natural. It is a miracle.

How can a plant synthesize these elements all by itself? How can it create these unique colors and forms? These are the questions we always have to ask ourselves, and we will see that the existence of every single flower is a mystical happening. We now have such a wonderful scientific picture of the universe—we know about the stars and nebulae and all these fantastic things—and we should meditate about just these things.

Omni: Do you believe in God?

Hofmann: Of course. I believe in the Creator, and the Creator is God.

Omni: Do you believe in an afterlife?

Hofmann: Yes. I don't know in which form, but I believe that, as Goethe said, "Things cannot disappear, they can only change." Science has also established this: that nothing disappears completely. Matter is simply changed into new forms of energy. I believe this is true for the spirit, too.

Omni: Isn't it extremely difficult for people living in cities, which you characterize as "dead," to have this religious experience?

Hofmann: Yes, it's an immense problem that people living in cities are surrounded by dead things. One is not part of pavement or concrete. People become sick when they have to live in a secondhand, man-made reality and no longer have contact with living nature, with creation.

Omni: In your book you discuss a strange level of relations between man and nature. When you first took the Mexican mushroom *Psilocybe mexicana*, in Switzerland in the mid-Fifties, you were overwhelmed by Mexican imagery, despite attempts to focus on other things. And you say that Gordon Wasson, the author of *The Wondrous Mushroom*, had this experience repeatedly. Are you suggesting that different plant hallucinogens carry their own images or archetypes?

Hofmann: I think that's very possible. Not only did Wasson and I have that experience with psilocybin, but so did Rudolf Gelpke's wife—in a very interesting way. She was a graphic designer, and after taking the mushroom, she started drawing. She had never been to Mexico or even seen Mexican art, but she drew these startlingly Mexican designs. She didn't even realize this until she took a look at some Mexican art a few months later and was amazed by the similarities.

> *"I realized LSD could be very useful in psychotherapy. Patients could leave their ordinary reality, their problems, and get into another sphere of consciousness."*

Omni: Is this where you got your ideas about a crack in the rational concept of reality about hallucinogens working at a borderline where mind and matter merge?

Hofmann: No. I got those ideas from my experiences with LSD, from the fact that a trace of this substance can transform one's consciousness, even transform twenty thousand people. There is a poem by Goethe that says, "How could our eyes see the sun, unless they are sunlike themselves?" I have changed that to say, "If there were not something of mind in matter, how could matter change the mind?" This does not mean that we are simply made up of matter but that the material world has a spiritual element.

Omni: Are there any natural substances in the brain with the same active principles as LSD or other hallucinogens?

Hofmann: None are identical, of course, but the active principle of the magic mushroom psilocybin, for example, is very similar to that of the neurotransmitter serotonin in the brain. The only difference between them is the position of a hydroxyl group. It may be because these plant substances have a similar structure that they are able to intervene in the action of our brain hormones.

Omni: You have said you see a broader future for LSD in the context of meditation centers. Won't there be the same potential for misuse that existed in the Sixties?

Hofmann: I don't think so. The leader of a responsible meditation center should serve as something like a psychiatrist and know the people with him well enough to decide who should and should not use LSD—who is ready to use it as a pharmacological catalyst.

Omni: Do you think there's a realistic possibility that Western governments will ever sanction this kind of LSD use?

Hofmann: Yes, but not in the near future. It's more important that it become more readily available for psychiatry, where its use should never have been stopped. But official Western medical schools are relying more and more on meditation as a means of treatment. Eventually LSD can be used as an aid to meditation, not just for the ill but for healthy people as well.

Omni: You also mention that LSD might be used for the terminally ill—to soften their experience of oncoming death.

Hofmann: Yes. In certain American clinics it has already been used for terminal cancer patients who are suffering from extreme pain and no longer responding to conventional medication. The reason LSD can alleviate or even abolish pain may be that patients under its influence are psychologically so dissociated from their bodies that their physical pain no longer penetrates their consciousness. There are many case histories telling of patients who, once freed from acute pain, gained meaningful insights about life and death and their fate—and died peacefully.

Omni: Huxley took a massive dose of LSD when he was dying. Would you use it if you saw your life ending?

Hofmann: I don't know. Maybe I will be very happy without LSD when I am dying. Maybe if I were suffering as horribly as Huxley was from cancer, I would. It's a situation I can't foresee.

Omni: You yourself haven't used LSD since 1972. Do you anticipate doing it again?

Hofmann: Maybe sometime, but there's no pressing need. I have a wonderful life now with my seven grandchildren and my home in the Jura Mountains. And I still get a lot of visitors, young people from the United States and around Europe, who come to speak about their problems, about God and nature and our world situation. I like these young people and receive them whenever possible. We get into these long discussions. I'm still a kind of guru. ∞

Embryos sleeping in a frozen nether world may outwit sterility and survive atomic armageddon

BIRTH ON ICE

BY MICHAEL JEFFRIES

Francesca, who is sterile, and her husband, Mark, plan to have a baby in a few years. The child will be five years old at the moment of birth. Infertile women giving birth to five year-old newborns isn't as paradoxical as it seems. Before disease robbed Francesca of her ability to become naturally pregnant, she had three eggs fertilized by her husband deep frozen in suspended animation. Now years later, doctors will reimplant the eggs in her womb, where she can carry them to term. Three successive children, entirely Mark's and her own, will have spent several years in a cryogenic tube before the journey toward birth.

The remarkable possibilities of freeze-drying livestock embryos are well-known. Within two years British researchers will bring the technique to humans. Couples like Francesca and Mark may be having their offspring frozen before birth and saved to begin life in the future.

Cryogenics involves plunging living cells into a bath of liquid nitrogen, where they exist on the edge of extinction. To prevent ice crystal formation and death, the cells are drained of their water content. This halts all their biological activity before they are frozen. The "reduced" cells can remain at −196°C for generations and still be reactivated without damage.

Cryogenic cattle breeding actually sprang from U.S. laboratories more than a decade ago. At Rio Vista Laboratories, in Texas, and Jackson Laboratory in Bar Harbor, Maine, embryonic freezing became fully commercially practical. Several American zoos are experimenting with the technique as a way to save rare or endangered species.

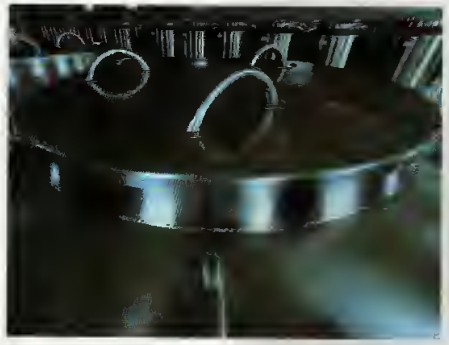
But it is in England and Australia where American techniques are finding their most exciting application. Already Australian scientists have frozen a dozen human embryos. When two embryos were thawed in the lab, they resumed normal growth.

"Freezing embryos," says Dr. Carl Wood, leader of the Australian team at Queen Victoria Medical Center, in Sydney, "complicates the concept of reproduction so that I could not sanction the process before appropriate legal review. I am concerned about the ethics of it."

For instance, cryogenics would make it possible for a child's life to begin long after his father had died. Since the father's estate already would have been probated, what inheritance rights would the belated child have? If his mother dies, who becomes the child's legal guardian? What if both would-be parents die before they thaw their cryogenic embryos, should the semi-living ice capsules be destroyed, or be implanted in a surrogate, or be left in the limbo of the deep freeze?

There is more. Scientists are convinced that an embryo conceived today can be held in suspended animation and resurrected hundreds of years hence—after both parents have died. The development of techniques to produce test-tube babies so that an embryo can be implanted in any mother, not necessarily its biological mother, has cleared the last major obstacle to keeping embryos in suspended animation for as much as 1,000 years before birth. The Rip van Winkle legend is coming true in a modern scientific idiom.

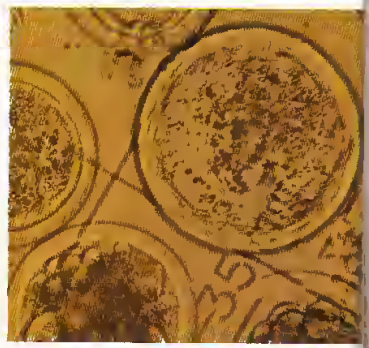
It has just begun to dawn on scientists that cryogenics offers the potential for human survival after nuclear war. A nucleus population of frozen embryos from volunteer couples of healthy genetic stock could survive to inherit an otherwise doomed world. In vaults deep underground, cradled in their lead-lined nitrogen casks, an en-



It's difficult to differentiate frozen embryos from their supercold environment (left), in a thick, insulated steel tube (above)

PHOTOGRAPHS BY DAN McCOY/RAINBOW

"Cryogenic techniques could be applied to storing human organs in transplant banks . . . creating perfect lab animals and preserving people of the present day as ambassadors to the future."



tire population would sleep safely through the holocaust above. Researchers have yet to consider in any serious manner the creation of a human "population bank" held in suspended animation against such a catastrophe. But they acknowledge that, theoretically at least, the concept is scientifically feasible.

The trick in making cryogenics feasible isn't the freezing—scientists have long known the effects and problems of keeping living material, such as food, fresh and cold—but the thawing. Bringing a cell from such a low temperature back to life is a tricky process.

In the case of a human embryo, temperature in the steel tube where the infant slumbers is raised at a precise rate from −196° C to 37°C, normal body temperature, inside an electronically controlled thawing chamber. Embryologists culture the child in a body-temperature incubator until they are sure its cells are functioning and developing normally. In particular, microscopic checks identify the child's sex and determine whether chromosomes controlling the baby's genetic development are undamaged. Once the embryo's vitality is ensured, it is gently implanted inside its mother's womb with a quick and relatively painless procedure.

The science of applying cryogenics to biology grew unsteadily for 20 years following its birth in 1949, when scientists discovered that certain bird sperm can be deep-frozen, then returned to normal. The big breakthrough came in 1969, as British researchers closed in on the possibility of creating a test-tube baby.

Scientists fertilized human eggs in the lab but were unable to implant them in women successfully. They determined after many failures that the eggs would take only when the mothers' hormone cycles and balances were in perfect harmony. That meant waiting at least a month from the moment biologists removed an egg from the prospective mother for fertilization until they attempted to implant it.

Dr. Patrick Steptoe, leader of the research, felt that it should be possible to freeze embryos for a month until the recipient's next reproductive cycle. He was not the only one with that idea. In 1972 another

Cryogenics has long proved successful with farm animals. Ova are drawn from cows, for example (above), then artificially inseminated (lower left). A fertilized embryo (above left) is then readied to enter the freezing liquid-nitrogen tank.

British scientist, Dr David Whittingham, reported the first successful freezing of baby mice in embryo form. (Dr Ian Wilmut, a talented researcher at the Agricultural Research Council's laboratories at Cambridge, achieved a similar, independent success. Unlike Dr Whittingham, he did not implant his thawed embryo for birth.)

At the time Whittingham was not concerned with human embryos. However, since the reproductive systems of mouse and man are similar in many ways, he soon turned his attention to man. At Whittingham's lab in the Medical Research Council's Mammalian Development Unit at University College, London, pink-eyed white mice scamper around a cage. They live, eat, and mate quite normally after being revived from five years of embryonic suspended animation. "They are perfectly healthy and normal," Whittingham says. Recently some mice frozen for seven years—more than three times their natural life span—have been successfully thawed and have survived birth. This is probably the longest period after which any mammal has been successfully revived from cryogenic storage.

Three days after his mice mate, Whittingham removes the colorless embryos, which by then have grown from one to eight cells, from each mouse's reproductive tract and prepares them for immersion in supercold liquid nitrogen.

For the next few years the churn, with its temperature kept constant, becomes the embryo's artificial womb, though of course the cells cannot grow. The frozen creatures clamp into an unrecognizable, grayish mass. "There are about thirty frozen mouse embryos in a test tube," Whittingham's technician Alison Halsey explains. Tapping a container of nitrogen on the floor with her toe, she continues, "We still have mice from the original batch of several hundred frozen in 1973 in here."

Whittingham has achieved an 80 percent survival rate after freezing and thawing more than 10,000 mouse embryos, up to 70 percent of the mice were actually born. Today more than 20 laboratories use this technique, some in modified form, to freeze embryos of rats, rabbits, sheep, goats, and cattle successfully.

So what are the chances for the human race? "If the woman is made to produce extra eggs, they could be fertilized and stored at the eight-cell stage," Whitfingham has stated. "An embryo could then be reimplanted in a subsequent cycle, say three months later.

"If the first attempt was not successful, you could easily repeat the process," he notes. "The procedure could also be repeated when the woman wanted a second child without going through the initial process of superovulation. This raises the possibility of egg banks or of having children by donor."

Whittingham recently collaborated with London gynecologists who hope the technique can produce test-tube babies much more reliably. So far he has not reported any success. Of two human embryos frozen, one was lost and could not be recovered. The other was dead after thawing.

Many biologists believe success is only a relatively small technical step away. Closest to achieving a viable cryogenic baby is probably Dr. Ian Cratt, of the Royal Free Hospital in London. It is ironic that Dr. Cratt's attempts to open a new realm of possibility for women who want babies depends so much on women who want to avoid having children. His lab specimens for artificial fertilization and freezing are human eggs donated by women about to be sterilized. Cratt's research program is approved by the hospital's ethics committee.

At present the biologist is perfecting the basic technique of freezing and reviving two-cell human embryos that were fertilized in the lab. These experiments will continue until Cratt is satisfied he can safely transfer a defrosted baby into one of his 45 hopeful patients. When is that likely? "I would hope within the next two years to have some success in freezing an embryo and reimplanting it into a mother," he says.

"In cryogenic suspended animation, the span from conception to birth can be extended forever. An embryo could be revived after 1,000 years . . . It's Rip van Winkle come true."

Cratt says that he is prepared to use frozen embryos to help sterile patients conceive, but he would stop short of using a surrogate mother.

Eventually some doctors think cryogenic techniques may be applied to the extremely difficult problem of storing complete human organs with their many differentiated cells in transplant banks. Once these organs can be safely frozen, the surplus of kidneys, livers, hearts and other transplantable tissues would enable surgeons to ensure much better matching to prevent rejection by the recipient's immune system.

The potential of human cryobiology is presaged in agriculture's incredibly successful results with cryobirth. Among farm animals, the success rate for frozen-embryo birth is 50 to 60 percent.

Cattle and sheep grazing contentedly in the emerald pastures of England's Institute of Animal Physiology in Cambridge are testimony to this fact. Healthy calves and lambs have been born there after spending up to three years in suspended animation. Visitors are invited to meet the aptly named Frostie, a brown and white cow born after having been frozen for three months.

Animal research biologist Dr. Christopher Polge is collaborating with Cratt in adopting similar techniques for humans. Dr. Polge says, "These animals are quite normal and produce healthy offspring of their own after freezing." So reliable is the liquid-nitrogen storage technique that the institute and commercial companies have begun exporting high-grade strains of farm livestock to New Zealand and Poland. Polge asks pointedly, "Why export a cow weighing half a ton when you can send one hundred frozen embryos by airplane in an insulated flask?"

As for the safety of long-term freezing, Polge discloses that he carried out a unique experiment, perhaps the strangest activity to mark the silver jubilee of Queen Elizabeth II. In 1977 he defrosted bull sperm that had been frozen in 1952, the year of her accession. "It was perfectly healthy and produced a normal calf," he says. "This quarter of a century survival is regarded as the longest cryogenic storage of living sperm."

Such success augurs well for man's future. A number of scientists agree that once a human embryo is frozen, biological aging becomes irrelevant. Theoretically it can exist virtually indefinitely in a state of suspended animation, provided it is capable of withstanding freezing to a temperature at which there is no further biological activity," Polge asserts.

Could there ever be a need to store animals or humans in this way and awaken them 200 or 1,000 years from now? Who knows? Anthropologists in a thousand years might decide it would be interesting to resuscitate a human being from the present century to see how genetically he would differ from the population of the world in the future. Polge declares, "It is not fictional. In theory it could be done. Farm animals such as Frostie, laboratory mice, and human test-tube births have shown the way."

Scientists, however, shy away from any projection of their research into the arena of surviving nuclear war. And clearly such a use poses extreme problems. One immediate challenge of a nuclear attack is to withstand the cessation of essential services and the failure of all utilities. "If the embryos were to survive, one would have to ensure that refrigeration equipment would be developed to keep them at the temperature of −196°C for some years," one scientist points out.

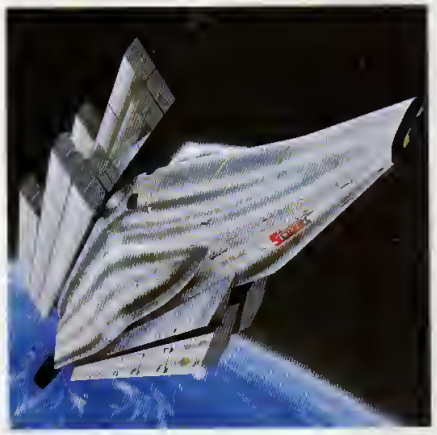
They would need developments in low-energy, long-term refrigeration techniques, probably utilizing solar, nuclear wave or some other form of energy. Further research may enable embryos to be stored at higher temperatures, reducing power demands. Self-contained power sources that would be safe from nuclear attack are al-

CONTINUED ON PAGE 94

Strange experiences among the alien races of Magellan's Cloud

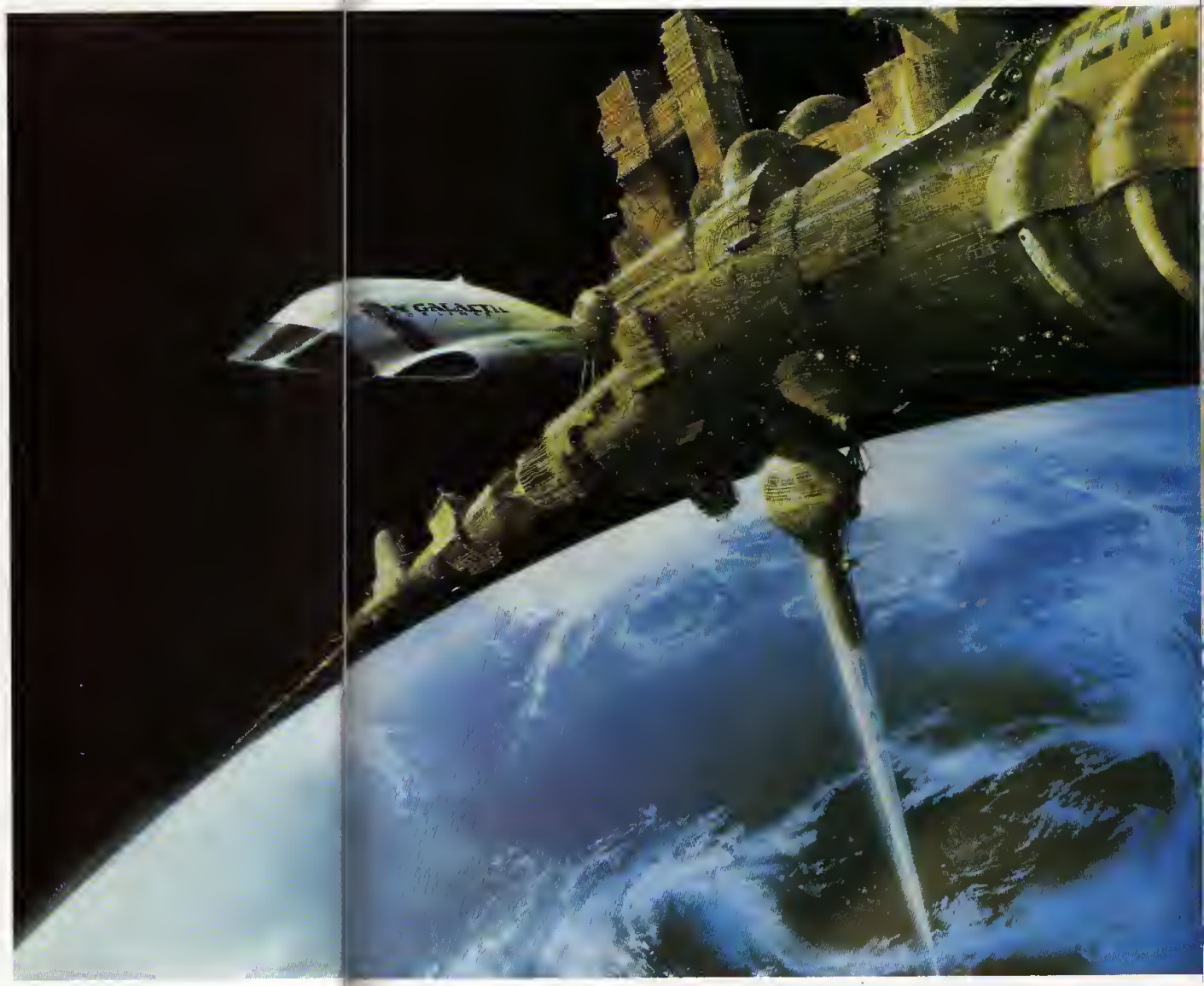
TOUR OF THE UNIVERSE

BY ROBERT SHECKLEY



Guess what? Caroline and I just won a tour of the universe! We'll see Dykstra's World, where mucoid parasites communicate with their host through dreams. And Addler's Planet, where time oscillates across a two-hour span making everyone late for work. We'll also see the Magellan Singularity, where the space/time distortion can do strange things to cosmic voyagers. Good-bye, Ring City (right), hello, Universe.

