OMNI

02484

MAY 1984 $2.50

ARTHUR C. CLARKE: MARS OR BUST!

RIGHTEOUS STUFF: HOW ASTRONAUTS FIND GOD

JAMES WATSON: CREATING NEW LIFE FORMS

CHEMICAL SEX AND DESIGNING YOUR OWN MOLECULES

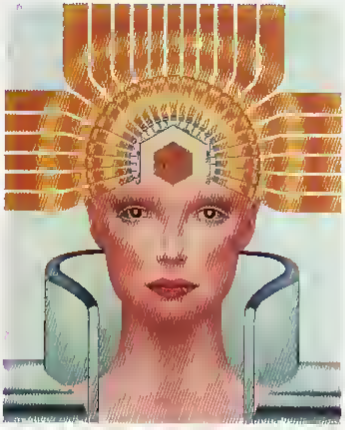
02484 05

0 778845

OMNI®

VOL. 6 NO. 8 MAY 1984

CONTENTS



The woman portrayed in artist Stanislaw Fernandes's Techno-Madonna *represents a new-age archetype: the androgynous goddess of artificial intelligence. She is a nearly perfect android—except for the drop on her lip, which is a symbol of the human capacity to err.*

OMNI (ISSN 0149-8711) is published monthly in the United States and Canada by Omni Publications International Ltd., 1965 Broadway, New York, NY 10023-5965. Second-class postage paid at New York, NY, and at additional mailing offices. POSTMASTER: Send address changes to Omni Magazine, 90 New Bridge Road, Bergenfield, NJ 07621. Volume 6, Number 8.

FIRST WORD

By Bill Perry, Jr

"I was involved in the business of selling bomb makers and the bombs they made. My dream job had turned into a private nightmare."

In 1981 and 1982, when the intensity of the nuclear-weapons debate was at its peak, I held a critical job. I was the director of public affairs and chief spokesman for the Lawrence Livermore National Laboratory.

The laboratory, located in Livermore, California, is one of only two nuclear weapon-design facilities in the United States. The developer of the MX missile, the neutron bomb, and assorted other nuclear devices, Livermore also figures prominently in President Reagan's proposed star-wars defense system.

In many ways my job at Livermore was a dream come true. Director of a well-funded, 27-member public-relations staff, I had been hired to create, project, and promote an image of the laboratory as a place of technical excellence. The place boasted many bright and professionally intuitive people who lived on the proverbial cutting edge of science. I was excited about the prospect of working there, and I was eager to try my hand at promoting big science. It was, I felt, a rewarding assignment after 20 years in the public-relations business, but I quickly developed doubts about the nature of my work. After only five months I realized that nuclear weapons so completely dominated the lab's consciousness that science itself, big or small, was almost a by-product.

One of the memorable episodes during my tenure at the lab was a series of peace demonstrations that took place outside the fences of Livermore, starting in February 1982. Such protests tended to bring out a siege mentality, and the atmosphere inside was similar to that of a warship under attack. My mission was to create a "balanced" media coverage of the event. To that end, I carefully drilled my staff in the fine mechanics of press relations. I had a press room built inside the lab to ensure that reporters would be shielded from the wrong kind of noise. Barricaded in this way, my department weathered the onslaught of five demonstrations in 1982.

Many of my colleagues felt as if they were winning the media battle, but as the intensity of the demonstrations escalated, I began to feel vaguely but increasingly disturbed. The so-called enemy, as all opposition outside the lab's fence is generally regarded, were not just 'left-wing hippies and flakes.' Instead, the protesters appeared to be men, women, and children from every part of society—people whose diverse political and social origins defied the stereotypes held by many Livermore employees. I learned much from talking to these demonstrators. I was surprised at how well informed and reasonable they seemed to be about political and military affairs.

Had I not gone to Washington, DC, in January 1982 and heard Dr. Helen Caldicott, then president of Physicians for Social Responsibility, address a meeting of the American Association for the Advancement of Science on the medical consequences of nuclear war, and had I not viewed *The Last Epidemic*, a film that graphically underscored Caldicott's theme, and had the demonstrations not come to Livermore, my doubts might have taken longer to emerge. I do feel, however, that these doubts would have eventually caused me to leave the lab anyway. I had too many questions about what was going on in the world. I knew I would not be able to handle my job effectively for long. As one of the directors commented when I finally left, "You and the laboratory were a clash of cultures."

Cultures? I had come from a Roosevelt-liberal family and was influenced by the years I spent as a poet in New York's Greenwich Village. Sensitized and toughened by my civil-rights activities during the Sixties, I was also strongly influenced by ten years of work in the mental-health field. My values were not those of your typical Livermore employee.

My dream job had turned into a private nightmare. There I was, whether I liked it or not, deeply involved in the business of selling bomb makers and the bombs they made. I was working with people who, masked behind a thin veil of science, created devices (their marvelous euphemism) designed for killing. Their theme, like that of the Reagan administration, was and is deterrence; their by-product, no matter how well disguised, was and is death. Although I discussed my reservations with members of my staff, my fears were not of the sort that a PR man could discuss with his superiors.

This agonizing dilemma ended abruptly when I resigned from Livermore on May 17, 1982. My move was not done in protest. I simply wanted to do something else with my life.

A month later, still unsure of where I would go, I started speaking to groups on the question, "What is it really like inside Livermore laboratory?" Meanwhile, meetings with titles like 'Upgrading Lethality' were being hosted by scientists at the laboratory.

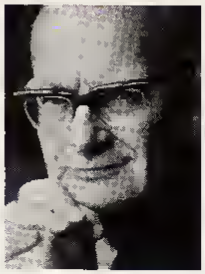
Eventually I came to realize that in spite of my absence, the ongoing work of the laboratory continues to add to the unstable state of the world. Design of nuclear weapons today, star wars tomorrow—who knows what, if anything, will follow. There are minds at Livermore that are smart and able enough to design and create undreamed-of terrors. It is for this reason that much of my time and energy today is spent pursuing ways to reduce the threat of the nuclear disaster that is sure to come if we continue on our present course. ∞

Bill Perry, Jr., directs Perry Associates, a public-relations firm in California. He is writing a book on his experiences at the Lawrence Livermore National Laboratory.

CONTRIBUTORS

OMNIBUS


LIVERSIDGE


CLARKE


WINTER


WEIL


JACOBS

Recent developments in science are proving that aphrodisiac seekers throughout history were on the wrong track. The chemicals that stir interest in lovemaking are not created in laboratory test tubes but within each of us. In "Hooked on Love," on page 78, *Ruth Winter* and *Kathleen McAuliffe* introduce us to a new generation of scientists who are tracing the powerful effects of natural love potions: chemical substances produced in the body. The biochemistry of desire is a complicated process that includes visual, olfactory, auditory, and tactile stimuli that release pheromones and hormones. And these chemicals, in turn, affect sexual behavior.

Ruth Winter, a syndicated columnist, and Kathleen McAuliffe, a contributing editor for *Omni*, describe what really happens to us when we desire someone. Some of us—"attraction junkies"—are turned on by falling in love—and our symptoms are remarkably similar to those of an amphetamine addict. At another extreme, "attachment junkies" are obsessed with relationships long after the initial attraction has worn off or died. Whatever our addiction, we are more vulnerable than we think to the chemistry of love.

While researchers ponder the intricacies of our physical desires, science writer *James Gorman* tracks the journey of three astronauts who have more celestial concerns. "Righteous Stuff" (page 46) is the Gospel according to James Irwin, Charles Duke, and Edgar Mitchell, converts in the glory days of Apollo. Each of these men had profound religious experiences—two during their moon trips and one afterward. In each case the conversion experience redirected the astronaut's life and led him into new, spiritual travels—beyond the moon. Gorman interviewed all three astronauts, and he provides a glimpse into an inner, psychic landscape as exotic as the craters and mountains of the moon.

As men were beginning the race to the moon in the early Sixties, James D. Watson was receiving a Nobel Prize—in 1962—for research on another uncharted frontier. His achievement, work that helped unravel the structure of DNA, laid the foundation for molecular biology and its latest spinoff, genetic engineering. Although Watson has been aloof to the press, he spoke candidly to freelance writer *Anthony Liversidge* for this month's Interview, on page 74.

The man who helped uncover the secrets of nature remains fearless about where his discoveries will lead. Outspoken, self-admittedly arrogant, Watson abruptly dismisses attempts to rein in new genetic experimentation. Liversidge remarks, "The man has the habit of people who are original thinkers. They rarely complete a sentence. And, typically, he retracted very few of his contentious statements."

The interview took place at a time when this country is profoundly concerned about whether our schools can go on producing innovative scientists like Watson. Bulletins from the National Science Foundation warn that America is rapidly losing ground to foreign nations and that our children may become "stragglers in a world of technology."

Omni editor *Robert Weil* outlines the scope of the problem in "Dixie's New Wave" on page 50. Mississippi, beset by rural poverty, a high rate of illiteracy, and a substandard science program, has ranked fiftieth in the country in general quality of education. In a recent year, the state produced only four new chemistry and physics teachers. But in 1982 the Magnolia State passed a dramatic education-reform act, the most comprehensive education bill of its kind in this country. Weil, encouraged by the progress that has already been made, says, "Mississippi may yet prove to be a model of enlightened leadership in education."

Among fictional offerings, *Arthur C. Clarke's* "Transit of Earth" (page 70) is a short story that will partially come true this month. Originally published in 1971, it is the journal of an astronaut on Mars who becomes the first person to see the transit of Earth, a real astrological event that occurs once every 100 years.

And *Harvey Jacobs* provides a delightful change of pace in "My Rose and My Glove" (page 56), a sardonic tale about obsession. Jacobs is the author of a short-story collection and two novels. He writes extensively for television.

OMNI®

BOB GUCCIONE
publisher & publisher

KATHY KEETON
president
OMNI PUBLICATIONS INTERNATIONAL LTD.

THE CORPORATION
Bob Guccione (chairman of the board)
Kathy Keeton (president)
David J. Myerson (chief operating officer)
Anthony J. Guccione (secretary treasurer)

EDITORIAL
Chief Bob Guccione Editor Dick Teresi
Editor Paul Hitts Executive Editor Gu
Jr. Senior Editors Douglas Colligan
Untraub Fiction Editor Ellen Datlow, Ho
Bill Lee, Staff Writer Kathleen Stein Fa
Robert Well, Associate Editors Jane
Epstein Editor Book Division Rob
Administrative Editor Bev Nerenberg, A
Editors Bebatte C. Lefrak C
C. Fox, Copy Editors Brian McKe
Editorial Assistants Murray Cox, B
Editorial Asst. Andie Burland, G
Writers, Contributing Editors Owen
Hooper Kathleen McLuliffe Dr
Robert Sheckley Dava Sobel Offices
1965 Broadway New York, N.Y. 10023-5965
(212) 496-6100 Telex No. 237125

ART
Graphics Director Frank DeVino Art Dir
Beth Woodson Asst. Art Director Liz S
Ingmar Victor H. Chan Art and Photo Editor
Gerd Kron Asst. Photo Editor Lisa Shin
Photographers Pat Hill, Tony Guccione Assoc
Photographer John Muth Art Rights Editor Gwe
Ellis Norman Art Asst. Patricia S. Ostrowski

ADMINISTRATION
Executive V.P. David J. Myerson, Sr. V.P./Admin
Services Jeri Winston, Sr. V.P./Production
Evans, V.P./Finance John Prabich,
Dick Gavin Bus. Mgr. Cathe Chan
Promotion and Planning M
Region Sales Chuck Ando
Sales Bruce Eldridge Ne
Mgr. Lori Rossi Dir. of Circ. Intl
Berg Dir. of Public Relations M
Mgr. Claudia Dowling Dir. of
Beverly Greiper Prod.
Asst. Prod. Mgr. Tom Sti
Eileen Koslow Subscription Mgr.
Traffic Mgr. William Harbutt
Special Issues Don Myrus Foreign
Suzanne Locatelli Dir. of Publications
David Jones

ADVERTISING
Director of Advertising Howard Pissare
Dir. New Bus. Development Beverley
Sr. Adv. Dir. Linda Newman N.Y.
Midwest Adv. Mgr. Gene Smith
Mgr. Roger McCord, Sr. V.P./South
Blacksmith Western Adv. Dir. Wendy Bl
Sr. Dir. Toni Wagner Adv. Prod. M
Dir. Adv. Admin. Leslie Moses
1965 Broadway New York, NY 1
496-6100 Telex No. 237125
Wacker Drive Suite 1012 Ch
(312) 565 0466 Northeast an
Road East Westport Ct. 06
South 1707 H St. N.W.
Tel. (202) 298 6050 West
Blvd., Suite 1002 Los Ange
824-9531 U.K. & Europe 13
Gar don SW1 Tel. (01 828
Japan Barto & Media Service 3 1 Kanda
Chiyoda-ku Tokyo 101 Tel. (03 252
Telex J25472

FOREIGN EDITIONS
Int'l Foreign Editions John Evans Japan
The Ohmsha Company Ltd. 65 Yokodera-Cho Shinj
162 Germany Redaktion OMNI Wope
Books AG Postfach CH6021 Zurich, Switzerland
Italy

LETTERS

COMMUNICATIONS

Fiction Faces Facts

Lawis Shiner's "Desarted Cities of the Heart" [February 1984] was superb.

I am a former science writer, a retired managing editor of a newspaper, a student of the Maya, and have taken several trips to Mexico and Guatemala to visit ruins. So I feel qualified to bestow an A+ on my fellow Texan for his writing and the authenticity of his details.

James Christensen also rates a top grade for his illustration. But somebody has a communication problem. That's an Olmec—not Mayan—face shown in the painting.

John Newell
San Antonio

Grandma's Remedy

In the January 1984 Continuum you reported Dr. Jay H. Herman's hiccup remedy: eating a lemon wedge soakad in Angostura bitters. Herman noted that his solution often worked when the conventional treatment: eating granulated sugar, did not. Perhaps his 88 percent success rate would be improved if he tried my grandmother's folk remedy: Angostura bitters *and* granulated sugar on a lemon wedga (no naed to aat the rind for this remady). We have never seen a failure with this mathod.

Debbie Swackhamer
Mill Valley, CA

Mystery Hanging

I was a little startled by Jamas Gorman's quary in February's Last Word about socks ("Wa all know where thay come from, but where do they go?") because that mystary was solved some years ago by a team of palaochamists at the University of Chicago.

After conducting a series of studies at several launderettes and in the privacy of their own bedrooms, they determined that certain socks have chemical properfies that when exposed to soapy water transform the textile fibers into wirelike rods. The agitation of the washer's spin cycle then bands these rods into roughly triangular shapes.

A careful correlation of the number of missing socks with the number of extra hangers that suddenly appeared in their closats confirmed their suspicions.

James Yuangar
Director of Naws and Information
University of Chicago

Discoverars Credited

In "Chilean High" [December 1983] Patrick Tierney incorrectly implies that I discovered the most distant known quasar. It was actually discovered by B. Paterson, A. Savage, D. Jauncy and A. Wright, who usad the 3.9-meter Anglo-Australian telescope. They deserve the credit for finding this important object.

Patrick Osmer
La Serena, Chila

Automated Insults

Omni has a reputation among educatad Amaricans tor honest and nonbiased writing. But in the article "Robot Nurses" [Breakthroughs, December 1983], by Phoeba Hoban, you are helping to perpetuate a steraotype of nurses—that their work consists mainly of repetitive, mechanical tasks that require very little intelligent thought. The article discusses computerized mechanical assistance for handicapped persons in their daily activities. Professional nurses diagnose and treat patients' responses to health problams. Nursas who work with the handicapped do indeed sometimes perform the tasks that the new robots can do, and thesa nurses are happy to see any device make a handicapped person mora indapendent. But to dub these robots nurses, even jokingly, is an insult to the nursing profassion.

Elizabeth Richardson
Galvaston, TX

Reader's Rights

I am continually amazad at the cosmic levels of imagination and intelligence gleaming from the pages of every issue of *Omni*. Let us amend tha U.S. Constitution to include a new, inallanable right to the latest copy of *Omni*.

Tarbrand Rulless
Kilgore, TX

DIALOGUE

FORUM

Omni welcomes speculation, theories commentary, dissent, and questions from readers in this open forum. We invite you to use this column to voice your hopes about the future and to contribute to the kind of informal dialogue that generates breakthroughs. Please note that we cannot return submissions and that the opinions expressed here are not necessarily those of the magazine.

Disruptive Influences

In the past year, we've worried about robots taking blue-collar jobs, computers taking white-collar jobs, Japanese robots and computers taking all our jobs, and the Russians taking all our computers and robots. Now T. A. Heppenheimer [First Word, January 1984] would have us worry about computers in education, perhaps the one place that almost everyone would agree they can do nothing but good.

Equating simple mistakes made on a calculator with the supposed pitfalls of computer-aided teaching must be one of the weakest Luddite arguments to cross the pages of *Omni*. As the effort at Manhattan's Bank Street School shows, computers can stimulate enthusiasm for subjects that once put kids to sleep—with improved results and performance standards to boot.

Heppenheimer then flogs us with three red herrings: underpaid teachers, violent students, and that favorite failure—new math. Any idiot would agree that most teachers are underpaid and that students who assault teachers belong in jail. Appropriate discipline is something almost everyone supports. Using the new-math guilt-by-association generalization to say that all innovations are failures is a cheap shot. I'd bet that Plato and Aristotle would have welcomed the computer as a marvelous educational tool.

Let's worry about something worthwhile—like robots stealing our jobs, the Russians stealing our robots, and—

Mark Hays
Lomita, CA

Heppenheimer wants a Supreme Court decision that would allow teachers to expel disruptive students and keep them out of the schools. Heaven knows we don't need such malcontents interrupting the serious work of educating the future leaders of our land. Let's forget that those malcontents are probably bored with the mindless assignments that do *not* "go beyond rote memorization." Let's forget that in this country education is the great equalizer. Instead, let's have those teachers of "doubtful competence" decide who should be educated.

Sheilah Hayden
Northfield, MN

I wanted to cry when I read T. A. Heppenheimer's First Word. I felt the same kind of despair as when I listened to Ronald Reagan's first speech to the American public.

During my freshman year in high school, my grade point average was about 1.0, and I could probably have been described as a "disruptive student." As a freshman in college, I made the dean's list and was an interested and active student. If Heppenheimer had had anything to say about it, I would never have had the opportunity to be educated beyond the ninth-grade level.

Computers in class: gimmick or godsend?

If Heppenheimer has had any experience with the public-school system, he should be able to recall what some of the teachers were like. He admits that teacher-competency exams require only that a teacher "read at the tenth-grade level and do eighth-grade-level math," and that "of the applicants taking such tests, twenty to fifty percent have flunked." Yet, he would give these same people the power to decide which children should be educated and which should be denied the chance of further education. This is completely illogical and the thought of it makes my heart sick.

My only consolation is that I don't believe Heppenheimer could ever find enough people to go along with his idea to make it a reality. But then again, this is 1984 and anything is possible.

Sharon Holland
Orlando, FL

Heppenheimer's critique of our school system smacks of the tunnel-visioned authoritarianism and heavy-handed self-righteousness sweeping our nation.

Heppenheimer should speak to parents and teachers of uninspired or learning-impaired children who have seen their children grow intellectually and creatively through the use of innovations that Heppenheimer terms distractions. It seems ludicrous that we should expect students to be automatically inspired. It is the job of educators to arouse pupils' interest in studies.

Dale Adler
Charlottesville, VA

Heppenheimer's observations about how education depends upon gimmicks and technology are valid. It still takes quality teaching, personal interaction and positive role models to encourage achievement on a higher level.

Campbell Witherspoon, Jr.
Curriculum Coordinator
North Allegheny School District
Pittsburgh

MIND

By Patrick Huyghe

"Oh no, I can't do that," stammers a woman who has been asked to take some photographs with an instant camera. "Cameras and I just don't get along—it won't work," she explains. Overriding these objections, her employer proffers an Instamatic, shows her how to use it, and offers the reassurance "Sure you can do it." Three broken cameras later, without a single snapshot to show, no one is so sure anymore.

The age of technology is not welcomed by all. Many people repeatedly encounter some quite serious and inexplicable difficulties in their interactions with machines and electronic equipment. Computers crash in their presence, copying machines jam up, watches stop functioning, and telephones won't work.

"Relatively few of these anecdotes have found their way into the literature," notes Robert Morris, an experimental psychologist at Syracuse University who has been studying human performance anomalies of this kind for about two years. "We seem to be dealing with a very informal kind of industrial folklore."

Morris, who resembles a slight, mild-mannered Jack Nicholson with thick glasses, occupies a small office in a shabby ten-room suite known as the communications-studies laboratory. It is here that he hopes to solve the puzzle of why people come to regard themselves, or are regarded by others, as being linked with the failure of the machinery around them. He refers to such individuals as malfunction-linked people, or MLPs.

According to an informal survey that Morris conducted, at least one person in ten falls into this category. But since the results came from a small sample of people interested in technology, Morris expects the proportion of MLPs in the general population to be much greater.

Exactly why technology repeatedly fails for certain individuals is something of a mystery. To find the answer, Morris has begun collecting relevant anecdotes on the subject. Some of the stories involve people who are unable to wear wristwatches, including one individual who went through 19 new watches before giving up on the idea. Other stories concern such things as computer systems that have a reputation for breaking down just when those most skilled at repairing them are unavailable.

He also found a story in which a person's knack for having things go wrong had reached legendary proportions. Wolfgang Pauli, a Nobel Prize-winning theoretical physicist, was apparently so accident-prone that malfunctions occurring in his vicinity were attributed to something called the Pauli effect. Writing in the July 1959 *Scientific American*, physicist George Gamow noted that "apparatus would fall, break, shatter, or burn when he [Pauli] merely walked into a laboratory."

Of course, accident-proneness has been a familiar concept in the psychological literature since the early part of the century. But much uncertainty still surrounds this phenomenon. Are accidents just the result of a risky job or poor working conditions? Or are they due to fatigue, carelessness, and incompetence? Reliability engineers and industrial psychologists have long recognized such precipitating factors. Yet these alone cannot account for most instances of accident-proneness. It would appear that accident-proneness involves still other variables that have so far eluded scientific detection.

That's why Morris is open to the possibility that psychokinesis, or PK, as it is commonly known, may be at work. PK is the alleged ability of human consciousness to have a specific, concrete effect on the behavior of physical systems.

Morris hit upon his idea quite accidentally, when he was running a PK experiment two years ago. The goal of the study was to see whether subjects could influence the behavior of a computerized random-number generator. Because it is widely believed that striving for desired results works against PK, subjects were instructed to adopt an attitude of passive cooperation in their interaction with the equipment. By the time Morris tested 33 of the 64 subjects, however, the computer had crashed in the presence of 13 people, the experiment was aborted.

CONTINUED ON PAGE 125

SEARCH FOR THE RI

EARTH

By J. Richard Greenwell

I first heard of the *ri* in 1981, while visiting a friend at the University of Arizona. She happened to mention anthropologist Roy Wagner, who had recently returned from New Guinea with reports of a strange marine creature resembling the traditional mermaid. As editor of *Cryptozoology*, the journal of the newly formed International Society of Cryptozoology, I was intrigued, so I contacted Wagner, a professor at the University of Virginia.

Wagner had spent 20 years studying social structure and symbolism among New Guinea highlanders. In the late Seventies, however, he'd begun to study the Barok, a tribe from central New Ireland, an island province off New Guinea's coast. These people reported an array of fascinating bush beings. But they also spoke of the *ri*—an air-breathing mammal with a human head and torso and a legless lower trunk terminating in flukes. Unlike other creatures in their fanciful anthropomorphized bestiary, the Barok insisted that the *ri* really existed.

As time went by, Wagner collected a growing number of reports from "reliable individuals." One witness said he'd left a captured female *ri* with some boys on the beach while he went for help, but it managed to escape.

Another person told of a *ri* that had been caught, thrown in the back of a truck and later butchered, though the *ri* is said to have no command of language, this unfortunate creature's cries sounded almost human.

After publishing Wagner's article on the *ri*, I received several letters from interested scientists, including zoologists who said they had never believed such sea mammals as dugongs and manatees were good candidates for the mermaid—something writers have long assumed. By the spring of 1983 several of us had begun to talk of an expedition, and a three-person team finally left for New Ireland in June. With Wagner and myself was geographer Gale Raymond, of Texas. Geographer Kurt Von Nieda, of Los Angeles, joined us in early July.

Toting cameras, supplies, and a rubber dinghy, we flew through Port Moresby into Kavieng, the capital of New Ireland. There we met with the provincial prime minister, who extended full cooperation to the expedition. Soon after, we drove south to Ramat Bay, where Englishman Bernie Gash kindly gave us the use of a plantation house.

We then began visiting nearby villages, where Wagner met with old tribal friends. I tried to gather information quickly, but things move slowly, especially by American standards, in New Ireland. A few days after our arrival, for instance, one of the Barok natives died, bringing our quest to a screeching halt during a two-day funeral and pig feast.

In the meantime I explored the jungles and beaches, still strewn with Japanese tanks, antiaircraft guns, and crashed planes (including a fighter with no signs of rust) from World War II. Mangrove estuaries housed the world's largest marine crocodiles, and the zoological productivity in and about the coral reefs was mind-boggling. Gash had said that since the war only one biologist, a bat collector, had been in southern New Ireland, and I wondered how many new species of fish an ichthyologist might find there. I was very careful to take photos of all the specimens collected—including some reef sharks—to send to the American Museum of Natural History. Naturally, the unexpected appearance of a *ri* was often on my mind.

After a couple of weeks, though, it became clear that the *ri* were not appearing as often as expected in Ramat Bay. Thus, we were told to visit Nokon, about 50 miles of difficult road farther to the south (outside the Barok area) where villagers were claiming sightings almost every day.

Nokon Bay is about 1,500 feet wide, with reefs on both sides, the most turquoise-blue water I have ever seen, and a few thatched huts sprinkled along the shore. If there weren't mermaids here, I thought, there should be.

Our inquiries at Nokon soon determined that the natives had never heard of the *ri*, for obvious reasons—these were the Susurunga people, and in their

CONTINUED ON PAGE 130

CANCER FISH

LIFE

By Peter J. Ognibene

Outwardly they looked like regular saugers and walleyes, the usual catch of the day from Torch Lake, on Michigan's Upper Peninsula. But inside they were carrying the heritage of a careless industrial society: their internal organs were riddled with tumors. In some of them, the liver—reddish tan in a healthy fish—had turned a strange pale yellow. The anglers who fished Torch Lake may have suspected they were looking at more than a few sick fish, but they could not have known what scientists now fear: that those fish were just a few of many, the first ominous signs of a massive epidemic threatening our rivers and lakes.

Although the Michigan Department of Public Health warned people not to eat the fish, and reporter Barbra Swift of the *Daily Mining Gazette*, in nearby Houghton, wrote extensively about Torch Lake, it was not until Cable News Network correspondent Bob Vito filed the story that it was brought to national attention.

"I was having a cup of coffee in a small town up there," explains Vito, "and I started talking to one of the local fishermen about another story I was working on. He nodded and said, 'Well, if you really want a *big* story, just walk to that lake over there. The fish all have cancer.'"

Although the cancer epidemic among fish in Torch Lake came as news to the nation, it was an old story to John C. Harshbarger, director of the Smithsonian Institution's Registry of Tumors in Lower Animals. Harshbarger had first been alerted to the problem in 1973, when a graduate student in Houghton sent him fish specimens from Torch Lake. "We didn't just wake up one day and say, Aha! This is what's happening," Harshbarger remarks. "We've been building a database over the years."

After extensive research, Harshbarger and three colleagues published their findings in the October 1982 issue of *The Journal of the National Cancer Institute*. That information, coupled with recent experimental efforts such as those conducted by John J. Black, a coauthor of the Torch Lake study, leave little doubt that chemical carcinogens are to blame for the tumors.

A senior cancer-research specialist at the Roswell Park Institute in Buffalo, New York, Black traced the source of tumors in bullheads in the Buffalo River. He condensed sediment from the riverbed and painted the extract on the skin of laboratory fish. He also administered the same extract to mice. Cancerous lesions appeared on both species.

"Fish are in the first line of insult," says Black. "They are prisoners of their environment and may be constantly exposed to pollutants, often at relatively high concentrations."

Though widespread, fish cancer is not a uniform phenomenon nationwide. It is most prevalent in waters that receive heavy doses of such industrial chemicals as the aromatic hydrocarbons derived from coal, petroleum, and other fossil fuels. Three prominent examples:

- In Seattle's Duwamish River, 25 percent of the English sole and starry flounder have liver cancer.
- In the Black River, near Lorain, Ohio, almost every brown bullhead older than three years has liver tumors.
- In New York's Hudson River, tomcod "have the biggest and worst-looking liver cancers of fish at any of the locations," says Harshbarger.

This mass of evidence led Representative John B. Breaux, the Louisiana Democrat who chairs the House subcommittee on fisheries, to remark at a congressional hearing last fall: "What we are witnessing, whether we recognize it or not, is a natural population—a natural biological indicator, if you will—that is trying to show us there is something very, very wrong with the environment."

Already the carcinogens that have been detected in fish appear to be working their way up the food chain, particularly in areas with heavy industrial runoff, such as Wisconsin's Lower Fox River, some 200 miles south of Torch Lake.

The Lower Fox, which begins at Lake Winnebago and empties into Green Bay, carries a higher percentage of effluence from pulp and paper mills than any other

CONTINUED ON PAGE 116

Pollutants dumped into rivers and lakes are slowly killing many of America's fish

ARTIFICIAL INTELLIGENCE

By Anthony Liversidge

Arthur Olson may be treading the path to immortality. A molecular biologist at the Scripps Clinic in La Jolla, California, Olson is sitting in front of a computer screen that is filled with colored balls and arrows, like fireworks bursts in a night sky.

The lights represent the structure of two molecules—the arrangement in space of their atoms, connecting bonds and electronic force fields. Twisting a bank of knobs beside the keyboard, Olson steers one molecule forward so that a protruding part of it enters a cavity in the other structure. He is trying to find out how well a protein structure fits into the receptor site of another protein.

Olson is refining one of the most promising applications of computers: sophisticated graphics programs that provide chemists with beautiful, three-dimensional simulations of molecules—images they can instantly shrink, expand, swivel or merge to form more complicated structures.

A quantum jump ahead of the Tinkertoy-like models that have long been used to visualize molecules, computer graphics are causing a revolution in organic chemistry, enhancing the creativity of chemists much as word processors have boosted writers' output. And if, as some hope, artificial-intelligence techniques are successfully joined to the new technology, the ultimate benefits to human health may be astonishing.

This modeling technology is already proving indispensable in designing new drugs, according to organic chemists at pharmaceutical companies such as Hoffmann-La Roche and Merck. Using a computer and sophisticated software, they can narrow down choices and save the labor and time of synthesizing tens, perhaps hundreds, of alternative compounds.

Several drugs designed with the aid of computers have reached the stage of clinical trial, though none have yet been marketed. Many drug and chemical companies are making huge investments in the best equipment available—Du Pont is committing some $24 million to provide every lab in its research division with a state-of-the-art computer terminal.