Illustrations from *Tour of the Universe*, by Robert Holdstock and Malcolm Edwards. Published in the U.S.A. by Mayflower Books, New York, N.Y. Illustrations © 1980 by Young Artists, Ltd.



We got off the Jupiter shuttle on Ganymede and were taken to the interstellar terminal (left). On the lower far right you can see the Stargate Magellan parked on the Singularity that makes our trip to another galaxy possible. Some ruins we visited on Pluto (lower near right) are supposed to have been left by a people so alien they didn't possess the numbers 9 through 72. In the Magellan System we visited two arachnoid life forms that gave us some interesting tips on double-entry bookkeeping. The creature between them is Caroline. When we passed through the Singularity, her molecular-reassembly process went haywire. Our ship's doctors say she'll snap out of it after our next space/time jump. You'd think they would have worked out the kinks by now.

"The association of Pluto's most ancient ruins with these long-vanished aliens is dubious."

"The vibrating Prismoids of Annax IV are the most enigmatic of known intelligent life anywhere."

On our next stop we met the carnivorous Behemoths of Orionis Delta III (far left). Intelligent and sulky, the Behemoths would be extremely dangerous if their teeth hadn't grown together in an evolutionary development whose meaning is still not entirely clear. On the lower left is an artist's rendering of a coffee break during the Battle of Shiva's Rift. At the upper near left are some of the intelligent crystal forms of Annax IV emitting short bursts of light (their way of clearing their throats). Finally, on the right is a complex symbiotic multiple organism from the Ptiax System. Caroline is visible as one of the spires in its upper left-hand corner. That last space/time jump was too much for her. The doctors advised her to stay put. I'll miss her on the trip back to Earth. ∞

BLIND SPOT

CONTINUED FROM PAGE 64

something in her rejected them A normal person would be satisfied with the sight they gave her But she was not normal She was a genius She demanded perfection or perhaps something beyond something that made her subtle creations possible She would not be satisfied with anything less and three times the implanted nerves withered and died

They fried the prosthetics next He did the delicate work the implanting of the organically neufral interfaces, the almost unnoticeable (because he was sure that this was what she wanted) exterior scanners And though it wasn t his personal responsibility, he watched over her therapy his face twisted into a frown as again and again she lurched through the obstacle course A genuinely blind subject would have done better And this from a mind that could curve shapes together into the subtlesf of relationships an artist whose works were balanced to within a microgram a millimefer

"It s not seeing I can't *see*,' she insisted over and over Often her control would fail and she would pound on the nearest objects with her hard, bony fists bruising those fingers that had worked miracles

He had carefully adjusted her prosthetics to normal vision He tested them repeatedly showing her how the graphs matched up how the prosthetics were well within the tolerances

And still she tought—or wept 'I can't *see*'

He tried to comfort her but she only turned away No one else in the giant hospital complex had any better luck He thought of getting her foster parents to help, but they were missionaries of a rootless sect on whose homeworld religion had died centuries before and they had already moved on, not wanting to linger in a world that denied the need for what they offered Now they were on another endless voyage to another primitive world riding one of the giant wombships hollowed-out asteroids that carried the necessities of life from world to world Wombships traveled more slowly than light but they were fast enough that their voyages involved relativistic time contraction People aboard the ships lived months while decades passed on the worlds they visited Only simultaneity projectors could exceed the speed of light and they were limited to transmitting knowledge, programs, and nonmaterial information

'Don t keep showing me your machine-made charts They re wrong they're all wrong I can t see!'

He searched for others on this world who might help—feachers lovers friends But she had so surpassed her teachers, and so quickly, that she had formed no lasting relationships with any of fhem As for lovers or fnends she was an alien, an ott worlder obsessed with her work She had none Her life had been her art and her art her life and now she had lost it

There were a dozen rehabilitation centers in the giant medical complex Physical therapy occupational therapy (the cruelest failure of all) many varieties of mental gymnastics—and she tried every one of them unsuccessfully

'I can t see'

Failure *His* failure His *first* failure

He should have been glad when she announced 'I'm going home'

But in his own way he was as fanatical about his work as she was about hers First he ordered no as her doctor When she laughed in his face he threatened cajoled begged, fried to have her declared mentally incompetent sulked when that failed and always always argued Usually she ignored him Once when he accused her of deliberately denying her art to the worlds she answered wearily 'My world has simultaneity projectors now like any *civilized* world Or at least the cresters do' It was the first time he realized that her world was populated by two separate races

'I'm a trog' she asserted matter-of-factly 'But the cresters aren't fools They've enjoyed the prestige of my work for years simply because I come from their world If I ever manage to work again they'll trip over themselves rushing to program duplicates through the simultaneity projectors for other worlds to admire'

"I m going with you' he declared

'What?' She was incredulous Then 'Why? Love? It s physically impossible you know'

'I m a doctor' he reminded her

"Then you d know better than I But it hasn t stopped—the infatuates the worshipers those who tried to translate artistic admiration into something more physical

'I'm a doctor' he repeated stubbornly 'You re my patient'

She shook her head 'You don t know the floor' You can t imagine believe me, fhere s nothing *nothing* you can do'

For once immovable object met irresistible force 'Your world is primitive except for a few high T enclaves I know that All right I'll just have to be caretul to bring everything I might need with me that's all'

'Doctor—' She took a deep breath for the first time moving those unseeing eyes away from him "It isn t just the primitiveness My world is far away We couldn t get a direct route We ll be lucky if we have to change wombships only once In real time that s fifty years a hundred, or more, for the trip If you ever returned here all your friends children family—all will be dead or changed almost beyond recognition And your profession—'

'If I ever return I'll catch up professionally and personally But if it's such a bad trip why are you taking it?'

I m going home she muttered And he told himself he didn t hear two more unsaid words to die

He consulted a reference library about her world and found out why she didn t want him to go Her world was even more primitive than he had thought The trogs lived on the forest floor in an efernal night produced by the shadows of the giant leaves in the crests of immense trees animals among animals without language clothing tools or society

The cresters were a different race entirely: they lived in the sunlight in the tops of the huge trees Not much was known about them except that they were bioengineers with the highest skills Crester plants for food or cloth or simply exotic beauty were valuable exports that had paid for the simultaneity projector that was installed and for the technicians willing to exile themselves from their homeworlds to keep the device running

Some of the other information about them was confusing or simply unbelievable (Cultivating on giant leaves? Irrigating *leaves*?) Most physical trading was done through the wombships And the simultaneity projector disseminafed all kinds of art and information but the cresters were nof so foolish as to pass on the secrets of their skills

The doctor absorbed all the information he could and when his patient boarded the wombship, he was right behind her

The wombers refused payment (They revered the artist and her work.) And the doctor agreed to spend time and skills on patients aboard the ship He even trained as many healers as possible in whatever skills he could pass on

He never asked what the wombshippers thought of her as a person or what they thought of him for that matter but he was fascinated by them

For fhousands of years wombshippers had been pariahs But they were also the only thread that held the human worlds together that is the worlds colonized by humans, or what had been humans before they adapfed to their new environments Each isolated world fhought of itself as the norm its people as human and anyone different—and the wombship pariahs were

> *In and around and on and under and through was a living forest, a veritable ocean solid with life, growing, competing, eating, dying, layer on layer, predator on predator*

invariably different—as not human.

Then the simultaneity projector was developed, linking the worlds together with pictures. World after world realized that *all* of their thousands of brother and sister worlds held intelligent beings who were different yet "human."

Some worlds reacted by raising their barriers higher, rejecting projectors and wombships alike.

Some rejected only the projectors, grudgingly allowing the alien pariah wombshippers to trade.

And some transcended their insularity, their prejudices and recognized that it was the soul, not the body or the culture, that was important.

And the pariahs, too, were a culture—a culture formed by countless years of rejection and by the radiation they couldn't shield against entirely, that killed many of them in their physiological teens and twenties. It was a cosmic irony that one of the reasons why they were rejected was that they seemed immortal, possessing the immortality that relativistic time contraction at almost light velocities gave them so that they would return after fifty planetary years and seem only a few months older. The truth was that their actual life spans were much shorter than those of most planet-bounds.

The wombship itself was a spaghetti tangle of corridors and living spaces. The doctor's guide was a tall, thin, but prepubescent female, bald and radiation scarred, whose vocabulary consisted of "Essr" and "Nossr" and whose jaw continually worked on something. He preferred not to speculate on what it was. The first time she took his hand and they were, with no transition, he could detect someplace else; he nearly had a heart attack. Eventually he learned to appreciate the speed of travel and to be thankful that his hosts had assigned him a guide capable of taking him as well as herself "through." He did what research he could on psionics, another gift of radiation, but his results were contradictory, and with a sigh he simply accepted.

There were plenty of medical problems to occupy his time, and doing what he could for the wombers helped keep his mind off the continued deterioration of his prime patient. Over the months he became friendly with many of the wombers, mostly the medical staff, and especially their chief, a wizened gremlin of a woman with the unlikely sobriquet of Camel. But when he told her his pet theory regarding his patient, she only threw back her head and laughed.

"This is the wrong place to talk about back to the womb, you know." She sobered. "But it's certainly one of our major problems. If that's her trouble, you needn't worry. She'll decide to stay here, and we've developed a few"—a toothless grin—"techniques that might prove effective. Anyway, once a diagnosis is confirmed, you're more than halfway to a cure. But I think you're off the mark. Way off. I've talked to her myself, and I think she's just following instinct. Sometimes following one's instinct is the smartest thing to do."

"Even if it means going back to a primitive, scratch-for-a-living world?"

Camel shrugged. "You see it that way. But she wants to go *home*"—all the longing of a people denied a permanent home for generations contained in that one word. "Sometimes that's the best—and only—medicine."

He grew to like the wombshippers, to find in their company a relief from the continual frustration of his primary task. He was almost sorry when the voyage ended.

But nothing on the tapes had prepared him for the frantic vitality of the world called (not by its own people) Sequoia Upper.

It was hard to remember he was in the crest of a giant tree. He seemed to be walking on a thick, resilient carpet, muddy aqua (the basic plant color here). The gently

"As he watched, the body disintegrated. The teethed appetites of the swarm ate it, bite by bite. It wasn't a body any longer, it was a heap of crawling things."

moving, ever-changing "walls" were like a holo abstract: actually they were leaves, vines, stalks, growths, saprophytes, tendrils, some close, some far away, the whole blurring into a panorama of relentless growth.

"It's as if the very air were alive and growling," he told his guide, a short, prehensile-tailed male whose costume revealed no fewer than six apparently functional nipples as well as indisputable evidence of masculinity. (The doctor learned later that the costumes—all the "clothes" in fact—were plants, stem and hair roots concealed somewhere in the fur or manes, the rest growing in a controlled pattern around the Sequoian wearing them.)

"Rainforest, I believe it's called," the guide commented politely. "Though I understand on other worlds what they call rainforest would be a strand of sprouts not yet ready to be transplanted here. Now this tree, called baldcypress"—he waved his hand, and the doctor, who hadn't seen any trace of structure or point of division, wondered whether everything he saw wasn't part of a single organism—"has sprouted an ancient and honorable family. I myself"—a deprecating gesture, but a smug grin over it—"am proud to be an acknowledged branch of the hundred ninety-seventh generation nurtured within its leaves." He obviously expected a reaction. When it didn't come, he made a disappointed moue and went on, "So this entire tree is quite well cultivated and most tame. If you wish to visit one of the wilder trees, it can be arranged."

The doctor heard his patient mutter something under her breath.

"And of course"—the guide was obviously working up to an oration—"if there's anything you need, for any reason, we'll be pleased, and proud, and honored, to be allowed to serve, in however minor a fashion—"

The doctor tuned out the rest; he'd sat through banquets before.

It was then that a fluff of silver tendrils drifted against his patient's cheek. Automatically he reached over to pluck it off, but her hand was quicker. With a facile gesture that spoke of long habit, she grasped it, slid it into her mouth, and sucked on the arsenic-green roundness below the pale parachute.

He opened his mouth to protest, but she had already spit the thing out: not a gesture of distaste, but rather an absent-minded expulsion of something sucked dry of interest. It tumbled along the surface until he couldn't see it any longer.

She didn't drop dead, and before he could lick his dry lips and *ask*, his guide interrupted his monologue long enough to repeat the gesture: this time with a thing like two gray wings run together but no bigger than his finger.

This time he did ask, and the guide laughed and caught something from the air and put it to his lips. Five minutes later the doctor was still mulling over the multiple subtleties of his first taste of sequoia.

There was so much to assimilate: so many flavors and smells and customs and whatnot that adapting to life on the wombship had been like preform play while this was final specialization residency. But he was enjoying it—part of him even wallowed in the VIP treatment—until his patient told him the truth.

"We're both pariahs, you know."

He didn't believe her. He'd been escorted through some of their finest research strands of planting (though he still wasn't sure whether the sprouts were merely being nurtured on their leaf fields or whether they were products of the leaves themselves), wined and dined and deferred to and flattered and listened to and even entertained in an ancient but still appreciated fashion.

She interrupted his protests by reaching over and tapping the wall of the room they were in, one of several that was "theirs" for the duration. "Dead," she said simply. "Dead wood." She tapped again, and it was a dull sound. "The ultimate insult in their language is 'Go live in deadwood.'" She spat, and he watched the green-tinged

liquid disappear into the floor. Or is it merely the penultimate insult?' she mused aloud. 'Go live with the trogs. Yes, I think that is the ultimate. And I wonder which of us they despise more, me, the trog, or you, the trog lover.' A breath. 'Doctor.'

Yes?' He wondered about something himself: what the penalty was here for a doctor strangling his patient?

'Take my advice. Take the next womb-ship away from here, no matter where it's going. Just go. Get away. This isn't your world, and ultimately it will reject you.'

'You're my patient, and I'm going to cure you. I promise.'

'Blind, blind,' she murmured. 'But which of us is it that will not see?'

Three days later she was gone.

'Once a trog, always a trog,' said the incredibly old woman coldly.

And that's it. Throw her and her potential away." He had bulled his way up to this Sequoian Ultimate Authority in a barely controlled rage.

'She's a trog.' the woman muttered. Something fluttered through the air and landed against her cheek. Her fingers went up in a caressing gesture and—he blinked—had those fingers somehow flicked the airborne wisp away or had it been absorbed into the crepey powdery old skin?

'And that covers it,' he heard himself snarling. Some of the leaves from the plant he'd been forced to wear fluttered away from his mouth, and he saw her flinch. That plant had driven home his patient's point about his being a pariah. It clung to and covered every inch of skin and gave off a rank odor. Even the windborne kept away from him, and he knew it for what it was: this world's equivalent of a contamination suit. Nothing of him must infect their happy lives. 'Just throw her away. She's a trog, a worthless, useless animal of a trog. All right, all right then. But don't be surprised at how other worlds react to what you've done. Other worlds have values different from yours. They might see your actions in an unflattering light. On other worlds racial prejudice is considered—'

Prejudice!' She was slight and slender, antique and fragile. 'Oft-worlder, you came here, *knowing* you knew all there was to know about us. You look and you do not see. You are a—a dissonance, a flaw in our lives, a wrongness we cannot right. Yet we have made you welcome. And in return you would tell other worlds about the sins that we committed only in your mind.' She stood, one hand against a leaf that formed the wall of this cozy nook, and tiny tendrils twined around her arm. He had a sudden vision of woman and tree, unity, a single living organism.

'Your prejudice,' he said, but more calmly, 'drove her off this world in the first place. And now it has driven her down to her death.'

'*Our* prejudice? Prejudice means pre-judging, doesn't it? Were we given a chance, or were we prejudged off-worlder? Some people see only what they want to see, and perhaps the motives of those so-called selfless missionaries ought to be examined more closely.' He caught his lip, remembering a news holo of an awards ceremony, there had been several off-worlders with the artist then, all of them radiating a complacent, almost arrogant pride. 'The trog was spirited away from here. Did you know that? Because my predecessors protested at the very thought. And after, when we warned that she would be damaged away from her home, when we asked that she be returned, we were sneered at, accused of wanting to keep her treasures selfishly to ourselves, accused—it was sickening. And no one believed us, as you don't believe us now.' She shrugged. 'We could prove all we have said, but you outlander with your closed mind have already determined our guilt. Would you believe the truth if it were right in front of you?'

> *He didn't see the chief make a gesture to a guard standing directly behind him, he didn't see that guard move. Then he didn't see anything at all.*

Try me.'

If will be dangerous.'

For you or for me?' He couldn't help sneering.

So be it.' Her pale lips were tight, and the very wall of living plant seemed to shudder with her restrained anger.

The only way down, short of the dangerous climb down the cliff-like trunk, was by being lowered at dizzying speed on immensely long vines.

The others were armed with a variety of weapons, only some of them recognizable. His companions were all grim, their prehensile tails stiffly erect, and he knew that if looks could kill, he wouldn't survive to reach the floor.

The floor, if wasn't as totally dark as he'd imagined, because many of the plants—and animals, too—phosphoresced. A phrase he'd heard once long ago kept echoing through his head. The caves of night. He was wandering lost through the caves of night. Above was a leafy canopy of solid darkness. And beneath . . .

The trunks of the giant trees were tens, some even hundreds, of meters in diameter and girding their lower reaches were living buttresses, great knees of wood larger than most of the trees he was accustomed to. And in and around and on and under and through was all living forest, a veritable ocean solid with life, competing, eating, growing, dying, layer on layer, predator on predator. A normal rainforest (he had consulted the records he had brought) was actually scant of life on its floor, because the canopy above shut out too much light. But here, even without light, there was enough organic material raining down from the giants above to provide the basis for an ecology. And what an ecology! What a competitive, fetid, voracious ecology! And so complex!

He saw vines climbing up a treeling a mere ten meters or so high. He blinked, and the vines swarmed upward and spread out, sending in tendrils to tap the tree's life fluids, round and round, leaves unfurling and sending spines into the treeling until, between one breath and the next, what had been a tree was a mound of pulsing leaves.

'Stranglervine,' one of the guides (guards) answered to his stammered question. 'By tomorrow it'll have sucked the infant dead and dry. Then it'll curl up in a ball and tumble away, until, leaf, breath, wind brings it to another vine.'

'Will it . . .'

She snorted, her swishing tail imperiously contemptuous.

You wouldn't taste right. But there are threats here, plant and animal, that make the stranglervine seem like Anna Sweet-teat.'

He glared. But in minutes he knew she had spoken the simple truth. The floor was a pesthole, a hothouse and breeding ground for desperate appetites. Animal, plant—and trog.

Two strong cresters were at point, hacking with off-world metal machetes at the living mass. Hacked and headless corpses of small animals were trampled underfoot along with the severed plants. The cresters' progress was measured in meters. He could still see the doomed tree under its mound of stranglervine when a shapeless, many-legged horror dropped onto the shoulder of a crester walking not two paces in front of him. The victim dropped without as much as a gasp, but another guide reached over and touched the wetly glistening horror with a vine wrapped around her wrist, and with a teeth-tearing keen, legs convulsing, the horror shriveled and fell off, to be kicked away into the dimness. Its victim was loaded onto a sling and carried by his fellows.

The attacks were almost continuous. From above, behind, the side, the front. Things even slithered up out of the crushed-down matter they were walking on. Big things, little things, all bristling with every natural weapon he'd ever heard of, and a few he wouldn't have dreamed existed. Things crisped by lasers, hacked by machetes, destroyed by the symbiotic plants. Still, dying, they came on, claws

grasping tendrils reaching, teeth slavering spitting acids dribbling caustics limbs flailing tentacles reaching—reaching—reaching—

Despite all their efforts there was soon a second casualty and even before that victim could be settled in a sling to be carried a third one

The trogs, his guide informed him between attacks are among the most dangerous of the floor dwellers thanks to their claws and teeth, their cunning and ferocity they glide through the growth like sunbeams through broken clouds They kill and eat and breed prolifically a dozen or more to the litter and so survive. They're marsupial and if the mother's killed, the tough pouch convulses shut, protecting the litter against all but the worst of tooth and claw and acid The newborn are tiny and the pouch is small, often the killer swallows it whole But inside the stomach, the dissolvents act on the pouch in a curious way The pouch has a simple nervous system of its own, it attaches itself to the stomach wall and absorbs nutrients from its surroundings to feed the litter The litter grows until it completely blocks off the stomach and the killer starves Then the litter eats its way out of the pouch fast, before the floor dwellers can devour corpse pouch litter and all

"But would you have believed this?" she finished with a grim nod to the voracity around them "Any of this if you hadn't seen it with your own eyes actually experienced—the floor?"

Around him birth and death alike exploded in the green white light

"How long do you think a blind trog would survive?"

"Seconds," he admitted 'minutes no more But can't *you* understand? I have to *try*!' Despite the protective clothing he'd been given things had burrowed under it He could feel the skittering legs—or were they tendrils?—in a dozen places He jumped abruptly as a white-hot needle bored in just below the point of his left shoulderblade

And then a trog attacked It had the cunning to go for one of the back points but the troops were all watching one another and a loud voice gave the alarm before the victim hit the ground The trog tore off a great chunk of its victim with its teeth and ran, the bleeding strip dangling from its mouth One of the guards made a throwing motion with her arm, and the trog went down its booty still clamped tightly between its teeth By the time they ran up to it both the trog and its gruesome treasure were being swarmed over by hundreds of tiny crawling and flying things

He watched, gulping and unable to speak Dead eyes yellow-green like hers stared up at him, the white fur was slimed with dark blood the teeth glistened with it As he watched the body disintegrated and the swarm ate it, bite by bite It was no longer a body it had become nothing but a heap of crawling fighting—

Fascinated, he continued to watch until he was staring at a scatter of yellow bones polished gleaming clean Something no bigger than his hand a cuddly gray ball of living velvet ambled over snapped off a rib, and chewed it with gusto The rib went down in seconds and the ball cracked off a second and began chewing but an odd growled rumble made it freeze and then scurry hastily away

The "dead" guard was being attended to by one of the troops The doctor was embarrassed professionally shamed It was his duty after all to tend the wounded He had seen the bright arterial blood spurting from the torn throat but the trog had been the greater compulsion Even so, he told himself, what could he have done with the few supplies he'd brought with him? He was about to ask why the corpse hadn't been attacked by the crawling things when the "corpse" fluttered her eyelids

"An even chance for her if we turn back now" the chief of the guard said

"But how? It would have taken a high-T machine to have stopped the bleeding in time I don't understand"

She shrugged "What you do with machines we do with life" Impatiently "How many of us must die before you are convinced?"

His head flicked back the way they'd come then again forward drawn by the inexorable compulsion drawn to the floor, the hotbed of life knowing he was a fool, knowing it was failure His failure he couldn't face and yet— He licked his lips and said "As long as there's a chance, any chance that—"

He didn't see the chief make a gesture to a guard standing directly behind him he didn't see that guard move Then he didn't see anything at all not even the guard's rueful mixture of regret and admiration as she gazed down at his limp body

He opened his eyes to an almost perfect replica of his room back at Continental General It wasn't until he reached out his hand to the intercom that he realized it was a clever fake Everything was plant growth But even as intellect recognized falsity, his instincts were relaxing so that he was already smiling muzzily when the crester bustled in clothed in the traditional blue of surgery service

'Don't tell me plants' he murmured a man purged temporarily at least of every emotion but a sort of languid curiosity 'But how did you get them the right shade of blue?'

She twinkled at him her tail curling and uncurling joyously 'Oh you're feeling better at last Wouldn't a little sun be nice eh? Easy over now—

He had a lot of time to think sitting in the warm sunlight shaded by a friendly leaf 'I can teach you as much as you can teach me,' he told them And it was true He never found their secret how they grew the plants they did but he isolated a dozen useful ones and helped them develop a dozen

more from the little saprophyte that could be clamped on an open wound and would seal in seconds reducing blood loss immeasurably to a seed that when swallowed went directly to a ulcer and grew over it protecting all the delicate tissues He taught them new medical techniques how to set a bone pin, how to treat the stump of a limb so that when it healed it could be fitted with a (hand-carved) prosthetic how to transplant organs and how to do a bypass

And then the wombship came When it left he went with it taking supplies of all the plants he thought would be useful on other primitive worlds, as well as the Agrippa seeds he had learned to love chewing

His patient had been right as much as he loved his work this wasn't his world and if was better that he leave it

He knew that he could never go back to his own world Too many years too many changes had alienated him as much as any of the wombers

And the years passed Few for him many for the worlds spinning warm and smug around their suns, and he discovered that thanks to relativistic time contraction and the simultaneity projector (were *people* really going through the projector now?) he was becoming a legend Whole worlds were grateful to Johnny Healerseed

Even the wombers took to calling him that at first in gentle derision later just from habit and he gradually forgot he had once been called by any other name

It was on a world called Getchergoat that he found the last piece of his personal puzzle Getchergoat had projectors, and a fairly high level of technology so that he was learning as well as teaching When he learned and taught as much as he could and knew that his ship would be orbiting for several standard weeks yet he asked as he had on many other worlds what sights his colleagues recommended he see

Everyone agreed that the one thing he mustn't miss was the Pan-Art Exhibition in the Septmillennial Memorial Audisseum The Audisseum was multilevel a freeform hugeness in transparent weather sheathing He hesitated in the dilating entrance a radiation-scarred old man, and an ovoid shimmer materialized at his elbow "May I direct you to any specific exhibit?" the ovoid inquired

"Have you anything here by the Sequoian troglodyte Inanna Kantanitanki?

"A man of taste ' the ovoid purred Do you prefer Early Mature or Final period?"

"All three " he said

In the Early display he was pleased to see a copy of *Mayflight in the Morning* enlarged so that it sang baritone instead of soprano When he tried to arrange some sort of credit so he could have another copy to replace the one left behind somewhere long ago he was embarrassed because they refused any exchange A middle-aged man, attired only in Mercury's winged shoes came sailing out on a striped orange-and-lime flying disc He was holding a large sized copy in his arms and he refused to take anything The artwork would be the smallest possible appreciation to Johnny Healerseed from the grateful world of Getchergoat

It was this man—"My current label is Drifting-through-Anomie " he said—who insisted on guiding him through the rest of the display which ended in a series of untitled pieces "Why untitled?" he wondered aloud his hands caressing a piece that curved subtly around and through itself

His guide shrugged "It's the custom here with pieces untitled by the artist or where the title is unknown or has been lost '

"Solipsism ' he said still playing with the piece

"Good good, very good " Drifting-through-Anomie beamed 'Should I add it to the list of suggested titles?"

"No " He continued to turn the piece shaking his head "So many pieces I don't recognize and I thought I knew most of her work I must be getting senile '

"Idegosuper forfend!" Drifting-through-Anomie was appalled "No these would be the pieces discovered on Sequoia after you left there to begin your pilgrimage I'm sure!'

"Discovered *after*—" His mouth dropped open "You mean she was alive after all! *She was alive, and I left her!*"

"I'm sure not " Drifting through Anomie cocked his head to one side as if listening to unheard silent voices as he undoubtedly was "No the first work of her final period was discovered in Stanyear 809 at least two hundred years after she returned to her native world The next three—'

"Two hundred!"

"Oh dear! How mannerless of me! You'd like to see it *in situ*, wouldn't you?" Between them a tiny sphere appeared and the doctor realized it was a holo taken from the crests "It was a womber who spotted it—" The view descended hovered over the treetops and focused on the oddly convoluted crest of one particular tree

Aesculapius!

The style is unmistakable, of course The original is about seventy meters high and about twenty five meters in diameter and its song has been recorded —a deep rumble of triumph filled the air around them—"though how that great genius managed to shape the growth of the frees we don't know—"

The doctor thought of a hand putting a seed into a mouth the mouth spitting it out again—of chemical signals of amazing complexity that make a body grow and change—of a world where plants and animals had grown so interrelated that he had often thought of it as one immense complex single living organism a living world that isolated outside contaminants in deadness—and he knew how his once-hosts grew their medical and other miracles and why the trog had *had* to return He smiled gently at Drifting-through-Anomie

"They ate her soul with her bones " he said OO

BIRTH ON ICE

CONTINUED FROM PAGE 80

ready being researched for use in emergency government bunkers

But before they can prove that cryogenic embryos can outlast a nuclear attack scientists have to evaluate the potential damage to frozen animals from the natural radiation to which we are all exposed daily During cryostorage normal enzyme repair mechanisms of cells do not function Even so natural levels of background radiation would be so low that 50 percent of mouse embryos stored between 200 and 1,000 years would be able to survive Whittingham predicts

This is based on collaborative work with geneticists Dr Mary Lyon and Dr Peter Glenister at the Medical Research Council's Radiobiology Unit in Harwell England Dr Lyon bombarded frozen mouse embryos with up to 100 times the natural background dose of radiation for periods of from 6 months to 27 months

At all radiation levels the embryos were capable of development to the implantation stage Those transplanted into adult female mice developed into fetuses Some were allowed to proceed to natural birth and the resulting mice mated

Twenty to 30 percent of the 7 000 embryos used in these experiments were born a figure researchers are confident they can improve with better techniques Lyon has calculated that about 500 mouse embryos would have to be stored in ice to provide a surviving colony with a good safety margin Thus the preservation of unique genetic stocks of mice by storage as frozen embryos is now a feasible proposition she has reported

If this finding proves to be similar in man then anthropologists in 32 000 years might decide to retrieve one of our contemporaries from suspended animation By then if history is anything to go by the average human could be as different from us as we are from the hairy Neanderthal

Long before that day the benefits of frozen embryo storage will be reaped in medicine and agriculture In research, for instance the major advantage of using inbred animals is to maintain uniformity Unfortunately genetic drift is difficult to control because of the continual natural mutations that gradually accumulate in lab animals This can distort the results of similar medical research carried out at different centers Alternatively cryogenic animals can remain constant, created specifically for a set of tests

Despite present progress we are still exploring the foothills of the cryogenic potential for man Within the next few years cryogenic storage should begin to ameliorate the widespread problems of infertility in marriage such as those faced by Francesca and Mark For the future it just might be the closest we'll ever come to attaining immortality OO

THE OMNI-MENSA I.Q. TEST

By Scot Morris

Our readers love to test themselves. After we published "The World's Hardest I.Q. Test" in April 1979, so many of you sent in answer sheets—about 25,000 at last count—that the California society scoring the test was overwhelmed by the volume and fell several months behind in processing. We apologize again for the inconvenience this caused you.

The results of that test are now in, and we couldn't be prouder. Among the first 20,000 persons whose answer sheets were scored, the average I.Q. was 137. An I.Q. of just 133 on a standardized test puts you above 98 percent of the general population and makes you eligible for membership in Mensa, the high-I.Q. society. Well over half of you scored above the Mensa qualification level.

Ten percent of the *Omni* readers who entered had I.Q.'s of 154 or higher. Two percent of you scored above 163, the cutoff for membership in the Four Sigma Society, makers of the test. Four hundred *Omni* respondents qualified for membership in this elite club. Twenty of you had I.Q.'s in the intellectual stratosphere above 171.

The volume of response more than confirmed the popularity of this I.Q. feature. We have decided to try it again, this time with the help of Mensa, and with a test that readers may score themselves. The answers and a complete analysis of the test will appear next month.

Mensa is an international society with more than 42,000 members in the United States alone. Each year about 35,000 people try to qualify for membership and 15,000 succeed. Some of these people go on to become active members, most are satisfied merely to know they made it. There is only one qualification for membership in this organization—a score on any standardized intelligence test that is in the upper 2 percent of the general population. On the Wechsler Adult Intelligence Scale (WAIS), this corresponds to an I.Q. of 130. On Scholastic Aptitude Tests a qualifying score is 1250 (verbal and math combined).

Other than their ability to get high scores on "intelligence tests" (which may measure nothing more significant than test-taking skills), Mensa members have little in common. The society has no restrictions on race, religion, sex, and age (there are currently three members who are four years of age and several in their nineties).

With the help of Alice Fixx, public relations director for Mensa, we prepared a preliminary test consisting of 46 items similar to those found in standardized intelligence tests. Marvin Grosswirth, a past chairman, helped organize a session of the New York City Mensa, at which 88 members kindly took this test.

After scoring the test (each scored another's paper), we went over it item by item. Members were asked to criticize or praise the items, point out ambiguities, suggest alternate interpretations, or judge items too difficult or too easy. As a result of this session 7 items were discarded, leaving the 39 items presented here.

We did not impose a time limit on the Mensa testees, but we asked them to work as fast as they could and to raise their hands when they were finished. A tally indicated that most took about 35 minutes to complete the 46-item test. For this 39-item test, allow a limit of 30 minutes to make your score comparable to those of the Mensa sample.

Next month we'll give you the answers, with explanations, and some data that will help you make sense of your score: (1) a report on which questions were easiest and which were hardest for Mensa's members; (2) a test profile showing how the 88 Mensa members scored, and (3) guidelines for converting your raw score into a rough estimate of your I.Q.

Scores on this test are not recognized for membership in Mensa, but they can indicate whether you would be likely to do well on an official test. The procedure for applying to Mensa will be presented here, with the scoring instructions, next month. Good luck!

THE OMNI–MENSA I.Q. TEST
Time limit: 30 minutes.

1 What number follows logically in this series?
2 3 5 9 17 _____

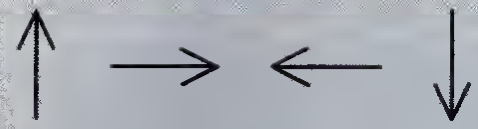
2 In the group of words below, underline the two words that are most nearly opposite in meaning.
[Example: heavy large flat light bright]
punish vex pinch ignore pacify determine

3 Figure out the rule that is used to determine the prices below and find the price of the last item.

Watch	$46
Bracelet	$ 4
Earrings	$10
Chain	$ 6
Ring	$?

4 Study the four drawings in the top row. Which of the four drawings in the bottom row should appear next in the series?

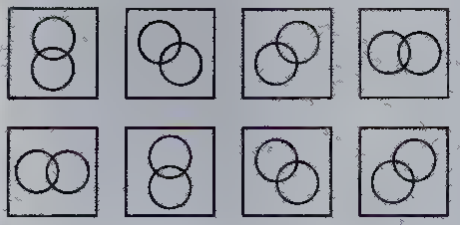
5. The arrows represent a simple code. What common English word do they spell?



6. In the square below, a rule applies both from top to bottom and from left to right. Find the rule and figure out the missing number.

Example	2	7	9
	5	4	9
	7	11	18
	6	2	4
	2	?	0
	4	0	4

7. Which drawing in the bottom row logically comes next in the series that is shown in the top row?



(a) (b) (c) (d)

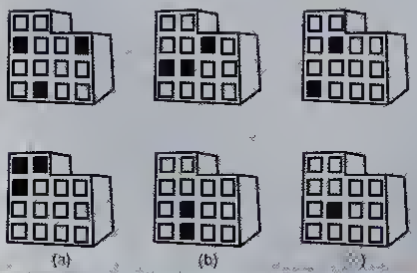
8. Complete this analogy by writing one word on the lines, ending with the printed letter.
Lend is to borrow as harmony is to _ _ _ _ _ _ D

9. Underline the two words in parentheses that have the same relation as the two words in the first phrase.
Island is to water as (without, hypotenuse, center, diagonal, perimeter)

10. If Doris turns either left or right at the stop sign, she will run out of gas before reaching a service station. She has already gone too far past a service station to turn around and return to it. She does not see a service station ahead of her. Therefore,
(a) Doris may run out of gas.
(b) Doris will run out of gas.
(c) Doris should not have taken this route.

11. Find the number that logically completes this series.
1, 2, 6, 12, 36, _____

12. Which building logically is next in the series?

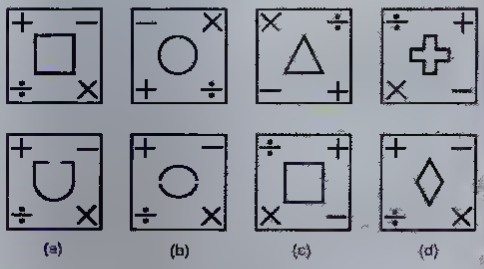


(a) (b) (c)

13. M is above N and O.
N is above O and below P.
Therefore
(a) M is not above O and P.
(b) O is above N.
(c) P is above O.
(d) O is above P.

14. In the group of words below, underline the two words that are most similar in meaning.
Example: mat, linoleum, floor, rug
beam, lump, wood, ray, chuckle, silver

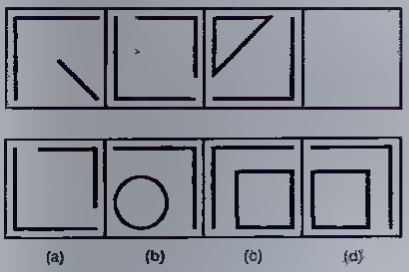
15. Which figure in the lower row should appear next in the series of figures in the upper row?



(a) (b) (c) (d)

16. If A×B = 24, B×C = 24, B×D = 48, and C×D = 32, what then does A×B×C×D equal?
(a) 480 (b) 744 (c) 768 (d) 824

17. Complete the top series with one of the lettered figures.



(a) (b) (c) (d)

18. "Don't throw good money after bad" means,
(a) Take your loss and walk away from it.
(b) Don't gamble, think of the future.
(c) Don't invest in a losing proposition.
(d) Don't borrow to gamble.

19. Sam, Fred, Steve, and Joe are weight lifters. Joe can outlift Steve, and Fred can outlift Joe. Steve can outlift Sam. Therefore
(a) Both Sam and Fred can outlift Joe.
(b) Joe can outlift Sam but can't outlift Steve.
(c) Joe can outlift Sam by more than he can outlift Steve.
(d) None of the above is true.

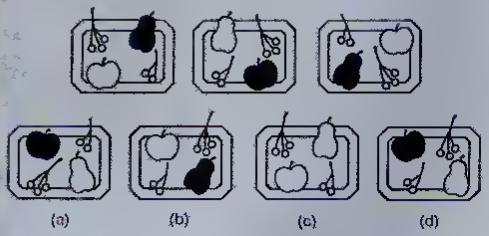
20. Select the two figures in the following series that represent mirror images of each other.

(a) (b) (c) (d) (e)

21 Determine what process was followed in arriving at the prices below and find the price of the last item.

Skirt	$50
Tie	$30
Raincoat	$80
Sweater	$70
Blouse	$?

22 Which plate in the bottom row belongs next in the series in the top row?

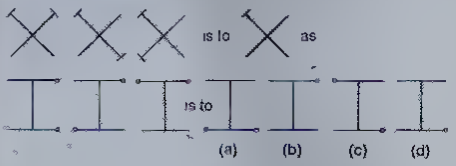


(a) (b) (c) (d)

23 What number logically comes next in this series?
7, 12, 27, 72, _____

24 The old saying "The good is the enemy of the best" most nearly means
(a) If you are good, you will best your enemy
(b) Be good to your best enemy
(c) Don't accept less than your best
(d) The good struggle against the best

25

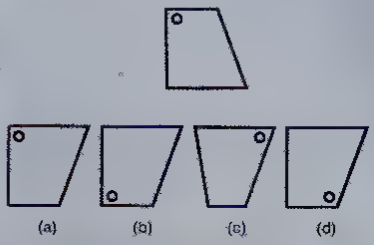


(a) (b) (c) (d)

26 Alex, Allan, Carol, Celia, and Sharon took intelligence tests. Celia scored higher than Carol, but Allan scored higher than Celia. Carol outscored Alex, but Allan outscored Carol. Sharon scored lower than Allan. Therefore
(a) Celia scored higher than Alex but lower than Carol
(b) Both Alex and Allan outscored Celia
(c) Sharon scored higher than Carol
(d) Celia outscored Alex by more than she outscored Carol
(e) None of the above is definitely true

27 What number follows logically in this series?
9, 12, 21, 48, _____ (a) 69 (b) 70 (c) 129 (d) 144

28 Which one of the lettered diagrams in the bottom row can be turned over or rotated to become the same as the diagram below?



(a) (b) (c) (d)

29 In the group of words below, underline the two words that are most nearly alike in meaning.
tale, novel, volume, story, book

30 If Barbara's daughter is my daughter's mother, what relationship am I to Barbara?
(a) Her grandmother
(b) Her mother
(c) Her daughter
(d) Her granddaughter
(e) I am Barbara.

31 In a row of four houses, the Whites live next to the Carsons, but not next to the Reeds. If the Reeds do not live next to the Lanes, who are the Lanes' next-door neighbors?
(a) The Whites
(b) The Carsons
(c) Both the Whites and the Carsons
(d) Impossible to tell

32 Wall is to window as face is to
(a) skin
(b) hair
(c) eye
(d) teeth

33 Select the two figures in the following series that represent mirror images of each other.

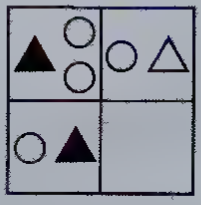
(a) (b) (c) (d) (e)

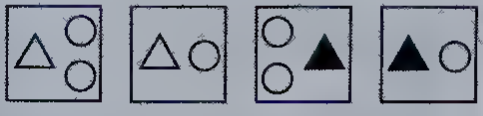
34 What is the next number in this series?
21, 20, 18, 15, 11, _____

35 Underline the two words in parentheses that have the same relation as the two words in the first phrase.
Eyelid is to eye as (window, glass, view, curtain, lash)

36 Complete the following analogy by writing one word on the lines, ending with the printed letter.
Skull is to brain as shell is to _ _ _ K

37 Complete this diagram.





(a) (b) (c) (d)

38 "A stream cannot rise higher than its source" means
(a) You decline after achieving your highest level
(b) Streams of knowledge can't come from high sources
(c) Your stream of consciousness is highly resourceful
(d) Your stream of achievement is limited by your background.