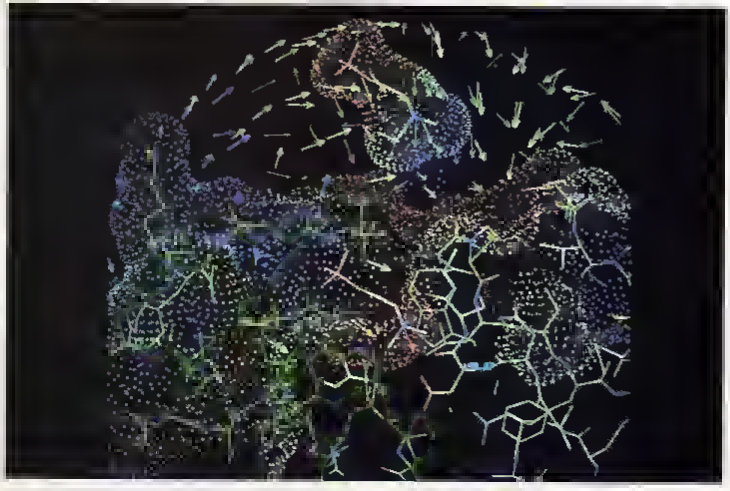
Proteins, biochemicals of staggering complexity, are obvious candidates for computer graphic design. Although proteins are nothing more than long strips of amino acids, they rarely exist in nature in this simple, linear configuration. Instead, these ropelike molecules twist, turn and fold in on themselves to form elaborate knotted structures, each protein assuming its own unique three-dimensional architecture. To act on a protein, then, a drug must precisely match that protein's contours and join to it in the same way that a child's Lego blocks fit comfortably together.

Consider a body protein known as renin, which has been linked to high blood pressure. A commercial race is now under way to develop a drug that will block renin's action. One front-running team, led by Daniel Veber, at Merck & Company, is using computer modeling to refine several 'very good' renin inhibitors they have designed. The polishing is done by docking a suggested structure into a key receptor site on the renin molecule and then chemically redefining it for a closer fit.

Such docking is exactly like landing a Boeing 747, says David Pensak, who heads Du Pont's modeling effort. "Crashing through a hangar or overshooting the runway is analogous to a drug molecule coming out the back side of an enzyme." Pensak is considering buying a pilot-training simulator for the chemists in his program.

Researchers at Cambridge University in England gave a hint of what is to come when they used computer graphics and genetic engineering to invent a better enzyme. Enzymes are the large class of proteins that catalyze and control all chemical reactions in a living cell. The group changed the structure of one enzyme to make it bind better to another molecule, thereby improving the efficiency of a chemical reaction.

Greg Winter, coordinator of the project,



Computer model of a virus-fighting antibody molecule. Arrows show electrostatic field.

sees this success as a step toward eventually making proteins as yet unknown on Earth—proteins that would incorporate amino acids other than the standard 20 found in living beings. The computer graphics he used were relatively elementary, he says, but the new Evans and Sutherland equipment they have just installed will be much more useful. "We're on our way to creating the first alien life form," Winter says.

At present, computers are totally dependent on input data, which are often sketchy; the computers don't do any creative thinking for the chemists. Pensak judges that it will be at least five to ten years before the computers can do the modeling themselves. None of today's programs could have replaced James Watson, for instance, who won the Nobel Prize in 1962 for his part in the discovery of the double-helical structure of DNA, the molecule that carries genetic information. "The computer is incapable of generating wholly new structures," says Pensak. "It took Watson's genius to recognize DNA could be a spiral chain."

But what of the future? Expert systems programs that mimic expert decision making, are being developed; chemical engineers will soon put them to work. Intelligenetics, of Palo Alto, California, for example, markets both artificial-intelligence (AI) programs for the biotechnology field and database programs that draw on huge gene banks in Washington and Europe. Since genes serve as blueprints for proteins, these DNA data banks will help scientists explore how variations in protein structure are reflected in the underlying genetic code.

Robert Langridge, professor of pharmaceutical chemistry at the University of California at San Francisco and a leader in developing sophisticated modeling programs, hopes that computers will eventually be able to depict the exact shape of a protein merely by analyzing its genetic code. To do so, however, the AI program will have to recognize the DNA sequences that determine how proteins fold into zigzags and loops, which in turn determine their exposed surfaces and thus how they react with other molecules.

That capability would indeed be marvelous, agrees Columbia University's Barry Honig, professor of biochemistry and molecular biophysics. Anyone who came up with that program tomorrow would be awarded the Nobel Prize in chemistry, physics, medicine, and peace combined. "Is it pie in the sky? Langridge says. 'There are so many problems to be solved, but we like to think it might happen in the order of a decade.'"

Such programs would usher in a strange new world of tiny biological workhorses—proteins custom-designed to carry out such dreams as mining gold from seawater, regenerating lost limbs or teeth, or even achieving immortality.

Immortality? "It's conceivable," says Honig. "Everything is chemistry. If we can figure out how it works and how to affect it, everything we experience can be modified. And most biological functions are controlled by proteins. Why shouldn't we live as long as whales?"

NEW WARES, HARD AND SOFT

Laser beams are now zapping their way into computer printers, and Canon has come out with one of the first models that can be used with personal computers. The LBP-CX works much like a photocopy machine, except that images are created by a semiconductor laser scanning a rotating, photosensitive drum. Thanks to exchangeable ink-toner cartridges, the image can be printed in black, blue, or brown. Because the LBP-CX uses a laser, it is both very quiet and lightning fast, printing about eight pages per minute. The high-resolution printout can be used for letter-quality text,

"Such programs would usher in a strange new world of tiny biological workhorses—proteins designed to carry out such dreams as mining gold from seawater."

crisp graphics, and even photographs. Canon will not be mass marketing the printer, but will sell the basic machine to manufacturers to incorporate into their own products. When it is eventually offered on the retail market, a Canon spokesman says, an LBP-CX printer for microcomputers could sell for as little as $3,000. (Canon USA, One Canon Plaza, Lake Success, New York 11042.)

Synthesizer artists can now soup up their music with dolphin sounds. *Dolphin Dialogue* is a software program originally developed for a man/dolphin communication experiment at the Institute for Delphinid Research. The software generates high-frequency trills, clicks, and whistles—sounds used to represent actions and objects to dolphins. The sounds signify simple concepts like *time to eat* but sound like so much high-tech noise to human ears. As it plays, *Dolphin Dialogue* generates an on-screen display of the sounds' frequency, amplitude, and rhythm. The program can be used in conjunction with any of Syntaur Corporation's computer-music software, which transforms ordinary Apple II and IIe microcomputers into sophisticated musical synthesizers. ($39, from Syntaur Corporation, Suite 112, 4962 El Camino Real, Los Altos, CA 94022.)

MicroTouch Systems, Inc., produces hardware and software that allow owners of the IBM PC to reach out and touch—and move and change—data on their computer screen. The company's Point-1 ($995 to $1,495) includes a 12-inch screen with an invisible 1024-by-1024 grid that responds to touch. Users can position the cursor, pick items from menus, or manipulate graphics without using the keyboard. The system performs something like a 'mouse,' a small hand-held device that when moved over a horizontal tablet positions the cursor accordingly. "We call the Point-1 an on-screen mouse," says James D. Logan, MicroTouch president. A new program, Viewpoint ($875), allows Point-1 owners to construct their own graphics and then put them to work. Logan says it would be simple, for example, to draw a calculator keyboard, complete with special-function keys, on the screen and then make it perform like an actual calculator. The screen is designed to overlap the computer's keyboard so that the user barely needs to lift an arm in order to touch the display. (400 West Cummings Park, Woburn, MA 01801.)

It's difficult to improve on a good thing, but Lotus Development Corporation seems to have done just that with a software program called *Symphony*—an update of their all-time best seller, *Lotus 1,2,3*. *Lotus 1,2,3* combines three functions—graphics, data-file management, and spreadsheet analysis—into a single, integrated package. But *Symphony* takes the concept several steps further by including word processing and communications functions. The program also has room for ten more functions to be developed by outside companies. Potential programs include one to check spelling. Right now, *Symphony* requires 320 kilobytes of random-access memory and runs only on the IBM PC and PC XT, but it will soon be available for other personal computers, including Apple's Macintosh. (About $750, from Lotus Development Corporation, 161 First Street, Cambridge, MA 02142.)

Most thermal-transfer printers require special, expensive paper. But Fujitsu's TTP16 prints on almost anything, including plain paper, plastic, or fabric. The portable machine weighs just 11 pounds and measures 4.5 by 14 by 10.5 inches. It prints nearly letter-quality type at 45 characters per second. Driven by stepper motors, the printhead never contacts the printing surface and is extremely quiet. ($625, from Fujitsu America, Inc., 3055 Orchard Drive, San Jose, CA 95134.)

CONTINUUM

THE SECRET LIVES OF CHICKENS

For two minutes each day a man goes into a room and shouts at chickens. A new form of psychotherapy? Woody Allen's next movie? A tough man making chicken tender? Not exactly.

W. Burnham Gross, a veterinarian, and his colleague Paul Siegel, a behavioral geneticist at Virginia Polytechnic Institute and State University, were trying to find the best way to raise chickens. And the worst.

'Actually, Gross did it,' says Siegel, who confides that he was greatly relieved that he didn't have to be the shouter. "It's not a nice thing to do, and we really wrestled with ourselves over whether we should do it."

They decided to go ahead with the shouting ("We just scared the hell out of them") because they would be doing it to only a few of the 1,370 chickens in the experiment. The idea was to find out whether socialized chickens—those that the scientists touched and sang to—were healthier than birds that were 'hassled' or yelled at. If the experiment showed that socialization was good for the chickens' health, the researchers knew the benefits might be considerable both to the people who raise chickens and to chickens themselves—including the 4 billion we eat, in one form or another, every year.

That's right. In the United States alone chicken soup, the Colonel and barbecues account for the consumption of as many chickens as there are people on the planet. Or if 4 billion is too big a number to comprehend, think of it as 11 million chickens eaten every 24 hours, not counting the ones that lay eggs.

But chickens, first domesticated from the red jungle fowl in Southeast Asia about 5,000 years ago, have done a lot more for human beings and the progress of science than provide soup and sandwiches. Chicken research, in fact, is a vast and elaborate field. Ever heard of the pecking order, first observed in chickens by the Norwegian scientist Thorliet Schjelderup-Ebbe? How about beriberi? When Christian Eijkman fed chickens polished white rice, he induced the disease and proved it was caused by a thiamine deficiency.

Chickens have provided information on everything from immunology and genetics to endocrinology and cancer. Francis Peyton Rous won the Nobel Prize for medicine in 1966, in part for his work on tumor-inducing viruses in chickens. And, says Siegel, the study of these birds has produced two of the world's few antitumor vaccines, including one used to fight the chicken cancer known as Marek's disease.

If you assume, as most researchers have, that modern chickens are brainless meat machines, McNuggets on legs, reconsider. Researchers in Scotland and Australia got a big surprise when they put some cage-fattened birds out in the wild. Despite 5,000 years of domestication, the chickens did just fine.

You might also be surprised at some of the modern work done with chickens. A Dutch researcher flew back and forth to the Middle East in a 747 cargo plane in order to study the bends, or altitude sickness, in baby chicks. The reason? The Netherlands ships a lot of chickens to the Middle East and spends big bucks to pressurize the planes. The shippers wanted to know whether they could minimize pressurization (and thereby costs) *and* keep the chicks healthy.

Siegel has conducted less-immediately applicable research into the sexual behavior of chickens, breeding high- and low-mating roosters for 23 generations. The high maters are the ultimate roosters: you can't keep them down on the farm. And the low maters hardly mate at all.

Both types of rooster must be reproduced artificially, according to Siegel. For the low maters, the reason is obvious. For the high maters, the problem is different. Their passion is so great that they 'die of coronaries. They jump on one hen, they jump on another hen, and they drop dead.' A few times each year, Siegel adds, he'll hear a predictable refrain from some new student: "Wow, look at him go—six, seven, eight, nine, ten. Dr. Siegel, come quick!"

The mating experiment, designed to help understand the genetic and neurological basis of sexual behavior, may not benefit generations of chickens to come, says Siegel. But the shouting test yielded important information. Overall, chickens that were socialized 'by being gently sung and spoken to, as well as touched daily' were more resistant to infectious disease than the ignored and hassled birds. *You* may not want to pet a fowl, but if you're in the chicken business as a producer, an eater, or a chicken, this is important information.

"I'm having fun," Siegel concludes. "You can also do a lot of good, because people eat these things."—*JAMES GORMAN*

CONTINUUM

Trax: Faster than walking between terminals at O'Hare

LIFE IN THE FAST LANE

Now, from the makers of France's high-speed TGV (*trains à grande vitesse*) train, which travels at 165 mph, relief for the foot-weary: an automated pedestrian walkway that travels faster—not slower—than normal walking speed. Currently undergoing endurance tests in Nantes, France, the Trax system, developed by Ateliers et Chantiers de Bretagne, is scheduled to go into service in the Paris subway system this year. Surprisingly, the accelerating walkway is not new technology. An early prototype was exhibited at the Paris Expo of 1900.

Passengers enter at a speed of 2 mph and exit at 8 mph—without ever being swept off their feet. The key: a series of overlapping plates that are shifted to lengthen or shorten the treadway—thus accelerating and decelerating its motion. A handrail with similar overlapping links provides support. The Trax system travels so smoothly that elderly and handicapped passengers were able to maintain their balance at the higher speed of 8 mph during tests.

But what are the benefits of a conveyor belt that moves so slowly, even at maximum velocity? According to studies done on the Trax system by the Port Authority of New York and New Jersey, a typical pedestrian can actually save two whole minutes of time by traveling on a 1,000-foot Trax walkway. Explains research engineer John Fruin: "I've seen people wait five minutes for an elevator to avoid climbing five stories, so I think the time savings will be attractive." And since time equals money, a commuter who earned $10,000 a year and used the Trax system twice daily would save as much as $80 annually.

But perhaps the greatest advantage of the accelerating walkway is the frustration it alleviates. No longer will it take globe-trotting travelers longer to shuttle between airport terminals than to fly from New York to Paris on the Concorde. Says Trax's U.S. representative Howard Goldberg: "Trax systems are ideal for distances of one thousand feet or more—in airports, shopping malls, and parking garages."

The first systems in the United States are likely to go into New York's JFK and Chicago's O'Hare airports and in the heavily trafficked Times Square subway station in New York City.—Phoebe Hoban

"You can observe a lot just by watchin'."

—Yogi Berra

COKE SMUGGLER'S DEATH

Body packing seems like a foolproof way of smuggling cocaine. You swallow the powder in balloons or condoms and spend a few uncomfortable hours on a plane to the United States. Then you take a laxative. Hours later, you've got tens of thousands of dollars worth of the illegal drug.

But frequently the balloon breaks or the drug inside leaches through to your bloodstream. Then, says Dr. Margaret McCarron, of the University of Southern California Medical Center, in Los Angeles: "You go into a seizure and cardiac arrest. It's a horrible death."

McCarron was so appalled, that she worked with 75 body packers at a hospital prison, in hopes of saving their lives. Most were eager to be relieved of their burdens: up to 175 packets—nearly two pounds—of cocaine.

McCarron X-rayed each patient to determine what kind of packets had been swallowed and what condition he was in. Balloons or knotted condoms were the leakiest packages, it was safer to wrap a coke paste in foil and then seal it in latex tubing. Then, she administered anything from activated charcoal to absorb the drug to a gentle laxative to get rid of it. In one case surgeons operated to get a packet that wouldn't move.

"When we first searched the literature," notes McCarron, "all I could find were coroners' reports. Their subjects had all died."

—Douglas Starr

Too high: When the balloon breaks, dumping up to two pounds of cocaine into a smuggler's bloodstream, it's not a pretty scene.

American Indian roots. New linguistics, dental traits, and blood types may match Native Americans to their Siberian ancestors.

INDIAN MIGRATIONS

Scientists agree that America's native Indian population came from Siberia, migrating across a long-since-vanished land bridge across the Bering Strait and down the length of the North and South American continents. But experts have long disagreed on the number and dates of specific migrations and on the specific points of origin in Siberia.

Now a unique collaboration among scientists using three distinct methodologies may help unravel the puzzle. First, linguist Joseph Greenberg of Stanford undertook a new classification of Native American languages, trying to reduce the 200 or so postulated language families to a number that made more historical common sense. "If you've got two hundred separate families," Greenberg says, "it seems utterly unlikely that you can draw two hundred separate migrations from that. Following this line of thought, Greenberg examined 300 to 400 words in each of over 1 500 Native American languages and was able to pare the number of families down from 200 to only three. The Amerind (by far the largest, with some 1 000 languages), the Na-dene (including Navajo, Apache, and many Pacific Northwest languages) and the Eskimo-Aleut.

Meanwhile, anthropologists Christy Turner of Arizona State University and Stephen Zegura, of the University of Arizona, had been independently trying to classify Native American populations according to physical characteristics. Turner compared dental traits of Native Americans—both living and dead—with those of skeletal remains and living populations in Siberia. Zegura looked at blood types, enzymes, and proteins. Both scientists found their evidence produced the same three population groupings that Greenberg had identified.

Ordering and dating the migrations is trickier. Although details are still being worked out, the three scientists agree that the first migration, the Amerind, began at least 12 000 years ago near Siberia's Lena River valley. The Na-dene migration began in or near the Aldan River region at least 6 000 years ago, and most of the late arriving Eskimos (the Aleuts present a separate and as yet unresolved problem) started out some 4 000 years ago from the region of the Amur River basin, on the Sino-Soviet border.

These findings are sure to be controversial. Few linguists have been willing to group the Indian languages into any fewer than six families, while some archaeologists insist that Indians were living in North America as long as 50,000 years ago.—Bill Lawren

"If you cannot—in the long run—tell everyone what you have been doing, your doing has been worthless."
—Erwin Schrodinger

FRAGILE CHROMOSOMES

Cigarette smoke and other substances can increase the risk of cancer. But while some people exposed to a particular carcinogen get the disease, others do not.

Why? The crucial difference, says University of Minnesota geneticist Jorge J. Yunis, may be the presence of just-detected "fragile sites" in the chromosomes.

In the multiphase process of cancer, Yunis explains, the critical prelude occurs when a chromosome breaks down, rearranging itself and activating an oncogene, or cancer gene. When chromosomes come apart at the fragile, or defective, site, malignant tumors may grow. This genetic flaw, Yunis thinks, may make a person vulnerable to cancer.

Yunis compared chromosomes in tumor cells to chromosomes in normal blood cells. When a patient had tumor cells, he found that patient also had fragile sites in healthy blood cells. Thus, fragile chromosomes seemed to indicate a predisposition to cancer.

Now that Yunis has linked fragile sites to cancer, he has embarked on the long, tedious process of cataloging the genes in fragile sites and matching them to specific cancer genes. "Once we demonstrate a strong correlation between certain fragile sites and a predisposition to certain cancers," he notes, "we can go in and repair or replace those weakened chromosomes."—Rick Boling

"The wilderness is disorder. The wilderness is the earth itself, and the dust between the stars, from which new earths are made."
—Ursula K. LeGuin

"What scientists have in their briefcases is terrifying."
—Nikita Khrushchev

CONTINUUM

SUNSPOTS AND DISEASE

Astrologers trace our earthly ills to the heavens and in one sense at least, they may be correct Two European scientists, working independently, have just turned up evidence that cyclical sunspot activity can actually make people sick

An English epidemiologist has reviewed the course of the six major influenza pandemics of this century and found that they were 'synchronized'—at least as far back as 1917—with cycles of sunspot activity And according to the researcher, R E Hope-Simpson, of the Epidemiological Research Unit, in Cirencester England, all but one pandemic involved a major 'antigenic shift ' in which the flu virus evolved a new protein coat and became resistant to the immunities people had already built up

But *how* exactly do solar cycles affect the inner workings of human bodies? Ask Solco W Tromp, director of the Biometeorological Research Center, in the Netherlands Tromp claims sunspot cycles influence such vital biological processes as blood sedimentation rate (BSR), which parallels fluctuations in the amount of albumin and gamma globulin These substances in turn, can signal changes in resistance to infection Over the last 30 years, the Dutch researcher has been collecting figures on 730 000 healthy male donors from 25 blood banks around the world His report? Peaks in BSR in human beings have coincided uncannily with periods of maximum and minimum sunspot activity in the skies

'It's most likely' concludes Tromp "that this is caused or triggered by extraterrestrial forces "

—Robert A. Freitas, Jr.

Workers were told to gargle with salt water during the great influenza epidemic of 1917 Was the culprit extraterrestrial?

MAN BITES SHARK

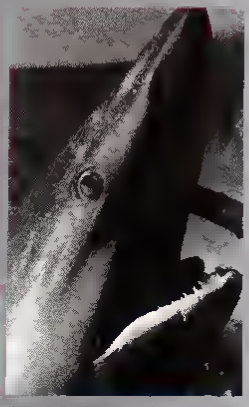
Some people fear that sharks may obliterate California's most cherished species the surfer But according to a number of West Coast marine biologists, it may be the shark itself who is at risk the victim not of careening surfboards but of its own scrumptious flavor

Last year alone California's shark catch amounted to some 8 million pounds—more than four times the size of the catch in 1976 Fishermen and connoisseurs particularly favor the hearty taste of the thresher, the soupfin the leopard, and the smooth hound As researcher Bruce Weldon, of Northern California's Moss Landing Marine Laboratory, puts it, "It's simply a great-tasting fish It's a delicacy "

According to Weldon, scientists are particularly concerned about the shark because it is slow to reproduce Thresher shark females, for instance do not become fertile for at least seven to ten years, and even then their long gestation period and relatively small birth cavity limit them to producing a maximum of four pups per year 'If the thresher is heavily fished,' Weldon says, "it doesn't really have the ability to turn on the juice and produce more young "

As yet no one is willing to put threshers and other commercial sharks on an official endangered list simply because not enough is known about such factors as population size and reproductive span But the danger may be exacerbated by the legal situation In California there are as yet no laws limiting either the size or the nature of the thresher catch The fish and game department prefers to watchdog the catch by granting permits only to specific fisheries "Still,' says Weldon, if a fishery has a permit it can kill as many sharks as it wants It can even take the babies ' All this could add up to big trouble for game sharks 'We should keep a close eye on these fish," cautions Weldon

—Bill Lawren



Jaws? Endangered? Just when he thought it was safe

"If you put tomfoolery into a computer, nothing comes out but tomfoolery But this tomfoolery, having passed through a very expensive machine, is somehow ennobled and no one dares criticize it '

—Pierre Gallois

Clifford Pickover Teaching computers to sing Handel

COMPUTER CHORUS

Mormon Tabernacle Choir watch out An IBM programmer has taught a computer to sing a few measures of the Hallelujah Chorus' in harmony This electronic chorus may be the most human-sounding piece of computer music to date

The trick was accomplished by Clifford Pickover an IBM researcher with a long-standing interest in music Pickover was working on a project to make computer speech more intelligible, when he decided to pursue something that had been nagging him for years "I wanted to see if I could make a computer simulate a chorus,' something he says, that had never been done

He began the project last year aided by several advances in the field One is an improved speech-simulation system that breaks English into 1 000 separate sounds, conferring an unprecedented, natural quality on the speech Another advance is a graphics system that displays prints of the computer s 'voice' on a screen By using a joystick to modify the voiceprints, Pickover can fine-tune the machine's output to sound like a human chorus While the result is impressive he adds it's slightly metallic, so it's not yet a threat to the community choir

IBM has no plans to market the music especially since Pickover s seven-second demonstration would fill an entire personal-computer disk But someday says Pickover computerized singing will fill America's homes "The human voice is limited by range and duration Someday composers will write music only computers can sing '—Douglas Starr

"The aim of science is not to open the door to everlasting wisdom but to set a limit on everlasting error.'

—Bertolt Brecht

RED FOR SPOILED

Tired of buying milk that is well on its way to cottage cheese when the stamped date assures you it's still fresh? And what about prematurely spoiled hamburger, expired drugs and those yellowish blotches on the snapshots you made using old film?

Those SELL BY ____ labels on perishables are all well and good but they can t take into account temperature variations, handling conditions and inadequate refrigeration Fortunately biotechnology has come to the rescue Cornell University food scientists Frank Kosikowski and Virkram Mistry have devised Band-Aid-size monitors that change from green to yellow to red—like traffic lights—reflecting how long a product has been on the shelves and under what conditions

Each chameleonlike monitor consists of two compartments—one filled with a lipid or fatty substance called tricaprione, the other with lipase, a fat-destroying enzyme made by the pancreas Once the product is packaged, the seal between the two sections is automatically broken, triggering a chemical reaction At first the mixture stays green denoting freshness But if the temperature rises above a preset level the enzyme breaks down the lipid into a fatty acid turning the tag yellow and then red Yellow means 'caution,' and red means "spoiled '

To judge by the scientists experiments with milk, the new color code is a better consumer aid than a stamped date Though the time-temperature tags now cost 20 cents apiece the manufacturers hope to cut the price tag to one penny Already in use on certain bulk supplies, they re expected to hit the super markets within a year

—Susan Lang

"Anyone who has common sense will remember that the bewilderments of the eyes are of two kinds and arise from two causes either from coming out of the light or from going into the light, which is true of the mind s eye, quite as much as of the bodily eye "

—Plato

When the tag turns red you ll know it s time to throw out that burger milk or roll of film In supermarkets everywhere—next year

CONTINUUM

SNAPSHOTS ON THE COUCH

A picture is worth 1 000 words, and according to psychologist Alan D Entin it may be worth a good deal more Photographs can divulge personal and family problems in a surprisingly powerful way, ' says Entin of Richmond Virginia "They are accurate recordings of reality '

How does one see that reality? Simply ask a lot of questions "Entin says Who are the people in the picture? How are they grouped? Who is touching whom? Is one person always in the center of the photograph? Is the eldest/middle/youngest child always in the favored position between his/her parents? Is your mother in-law hovering protectively over your spouse? And perhaps most important who *isn t* in the picture? Where was Dad? Why, over a period of years was Johnny absent? Did the family ever acknowledge that he had a problem?

These questions have helped Entin develop a technique called *phototherapy* in which patients study pictures to learn about themselves One patient was a successful adult male who appeared to be trying to prove something he couldn t comprehend At Entin's request he brought in the family album In many of the photographs the man was facing his mother with a longing look in his eyes And in one shot he was actually on his knees next to her

'He was in the position of a supplicant ' Entin said He was pleading In a succession of photographs it became obvious—to both of us—that he was still very much dependent on his mother, that he wanted desperately to prove he was a good boy '

Some pictures can also provide eerie clues about the future Entin studied one family album in which the father suddenly began appearing with his children to one side and his wife to the other Sometimes he actually seemed to be holding the kids away from their mother Several months later the couple was divorced, and the man filed for custody of the children

' Photographs have meaning " Entin concludes 'They don t lie.'

—Pablo Fenjves

Wh[illegible]rong with this picture? A lot probably Why is Pop in the center? And why does Egbert look so strained? Where s Mom?

The cortex is an enormous haystack and we are more likely to find our needles in some smaller bundle "

—J Z Young

BINGE-EATING CURE

Devouring a feast and then vomiting to stay svelte was acceptable social conduct at ancient Roman orgies Today such behavior when persistent is diagnosed as the disease bulimia

Simply stated, the bulimia sufferer wolfs down an incredible amount of food (for instance a box of cookies a half gallon of ice cream and a frosted cake) Then the bulemic purges her body by vomiting or by taking laxatives and by fasting for hours or days, until the compulsion to binge again takes hold Over 3 million Americans (90 percent of them women) are thought to suffer from this cycle of gluttony and starvation

Until recently psycho therapy was the only proven way to treat bulimia But now psychiatrist James Hudson, of McLean Hospital, in Belmont Massachusetts, has a medical cure Hudson realized that many bulimia patients also suffer from severe, chronic depression Thus he and colleague Harrison Pope began to put their bulimia patients on antidepressant drugs such as imipramine Of 100 patients treated in this way Hudson says 90 percent have been able to substantially reduce or even stop their binge eating "I m talking about people who binged and vomited every day for up to fifteen years ' he says 'and all of a sudden this urge turned off like a faucet "

No one is certain why antidepressants suppress the urge to binge But all indications are that the same imbalances in body chemistry underlie both bulimia and depression Hudson explains, so that the two

Bulemics often put away two or three cakes at a sitting

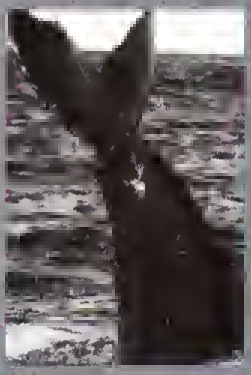
conditions are effectively controlled with identical medication 'Bulimia has responded to a wide variety of antidepressant drugs' Hudson says It seems that if it works for depression then it also works for bulimia'—Eric Mishara

'Don t you know that you are free?Well, at least in your mind if you want to be

—Sylvester Stone

WHALES ON LAND

Aeons ago, when India and Pakistan formed a continent separated from the rest of Asia by the Tethys Sea ancient whales apparently lived on land by the water s edge They had long, wolflike snouts and fed on the meat and fish they found along the Pakistani shore They were also much smaller than their modern descendants averaging six to eight feet in length and weighing somewhere between 300 and 400 pounds



Earlier whales walked on land and had wolflike snouts

Fossils of these 45-million year-old to 50-million-year-old mammals thought to be the oldest and most primitive whale specimens known, were recently recovered by a team of researchers headed by Philip D Gingerich of the University of Michigan From red sediment in the rocks of the Indus Valley between the Khyber Pass and Islamabad the fossil hunters extracted the back part of a skull and several teeth of an animal they named Pakicetus (whale of Pakistan')

The structure of Pakicetus's middle ear which was remarkably well preserved in the fossil bears none of the modern whale's adaptations for deep diving or for hearing underwater The skull fragment also indicates that the animal held its head angled down, like a cow or horse instead of straight out as ocean dwellers do

Paleontologists have long assumed that whales once lived on land, since all mammals must trace their origins to a single ancestor most likely a terrestrial reptile But the fossil evidence for land whales has been lacking

'Until we found our specimen ' reports Neil Wells, of Michigan's Museum of Paleontology, the earliest known whales were already marine animals Ours provides a really nice transitional form ' Wells adds that he hopes to return to Pakistan next year with Gingerich and the rest of the group 'There s more of the whale to find," he says —Dava Sobel

"Progress is a comfortable disease "

—e. e cummings

LASER CUTLERY

Always had trouble carving that roast for Sunday dinner? Hang on a few years, and the household laser should be handling that and many other tasks

The amazingly versatile laser knife No more carving doldrums for Dad, and if he slips the cut is automatically sterilized

According to laser expert Rocco Lobraico the first generation of kitchen lasers will probably carve the main course automatically inside your microwave, and future laser cutlery will be more versatile

Imagine a single knife that will split coconuts cut through crab shells and slice turkey right through the skin bones and flesh with phenomenal accuracy In addition, the laser knife should make decorative paring a breeze and after dinner it could be used to zap the residue in pans and ovens for easy cleaning

Lobraico who is secretary of the Mid-West Biolaser Institute, says these are speculations, but he sees no real technical obstacles Small, hand-held lasers he points out are already being made experimentally and though such problems as reflection of the beam off chrome objects will have to be dealt with, it is conceivable that lasers will eventually shrink enough to fit in with tableware

Injuries are possible, Lobraico adds, but even if you cut yourself, the consequences may not be as bad as those of a cut inflicted by a kitchen knife 'When used in surgery, the laser sterilizes the incision as you cut ' he explains 'I've accidentally zapped my fingers several times, and the wounds heal very rapidly'—Rick Boling

CONTINUUM

Where the flowers never wilt, the wine is served in crystal goblets, and the manicurist knows how to work around the I V

VIP HOSPITAL

You arrive in a chauffeur-driven limousine and go directly to your room, where the wretched little details of admission are handled Fresh flowers and fruit arrive daily, along with your choice of local and out-of-town papers Secretarial services are always available Hairdressers and manicurists are on call Gourmet meals—from an international menu, of course—are served on fine china with silver accessories And the wine comes chilled to taste in crystal goblets

It is you'll have to admit, one of the finer hospitals you've ever stayed at

Hospital? Yes Doctors Hospital, in Hollywood Florida, to be exact The pampered patients—those well-heeled enough to pay from $50 to $150 a day more than the standard rates—are housed in a super VIP wing that is the brainchild of hospital administrator Kenneth Berg

Berg is hoping the new wing will lure back to the small private hospital some of the patients lost to huge medical centers built in the booming Sixties In addition public-relations director Joan Meyers says the new facility may help make up for some of the funds that the hospital expects to lose because of changes in Medicare

The hospital, however doesn't want to limit the wing to the superwealthy "I don't want just the banker or the corporation president,' Berg says 'I want the everyday person who is willing to spend a little extra for some amenities I think the middle class can afford that —Robert Deckert

"This is my prediction for the future Whatever hasn't happened will happen, and no one will be safe from it '

—J B S Haldane

ALLERGIC DEAFNESS

The scientist spent countless hours in his damp, moldy laboratory, losing more and more of his hearing all the while Fortunately, his hearing loss came to the attention of Dr Leonard Girsh who spotted it for what it was an allergic reaction to mold And now thanks to medication the scientist hears just fine

The problem was that the scientist's allergic reaction had caused his eustachian tubes the crucial middle-ear passages, to swell and become blocked, reports Dr Girsh who is chief of allergy and clinical immunology at the Medical College of Pennsylvania, in Philadelphia Girsh has now treated more than 100 patients with hearing losses caused by allergies to substances ranging from wool blankets and household dust to pollen pet dandruff and certain foods (Mold or mildew in milk, wheat and corn are common culprits, according to the allergist) Some patients had been partially deaf for as long as ten years and had even resorted to unsuccessful ear surgery before getting help

Fortunately, allergic deafness is usually curable Once the allergen is identified, the patient can avoid it, or if the offending substance is too pervasive he can be desensitized with ever-increasing injections of it 'It's very gratifying,' says Girsh "One of the earmarks of allergic disease is reversibility Our method isn't perfect, but it can help many deaf people "

How did Girsh spot the allergic deaf? He simply gave patients a hearing test followed by a nasal decongestant and then retested them More than half of the 200 deaf patients in a recent study regained their hearing almost at once Allergic deafness may be more widespread than anyone imagined

—Eric Mishara

Cat dandruff pollen woolen blankets mold mildew household dust, wheat Some of the little things that can make you deaf

God's presence was overpowering
on the moon, and so they returned to spread the gospel
according to Apollo

Righteous Stuff

By James Gorman

test pilot always wants to go a little higher and a little faster. It's just like materialism. There's always more things that you want. Man can gain the whole world and lose his soul."—James Irwin

"God has humbled me. I mean, I wept before audiences, I mean, sobbed in front of high-school kids, because God doesn't need any grim-jawed, steely-eyed, proud fighter pilots. He needs a humble servant."—Charles Duke

"Evil is synonymous with ego."—Edgar Mitchell

painting by Luděk Pešek

These are astronauts talking—astronauts as in *The Right Stuff*. They started out as test pilots, like the men Tom Wolfe wrote about, rising in their careers by moving up a kind of pyramid, a ziggurat, in which the less skilled or unlucky were left behind, not infrequently by dying in a jet-fighter crash. A pilot well on his way up the ziggurat has a unique view of life. Or, as Wolfe puts it, "The entire world below *left behind*. Only at this point can one begin to understand just how big, how titanic, the ego of the military pilot could be."

So why are these men downgrading ego, pride, and flying high, far, and fast? And what is this talk of God? American heroes go to church, of course, but this sounds like something else. Besides, these aren't just any astronauts. They went to the top of the ziggurat, not only among pilots but among the astronauts themselves. They went to the moon.

Remember the moon shots? Some people still think it was all a deception, that the moonwalks took place out on the desert somewhere. Perhaps George Lucas directed. But 12 astronauts really did go to the moon between July 1969 and December 1972. They started during the summer of Woodstock, continued through the height of the antiwar marches, the Mylai massacre, the killings at Kent State, the Manson murders, and the Watergate break-in. It wasn't quite the way it was for the Mercury astronauts Wolfe wrote about, the cold warriors in single combat against the Russians. It wasn't the greatest time for American heroes. But they had parades, and their names are remembered, well, at least Neil Armstrong's name is.

Back on Earth, they went on to figure out life after the moon. Some of the Apollo astronauts went on to the shuttle program. John Young, the ninth man on the moon, flew the first orbital flight test of the shuttle. Others are in business for themselves or are consultants or beer distributors—an occupation that at one time claimed three Apollo astronauts. One was a senator, Harrison Schmidt, from New Mexico. (John Glenn never went to the moon.)

Some had painful reentries. Edwin (Buzz) Aldrin, the second man on the moon, documented his post-moon nervous breakdown in his book *Return to Earth*. Some astronauts have since taken unexpected career turns. Alan Bean, the fourth man to walk on the lunar surface, is now a painter of moonscapes, a full-time artist. And some have embarked on spiritual journeys.

James Irwin, Edgar Mitchell, and Charles Duke all wanted to do something different than flying the shuttle or selling beer. They all pursued, or were pursued by, some new version of the right stuff—call it the righteous stuff, God's grace, or consciousness with a capital *C*, as Mitchell did. And they all think they've found it.

The *Antares*, Apollo 14's lunar module, detached from the command module *Kitty Hawk* and landed in the Fra Mauro formation of the moon, an area of hills and ridges, on February 5, 1971. Stuart Roosa stayed in the command module while Mitchell, lunar-module pilot, followed commander Alan Shepard—America's first man in space and now a distributor for Coors beer—onto the lunar surface. Mitchell was the sixth man on the moon.

He was also the first to conduct an experiment in ESP (extrasensory perception) from space. He tried to use telepathy to send his thoughts to four different people on Earth. The experiment didn't work, except that the results were lower than could be expected statistically, which Mitchell thought might be significant. But the experiment was not authorized by NASA, and when the story came out, the newspapers went for it. It was, to Mitchell's dismay, a sensational story around the world.

Today Mitchell has his office in Jupiter, Florida, near Palm Beach, well south of Cape Canaveral. He is an independent businessman, working with corporate clients as a consultant on adapting aerospace materials to new uses. He also acts as a management consultant. There are wide windows in the office, and a balcony overlooking a lush subtropical bay. The balcony is covered with an amber-color all-weather rug. In the main room there is a vast wooden coffee table, matched by an equally vast white couch.

Mitchell doesn't look like an astronaut these days, or at least he doesn't look the way I expect an astronaut to look—mildly heroic military with a bit of test-pilot swagger. Mitchell looks like a Florida businessman. He is wearing hot-weather clothes, a light sport coat, and an open shirt.

He is an easy talker, with a deep, resonant voice that is slightly rough. He smokes cigarettes constantly as he talks, and he projects the facile, yet irresistible, warmth of a good talk show host. On late-night radio he could make a fortune.

Mitchell is fond of making distinctions and points out that he is not "religious." Says Mitchell, "I define spirituality as an individual's personal experience of divine reality. Religion is believing in someone else's experience of divine reality."

It is hard to pin down precisely what Mitchell's own experience of divine reality is. But his voyage to the moon is a good place to begin looking.

On the way back from the moon, while contemplating the earth, Mitchell had a "peak experience or a religious experience, depending on what word you want to use." It was an "explosion of awareness, an aha! a wow!" It was, apparently, what a religious person would call a revelation.

What it meant to Mitchell was that God was real—although Mitchell's is not a biblical God—and something more. He came to realize that the universe is made up of matter and spirit, but that they are not separate. The bridge is consciousness. God is something like a universal consciousness, manifest in each individual, and the route to divine reality and to a more sat-

CONTINUED ON PAGE 98

With a farsighted plan, Mississippians are resurrecting hope for troubled schoolrooms and their future

DIXIE'S NEW WAVE

BY ROBERT WEIL

You would have thought that it was 1952. The schoolhouse was a relic from bygone times. The ventilation was so poor that on hot days it became unbearable before noon. The toilets were always clogging; the windows had rotted. In one classroom there were thirty-three fourth-graders sitting in a mobile unit adjacent to the main wing. Teachers could not link experiments and lessons with scientific principles that should have been introduced.

"Even before you teach science to children you have to assume some basic reading competency. The fundamental problem in this school was indeed reading—and not only with the children. Many o

PHOTOGRAPH BY DAN MORRILL

the parents, I'd say well over fifty percent were functionally illiterate."

"When we tested the grade-school teachers, they performed poorly on standardized science achievement tests—some as low as on a third- or fourth-grade level. I'm afraid that problems like these remain in other rural schools in Mississippi."

The speakers—two Mississippi school principals and a state-college professor—don't want to be identified. To say that a school has problems is to admit that the future is clouded. That's unsettling news in any part of the country. But it's particularly unpalatable in Mississippi, where leaders have worked hard over the last 20 years to create a positive state image: devoid of racial tension. Land is so abundant and rich that it's sometimes easy to forget that problems remain. From the resort towns of Gulfport and Biloxi, which bask in humid breezes from the Gulf of Mexico, to the antebellum city of Natchez, with its Greek Revival mansions, Mississippi can captivate with a charm unlike that of any other Southern state.

But educators here, particularly those involved with the teaching of science and math, know Mississippi to be no land of lotus. The frightening numbers speak for themselves. Forty-four percent of the adults over twenty-five years old are illiterate. The dropout rate statewide is excruciating. Of the students who turned eighteen in 1981, less than three in five (58 percent) earned high-school diplomas. In March 1982 some 8,000 Mississippi teachers demonstrated in Jackson, the state capital, protesting the worst pay scale in the nation—an annual average of $14,141 per teacher.

If education in general is in trouble, the teaching of science and math is a potential disaster area. In 1982 the Mississippi university system produced only four new chemistry and physics teachers.

"I'm not saying this to belittle the state," says Dudley Peeler, executive officer of the Mississippi Academy of Sciences, "but if you view all the states in economic terms, Mississippi is essentially a Third World country. There are few centers for science here, and we simply don't have enough people whose presence is attractive to high-tech industry."

Mississippi isn't the only state with problems. A commission of the National Science Foundation warned last year that America is rapidly losing ground to foreign nations in its ability to teach children to become tomorrow's leaders. According to the report, "Our children could be stragglers in a world of technology." The 20-member commission proposed a crash program to boost science and math education. "There is a crying need for a national role and national leadership," the report said. It added that the first year of proposed remedies—including model schools, teacher training, tougher courses, and longer school days—would cost the country $1.5 billion.

In a speech last December, President Reagan argued that massive new funding wasn't the answer, his words reflecting a personal belief that federal aid for education must be reduced. "American schools don't need vast new sums of money as much as they need a few fundamental reforms," the President declared.

As it happens, Mississippi over the past two years has inaugurated "fundamental reforms," probably on a grander scale than the President envisioned. The guiding architect was the state's Democratic governor, William Winter. A lawyer from the edge of the state's renowned delta region, Winter was determined before he left office this past January to undo the shame of Mississippi's public-school system.

He drew up a bold plan to attack the crippling problems in the classroom. In the best Southern tradition, he went on the stump at town meetings and rallies to sell the idea to voters. And he convened a historic session of the Mississippi legislature in December 1982. Just a few days before Christmas that year the lawmakers responded, passing one of the most comprehensive education laws in the country.

> *"He was really a coach, but someone had to teach math, so he subbed. I thought he knew his stuff. Then I got to USM and realized I didn't know a thing about math."*

The Education Reform Act of 1982, as it is formally known, includes provisions for an extensive kindergarten program and a law mandating compulsory attendance in schools. In addition to these reforms, the law calls for more spending. It outlines a revised teacher pay scale comparable with salaries in other southeastern states and provided teachers with an across-the-board raise of $1,000. To bolster deficient math and science areas, the legislators established a scholarship program to encourage qualified college students to pursue public-school teaching. The total package will cost taxpayers $219 million in 1984 and 1985 alone.

In enacting the law, Mississippi became a symbol to the nation. Its legislators had anticipated the concerns later shown by the President and a bevy of ad hoc education panels. If Mississippi with its intransigent rural poverty could revitalize its troubled state school system, so could other states. Legislators in neighboring Arkansas put through an education package 11 months later. In California lawmakers adopted a $900 million school bill with many innovative measures that drew praise from U.S. Secretary of Education Terrel Bell. More than 30 states have set up task forces to improve math and science education. But educators across the country have paid particular attention to the Magnolia State and Winter's plan for his people.

The ominous question is, will a "few fundamental reforms"—action by educators or legislators on the state or local level—be able to overcome such problems as finding teachers, keeping them in the system, and dealing with a backdrop of illiteracy in the home? Or maybe the answer is much more money, combined with reform. Or most sobering of all, possibly neither reforms nor cash together can cure the cancer that has debilitated America's schools, the spawning ground for America's next generation of scientists.

"I can still remember senior math. If Mr. A—— didn't put me to sleep, I'd read a comic book that someone had brought to class or anything else I could get away with. A—— was really the wrestling coach, but someone had to teach math, so he subbed in. 'Did anyone do their homework?' he'd ask. 'No,' we'd yell from the back. 'Well, let's go over it,' the coach would say. Sometimes he'd leave in the middle of class and smoke a cigarette. But I always thought he knew his stuff. Then I got to USM and realized that he could have been teaching me Greek, because I didn't know a thing about math."

—A Mississippi high-school graduate

What student is not overjoyed by a note on the blackboard that says MISS MAIDSTONE HAS HAD A FLAT TIRE AND HER FIRST TWO ALGEBRA CLASSES WILL BE CANCELED TODAY?

But a temporary reprieve from the drudgery of quadratic equations becomes more serious when a month or even a year passes without a teacher in the classroom. High-school principals throughout Mississippi know this problem all too well. Hampered by insufficient funds and an empty pool of applicants, they simply cannot find new science and math teachers. As a result, staffing classrooms has become a herculean task, and the struggle to offer a science curriculum that measures up to state standards has become difficult.

Mississippi's reform act attempts to deal with this critical teacher shortage. The new law allows prospective science and math teachers to apply for interest-free student loans that need not be paid back—as long as the recipients teach for a specified period of time in the state.

For Mike Ramsey, a twenty-year-old honors student at the University of Southern Mississippi (USM) in Hattiesburg, the state-financed program means that he can now go on for an advanced degree. "I'm not going to have to scrounge up my pennies. Now perhaps I can come back for a graduate degree in science education," adds the idealistic junior from the coastal

community of Long Beach. 'Even without the scholarship program I had planned to teach in Mississippi because of the condition of the school system. Being what I consider a good student, I thought I could make a contribution.'

Despite such new incentives, overwhelming problems remain. Many new Mississippi college graduates refuse to teach in rural or economically disadvantaged areas. 'For two years we've been trying to find a math teacher who is certified,' says Anderson Liddell, principal of the virtually all-black Noxubee County High School. 'We are now sending one teacher back to school to get recertified in math.' Mildred McGhee is principal of Wilkinson County High School, which is located in a predominantly black area. She shares Liddell's frustrations. 'We use teachers who majored in science for grades nine to twelve, but we have a phys-ed coach teaching seventh-grade science and an industrial-arts teacher teaching seventh-grade math. We could use another math and science teacher, easy,' McGhee says.

'The problem is that administrators are having to hire people who are not qualified to fill the position,' points out USM science-education chairman Bobby Irby, whose homespun wisdom has guided hundreds of prospective science teachers over the years. With the recent state board of education mandate that Mississippi university freshmen must complete three years of high-school science prior to matriculation, the situation will undoubtedly grow worse, especially in such rural counties as Wilkinson and Noxubee, where the science curricula are hampered by too few teachers.

Administrators now pray for miracles, and once in a while their prayers are answered. 'We had to hire an assistant coach recently,' says Hollis Morris, Superintendent of Schools in northeast Amory, the rural village near Tupelo Elvis Presley's birthplace. 'The coach's wife happened to be a science teacher. She was working on a graduate degree when we had an opening in biology. We were very lucky to have found them.'

Snagging a science teacher may soon take on all the intense drama of a football-recruitment campaign. Twenty-one-year-old Lynn Wood comes from Laurel, the same town where Tennessee Williams's legendary heroine Blanche DuBois taught high-school English. Wood will teach science instead, and will bring tremendous joy to the Mississippi high school lucky enough to hire her in 1984. Dozens of high schools have approached the outgoing young woman now completing her master's degree in science education. One man, who wanted her to teach advanced biology, tried to hire her over the phone. 'You wouldn't believe the people who've called me to offer jobs,' she says.

Personnel shortages have forced many teachers into nightly bouts of cramming to prepare for classes in unfamiliar subjects. This 'teaching out of field' has become very widespread. A home ec instructor doubles as a chemistry teacher, a football coach handles a period or two of general science before the afternoon scrimmage. The education-reform act therefore commissioned a study to look into such classroom pinch hitting. When results are in this July, the investigation is likely to uncover severe problems in the science area, but the identification of such deficiencies won't translate into easy solutions.

John Flynt, principal of the tiny first through twelfth-grade New Hebron School in rural Lawrence County, lost his elementary-school science specialist some years ago. He has never found a replacement. Today regular elementary-school teachers cover basic science instruction, and a coach and a home-economics teacher handle science on the seventh- and eighth-grade levels. 'The science trailer was converted into two regular classrooms. I'd love to have another science specialist. My home ec teacher's first love is home ec, not science,' the principal says.

> *'I paddle the kids myself. You gotta know which kids you can paddle. Some are better left to the home, so I give the kid a choice. I love children, love to help them.'*

Higher pay for science teachers is often suggested as one possible solution. 'Tradition is hard to change; there's no doubt about that,' says USM's Irby. 'But if you need something and it's a commodity that is in great demand, you've got to expect to pay a little more for it. And it's time that the people begin to respect the needs of our educational system. Right now those needs happen to be in the areas of science, mathematics, and technology.' A regular secretary, Irby points out, does not resent that an executive secretary takes home more money. Nor do many Mississippi school districts have the slightest qualm about greasing the palm of a winning football coach. The best science teachers will head for Louisiana and beyond if similar inducements are not made, many Mississippi educators fear.

Andy Mullins, former special assistant to Governor Winter, adds a political perspective to the problem of teacher salaries. 'Unlike other Southern states, revenues are not coming in as expected,' Mullins says. 'It becomes a vicious cycle. You can't tax industry too much, and you can't cut teacher's raises. We don't know what will happen at this point.'

But Newtie Boyd, director of the General College at Alcorn State University, suggests that increased money will not solve the crisis. 'If you are a twenty-one-year-old and Dow offers you twenty-four thousand dollars and the schools offer you fourteen thousand dollars, where will you go? If you give students a sound education, they won't stay in education.'

'Our [Mississippi's] legislature has always shown a painfully loud reluctance to give money to public education.'

—Eudora Welty

Hiring a certified science teacher may actually be easier than *keeping* one in the classroom. How does a school hold on to a biology or chemistry instructor who can double his teaching salary by leaving for private industry? How can society confer a better status on the teaching profession when the American public associates poor pay with low prestige?

By and large, the most gifted science instructors leave,' says Herb Lamb, a district science coordinator in Pascagoula. 'I've watched it happen. I don't know how many times.' The reform act provides no solutions either, since its incentive program is aimed at college science majors, not veteran science teachers.

Bess Moffatt is one teacher who has chosen to stay in education. A marine-biology instructor at Pascagoula High School, Moffatt was feted at the White House last October as Mississippi's finest science teacher; her award was a token of the Reagan administration's support for science education in America.

Praised by admiring colleagues in distant cities like Hattiesburg and Jackson, Moffatt is known for her novel and often eclectic teaching philosophy. Besides the obligatory piles of faded *National Geographics* and colorful fish tanks that are essential decor in science classrooms anywhere, here a visitor finds two shelves crammed with sneakers. It's an odd sight, and someone aware of the teacher shortage in the state might come away with the wrong impression that she doubles as Pascagoula's gym coach.

But the sneakers are used by students to explore the wildlife of the Gulf Coast less than a mile away. The footwear hints at Moffatt's teaching ideology: that science should be taught through an inquiry method, and students should unravel the mysteries of science through their own investigations. Her classes often head for Horn Island, for example, to observe the osprey nests and to discover how hurricanes have resculpted the land.

While a television crew hovers outside Moffatt's classroom before her trip to the White House, a less newsworthy story is unfolding in a chemistry lab right down the hall. "I want to stay in teaching, but I don't feel I have much choice but to leave for a

CONTINUED ON PAGE 85

FICTION

He'd do anything
to recapture his childhood
Wouldn't you?

MY ROSE AND MY GLOVE

BY HARVEY JACOBS

James Huberman began collecting things in his earliest youth. He had an incredible sense of the future. When we were no more than nine or ten he told me, "Someday my childhood will be worth a fortune. My father's toys already sell in antique shops for tremendous prices. My mother's old clothes are collector's items. I'm not going to make the mistake they made."

Of course Huberman was a strange lad and the butt of many terrible jokes. When there was nothing else to do, it became the fashion to torture him in small ways. Once he was painted orange. Once an attempt was made to tattoo a picture of Hitler on his ass. Once his parakeet was held for a ransom of five hero sandwiches. Once he was locked in the school toilet over Washington's Birthday while the police searched for his body. Once a suicide note was "signed" by him and left along with his underwear and raincoat, near a raging river. Huberman made the most of those woeful experiences. He not only pledged to remember his assassins, he actually preserved mementos. He saved what was left of the orange paint; he sat for hours on a warm cloth to transfer Hitler's picture and succeeded in creating a kind of Nazi Shroud of Turin; and when the parakeet died of exposure he stuffed it himself. While he was locked in the school toilet, he copied and filed the graffiti he found on the walls. The suicide note, the underwear, the raincoat, and a specimen from the river, along with an article from the local paper decrying the incident, became an exhibit in

PAINTING BY CHARLES BELL

Huberman's own Museum of Indignities.

I was Huberman's only friend—at least his only active nonenemy. I had a premonition about him. I was afraid of his vengeance. Don't ask me why.

After high school, we all went our separate ways. Unlike Huberman, I was not a collector of either things or people. I dropped my roots into hostile soil: the communications business. After a few years in public relations, I realized that the essence of communications was noncommunication. I started out writing clear prose and making direct statements on behalf of my clients. Then I changed my style in favor of obfuscation and made it big. I grew moderately rich.

From time to time, I revisited my hometown. I always asked about Huberman, but nobody seemed to know his fate. He had opened an antique shop, predictably, then sold it and moved away. It must have been difficult for Huberman to sell anything, if ever he did sell anything. In the yearbook under Huberman's picture, the caption read, "He has one saving grace . . ." with *saving* in italics. Clever. I wrote that.

Things went well for me. One afternoon—it was in winter, a silver snow was falling over New York—I remembered my Rosebud, a toy motorcycle given to me by an uncle now dead. I had sold it to Huberman or exchanged it for a Howdy Doody ring. He got the better of the bargain. He always did. The ring was rusty. Now, twenty years later, at the top of my profession, I wanted my motorcycle. I wanted it. And I assumed that Huberman must still have it. Huberman kept his dandruff. But I did not know where Huberman was to be found.

My desire for the motorcycle became an obsession. I began checking information listings in cities I thought might appeal to Huberman. He would enjoy old cities suffering population loss with growing slum problems. As buildings crumbled, Huberman would be there snapping up parapets and door frames for pennies. As populations emigrated, Huberman would wait by the road to buy up their leavings. I found Huberman in a suburb of Cleveland, a small city named Wyet that once manufactured carbon paper. They still had a small plant that turned out the stuff—maybe one box a year—and the Japs were threatening even that company. When I heard about Wyet, I couldn't wait to call information. Sure enough: Huberman, James, was listed.

I dialed the number slowly, enjoying the anticipation. Huberman looked so funny painted orange, so serious stuffing his bird. A voice grunted on the telephone—conserving energy, not wasting it on *hello*. That was promising.

"I want my motorcycle back."

"It'll cost you," said Huberman, and it was James Huberman beyond any doubt.

"Huberman, how are you?" I said. "How the hell have you been?"

"How should I be?"

"What are you up to?"

"The same. You?"

"The same. Nothing has changed. So, it's good to talk to you."

"Ah. The motorcycle?"

"I really do want it. Ask me not why."

"Who asked?"

"Well, I'm not surprised that you still have it. Nor that you knew me by my opening remark."

"So what?"

"Just conversing, Huberman. Listen, I'll tell you what. I have a client in Cleveland. Usually I don't make house calls, not anymore, but maybe I'll come on out there to visit his plant, and while I'm there I can run over to Wyet. We can lift a glass and talk about days gone by."

"I don't know. I'm busy," Huberman said.

"Listen, *friend*," I said. "I'm quite anxious to see you."

"You are?"

"I most certainly am. And I'm equally serious about my motorcycle."

"I'll be glad to give you a price," Huberman said. "But it will reflect the market."

Of course, Huberman was a strange lad and the butt of many terrible jokes. When there was nothing else to do, it became the fashion to torture him in small ways.

"Did I call for a bargain? You know the trouble I went to to find you?"

"Trouble?"

"Trouble. Incredible anguish. I've talked with information operators in forty states."

"Mmm. Come then."

It was arranged. I flew to Cleveland and met with my client. When business was done, I called Huberman and we made plans for our reunion.

Once I called a girl I knew at college some fifteen years after the fact. She agreed to meet for a drink. On the way to our meeting place, I became very nervous. I suddenly felt the presence of time as weight. She must have felt the same. When we finally met, there was a split-second taking of inventory—we both looked thicker and older. She said, "Anything new?" and I said, "Not really, you?" And she said, "Not really." Meeting Huberman was different. I had always felt superior to him, everybody did. My career had blossomed into a fat and desirable flower. Huberman was stuck in Wyet, Ohio, still the man with the broom following a parade. Chaplinesque but unfunny. His pratfalls hurt. The very pleasure of comparing Huberman's track record with my own flooded me with guilt. I would offer him a large sum of money for the toy motorcycle. It would be a blatant handout, a bribe to lower his accusing eyes.

Reaching his street had a Dantesque quality. Wyet, the carbon-paper capital of America, had no lush houses left. On the main street, mannequins in new clothes looked like bag ladies. The town had the feeling of an abandoned spiderweb. And that was the classy neighborhood. The farther I got from the glittering center of Wyet, the worse it got. The web was torn. I found Huberman's "house." Not a house. A gigantic warehouse, certainly a relic of the days when every secretary carbon-copied to a long list. No more.

Of course Huberman James would have a warehouse. He had outgrown drawers and closets by the time he was fifteen. The warehouse would be bulging, and Huberman would know where every item could be found. That was Huberman.

Inches from the door, I nearly turned back. But I pressed the buzzer. After a wait I heard boxes moving, pots clanging, and the slow progress of a presence moving through impossible obstacles. Then the knob turned.

"Yes? Ah. So you did come."

There he was, much different from before, yet the same. Huberman seemed taller and much fatter, yet he had a short, thin appearance. If that sounds confusing, it is because the man emitted conflicting signals. He had a huge belly but a thin face. He had long legs, but crotch to head he reminded me of a golf ball. He wore shoes made for bad feet, striped gray pants that must have come from some executive's annual-meeting suit, a sweatshirt with a faded picture of the Beatles, and an Army fatigue cap. His face hung in space, a planet without promise. But his eyes glittered. He was actually glad to see me. I held out my hand. Huberman looked at it, then he grabbed it and pumped.

"Come in. How are you? I'll make tea."

"Not necessary, Huberman. I can't stay too long. I thought it would be nice to touch base. A lot of years under the bridge."

"Years and years. You look well. Are you doing well?"

"I make a living. And you've got quite a place here."

"Six floors."

The floor was a garden of used TVs, bicycles, sleds, washing machines, sofas, chairs, tables, whatever. Bare bulbs hanging from twisted wires lit the place. I saw a pile of newspapers and magazines and another pile of song sheets and comic books. The piles were immense, as high as pyramids. I sang, "Give me my rose and my glove."

"Why are you singing that?"

"It's from a song called 'People Will Say We're in Love.' About a man who saves souvenirs of a developing romance. The girl attempts to warn him—"

"I know the song," Huberman said.

'*Oklahoma*.' Rogers and Hammerstein. I bought the costumes from the original production. I have the *Playbill*. And one of Hammerstein's shoes.'

'I always thought that song should be your theme,' Huberman.

'I'm not sure I follow you.'

'Forget it. A bit of whimsy.'

We began walking upstairs. It was like navigating to the center of a hive. The walls were hung with posters of former presidents and film stars. We had to climb over a hill of manual typewriters and through a funnel of radios in wooden cabinets.

'Be careful.' Huberman said.

'Aren't you worried about fire?' I said.

Huberman stopped and turned. His face was almost purple. 'I'm very worried about fire,' he said.

I winced. Of course. It was the kind of question that didn't need asking. Are you worried about cancer? What else would Huberman be worried about if not fire? With his luck he must know that someday a spark from something or a lightning bolt would start a tiny flame that would grow and devour his spectacular hoard. Some prankster might throw a firecracker or cigarette. He *should* worry. Especially him.

On the third floor Huberman kept his living quarters. In the center of his mounds and piles was a clear area that held a bed, a table, two chairs, a TV, a sink connected to rubber tubes that led into the darkness to some source of water, and a hot plate wired to one of the ceiling fixtures.

'Home is where you hang your hearf,' Huberman said. That was very frivolous for him, and I chuckled. He laughed back at me. Huberman turned on his hot plate and filled a kettle made of chipped porcelain. He gathered up five or six used tea bags that had dried into knots and put them into a brown bag. He put the bag in a drawer. Then he took a new bag from a Lipton's package. One bag. He kept sugar in a tin that once held marshmallows, and powdered milk in a jar.

'This is cozy,' I said.

'It serves the purpose,' he said.

I saf and waited while he made tea. The tea was brewed from the single bag in large mugs with pictures of the young Queen Elizabeth. Huberman gave me the mug he dipped first. *One saving grace.*

'So, Huberman, here we are,' I said.