39 Underline the two words in parentheses that have the same relation as the two words in the first phrase.
Hat is to head as (spout, kettle, handle, copper, lid)

THE PALACE

CONTINUED FROM PAGE 55

practice their little pagan rituals and do a lot of dancing around the Maypole and chanting and screwing You expect me to believe that a bunch of gentle, goofy witches are going to make war on the Empire?"

She said "Not war An invasion

'Explain

'One of their high priests has proclaimed San Francisco a holy place and has instructed them to come down here and build a Stonehenge in Golden Gate Park in time for proper celebration of the winter solstice There are at least a quarter of a million neopagans in the Willamette Valley and more than half of them are expected to take part According to our Mendocino man the migration has already begun and thousands of Wiccans are spread out between Mount Shasta and Ukiah right now The solstice is only seven weeks away The Wiccans may be gentle but you're going to have a hundred fifty thousand of them in San Francisco by the end of the month pitching tents all over town "

Holy Jesus " Christensen muttered "Can you feed that many strangers? Can you find room for them? Will San Franciscans meet them with open arms? Do you think it'll be a love festival?"

"It'll be a fucking massacre " Christensen said tonelessly

Yes The witches may be nonviolent but they know how to practice self-defense Once they're attacked there'll be rivers of blood and it won't all be Wiccan blood '

Christensen's head was pounding again She was absolutely right chaos strife bloodshed And a merry Christmas to all He rubbed his aching forehead turned away from her and stared out at the deepening twilight and the sparkling lights of the city on the other side of the bay A bleak, bitter depression was taking hold of his spirit He signaled for another round of drinks Then he said slowly They can't be allowed to enter the city We'll need to close the imperial frontier and turn them back before they get as far as Santa Rosa Let them build their goddamned Stonehenge in Sacramento if they like " His eyes flickered He started to assemble ideas The Empire might just have enough troops to contain the Wiccans by itself but I think this is best handled as a regional problem We'll call in forces from our allies as far out as Petaluma and Napa and Palo Alto I don't imagine we can expect much help from the Free State or from San Jose And of course Monterey isn't much of a military power, but still— '

'We are willing to help," Ms Sawyer said "To what extent?"

"We aren't set up for much actual warfare but we have access to our own alliances from Salinas down to Paso Robles and we could call up say five thousand troops all told Would that help?"

"That would help— Christensen said

"It shouldn't be necessary for there to be any combat. With the imperial border sealed and troops posted along the line from Guerneville to Sacramento, the Wiccans won't force the issue. They'll revise their revelation and celebrate the solstice somewhere else."

"Yes," he said, "I think you're right." He leaned toward her and asked, "Why is Monterey willing to help us?"

"We have problems of our own brewing—with San Jose. If we are seen making a conspicuous gesture of solidarity with the Empire, it might discourage San Jose from proceeding with its notion of annexing Santa Cruz. That amounts to an act of war against us. Surely San Jose isn't interested in making any moves that will bring the Empire down on its back."

She wasn't subtle, but she was effective. *Quid pro quo: we help you keep the witches out; you help us keep San Jose in line; and all remains well without a shot being fired. These goddamned little nations,* he thought, *these absurd jerkwater sovereignties with their wars and alliances and shifting confederations.* It was like a game, like playground politics. Except that it was real. What had fallen apart was not going to be put back together, not for a long while, and this miniaturized *Weltpolitik* was the realest reality there was just now. At least things were saner in Northern California than they were down south, where Los Angeles was gobbling everything and there were rumors that Pasadena had the Bomb. Nobody had to contend with that up here.

Christensen said, "I'll have to propose all this to the Defense Ministry, of course. And get the Emperor's approval. But basically, I'm in agreement with your thinking."

"I'm so pleased."

"And I'm very glad that you took the trouble to travel up from Monterey to make these matters clear to us."

"Merely a case of enlightened self-interest," Ms. Sawyer said.

"Mmm. Yes." He found himself studying the sharp planes of her cheekbones, the delicate arch of her eyebrows. Not only was she cool and competent, Christensen thought, but now that the business part of their meeting was over, he was coming to notice that she was a very attractive woman and that he was not as tired as he had thought he was. Did international politics allow room for a little recreational hanky-panky? Metternich hadn't jumped into bed with Talleyrand, nor Kissinger with Indira Gandhi, but times had changed, after all, and—no. No. He choked off that entire line of thought. In these shabby days they might all be children playing at being grown-ups, but nevertheless international politics still had its code, and this was a meeting of diplomats, not a blind date or a singles-bar pickup. *You will sleep in your own bed tonight,* he told himself, *and you will sleep alone.*

All the same he said, "It's past six o'clock. Shall we have dinner together before I go back to the city?"

"I'd love to."

"I don't know much about Berkeley restaurants. We're probably better off eating right here."

"I think that's best," she said.

They were the only ones in the hotel's enormous dining room. A staff of three waited on them as if they were the most important people who had ever dined there. And dinner turned out to be quite decent, he thought—calamari and abalone and sand dabs and grilled thresher shark, washed down with a dazzling bottle of Napa Chardonnay. Even though the world had ended, it remained possible to eat very well in the Bay Area, and the breakdown of society had not only reduced maritime pollution but also made local seafood much more readily available for local consumption. There wasn't much of an export trade possible with eleven heavily guarded national boundaries and eleven sets of customs barriers between San Francisco and Los Angeles.

Dinner conversation was light, relaxed—diplomatic chitchat, gossip about events in remote territories, reports about the Voodoo principality expanding out of New Orleans and the Sioux conquests in Wyoming and the Prohibition War now going on in what used to be Kentucky. There was a bison herd again on the Great Plains, she said, close to a million head. He told her what he had heard about the Suicide People, who ruled between San Diego and Tijuana, and about King Barnum & Bailey III, who governed in northern Florida with the aid of a court of circus freaks. She smiled and said, "How can they tell the freaks from the ordinary people? The whole world's a circus now, isn't it?"

He shook his head and replied, "No, a zoo," and he beckoned the waiter for more wine. He did not ask her about internal matters in Monterey, and she tactfully stayed away from the domestic problems of the Empire of San Francisco. He was feeling easy, buoyant, a little drunk, more than a little drunk, to have to answer questions now about the little rebellion that had been suppressed in Sausalito or the secessionist thing in Walnut Creek would be a bringdown and bad for the digestion.

About half past eight he said, "You aren't going back to Monterey tonight, are you?"

"God, no! It's a five-hour drive, assuming no more troubles with the San Jose Highway Patrol. And the road's so bad below Watsonville that only a lunatic would drive it at night. I'll stay here at the Claremont."

"Good. Let me put it on the imperial account."

"That isn't necessary. We—"

"The hotel is always glad to oblige the government and its guests."

Ms. Sawyer shrugged. "Very well. We'll reciprocate when you come to Monterey."

"Fine."

And then her manner suddenly changed. She shifted in her seat and

"My safety systems have failed."

fidgeted and played with her silverware looking awkward and ill at ease. Some new and big topic was obviously about to be introduced, and Christensen guessed that she was going to ask him to spend the night with her. In a fraction of a second he ran through all the possible merits and demerits of that, and came out on the plus side, and had his answer ready when she said, "Tom, can I ask a big favor?"

Which threw him completely off balance. Whatever was coming, it certainly wasn't what he was expecting.

"I'll do my best."

"I'd like an audience with the Emperor."

"What?"

"Not on official business. I know the Emperor talks business only with his ministers and privy councillors. But I want to see him, that's all." Color came to her cheeks. "Doesn't it sound silly? But it's something I've always dreamed of, a kind of adolescent fantasy. To be in San Francisco, to be shown into the imperial throne room, to kiss his ring, all that pomp and circumstance. I want it, Tom. Just to *be* there, to *see* him. Do you think you could manage that?"

He was astounded. The facade of cool, tough competence had dropped away from her, revealing unanticipated absurdity. He did not know what to answer.

She said, "Monterey's such a poky little place. It's just a *town*. We call ourselves a republic, but we aren't much of anything. And I call myself a senator and a diplomat, but I've never really been anywhere. San Francisco two or three times when I was a girl. San Jose a few times. My mother was in Los Angeles once, but I haven't been anywhere. And to go home saying that I had seen the Emperor—" Her eyes sparkled. "You're really taken aback, aren't you? You thought I was all ice and microprocessors, and instead I'm only a hick, right? But you're being very nice. You aren't even laughing at me. Will you get me an audience with the Emperor for tomorrow?"

"I thought you were afraid to go into San Francisco."

She looked abashed. "That was just a ploy. To make you come over here, to get you to take me seriously and put yourself out a little. Diplomatic wiles. I'm sorry about that. The word was that you were snotty, that you had to be met with strength or you'd be impossible to deal with. But you aren't like that at all, Tom. I want to see the Emperor. He does give audiences, doesn't he?"

In a manner of speaking, I suppose it could be done.

"Oh, would you? Tomorrow?"

"Why wait for tomorrow?"

Are you being sarcastic?

"Not at all." Christensen said, "This is San Francisco. The Emperor keeps weird hours, just like the rest of us. I'll phone over there and see if we can be received." He hesitated. "I'm afraid it won't be what you're expecting."

"What do you mean? In what way?"

"The pomp, the circumstance. You're going to be disappointed. You may be better off not meeting him, actually. Stick to your fantasy of imperial majesty. Seriously, I'll get you an audience if you insist, but I don't think it's a great idea."

Can you be more specific?

No."

I still want to see him. Regardless."

He left the dining room and, with misgivings, began arranging things. The telephone system was working sluggishly that evening, and it took him fifteen minutes to set the whole thing up, but there were no serious obstacles. He returned to her and said, "The ferry will pick us up at the marina in about an hour. There'll be a car waiting on the San Francisco side. The Emperor will be available for viewing around midnight. I tell you that you're not going to enjoy this. The Emperor is old, and he's been sick; he isn't a very interesting person to meet."

All the same," she said. "The one thing I wanted, when I volunteered to be the envoy, was an imperial audience. Please don't discourage me."

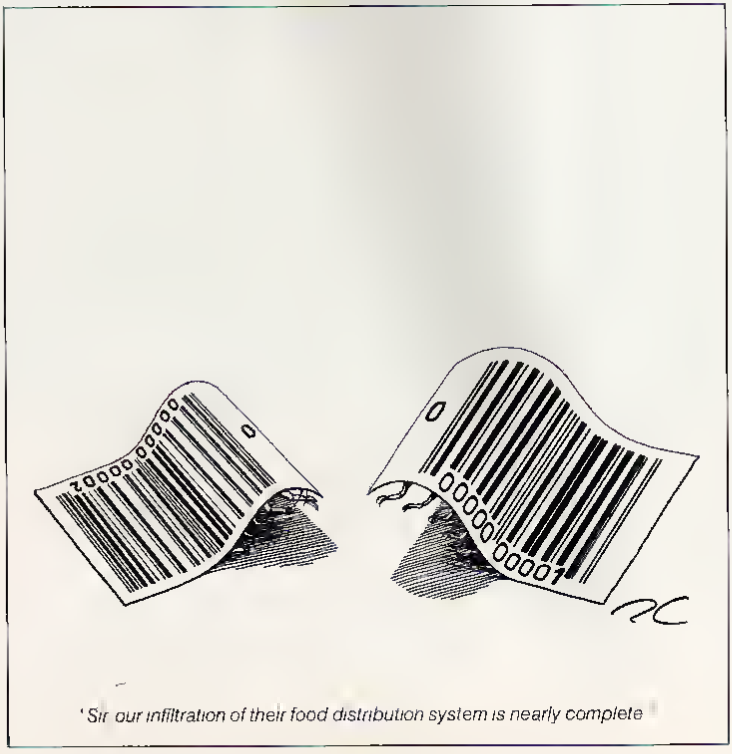
As you wish. Shall we have another drink?"

"How about these?" She produced an enameled cigarette case. "Humboldt County's finest. Gift of the Free State."

He smiled and nodded and took the joint from her. It was elegantly manufactured, fine cockleshell paper, gold monogram, igniter cap, even a filter. *Everything else has come apart,* he thought, *but the technology of marijuana is at its highest point in history.* He flicked the cap, took a deep drag, passed it to her. The effect was instantaneous, a new high cutting through the wooze of bourbon and wine and brandy already in his brain, clearing it, expanding his limp and sagging soul. When they were finished with it, they floated out of the hotel. His driver and hers were still waiting in the parking lot. Christensen dismissed his, and they took the Republic of Monterey car down the slopes of Berkeley to the marina. The boat from San Francisco was late. They stood around shivering at the ferry slip for twenty minutes, peering bleakly across at the glittering lights of the far-off city. Neither of them was dressed for the nighttime chill, and he was tempted to pull her close and hold her in his arms, but he did not. There was a boundary he was not yet willing to cross. *Hell,* he thought, *I don't even know her first name.*

It was nearly eleven by the time they reached San Francisco.

An official car was parked at the pier. The driver hopped out, saluting, bustling about—one of those preposterous little civil-service types, doubtless keenly honored to be taxiing bigwigs around late at night. He wore the red-and-gold uniform of the imperial dragoons, a little frayed at one elbow. The car coughed and sputtered and reluctantly lurched into life, up Market Street to Van Ness and then north to the palace. Ms. Sawyer's eyes were wide, and she stared at the ancient high-rises along



"Sir, our infiltration of their food distribution system is nearly complete."

Van Ness as if they were cathedrals

When they came to the Civic Center area, she gasped obviously overwhelmed by the majesty of everything, the shattered hulk of the Symphony Hall, the Museum of Modern Art, the great dome of City Hall and the Imperial Palace itself awesome imposing, a splendid, many columned building that long ago had been the War Memorial Opera House With the envoy from the Republic of Monterey at his elbow, Christensen marched up the steps of the palace and through the center doors into the lobby where a great many of the ranking ministers and plenipotentiaries of the Empire were assembled "How absolutely marvelous," Ms Sawyer murmured Smiling graciously bowing, nodding, Christensen pointed out the notables, the defense minister, the minister of finance the minister of suburban affairs, the chief justice the minister of transportation

Precisely at midnight there was a grand flourish of trumpets and the door to the throne room opened Christensen offered Ms Sawyer his arm, together they made the long journey down the center aisle and up the ramp to the stage, where the imperial throne, a resplendent thing of rhinestones and foil, glittered brilliantly under the spotlights Ms Sawyer was wonderstruck She pointed toward the six gigantic portraits suspended high over the stage and whispered a question, and Christensen replied 'The first six emperors And here comes the seventh one "

"Oh," she gasped But was it awe surprise, or disgust?

He was in his full regalia the scarlet robe, the bright green tunic with ermine trim, the gold chains But he was wobbly and tottering a clumsy staggering figure gray-faced and feeble supported on one side by Mike Schiff, the Imperial Chamberlain, and on the other by the Grand Sergeant-at-Arms, Terry Coleman He was not so much leaning on them as being dragged by them Bringing up the rear of the procession were two sleek pretty boys one black and one Chinese carrying the orb, the scepter, and the massive crown Ms Sawyer's fingers tightened on Christensen's forearm, and he heard her catch her breath as the Emperor in the process of being lowered into his throne went boneless and nearly spilled to the floor Somehow the Imperial Chamberlain and the Grand Sergeant-at-Arms settled him properly in place, balanced the crown on his head and stuffed the orb and scepter into his trembling hands "His Imperial Majesty, Norton the Seventh of San Francisco!" cried Mike Schiff in a magnificent voice that went booming up to the highest balcony The Emperor giggled

'Come on," Christensen whispered and led her forward

The old man was really in terrible shape It was weeks since Christensen had last seen him, and by now he looked like something dragged from the crypt slack-jawed, drooling, vacant-eyed, utterly burned out The envoy from Monterey seemed to draw back, tense and rigid, repelled, unable or unwilling to go closer, but Christensen persisted, urging her onward until she was no more than a dozen feet from the throne A sickly-sweet vaguely familiar odor emanated from the old man

"What do I do?" she asked, panicking

"When I introduce you go forward, curtsey if you know how touch the orb Then step back That's all "

She nodded

Christensen said 'Your Majesty, the ambassador from the Republic of Monterey Senator Sawyer to pay her respects "

Trembling she went to him, curtseyed, touched the orb As she backed away she nearly fell but Christensen came smoothly forward and steadied her The Emperor giggled again, a shrill, horrific cackle Slowly carefully Christensen guided the shaken Ms Sawyer from the stage

"How long has he been like that?"

'Two years three, maybe more Completely senile Not even housebroken anymore You could probably tell I'm sorry I told you you'd be better off skipping this I'm enormously sorry Ms — Ms — what's your first name, anyway?"

"Elaine "

"Let's get out of here, Elaine Yes?'

"Yes Please "

She was shivering He walked her up the side aisle A few of the courtiers were clambering up onto the stage now one with a guitar one with juggler's clubs The imperial giggle pierced the air again and again becoming rasping and wild The imperial levee would go on half the night Emperor Norton VII was one of San Francisco's most popular amusements

"Now you know," Christensen said

"How does the Empire function if the Emperor is crazy?"

"We manage We do our best without him The Romans managed it with Caligula Norton's not half as bad as Caligula Not a tenth Will you tell everyone in Monterey?"

"I think not We believe in the power of the Empire and in the grandeur of the Emperor Best not to disturb that faith "

"Quite right," said Christensen

"He thought about the Realm of Wicca, far off up there in green, happy Oregon, sending kindly goddess-worshiping neopagans to California to celebrate the rebirth of the sun — a mess."

They emerged into the clear cold night

Christensen said "I'll ride back to the ferry slip with you before I go home

"Where do you live?"

"In the other direction Out near Golden Gate Park "

She looked up at him and moistened her lips "I don't want to ride across the bay in the dark, alone at this hour of the night Is it all right if I go home with you?"

"Sure," he said

She managed a jaunty smile 'You're straight aren't you?"

"Sure Most of the time, anyway"

"I thought you were Good "

They got into the car "Frederick Street," he told the driver between Clayton and Cole"

The trip took twenty minutes Neither of them spoke He knew what she was thinking about the senile Emperor dribbling and babbling under the bright spotlights The mighty Norton VII ruler of everything from San Rafael to San Mateo from Half Moon Bay to Walnut Creek Such is pomp and circumstance in imperial San Francisco in these latter days of Western civilization Christensen sent the driver away and they went upstairs The cats were hungry again

"It's a lovely apartment " she told him

"Three rooms bath hot and cold running water Not bad for a mere foreign minister Some of the boys have suites at the palace but I like it better here "He opened the door to the deck and stepped outside Somehow now that he was home the night was not so cold He thought about the Realm of Wicca far off up there in green, happy Oregon, sending a hundred fifty thousand kindly goddess-worshiping neopagans down here to celebrate the rebirth of the sun A nuisance a mess a headache Tomorrow he'd have to call a meeting of the Cabinet when everybody had sobered up and start the wheels turning and probably he'd have to make trips to places like Petaluma and Palo Alto to get the alliance flanged together Damn But it was his job Someone had to carry the load

He slipped his arm around the slender woman from Monterey

"The poor Emperor" she said softly

"Yes" he agreed "The poor Emperor Poor everybody '

He looked toward the east In a few hours the sun would be coming up over that hill out of the place that used to be the United States of America and now was a thousand, thousand crazy fractured fragmented entities Christensen shook his head The Grand Duchy of Chicago he thought The Holy Carolina Confederation The Three Kingdoms of New York The Empire of San Francisco No use getting upset — much too late for getting upset You played the hand that was dealt you, and you did your best and you carved little islands of safety out of the night Turning to her he said, "I'm glad you came home with me tonight " He brushed his lips lightly against hers "Come Let's go inside "

FUTURE TING

CONTINUED FROM PAGE 50

signed to detect heavy long-lived particles and in his proposed mass region the eminent physicist claimed there were no such animals "Nevertheless" Ting remarks dryly, 'since I usually do not have much confidence in theoretical arguments we decided to proceed with our original design '

Experiments like this have their terrifying moments On Christmas Eve 1973, Ting was in Germany He received a phone call from Upton "Don't worry" the voice at the other end said "nobody was killed" A particle detector known as a Cherenkov counter a pressurized device containing large plastic mirrors had exploded with the force of a fragmentation bomb Fortunately all of the physicists were safe inside a nearby trailer

Another anxious moment came when they started operating the experiment Despite the fact that more than 10,000 tons of concrete shielded the machinery radiation inside the experimental trailer remained so high that the physicists would have received lethal doses of radiation in less than 24 hours

At last in the early summer of 1974 the experiment was ready to run At first the team concentrated on finding particles whose mass lay between 4 and 5 Gev a range Ting felt would yield rich experimental fruit. They searched for most of the summer and found nary a one It began to look as if their detractors had been right Then, in August they lowered the mass to the 3- to 4-Gev range Right away they began to see something "Then the counts began to come out " Ting remembers "That was very exciting Still we took two or three months to check it

Ting was almost too careful By November he still hadn't announced his discovery Meanwhile a team at Stanford's Linear Accelerator (SLAC), under the leadership of Burton Richter, were doing a routine check on their experiment They found one tiny annoying inconsistency at the mass of 3 Gev that couldn t be explained Probably a glitch in their machine they thought When Ting heard about their problem he knew immediately that they were seeing the first edge of the J particle

He then did something that he had never done before Ting bet Mel Schwartz a member of Richter's team $10 that the point at 3 Gev was just a glitch and that there was no new physics to be found there He hoped this would throw them off the scent But despite the bet the SLAC group soon figured out what was going on

In November Ting wrote up a brief note, reporting the discovery A few days later he saw Richter at SLAC and said "Burt I have some interesting physics to tell you about "

Richter replied, "No Sam, I have some interesting physics to tell you about "

Their reports appeared side by side The

only difference in them is that Ting called his discovery the J and Richter called his discovery the psi. Today diplomacy dictates its proper name. On the East Coast it is the J; on the West it is the psi. And if you aren't sure, just call it the J/Psi, or gypsy.