'Long time, no see,' Huberman said.

'And you seem confent.'

'I am. Are you?'

'Reasonably. So tell me. Any wife? Any kiddies?'

'I'm thinking seriously abouf marriage,' Huberman said. 'I have a girlfriend.'

'Congratulations.' I said. 'I was married for a time. No children though. Tell me about your girlfriend.'

'She's smart, and she's got tits.'

'Listen, nowadays that's plenty.'

'I know. She's rich. Her father was a doctor. He left her well fixed. She loves me.'

'I'm really glad.'

'Why?'

'Why? Because. On general principles.'

'Thank you. But I'm not sure yet.'

'Risk. That's what life is about, Huberman. Don'f hesitate because she's a doctor's daughter, smart, rich, and with tits. I mean, just because you're in the junk business. It's an honorable profession.'

'Junk business?'

'Whatever. Antiques. Collectibles.'

'I am a curator.' Huberman said deliberately. 'I am building a museum of art and artifacts. I live among priceless and beautiful things.'

'Oh. Right.'

'You think this is a temple of crap?'

'I never said that.'

'The temple of crap is outside.'

'I get your point, Huberman.'

'You came for your cycle. We fraded fairly. I gave you a Howdy Doody ring.'

'The ring was rusfy. It broke.'

'Risk. That's what life is about, eh?'

'Score one for you, Huberman. I had my eyes open. It's curious. I was sitting in my office one day, and I began to think about that motorcycle. That's weird.'

'If begins that way.'

'I realized how much I wanted it. I also realize I shouldn't be telling you. That's not how I usually bargain.'

CONTINUED ON PAGE 106

THE LESSER LIGHT

BY FRANK BUCK

This
pendent world, the most brilliant object
in the night sky,
has often tugged on the human psyche
as if it were
a tide, pulling it in and out
of moods,
revealing shades that the brighter light
of the sun hides
The moon is the source of time,
the wellspring of
calendars and clocks, the birthplace
of poetic inspiration.

*"The moon is the source of time,
the wellspring of calendars and clocks, the birthplace
of poetic inspiration."*

(It also served as an unassuming model for photographers Jake Rajs, Mitchell Funk, and Dan Morrill, whose landscapes are shown here.) Milton saw the moon as the seat of "moping melancholy and moon-struck madness," and in *Paradise Lost* called it the "offspring of heav'n first-born." For Tennyson, it was a "great phantom slowly sweeping through the sky." The Book of Genesis says, "God made two great lights . . . the greater to rule the day and the lesser to rule the night."

This lesser light has inspired contemplative passion—the inner flame, the pale fire. Among South American tribes of the Orinoco, who buried lighted brands in the ground before an eclipse of the moon, it was the guardian of real fire. If the moon were extinguished by the eclipse, then all the fire on Earth would be extinguished in turn. Some natives of New Guinea, who reckoned months by the moon's cycles, threw stones toward it to hasten its phases and thus shorten the trips of travelers. The moon has often been the scapegoat, receptacle of guilt beyond

our understanding. In medieval times, for example, it was blamed for a defective enzyme that left its victims unable to go out during the day and marked them with red teeth and oddly colored hairy skin. These were the werewolves, the moon's misbegotten children.

Those with good imaginations can find as many earthly figures on the moon's surface as there are constellations. In the dark areas that Galileo called *maria*, or seas, horses and rabbits seem to arise, and the proverbial man in the moon smiles or frowns, depending on who's looking. Songs of love have used the moon as a symbol of unity: lovers may one day be star-crossed, but only after they have discovered each other under moonlight. Great poets see much more, of course. Shakespeare found "an arrant thief" who stole 'pale fire' from the sun. Shelley saw an "orbed maiden with white fire." Romeo, bedazzled by the purity of lunar light, called out to Juliet: "Lady, by yonder blessed moon I swear." He should have kept his mouth shut. "Swear not by the moon," retorted Juliet, "that inconstant moon, that monthly changes in her circled orb, lest that thy love prove likewise variable."

"The moon is often used as a scapegoat, a receptacle of guilt beyond our understanding."

FICTION

A classic from a master of prophecy, with a new introduction

TRANSIT OF EARTH

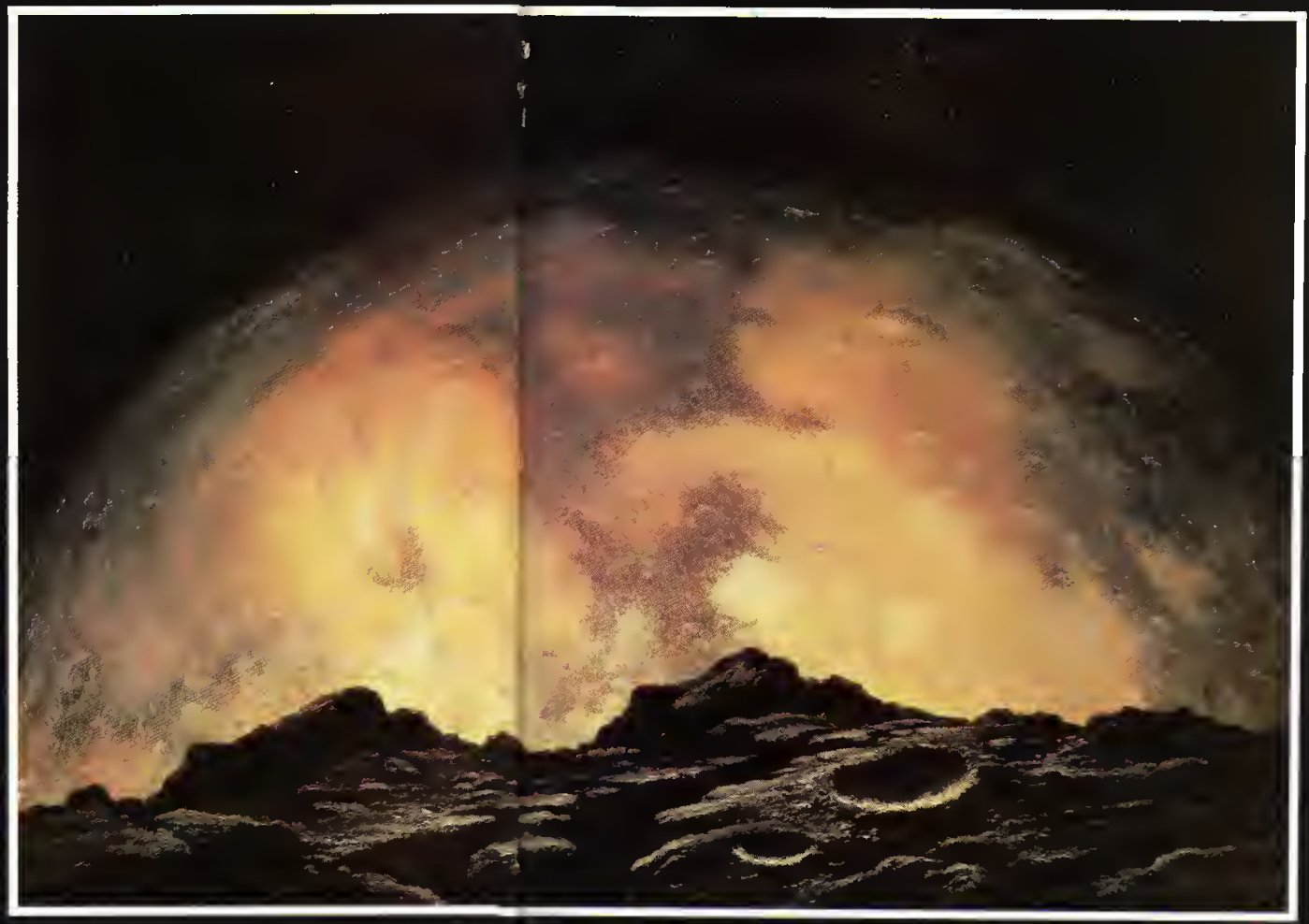
BY ARTHUR C. CLARKE

It is not often that a writer—especially of science fiction—can state categorically: "The events in this story will take place exactly as described, at the precise day, hour, and minute specified—fourteen years and four months from now."

With one slight modification, I could have made that claim on January 16, 1970, when I sat down to write "Transit of Earth" [the story following this introduction]. It would have required the addition of a single word to make it accurate: "The *astronomical* events . . ."

Since I am writing this in December 1983, for a few more months I must still use the future tense: "On May 11, 1984, Ephemeris Time four hours, thirty-two minutes, sun, Earth, and Mars will be exactly in line. An observer on Mars, looking through a medium-power telescope, would see Earth as a small dot crossing the face of the sun."

Though I would like to pretend otherwise, the prediction of such a transit would always have been far beyond my powers of computation, even in the days when I knew a little mathematics. It was first made by the Belgian astronomer Jean Meeus in the *Journal of the British Astronomical Association* (volume 72, number 6, 1962). I read Meeus's paper soon after its appearance, but the idea of using this unusual phenomenon as the basis for a story did not occur to me for almost a decade, during which I was



PAINTING BY LUDEK PESEK

somewhat distracted by other events (*2001 A Space Odyssey* and the Apollo project, not necessarily in order of importance). It is amusing to note that in later versions of his paper, Meeus used my story as reference, thus neatly closing the circle.

From our vantage point on the third planet, we have the opportunity of observing transits of the two interior planets, Venus and Mercury. At one time it was believed that there might be another world, Vulcan (no connection with *Star Trek*), inside the orbit of Mercury, and the transit of such a body was indeed reported by a French observer in 1859. We are now quite certain that Vulcan does not exist, but it is possible that some of the more eccentric asteroids, such as Icarus, may occasionally be seen crossing the face of the sun.

Because Mercury takes only 88 days to complete its orbit, it gets between us and the sun fairly frequently, and there are about a dozen transits in every century—always in May or November. (The next will be on November 12, 1986.) But they are inconspicuous events, visible only in a telescope and of little scientific importance.

Transits of Venus, though much rarer, are of far greater interest and have played a historic role in the exploration of our own planet. They are visible to even the (properly protected) eye, but you will have to wait until June 8, 2004, to put this to the test. There has not been one in this century, for though they occur in pairs only eight years apart, the twin transits are separated by more than 100 years (1761 and 1769, 1874 and 1882, 2004 and 2012).

The most famous of all the transits of Venus was that of June 3, 1769. In that year the British Admiralty and the Royal Society commissioned a then-obscure seaman named James Cook to carry a group of astronomers to Tahiti to observe the transit. After successfully performing this mission, Cook and the *Endeavour* went on to greater triumphs—the discovery of New Zealand and Australia.

As we travel farther out into the solar system and look back on more planets, the number of possible transits increases. From Pluto, if one waited long enough, one would eventually see *all* the inner planets crossing the face of the sun. Not until the arrival of the Space Age, however, did any astronomer bother to calculate when such extraterrestrial transits would take place. There seemed no point in predicting events that no one could possibly observe.

Since 1970, of course, much has happened in the nonastronomical world that luckily for my peace of mind, I did not foresee. Indeed, it is now quite difficult to recall the heady spirit of those days when man first set foot upon the moon. When I wrote "Transit of Earth," it did not seem utterly impossible that the next great goal might be reached by 1984.

It is now hard to believe that on the morning of July 16, 1969, in the CBS studio at Cape Kennedy, I heard an exuberant vice president of the United States exclaim, "Now we must go to Mars!" I would like to quote his exact words to Walter Cronkite on that memorable occasion. "I don't think we'd be out of line in saying we are going to put a man on Mars by the end of this century. And I think we should do it because, based on the rate of progress that we've shown, I think it's possible."

Until around the Sixties there was a widespread belief that some form of life existed on our enigmatic little neighbor. Though science-fiction writers had reluctantly abandoned beautiful oviparous princesses and tentacular, bloodsucking monsters, few of them really doubted that there was *something* on Mars. It seemed much too promising a piece of real estate to be utterly lifeless.

They may yet be right. We have still explored only a few hundred square meters of a planet whose surface area is almost exactly the same as that of Earth—above the waterline.

It is now virtually certain that some millions of years ago, Mars had a fairly dense atmosphere and an abundance of running water. Conditions were ripe for the evolution of life. And once life gets started, it can flourish under the most hostile conditions. Only a few months ago, in one of the most astonishing scientific discoveries of all time, colonies of bacteria were found to be thriving in superheated springs at the bottom of the Pacific, at a temperature far above the boiling point of water. Thanks to Ray Bradbury, everyone knows that paper burns at 451° F, the bugs in the Galapagos Rift would regard that as distinctly chilly.

If life can tolerate such extremes as these, there's little doubt that suitably evolved creatures would find today's Mars a veritable paradise.

As has often been said, absence of evidence is not evidence of absence. Soon after the *Viking* space probes made the first high-definition surveys of Mars, and their automated biology labs started sampling the surface layers with disappointingly negative results, I wrote a little memo to cheer up the folks at the Jet Propulsion Laboratory. It ran something like this:

"It does not yet seem to be generally realized that the *Viking* observations demonstrate the existence of a Martian technology of a very high order. To have *completely* camouflaged the global canal system in a period of less than a decade is an astonishing achievement. Moreover, to have predicted the exact impact points of the landers *and to have decontaminated the area so that no trace of carbon compounds could be detected* is even more remarkable. It is understood that those well-known scholars, Charles Berlitz and Erich von Daniken, are rushing to prepare the public for the implications of these results."

No such luck, I am afraid. But I would not be in the least surprised if someday we get news from Mars that is almost as remarkable as the dreams of the science-fiction (and fictitious-science) writers.

If you read this story in May 1984, go outside around midnight and look up at that brilliant red beacon riding high in the southern sky. Think of what might have been, if not for Vietnam and Watergate.

But at least our first robot emissaries are there, though they are now blind and silent after their brilliantly successful missions. And even though *we* didn't make it by 1984, I'm certain that—barring nuclear war or similar catastrophe—human eyes will be watching the next transit of Earth almost exactly 100 years later.

November 10, 2084: here we come.

—Arthur C. Clarke
Colombo, Sri Lanka

Note: All the astronomical events described take place at the times stated.

Testing, one, two, three, four, five. Evans speaking. I will continue to record as long as possible. This is a two-hour capsule, but I doubt if I'll fill it.

That photograph he's haunted me all my life, now too late, I know why. (But would it have made any difference if I *had* known? That's one of those meaningless and unanswerable questions the mind keeps returning to endlessly, like the tongue exploring a broken tooth.)

I've not seen it for years, but I've only to close my eyes and I'm back in a landscape almost as hostile—and as beautiful—as this one. Fifty million miles sunward and seventy-two years in the past, five men face the camera amid the Antarctic snows. Not even the bulky furs can hide the exhaustion and defeat that mark every line of their bodies and their faces are already touched by death.

There were five of them. There were five of us, and, of course, we also took a group photograph. But everything else was different. We were smiling—cheerful, confident. And our picture

CONTINUED ON PAGE 106

I don't think consciousness is something grand People said there was something grand down in the cellar that gave us heredity. It turned out to be pretty straightforward—DNA

INTERVIEW

JAMES D. WATSON

Two years after he and Francis Crick discovered the structure of DNA in 1953, Jim Watson twenty-seven went hiking in the Alps He and some friends were at the bottom of a glacier when he saw, in a party coming down upon them, a scientist who had worked on the same problem for a rival group 'Willy,' Watson wrote later, "soon spotted me slowed and momentarily gave the impression that he might remove his rucksack and chat for a while But all he said was, 'How's Honest Jim?' and quickly increasing his pace, was soon below me on the path"

The million readers of *The Double Helix*, Watson's notoriously personal account of the scientific feat that won him and Crick the Nobel Prize in 1962 were told of this unusual incident in a preface to the book Watson's manuscript was originally titled *Honest Jim*, making plain the outspoken flavor of the text Not many people would record the wariness and possible envy of a colleague But young Watson didn't mind admitting that he had been snubbed Such was life on the peaks of science for Honest Jim

Thirty years later in his uncluttered study in London Watson's middle-aged figure is solid and he no longer sports a turbulent mop of hair His demanding role has been half administrative for years Yet he still has the air of a scholar with fire in his veins Outside the view is of a peaceful, pretty square, its iron railing enclosing the playing fields of Westminster School Inside the atmosphere crackles with controlled tension One reason lies on his desk Watson has put down his pen in the midst of revising his textbook *The Molecular Biology of the Gene* After eight years of new discoveries it must be totally rewritten

At length the interview is adjourned to the Savoy Grill one of London's more comfortable lunch venues Warmed by obsequious service rich food, and a favorite wine Watson loosens

PHOTOGRAPH BY ANTHONY WOLFF

up But his views haven't mellowed on the "failures" and "crooks" among fellow scientists who as he sees it allow personal motives to corrupt their objectivity about the politics of genetic research Three decades after the discovery of DNA's structure Watson's passion for truth remains as unforgiving as ever Even among the stars of science he is unusual in his intensity the passion with which he has pursued important goals the blatant competitiveness that suffused *The Double Helix*, shocking his peers and intriguing the public, the combative relish with which he demolished opposition to recombinant DNA research

For a man who achieved a great feat of imagination Watson's appetite for raw unvarnished reality is exceedingly rare But the combination of realism and imagination makes a great scientist Along with Crick now at the Salk Institute, Watson accomplished what scientist critic Peter Medawar calls "the greatest achievement of science in the twentieth century" the foundation of molecular biology

Watson is also a remarkable author *The Double Helix* is a gripping thriller And his textbooks including the latest mammoth volume *The Molecular Biology of the Cell* are graced with a lucid style Important scientists are often highly literate but Watson was the one to invent a fresh literary genre the scientific memoir

If Watson matches his intensity with his literary candor it may be because in his youth his most interesting friends were books Born in 1928 James Dewey Watson grew up on the South Side of Chicago His Anglo-Saxon, Republican family were so poor they couldn't afford a car but they were rich in ideas Because his father's intellectual career was frustrated by illness he had a modest job in business which he loathed But he filled the house with books An expert ornithologist his father took young Jim bird-watching and introduced him to biology Jim won a scholarship at fifteen to the University of Chicago And there his overriding ambition emerged to unearth the secret of life nothing less than the molecular mechanics of reproduction At the time no one knew even the composition of genes

Eight years later Watson and Crick solved the puzzle, and the inspiration that put the final pieces together was Watson's The triumph left a trail of disappointment if not cracked egos in its wake Men and women whose contributions were used as building blocks by the duo knew that with a bit more energy luck or time they might have grasped the laurels for themselves

Watson and Crick had assembled a model of DNA the very long molecule that lies in the nucleus of most living cells DNA had been discovered in 1869, but it wasn't until 1944 that Oswald Avery, at Rockefeller Institute, in New York identified it as the material of the genes, the mysterious elements that carry the traits of living creatures from one generation to the next Although influential scientists remained skeptical of Avery's work the race to disclose "the secret of life" was on and interested researchers began to focus on the nature of DNA

Erwin Chargaff a Viennese chemist then at Columbia University showed that the four nucleotide bases of DNA—adenine guanine cytosine and thymine—were present in predictable ratios, suggesting that there was some underlying regularity to the molecule At King's College, in London Maurice Wilkins and Rosalind Franklin placed DNA crystals in the path of X-rays and photographed the pattern of diffraction created by the beam's interaction with the DNA's atoms This process, X-ray crystallography yielded clues to DNA's spatial configuration Wilkins and Franklin had already recognized the probable helicity of DNA and Linus Pauling the chemistry genius of Caltech, had proposed that proteins, too had the spiral staircase form of the helix

Watson was tipped off to the implications of the X-ray crystallography findings by a chance meeting with Wilkins in Italy in 1951 He immediately abandoned his postdoctoral genetics research in Copenhagen and went to Cavendish Laboratories, in Cambridge England where he could delve into the chemical structure of DNA He struck up a catalytic friendship with thirty-five-year-old Francis Crick a physicist who had joined the Cavendish effort to interpret protein structures using X-ray-diffraction techniques

Spurred by the knowledge that Wilkins and Franklin or Pauling (who did suggest a mistaken solution for DNA around the same time) could beat them to it, Watson and Crick went at it for just over a year using wire and brass models before they hit upon the right solution It was published in *Nature* on April 25 1953 DNA was a twin helical chain coiled around a single axis The pairing of the bases—like ladder rungs across the backbones of phosphate and sugar molecules—immediately suggested a possible copying mechanism for the genetic material

Fame followed rapidly Within six months Watson was photographed with Richard Burton in *Vogue* In 1955 he took a post at Harvard University and began research into animal cells their genetics and growth their surface membranes and the viruses that change them into tumors Then came the Nobel in 1962 (shared with Crick and Wilkins) And in 1968 he published *The Double Helix*

Watson had shown the manuscript to almost everyone mentioned in it and had toned down some of his ruder characterizations The personally candid tale nevertheless provoked a storm of outrage Crick and Wilkins saw it as an invasion of privacy The scientific community, forgetting that history-making scientists (including Galileo) have fought at times bitterly, over priority, deplored the characterizations of its members as competitors vying rabidly

for Nobel prizes. But the book's chutzpah inspired many young people, and continuing sale in 17 languages marks it as a modern classic. In the same year Watson married Elizabeth Lewis, a nineteen-year-old lab assistant, and began a weekend and summer career running a research lab at Cold Spring Harbor, on Long Island.

Watson lived down the repercussions of *The Double Helix* only to plunge into the thick of another hot issue: the controversy over the potential dangers of recombinant DNA. The idea of creating new kinds of life alarmed many people. Scientific and political Cassandras conjured the specter of an Andromeda strain of lethal bacteria escaping from the lab to ravage the human race. Harvard biologist George Wald wrote, "I fear for the future of science as we have known it, for humankind, for life on Earth." Watson, among the first to urge restraint until the dangers were properly assessed, reversed his position and spearheaded a successful movement to minimize controls. The critics were for the most part quashed, though eminent exceptions including Chargaff and biologists Robert Sinsheimer and Ruth Hubbard still express strong reservations.

In 1976 Watson quit Harvard to direct Cold Spring Harbor full time. Under his hand the research center has grown to include a faculty of 100, with summer conferences that attract some 3,000 people in molecular biology. Barbara McClintock, pioneering geneticist who received the Nobel Prize last year for her discovery of "jumping genes" (genes that move from place to place on the chromosome), is among the top scientists who work under Watson's direction. Since Watson has an uncanny intuition for looking in the right direction at the right time, it is hoped that his obsession with understanding tumor viruses will lead to a cancer cure. Much of the research at Cold Spring Harbor focuses on oncogenes—genes that cause uncontrolled growth of malignant cells—and on those viruses that cause unchecked cell division resulting in tumors. Chasing this kind of knowledge, Watson—arrogant, irritable, visibly driven—may again make scientific history.

Watson first met with science writer Anthony Liversidge in the scientist's study in London. As Watson described his early life, he began speaking in a mumbled whisper. Then, as the discussion moved to the frontiers of science, he talked louder, leaping from one unfinished sentence to the next, often with a quick grin or chortle to accent his remarks. Still later, in the din of the Savoy Grill, the topic became people, and his voice rose to drown out even the most emphatic businessmen in the vehemence of his convictions.

Omni: Your father didn't believe much in competition. Do you?

Watson: Yeah, right! To survive! I enjoy trying to win a tennis game, and I'm competitive in the academic sphere. Making money has never been my ambition.

Omni: When you were seventeen did you actually decide you wanted the answer to the secret of life?

Watson: Yes. That's a question people don't ask much anymore—what life is—but in those days it was fairly mysterious. I had always had a desire to know what life is, following in the footsteps of my father. He couldn't stand religion. My mother was nominally a Catholic, and until I was twelve I went to a Catholic church, and I was confirmed. Then I came to the conclusion that the church was just a group of fascists who supported Franco. I stopped going on Sunday mornings and watched the birds with my father instead. The Catholic church at that time had a pretty dismal world view.

Omni: Now that you've analyzed life on the molecular level, are there still unexplained questions?

Watson: Yes. But we're not going to get anywhere with a simplistic idea of Jesus and Mary. I think we all wonder at the subtlety of evolution. When I wrote the first editions of my text, I thought *I am rewriting the Bible—actually going back and finding out what's up*. When you get into the deeper questions of physics, you pass out of the sort of reality we live in, the stick-and-ball world of molecules and atoms. But when you ask what forces really are, you can be mystical if you want to.

Omni: How do you explain the fundamental initiating force? Why does an enzyme move to split DNA or to create protein? In *Molecular Biology of the Cell* you write, "How such a complex mechanism arose in evolution is still a mystery."

Watson: It is very complex, but it can be explained by the laws of chemistry by random thermal motion [agitation of free electrons in molecular structure]. It's complicated, there are many variables, but there's no doubt it's that. Every once in a while you get some insight, and you understand why something would occur in a certain way. You can't understand, say, how DNA multiplication is so accurate; the chemistry is so complex. Then something comes along and you actually understand. And you always feel so happy. There are physicists who always want to calculate the probability of how life came into existence. Well, that's impossible because there are just too many variables. You don't really know what the past was, so any calculation doesn't have much meaning. We just accept the fossil record and say we have to go back to the most primitive form of life.

Omni: What about Francis Crick's book *Life Itself*, which argues that life quite possibly was sent here in a spaceship?

Watson: Francis's thing about life coming from outer space? That's monumentally silly! It doesn't solve any problems at all. I mean, if life came from some other place, you'd still like to know how life itself came into existence! We don't really care whether it occurred on this Earth or some other place. For simplicity's sake, we can assume it was on this Earth. So we go along

CONTINUED ON PAGE 116

Aphrodisiacs, amphetamines, opiates—these are some of the love potions that nature uses to get partners addicted to each other

HOOKED ON LOVE

BY RUTH WINTER AND KATHLEEN McAULIFFE

If you know anyone who is color-blind," says sexologist John Money, "then you have a good idea of what it means to be love-blind." Head of the psychohormonal unit of Johns Hopkins University, in Baltimore, Money is referring to a condition caused when the pituitary gland malfunctions early in life, triggering hormonal deficiencies. Since 1951 he has treated this problem in 27 patients, all of whom he describes as being psychosexually normal except that they are "unable to fall head over heels in love." These individuals are sociable, form friendships, and may occasionally marry for companionship. But according to Money, they cannot experience intense romantic passions any more than the color-blind can perceive certain hues. In fact, giddy crushes and heartaches are feelings so foreign to his patients that most are unaware that they are different from other people, until subjected to special tests.

Love-blindness is just one of a broad spectrum of romantic problems now believed to result—at least in part—from chemical instabilities in the brain. In recent years psychiatrists have begun to suspect that neurohormonal imbalances can contribute to such widespread troubles of the heart as lovesickness, separation anxiety, and obsessive infatuations. Indeed, early clinical trials suggest that certain romantically disturbed individuals can benefit enormously from drug therapies designed to stabilize their moods.

What makes some people love-blind and others love crazed? The chemistry of love carries mystical connotations—and so it should. Scientists will never succeed in reducing physical attraction to a neat set of chemical formulas. But they are beginning to iden-

PAINTING BY PAUL WUNDERLICH

tify some of Mother Nature's love potions and the sorcery she uses to get us hooked on each other. Among other things, their research hints that this supreme matchmaker uses aphrodisiacs amphetamine-like compounds, and opiates to lure people together, arouse sexual desire, and keep partners in a state of pair-bonded attraction long after the flames of passion have cooled. In the end the difference between the love-blind and the love crazed may be a matter of chemical addiction.

The scientific study of love must begin with the pituitary gland and a closely associated region at the base of the brain, the hypothalamus. Up until a decade ago the pituitary was considered the body's master gland, releasing hormones that indirectly affect sexual desire and behavior. But that view changed in the Seventies with the revelation that the hypothalamus was the real chemical boss in the body. No bigger than a pea, this miraculous region of the brain receives input from all over the body and transmits its instructions to the pituitary in the form of chemicals called releasing factors. These substances stimulate the pituitary to release its various hormones, which in turn affect the sex glands' production of hormones—estrogen and progesterone from the female ovary and androgens from the Leydig's cells of the male testes.

As Money reports, the love-blind suffer from an impairment of two vital neuropathways in this system—damage incurred before birth or later in life. The first neuropathway, which connects the hypothalamus to the pituitary, tells the pituitary when to release hormones. The second connects the hypothalamus to the higher-thinking and knowing part of the brain and tells the animal when to initiate the appropriate mating behavior. Consequently, this impairment is known in medical circles by the jawbreaking name hypopituitarism.

The biochemical switchboard of the hypopituitary system clearly is critical to human bonding. Even the olfactory center of the cerebrum conveys electrical signals—after one intermediate stop—to the hypothalamus. So even this part of the brain may be involved in such subtle aspects of sexuality as the ability to respond to the subliminal scent messages of others. Although pheromones were once thought to be the sex bait of insects only, new evidence indicates that smell is also part of the courtship language of reptiles, birds, fish, and mammals, including primates.

When you see someone of the opposite sex whom you find attractive and who finds you attractive, you may be exchanging barely perceptible olfactory cues—even across a crowded room. The existence of human pheromones, while still debated, has gained support with the discovery of apocrine glands—narrow pits at the base of hair follicles that produce an as-yet-unidentified scent chemical. Our underarm and genital hair is designed to collect this odor. As with all other mammals, human apocrines are small until puberty.

In an experiment at the University of North Carolina, both male and female partners engaged in more frequent sex after they had received topical applications of synthetic vaginal scents. A synthetic male pheromone, the researchers speculate, would have a similar impact on the couples' sexual behavior.

No one knows to what extent the odors we release are unique to each individual. But West German biologists showed that blindfolded men and women could identify the perspiration of their mates. In a similar study, Japanese women labeled the odors of their mates more unpleasant than their own, proving that smelliness does not necessarily add up to sexiness. The scientists involved in the latter study hypothesized that the reason for the strong Japanese aversion to body odor may be because their marriages were arranged. Perhaps related to this finding is the observation that among couples in Japan, lack of male sex drive is reported to be far more prevalent than in the United States.

"Men and women may exchange barely perceptible olfactory cues by means of special glands at the base of pubic hairs that produce scent chemicals."

Though the influence of scents on human behavior is often barely discernible at a conscious level, other sex stimulants are known to produce more dramatic effects. At present, the greatest interest surrounds the recent discovery of a hypothalamic chemical that some scientists have dubbed the ultimate aphrodisiac. Called LHRH (for luteinizing-hormone releasing hormone), it was initially thought to be involved only in triggering the pituitary's release of sex-gland stimulating hormones. But in rats, LHRH was shown to function as a sex stimulant even when the animals' sex glands had been removed. To Robert L. Moss, a professor of physiology and neurology at the University of Texas Health Science Center in Dallas, this suggests that the compound acts not only upon the pituitary to produce endocrine changes, but must also stimulate the brain directly.

As he observes: We can take away a rat's ovaries and pituitary gland, inject as little as ten billionths of a gram of LHRH into its brain, along with a minimum amount of estrogen as a primer, and the animal will engage in sexual behavior for as long as eight hours at a stretch.