What is the J? After some wrangling, physicists now believe it to be the first of a large new class of particles that contain a special kind of quark, called the charmed quark, for strictly whimsical reasons. The particle itself reveals the richness of matter's structure and provides a new tool for exploring this structure. In 1976 Richter and Ting received the Nobel Prize for their simultaneous and independent discovery. Richard Feynman, himself a Nobel laureate, sent Ting a telegram the day the prize was announced. "Dear Sam," he asked, "why do they give a prize to somebody who discovers something I couldn't understand?"

The Nobel Prize has had surprisingly little effect on Ting's life-style. The only solid advantage he sees is that if he goes to a Chinese restaurant, people know who he is—without an American Express card. "And I certainly get better service. Oh, yes," he adds, "my daughters were even nice to me for about a month."

A CHINESE REFUGEE

If great events don't shake Ting's life much, it is because his roots run deep—all the way back to a vagabond childhood in China. Ting was born in Ann Arbor, Michigan, 45 years ago, but his parents, both Chinese students at the University of Michigan, returned home shortly after his birth because Japan had invaded China. "Being patriotic sorts," Ting recalls, "they decided to go back to China. I was exactly, to the point, three years old at the time."

The future physicist spent the next nine years as a refugee, one step ahead of the Japanese. He saw quite a lot of China, though scarcely a glimpse of its classrooms. "When you are a refugee," he says, "you're worried about survival, not education. I went to first grade once, but only for a few days. Then I had to leave because there was bombing every day." If this experience left him with any scars, they don't show. Asked what it was like during the war, Ting only smiles and says, "Well, it was very good, because I never had to go to school."

But all good things must end, and for Ting's family the end came with peace in 1945. They moved to Taiwan, where Ting's parents taught at a university and he finally went to school. He was nine and could barely read. But, he notes archly, "I managed to catch up rather quickly."

In school, Ting became deeply engrossed with the concept of truth. The pursuit of truth ultimately sent him back to the United States, to study at the University of Michigan. He enrolled in the school of engineering and nearly flunked out. "I couldn't understand engineering drawings. So the next term I took some physics and mathematics courses. And the term after that I wanted to take some more, but my adviser told me, 'You have taken more than your share in the engineering school. You should take some more circuitry or mechanical drawing.' Well, I couldn't do that. I'd lose my scholarship. So my adviser said, 'Then you have to transfer to physics.' I said, 'Okay time.' And that was that. That was his sophomore year. By his junior year, he admits, he had even begun to find physics *interesting*.

In graduate school at Ann Arbor, Ting met Martin Perl, now of SLAC and then a Michigan professor eager for help with his experiments. In April of 1960, Ting recalls, Perl said, "Well, we have an experiment in California, and we need a pair of hands for the summer. We pay three hundred dollars a month plus a round-trip ticket."

Ting says, "I was interested in theoretical physics, but because of this seduction I went to Berkeley. Just as a helping hand."

At Berkeley Ting was first exposed to the rigorous demands of high-energy experimentation. Often he was expected to work round-the-clock, readying an experiment for operation, making hasty repairs or monitoring voltage levels and particle counts. This dizzying, breakneck pace is necessary because only a few experiments can be done at any given time on an accelerator, just as only a small section of the heavens can be examined at a time through a large telescope.

> *"High-energy physics is a lot like a motion picture: a large-budget project, long planned, with dozens of experts working to express the vision of a single auteur."*

Ting, now legendary for the long hours he spends on an experiment, took a while to adjust to the pace. "I remember the first time I spent on the night shift. The next morning was really bad. Who on earth would do such a stupid thing, spend all night running a stupid counter! But after some time I came to understand most of it: the importance of actually doing something, actually managing to get something working."

By the end of the summer Ting was hooked, not so much because he found the work particularly gratifying, but because Perl said that if he stayed, he would get his degree quickly. A graduate student can hear just about no sweeter words.

It took one further bit of prodding, however, to turn Ting into an experimental physicist. This added impetus came from George Uhlenbeck, a professor at Michigan who is famous for his discovery of the electron's spin.

Ting asked Uhlenbeck whether he should become a theoretical physicist. "Well," Uhlenbeck said, "if I were to do it over again, I would do experiments." Why? "An average experimentalist is very useful, and an average theoretician is not. In theoretical physics only a very few theoreticians are very important. In an experiment, whatever you do can make a contribution." Above all, Ting wanted to make a contribution. "It was a standard talk of mine," Uhlenbeck recalls. "Some people took it seriously, thank God!"

AN AIRBORNE TASKMASTER

Today Ting lives with his wife, Kay, and two daughters in a ranch-style house in Lexington, Massachusetts, a suburb of Boston. Kay, an architect, is designing a new home with their Nobel Prize money, but if the past is any indication, Ting won't spend much time in it.

Officially he is a professor at MIT, but he spends much of his time enroute from one giant particle accelerator to another. He makes 40 transatlantic crossings each year and spends only every other weekend at home.

Ting is notorious among particle physicists—hard workers in their own right—for his dedication and energy. He demands no less from his colleagues. Once students put up a gag sign in his office that demanded: staff work 16 hours a day and seven days a week. Some weeks, in reality, that schedule would seem a vacation.

Ting is known for taking naps in the middle of the afternoon so he can turn up late at night, full of energy to prevent people from quitting early. Staffers grumble, but most members of the group seem to thrive on the pressure. They know that these are the sacrifices they must make to live on the frontier of physics.

The working pressure is enhanced by another patented Ting trick. To make sure nothing is overlooked, he divides his group into two competing factions. As Ulrich Becker, Ting's right-hand man, explains: "One must avoid that famous, dangerous thing—commonsense belief. Everything is done twice, double-checked. This meticulous care allows Ting to make an almost-unprecedented claim. His only published mistakes are typographical errors. "I think that if I were to make a mistake, it would bother me," Ting says without a trace of a smile.

For Ting, physics is the only thing and experiments are the only truth. He is already planning projects into 1986. For him, experimental physics is not a job; it is a quest. "Unless a thing is measured and confirmed," Ting states, "it does not exist." Ting's discoveries in particle physics confirm his existence and define the ultimate limits of reality.

Our cover finalists portray the Omni focus

PHOTO CONTEST

By Geoffrey Golson

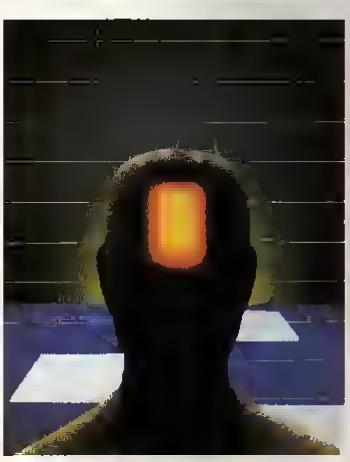
Fantasy and surrealism dominated the more than 1,500 entries we received for our Cover Photography Contest, announced last January. Readers were asked to capture *Omni*'s special editorial emphasis in a single photograph. Robert Kittila's winning entry appears on *Omni*'s June cover (see last month's issue). This month, at right, we present the runners-up. All finalists were selected by *Omni* Publisher and Design Director Bob Guccione.

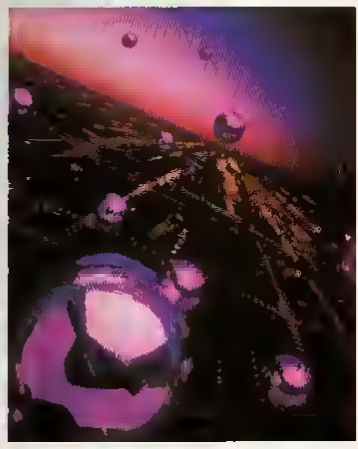
John Pisano, of Fort Lewis, Washington, produced the second-place winner, a symmetrical, well-framed depiction of the Seattle Aquarium at sunset (shown at top, left). Pisano photographed this sea gull, which unknowingly crowns a triangular pattern in nature, on Ektachrome 64 film. Pisano received a silver-embossed certificate from *Omni*.

The third-place winner (shown at top, right) was created by Joseph Mauro, of Bethel, Connecticut. His rose-and-egg still life is the result of several developmental stages, including hand-coloring the two subjects with pigment before rephotographing them. Mauro used a Forox SD camera and a Nikon macro lens to record the compelling textural differences between egg and flower. Mauro included the *Omni* logo, presumably to help influence our decision. It didn't help. He received a bronze-embossed certificate of achievement for his effort.

Photographer Rick Ueda says his runner-up entry (shown at bottom, left) deals with man as "an everlasting source of thought, energy, and imagination, no matter what environment he chooses to live in." Ueda built the set by hand in his studio. His photograph was taken with a 4" × 5" view camera loaded with Kodak Ektachrome sheet film, which was double-exposed.

Strato Spheres is the title of Erich Schrempp's runner-up (shown at bottom, right). Perched atop Chicago's Sears Tower, Schrempp shot a night-lit cityscape on high-speed Ektachrome film. The 35mm slide was then enlarged to a 4" × 5" transparency and rephotographed with ball bearings and Christmas ornaments. The final product, Schrempp says, "is a squadron of enigmatic little orbs drifting over Chicago on a winter evening."





There are many accomplished photographers among the ranks of *Omni* readers. Spectacular levels of imagination and craftsmanship reflect the care with which readers respond to our Photo Contests. We want to see more. In the June *Omni* we announced the third in a series of photography invitationals. Readers are asked to portray the year 2000 by using cameras as crystal balls to peer into the future. Travel through time, using your imagination and the appropriate technology to capture the world a generation from now. We're waiting to see what you'll show us next. ∞

FORUM

CONTINUED FROM PAGE 12

instruction manual, I am clearly identified as the president of that company and Mr Mendelssohn is not mentioned at all I have filed suit against Mr Mendelssohn for misrepresentation, and my lawyers may subpoena you as a witness But in any case thank you for writing about my company and my Robot Eggs

MAX THE ROBOT
President
Intergalactic Robot Eggs Inc

More Atomic Vets

As a veteran of 22 nuclear tests conducted by the U S government at Eniwetok Atoll in 1958 I feel both compelled and qualified to refute Lieutenant General Harry A Griffith s letter [Forum April 1981] When General Griffith said that Eleanor Smith s article about atomic veterans in the November 1980 Earth column contained errors of fact he was practicing the "big lie" technique which the Defense Nuclear Agency (DNA) has perfected over the years Griffith would have the reader believe that this agency is exhausting all resources to help the atomic veteran when just the opposite is true

First Griffith alleges that hundreds of documents have been declassified and made available to the public through the National Technical Information Service (NTIS) The key word in this statement is *through* NTIS for it absolves the DNA of further responsibility NTIS annually publishes the Government Report and Announcement Index which is required to identify a document and its NTIS catalog number If you can t attord $275 for the report certain colleges and hospitals subscribe to the index You must have the NTIS catalog number to obtain a document and there is a substantial charge

Second, Griffith states that more than 40 000 veterans have contacted the DNA and received information The omitted part is the quantity and quality of information that the DNA provides When a veteran contacts the DNA he receives a form to fill out concerning his participation in nuclear testing Under the health portion of this questionnaire the DNA asks whether you have any health problems without giving any indication of what diseases or problems a veteran could expect from radiation exposure

After this initial contact a veteran will never hear from the DNA again unless he is aggressive Those who receive a DNA response are sent statements that they received little if any radiation during the tests This is followed by a statement that tells you that scientists will be studying the radiation problem for years!

Third Griffith forgot to mention how the DNA unsuccessfully tried to influence the study of the Smoky test veterans The DNA paid for a contract with the National Academy of Sciences–National Research Council to duplicate the Dr Caldwell study with the *same* group of Smoky veterans The result? Confirmation of Dr Caldwell's findings that leukemias have been occurring excessively among Smoky veterans! All of these leukemia victims received less than the federal guideline of five REMs

Fourth Griffith asserts that more than 99 percent of atomic veterans received less than five REMs He speaks in terms of average exposure as if he were dividing up Mom s apple pie! The omission in this statement is 28 airmen who as part of Operation Castle in 1954 were exposed to very high levels of radiation through an accident with a 17-megaton bomb

There were also 239 Marshallese natives and 23 Japanese involved in this accident The Japanese received almost immediate lump sum payments from the U S government and the Marshallese are still receiving free medical treatment for numerous radiation-related diseases

This is documented in a Brookhaven National Laboratory study entitled "A Twenty Year Review of Medical Findings in a Marshallese Population Accidentally Exposed to Radioactive Fallout

Three of the 28 airmen with whom I correspond have documents from the U S government stating their individual exposures were *86 REMs*! However since their initial medical examinations in 1954 the government has made no follow-up inquiries concerning their health

The "big lie" technique will no longer work for concerned veterans have formed the National Association of Atomic Veterans (NAAV) Our headquarters is at 1109 Franklin Street Burlington IA 52601 telephone 319-753-6112 NAAV provides atomic veterans with facts and assistance including the names and addresses of fellow participants

George E Mace
Hagerstown Md

PHOTO CREDITS

Page 8, US Pat Hill; **page 8,** Cliff Olson John Muth; **page 14,** Dan Morrill; **page 16,** Marc B Garnick; **page 18,** James Long **page 20,** Larry Hamill **pages 24 and 26,** D C Comics Inc ; **page 27,** Tony Guccione; **page 28,** Pete Turner; **page 30,** Donna Engler; **page 32,** Kal Korff; **page 36 top,** UPI; **page 37 bottom,** Movie Star News; **page 38 top,** Steve Allan/Black Star; **page 38 bottom,** John Running/Black Star **page 39 left,** Bernard C Silberstein/Photo Researchers **page 39 right,** American Animal Hospital Association; **page 40 left,** Don Carroll © 1979/Image Bank; **page 40 right,** UPI; **page 41 top,** Noel Habgood **page 41 bottom,** Guy Connolly Denver Wildlife; **page 42 top,** NASA Research Center; **page 42 bottom,** EROS **pages 56–57,** Ocean Films Ltd ; **page 57 top,** Rodney Catanach; **pages 58–59,** Ocean Films Ltd ; **pages 60–61,** Stewart Goodman Productions; **page 61 bottom,** Ocean Films Ltd; **pages 62–63** Henri Rousseau *Urwaldlandschaft mit untergehender Sonne* 1910 Kunstmuseum Basel **pages 82–87,** taken from *Tour of the Universe* by Robert Holdstock and Malcolm Edwards copyright (illustrations) © 1980 Young Artists & Artist Partners **page 92** Colin Hay **pages 92–93** Tony Roberts **pages 84–85 top left** Tony Roberts **page 85 top right** Terry Oakes **page 85 left bottom** Colin Page **page 85 right bottom** Tony Roberts **page 86 top left,** Richard Chilton Dey **page 86 top right** Les Edwards **page 86 bottom left,** Jim Burns **pages 86–87 bottom,** Jim Burns **page 124** Don Dixon

EARTH

CONTINUED FROM PAGE 14

by the year 2000 Losses caused by ozone in this region are estimated to be 233 million bushels Millions of cubic feet of valuable timber is lost each year to the invisible pollution that weakens trees and slows their growth Those who want to use coal Loucks warns must follow that plume of pollutants from the smokestack to its ultimate effects and only then decide whether the tradeoff is worthwhile

The regions hardest hit will seldom be the ones that benefit from use of the coal Ecological fallout from the Midwest will be visited on neighbors in the Northeast, which may soon have air pollution rivaling that of southern California "If industrial conversion to coal continues ' Loucks predicts the United States will experience severe food shortages decreased forest growth and an acceleration of the greenhouse effect Loucks expects increased political tensions with Canada over environmental issues

The nation s renewed interest in coal has intensified this warming trend Production levels are up In the United States where more than half the electricity is coal generated mining rose last year by 10 percent The coal industry is pushing for aggressive development of the 438 billion ton U S coal reserve Utilities throughout the country are converting to coal power now that the government has relaxed clean-air restrictions And several other coal-rich areas like the Four Corners region of Arizona, Colorado Utah and New Mexico are producing more coal to meet demands from neighboring regions that require electricity Soon these coal-rich regions will face problems similar to those of the Ohio River basin

"I know there will be a change when we have poisoned enough people and starved ourselves " he says "I am concerned about our capacity to make the necessary changes soon enough It is possible to avert these catastrophes but only if we can persuade people that there is a need now to avert them '

Damage from coal use can be countered by building smaller power plants with effective emission-control devices "More important ' says Loucks is increased development of conservation as an alternative energy source Along with increased utilization of solar and wind energy by utilities, I am encouraged by the fact that we now have an opportunity to have an advanced global society without the threat of wastes and toxic substances

"There are no simple answers " he adds "That s why we have to take a closer look at the whole answer—coal conversion acid rain carbon cycles We already have ahead of us decades of hard work We will need to adjust to energy efficient values and life-styles There is no silver lining in this cloud ∞

Psssssst!
Have you heard ___?

COMPETITION

By Scot Morris

Last November, when we announced our Competition #17 for Unconfirmed Rumors, we had no idea of the mass-market appeal that a good rumor can have. At that time only one major rumor had "gone Hollywood." The canard that no astronauts ever went into space and that all the "moonwalks" were secretly filmed in a Nevada desert became the inspiration for the 1978 film *Capricorn One*, starring James Brolin, Hal Holbrook, and O. J. Simpson.

Almost immediately after we announced our contest, three other famous rumors made their screen debuts. Within weeks we saw the release of *The Formula*, which had George C. Scott vs. Marlon Brando and the secret of the cheap fuel that is being kept from the public by greedy oil companies, *Hangar 18*, about the crashed UFO and those alien bodies in deep freeze at Wright-Patterson Air Force Base in Ohio, and *Alligator*, the real truth underlying the manhole coverup in the New York City sewer system.

If the trend continues, other rumors mentioned when we announced this contest are soon to become motion pictures. First out will be *Scallop!*, about a ruthless restaurateur who serves cut out shark or skate to unsuspecting customers who have ordered shellfish. We are currently negotiating the screen rights to our rumor that reading *Omni* will make one multiorgasmic. (It's probably because of the sex pheromones we add to our ink.)

THE RUMOR HALL OF FAME

What makes for a classic rumor? The best are paranoid, plausible, provocative, officially denied, and outrageous.

Solid paranoid thinking underlies the very best rumors. The truth is known only to a few because the powers-that-be are covering it up. Paranoia is the easiest mental aberration to slip into and the one that appeals to the most creative, intelligent minds. If you can't find conspiracies all around you, you're not paying attention. A good rumor must be plausible, of course, but to the truly imaginative there are few situations that aren't.

Plausibility then provokes investigation. It was a classically provocative rumor that Paul McCartney was dead. That rumor inspired diligent, creative people to investigate it and uncover new "evidence." They were then able to say, "If it *isn't* true, explain *this*." And then they would recite a catalog of substantiations.

Investigation sometimes leads to an official denial, which, for a rumor, is the equivalent of being nominated for an Oscar. After all, those stories about rat parts found in a bucket of chicken, worm meat in hamburgers, and spiders' eggs in bubble gum had only moderate word-of-mouth circulation. Most of us first heard of these outrages when the companies' official denials were carried nationally by the news media.

Finally, if any of the above qualities are lacking, an outrageous sense of humor is the saving grace.

For purposes of our contest, another quality was looked for, namely originality. It didn't matter whether the rumor was "real" or made up. If too many versions of a rumor came in, we discarded all of them.

RUMOR THEMES

After sifting through thousands of rumors, we began to notice recurring themes. The most commonly overdone categories were:

1. They're Still Alive! Hitler, the shah of Iran, Howard Hughes, Jim Morrison, Elvis Presley, Bruce Lee, even John Lennon, are

RUMORS GO HOLLYWOOD. Terror from the sewers (top); a phony astronaut landing (bottom).

all still with us, in hiding. We saw so many resurrections of J.F.K. (always "a vegetable") that we had to give a prize to the second-order rumor that finally lays him to rest.

2. The Aliens Are Among Us! Known extraterrestrials: Einstein, Heinlein, Sagan, and at least one *Omni* editor. Recently discovered: Senator William Proxmire, who is trying to keep earthlings from learning the real secrets of the universe.

3. They're All Impostors! None of them are the real *them*: Ronald Reagan (he died in 1952, the man in the White House is a fifty-five-year-old stand-in, possibly his own illegitimate son); Jimmy Carter (the switcheroo came when he changed the part in his hair); Ayatollah Khomeini (in exile he had nine fingers; the impostor in Iran has ten); and Isaac Asimov (who is known to be *at least* triplets).

4. They're Suppressing the Miracle Patents! Everyone has heard about the 100-mpg carburetor that Standard Oil bought for millions of dollars and then buried. But what happened to the inventor? Some say he was bumped off. Others suspect that he became a specialist and went on to produce other suppressible inventions, such as the 50-year light bulb, the permanent battery, the million-mile tire, the tooth-decay preventative, and the runless nylon stocking.

5. The Secret Ingredient. Girl Scout cookies are laced with hashish. Famous Amos uses pure THC. Addictive drugs are added to pizza, gum, and, of course, cola. ("Why do you think they call it Coke?")

6. The Real Purpose of *Omni* and Competition #17. Several sneaky entrants hoped to win the money by mentioning *Omni* or this contest. One succeeded (Corne J. Bergeron, Jr. below), but most didn't. Some claimed that this contest was a thinly disguised attempt by the American government to find out who knows what is really going on; any entrants who divulged real government secrets would be eliminated quietly.

Another invidious claim was that the government paid *Omni* to run this contest in order to convince people that stories about the AMA's subsidy to the tobacco industry and the alien bodies on ice at Wright-Patterson are "just rumors." Several real conspiracies are planted in the results as well, so that people will associate them with crackpot ideas and dismiss all of them as untrue.

Don't believe a word of it.

GRAND PRIZE WINNER $100

There is a strain of albino marijuana growing in the New York City sewer system. The nutrient-rich sludge has germinated the seeds that were flushed down the toilet during drug raids, resulting in extremely powerful plants, known locally as Manhattan white or subway silver. It is hard to harvest, however, because it is guarded by all those alligators.

—Daniel Cohen, Port Jervis, N.Y.

RUNNERS-UP $25

It is widely rumored that John F. Kennedy was not killed in Dallas. His brain was destroyed, but he is "alive"—as a human vegetable—on the Greek island of Skorpios. Jackie, married Aristotle Onassis on the condition that he provide a secret place where J.F.K.'s body could be kept alive for as long as possible. I have heard that J.F.K.'s body *did* die in 1978, although that is still unconfirmed.

—Kathy Hurley, New York, N.Y.

Someone found that the red M&M's can be used as an aphrodisiac. So the FDA ordered most of them taken out of the mix. If you find any, save them. You need at least five.

—Kevin L. Clark, Crown Point, N.Y.

Popular arcade games such as Asteroids, Space Invaders, and Tail Gunner are programmed to record the initials of the highest scoring player. When you enter your initials, a photograph is secretly taken of you. The "games" are actually mechanisms for selecting, sorting, and training slave labor for duty in military spacecraft and on star bases. People who get good at these machines disappear under suspicious circumstances. You won't find *my* initials in one of those things, no matter how good I get!

—Larry Pike, Portland, Ore.

The U.S. government secretly is trying to increase inflation. Eighteen percent inflation could double your income every four years, placing you in a higher tax bracket without increasing your real income at all.

—Dan J. Hicks, Orlando, Fla.

I have heard that a man in Kerry [Ireland], on his deathbed, expressed a desire to be buried at sea and that three of his sons drowned trying to comply with his wishes.

—William Anderson, Calkey, Ireland

Seeking the reputation of a visionary—like Heinlein, Wells, and Verne—a certain well-known science-fiction writer has paid enormous sums of money and has even put innocent lives in danger, just to make sure that a wild prediction he made in a short story several years ago will come true on schedule.

—P.J. Veber, Mount Pleasant, S.C.

David Berkowitz obtained his pseudonym by listening to Jimi Hendrix whisper "Son of Sam, Son of Sam," halfway through "Purple Haze" on the right channel.

—Robert Rudd, Danbury, Conn.

Killing turkeys causes winter.

—Brian Siano, Cherry Hill, N.J.

The *National Enquirer* is paying Scot Morris $1 for each item he receives for *Omni* Competition #17. They expect to get at least two years' worth of cover stories from this investment.

—Corrie J. Bergeron, Jr.
College Station, Tex.

HONORABLE MENTION

Humpty Dumpty was pushed.

—Michael Martin, Brisbane, Australia

Lee Harvey Oswald shot John F. Kennedy.

—Kurt Friedman, Oxon Hill, Md.

We Chinese believe that one's destiny is determined by one's physical features. In the case of a politician, the fate of a country can be predicted. Take Sun Yat-sen, for instance. China under Sun Yat-sen was divided into the Nationalist and Communist camps because he parted his hair in the middle. Chiang Kai-shek lost the whole of mainland China because he shaved off all his hair.

And the secret deep freeze at an Air Force base where alien corpses are being kept on ice

Chairman Mao Zedong was able to sweep across China and unite the country because his hair is swept back without any parting. He had one problem, though: the island of Taiwan, as shown by the mole on his chin.

—S. T. Quah, Singapore

The Antichrist prophesied in the Bible (Revelations 14:18) has arrived. He is Ronald Wilson Reagan. Count the letters in each name to get "the number of the beast," 666. I realized this on election night, 1980, when the winning number in the Maryland State Lottery was—you guessed it—666.

—David Chiarenza, Columbia, Md.

The SAT scores are low because educators who make the tests have added more difficult questions to get more federal funding for their projects.

—Bill Loercher, Manheim, Pa.

If nobody voted in a U.S. presidential election, a candidate would still win because big business computers have the winners of each election taped 12 years in advance. This explains why no one admits he or she voted for Nixon. No one did.

—Jennifer R. Habersaat, San Jose, Calif.

In the background noise of the Ohio Players' song "Love Rollercoaster," one can hear a girl being stabbed to death. It was recorded in a thin-walled studio in New York City, and the screams couldn't be edited out completely.

—Vernon Nelson, Springfield, Ill.

"Max," the eccentric millionaire who had himself cloned in David Rorvik's book *In His Image: The Cloning of a Man*, was in reality Alex Comfort.

—Ken Stein, Baltimore, Md.

If you drink the water from the Charles River in Boston, it will cause you to be unable to pronounce your *r*'s.

—Ben Edelhart, New York, N.Y.

Dr. Pepper is carbonated prune juice.

—Bryan McLane, Hollywood, Fla.

Prehistoric man did not associate childbearing with intercourse because of the long delay between the two events. He did, however, understand the hair on his palms.

—Chris Doyle, Burke, Va.

NFL Commissioner Pete Rozelle's main job is to keep pro football honest so that people will continue to bet on it.

—Eugene H. Bales, Savannah, Mo.

In the Tibetan *Book of the Dead*, there is a description of a technique whereby one can learn to tickle oneself.

—Stuart S. Dennch, Baltimore, Md.

Colonel Sanders's "Extra Crispy" chicken is *yesterday's* Original Recipe chicken. If this isn't so, explain why "Extra Crispy" usually costs *less* than "Original Recipe."

—Laurie M. Young, Decatur, Mich.

The movie *The Invasion of the Body Snatchers* was a documentary.

—Richard Green, Livermore, Calif.

The main ingredient in toothpaste is sugar.

—Janet Jacobsen, Scottsdale, Ariz.

The Peoples Temple cultists did not commit suicide in Guyana. They were murdered by the CIA in order to create an anticult hysteria that would aid the FBI in its war against the Church of Scientology.

—David Palter, Hollywood, Calif.

The reason why Anita Bryant hates homosexuals is that when she was in kindergarten three gay boys tied her up naked after school and gang-rejected her.

—Mike Stasko, Columbus, Ohio

The U.S. government is reluctant to fund the space program because it doesn't want to lose taxpayers to L-5-type colonies.

—Donald R. Gentry, Independence, Mo.

Isaac Asimov, Martin Gardner and James Randi are aliens with psi powers and are debunking flying saucers and paranormal

CONTINUED ON PAGE 122

SPACE

CONTINUED FROM PAGE 18

neatest thing in the whole world.

Mission control: 'Where can I sign up?'

And then Christopher C. Kraft, who had been a part of the Mercury, Gemini, and Apollo programs and who was now one of the 'wise gray heads' of NASA and director of the Johnson Space Center in Houston, summed it all up with one sardonic line. We just became infinitely smarter.

The pilgrims in the desert were celebrants now. The Coors truck was passing out free beer. The *Omni* area had turned into a champagne party. The years of frustration and delay, the budget cuts and engineering problems, the criticisms and threats to cancel the shuttle program altogether—they were forgotten now. We had all just become infinitely smarter. We had a spaceship sitting out there on the desert, a visitor from outer space. *Columbia* and her sister craft being built by Rockwell are meant to work in orbital space. Her time here on the surface of our planet is only the time between missions—waiting time.

By now Young, who has flown more space missions of greater variety than any other human being, impatient almost to the point of testiness, had finally climbed down out of *Columbia* and was circling the craft, inspecting it like a rookie pilot who has to see and touch the machine that carried him aloft.

All that took place three months ago. *Columbia* is now back at Cape Canaveral, being readied for her second trip into space. *Challenger*, under construction in California, will be ready for flight next year.

In Washington, the new team heading NASA now has a powerful argument to convince our political leaders that a new era in space transportation has truly begun. Never again can the debate be over whether the space shuttle will fly or not. Now the question is: How much do we want to accomplish with the shuttle? How soon will we use her capabilities to help build a permanent American presence in near-Earth orbit?

For the first time since its inception, Space Week will have an entirely new and different American achievement to celebrate. We are in space again. And this time we are there to stay. No longer the glamorous, one-shot missions that grabbed headlines and then faded into oblivion. Spaceflight is on its way to becoming as routine as commercial air travel.

Even the longest journey is started with a single step. *Columbia* has taken that first step for all of us.

Crippen said it best the day after the landing, when he told a press conference in Houston that, despite all the problems and setbacks that had beleaguered the shuttle program, 'It was worth it.'

None of the pilgrims who ventured into the desert that morning to see the dawn of the Shuttle Era would disagree. ∞

UFO

CONTINUED FROM PAGE 32

planned scientific experiments. In March 1968, several college students at the University of Maryland were listening to a call-in radio show interview with a man who claimed to have been taken by flying-saucer people to their home planet, Lanulos, in the distant constellation Ganymede. One of the students, Tom Monteleone, an avid science-fiction buff, called to ask a question. Then Monteleone suddenly thought: *Just for the heck of it, why not claim I've been to Lanulos, too? It'll blow his mind!*

And so he did, and it did. The dumbfounded "contactee," Woodrow Derenberger, quickly regained his composure and corroborated Monteleone's description of the planet Lanulos, agreeing with details that contradicted things Derenberger had just disclosed on the show. Fifteen minutes later, Monteleone hung up and enjoyed a good laugh with his roommates—until the phone rang. The radio station had traced his call and now wanted further information.

For the next two years, Monteleone went along with the ruse, cleverly providing UFO investigators with information gleaned from Derenberger's accounts and from the general UFO literature. Whenever he corroborated information given earlier, his credibility rose further (he had told investigators that he was unfamiliar with UFO literature and they believed him). UFO publicist Harold Salkin was impressed that Monteleone's story was "so tightly synchronized with Derenberger's, UFO writer and editor Timothy Green Beckley taped an interview and wrote several magazine articles that presented the account as factual. noted UFO author and theorist John Keel called the story "one of the most puzzling contact stories in my files. I'm forced to accept that it's true" (even though, as Monteleone noted, Keel's published accounts of the story were vastly distorted).

I underwent long interviews," Monteleone recounted in *Omni* (May 1979). "I not only repeated my false experiences but also added further embellishments and absurdities—just to see how far I could carry the hoax before being discredited." Monteleone even submitted to a hypnosis session sponsored by Salkin, during which he faked the trance and "passed" the test like a champion.

Strangely enough, when the full admission of the hoax was published in *Fate* magazine late last year (*Omni* had scooped *Fate* by a year and a half), Monteleone was the one blamed for all the confusion. His actions, wrote author Karl Pflock, "served to muddy still further the already muddy waters of ufology. The last thing we need...if we are to unravel the UFO mystery is false leads that absorb any part of the far-too-limited resources of serious researchers"—which Pflock considered Salkin, Beckley, and Keel, among others, to be. This ironic complaint appeared to absolve the gullible investigators of any responsibility for their careless and credulous acceptance of Monteleone's deliberately absurd fabrications. *Fate* magazine seemed to be saying that it was not their fault that they were hoaxed.

Some other reactions to Monteleone's confession are quite amusing. Salkin, who is described by long-time ufological observer James Moseley as "a warm, likable but somewhat gullible sort," still refuses to believe Monteleone's confession. Keel is particularly upset and has issued a statement calling the *Fate* piece "an attempt to discredit my entire body of work and my professional reputation as a journalist for over 35 years." Keel is preparing a lawsuit, according to some accounts.

As for Beckley, he has to worry about fresher wounds in his credibility as a competent UFO investigator. In a recent issue of his monthly tabloid *UFO Review*, Beckley apparently became the victim of yet another UFO hoax.

In an article entitled "Erotic Encounters of the Very Close Kind," Beckley opened with the startling words: "It is not uncommon for the occupants of UFOs to have sexual contact with humans." He tried to lay the foundation for this far-out story in an editorial on the facing page. "Some readers undoubtedly will believe that we are getting a wee bit carried away when we turn to sex in order to sell a UFO newspaper. ... We really aren't trying to capture a larger audience by printing a sensationalistic headline on our cover. If we wanted to take this approach we'd simply fabricate the stories we print. But we don't cater to the gullible. All the items we mention in our story are fully documented. We need not substitute fiction for truth—for truth is far greater than fiction in the field of UFOlogy."

The principal source of Beckley's saucer sex story was a newspaper account dated February 12, 1978, which carried the headline KIDNAPPED TO VENUS. Reporter Jerry Burger told of a thirty-one-year-old librarian found by police as she rambled around in a park wearing no clothes. She claimed she had been "abducted by Venusians" and taken to the "back of the moon," where she was "implanted with outer-space semen" before being returned to Earth. Beckley reported the case as true and added that "such reports are taking place on a global scale. ... There can be little doubt from the documented evidence that some tremendous event is slated to happen that will guide us to a higher understanding of ourselves and the cosmos. The UFOnauts are trying to teach us a lesson—that love is universal and encompasses every living creature regardless of their planet or dimension of origin." And for those readers who wanted more information, Beckley added that the "saucer sex" story is just one chapter in his new book *Strange Encounters—Bizarre & Eerie Contacts with Flying Saucers*, avail-

able from the author for $6 95 plus postage and handling

Unfortunately Beckley's story is even more absurd than it first appears Houston spaceflight expert Robert Nichols sent *Omni* the actual source of the "outer-space semen" story in the form of the newspaper clipping Beckley quoted The article did not come from a newspaper at all but from a 1978 satirical publication the *Sunday Newspaper Parody* written by the *National Lampoon* Beckley (or someone on his staff) evidently made some editorial changes by adding realistic touches to the article and changing the original spelling of the saucer-rape victim from the highly suspicious "Penelope Cuntz" to the acceptably ethnic "Penelope Kuntz " Beckley also altered the name of the newspaper from the ufopian Dacron Ohio *Republican-Democrat* to the Toronto *Sunday Sun* The entire account then is a fictional spoof but the extent of Beckley's role in promoting and altering it (or merely passing it along credulously) is still undetermined

Photographs are even more subject to hoaxing In fact while only a very small percentage of raw UFO reports are hoaxes it is generally acknowledged even by UFO believers that the overwhelming majority of published UFO photographs are hoaxes—either forgeries models or misrepresented ordinary phenomena

A classic UFO photographic hoax involved the "Fogl flying saucer" pictures taken in December 1957 and first published in 1959 As chronicled by skeptical ufologist David A Schroth the photographs were embraced by magazines in Great Britain and the United States, UFO experts argued that some features on the bottom of the flying saucer were identical to features seen in other photographs testifying to the authenticity of Fogl's photographs American UFO publicist Ray Palmer declared "We are forced to admit this is not a fake " In 1966 one of the photographs was presented as authentic in *Life*

That may have been the last straw for Fogl who finally revealed that the UFOs were faked—made with a small model hung on a wire When asked why he did what he did Fogl replied that he wanted to show that certain people make utter fools of themselves Far too many people make a racket of the UFO business writing phony books supported by faked pictures "

As if in fulfillment of Fogl's point UFO writers continued to use the hoax pictures Palmer (who is credited by UFO historian Daniel Cohen with having invented the concept of "flying saucers") wrote that it was "impossible" for the photos to be fakes and that Fogl's confession must be a hoax And in 1979 McGraw-Hill published David C Knight's *UFOs A Pictorial History* with page 86 proudly presenting one of Fogl's pictures as still authentic

Another famous UFO hoax provides eloquent warning against well-meaning UFO stories that originate at a great distance in space or time They are thus immune from any real investigation If they are hoaxes it is next to impossible to prove

As part of a "UFO flap" in 1897, the story of Alexander Hamilton of Yates Center Kansas stands out The farmer reported that a cigar-shaped airship flown by jabbering humanoids hovered over his farm and caught hold of a calf with a rope Hamilton's account was published in the local newspaper along with a statement vouching for his honesty signed by five leading citizens of the town The story rapidly spread around the world and for decades UFO writers considered it one of the best-documented "close encounters of the third kind" ever

Hamilton and the five leading citizens actually had organized a local Liars Club and Hamilton's "calfnapping airship" whopper a tall tale through and through topped all other fabrications The newspaper story was all a joke as it turned out but neither the editor nor the town citizens realized how seriously the outside world had taken the account It was not until early 1977 that the full story appeared in *Fate* magazine Associate editor Jerry Clark a diligent and highly principled pro-UFO investigator revealed what he called "the biggest hoax ever known in UFO history" when he published hitherto-unknown documentation that established beyond a shadow of a doubt that the Kansas farmer's story was phony

But the same old uforic patterns continued New writers based their books and articles on older UFO books and articles not relying on original sources or their own independent verification Among the subsequent UFO literature that continued to use the Hamilton story as if it were authentic were Knight's *UFOs A Pictorial History* and *Ripley's Believe It or Not Stars Space and UFOs* (thirty-third in a series)

The January 1980 issue of *UFO Journal* (issued by MUFON the Mutual UFO Network a well-organized private research group with a good reputation) provided some very interesting insights into the minds of a UFO hoaxer and of the UFO investigator who worked on the case The witness was a twenty-six-year-old security guard who claimed to have encountered aliens in the San Joaquin Valley on February 27 1977 A year and a half later after trying to dig up supporting evidence he contacted MUFON

The investigator (who along with the witness was kept anonymous in the article) reported "I was impressed with this young man's sincerity his apparent honesty and his concern that he was unable to locate any other witnesses I am by nature a cautious and suspicious person having run into enough hoaxes and fraudulent cases in my 22 years of investigation to give me adequate insight and recognition for such incidents I was quite satisfied as to his honesty The UFO incident filled nearly four pages in the magazine

But at the end of the article the entire tone changed. "The important message for all of us," wrote editor Richard Hall, "is that this case is a hoax—a confessed hoax." The investigators didn't find this out for sure until the article had been typeset, but they decided to publish it anyway as a lesson in human vulnerability to hoaxes. The story content fit so well with other cases, and the reporter seemed so sincere and in a responsible position, that we were nearly taken in." Even without the confession, MUFON investigators had become suspicious of glaring discrepancies in the story as told to different investigators, but even those considerations might not have been enough to prove the case a hoax if the witness himself had not confessed when confronted with the inconsistencies and contradictions in his story.

In a letter to MUFON, the hoaxer (code-named Carl to preserve his anonymity) explained his motives. "All my life I had been a nobody, unimportant. I wanted to be important. I am not psychologically deranged but just wanted some attention." But he had not apparently acted as if he sought attention. He certainly had not sought publicity. Indeed, the investigator had originally reported that "fearing ridicule and harassment from friends and coworkers, Carl kept this story to himself until he simply had to tell someone who would help ease his frustration and anxiety." Evidently the adequate insight into hoaxes that the MUFON investigator claimed to possess involved something other than factual evidence.

MUFON's decision to publish the San Joaquin hoax story with the confession was a courageous one, since it did make its investigator sound rather foolish. But the UFO group demonstrated commendable maturity in choosing to try to have all its investigators learn from the experience, lest it be repeated on a wide scale. It still may not help.

The other famous hoaxes were not universally swallowed, either. Monteleone's space trip to Lanulos was never believed by most of the "nuts and bolts" UFO buffs who have for so long despised the crackpot contactees and the bad publicity they have brought to the subject. James Moseley, editor of *Flying Saucer News*, wrote that Monteleone clearly was not a "classic contactee" and evidently never believed his own story. A perceptive conclusion! However, the Fogi photographs and Simpson's experiment in England would probably not have survived the sophisticated photoanalytical techniques now used by some UFO groups, notably William Spaulding's high-technology Ground Saucer Watch in Phoenix and the GEPAN laboratories in Paris.