Human studies with LHRH have not yielded such spectacular—or for that matter clear-cut—results. It is worth noting, however, that early clinical trials have been restricted, mostly to men suffering from secondary—usually stress-related—impotence. For example, Moss administered LHRH to 50 impotent men. The result: About 60 percent showed some positive effect on their sexual functioning.

"The spectrum of improvement ranged from very slight to dramatic," says Moss. "Some men simply reported feeling sexy and then obtained an erection several hours later. Others became very sexually aroused, obtaining an erection almost immediately after the injection." Moss also reports that the duration of the LHRH-induced response varies tremendously. Some studies indicate sexual arousal is dependent on continual administration of the drug, and others have demonstrated more long-lasting effects.

Another question left unresolved is whether LHRH produces a state of sexual arousal per se or a more generalized state of arousal. To find out, Moss and senior research associate Carol A. Dudley placed a female rat in the center of a maze, out of which radiated several runways. "At the end of one runway," explains Moss, "is a sexually active male; at another, a castrated male; and at still another, a female. If the female in the experiment has been injected with LHRH, she invariably runs right to the sexually active male. When she has not been injected, she doesn't make any particular choice. That tells us that the effects of LHRH are highly specific for sexual behavior. In fact, I know of no other brain chemical that can produce such a narrowly specified response."

Interestingly, in animals, LHRH seems to be responsible for synchronizing the behavioral and endocrinological aspects of mating, so it produces sexual arousal of the brain prior only to ovulation, when the female is most receptive to impregnation. In people, however, no such synchrony is apparent. This difference may well explain why human beings are the sexiest creatures on Earth, virtually alone among species in their freedom to engage in sex all the time, irrespective of reproductive considerations or seasonal changes.

In the book *The Sex Contract: The Evolution of Human Behavior*, anthropologist Helen E. Fisher offers one plausible explanation for what brought about our biochemical emancipation. When our ancestors chose to walk upright, she points out, an often-forgotten by-product of this anatomical revolution was the shrinkage of the birth canal by one, or even two, major diameters. The only protohominids that appear to have gotten around this obstetrical problem were those who gave birth to more immature infants. But this in turn produced another difficulty. The helplessness of the young meant that females now needed full-

CONTINUED ON PAGE 102

NEW WAVE

CONTINUED FROM PAGE 6b

higher-paying job in industry," says Kay Kendall, who has just finished navigating her chemistry class through an introductory lesson on spectroscopy and electromagnetic radiation. Kendall has taught science in Pascagoula for seven years.

"When I was married," says the talented young instructor, "my salary was secondary to my husband's, but now, my daughter and I have to depend on what I make. To be a teacher today one either has to be married or else one has to live off of savings." Kendall's sister did not follow the family into teaching, opting instead to become a corporate lawyer in Baltimore. "I'm real proud of her," Kendall says.

It even an affluent district like Pascagoula where salaries are among the highest in the state struggles to hold on to its gifted teachers, less privileged school systems face far greater woes. The reform act will provide no extra money for science teachers in deprived areas or for Pascagoula High School's Kendall. And the exodus is likely to continue.

A few science teachers reject the notion that they should be singled out for higher compensation because of their coveted skills. "I don't think that I should get paid more because I'm a science teacher. I think *all* teachers need more pay," says McComb High School's Mervin Denton in defense of all his underpaid colleagues.

But the bearded biology teacher, who has taught at McComb for ten years, is in the minority. Most Mississippi science teachers believe that their special training entitles them to more pay than, say, an English teacher. The situation is already prickly. And it will take on added controversy and significance as the science drain escalates in the coming years.

"It's true we do have a high percentage of unwed mothers. I see them getting younger each passing year. We have one seventh-grader right now who's about fourteen and she still goes to class. She'll stay in school until her doctor advises her not to. There's certainly no stigma attached to this sort of thing. It may even be a popularity thing for kids. But an unwed mother's future here is welfare. Because her marriage chances are slim, she'll just deal with someone [start a new relationship] and have more children."

—A Mississippi school principal

There are problems so deep-rooted in Mississippi schools that they cannot be corrected by the passage of new laws—at least not within the span of one generation. Finding new teachers, keeping veterans on the job—these sound educational strategies alone are not enough. "Mississippi is a plantation society," comments Bill Powell, a Gulfport teacher, in Jackson's *Clarion-Ledger*. In a state where welfare payments constitute the second largest source of income, teachers know before legislators that social and economic problems begin in the home and the community. "We are attempting to educate for high-tech positions the people who would have been sharecroppers," says Alcorn State's Newtie Boyd.

About 15 miles due east of the Alabama border lies Noxubee County High School, in the quiet town of Macon. The principal is Anderson Liddell, and the school is 99 percent black. His father, B. F. Liddell, runs the elementary school nearby. "I paddle the kids myself," says Liddell Junior. "You gotta know which kids you can paddle. Some are better left to the home, so I give the kid a choice. I love children and love to help them," he continues. "Kids come back and tell me, 'I'm glad you used to spank me.'"

Once a chemistry and physics teacher, Anderson Liddell talks enthusiastically about his 800 students. But he is also realistic about Noxubee High School's problems, especially the lack of funding. "Money would help make classes smaller, and smaller classes help remedial readers," Liddell notes. Additional money would also enable schoolteachers to buy materials and chemicals that are missing in science classes.

"When you say evolution, a lot of dark and bad things spring forth in the minds of people, and immediately you create a militant standoff."

But money cannot improve conditions in the home. Liddell estimates that 80 percent of the adults in this farming county are functionally illiterate, 75 percent receive some kind of subsidiary aid from the government, and 98 percent of the students qualify for the free-lunch programs. "The only time they [the children] are exposed to learning is when they come to school," Liddell adds. Adult illiteracy, in fact, is a drastic problem throughout this rural state. Even before he took office, Bill Allain, the state's new governor, vowed to make adult education one of the foremost goals of his administration.

Liddell is one of many black educators who believes that students' respect for learning has deteriorated over the last 15 years. "The teaching of science has gotten better, but the student hasn't," agrees Boyd. "The imagination is disappearing with this generation [of students], and we haven't learned how to teach them. This is the first full generation in which both parents work." Only 50 percent of the students at Noxubee High now attend Sunday school, down from an estimated 70 percent in 1962. "You keep beating your head against the wall," Liddell sighs.

And in the southwestern hamlet of Woodville, once described by Harvard University as the town best typifying the antebellum South, an increasing number of schoolgirls are learning the ABCs of reproductive biology the hard way—through self-experimentation.

Veteran black administrators show less enthusiasm for the new reform act than their white colleagues do, reflecting a fairly uniform belief that laws are not enough. Observes Boyd: "I don't know if there is going to be the money to do these things. You're going to need the help of the parents to make kids perform better." Boyd believes that the reform act is a step toward addressing some of the state's problems. But the legislation itself presents some additional burdens for blacks.

"I believe that the reform act is putting too much pressure on us and is going to hurt black kids' chances of getting into college," Liddell says. "A lot of kids won't measure up to the requirements. We need more time to prepare, since we won't have enough math or science by 1986 [to satisfy new state requirements]. But other than that, it's a good thing."

Many small rural districts, threatened with consolidation, are not entirely convinced that the reform act is a good thing. In one of its most controversial directives, the reform act empowered the State Board of Education to strip school districts of accreditation if they fail to comply with school consolidation decisions beginning in 1986. Though merged county schools would be able to offer a wider range of science courses taught by qualified instructors, hundreds of stubborn backwater communities just don't care. Many rural citizens regard the new law as unwelcome interference and will be sure to take up the cudgels if mergers endanger their schools and towns.

Rural New Hebron, south of Jackson, is a case in point. "I felt like I was going back twenty years in history," says educator Iva Brown of visits she made to the New Hebron School. "It should have been consolidated years ago. A lot of teachers had to teach outside their disciplines."

But John Flynt, the school's redoubtable principal, vehemently challenges any suggestion that his schoolhouse should fall prey to the well-intentioned whims of urban lawmakers. "Some kids might have to go forty miles to reach Monticello [after consolidation]. People here need a school," says the principal, who doubles as a football coach. He's even driven the school bus on occasion. "You'd just kill New Hebron if you had no school," Flynt warns. "Would you move to a town without a

school? I've been teaching physics here since 1966, and larger schools don't even have physics.'

'We are proud of our small school,' concurs Bo Stevens, the newly appointed principal of Smithville High School, located in Monroe County, near the Alabama border. 'I feel like a lot of people would be upset [about consolidation].'

Mississippi's reform act can require children in isolated areas to attend larger county schools. But state lawmakers are less able to legislate *how* science education will be taught in public schools throughout the state. Much of what goes on in the classroom today manifests itself in the way teachers themselves were taught and reflects the deeply held beliefs they bring to the classroom.

It may be difficult, for example, to outlaw rote teaching—the recitation of facts that travel verbatim from teacher or textbook to student's notebook. Rote teaching is by no means peculiar to Mississippi. But here, where a surprising number of elementary school *teachers* in some of the state's finest districts fail to master simple science concepts, rote teaching is an epidemic.

Explains Brown, who trains USM students to become science instructors: 'Teachers don't have the time they need. They have too many students and too many classes. So much of our time is spent doing the wrong thing. We need to develop children's thinking skills as a mechanism for understanding basic science concepts. But teachers go back to the textbooks, to recalling bits and pieces of information.'

Herb Lamb, who oversees Pascagoula's science program, says instruction in some other schools he's visited fails because students never get their noses out of the books. 'These programs don't get kids involved in what I consider to be the thrill of science,' Lamb says. 'And that's doing things. To me, elementary science should largely be an activity that piques children's curiosity. I would like to see first-, second- and third-graders manipulate objects—just to see what happens.' Such simple investigations are central to the elementary-science program that Lamb helped launch in 1982. Unless such activity-based programs are introduced in the primary grades, 'children will hate science by the time they leave elementary school.'

If Mississippi legislators seem unable to reduce ingrained reliance on rote teaching, they are even more reluctant to confront evolution. In fact, if you listen to some Mississippians, there is no controversy, since Darwinian theory doesn't exist.

Don't let the modern oil refineries on the Gulf Coast or the maze of interstate highways in Jackson fool you: Mississippi can be an old-fashioned state. Some notions just don't change here—especially those that deal with the Good Book. The teaching of creationism continues in many of the private, segregationist academies, which roughly 50,000 children attend. And off the record, some educators admit that creationism is taught even in a few public schools in rural pockets of the state.

More common are science classes in which evolution, like some Victorian obscenity, is never mentioned by name. Teachers prefer a more delicate euphemism, such as *organic change*.

Sara Maghan, principal of Pascagoula High School, says: 'In this school district no one teaches creationism. But evolution is not discussed a great deal either. They [the teachers] devote a cursory amount of time to it in tenth grade, and that's it. But it's really not a problem here,' says Maghan of her progressive district. Another Mississippi educator says, 'When you say evolution, a lot of dark and bad things spring forth in the minds of people, and immediately you create a militant standoff between the old guard and this type of thought [evolution].'

'The early period of the Sixties was a real tough time. People were knocked through plate-glass windows; they were threatened. There was an environment of hostility and fear. You would think that if this [violence] is taking place on the streets, you would have it in the schools. But that didn't happen. Our leadership in this community—the city council, civic groups, and the local government—had no thought of abandoning public education.'
—Ted Alexander
McComb Superintendent of Schools

> *'They had a little extra money, so they bought twelve Commodore 64s, but they had no software and no one to instruct. For six weeks the computers sat in the box.'*

What makes a school stand out? Can money and legislation generate good teaching and overcome community problems? Or, as supporters of decentralization and Reaganomics have come to believe, is vigorous community leadership the key to excellence in the classroom?

Long before there was a reform act, some Mississippi school districts—and not necessarily the richest—were providing first-rate education. The town of McComb, nestled in Pike County, is one such place. McComb isn't affluent. Some 67 percent of the students qualify for a free lunch. But something is working here. Last year the federal government designated McComb as one of approximately 150 National Model Schools throughout the nation.

Even before this recognition, 'McComb was known as a college-prep school with a traditional college-preparatory program,' says the high school's assistant principal, Donald Dick. From the early 1900s, when McComb High School pioneered a cooperative work-study program, to the Thirties, when the academic program expanded despite the severity of the Depression, visionary school leaders have always made McComb a model district in the state.

Though its strong school system might set it apart from similar Mississippi communities, McComb (population 12,000) is, by anyone's definition, a classic Southern town. Religion and football are practiced in separate halls of worship but are followed with equal devotion.

'There's something about booing football players that bothers us. It reflects stupidity,' warns the local paper in a lead editorial. An item on the school page notes that 'chicken and dumplings, green peas, and a yam pattie' will be served at the high school on Thursday. The Rotarians convene on Wednesdays to a repast of chitlins and other Southern fare, and then watch a film on, say, turkey wildlife habits. At a filling station out on Delaware Avenue, the attendant mutters in a tortuous Southern drawl while a dog curls up lazily in the shade by the men's room door. The phone book lists no less than 70 churches in the greater McComb area—everything from the First Baptist Church to the Church of God of Prophecy, where Pastor Jimmie Bailey presides.

But not everyone shares this postcard-picture image of Southern tranquility held by McComb residents. A television reporter from Biloxi voices incredulity that anyone would even want to visit a backwater spot like McComb.

To others, the name McComb is synonymous with Sixties violence. Its mere mention retrieves buried images of burning crosses and church explosions.

The Long, Hot Summer of 1964, as it was known, ended in McComb when 650 town leaders and citizens, at a historic meeting at City Hall, signed a statement of principle pledging racial justice for all. In many Mississippi towns, droves of white parents enrolled their children in segregationist schools when federal courts mandated statewide integration. But not McComb. "The history of one of the most influential public-school districts in the state [would have been] severely damaged if abandoned by leadership and support of the community," noted the *Enterprise-Journal*. White children stayed in the schools, and integration began in the late Sixties. The virtually equal ratio of black to white students in the McComb schools today attests to a successful integration program that has yet to be matched by many Northern school districts.

"We never lost one hour of school time," says Ted Alexander, the Superintendent of

Schools "There has never been a racial incident that has resulted in a disruption of our instructional program."

A former biology instructor, Alexander perpetuates the school tradition established in McComb so long ago. He is determined to provide the district's 3,200 students with an outstanding education. This is reflected in the breadth of the high school's curriculum, the enthusiasm of the faculty, and the success that McComb has had in getting grants for the district.

Mandated by the education-reform act, a compulsory-attendance policy and kindergarten instruction are just now being implemented in McComb. A truant officer has recently been hired to inform parents that they must send their children to school. But other educational reforms have characterized the district for years. A data-processing center run by the McComb system commenced operation in 1967. "It was the first effort in this part of the nation at computer-assisted instruction and utilization of data processing for management purposes," says Alexander. Another measure of achievement is McComb High School's minimum requirement of 19 units for graduation, the state requires but 16.

The science department also anticipated the new course requirements set forth by the state board of education. It offers everything from general science to contract biology, a course in which students take on a specific research project for the school year. The math department introduced advanced-placement calculus in the fall of 1983, and ambitious plans are currently under way to launch advanced-placement physics and chemistry in the next several years.

Until the mid-Seventies McComb had no school-wide coordination of the math and science programs. Today a computerized "skills continuum" printout has been developed as part of the district's science program. It holds students accountable for mastering precise concepts at each grade level. A McComb grammar-school student, for example, is introduced to the parts of the atom in the fourth grade. A seventh-grader must understand Archimedes' principle of water displacement, and a tenth-grader should know the biological functions and the cellular structure of a fern plant. Concepts introduced in the primary grades are reviewed and approached in a more complex way as the student ascends through the higher grades.

New technology is filtering not only into the schools but into the community as well. "I feel like I'm trying to sell people a car and they're still used to a horse and buggy," crackles twenty-six-year-old Doug Akins about the prospective customers who drift in and out of the computer store he manages, Computers For All, opened in the spring of 1983. Its location on North Broadway, across the street from the Five Point Barber Shop and other more traditional businesses, seems like an oddity in this former railroad town. But if the local accountants, schoolchildren, and dairymen who patronize Akins's store are any indication, it is a safe assumption that the computer may someday be as pervasive in Main Street America as the mighty television is today.

Even McComb, a National Model School, has its problems. For example, the school's skills-continuum printout, with its attention to minute factual detail, may actually encourage rote teaching at the expense of investigative learning. Criticism also surrounds McComb's computer program. "They [the McComb school system] had a little bit of extra money and they bought twelve Commodore 64s but had no software and no one to instruct," says Akins, a 1975 graduate of the high school. "For the first six weeks, they sat in the box. Only now are they being implemented."

Akins's observations are not without merit—both throughout the South and the nation as a whole. Too many administrators choose to view computers as the latest technological bromide, instead of asking whether anyone on staff knows how to use the equipment.

"From just south of Memphis to the Gulf of Mexico, educational reform has become a revered gospel. Mississippi school districts, both rural and cosmopolitan, welcome the reform act."

Though reticent to discuss whatever inadequacies exist within the science program, the administration in McComb is eager to correct major problems. Here the reform act seems to bolster a self-evaluation process that has been in existence for years. In 1983, in fact, the school system hired a math teacher with a background in computers; so many of the problems to which Akins refers may soon be remedied. Likewise, the reform act mandates that each Mississippi school district must have an in-service teacher development program for the 1984–1985 school year. But science teachers from McComb took part in a Science Teacher Improvement project as early as 1981. Designed by the department of science education at USM, the program helps teachers become more effective in the classroom. A comprehensive in-service teacher-training program was also established for the entire faculty at McComb a few years ago.

"Your student program is only as effective as the people you have working with it," observes Alexander. "On Wednesday afternoons our students now go to youth groups, church choirs, city recreational activities, Boy Scouts, Girl Scouts. But our staff, for thirty-six consecutive weeks, is in in-service and staff development—every Wednesday afternoon, all year long."

The success of the McComb program raises important political questions. Should this town, with its reliance on solid school leadership, be held up as a model to the nation? Republicans might like to think so. "Government is not the solution to our problem; government is the problem," says President Reagan. And this self-directed community, whose system today ranks in the top 1 percent of all American schools, has succeeded without the benefit of state legislation or government subsidies.

But from just south of Memphis to the Gulf of Mexico—and even in McComb—educational reform has become a revered gospel. Mississippi school districts, both rural and cosmopolitan, welcome the reform act. They do not view it as unwanted interference by big government. Rather, most see the bill as an urgent signal that the Eighties is a time to learn from the errors of the past and that the state's economic future will rest heavily on the strength of its school program.

William Winter left office in January with the education-reform act as his cornerstone achievement. "I think it's the most important piece of legislation passed during my term of office," he says.

Bill Allain became governor on January 10 after campaigning strongly for school reforms. According to his press secretary, JoAnn Klein, Allain plans to augment the existing legislation. Besides launching an adult-literacy campaign, the new governor hopes to create a special education trust fund that will protect tax money that has been collected specifically for the schools.

While the changing of the guard has proceeded smoothly at the stately Governor's Manston on Capitol Street, the new bill's efficacy has yet to be demonstrated. Can more money reduce the number of Mississippi school dropouts whose labor-intensive presence perpetuates the state's plantation-society structure? Will that new carton of microcomputers go unopened if there is no knowledgeable instructor to use them? If the instructor can be found, will industry tempt him away after a year or two? And will other districts be able to follow McComb's success, promoting and encouraging strong local leaders? "Getting the bill through the legislature was very easy compared with making it work," says Dudley Peeler, in Jackson.

What is more certain is that the success or failure of the reform act in Mississippi will serve as an instructive example. If Mississippi can change its educational system, then its success will augur well for more economically privileged regions. But if Mississippi fails, despite its deep care and abiding commitment to its children, so too might the nation. ☒

"We can account for decades of UFO sightings without resorting to supernatural explanations"

ANTI-MATTER

UFO UPDATE

In last month's UFO Update J. Allen Hynek called intergalactic travel physically impossible, arguing that UFOs could *not* be craft carrying emissaries from space. Instead, Hynek, director of the Center for UFO Studies in Evanston, Illinois, suggested that unidentified flying objects may represent an alternate reality, or even doors connecting our universe to some parallel dimension.

I would like to counter that theory with the null hypothesis, which holds that we can account for decades of UFO sightings without resorting to extraordinary explanations. Under this hypothesis, put forth by skeptical UFO theoretician Robert Sheaffer, there would still be innumerable UFO reports, including some seemingly unexplainable cases. There would still be hypnotically extracted stories of abductions by flying saucer crewbeings. There would be close encounters of the first, second and third kind.

There just wouldn't be any UFOs.

Proof of this hypothesis lies in a simple thought experiment. Ufologists now claim that of all UFO reports, 90 percent can be explained, while 10 percent are true UFOs. But imagine that all true UFOs go away for a period of time, leaving the UFO reports caused by readily explainable misperceptions, pranks and hoaxes. Since it is unreasonable to expect amateur UFO investigators to solve all such prosaic cases, we would be left with a residue of false UFO cases, indistinguishable from what pro-UFO investigators present as true UFOs. The obvious implication is that the real world doesn't have real UFOs after all.

Ufologists such as Hynek refute this experiment by pointing to the credentials of witnesses. But witnesses need not be drunk, uneducated, myopic, hysterical or psychotic to succumb to limitations of human perception and memory. In fact, studies suggest that the better educated an individual is, the more likely he or she is to fill in the blanks unconsciously.

An excellent example is a set of cases endorsed by Hynek himself. Astronomers in the Caucasia and Volga regions of the USSR reported sighting UFOs throughout 1967. The men were actually seeing tests of space-to-Earth orbital thermonuclear warheads, but their reports were interpreted by leading American ufologists as proof that even highly educated people see UFOs.

Until pro-UFO researchers grapple with the reality of human perception and self-deception, alternate universes and interdimensional communication are destined to remain hypotheses in search of data.

Maybe alien starfaring civilizations who *have* mastered the secrets of intergalactic travel are observing our planet. Such beings would, in Arthur C. Clarke's words, be capable of feats "indistinguishable from magic" and could thus conceal themselves from us. Having done so, they may even now be searching for the identity of the UFO pilots, since they know it isn't they!—*JAMES OBERG*

James Oberg is a UFO skeptic and an aerospace engineer.

VAMPIROLOGIST GOES UNDERGROUND

Dozens of cultists recently killed an unsuspecting victim and drank his blood. That, at least, is the claim of Stephen Kaplan, director of the Vampire Research Center in Queens, New York. I informed the police, Kaplan says, "but they didn't get enough evidence to make an arrest, which means those sickies are out there looking to suck *my* blood for revenge. So I'm not just changing my voice, I'm going underground."

After 13 years as a vampirologist (someone who studies vampires), Kaplan says he will no longer interview bloodsuckers in the comfort of his home. Instead, he explains, he will change his address and conduct his research at a public meeting place, like McDonald's, under the protection of an armed bodyguard. He will also ask more questions to probe his subjects' mental health. "If a so-called Dracula tells me he turns into a bat," Kaplan explains, "then I know he's auditioning for the *Gong Show*. He's a nut who might go for my throat."

Real vampires, Kaplan says, are just ordinary folk who happen to satisfy their daily nutritional requirement with blood. They don't live in coffins, and they don't have to suck blood from a person's neck. "Instead, they join fetish clubs, where they draw one another's blood out with needles and drink it mixed with red wine."

Unfortunately, says Kaplan, "in my business, I meet more nuts than vampires. Some of the followers of [rock musician] Ozzy Osbourne have a vampire cult whose members draw blood by ripping the flesh. I've fingered some members of this group, but the others are sending me letters threatening to pluck out my eyeballs."

Though Kaplan is living in fear, the police, he says, "just don't help. They think that a vampirologist is the same thing as a vampire and tell me I should be immune to death. But, ask you, Does a bacteriologist have to be a bacteria [sic]? I need protection. If anything happens to me, I'm going to miss myself."

Kaplan won't reveal his new address, but he *can* receive mail at Box 252, Elmhurst, New York 11380.—Peter Rondinone

---

"If we cannot stem the tide of rock 'n' roll, with its waves of rhythmic narcosis and future waves of vicarious craze, we are preparing our own downfall in the midst of pandemonic funeral dances."

—A. M. Meerlo

SPOON-BENDING PARTIES

When McDonnell Douglas engineer Jack Houck throws a party, no one plays pin the tail on the donkey. Instead, each guest is given a spoon and told to yell "bend, bend, bend!"

"In minutes," says Houck, guests psychically generate heat in the metal spoons, flop over, and eyeballs bulge like popcorn."

According to Houck's friend, Oregon engineer Walter Uphoff, those attending the parties are frequently skeptical at first. Citing his six-year-old granddaughter, for one. "But once she saw how easy it was," says Uphoff, "she bent five spoons in a night."

In fact, says Uphoff, Japanese television has picked up on the spoon-bending craze, broadcasting a weekly party show and encouraging millions of Japanese to destroy dinnerware in the privacy of their homes.

Houck points out that soft silver spoons bend the fastest, in two minutes as opposed to 15 for stainless steel. In one night, he says, "I mangled an entire inheritance of silverware from my grandparents. I bet they never imagined they would be making a donation to science."

But the future of spoon bending, Houck adds, lies in space. He hopes to invite the space shuttle astronauts to his next party. After all, he points out, "If the astronauts were stuck in space without a wrench, they could throw a little party and bend metal to make a necessary life-saving repair."

Over the last two years, Houck has thrown more than 105 spoon-bending parties for 2,000 people. Guests, including doctors, teachers, and truck drivers, learn about the parties through word of mouth or local newspaper ads. "It's free," he says.

Peter Rondinone

"Man won't fly for a thousand years."

Wilbur Wright

EXPLODING HEART

Nitroglycerin is a deadly explosive But its derivatives are also used in the treatment of heart disease Film patches soaked in inert nitro compounds in fact can be attached to the skin sending the drug through the body to expand blood vessels and fend off attacks The patches introduced to the market in 1982 have just one drawback They can turn into firecrackers

The problem emerged last year at the Naval Regional Medical Center in Charleston South Carolina where physician John Babka was trying to save a heart-attack victim who was wearing a nitro patch Using standard medical procedure Babka applied electrical shocks to the patient's chest But as the electricity flowed Babka heard a loud bang There was a flash and a puff of yellow smoke he says, "and then the patch turned black

Although the explosion didn t harm his patient (the man died subsequently, of a heart attack) Babka set out to determine the cause of the explosion First he fastened a nitro patch to a corpse Then he applied electric shocks to the chest He found that the patch popped only when it received a direct jolt of electricity Then after cutting open the burnt patch, Babka found a layer of aluminum foil Obviously he concluded when the paddle delivering the shock met the aluminum it behaved like a screwdriver in a live socket

Babka forwarded his results to the company manufacturing the patches CIBA-GEIGY Pharmaceuticals, in Summit New Jersey Responding to Babka s alert the company s communications manager David Catlett says "We're now putting labels on the patches warning doctors to remove them before applying a shock But since this occurrence is quite rare we re not recalling the product We don t know how many patches are out there anyhow '

Babka however would like to see doctors warned as soon as possible He s had only two reports of exploding patches this year But he points out, 'when a person's heart stops beating every second of treatment is vital So if a doctor is momentarily distracted from his patient because of an unexpected explosion, it could mean that person s death

—Peter Rondinone

Luddites and anti intellectuals do not master the differential equations of thermodynamic or the biochemical cures of illness They stay in thatched huts and die young "

—E O Wilson

NEAR DEATH KIDS

Adults are no longer alone in the realm of near-death experience Recently a seven year-old Washington girl who nearly drowned in a community swimming pool was rushed to a hospital emergency room She sank into a deep coma and, on regaining consciousness three days later, related the following tale 'I was dead Then I was in a tunnel It was dark and I was scared I couldn t walk A woman named Elizabeth materialized to escort her to heaven she said Once there she encountered her dead grandparents, a dead aunt and ' the heavenly Father and Jesus When asked whether she would like to see her mother the girl said yes and awoke in the hospital

Reported by pediatrician Melvin Morse in the *American Journal of Diseases of Children* the incident is the first juvenile near death experience to appear in the literature Morse, of the Children s Orthopedic Hospital and Medical Center in Seattle noted that the girl was raised as a Mormon and believes in the hereafter including a celestial kingdom in heaven where the dead are reunited with family

He has since interviewed several more children who took similar ' voyages" after traumatic accidents One girl recalled being scolded in a classroom in heaven another was carried on a beam of light through a long dark tunnel

The pediatrician contends that doctors who traditionally shrug off such stories as just so much fantasy would do well to put more stock in near death phenomena

Robert Brody

ALIENS AMONG US

Do you know someone who constantly misuses everyday items? Is his skin ice-cold or too hot? Does his mood change when you turn on the microwave oven Does he own plenty of exotic high tech gadgetry? And is he forever poring over newspapers, magazines scientific journals and mail-order catalogs?

Beware These could be telltale signs of a cleverly disguised extraterrestrial says Brad Steiger coauthor with his wife Francie of *The Star People*, a nonfiction book about Earthlings descended from aliens

Brad Steiger believes that humankind may actually be a sort of biology lab project for some distant alien race that sends observers to learn our ways and gather information about us 'They want to see whether we are developing a scientific technological and spiritual evolution he suggests

What to do if you spot some oddball absentmindedly eating french fries with a spoon or methodically speed-reading his way through a stack of magazines ' Since the alien would be here just as an observer ' Brad Steiger says take no action I would hate for the Ku Klux Klan to start hunting aliens

—Eric Mishara

'I can tell from here what the inhabitants of Venus are like they resemble the Moors of Granada a small black people burned by the sun, full of wit and fire, always in love, writing verse fond of music arranging festivals dances and tournaments every day

—Bernard de Fontenelle

TURKEY CHORUS

Musician Jim Nollman is so impressed with what animals have to say that he has dedicated his life to composing songs for them

Nollmans career began in an Indian village in Mexico where he had gone to seek solitude after years of playing the guitar at shows and clubs Next door lived a family who owned a turkey I was practicing the flute when I noticed that if I hit certain notes the turkey would gobble, Nollman says Soon he learned to ride the turkey's energy teaching it to join in a flute/gobble duet Elated he took the discovery home to San Francisco where a farmer allowed him to organize 300 turkeys into a chorus The result, called 'Music to Eat Thanksgiving Dinner By became a modest hit on local radio

Since then Nollmans reputation has spread like seeds around a barnyard Camping at a California wolf preserve he learned to sing wolf harmony at the rise of the moon Later he developed underwater instruments and made music with killer whales and dolphins in Canada Hawaii Mexico and Japan ("They would come around " he says "and start jumping whenever I played ') He played mandolin for buffalo—which silently surrounded him—for ABC television and he set up a grunting chorus of howler monkeys for educational TV In 1982 he produced an album that featured the squeaks, gobbles and barks of Jim Nollman making music with whales turkeys and wolves

Now he's preparing for a project to cap them all filling a boat with his electronic equipment to seek out the most musical animals in the world He compares the plan to what Jacques Cousteau has done with his ship the *Calypso*. "This boat can be a new age Ca*lypso*, he says What Cousteau did for ecology we plan to do for interspecies communication "

—Douglas Starr

" To be is to do '—Socrates
'To do is to be
—Jean Paul Sartre
Do be do be do
—Frank Sinatra"
—Kurt Vonnegut

Righteous

CONTINUED FROM PAGE 48

isfying human material reality is through the human consciousness.