The extent to which serious UFO groups seem determined to detect and reject hoaxes was demonstrated last year when virtually without exception all major groups and leading investigators publicly denounced Genesis-III Productions' photo book *UFOs: Contact from the Pleiades*. While the strikingly handsome collection of flying-saucer photographs was being billed by its publishers as the greatest UFO breakthrough in human history, a number of pro-UFO researchers circulated reports that claimed that the whole business was a money-making fraud. For once UFO skeptics agreed with their traditionally antagonistic pro-UFO counterparts, though a Genesis III spokesman continues to deny that his company is involved in any hoax.

UFO skeptics, however, go even further in their allegations that there have been hoaxes, and they find themselves in bitter disagreement with pro-UFO forces. Some of the highly publicized classic UFO encounters (such as the 1973 Pascagoula fishermen's account and the 1975 Snowflake, Arizona, woodcutters' account) and some of the classic UFO photographs (such as the 1950 McMinnville photos and the 1957 Trindade Island photos) are considered by skeptics to be hoaxes. Half of the "best UFO cases" of the 1970s—as judged by a blue-ribbon panel of UFO experts sponsored by the *National Enquirer*—are considered hoaxes, according to independent research by skeptics. Here the battle lines are clearly drawn.

Suggesting that a UFO case is a hoax poses delicate problems. First of all, the UFO witness (whether a hoaxer or not) may have grounds for a libel lawsuit. Although many threats along these lines have been made, so far no suits have been filed. Second, without a confession it is extremely difficult to *prove* an accusation of "hoax," however spurious the story may sound. Last, UFO skeptics (in particular, the world's undisputed leading skeptic, aviation journalist Philip J. Klass) open themselves up to countercharges of "character assassination" and "vicious ad hominem attacks" when they point out, usually quite correctly, that the reliability of many famous UFO witnesses is highly questionable because of their past and subsequent histories of exaggeration, fantasy and outright deception (pro-UFO groups generally downplay or even cover up such behavior on the part of people whose credibility they wish to emphasize).

Despite the problems caused by UFO hoaxes (mainly, that they can be far more difficult to solve or even recognize than are "ordinary" honest UFO reports), these patterns in deception can be made useful. Successful hoaxes can help calibrate the reliability of UFO research, as in the case of Monteleone's and Simpson's hoaxes; hoaxes can also instruct serious investigators in caution and humility, as with the San Joaquin hoax reported in *UFO Journal*. The claim of the superskeptics that unsolved UFO cases can all easily be dismissed as unrecognized hoaxes is unsubstantiated; the claim of UFO eager believers that the hoax problem is under control is equally unsubstantiated if not refuted. And since no one wants to look foolish, the disagreement continues. ◻◻

MUSIC

CONTINUED FROM PAGE 27

ological applications of music. We probably know more than anyone else about the psychological and physiological effects.

"What we claim to offer is a really functional music in worker areas. We arrange and record all our own music, and we give it a stimulus factor. Then we play in fifteen-minute segments, on and off, programmed sequentially so that the last composition in the fifteen-minute segment has the maximum amount of stimulus value. Although it's not entertainment, we still use music from the Top Hundred, and we even compose some of our own."

Muzak is made in the studios of the company's world headquarters at 100 Park Avenue, in New York City, by musicians like Dick Hyman, Warren Covington, Lionel Hampton, Tony Mottola, Al Caiola, and maybe even Bucky Pizzarelli. After the compositions are properly mixed, they're put in the library where they become part of the daily schedule of programming.

All the programming is done by computer. There is a computer printout for each day. A program is never repeated. The programmers produce 24 hours' worth of music every day.

The printout for this day's program, tomorrow's program, and so on, goes out to Westbury, Long Island, where there's an automated studio. Until very recently the program was duplicated onto tapes that went on a 15-city circuit about every three days. First the tapes were played at 100 Park Avenue and then, by lease line, went to the antenna atop the Empire State Building. There the tapes were transmitted on the subchannel of an FM station before being sent to Philadelphia and then to the next city on the circuit. Ultimately they returned to Westbury, where the process began all over again.

Now Muzak is going satellite. Instead of producing tapes, copying them, and sending them city to city, Muzak is beamed directly from the satellite to the subscriber.

The price of a subscription depends upon the number of speakers a restaurant, office, or elevator has. The greater the number of speakers, the greater the distribution on the subscriber's premises. A simple little restaurant with two or three speakers may pay $40 a month. And then there are installations that pay $10,000 a month per franchise.

"We have four programs to choose from: Office, Travel, Public Area, and Industrial, which has lots of brass. Most of the heavy industry that we play is at night, because the workers on the third shift require the greatest amount of stimulation. That's why they get a lot of brass."

A whorehouse in Stuttgart requested a "Light Industrial Program," although it's not clear to Bing Muscio whether it was to increase the workers' productivity or to relax the customers. ◻◻

COMMUNICATIONS

CONTINUED FROM PAGE 10

fine and a laudable one; reality dictates that the human race has not yet reached such a level of progress and unity.

The Communist doctrine maintains that capitalism is merely a tool in the hands of "imperialist aggressors." Yet, by observing recent history one cannot help noticing that the USSR has cast an ever-widening shadow of imperialist influence and aggression over the world, not necessarily for the good of the common people.

Can we doubt that this philosophy will be carried into space as well? Leaders of democratic countries should not allow such dangerous weapons to be placed in orbit by a government that is totally hostile to democratic societies.

Frank D. Patrick
Clem, W.Va.

The Stealth Brouhaha

As a writer who specializes in aviation, I was interested in "The Stealth Affair" [Continuum, April 1981]. Paul Nahin is correct in disclaiming former President Carter's statement that the Stealth aircraft was a technological breakthrough, but it is certainly far more than a "rubber-coated airplane."

Stealth is a combination of technologies: structural materials, air frame and engine design, and electronics, all of which exploit the physical properties of radar and infrared detection.

Radar-absorbing coatings are only one small element of the Stealth program. Another type of coating uses a phenomenon of physics known as destructive interference. Graphite fibers, epoxy resins and high-strength ceramics reflect radar more effectively than conventional metals do. An aircraft design with a small cross section, curved surfaces, and no sharp angles intersecting edges, engine pods, or vertical control surfaces will produce a much weaker echo. Finally, there are electronic systems that can deceive and baffle radar.

Dr. Nahin got the politics right on the Stealth brouhaha, but the technologies and electronic countermeasures involved are equally important.

John-Allen Price
Lewiston, N.Y.

Moon Rocks Revisited

I was fascinated by the more serious side of David Saltman's Last Word [November 1980] concerning lunar rocks.

In the science-fiction novel *Inherit the Stars*, by James P. Hogan, a 50,000-year-old human skeleton in a space suit is found on the moon. At that time *Homo sapiens* could not have evolved to this human form, much less to the level of intelligence required for space travel. This man could not have existed. The evidence of rock samples piled randomly only on the far side indicates that a major cosmic blast occurred in our galaxy 50,000 years ago.

I thought Hogan's book was pure science fiction. Imagine my surprise and excitement on reading Saltman's article. There really is a difference between the two sides of the moon! Imagine my anger and dismay that most of the rocks retrieved by *Apollo 11* are still lying penned in silence, begging to blurt their knowledge of the time, place, and cause of Earth's birth.

As demonstrated by Hogan's book, an open mind, a unique line of thought, and a willingness to challenge the obvious and the widely accepted are necessary for man to succeed. Fear of the unknown should not hinder our healthy curiosity.

Julie Palmer
Toronto, Ont., Canada

Worried about Washoe

Thank you for the way in which you handled the article that told about my accident with Washoe, the first chimpanzee to learn human sign language [People, February 1981]. I worried that a report of this kind might damage the possibilities for future work with apes, but Ms. Rob's treatment of the incident was such that there couldn't be any adverse effect.

Let me take this opportunity to tell you how much my family and my coworkers appreciate the good job *Omni* is doing.

Karl H. Pribram
Stanford, Calif.

EXPLORATIONS

CONTINUED FROM PAGE 30

of exploring Russian spacecraft In the highest orbit stoically presiding over the hall is a great bronze head of Lenin

As you wander around these museums and monuments a great many impressions begin to crystallize The first few are obvious The sheer number of these memorials and the titanic size of some speak of a great national pride in and grass-roots commitment to the Soviet space program But these observations don't get at the Russianness of the matter The United States also boasts of a great many aerospace exhibits most of them larger than anything comparable in the USSR The differences between Eastern and Western attitudes toward space exploration are far more subtle bound up with the history and temperament of the people

The omnipresent likeness of Lenin is one clue It's not a simple case of hero worship for a founding father One of Lenin's legacies in the Soviet Union is a profound belief that science and technology can lead the way to utopia

In the Soviet government's earliest days when its very existence was threatened by civil war, Lenin set up one research organization after another determined to build a powerful scientific community Cosmonautics is one of the most visible and most successful scientific programs in the USSR Here the countenance of Lenin becomes a symbol and a reminder of the Soviet people's faith in *nauka* the productive force of science and technology in Communist society

There are also some subtle insights to be squeezed from the massive bronze and concrete monuments though not so much from size as from design The Social Realism school of sculpture uses every device to convey dynamic movement Figures never stand they stride The air is never still around them the wind whips their coats The Monument to Space Conquerors is a rocket that shoots heavenward riding a bronze trail of exhaust These sculptures may seem melodramatic to Westerners but there is something about them that evokes an emotional response Compare the 15-story-high Monument to Space Conquerors with a leviathan space memorial in the United States the Saturn 5 moon rocket lying on its side at the John F Kennedy Space Center The cigar-shaped rocket rising above Moscow may look like a science-fiction caricature, but which monument communicates more of a feeling of progress?

In the Kaluga museum there is a working model of the Cosmodrome at Baikonur It's not sophisticated as models go The operator is in full view of the audience and the rocket never quite launches but it has a magnetic appeal for Russian visitors Children adults and important-looking figures in military dress crowd around and hang over the balconies on the upper levels intent on watching the tiny *Vostok* rocket as it swings slowly into launch position

Somewhere a patriotic theme begins to play softly Over that a tinny sound two men talking the original recording of Korolev addressing Gagarin moments before liftoff on April 12 1961

Korolev How are you feeling?

Gagarin I'm not worried I feel fine How are you feeling?

Suddenly the music swells to a crescendo and the museum shakes as the rockets burst into life From atop the thunder Gagarin shouts *'Peahyekalee!*

Now freeze the action a split second after liftoff a split second before the visitors to the museum break into an ovation on that one word *peahyekalee!*

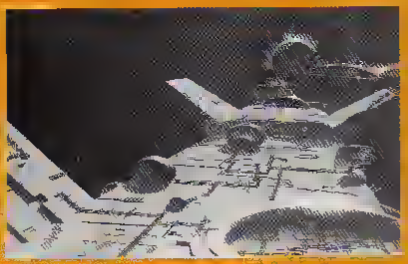
It was the spontaneous exclamation of a young man about to do something no one had ever done It was the speech that inaugurated the Space Age A simple Russian colloquialism it sums up a cultural experience It's best translated as 'We're off!' But it carries with it a whole universe of meaning adventure expectation and the love of a rider for his steed

And it's that one exhibit, that one word played over and over amid the electronic hiss and noise and rumble of rockets that perhaps best defines the relationship of Soviet citizens to the awesome technology of the Space Age

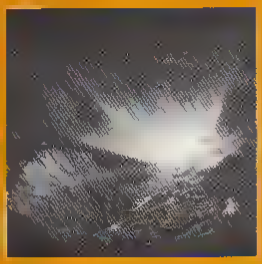
NEXT OMNI

STAR LAWYER

RIGHT TO DIE



FICTION



EDEN

ATTORNEY TO THE STARS—Art Dula takes on the big questions. Who should mine the moon? Who pays if a rocket crashes? Who owns the stars? He finds the answers in the laws of the Roman Empire. Working out of a computerized house in downtown Houston, Dula is the first lawyer in private practice to devote himself to space and technical law. At thirty-three, he is already odds on to be the first federal judge on the moon. To find out why, see this exclusive profile in the August *Omni*.

THE RIGHT TO DIE—One spring morning in 1975 Derek Humphrey handed his wife a cup of coffee containing a lethal mix of sleeping pills and painkillers. With his emotional support, Jean Humphrey had decided to end her long and painful struggle against cancer. Derek has gone on to lead the grass-roots suicide movement, promoting the right of the aged or the terminally ill to end lives they find intolerable. The society he founded, Hemlock, has 15,000 members and is growing rapidly. A more radical group, Exit, is bent on bringing out a detailed how-to of suicide. Battling fierce opposition, the right to die movement has gained startling momentum on both sides of the Atlantic. Read about these groups next month.

VISIONS OF EDEN—The interpenetration of ocean, mountain, and sky is the subject of "Green World," next month's pictorial. The art of Friedrich Hechelmann, with text by Robert Sheckley, explores a strange, yet familiar world of the imagination, the primal garden that calls to us from our genetic memories. A leading painter from Vienna's school of Fantastic Realism, Hechelmann has displayed his distinctive style in many exhibitions and films. He recently illustrated a book of gothic tales. Next month in *Omni*, the artist celebrates the illusive paradise of our mind's eye.

INNOVATIONS—Many breakthroughs in personal technology are transforming the ways we enjoy our leisure time. Next month *Omni* selects the best of innovative products that facilitate outdoor summer explorations. An underwater telephone, a jet surfboard, and a parafoil kite are to be found among the fantastic machines and gadgets composing a portfolio of items that fuse nature with technology. Look for our rundown on what's up in electronics, sports machines, and ingenious devices.

SCIENCE FICTION—Included in the August issue are an excerpt from Ben Bova's new novel *Voyagers*, speculating on humankind's first contact with an alien in space, a lighthearted story of the unexpected havoc wreaked by Ian Stewart's miniature robots in "The Microbotic Revolution", and Melisa Michaels's tale of a sentient spaceship determined to reach the stars, "I Am Large, I Contain Multitudes."

COMPETITION

CONTINUED FROM PAGE 113

powers to protect their secret
—Susan Daniels, Moab, Utah

On August 1, 1981, one person will be randomly selected from the list of charter subscribers to *Omni* and awarded room aboard the space shuttle *Columbia*.
—P. Demarest, Pensacola, Fla.

Jeane Dixon predicted that a mass murder would occur in the basement of a dormitory at a Big Ten university, but her publishers didn't print the prophecy for fear it would cause a panic.
—Steve Banker, Bloomington, Ind.

The nuclear plant that powered *Skylab* separated and stayed in its orbit when *Skylab* crashed. In March 1980 it fell to Earth unheralded and crashed into the dormant crater of Mount St. Helens where it triggered the eruption of that mountain.
—Dale E. Currier, Portage, Me.

Walter Cronkite has no legs.
—Stan Gilbert, Jr., Austin, Tex.

Einstein solved the unified field theory long before his death, but he carried the secret to his grave because he felt that man was not yet ready for the knowledge.
—Lona Rawlings, Santa Barbara, Calif.

All food in New York City's Chinatown restaurants comes from one huge underground kitchen.
—Francesca Heller, New York, N.Y.

Mystery singer Leon Redbone is actually Frank Zappa in disguise.
—The More Freedom Rhapsodists, Tipp City, Ohio

Parking meters are designed to speed up during the last ten minutes of an hour.
—Vincent J. Kish, Bellerose, N.Y.

The insignia at the base of JFK's neck on the half dollar is a hammer and sickle. It was placed there by the coin's designer, a Communist sympathizer, and was not noticed until the coin was in circulation.
—Richard W. Fulton, Walkerton, Ind.

Mae West died of toxic shock.
—Doug Thomson, Soquel, Calif.

Swine flu shots actually were vaccinations against a virulent bacterium that escaped through negligence from government research laboratories.
—Tony Reeder, Bowie, Md.

The Japanese actually bought the 100-mpg carburetor from an unknown inventor in 1952. It was not, as is often said, bought by the big oil companies and then buried. Now, after many years, the Japanese are using this invention against us, but only ten

mpg at a time This year the 50-mpg car next year the 60-mpg car and so on
—Peter Lefferts San Martin, Calif

Jimmy Hoffa is alive and helping to organize the labor movement in Poland
—Gordon Dodge DeSoto, Mo

The FBI was responsible for seeding the clouds above the Woodstock Festival
—Anthony Connolly, West Bridgford England

Flossing is the only effective way to loosen dental fillings
—Alan M Schwartz Costa Mesa Calif

Omni is suing the Four Sigma Society, publishers of "The World's Hardest I Q Test" (April 1979) for inordinate delays in processing the score reports of readers
—A Fixx, Detroit, Mich

A few years ago there was an attempt to remove superglue' (cyanoacrylate) from the market The reason given was the possible danger to children s skin and eyes The real reason was that an irate Michigan housewife discovered her husband's infidelity and glued his penis to his leg while he slept
—Dan Blake, Elkhart Ind

There is only one fruitcake in the entire world, it is simply passed around from person to person changing hands every Christmas
—A Baird, Davis, Calif

Here We Go Again Dept Dr Charles Drew, the black American physician who discovered a way to separate blood for storing, died outside a hospital because it was for whites only
—Dennis Hotter Independence, Mo

East and West Africa have a rift between them
—Isaac Asimov New York, N Y

Ambrose Bierce Judge Crater, and Amelia Earhart are living in a *ménage à trois* in Nicaragua
—Harlan Ellison Sherman Oaks, Calif

Corrugated paper clips were taken off the market because they work too well The manufacturers found that smooth clips slide off and are lost more readily bringing a faster turnover in sales So smooth clips are now all they sell
—Martin Gardner Hendersonville, N C

The *Omni* Games editor is a CIA spy, using the Games column as a tool for hunting out people of a devious enough intellect to pose a possible threat to the U S government Anyone who sends in a really creative answer to a problem or a Competition disappears within a few days and is never heard from again
—Timothy A Livengood St Louis, Mo

LIFE

CONTINUED FROM PAGE 16

sperm away from it Each testicle should be examined separately with both hands by holding it between the thumb and index finger and rolling the organ to sense its smoothness and firmness

'Any lump in the testicle can be presumed to be cancerous until proved otherwise," Dr Garnick warns "Many men with testicular cancer have made the mistake that an enlarged testicle is a sign of greater virility and have postponed a visit to the physician until it was too late "

Any enlargement, hardening or lump not associated with infection should be checked immediately by a physician, preferably by a urologist

While all of this may astound or frighten most men" Garnick says "keep in mind that just ten years ago the chances of surviving testicular cancer would have been as low as ten to forty percent Death often came within two years of discovery But today there's a ninety-five to one hundred percent chance of survival if we catch it early enough while the cancer is still confined to the testicle

To promote wider awareness of the disease the Farber Institute and the Massachusetts chapter of the American Cancer Society have designed a project to educate teen-agers and their parents The Massachusetts ACS has published pamphlets and lends out a ten-minute film depicting a case history The American Cancer Society in New York is preparing similar publications which will be distributed later this year

Obviously" Garnick concedes, "there s a long way to go before the men and boys of America come out of the Dark Ages and realistically confront the threat of testicular cancer But I believe that before this decade is out we shall all be changed by this knowledge Already the Army and the Navy are using our procedure in a film for their recruits I see the day not too far from now when young men will be completely comfortable in their knowledge of sexual health just as they are today with tooth decay prevention "

For more information on testicular cancer, send for the brochure "TSE," available at no charge from the American Cancer Society 247 Commonwealth Avenue Boston MA 02116

Schools civic associations and other appropriate organizations can also borrow, or buy for $200 the ten-minute film about testicular cancer suitable for general audiences Write to Norwich-Eaton Pharmaceuticals Film Library Norwich, NY 13815

The American Cancer Society headquarters in New York distributes to its local chapters throughout the country a brochure entitled 'Facts on Testicular Cancer" To obtain more information write to the American Cancer Society 777 Third Avenue New York NY 10017

RETHINKING HUBBLE

STARS

By David K. Lynch

It isn't every day the universe shrinks much less in half. It happened, though. On November 8, 1979. And, unlike the rest of us, it got younger, by between 6 billion and 9 billion years.

If you didn't notice, don't worry about it. It was nothing dramatic. The stars didn't suddenly leap closer; it was only a quiet announcement at a meeting of astronomers. All the same, the universe was suddenly a lot smaller and younger than most of them thought.

What happened is that three American scientists—John Huchra, of Harvard; Marc Aaronson, of the University of Arizona; and Jeremy Mould, of Kitt Peak National Observatory southwest of Tucson—reported a new estimate of the Hubble constant, H. Along with a number called the deceleration parameter, H determines the size and age of the universe. Much of today's cosmological research hinges on the magnitude of the Hubble constant.

Edwin Hubble was a tall, chilly Missourian who spoke with an Oxford accent and spent most of his career at California's Mount Wilson Observatory. If was Hubble who proved that the long-mysterious nebulae were galaxies like our own. He had measured the distance to many of them.

Then, in 1927, Hubble compared his work with that of Vesto Slipher, of the Lowell Observatory in Flagstaff, Arizona. Slipher had spent several years studying the nebulae and, much to his surprise, had discovered that nearly all were moving away from Earth, at speeds up to 1,000 miles per second. What Hubble found was that the farther the galaxies were from Earth, the faster they were receding. He had found the expanding universe predicted by Einstein's theory of general relativity in 1916.