The scientific-materialist world view says Mitchell, is wrong. What would be closer to the truth is that mind or consciousness is the substrate or base of material reality. At one point he suggested to me that matter might be viewed as "dense thought."

To pursue these ideas Mitchell changed his life. In October 1972, two years after Apollo 14, he resigned from NASA and the Navy and founded the Institute of Noetic (from the Greek *nous*, meaning mind) Sciences to study human consciousness.

He is still the head of the institute, although his business interests take up much of his time. And he has continued on his own inward journey. To "free his mind from subconscious emotional garbage," he has tried yoga, gestalt therapy, psychodynamics, transactional analysis, rolfing, rebirthing, reflexology, acupuncture, acupressure, shiatsu, meditation, and "a lot of breathing techniques."

"I use the following little analogy, which I like: If you're going to clean up your house, a vacuum cleaner is very handy, and you have to have a number of tools for that vacuum cleaner. You have a rug device, you have a floor device, you have a crevice device, and you have a drapery device. All of these techniques are tools that you put on the vacuum cleaner."

And one of the things you find when the house is all cleaned up is ESP. "The press has overblown the interest in that," says Mitchell, but the interest is certainly real. Mitchell thinks that psychic phenomena are as much a part of life as the other five senses—and he's not just speaking of garden-variety telepathy.

"I've witnessed most types of psychic events under very credible conditions," he reports. "I've looked at psychic surgery. I know about psychic healing, healing at a distance, diagnosis at a distance."

Mitchell believes that traditional science has not found these phenomena replicable because people who don't believe in them won't see them. "You cannot know that which you have not experienced. Some would debate that. But once you have experienced the knowing, all you can say is 'I'm sorry, try it, and you'll find you like it.'"

Mitchell obviously likes it. He is challenged by his exploration of inner space and he is optimistic about changing humanity. He wants to go after the ego, "that edifice we erect to interface with the outside world," which Mitchell says causes violence and wars and interferes with our essential nature as "loving spiritual beings." He doesn't aim to destroy it, as he says some of the Eastern religions do, but he doesn't want to let it dominate the psyche to the degree that it does in your average test pilot. He wants to transform it to free it from Western reductionist ego

oriented materialistic reality

But there may be something of the test-pilot swagger left here after all. Mitchell is saying that you have to fly your own psychic ship to get to the other world. And science or no science, he says, he knows what he knows. He has a personal certainty about a special knowledge, a special experience that few share. It's not quite the ziggurat of flying. But if you stick to a scientific world view and if you are stuck in that old materialistic reality with the rest of us, then you are on the outside, only partway up the ziggurat. *left behind*

James Irwin was the eighth man on the moon. The lunar module *Falcon* landed in the Hadley Rille region on July 30, 1971. Dave Scott, the commander, led the way. Al Worden stayed in the command module while Scott and Irwin used the Lunar Rover for the first time. Their base camp was at the foot of the Appenine Mountains, which rise to a height of 15,000 feet.

When they returned to Earth, they were honored with a ticker-tape parade in New York City. Irwin and the others sat on the back of an open limousine to let the crowd see them. Someone had to sit on their feet so they wouldn't fall off if the limo sped up. The man holding down Irwin's toes was John Lindsay, mayor of New York.

No one is sitting on Irwin's toes today as he drives from Colorado Springs to Pueblo for the annual banquet for the volunteers of the Colorado State Hospital. Irwin will be the speaker at the lunch. He now heads the High Flight Foundation, a nonprofit Christian organization, his shipmate Alfred Worden is vice president. En route to the luncheon, he talks about his life as an astronaut and as a public speaker, spreading the Christian message.

He is a small man, thin now after two heart attacks. His actions and his words are deliberate, there is no superfluity of gesture, no easy flow of small talk.

He is as different in style from Mitchell as Colorado Springs is from Palm Beach. In the cold shadow of Pike's Peak you might take Irwin's reserve for Western taciturnity—mountain-bred silence—but he was born in Pittsburgh and grew up in Florida. His slowness with words is his own, the mark of a man who, in his youth, preferred jet planes to human company.

The moon flight changed that. Irwin wrote about his experiences in *To Rule the Night*. There is a great deal of information in the book about exploring, spaceflight, and the vicissitudes of moon life—Irwin's fingernails bled because of the difficulty in manipulating the gloves on his space suit. But the point of the book is elsewhere.

"On the moon the total picture of the power of God and His son Jesus Christ became abundantly clear to me. I felt an overwhelming sense of the presence of God on the moon. I felt His spirit more closely than I have ever felt it on the earth. I right there beside me—it was amazing."

Irwin felt that God provided him with rev-

elations on the moon. He provided a solution to a problem Irwin had in setting up some scientific equipment, and Irwin believes that God had a hand in the discovery of a 4.5-billion-year-old rock. NASA scientists had told Scott and Irwin to look for a particular kind of white rock, and despite the dust that covers the moon, directly in the path of their Rover they found just such a rock on top of another bigger rock. Says Irwin: "I think it was providential that this particular rock was lifted up and displayed to us."

Irwin's religion had been private, but now he went public. He spoke to reporters, church groups—to everyone—about his sense that God was with him on the moon. He set up the High Flight Foundation. He now goes to India, China, and other countries to spread his spiritual message.

He also embarked on a new effort: not to reach another planet or to search for moon rocks, but to find Noah's ark. Irwin has led three expeditions to Mount Ararat in Turkey. So far he has found only an inscription on a rock and has sighted some wood stuck in the mountain's ice cap, which he hopes to reach on another expedition.

"I don't know if the ark is on Mount Ararat. That's an assumption. The Bible says only that the ark came to rest in the mountains of Ararat. That's the mountains of eastern Turkey, a vast area." In fact, says Irwin, the ark might not be on the mountain at all. "I read a commentary on the Bible just last week, and it said the ark came to rest not on the top of the mountain but in the valley. That's very interesting because at the foot of Mount Ararat there is an impression in the lava flow of a vessel, and it has almost the exact dimensions of Noah's ark." Irwin has seen photographs of the impression.

If you can get lost in the twists and turns of Mitchell's spiritual travels, you could also become lulled by Irwin's matter-of-factness. As we ride down Interstate 25, Irwin is talking about Noah's ark as if it were as real as the moon, as if everyone believed that a man named Noah built a boat of gopher wood, 300 cubits by 50 cubits by 30 cubits, and took with him "of every living thing of all flesh, two of every sort."

But Irwin has no doubts about the ark, and he sees no conflict with science. "As far as I'm concerned, Noah's ark did exist. There's no question about it. If we could find evidence of Noah's ark and convince the scientific community of it, then maybe they'd rethink the origin of the earth. Maybe it would bring science and religion closer."

To Irwin, the search for Noah's ark is just another expedition. He has always believed in the Bible. Exploring comes naturally to him, and he loves mountains. The real change that Irwin sees in his life has been internal, the high flight with God that began with his experience on the moon.

"Before the flight, I tell that my life was rather selfish. I was in it for what I could get out of it. I was in it for flying high and fast. Not any longer." And says Irwin, he is no special case. "We're basically selfish. The only way we can hope to change that attitude is through the transforming touch of God, a relationship with Christ." He agrees with Mitchell in a way that to find peace in life, one must "negate self—take self out of it somehow." It's just that Irwin's way is more old-fashioned.

We arrive in Pueblo at the Sangre de Cristo Arts Center, where Irwin is to give his speech. He doesn't talk about the ark, but he does talk about his flight to the moon, about God, about the sustaining power of Jesus on the moon and on Earth. The audience loves him. And the man who had so much difficulty adjusting to speaking in public handles the crowd very well.

But there is an odd quality to his speech. His tone rises and falls in a hypnotic cadence; he smiles broadly and warmly throughout it. After a while the singsong quality of his speech and his intense goodwill ring a bell. I am not listening to an after-lunch speech. I am back in church on a Sunday morning, hearing a sermon. The text this time is not from Matthew, Mark, Luke, or John. It's from Apollo 15, and the preacher is an astronaut.

> *"Irwin, Mitchell, and Duke all pursued, or were pursued by, some new version of the right stuff—call it the righteous stuff, God's grace, Jesus Christ, or consciousness."*

Apollo 16 was the next-to-last moon mission. Charles Duke and Commander John Young landed their lunar module, the *Orion*, near the Descartes crater on April 20, 1972. Thomas K. Mattingly II stayed in the command module. Both Young and Mattingly have gone on to fly the shuttle. Duke was the tenth man on the moon. There would be only two more men to step on its surface during Apollo, and there will not be any others for a long time.

Duke felt nothing on his moon voyage. That's not to say it wasn't a triumph, a thrill. But he had no mystical experience. When you hear him give a recruiting talk or what he calls his "gee whiz, what's it like on the moon" pitch at Northeastern University, you think: "Here is the kind of astronaut who talks like an astronaut." He has a slow Carolina drawl that makes several syllables out of the word *school*, an easy smile, and none of the stiffness you would expect from a brigadier general in the Air Force Reserve. He would be at home wherever he is, and that's just the way he says he felt on the moon— right at home.

He knows the technical details you expect: "The Saturn rocket was thirty-three feet in diameter, three hundred sixty feet tall. It weighed six and a half million pounds and it developed seven and a half million pounds of thrust." And the jokes: "How do you go to the bathroom up there? I told this lady one time, 'We don't. That's why we walk so funny when we get back.'"

And he also has a chilling story. Duke did a little high jump on the moon because the Munich Olympics were coming up. But when he shot up in the air, he realized that his backpack was heavier than he was, and he started rotating backward around his center of gravity. He wasn't going to land on his feet.

"I knew that when I hit the moon the zipper was going to split open in that suit, and I was going to be dead, like *that*. I hit the moon, bounced up, and I don't remember exactly what happened after that. But the next thing I knew it was very quiet, and my heart was pounding like crazy." He checked his pressure gauge, and he heard the oxygen pumps. The suit hadn't split, and he realized he had performed his stunt on television for everyone at mission control. The camera was pointed right at him. They said, "Charlie, we don't think you ought to do that anymore."

This is astronaut talk, the kind of cool, drawled description of danger that the devotees of the right stuff are always coming up with. There is not a word about God.

But afterward, when a student asks Duke if he had had any mystical experiences on the moon, Duke says no, but that later on he had a personal experience with Jesus Christ and that the walk with God was more exciting than the walk on the moon had ever been.

Though the student seems unconvinced, Duke can nonetheless be a very convincing man. Up close you can see that there is something about his eyes—a touch of softness, sorrow perhaps, or compassion—that doesn't seem to fit with a general's uniform.

And when Duke starts talking religion, he has an old-time fervor. There are certain fundamentalist preachers that, through a powerful grasp of rhetoric, a hot line to basic human emotions, or something else, have the ability to send chills up the spines of people who think that Noah is a French tennis player and that Gideon wrote the Bible. Whatever it is, Duke has it too.

He starts out slowly. "I wasn't really seeking God," Duke tells me as we sit in the faculty club of Northeastern University, discussing his trip to the moon. "To me religion was maybe a crutch for people who had problems. I've always been an engineer and technically oriented. And I liked mechanical things, so when I was on the moon, to me that was the major thrust of it—to do a good technical job.

"After the moon it was sort of a letdown.

a frustration started to enter my life How do you channel all this energy and drive that we had?' Duke took on a Coors distributorship in San Antonio Texas He did very well and then sold it Now 'blessed financially,' as he puts it, Duke lives near San Antonio manages his investments, and works on military recruitment

It was his wife who changed first "She opened her heart to the Lord and that really set her free' And as a favor to her Duke went to a Bible-study group where he made a decision that Jesus was real and that he would follow the Bible 'It's the manufacturer's handbook"

About eight months after I'd become a Christian, one night I woke up and I felt this strong presence in my room It was almost overpowering I felt a hand on my shoulder pulling me out of bed I got up and went into the next room and knelt down and my hands went up in surrender to God It was just 'Lord, I surrender' "

Duke realized later that the Lord Jesus exploded in my life that night Since then he has prayed for the sick, laying on hands as the Bible directs 'God healed a cancer in a friend of ours' Duke says, "and then I watched Him open the eyes of a blind girl as we prayed for these people'

Duke travels with two businessmen to visit 'leaders of nations'—the Sandinistas in Nicaragua the presidents of Honduras Guatemala Germany and Austria, Indira Gandhi, and Ferdinand Marcos in the Philippines His mission is peace, 'but not in the world sense of the absence of war Peace with God is the message we bring'

What must they think of him the Marxist revolutionaries, listening to a U S Air Force general talk about God? And what did Indira Gandhi think when he talked about Jesus in a land of half a billion Hindus?

Duke is a Biblical literalist He tells everyone that only through Jesus is there salvation You can't get to heaven just by being a good person if you are a Buddhist a Hindu a Jew or a Shiite Moslem

Duke used to be less convinced He was also an evolutionist, he says but now that has changed and he believes the Bible's account of creation His message is shared with love" but the way is the way

Duke starts to quote Scripture His tone is soft he is almost whispering But the intensity hasn't lessened When he talks about weeping before high school students and God needing a humble servant, he says, 'If you're willing to be used by Him he will destroy the pride

'I mean, I don't particularly like crying in front of audiences, but it's like Jeremiah the prophet says 'The word of God is shut up in my heart it's burning like a fire It's shut up in my bones I am weary of holding it in indeed I cannot' "

Duke the tenth man to have walked on the moon could have stepped straight out of a pulpit in a fundamentalist church'50 years ago And according to him, what he has now far surpasses what he had as an astronaut "For six years afterward I walked around saying, Gosh, I could live for a thousand years and never have an experience like walking on the moon But that's not true because I had an experience with the living God The experience with Him is so much more tantastic that the walk on the moon is like the dust in my life"

Did the moon do it? Does just going to the moon turn your life around? Obviously not Not all the moonwalkers share the same experiences But Irwin says he has seen a great change in all of the men who walked on the moon whether they talk about it or not And the biggest change he thinks, is in the five lunar-module pilots men who he says had fewer duties and more time to observe and think Aldrin, who suffered a breakdown was one of them Bean, the painter, another Bean says that having been to the moon gave him the confidence to try for a place in art history Duke, of course says the moon trip didn't do a thing to him although both Mitchell and Irwin suggest there might have been a delayed effect

How does the moon do it? Irwin says it may just be the contrast—'the lifelessness of the moon versus the place where life abounds, the earth'—that makes you think deeply about your life and life in general

The moon shots have faded in memory now even the image of the earth from space seems remote Most of the Apollo astronauts' names are remembered only dimly The Apollo program did change the place of the moon in the public mind Once an object of mystery, the moon has become a symbol for the failure of technology to give us what we want "They can send a man to the moon but they can't . . . Finish the sentence yourself

And it wasn't only the public that the moon shots didn't satisfy Irwin's wife wrote a book called *The Moon Is Not Enough* Well of course it's not, when you think about it You can't live life on a memory even if it's a memory of walking on the moon Maybe it's not the moon that makes the change but coming back to Earth

That must be particularly true if you are the sort of man who had the drive to get there in the first place Besides being an astronaut—even a moonwalker—isn't what it used to be Irwin, at the luncheon was greeted by one of the organizers as Colonel *Irvin* And when Duke spoke at Northeastern there were only five people in the auditorium when he was ready to start Something had gone wrong with the publicity or the students and the officers with Duke had to shanghai students from the halls to bring the audience up to about 25 No wonder the moon isn't enough

But Duke took it in stride Like Irwin and Mitchell, he has found something to match or surpass the moon "You know, if I drop dead right now I know that I'm going to be in heaven If you ever hear that Charlie Duke's dead say 'Glory Hallelujah he's in heaven' "

Higher even than the moon ∞

LOVE

CONTINUED FROM PAGE 82

time mates to help them out How was this problem finally resolved?

If Fisher is correct, females lured males into domesticity by offering them sex on a regular basis The anthropologist notes that female primates in heat are extremely popular with males, who attend to them regularly and, in the case of chimpanzees, even provide them with more food than nonestrous females get So natural selection, Fisher argues, would have favored females who maintained sexual drive beyond their estrus cycles

Translated into biochemical terms, Fisher seems to be proposing that women evolved brains that could be activated by LHRH even when they weren't ovulating And this is in fact exactly what Moss thinks has happened "As you move up the evolutionary scale" he reports, "there is a tendency for LHRH brain arousal to be less rigidly controlled by hormonal feedback from the ovaries That's the reason why a spayed cat loses its sex drive, while a woman who has had her ovaries removed feels no less sexy than a woman with her reproductive organs intact'

Though seldom noted, it is clear that human intercourse started to become distinct from procreation long before the invention of birth control And in the process, our brains seem to have developed much more complex thoughts and feelings associated with the act of sex For many human beings, an important prerequisite for physical intimacy is being in love—a state of mind that encompasses many more emotions than simply feeling sexy

"A giddy high similar to an amphetamine boost inevitably accompanies the state of falling in love" observes Dr Michael R Liebowitz of the New York State Psychiatric Institute "But with continued intimacy the novelty of the relationship wears off, and the initial feeling of elation usually gives way to new emotions that serve to cement the tie between partners. At this stage, the presence of a loved one no longer heightens arousal but has a calming influence inducing a sense of general well-being"

Liebowitz believes these two phases of romance, which he calls attraction and attachment, are for the most part biologically determined and involve two distinct neurochemical systems He developed this theory over the course of clinical practice when he noted that patients obsessed by love often appeared to have an imbalance in either neurosystem He theorizes that this disruption can be the result of inheritance early learning experiences, or both In his newly published book *The Chemistry of Love* (Little Brown), Liebowitz recounts the story of one young man whom he describes as a classic 'attraction junkie'

"He used to tell me that 'falling in love was like taking amphetamines' On one occasion he met someone he really liked,

and the two of them spent the next five days together. What made this a little unusual was that they barely slept during that time and also never spent more than one day in the same city. They met in New York, went down to Baltimore to meet her brother and get the keys to the brother's boat, which was docked up in Newport, Rhode Island, but on the way detoured to visit someone in Boston. On the fifth day my patient was just beginning to tire out when they met a cousin of his new girlfriend. The cousin took one look at her and asked my patient, 'How long has Jane been acting like this?' He said, 'Acting like what?' To which the cousin replied, 'Not sleeping, talking all the time, making plans to sail to Georgia, that kind of thing.' My patient said, 'She's a little high, but so am I, we're in love.' At this point the cousin said, 'Jane, when did you stop your lithium?' Turns out Jane was a manic-depressive and had not taken her lithium for two weeks. 'You may be in love,' the cousin said to my patient, 'but I think she's manic again.'

The young man described above has a romantic disturbance that is prevalent among what Liebowitz's associate, Dr. Donald F. Klein, calls hysteroid dysphorics. As the story illustrates, the condition resembles manic-depressive psychosis except that severe mood swings are determined by whether or not the individuals are in love. These people usually have a history of forming one disastrous relationship after another. A common problem among them, the researchers observed, is that they are so desperate for the giddy thrill of new romance that they don't allow enough time to take a good look at just who they are falling for. Klein began to wonder whether their relentless pursuit of love reflected a craving for phenylethylamine—the brain's equivalent of amphetamine.

To test his colleague's hypothesis, Liebowitz placed his male patient on a monoamine oxidase (MAO) inhibitor—an unusual class of antidepressant drug that prohibits the breakdown of phenylethylamine. Within a few weeks, Liebowitz reports, the man "settled down to a more normal attraction pattern. He no longer got so carried away by romance. The frantic need to have somebody all the time seemed to vanish."

This was all the more surprising since the patient had undergone several years of psychotherapy with little sign of improvement. 'Talk therapy helped him understand himself better,' Liebowitz is quick to point out, 'but it appears that until the MAO inhibitor was administered, he was largely unsuccessful in applying what he had learned, because of his overriding emotional response.'

Of course, a solitary patient's reaction to a drug proves little—if anything. So Liebowitz tested several dozen more patients in a carefully controlled clinical trial, which he carried out in conjunction with colleagues at Columbia University and the New York State Psychiatric Institute. The results, which will be published soon, show that the overwhelming majority of hysteroid dysphorics benefited markedly from treatment with a MAO inhibitor. By contrast, few responded to a more common class of antidepressant drug.

Liebowitz's work has recently expanded to include people who might be called attachment junkies. In direct contrast to attraction junkies, these individuals tend to single out one partner whom they then cling to with the tenacity of a barnacle. "Even if the relationship proves disastrous," says Liebowitz, "they won't loosen their grasp for fear of being overwhelmed by anxiety or depression."

Researchers have noted that the attachment junkie's response to being separated from a long-term partner closely parallels the withdrawal symptoms of a heroin addict. And in fact, animal studies now highlight dramatic similarities between social dependence and narcotic dependence.

"At a neurochemical level," reports Jaak Panksepp, a professor of psychology at Bowling Green State University in Ohio, "attachment is essentially an addictive phenomenon involving opioids [the brain's version of opiates]." Panksepp and his colleagues have studied the distress-vocalization response of puppies, young guinea pigs, and baby chicks who are removed from their normal social environment. To discover which neurochemicals trigger separation anxiety, the researchers tried to modify the animals' responses with a variety of drugs, including stimulants, sedatives, antipsychotics, and tranquilizers. Only two types of drugs were found to suppress crying without also sedating the animals: narcotics, most notably a brain opioid called beta endorphin, and clonidine, a poorly understood drug used to reduce the severity of withdrawal symptoms in heroin addicts going "cold turkey."

"It's fairly unambiguous that brain opioids tend to inhibit activity in the crying circuit," says Panksepp. "So one might say that an animal learns attachment by the stimuli—usually contact with its mother or father—that trigger the release of opioids and thereby relieve separation stress."

> *"Human beings are the sexiest animals on Earth, virtually alone among species in their freedom to engage in sex all the time, irrespective of reproductive matters."*

Panksepp and his colleagues have also used electrical-stimulation procedures to map out the animals' distress-vocalization circuits. The crying pathway was found to be situated in a brain region dense in opioid receptors, providing further confirmation of the theory.

Since this finding has been shown to hold true across a diverse range of species, it is likely that the same neuromechanisms underlie human bonding. Extrapolating from the animal findings, Liebowitz believes a dependence on opioids is what fosters close ties between infant and mother, as well as between man and woman. He speculates that this method of pair-bonding evolved in the latter case "so that partners would stay together at least long enough to conceive and rear young." According to Liebowitz, amphetamines may bring people together, but it is opioids that keep them together.

As for his attachment junkies, Liebowitz thinks they "probably produce too few opioids, so they cling onto their mates to keep the level in their neural reservoirs from falling below the threshold mark, which would trigger a panic attack. Put another way, they are unknowingly using their partners as mood regulators."

While a dearth of opioids may foster unhealthy dependencies, too many opioids may prove even more debilitating. Not only do socially deprived animals stop crying when they are injected with opioids, they also show a reduction in gregariousness. They cease to seek out physical contact with their parents or siblings and instead engage in unusual, highly repetitive activities in isolation. These behaviors, in the opinion of Panksepp, suggest an animal model for autism.

'Autistic children are also known to engage in ritualistic activities, and while they do cry, it's never due to separation distress,' explains Panksepp. 'So we've been entertaining the possibility that autism is caused—at least in part—by overproduction of opioids. Our tentative hypothesis is that kids with a surplus of opioids would not bond to their mothers or feel a need for physical affection, as other children do.'

The poet in us may be offended to hear researchers equate longings of the heart with an addiction. But a craving for love need not carry the same pejorative connotations as say a craving for heroin. Drug abuse is unhealthy, argues Liebowitz, because it induces a good feeling without having accomplished anything. By contrast, getting that fix from another human being exerts an overall beneficial influence on our lives and motivates us to engage in the very activities that are most vital for survival. 'That's why love is, by definition, the strongest feeling we can have,' insists Liebowitz. "Other things—stimulant drugs, passionate causes, manic states—can induce powerful changes in our brains, but none so reliably, so enduringly, or so delightfully as that 'right' other person."

MY ROSE

CONTINUED FROM PAGE 61

'You can t have the motorcycle You have nothing to trade No wife No children Nothing'

'I have cash Huberman

Cash? Are you serious? Cash? Now tell me you have stock certificates and municipal bonds Huberman roared He spilled his tea and coughed He was really having himself a good time

'I don t get the joke I said

'Finish your cup of tea Come with me' Huberman said

I finished my tea and followed Huberman up two more flights We went through a fire door to another landscape of 'art and artifacts ' There sorting through yellowing dentures in an Ivory Soap carton was a hunched little man

'He's cataloging ' Huberman said 'Do you recognize him?'

Should I?'

'He once painted me orange Huberman said

'Bill Vanderweil? The football player?

'The very same '

'What s he doing here?

'He wanted his skates We'd done a fair trade I gave him lollipops He liked lollipops He gave me his skates Then he wanted his skates '

'Bill Vanderweil He must have really wanted his skates' I said

'He did Very much He works here now Very reasonably He s been an enormous help Look over there

In the shadows I saw a slender woman wiping thick dust off a grandfather clock It stood among a graveyard of grandfather clocks There were hundreds

'Jinny Sue Ellenbogel Huberman said

The majorette?'

'Remember how she twirled her baton? Wasn t it elevating?'

'Jinny Sue I had such a crush on her

She traded her baton for a rhinestone brooch the silly bitch Then she wanted her baton It took time but she understood that she needed her baton Now she's employed here Nonunion I might add Her boyfriend, Lobster Hallmark killed my parakeet He exposed it to the elements '

'Lobster Hallmark The one with the convertible '

'The convertible is upstairs He sits in it on his day off He shifts the gears I don't allow him to blow the horn except on Christmas

'Listen Huberman' I said 'I m prepared to offer you twenty five dollars for my motorcycle but that s it'

'No deal Come back when you're ready to do business '

'Thirty dollars Not a penny more I can live without the motorcycle The driver s head is loose The rear wheel is bent Thirty is my final offer

Of course it is ' Huberman said 'Would you like more tea? Some time to think?

' No more tea ' I said I drink Earl Grey Not Lipton s '

I'm sorry ' Huberman said

On the way down, we passed several children carrying boxes up the stairs Their faces looked familiar But I didn't ask about their parents

Tell me something, Huberman said on the bottom landing 'What do you feel about the neutron bomb?'

'What do I feel? I hate it How can you feel about a bomb that saves property and kills people? '

'Affectionate said Huberman 'Let s lay it on the line You're in public relations The neutron bomb is getting a lot of god-awful publicity The other side of the story should be told '

' What other side of the story?

'The good side The positive side The life of objects Objects are a life form you know A campaign could be mounted People believe that plants have feelings even consciousness They need to be educated about things'

'You want me to mount a campaign that celebrates the neutron bomb?'

'We were friends after a fashion You never stomped on me If you agree to the campaign I'll give you your motorcycle If not well what are friends for?'

'Never' I said 'Besides my best client

is a coal company with no involvement in nukes How do you think they would feel if my organization—

'The ball is in your court

'Sixty dollars,' I said 'The new tax laws exempt collectibles from Individual Retirement Accounts and Keogh Plans Remember that Huberman '

'Please consider Huberman said the realities There is every chance that life on earth will be destroyed or rendered senseless Even if there is no war a mechanized world with consequent leisure will destroy the population Look what s happened to love It's become sensation hardly competitive with video games And take video games The most popular one feafures the perfect cannibal It devours everything Winning is consuming But winning is losing Because everything becomes nothing So they come to me And even when people cease to come for their bafons skates convertibles—yes motorcycles—*others* will come What will *they* find? What I have collected and collated This building is a time capsule The only real history Books lie Film and tape can be edited But my objects *are* When *they* come here they will fondle real *things* ratty mattresses stained pillows cups with rings at the bottom—glorious things And *they* will play with my toys *They* will ask themselves about the man who stocked this lode His birthday will become a holiday'

'Like Washington Huberman you ve never forgotten that incident in the toilet'

'If you want your motorcycle it's going to cost you my friend Buf because you were my friend I'm willing to let you share in this splendid adventure A modest campaign, possibly some television some print a speech here and there I'm not asking for billboards Just explain that the shadow burned on a wall is as important as the shadow s father or mother You know Neutrons are your friends Like that All I want is equal time '

'Huberman you re mad but I want that motorcycle One hundred dollars '

'Done'

'You'll take it?'

'Of course I ve got to eat I ve got to pay the electric bill I m considering marriage CDs I can t survive on ideals Cash No checks No charge cards No receipt I ll get your motorcycle I ve already packed it Gift wrapped '

Huberman got me the package I gave him five tens and a fifty

'Would you have taken thirty? I said

'Who knows? Tell me how's the old town? Is that little park still there the one where they stripped me and tried to tattoo Hitler on my ass? Lord those were gay times But you can t go home again'

'The park is gone,' I said 'It s a shopping center '

I drove to Cleveland and flew back to New York I put the motorcycle on a shelf in my office It looked marvelous there I was glad to have it back I think I would have done anything to get it ∞

TRANSIT

CONTINUED FROM PAGE 73

was on all the screens of Earth within ten minutes. It was months before *their* camera was found and brought back to civilization. And we die in comfort with all modern conveniences—including many that Robert Scott could never have imagined when he stood at the South Pole in 1912.

Two hours later. I'll start giving exact times when it becomes important.

All the facts are in the log, and by now the whole world knows them. So I guess I'm doing this largely to settle my mind—to talk myself into facing the inevitable. The trouble is, I'm not sure what subjects to avoid and which to tackle head on. Well, there's only one way to find out.

The first item. In twenty-four hours, at the very most, all the oxygen will be gone. That leaves me with the three classical choices. I can let the carbon dioxide build up until I become unconscious. I can step outside and crack the suit, leaving Mars to do the job in about two minutes. Or I can use one of the tablets in the med kit.

Carbon dioxide buildup. Everyone says that's quite easy—just like going to sleep. I've no doubt that's true; unfortunately, in my case it's associated with nightmare number one.

I wish I'd never come across that damn book—*True Stories of World War Two*, or whatever it was called. There was one chapter about a German submarine, found and salvaged after the war. The crew was still inside it—*two* men per bunk. And between each pair of skeletons, the single respirator set they'd been sharing.

Well, at least that won't happen here. But I know, with a deadly certainty, that as soon as I find it hard to breathe, I'll be back in that doomed U-boat.

So what about the quicker way? When you're exposed to a vacuum, you're unconscious in ten or fifteen seconds, and people who've been through it say it's not painful—just peculiar. But trying to breathe something that isn't there brings me altogether too neatly to nightmare number two.

This time, it's a personal experience. As a kid, I used to do a lot of skin diving when my family went to the Caribbean for vacations. Out on a reef was an old freighter that had sunk twenty years before. Its deck was only a couple of yards below the surface. Most of the hatches were open, so it was easy to get inside to look for souvenirs and hunt the big fish that like to shelter in such places.

Of course it was dangerous—if you did it without scuba gear. So what boy could resist the challenge?

My favorite route involved diving into a hatch on the foredeck, swimming about fifty feet along a passageway dimly lit by portholes a few yards apart, then angling up a short flight of stairs and emerging through a door in the battered superstructure. The whole trip took less than a minute—an easy dive for anyone in good condition. There was even time to do some sight-seeing or to play with a few fish along the route. And sometimes, for a change, I'd switch directions, going in the door and coming out again through the hatch.

That was the way I did it the last time I hadn't dived for a week—there had been a big storm, and the sea was too rough—so I was impatient to get going. I deep-breathed on the surface for about two minutes, until I felt the tingling in my fingertips that told me it was time to stop. Then I jackknifed and slid gently down toward the black rectangle of the open doorway.

It always looked ominous and menacing—that was part of the thrill. And for the first few yards, I was almost completely blind; the contrast between the tropical glare above water and the gloom between decks was so great that it took quite a while for my eyes to adjust. Usually, I was halfway along the corridor before I could see anything clearly; then the illumination would steadily increase as I approached the open hatch, where a shaft of sunlight would paint a dazzling rectangle on the rusty, barnacled metal floor.

> *"So what's wrong with poison? Nothing, I suppose. The stuff we've got takes only fifteen seconds. But all instincts are against it, even when there's no sensible alternative."*

I'd almost made it when I realized that this time the light wasn't getting better. There was no slanting column of sunlight ahead of me, leading up to the world of air and life. I had a second of baffled confusion. Then I realized what had happened—and confusion turned into sheer panic. Sometime during the storm, the hatch must have slammed shut.

I don't remember making a U-turn; the next thing I recall is swimming quite slowly back along the passage and telling myself: Don't hurry—your air will last longer if you take it easy. I could see very well now, because my eyes had had plenty of time to become dark-adapted. There were lots of details I'd never noticed before—such as the red squirrelfish lurking in the shadows, the green fronds and algae growing in the little patches of light around the portholes, and even a single rubber boot, apparently in excellent condition, lying where someone must have kicked it off. And once, out of a side corridor, I noticed a big grouper staring at me with bulbous eyes, his thick lips half-parted, as if he were astonished at my intrusion.

The band around my chest was getting tighter, it was impossible to hold my breath any longer—yet the stairway still seemed an infinite distance ahead. I let some bubbles of air dribble out of my mouth. That improved matters for a moment, but once I had exhaled, the ache in my lungs became even more unendurable.

Now there was no point in conserving strength by flippering along with that steady, unhurried stroke. I snatched the ultimate few cubic inches of air from my face mask—feeling it flatten against my nose as I did so—and swallowed it down into my starving lungs. At the same time, I shifted gear and drove forward with every last atom of strength.

And that's all I remember until I found myself spluttering and coughing in the daylight, clinging to the broken stub of the mast. The water around me was stained with blood, and I wondered why. Then, to my great surprise, I noticed a deep gash in my right calf. I must have banged into some sharp obstruction, but I'd never noticed it and even now, felt no pain.

That was the end of my skin diving until I started astronaut training ten years later and went into the underwater zero-g simulator. Then it was different because I was using scuba gear, but I had some nasty moments that I was afraid the psychologists would notice, and I always made sure that I got nowhere near emptying my tank. Having nearly suffocated once, I'd no intention of risking it again.

I know exactly what it will feel like to breathe the freezing wisp of near-vacuum that passes for atmosphere on Mars. No, thank you.

So what's wrong with poison? Nothing, I suppose. The stuff we've got takes only fifteen seconds, they told us. But all my instincts are against it, even when there's no sensible alternative.

Did Scott have poison with him? I doubt it. And if he did, I'm sure he never used it.

I'm not going to replay this. I hope it's been some use, but I can't be sure.

The radio has just printed out a message from Earth, reminding me that transit starts in two hours. As if I'm likely to forget—when four men have already died so that I can be the first human being to see it. And the only one for exactly one hundred years. It isn't often that sun, Earth and Mars line up neatly like this. The last time was in 1905, when poor old Lowell was still writing his beautiful nonsense about the canals and the great dying civilization that had built them. Too bad it was all delusion. I'd better check the telescope and the timing equipment.

The sun is quiet today—as it should be anyway, near the middle of the cycle. Just a few small spots and some minor areas

of disturbance around them. The solar weather is set calm for months to come. That's one thing the others won't have to worry about on their way home.

I think that was the worst moment: watching *Olympus* lift off Phobos and head back to Earth. Even though we'd known for weeks that nothing could be done, that was the final closing of the door. It was night, and we could see everything perfectly. Phobos had come leaping up out of the west a few hours earlier and was doing its mad backward rush across the sky, growing from a tiny crescent to a half-moon. Before it reached the zenith, it would disappear as it plunged into the shadow of Mars and became eclipsed.

We'd been listening to the countdown, of course, trying to go about our normal work. It wasn't easy, accepting at last the fact that fifteen of us had come to Mars and only ten would return. Even then, I suppose there were millions back on Earth who still could not understand; they must have found it impossible to believe that *Olympus* couldn't descend a mere four thousand miles to pick us up. But when the permafrost under landing pad three finally gave way and *Pegasus* toppled, that was that. It still seems a miracle that the ship didn't blow up when the propellant tank ruptured.

I'm wandering again. Back to Phobos and the countdown. On the telescope monitor, we could clearly see the fissured plateau where *Olympus* had touched down after we'd separated and begun our own descent. Though our friends would never land on Mars, at least they'd had a little world of their own to explore, even for a satellite as small as Phobos. It worked out to thirty square miles per man. A lot of territory to search for strange minerals and debris from space—or to carve your name so that future ages would know that you were the first of all men to come this way.

The ship was clearly visible as a stubby, bright cylinder against the dull-gray rocks. From time to time some flat surface would catch the light of the swiftly moving sun and would flash with mirror brilliance. But about five minutes before liftoff, the picture suddenly became pink, then crimson—then vanished completely as Phobos rushed into eclipse.

The countdown was still at ten seconds when we were startled by a blast of light. For a moment, we wondered if *Olympus* had also met with catastrophe; then we realized that someone was filming the takeoff and the external floodlights had been switched on.

During those last few seconds, I think we all forgot our own predicament; we were up there aboard *Olympus*, willing the thrust to build up smoothly and lift the ship out of the tiny gravitational field of Phobos—and then away from Mars for the long fall sunward. We heard Commander Richmond say "Ignition," there was a brief burst of interference, and the patch of light began to move in the field of the telescope.

That was all. There was no blazing column of fire, because, of course, there's really no ignition when a nuclear rocket lights up. "Lights up" indeed! That's another hangover from the old chemical technology. But a hot hydrogen blast is completely invisible; it seems a pity that we'll never again see anything so spectacular as a *Saturn* or a *Korolov* blastoff.

Just before the end of the burn, *Olympus* left the shadow of Mars and burst out into sunlight again, reappearing almost instantly as a brilliant, swiftly moving star. The blaze of light must have startled them aboard the ship, because we heard someone call out, "Cover that window!" Then, a few seconds later, Richmond announced, "Engine cutoff." Whatever happened, *Olympus* was now irrevocably headed back to Earth.

A voice I didn't recognize—though it must have been the commander's—said, "Good-bye *Pegasus*," and the radio transmission switched off. There was, of course, no point in saying, "Good luck." *That* had all been settled weeks ago.

I've just played this back. Talking of luck, there's been one compensation, though not for us. With a crew of only ten, *Olympus* has been able to dump a third of her expendables and lighten herself by several tons. So now she'll get home a month ahead of schedule.

Plenty of things could have gone wrong in that month; we may yet have saved the expedition. Of course, we'll never know—but it's a nice thought.

I've been playing a lot of music—full blast, now that there's no one else to be disturbed. We have a fine collection, but I have to choose carefully. Nothing downbeat, and nothing that demands too much concentration. And nothing with human voices. So I restrict myself to the lighter orchestral classics: the *New World Symphony* and Grieg's piano concerto fill the bill perfectly. At the moment, I'm listening to Rachmaninoff's *Paganini Variations*, but now I must switch off and get down to work.

Five minutes to go: all the equipment is in perfect condition. The telescope is tracking the sun, the video recorder is standing by, the precision timer is running.

These observations will be as accurate as I can make them; I owe it to my lost comrades, whom I'll soon be joining. They gave me their oxygen so that I can still be alive at this moment. I hope you remember that, one hundred or one thousand years from now, whenever you crank these figures into the computers.

Only a minute to go; getting down to business. For the record: year 1984, month May, day eleven, coming up to four hours, thirty minutes, Ephemeris Time ... now.

Half a minute to contact: switching recorder and timer to high speed. Just rechecked position angle to make sure I'm looking at the right spot on the sun's limb.

Using power of five hundred—image perfectly steady even at this low elevation

Four thirty-two. Any moment now—

There it is . . . there it is! I can hardly believe it! A tiny black dent in the edge of the sun, growing, growing, growing.

Hello, Earth. Look up at me—the brightest star in your sky, straight overhead at midnight. Recorder back to slow.

Four thirty-five. It's as if a thumb were pushing into the sun's edge, deeper and deeper—fascinating to watch.

Four forty-one. Exactly halfway. Earth is a perfect black semicircle—a clean bite out of the sun—as if some disease were eating it away.

Four forty-eight. The ingress is now three-quarters complete.

Four hours, forty-nine minutes, thirty seconds. Recorder on high speed again.

The line of contact with the sun's edge is shrinking fast. Now it's a barely visible black thread. In a few seconds, the whole Earth will be superimposed on the sun.

Now I can see the effects of the atmosphere. There's a thin halo of light surrounding that black hole in the sun. Strange to think that I'm seeing the glow of all the sunsets—and all the sunrises—that are taking place around the Earth at this moment.

Ingress complete—four hours, fifty minutes, five seconds. The whole world has moved onto the face of the sun, a perfectly circular black disk silhouetted against that inferno, ninety million miles below. It looks bigger than I expected: one could easily mistake it for a fair-size sunspot.

Nothing more to see now for six hours, when the moon appears, trailing Earth by half the sun's width. I'll beam the recorded data back to Lunacom, then try to sleep.

My very last sleep. Wonder if I'll need drugs. It seems a pity to waste these last few hours, but I want to conserve my strength—and my oxygen.

Ten hours, thirty minutes. Ephemeris Time. The doctor was right. I took only one pill and don't remember any dreams.

The condemned man also ate a hearty breakfast. Cut that out.

Back at telescope. Now Earth is halfway across the disk, passing well north of center. In ten minutes, I should see the moon.

I've just switched to the highest power of the telescope—two thousand. The image is slightly fuzzy, but fairly good, atmospheric halo very distinct. I hope to see the cities on the dark side of Earth.

No luck. Probably too many clouds. A pity—it's theoretically possible, but we never succeeded. I wish . . . Never mind.

Ten hours, forty minutes. Recorder on slow. Hope I'm looking at the right spot.

Fifteen seconds to go. Recorder fast.

Damn—missed it. Doesn't matter—the recorder will have caught the exact moment. There's a little black notch already in the side of the sun. First contact must have been about ten hours, forty-one minutes, twenty seconds, E.T.

What a long way it is between Earth and moon—there's half the width of the sun between them. You wouldn't think the two bodies had anything to do with each other. Makes you realize just how big the sun really is.

Ten hours, forty-four minutes. The moon is exactly halfway over the edge. A very small, very clear-cut semicircular bite out of the edge of the sun.

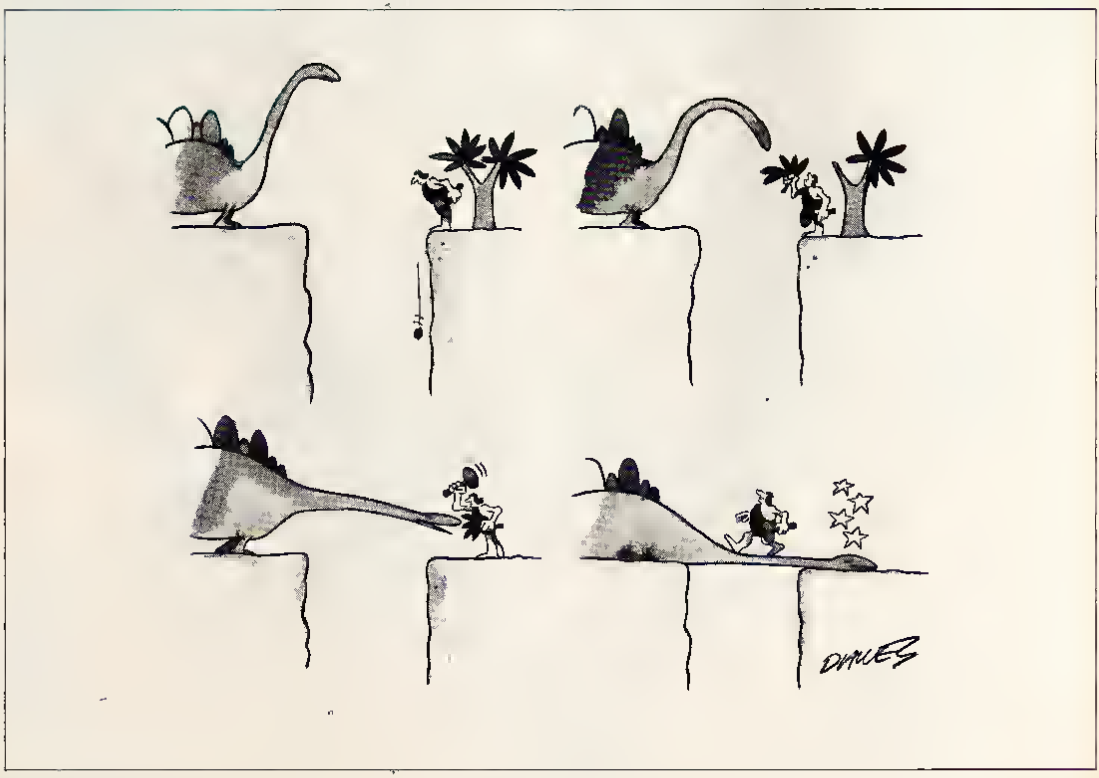
Ten hours, forty-seven minutes, five seconds. Internal contact. The moon is clear of the edge, entirely inside the sun. Don't suppose I can see anything on the night side, but I'll increase the power.

That's funny.

Well, well. Someone must be trying to talk to me. There's a tiny light pulsing away there on the darkened face of the moon. Probably the laser at Imbrium Base.

Sorry, everyone. I've said all my goodbyes and don't want to go through that again. Nothing can be important now.

Still, it's almost hypnotic—that flickering point of light, coming out of the face of the sun itself. Hard to believe that even after it's traveled all this distance, the beam is only one hundred miles wide. Lunacom's going to all this trouble to aim it exactly at me, and I suppose I should feel guilty at



ignoring it But I don t I ve nearly finished my work and the things of Earth are no longer my concern

Ten hours, fifty minutes Recorder off That s it until the end of Earth transit two hours from now

I ve had a snack and am taking my last look at the view from the observation bubble The sun's still high so there s not much contrast, but the light brings out all the colors vividly—the countless varieties of red and pink and crimson so startling against the deep blue of the sky How different from the moon—though that too has its own beauty

It s strange how surprising the obvious can be Everyone knew that Mars was red But we didn t really expect the red of rust—the red of blood Like the Painted Desert of Arizona after a while the eye longs for green

To the north there is one welcome change of color The cap of carbon dioxide snow on Mount Burroughs is a dazzling white pyramid That s another surprise Burroughs is twenty-five thousand feet above Mean Datum, when I was a boy there weren't supposed to be any mountains on Mars

The nearest sand dune is a quarter of a mile away and it too has patches of frost on its shaded slope During the last storm we thought it moved a few feet but we couldn t be sure Certainly the dunes are moving like those on Earth One day I suppose this base will be covered—only to reappear again in one thousand years Or ten thousand

That strange group of rocks—the Elephant the Capitol the Bishop—still holds its secrets and teases me with the memory of our first big disappointment We could have sworn that they were sedimentary How eagerly we rushed out to look for fossils! Even now, we don't know what formed that outcropping the geology of Mars is still a mass of contradictions and enigmas

We have passed on enough problems to the future and those who come after us will find many more But there s one

mystery we never reported to Earth nor even entered in the log

The first night after we landed we took turns keeping watch Brennan was on duty and woke me up soon after midnight I was annoyed—it was ahead of time—and then he told me that he'd seen a light moving around the base of the Capitol We watched for at least an hour until it was my turn to take over But we saw nothing Whatever that light was it never reappeared

Now Brennan was as levelheaded and unimaginative as they come if he said he saw a light then he saw one

Maybe it was some kind of electric discharge or the reflection of Phobos on a piece of sand-polished rock We decided not to mention it to Lunacom unless we saw it again

Since I've been alone, I ve often awakened in the night and looked out toward the rocks In the feeble illumination of Phobos and Deimos they remind me of the skyline of a darkened city And it has always remained darkened No lights have ever appeared for me

Twelve hours forty-nine minutes, Ephemeris Time The last act is about to begin Earth has nearly reached the edge of the sun The two narrow horns of light that still embrace it are barely touching

Recorder on fast

Contact! Twelve hours fifty minutes sixteen seconds The crescents of light no longer meet A tiny black spot has appeared at the edge of the sun, as the earth begins to cross it It's growing longer, longer—

Recorder on slow Eighteen minutes to wait before Earth finally clears the face of the sun The moon still has more than halfway to go it s not yet reached the midpoint of its transit It looks like a blob of ink, only a quarter the size of Earth And there s no light flickering there anymore Lunacom must have given up

Well I have just a quarter hour left here in my last home Time seems to be accelerating the way it does in the final minutes before a liftoff No matter I have

everything worked out. I can even relax.

Already, I feel part of history. I am one with Captain Cook, back in Tahiti in 1769, watching the transit of Venus. Except for that image of the moon trailing along behind, it must have looked just like this.

What would Cook have thought, two hundred years ago, if he'd known that one day a man would observe the whole Earth in transit from an outer world? I'm sure he would have been astonished—and then delighted. But I feel a closer identity with a man not yet born. I hope you hear these words, whoever you may be. Perhaps you will be standing on this very spot, one hundred years from now, when the next transit occurs.

Greetings to 2084. November 10! I wish you better luck than we had. I suppose you will have come here on a luxury liner—or you may have been born on Mars and be a stranger to Earth. You will know things that I cannot imagine, yet somehow I don't envy you. I would not change places with you even if I could.

For you will remember my name and know that I was the first of all mankind ever to see a transit of Earth. And no one will see another for one hundred years.

Twelve hours, fifty-nine minutes. Exactly halfway through egress. The earth is a perfect semicircle—a black shadow on the face of the sun. I still can't escape from the impression that something has taken a big bite out of that golden disk. In nine minutes it will be gone and the sun will be whole again.

Thirteen hours, seven minutes. Recorder on fast.

Earth has almost gone. There's just a shallow black dimple at the edge of the sun. You could easily mistake it for a small spot, going over the limb.

Thirteen hours, eight.

Good-bye, beautiful Earth.

Going, going, going, good-bye, good—

I'm okay again now. The timings have all been sent home on the beam. In five minutes they'll join the accumulated wisdom of mankind. And Lunacom will know that I stuck to my post.

But I'm not sending this. I'm going to leave it here, for the next expedition—whenever that may be.

So this capsule will stay here, as Scott's diary remained in his tent, until the next visitors find it. But they won't find me.

Strange how hard it is to get away from Scott. I think he gave me the idea. For his body will not lie frozen forever in the Antarctic, isolated from the great cycle of life and death. Long ago that lonely tent began its march to the sea. Within a few years it was buried by the falling snow and had become part of the glacier that crawls eternally away from the pole. In a few brief centuries, the sailor will have returned to the sea. He will merge once more into the pattern of living things—the plankton, the seals, the penguins, the whales, all the multitudinous fauna of the Antarctic ocean.

There are no oceans here on Mars, nor have there been for at least five billion years. But there is life of some kind down there in the badlands of Chaos II, that we never had time to explore. Those moving patches on the orbital photographs. The evidence that whole areas of Mars have been swept clear of craters by forces other than erosion. The long chain, optically active carbon molecules picked up by the atmospheric samplers.

And, of course, the mystery of *Viking 6*. Even now, no one has been able to make any sense of those last instrument readings before something large and heavy crushed the probe in the still, cold depths of the Martian night.

And don't talk to me about *primitive* life forms in a place like this! Anything that's survived here will be so sophisticated that we may look as clumsy as dinosaurs.

There's still enough propellant in the ship's tanks to drive the Marscar clear around the planet. I have three hours of daylight—time to get down into the valleys and well out into Chaos. After sunset I'll still be able to make good speed with the headlamps. It will be romantic, driving at night under the moons of Mars.

One thing I must fix before I leave. I don't like the way Sam is lying out there. He was always so poised, so graceful. It doesn't seem right that he should look so awkward now. I must do something about it.

I wonder if I could have covered three hundred feet without a suit, walking slowly, steadily—the way he did to the very end.

I must try not to look at his face.

That's it. Everything shipshape and ready to go.

The therapy has worked. I feel perfectly at ease—even contented, now that I know exactly what I'm going to do. The old nightmares have lost their power.

It is true: we all die alone. It makes no difference at the end, being fifty million miles from home.

I'm going to enjoy the drive through that lovely painted landscape. I'll be thinking of all those who dreamed about Mars—Wells and Lowell and Burroughs and Weinbaum and Bradbury. They all guessed wrong, but the reality is just as strange, just as beautiful as they imagined.

I don't know what's waiting for me out there, and I'll probably never see it. But on this starveling world, it must be desperate for carbon, phosphorus, oxygen, calcium. It can use me.

And when my oxygen alarm gives its final ping somewhere down there in that haunted wilderness, I'm going to finish in style. As soon as I have difficulty in breathing, I'll get off the Marscar and start walking—with a playback unit plugged into my helmet and going full blast.

For sheer, triumphant power and glory, there's nothing in music to match the *Toccata and Fugue in D Minor*. I won't have time to hear all of it, that doesn't matter.

Johann Sebastian, here I come. ∞

LIFE

CONTINUED FROM PAGE 28

river in the United States. In 1977 the federal government outlawed the use of polychlorinated biphenyls, or PCBs, in the manufacturing of paper and other products. But although PCB levels in the Lower Fox are steadily decreasing, the problem remains because these deadly chemicals become more concentrated as they ascend the food chain. "A human would have to drink Great Lakes water for about one thousand years," says Black, "to equal the amount of PCB that is in a one-pound serving of a fish contaminated with PCB at five parts per million."

The Wisconsin Division of Health has explicitly warned children and women of childbearing age not to eat anything taken from the Lower Fox or Green Bay. That warning may reduce some of the danger facing local citizens, but it can do nothing for the cormorants and other fish-eating birds that depend on those waters. Once nearly wiped out by the now-banned pesticide DDT, these birds had been making a comeback along the river and bay. Now they are starting to suffer from the effects of PCBs and other toxic chemicals. According to a joint federal/state study published last summer, birth defects and other abnormalities among these birds run 50 times greater than normal.

In spite of the warning posed by these sentinels, the Reagan administration has all but dumped the problem onto the states. To make matters worse, it also has been trying to cut or even terminate funding for the laboratories that have taken the lead in studying fish cancer. Legislation being prepared by Representative Dennis M. Hertel, a Michigan Democrat, would compel the government to take a more active role in eliminating this deadly pollution. It would not be the first time the government took heed of a warning.

When scientists traced cancer in hatchery trout to aflatoxins produced by a peanut mold in the fish food, the FDA established standards for aflatoxins in such human foods as peanut butter. "Today aflatoxins are recognized as extremely potent carcinogens," says Harshbarger. "The FDA standards have undoubtedly prevented many human cancers." ∞

CREDITS

Page 10, John Muth. Charles Adams, John Muth, Adam Jacobs. **page 18,** Sid Di Marco/Black Star. **page 20,** Francisco Melo. **page 24,** Pierre Lacombe. **page 28,** Don Morrill. **page 32,** Photograph by Elizabeth Getzoff and John Tainer, using computer software *GRAMPS* and *GRANNY*, by A. J. Olson, T. J. O'Donnell, and M. L. Connolly. Data provided by D. R. Davies, National Institutes of Health. Copyright © 1984 SCRP. **page 38 top,** DGI Internation al Inc.. **page 38 bottom,** Olga Spiegel. **page 39,** The Bettmann Archive. **page 40 top,** Movie Still Archives. **page 40 bottom,** The Bettmann Archive. **page 41 top,** IBM. **page 41 bottom,** Olga Spiegel. **page 42 left,** Olga Spiegel. **page 42 right,** Olga Spiegel. **page 43 bottom,** Richard Kolar/Animals Animals. **page 44 top,** © Norwood. **page 44 bottom,** Alice Kandell. **pages 70 and 71,** Special thanks to Fred Durant, Lynn Woodman, and the Cleveland Museum of Natural History. **page 93,** David Mattingly. **page 94,** The Bettmann Archive. **page 95 top,** Pierre Lacombe. **page 95 bottom,** Olga Spiegel. **page 96 top,** Leonard Lee Rue III/Animals Animals. **page 96 bottom,** David Mattingly.

Own Ancient Coins

Ancient coins are markers in the junctures of mankind's history. They change and in doing so, reflect the influence of the great conquerors, their empires, civilizations, and the turning of the ages from 600 B.C. to 1453 A.D.

Artistic, aesthetic and intrinsically valuable, you can own these miniature treasurers that are themselves part of our history. Prices are modest because the general public does not know these coins exist, are genuine, and available. It is our pleasure to offer you the coins shown here for sale.

30 PIECES OF SILVER

Tyre, Shekel, After 126 B.C. Tyre was the principal port of the Phoenician coast and of great commercial importance as suppliers of coins for the area including Judaea. 30 of its silver coins bribed Judas and became the "30 pieces of silver".

These Mint State coins bear the portrait of Malquart on the obverse (the Eastern version of Hercules) and are priced at $550 each

SYRACUSE BRONZE

Agathokles, 317-289 B.C. Issued by the tyrant Agathokles of Syracuse, this bronze bears a bust of Arthemis on the obverse with a quiver on her shoulder. The reverse bearing a winged thunderbolt proclaims Agathokles King

In Good Fine condition at $55 each

MEMBER
Professional Numismatist Guild
American Numismatic Society
American Numismatic Association

JUSTINIAN THE GREAT

527-565 A.D. Gold Solidus. Justinian ruled the Byzantine Empire for nearly four decades. He built the great church of St. Sophia, codified Roman law, and made the Mediteranean a Roman lake for the last time in history.

We offer this Mint State gold solidus of Justinian I bearing his portrait, for $485

IMPERIAL ROMAN COUPLE

Septimius Severus was the final victor in the civil war that errupted after the assassination of Commodus, son of Marcus Aurelius. He ruled from 193 A.D. until his death in 211 A.D. founding the Severign dynasty.

His wife, Julia Domna, lived to see her son, Geta, murdered in her arms by lieutenants of her other son, Caracalla.

Silver denarii at $90 for either or $170 for both

CORINTH

Corinth was one of the most illustrious cities in ancient Greece because it was on the isthmus between Peloponnesus and the mainland of Hellas. This was the meating point of the great trade routes between the East and West.

These silver staters of Corinth were among the most beautiful of ancient Greece's dominant commercial instruments. They bear the portrait of a spirited flying pegasus on the obverse and on the reverse, a youthful but intelligent Athena wearing a Corinthian helmet.

Corinthian Stater 330-300 B.C. at $245 each.

Six times a year, we hold fully illustrated mail auctions in which we offer 275 to 450 ancient coins and antiquities for sale. To receive a copy of our sale, send $3. If you are a successful buyer we will keep you on the mailing list for one year entitling you to six sales.

ATHENS SILVER TETRADRACHM

196-87 B.C. These new style tetradrachms were issued as a result of friendly relations between Athens and Rome and the head of Athena on the obverse which was copied from a famous statue by Pheidias that stood in the Parthenon. The famous owl of Athens is on the reverse.

This coinage marks the last important issue of Greece's greatest city-state and is available in Very Fine condition at $300 each.

ROMAN IMPERIAL BROTHERS

For the first time in Roman history two emperors of equal status ruled Rome. They were the brothers, Caracalla and Geta. The arrangement only lasted one year, until February 212 A.D., when Caracalla had Geta murdered. To consolidate his power Caracalla killed 20,000 of Geta's supporters and destroyed all statues in the empire bearing Geta's portrait. Five years later in 217 A.D., the brutal Caracalla was himself murdered by Marcrinus the Protorian Perfect.

Silver Denarius:
Coins of Caracalla ... $65 each.
Coins of Geta ... $75 each.
The pair ... $130 each.

All coins are guaranteed genuine and exactly as described.
Quantities are adequate but limited.

Ancient coins differ from one another because they are struck one at a time on hand-made planchets with hand-made dies.

Harlan J. Berk, Ltd. ESTABLISHED 1964
2417 West Jefferson Street, Joliet, Illinois 60435. (815) 723-1228.

INTERVIEW

CONTINUED FROM PAGE 77

trying to solve it one way or the other. On the level of DNA, it goes very well. On a more complicated level, we're still trying to figure it out. Embryology is much harder. And in neurobiology there are very few insights. But someone will have a moment when the light will come on and he will understand why the brain is organized the way it is. Just as Francis and I had the feeling, when we saw the base pairs, that the problem of replication of the genetic material would disappear as a great intellectual question.

For fifty years people had wondered pretty seriously how it could happen, and we saw the answer. People may not have that same feeling of near ecstasy when they think about the brain. The problem of explaining consciousness in biological terms is a tougher one, but I'm sure it will fall out. You hear Jesuit arguments why you can't use the brain to understand the brain—I think that's just silly.

Omni: In *The Double Helix*, you recall that Crick bounded into the pub and cried, "We have discovered the secret of life!" So that phrase is not an exaggeration?

Watson: Oh, no. We wouldn't have been doing it if we hadn't believed that chemistry would explain it. Up to then people felt that chemistry wasn't ever going to be enough, that you needed religion to explain life. But even when I was in college I was influenced by Linus Pauling's insistence that you can explain life on the basis of chemistry. I'd say we stopped the argument. The mystery of 'what's life' went out of it when we found DNA. People don't ask "What is life?" anymore.

But I wanted very strongly to understand life, just as Crick did, though he was much more vocal in his disdain for religious explanations. It was the major puzzle if you weren't a physicist. If you were a biologist, you had to explain life. To do that you had to explain heredity—get into the genes.

Omni: But even if you thought you had a good shot at coming up with a solution, it was certainly bold to say that the secret of life could be found.

Watson: Well, that's why we're well-known! We decided it was. We weren't that far out. Actually, a community of perhaps fifty people with similar beliefs had an interest in it at that time, although most of them weren't doing research that would let them solve it. It was a pretty small group—fifteen people in England, five or six in France, odd places. There were a number of very good geneticists, but most of them weren't theoretically inclined to guess what the gene was. Most just did breeding experiments and tried to deduce what the gene was through the genetic crosses, which won't work. We had faith it could be solved through molecular structure—a belief held by Linus Pauling, several groups in England, and that was about it. I was the only biologist who was interested in the molecular structure approach. The rest were physicists or chemists.

Omni: Do you think you succeeded because you were arrogant?