What is more, he had found a clear relationship between the velocity of a receding galaxy and its distance from Earth. A galaxy leaves our neighborhood at roughly 525 kilometers per second per megaparsec (about 3.26 million light-years), or 360,000 miles per hour per million light-years. And that is the Hubble constant. Once it is known, we can calculate the size and age of the universe, the lower the constant, the larger and older the universe.

Hubble's estimate turned out to be too high. It has fallen—and the universe has grown—with each revision ever since. For the past two decades the leaders in refining the Hubble constant have been Allan Sandage, of the Hale Observatory; Gustav Tammann, a Swiss; and Gerard de Vaucouleurs, of the University of Texas. According to Sandage and Tammann, the Hubble constant is roughly 50 kilometers per second per megaparsec, which puts the age of the universe at about 18 billion years. De Vaucouleurs, however, believes the constant is about 100 and the age only 9 billion years.

There are several reasons for this conflict, but one is crucial. De Vaucouleurs has found that the Milky Way is being pulled toward a congregation of galaxies located in the constellation Virgo. Our speed, 450 kilometers per second, or about 1 million miles per hour, makes the Virgo "supercluster" appear to be receding more slowly than it really is, reducing the estimated Hubble constant. De Vaucouleurs compensates for this by measuring the distance of galaxies outside the supercluster. Sandage and Tammann do not. But their estimate has been almost universally accepted for the last decade. All of this brings us back to November 8, 1979.

Edwin Hubble. His constant is still changing.

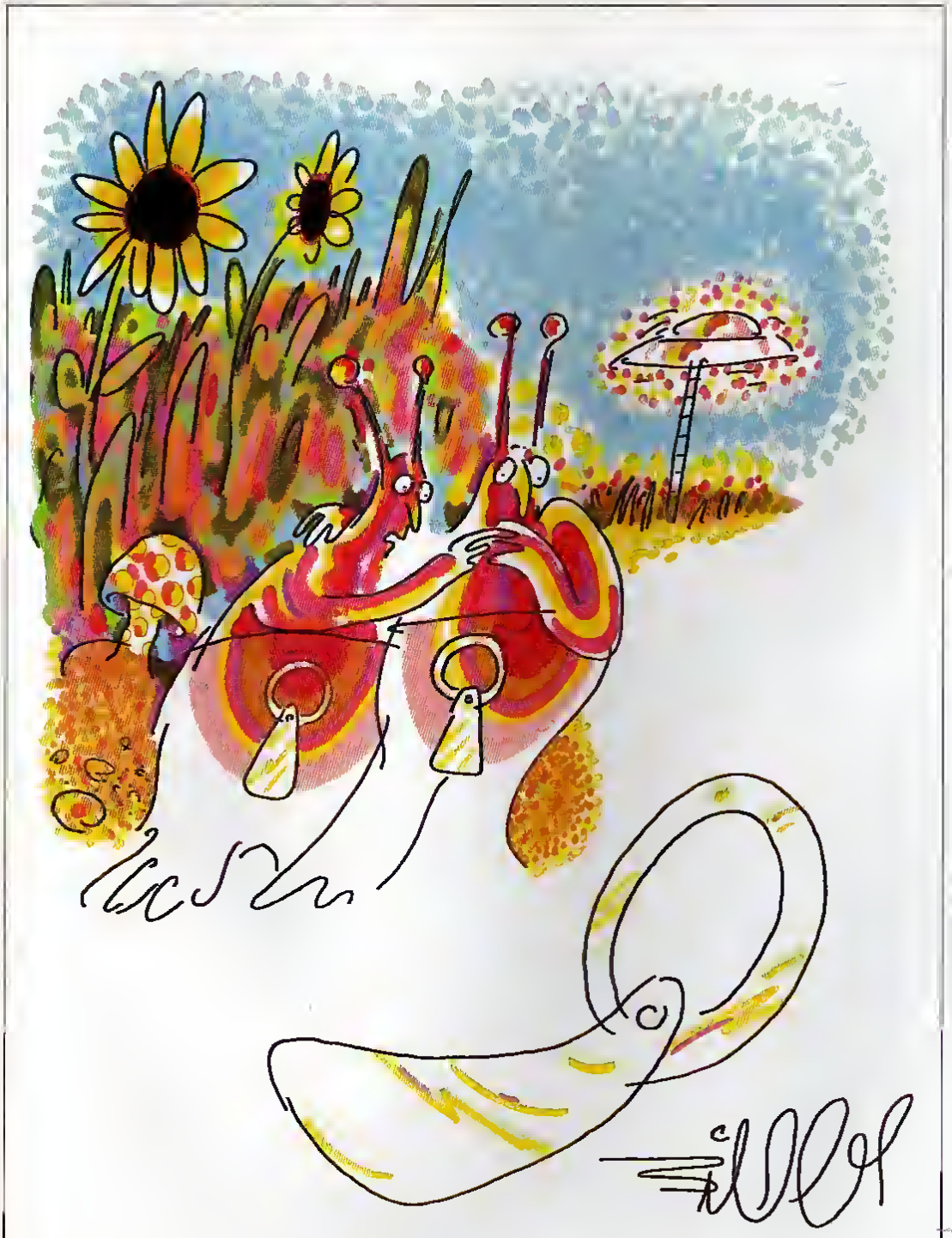
Huchra, Aaronson, and Mould have found what they believe to be a reliable new way to measure the distances to far galaxies. They start by examining the frequency and shape of radio waves emitted by hydrogen in a galaxy. The signal's frequency depends on the speed at which the galaxy is moving away from the earth, and its shape depends on the galaxy's speed of rotation.

The astronomers already knew that a galaxy's rotation and intrinsic brightness are governed by its mass. So they could string all these functions together with a little complicated arithmetic and calculate the galaxy's distance by measuring how bright it appears. Compare with other galaxies, and you have a new estimate of the Hubble constant.

When Huchra, Aaronson, and Mould looked at galaxies outside the Virgo supercluster, they found a Hubble constant of 95 kilometers per second per megaparsec—almost exactly what De Vaucouleurs had been claiming for years. That makes the universe roughly 9 billion years old, half the commonly accepted age. And if the universe is half as old as we thought, it must be half as large.

Like many scientific debates, the controversy over the Hubble constant hinges less on the accuracy of the measurements than on the assumptions that go into interpreting them. Each team can cite flaws in the arguments of the other, and for the moment neither side of the debate is clearly stronger than the other. Most astronomers are waiting to see more and better observations before they take sides.

Meanwhile the universe, quite unconcerned with our struggle to discover its size and age, continues to expand—as it has for 10 billion or 20 billion years.



"It s the codpiece of a giant!"

PHENOMENA

A scar from welding steel to glass tears a path across a sculpture that abstractly portrays the scope of the universe. In the city of Kristiansand, in southern Norway, the sculpture bears the welding mark of its sculptor, Marius Heyerdal, to signify the riveting effect of a marriage between two elements in our cosmos. Photographer Károly Buday focused on this aspect of the glass and steel sculpture to magnify and enhance the symbolic scar. Thus, the camera converts sculpture into a new visual expression—a metamorphosis created and controlled by the artist-photographer. "Through photography we can see things we would not be able to see in any other way. We cut through the visible to see the 'invisible,'" Buday says. He closed in on the scar with a Canon 50mm lens, attached to a Canon F-1, set for a 1/30th-second exposure. The blue and gold fusing of metal to glass was captured on Ektachrome X film.

Soapy Sam strikes again, and a baby step for man

GAMES

By Scot Morris

Samuel Wilberforce, bishop of Oxford nicknamed Soapy Sam by his contemporaries because of his slippery debating tactics, is best remembered for his confrontation in 1860 with Thomas Henry Huxley before the British Association for the Advancement of Science in a debate over the new theory of evolution.

Wilberforce was also a puzzle maker. Last December we printed four unsolved riddles attributed to him that had been sent to us by Dr. Richard Wrangham, a distant relative of Wilberforce's and a biologist and research fellow at King's College, Cambridge, England. The riddles were discovered in the bishop's personal papers, Wrangham said, and as far as he or other Wilberforce descendants knew none had yet been adequately solved.

We challenged our readers to solve the Wilberforce riddles and offered $50 for the best solution to each riddle. As always, we underestimated readers' ingenuity. Thousands of cards came in, analyzing these enigmas from every conceivable angle. Some riddles attracted hundreds of different answers, others arrived with long explanations often in rhyme. We picked out the most plausible, most clever, and most outrageous of these and sent a summary to three guest judges for their opinions: Willard R. Espy, author of numerous wordplay books, most recently the delightful *Another Almanac of Words at Play* (Crown, 1980); A. Ross Eckler, editor of *Word Ways*, the journal for logophiles, and Will Shortz, puzzle editor of *Games* magazine.

These eminent wordsmiths indicated their preferred "best" solutions, and we made a final judgment in the case of disagreements. All cards containing the chosen "best" solution for each riddle were placed in a pile, and the money winner was chosen randomly from them (using the last digits of numbers in the Manhattan telephone directory).

Here, then, the results of our quest to crack the bishop's century-old enigmas:

RIDDLE #1

I'm the loudest of voices in orchestra heard
But yet in an orchestra never was seen
I'm a bird of gay plumage, but less like a bird
Nothing in Nature ever has been
Touching earth I expire, in water I die
In earth I lose breath, I can swim, I can fly
Darkness destroys me and light is my death
I can't keep alive without stopping my breath
If my name can be guessed by a boy or a man
By a girl or a woman it certainly can

This one proved the toughest, with the widest variety of entries and the smallest consensus. The commonest solution was *orchid*, allowing a stretch of the imagination to make the lines fit ("in water I die"?). Henry Ernest Dudeney, the English puzzlist, wrote in 1920 that he thought *bubble* was the best answer for reasons that seem far fetched, or at least farther fetched than the reasons we found to back our choice for best solution—*whale*. "Orc" (the Latin root for whale) is the loudest syllable in *orchestra*; a blowhole spout could be seen as plumage; a beached whale dies unnaturally; others die in water; a breaching whale "flies." The "Darkness destroys me and light is my death" line may refer to whale oil lamps; and the last lines to whalebone corset stays, both more common associations in Wilberforce's day.

Some other gallant attempts at solution were offered for *sound, wind, gossip, fire* and *the letter k*.

Soapy Sam remains as slippery as ever with this one. *Whale* was judged the best solution, albeit imperfect, and from 21 *whale/orc/orca* entries our randomly chosen winner was Mike Gormly of St. Louis.

It is possible that we still haven't found the answer or the rationale that Wilberforce had in mind; the sentiment expressed by Darrell H. Bartee of Wichita, Kansas:

The bishop went too far this time
In listing clues to make his rhyme
He included everything, I think
Except perhaps the kitchen sink
The answer—as tricky I presume—
Lies by the bishop in his tomb

RIDDLE #2

Man cannot live without my first,
Both day and night 'tis used
My second 's a thing accursed
Both day and night abused
My whole is never seen by day
And never heard at night
'Tis most desired when far away
And hated when in sight

Dudeney discussed the above riddle in *300 Best Word Puzzles* (Scribner's, 1972), calling it an "unsolved enigma that is widely known" attributed to Bishop Wilberforce. His own suggested answer was *heartache*. Probably it is not correct," he said, "but all other attempts seem inferior." Dudeney quotes the last three lines a bit differently: "And never felt by night / 'Tis dear to friends when far away / And hateful when in sight."

Many readers agreed with Dudeney, but we saw too many problems with *heart ache*. An ache isn't abused, a heartache is never desired and never in sight.

We judged the most reasonable answer to be *firefly*. This fits most of the riddle's lines, though the last two still seem to be questionable. If the answer is correct, "in sight" must mean something like "in your eye." From 49 *fireflys* submitted, the winning entrant was Marshall B. Mills of Tucson.

The "my first/my second" format is called a charade and suggests that the answer is a compound word. Some ingenious arguments were made for these alternate answers: *lifetime, willpower, earthworm, homework* and *cockroach*.

RIDDLE #3

Not newly formed, yet made to-day
And most in use while others sleep
What few would wish to give away
And none would wish to keep

At last we have a riddle with a clear solution. Of nearly 1,000 entrants, 255 agreed on a *bed*; the last line refers to the obsolescent phrase "to keep abed," i.e. to be sick. What isn't clear is whether Wilberforce actually wrote this riddle. Other sources attribute it to Charles J. Fox, an eighteenth-century statesman and orator. It is possible that Soapy Sam penned the riddle into his personal papers without noting that it wasn't his own and that his descendants only assumed it was original. (A similar fate may have befallen

riddle #4 which one source attributes to William Cowper)

Some clever arguments were made for a secret a *snoring mate VD a mistress "made" today the letter e* and a *New York City sanitation truck* The money went to Mike Moore, of Springfield, Ohio

RIDDLE #4

I'm just two and two I am hot I am cold
I'm the parent of numbers that cannot be told
I am lawful unlawful a duty a fault
And often sold dear good for nothing when bought
An extraordinary boon—a matter of course—
And yielded with pleasure when taken by force

Love passion sex and *a kiss* were the commonest answers The last line proved

WHAT IS THIS? Here's a visual puzzle to complement this month's verbal ones Under a strong light stare at the spot in the center of the drawing above Don't move your head or the magazine, for about 20 seconds After that time, look at a white wall or a blank piece of paper An afterimage will appear, and it may hold quite a surprise for you

troublesome for all We finally had to write it off to the different attitudes of another era Although Espy and Eckler preferred *love* we agreed with Shortz that a *kiss* better satisfies the first line, "I'm just two and two" (Incidentally, two readers independently argued for *heart* by placing a pair of 2's face to face S2)

The winning *kiss* from a stack of 39 came from Grif Mauser of Jacksonville Texas

We acknowledge the following readers who made solid explanations for "right" answers or valiant attempts at wrong ones, who sent the cleverest rhymed replies, or who otherwise honored themselves in this contest David Benaron, Graeme Bennett Theodore L Brown, Anne Davidson Dan DiMase, Chris Doyle Mark Farnen Ben Gottlieb C E Jackson, Carl Lippitt Samuel G McLellan Wally Nickel, D S & R Twohy William J Velek and Neal White III

READER ORIGINAL

$25 Sam Bassett of Palo Alto California writes that while he was driving behind a late-model Volkswagen, he noticed that its license plate read ML8 ML8, when he caught on he "nearly ran off the road laughing"

Question What color was the car?

OLD BUSINESS

In February's "How Observant Are You?" Quiz we offered "DOC," a mnemonic to tell whether the moon is waxing or waning by observing whether its curve is "D"- or "C"- shaped This was appallingly northern-hemispherist of us Australians of course, use "COD" Problem #14 in "Quick Quiz" [April] had an obvious misprint It referred at one point to toothpicks and at another to matches This wasn't meant as an extra April Fool's joke on readers, but it turned out to be one on us

READER ORIGINAL Here's the answer to the ML8 ML8 license plate problem, above

The car was a white Rabbit, of course ("I'm late! I'm late!") Bassett is a Lewis Carroll fan

COMPETITION #21 SMALL STEPS

"That's one small step for man one giant leap for mankind"

We commemorate the moment—12 years ago, on the twentieth of this month—when one of the strangest sentences of all time was uttered What did it mean? What was the distinction between "man" and "mankind"? There was none of course Neil Armstrong misspoke What he *meant* to say was, "That's one small step for a man, 'by' a man meaning himself The line, fluffed through overrehearsal or the momentousness of the occasion was a small step away in wording a giant leap away in effect Here are some "small steps," just off the mark

- $E = mc^3$
- World War Jr
- "Lightning never strikes twice at the same time
- *Fiddler on the Porch*
- *Lawrence of the United Arab Republic*
- The United States of Vespucci
- Mercury Venus Earth Mars, Jupiter, Saturn, Uranus Neptune and Goofy
- "One if by land two otherwise"
- "Beware March fifteenth"
- "'Twas brillant and the slimy toads did gyrate and gambol in the waves"
- *Gödel Escher Brahms*
- The joy of victory the downer of losing
- Zerox 6-Up Bob Dillon
- "Give me liberty or kill me

These are the titles names, and phrases that might have been Mary Ann Madden in her *New York* magazine competitions column (which we acknowledge for the idea and some of the examples) calls them near-misses To us they are "small steps"—close, but not quite on target

We're looking for more We'll pay $100 for the best of the genre $25 each for runners-up (2–10) Postcards only, please with *no more than two* entries per card Entries become the property of *Omni* and cannot be returned Send your Small Steps, postmarked by August 15 1981, to *Omni* Competition #21 909 Third Avenue New York, NY 10022 ◻◻

LAST WORD

By Jeff Rovin

I remember when spaceships left a giant ticktacktoe board on an enormous plateau in Peru, which turned out to be a genetic code

On a historic night in 1953 a wizened figure eased cautiously from retirement to present a firsthand account of the Crucifixion of Jesus. Since that historic interview, the Two Thousand Year Old Man—also known by the less imposing name of Mel Brooks—has been enlightening audiences the world over with his insightful recollections.

Omni is pleased to present the following exclusive interview with the ancient sage, a man whose opinions about the future of humankind are as compelling as his vision of the past.

Omni We'd like to thank you for taking time from your busy schedule to—

2,000. Wait just a minute. Hold on. This little thing is a tape recorder? Why isn't there a light to tell you whether it's working? What kind of technology is this, to have to check with your eyes to see whether it's turning? By the way, I gave that line to Galileo.

Omni What line?

2,000 It turns! Happened during lunch one day. I told him to turn and get some sun. He thought I said the earth turned around the sun. He blabbed it all over and they threw him in jail.

Omni Whom else did you know?

2,000 Well, I knew H. G. Wells, who had agoraphobia. He started writing science fiction because he couldn't get served in restaurants. Don't you see the dynamics? He hated this world. So he destroyed it and created a new one.

Omni That's very interesting. Have you ever tried to write science fiction?

2,000 As a matter of fact, no.

Omni What's the earliest science-fiction story you recall having heard?

2,000 That would be in the cave days. They spoke of fires that came from the sky, and there was evidence of them. I remember that spaceships once left a giant ticktacktoe board on an enormous plateau in Peru. We used it to play games, but it's really an incredible code. It has to do with genetics. If you get three x chromosomes in a row, you win a godlike prize.

Omni Does the idea of gene splicing appeal to you?

2,000 Only if we can make a nice, good-looking Jew by giving him a gentile nose. Once you can blow with one Kleenex. In return, we can teach the Gentiles how to add fast on the back of a brown paper bag with a short, stubby pencil.

Omni You once remarked that transportation was made imperative by fear. Do you still believe that?

2,000 Absolutely. A loud sound, a big dog, a clash of steel, a thirty-eight Buick. These have a tendency to move us along more quickly than polite conversation.

Omni Have you flown on the Concorde?

2,000 Only as a passenger.

Omni Did you like it?

2,000 It's like sex. You get it over with fast.

Omni We take it then, that you wouldn't like to fly in the space shuttle.

2,000. I would, but only if I could ride the local, take a look around, get off, and come back. Anyway, it's gonna be the same as we got now. They're going to overbook, and they're going to give us little white plastic spoons and forks and make us eat little white plastic sandwiches.

Omni Is there anything that would persuade you to travel to Mars?

2,000 Yes. I'd go there if I could get a light as a feather matzo ball. You haven't been able to get it on Earth anymore since the old Jews from Odessa and Kiev started to die.

Omni Let's discuss the energy crisis.

2,000 There is no energy crisis. That's a lot of baloney. There's a *lazy* crisis. They made energy for us, and we used it all up. We don't understand moderation. We don't even understand energy. If we did, we'd have more than enough to go around. What is nuclear energy? It's a super excitement of atomic particles, that's all. So if you took a rock and shook the day lights out of it, you could create your own nuclear energy.

Omni You'd have to shake it a long time—

2,000 Yes, or else whisper. The Germans are coming. That scares the hell out of rocks. But we're so lazy! We don't even put little lights in tape recorders anymore to tell us that they're working.

Omni So you've indicated. How would you solve the energy crisis?

2,000 Very simple. We won't use another drop of oil, not another drop.

Omni How will we run the economy?

2,000 We won't. We'll all pull up a chair. The Arabs can wait, and we'll wait. We won't give them a nickel, and we won't give them a can of carrots and peas. We'll eat what we've got, and we'll let them eat what they've got, which is oil. Let's do that and see who wins.

Omni Do you think that automation can help us sort out some of our problems?

2,000 No, it's too complicated. If your hand can't make it, it's a fake. That's why they say "handmade" to show that something is good.

Omni But hands make machines!

2,000 That's a lie. They're made by other machines. It's a ghost world, nonliving things making more nonliving things. Take video games. They're not for us. They're here to entertain the television.

Omni How did you get so smart?

2,000 By paying attention every day of my life, and by reading a lot of science fiction. It takes me out of the normal, everyday, stupid, pedestrian world into something wonderful and prophetic. About fourteen hundred years ago, when I was a kid, just a babe in the woods, I started reading science fiction. You know, books about great mechanical monsters swallowing defenseless creatures. And all of it has come true! Gulf and Western eating up Paramount, Transamerica swallowing up United Artists. Who would have dreamed it would turn out to be science fact?