Watson: As I relate in *The Double Helix*, the time was right. You couldn't have isolated the structure even two weeks before. But when we solved it, it was a very simple thing to do. If you come from outside you're not overwhelmed by certain facts and certain people. It's painful when your own children disagree with you, but success means disagreeing with others on fundamental things. To solve the problem you have to reject conventional wisdom. You can spot those people who have the real scientific ability by this agnostic attitude. My arrogance was always helped by a few teachers who encouraged me. Some didn't. Certain people told me I was being silly, but still supported me. In the last analysis, I was very well looked after, sometimes at a distance. I didn't do it all by myself.

> *"People are very practical. A large agricultural company might be interested in superpig, but they're not interested in producing creatures out of Greek mythology."*

Omni: *The Double Helix* suggests that at the critical moment you were the one who had the final brainstorm. Is that true?

Watson: I think I found the base pairs because I was the one who was doing it. You see, I had cut out the cardboard models and was playing around with them while Francis was working on his Ph.D. in the same room. His thesis was dreary, so he was easily diverted, and we talked all the time. When Francis saw the base pairs and their symmetry, he gave up working on his thesis. Then he worked very hard to build the first model, which was a key thing, because you could have the right base pairs and still not find a satisfactory structure. A week after we constructed the model, we had the structure.

Omni: By the time you got the Nobel Prize in 1962, Rosalind Franklin had died of ovarian cancer. Do you think she would have gotten the Nobel if she had lived?

Watson: According to the Nobel statute, the prize can be given only to three people. I don't know what would have happened if Rosalind had still been alive. Tragically, that possibility was never faced. I guess she wouldn't have gotten it.

Omni: Did she deserve the Nobel Prize?

Watson: Yes. The answer would be yes. She did the key experimental work. She did beautiful science. Equally important, after her DNA period, she went ahead and did really outstanding work on tobacco mosaic virus: its crystal structure and the location of the viral nucleic acid. I think it was apparent to everyone that she was a first-rate scientist. She did very pretty work.

Omni: In 1968 you became a part-time director of Cold Spring Harbor Laboratory, married, and published *The Double Helix*. Was there any connection between all three of these events?

Watson: I'm sure you get married when the circumstances are right, but I began the first chapter of the book somewhere around 1962, before we got the Nobel. I didn't plan to finish it because I didn't think it was publishable, at least not until we got the Nobel Prize! It wouldn't have aided the process!

Omni: When you started writing it, did you intend it to have the dramatic tone it did?

Watson: Oh, yes. The first sentence read, "I have never seen Francis in a modest mood." It was a good story, and I had always wanted to write it in some detail. I got through a great deal of my childhood reading novels because the environment was boring. If a child on the South Side of Chicago learned much of anything, he learned it from books, not from peers. Peers aren't generally very interesting when you're young. It's books that give you a sense of the outside world.

Omni: You wrote *The Double Helix* from your point of view, and it was violently attacked as one-sided, misleading, and unscientific. Did critics misunderstand what you were aiming at?

Watson: I told the story. It wasn't a scientific history. I wanted it to be read by a general audience unversed in science, so I put it more in the form of a lively autobiography than a real piece of history of science. I tried to write it with the same youthful arrogance I had had at the time. For some people, that came across as flippant or nasty or bright or something. I knew there would be as many people who would disagree with it as had found me impossible when I was that age. But those were the sort of attitudes I had then. I was not a lovable character. I was not going around telling people what good work they were doing! I was saying, "You bore me!"

Omni: When you published *The Double Helix*, had you reformed?

Watson: Oh, I was certainly calmed down because I was running a lab. I was always an outsider at Harvard. It was only when I began directing Cold Spring Harbor that I felt, well, you have to be cautious because you can't let people think you're undependable. Of course, you're more at ease once you've had some success. You can look at other people's weaknesses, not wishing to exploit them but to help them. At Cavendish we weren't out to get anyone. We were just trying to survive and get around people who were indifferent to-

ward us and believed we weren't getting anywhere. But we never tried to ingratiate ourselves with people who were really rather fools!

Omni: Did you regret publishing *The Double Helix*, even though it was a best seller because of the disapproval that it evoked from colleagues?

Watson: Oh, no. The reception was better than I expected. I only published it because I thought it would be considered a serious work of literature, not just a magazine story. If I had thought it was not first class, I really would have suffered!

Omni: Crick was vehemently against its publication, wasn't he?

Watson: He was then, but now he is not. He and I have jointly contracted with a film producer to make a film. I think he, in a very human way, thought well, it's the work of both of us. You know, we tell each other if wouldn't have happened without the other. The book should bear both our names. But of course you could never write a book like that as a collective. And at first sight no one really likes to see his motivations talked about like that in a book. It takes away a little of your privacy. Afterward Francis said that his loss of privacy was not a bad thing, he got invited to dinners he'd never have been invited to. In fact the effect on his life was positive, not at all negative because readers knew I was treating him with nothing other than enormous respect.

Omni: You were very complimentary. But in a letter soon after the discovery reprinted in Horace Freeland Judson's *The Eighth Day of Creation*, you castigated Crick for wanting to give a BBC talk on the topic. Why were you so anxious?

Watson: That was nothing. That was because in those months the structure was referred to by the Cambridge biochemists as the WC structure.

Omni: From the British slang for the lavatory or water closet?

Watson: Yes. And I figured well, we've made the greatest discovery of the century, so we might as well stay quiet until these idiots shut up. People were saying we stole their data and so on. We got so much publicity that we didn't have to seek it. Francis never really fitted into Cambridge because he didn't follow the rule that you're not supposed to go out and say that you've done something important. It's all right if someone else does!

Omni: Do you think *The Eighth Day of Creation* is a good book?

Watson: I guess it must be. People read it and like it. I read only parts of it. I don't think that Horace Judson approved of me, so his statements always have a strange quality. Judson never understood science. He refers to Alex Todd—a professor of chemistry who found the chemical bonds linking DNA—as a professor of organic physics. After ten years Judson did not know the difference between physics and chemistry! He wasn't a professional. And I don't think he has any feeling for people.

Omni: You were interviewed by him.

Watson: Yes, on a couple of occasions. On a couple of occasions I threw him out.

Omni: Why were you willing to appear on the Phil Donahue show twice?

Watson: I think you have to try and meet the media halfway because the outside perception of your occupation is provided by the media in one form or another. On the first show a woman attacked me for implying deformed babies shouldn't be born. And I said, "Well, I wouldn't want to have you as a mother!" The women in the audience clapped because they saw the point that she'd bring to birth someone who by nature was going to be miserable every moment of his life.

Omni: Your latest enterprise at Cold Spring is an attempt to make an anti-blood-clotting substance. Does this hold promise for victims of stroke?

Watson: Well, recombinant DNA offers a way to make tissue plasminogen [a substance essential to dissolving blood clots] activators. The problem is practical: to help people with thrombosis in the leg, say. Of all the recombinant-DNA-producing things this is one that everyone is hoping will come off—the biggest one. Recombinant DNA hasn't yet brought in a new world. It brought us interferon, but so far interferon hasn't cured anything. Now it's hoped that plasminogen activators will work, at least for thromboses and for the lungs—things that kill pretty fast. Whether they will yield something constructive is still uncertain. Until recently, plasminogen activators haven't been available, now you can make them by the gram.

Now one just wants to see if it will work. If it does, all these people who are so worried about recombinant-DNA safety will finally shut up! Society has to have something that works!

You know, you could do a very interesting article on one of the more exciting consequences of recombinant DNA—the detection of alpha thalassemia in unborn children in Sardinia. Thalassemia is a form of anemia, like sickle-cell anemia, that appears in the Mediterranean. It's a gene mutation that has taken over in Sardinia to the point where one person in every hundred twenty carries a copy of the bad gene. The diagnosis is now one hundred percent perfect, and if these children are never born, the disease can be wiped out. The new technology that allows you to isolate these genes is one hundred percent dependent on recombinant DNA.

Now, apparently, according to my source, the Cardinal of Sardinia is all in favor of abortion. The church is not saying it officially quite yet, but if everyone in Sardinia is practicing abortion, that has to be significant. I think within twenty years the Catholic church will have to sanction abortion. I think there's going to be a very great change in morality and general feeling toward abortion because of this new appreciation of what you can do about obliterating genetic diseases.

Omni: Why did you originally think recombinant-DNA techniques were dangerous?

Watson: When I think back, the arguments weren't very good. The most charitable thing you could say is that the nature of tumor viruses was much less understood. The main argument that got to the press was the fear of starting epidemics by putting tumor-virus genes in bacteria. Supposedly if they got into your intestine, then they could somehow get into you. But what we've learned pretty well is that these tumor viruses are already in our bodies, so that was a fairly ridiculous scenario.

The second argument was that maybe you could construct germs a lot worse than you have now. And you should be careful before you put together the most superpathogenic organisms you could think of. One could imagine they would be used by the military. The third fairly general argument was that you don't know what's going to be created.

The point of the first moratorium was that we wanted a meeting to talk about these things. We were rather silly. I would never have signed it if I thought the meeting would come across with regulations. Most of us were probably slow in realizing how much we needed recombinant DNA, how future progress in science was going to be totally dependent on it. We didn't need the several years' delay that occurred. I was against the moratorium from the first press conference. That turned out to be a disaster because people compared recombinant DNA with the banning of nuclear weapons. I felt it belonged in a different category. Because I had changed from being someone who had never worked with anything potentially dangerous, to someone running a lab that was working with tumor viruses, I suddenly wondered whether we should spend money we did not have on safety or whether we should work with the risk.

Eventually I gave up worrying because people weren't falling like flies. In the last analysis, I realized that tumor viruses are the only way of understanding cancer, and we know that only because of the work. Unless you work on something, you don't know the real danger. I guess if you've got any guts you go ahead. If the prize is understanding cancer, and there has been enough work to know that people aren't highly infectious, then it has to be done. Yes, some people died who worked with yellow fever. But if someone hadn't worked with yellow fever, it would still be keeping you from relaxing in the tropics.

Omni: Are tumor viruses contagious?

Watson: No. And I don't care whether you can make a more pathogenic anthrax bug! Even if you ban it, it's not going to prevent someone in the Russian military or even conceivably in our own from doing it. So trying to prevent it is a waste of time.

Omni: What about the third argument, that once you release something mysterious and unpredictable into the environment, it's going to be around forever?

Watson: Whatever you release into the environment isn't going to be around forever because most things don't survive. The K-12 bacteria that we work with, we always knew really had almost no ability to colonize anything. If was a pretty sick type. So the thought that K-12 was a candidate for colonizing the world struck us as unlikely except for a rare accident. When you walk through a field and see all these flowers and you bend down and pick one, you don't know that maybe it is a deadly nightshade. You put the berry in your mouth.

The majority of people who opposed recombinant DNA did so for political, not scientific, reasons. And that's never been written up, though I have implied it. They either didn't like science, couldn't stand Crick or me, didn't like DNA, or were well-known malcontents. It was never genuine conviction. These people already hated our guts. We were enemies to start with. They were very unsuccessful enemies and rather miserable people.

Omni: Might some scientists take greater risks to further their careers?

Watson: They are not willing to take a risk that they feel may lead to their death. There will always be a few madmen, but I don't know one person who is doing it who feels frightened. In the sense that scientists base their careers on trying to outguess the future, they are future, not past, oriented. Scientists must decide whether they are willing to take the risk or whether they want someone else to do it. If all recombinant-DNA work was done by poorly paid technicians whose bosses were elsewhere, then you could say something smells. But I do not know one person doing recombinant-DNA work who is worried. They aren't thinking they're all going to win Nobel Prizes and for that they're willing to take a one-in-ten chance they're going to be done in.

Omni: If we can manipulate sections of DNA does that mean we can eventually construct creatures of any shape and size?

Watson: Not now. The extent to which you can genetically engineer is still very limited. People are going to try it. Supermouse has been made, so people are going to try and produce cattle that grow a little faster so they have to go out on the range a shorter time. I am not sure that supercow would give you any better milk, but I think people are going to do it for the same reason they try to breed better wheat or corn. If you can do it better, you try and do it better.

Omni: We haven't reached the stage where we can have a creature with a cowlike head and a horselike body?

Watson: Oh, that's so complicated that none of us will ever figure that out. People are very practical. A large agricultural chemical company might be interested in superpig or something like that, but they're not interested in producing creatures out of Greek mythology. As for artificially designing humans, any attempts at genetic engineering will probably put the genes in the wrong place and harm the person. Only

if you can throw away your failures can you do this form of genetic engineering. With humans you wouldn't know that you had a failure even upon birth. So I think given what exists today I don't see anyone thinking of working this sort of radical change in a human being.

You meet many people who believe there is something sacred about the human genome and think that manipulating it is a witchlike act. I don't understand that. If you could give people healthier and more productive lives through some form of gene addition, I think everyone would agree it was fine. It's just that people say you're going to use it for political reasons to enslave humanity, as Hitler tried to do, or to convert the Jews into stupid people and take away all their wonderful qualities. This Hitler argument comes up over and over. In fact, Hitler could do pretty awful things without genetic engineering. So a recent statement of religious leaders opposed to genetic engineering was unfortunate. I thought, *uh oh, they've been conned.*

Humans are far from perfect, but making them better in any credible way would be incredibly hard. But if you could in some way improve my genomes so that I or my children didn't suffer from hay fever, boy that would be wonderful. But I don't know how to do it.

Omni: Haven't there been reports of cloning mice and frogs?

Watson: Mice have been cloned from the two- or three-cell stage, but not from anything that looked like a mouse. There's one claim that they have cloned a frog, but it is not now believed by people. There was work done in Switzerland, but some of the work done in that laboratory is regarded as possibly having never been done, though it was published. Moreover, the cells there had to come from embryos. You can't take the cells from an adult frog, probably because the chromosomes are rearranged during development. Cloning even mice is on the back burner now. What interests people is putting individual genes into mouse eggs to see if you can add desired qualities. When those experiments run their course, maybe someone will go back to it. But for any reputable scientist now to put a colleague to work cloning the mouse would be sadism. You would put someone on it only if you wanted his career to go nowhere.

Omni: So if we want to clone a dinosaur, we would have to find a pregnant dinosaur in a glacier and use one of the cells from its embryo?

Watson: And then you'd have to put it into another dinosaur egg and hope that this would work. It would be a great feat if you could get a dinosaur back! It would be a curiosity. But it's science fiction! It's not practical. It's the type of experiment that has a one-in-a-trillion chance of success. So no normal, intelligent person would want to waste his life that way.

Omni: If cancer cells can multiply indefinitely, will we be able to find a way of making every cell multiply indefinitely and consequently live forever?

Watson: I'm sure people will try, but right now no one has the slightest idea how we could do it. Unlimited life is only one of the components making a cell cancerous. If you grow a large number of mouse cells, after a certain time nearly all will die. But a very, very small number of them will have had a mutation, some change that then lets them go on. You can also immortalize a cell by adding the DNA from certain tumor viruses that carry genes we call immortalizing genes, though we don't know what they do yet. One of the most exciting aspects of cancer research now is to figure out which are the immortalizing genes and what is their biochemical function.

Omni: But do you think that immortality is in the cards—perhaps getting an artificial protein and enzyme synthesis to renew the aging human body?

Watson: Right now it's science fiction. I think as we learn more about cells, we are going to learn more about what aging is. But then finding out why we age wouldn't necessarily give us any power over it. My son was asking me if there were some way—if you knew what the hydrogen bomb was—of preventing its energy from blowing everything up? And the answer is no. You can know what a thing is without any control over its dire consequences.

> *"As a joke, you could publish a book called* The Whole Risk Catalog—*one for old people, one for children—and give people a feeling for things they should watch out for."*

Omni: Would you be interested in immortality if it were offered to you?

Watson: Of course. I think all of us would, depending on whether life is interesting or not. I'm enjoying life! I read every issue of *Nature* magazine with pleasure. I haven't got to the point where I am bored with science or bored with life.

Omni: Did you expect to?

Watson: You never know. Most scientists get bored with it after forty in the sense that it isn't the sole preoccupation in their life. You can lose the real intensity so that if you can't see scientific journals you begin to feel twitchy, just as you feel twitchy if there's a strike and you don't get the *Times* for breakfast.

Omni: You concentrated very intensely on science early in your career. Do you find that you concentrate less on it now?

Watson: I'm administering science, so I still read scientific journals with considerable intensity. I couldn't function in my position if I didn't know what science was important or what I thought was going to be important in science five years from now.

Omni: How does recombinant DNA promise to pay off at Cold Spring Harbor?

Watson: Our chief interest still, is understanding cancer. Now, with recombinant DNA, we may be able to isolate the segments of DNA that through some kind of mutation, now misfunction. This is something we couldn't have had before recombinant DNA. The key first step is the so-called cloning of the gene involved. First you take DNA from a cancer cell and add it to normal cells, and some of the normal cells become cancerous. Then some genetic tricks let you pull out the piece of DNA that was responsible for making a cell cancerous. We were among the first labs to start this work. Now it's being done worldwide. We hope to find the aberrant protein, then we might be able to think of ways in which we could inhibit this protein. It's quite possible that in many cases cancer is caused by the presence of too many copies of a normal protein. And it's been shown that in many human tumors, certain of these cancer genes become amplified, that is, they are present in many copies. Also we are finding that not only are they amplified but that sometimes the genes are changed, and the protein that is produced is altered in some way. The main category of such genes is called *ras*.

Omni: The famous oncogenes?

Watson: Yes. They're normal genes that become oncogenes only after they change and make the cell cancerous. To say that we're carrying around in our body a number of cancer genes is slightly misleading. Our DNA can potentially change so that one of our genes functions to make the cell cancerous. For sixty years people have been trying to find the biochemical differences between normal and cancerous cells. But it's really only now, by going to the genetic level and isolating the genetic change that gave rise to the cancer, that we can finally attack the biochemistry in a straightforward fashion. It's not going to be a walkover in any sense, but we think with time we can understand cancer.

Omni: Do you have any instinctive feeling for when the solution might come?

Watson: When I first became interested in tumor viruses back in 1958, the research was not filled with the best people doing biology. Most people considered it too difficult. Cancer-research institutes were filled with people who were doing things that even at the time looked fairly drab. That situation has changed totally. Cancer research is now perhaps the most exciting field in biology, and it has attracted many bright people. No one is going out and giving a time frame, but in science you're generally not in something unless you think a lot will happen in the next five years. By

working on cancer genes we know we are going to succeed and that we'll find out about the nature of the disease You could argue that we're not spending enough money trying to find the cause of colon cancer If you don't have any ideas about where it will lead it's just money down the drain There have been what I might call sentimental projects at the National Cancer Institute where people have so-called organ-site programs A group of people will study colon cancer, prostate cancer and so on Up to now this approach has been of no value whatsoever because there weren't the clues to start with

You have to ask what the bright people want to do You can't tell them they should do something Sometimes you can have a lark and bring them together and say "Look here are all these clues about diseases maybe you could use your knowledge in biology to come up with the answer

I'm trying this now We have a course on the diseases of the nervous system because we're beginning to understand some fundamental things about the field and hope that someone could have some clue as to say what Alzheimer's disease is or why it happens But it's not our main emphasis I think you should put most of your money into studying the nervous system or studying the genes in the hope that something will fall out that will let you do something about the disease That's better than just saying we have got to cure a disease To cure a disease, you have to have an unexpected breakthrough No one thought that fundamental work on DNA chemistry was going to be the best way to fight genetic diseases You'd say we should have done something more applied But now the recombinant DNA techniques have come up with these increasingly sophisticated procedures for diagnosis of genetic diseases So we keep coming back to prevention because it's infinitely cheaper and it's a solid tact Curing a disease is another thing altogether

Omni Are you an optimist about the environment and pollution?

Watson I don't go around worrying that I'm going to be done in by air pollution! Human life expectancy isn't going downward.

Omni You certainly don't seem to worry much about change

Watson No I only worry about things I have reason to worry about The most miserable people in this world are the doubters They don't do anything. I thought as a sort of joke you could publish a book called *The Whole Risk Catalog*—a whole risk catalog for old people a risk catalog for children Soon you could try to put the various things in perspective danger from bicycles the danger of slipping down the stairs—you know give people a feeling for what things they should really watch out for The biggest danger to us right now is clearly nuclear weapons That's just so overwhelming that to worry about DNA is silly!

Lots of things can knock us out *The Whole Risk Catalog* is too big You have to count That's the real difference between scientists and most people Most people won't *quantify* things Today people in Los Angeles don't die at a younger age than in other parts of the country When you try to figure out where they do live the longest you find it is Minneapolis and it has *nothing* to do with the environment Many people there are Swedes and Swedes live longer than Norwegian men, Danish men and Englishmen The environmental movement, when it is not dealing with aesthetic things such as the horrors of strip mining has to count I cannot associate with people who don't count It's a subtle thing and many people just don't like to count And they think that when they can't count they can have some divine revelation as to whether something is dangerous or not I think it is best to assume that you can walk into a restaurant and drink a cup of coffee and you're not likely to be poisoned by typhoid in the cream!

Omni Is work on the nervous system going to be a big field?

Watson Right now in our lab we place our main emphasis on cancer but thirty years from now I would be surprised if our main emphasis weren't trying to understand the nervous system through genetic tricks and study of the interaction of the nervous system with DNA If I had a great deal of money to start and support something new at the lab I would go into the nervous system There are many people who have studied the nervous system The Society for Neuroscience may have ten thousand members in the United States But very few of them will use the approach of starting with the DNA, which is proving so successful in cancer research and which I think will eventually be very successful with the nervous system This is the field of a few hundred people—a nice small group

Omni Will the work throw light on what consciousness is?

Watson I think the question of what is the conscious mind will disappear It just means that we are constantly integrating information that has been stored in our brain with data from outside and so we are being constantly stimulated I don't really know what more it is! I don't think it is a profound question I think consciousness is nothing more than the perception of information, not something grand the way people said there was something grand down in the cellar that gave us heredity That turned out to be pretty straightforward—DNA Bacteria have ways of perceiving which way they should move to eat I think there is no reason to assume the leech isn't conscious I don't see where you draw the dividing line A bacterium wants to perceive the outside world so it can get a little bigger an amoeba wants to perceive the outside world All you can really say is that an amoeba isn't a human being And there are some people who will say a dog is conscious

Omni Is there a qualitative sense in which one could say that a human being is a dif-

terent order of being than a dog?

Watson: Oh, sure. In the sense that I think you could say a human has a language. I think you could say that's very qualitative. We can write.

Omni: Don't dogs have a language?

Watson: Yes. Of their own. But I am really not very interested in dogs. I'd rather read a newspaper than look at a dog!

Omni: What about people?

Watson: Well, I think you're interested in people who are interested in what you are. No one finds all people equally interesting. I am interested in people whom I can talk to about things I am interested in. I think you're lucky in this world if you can get good people whom you enjoy talking to.

Omni: You've said a scientist doesn't really interest you for very long if he doesn't have a monomaniacal interest in his work. Wouldn't such a person be rather narrow-minded from concentrating so exclusively on one part of life?

Watson: Yes. Yes. Narrow-minded is a good thing. If you play tennis two hours a day you're never going to make it to the top. You're never going to defeat McEnroe or Borg. They play tennis all day. Similarly if you play the piano you won't be a Rubinstein if you play the piano one hour a day because he played it six hours a day.

Someone equally interested in music and science is at a disadvantage. Instead of doing the crucial experiment he may be playing the violin. That may be mentally refreshing to a limited extent. But you have to have one thing more important than anything else. You get the rare exception, but when people are interested equally in everything they don't succeed. If you look at straight-A students, they're not often the ones who finally succeed. In science you can't be a late bloomer, because you're tested so often. Unless you're blooming at twenty, you won't be allowed to go on to twenty-five. And it's a very hard thing to enter late. The careers of most scientists probably go on eight or ten years before they do anything. Assuming they become serious at fourteen, they seldom do anything before twenty-three to thirty. This is a long preparation. I am not interested in people who won't work ten hours a day and be there on Saturdays and Sundays because someone else will be. I don't know any successful scientist who doesn't work harder than or as hard as virtually anyone else in his field. The thought that there are some very clever people who survive without working very hard is the sort of illusion you sometimes get in school, when someone doesn't seem to study for exams and yet he gets the top grades. You just don't see that in science. It was always disillusioning to see that the top grades in college went to people who didn't work as hard as I did. But those aren't the people who actually make it later in life.

Omni: Because they didn't concentrate on one particular thing?

Watson: Yeah. They really didn't care. You have got to care!

mind

CONTINUED FROM PAGE 20

At first Morris and his associates joked about whether these subjects had taken their task too seriously. But before examining the attitude questionnaires that the subjects had completed at the start of the experiment, Morris decided to formulate a couple of hypotheses about what might have happened. Perhaps, he thought, the computer had failed in the presence of those subjects who held the more negative attitudes toward psychic phenomena and who were more inclined toward having performance anxiety.

"That's exactly what we found," says Morris. "The thirteen people for whom the computer had crashed were significantly more negative in their attitudes toward psychic abilities. They were also significantly more prone toward anxiety when called upon to perform. Of course, our numbers are very small, so either this is a statistical aberration of some sort and there really is nothing here, or else we have blundered into something quite important."

Morris later traced the computer problem to a faulty interface board. The board apparently had several structural flaws that caused it to malfunction periodically. It is tempting to attribute sole responsibility for the computer crashes to this interface. "But why then," Morris asks, "did it occur so consistently in relation to the attitudes of the people involved?"

For now, Morris hopes to begin a project that will enable him to isolate the PK effect, if it actually exists. "We want to identify the conditions that seem to be consistently linked to high rates of equipment malfunction," he explains.

All psychic phenomena, Morris thinks, can be viewed as anomalies of human communication. "Everything that is usually labeled as psychic functioning seems to be a matter of information or human influence getting from one place to another in ways that we don't understand," he says.

MLPs are not Morris's only concern, however. He is also trying to understand why certain people tend to be successful in interacting with technology. He calls them function-linked people, or FLPs. Who hasn't heard stories about machines that work only when the repairman is present?

Our goal," says Morris, "is to examine how MLPs and FLPs differ from one another in order to suggest hypotheses about ways to make the former more like the latter. We hope to be able to train people to be more effective when interacting with equipment. We want to help people get along better with technology."

Malfunctions are now Morris's stock-in-trade, but they seldom bring him satisfaction. Like all researchers, he needs funding. His work, however, has a particular drawback. As you can imagine," he says, "having equipment break down all the time tends to get quite expensive.

COMING IN THE JUNE OMNI

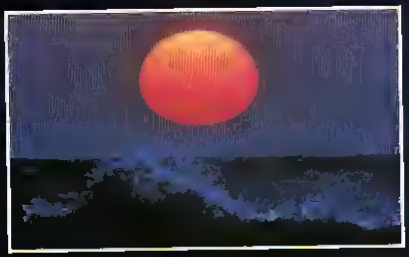
AUTOMATON

Once dreary, dumb, and blind steel-collar workers were relegated to a remote corner of the factory floor. Now the robot proletariat is everywhere—in homes and offices as well as on production lines. The new breed of robot helper is gifted with incredible manual dexterity, a crude but useful set of eyes, and the ability to wander where its circuits lead. For a closer look at this new breed of machine, watch for the portfolio of new robot helpmates, in the June issue of *Omni*.

SHAKE YOUR MBUTI

From the heart of darkness to the lost paradise of Zairian rain forests, renegade anthropologist Colin Turnbull has explored the secret worlds of the primitive—embracing their knowledge of the sacred, participating in their blood rituals. He became a member of the Mbuti, a pygmy tribe. Later he observed the horrific existence of the Ik, a dislocated people who, transformed into wretched, rage-filled subhumans, took to eating dirt to fill their stomachs. In June's Interview Turnbull offers dramatic lessons on how to make the world a more spirit-filled place, and he ponders the crimes he'll have to commit to study American prisons under proper ethological conditions.

OL' MAN-MADE RIVER



The future of lands from Nebraska to western Texas depends on an underground water supply, a natural treasure called the Ogallala Aquifer. But now the supply is beginning to dwindle, as rich farmland soaks up the Ogallala's resources. Some experts predict that early in the next century, the Great Plains may become a vast, barren dust bowl. One solution is a man-made river rivaling the Mississippi. The project would divert water from Alaska and western Canada and use it to irrigate American farmland. The plan is feasible. And, *Omni* suggests, it may be unavoidable.

FICTION

Bruce Sterling's first piece of fiction for *Omni* was the collaboration "Red Star, Winter Orbit." In June he goes solo with "Sunken Gardens," a tale set in a far-future "shaper's" universe. In this story, genetic engineering is a fact of life, and humanity, divided into economic and social factions by genetically altered biotypes, has spread throughout the solar system, terraforming planets all along the way. Mirasol, the protagonist of "Sunken Gardens," has the opportunity to climb the rigid social ladder set up by the ruling class—if she wins the annual, highly competitive contest to terraform Mars. Prizewinning novelist Elizabeth A. Lynn's story "At the Embassy Club" also takes place in a far future, one in which off-world diplomacy and trade are commonplace. The planet Tanderai has a very elaborate social system involving the wearing of masks. When a young diplomat falls in love with a high-caste native, he puts his career and possibly his life on the line.

PHENOMENA

Undaunted by the menacing pink tentacles of a sea anemone, a shrimp sallies forth in search of plankton and other tasty morsels. The anemone's arms are laced with venom, but the shrimp escapes their deadly embrace by coating itself with the same material that covers its host's body. By this ingenious tactic, the tiny crustacean achieves a form of immunological camouflage. The anemone is unable to distinguish the shrimp from itself, and so it tolerates the intruder. For the shrimp, the reward for this clever disguise is twofold—it obtains protection from predators as well as a share in some of the food that the anemone catches. Nature photographer Pete Carmichael came upon this wildlife scene while skin diving off the Florida Keys, but the turbulence of the water forced him to remove these specimens to the tranquil confines of a home aquarium. There, Carmichael photographed his subjects using a Pentax 35mm camera loaded with Kodachrome film. ☒

EARTH

CONTINUED FROM PAGE 24

language the animal is known as *ilkai* But they offered the same description as the Barok had humanlike arms fused to the sides of the body The eyes are set toward the front of the head (as with humans apes monkeys—and seals) the mouth is small often said to be protruding and "peculiar" And the lower part of the body is fishlike but smooth with no scales

From the description it was obvious we were dealing with a mammal And I couldn't get the idea of the dugong out of my mind I knew that the Indo-Pacific dugong (*Dugong dugon*) inhabits the waters around Australia and New Guinea The problem was that the natives claim to know it as an animal *separate* from the *ri* and even give it a different name (*bo narasi* in Barok)

Could they see—and sometimes catch—the same animal at different times giving it different names? I asked myself And why the varying descriptions?

With these questions in mind Wagner, Raymond, and I rose on the morning of July 5 to see whether we could glimpse the *ri/ilkai* ourselves The villagers told us that dawn and dusk are the best times to observe the animal and although I am not by nature an early riser I left for the reef braving the first streaks of sunlight with Wagner while Raymond stayed closer to the village Wagner and I watched with binoculars for close to an hour but all we saw were some sharks

Suddenly our attention was riveted by a group of boys waving us back to the beach We rushed to their side and learned that they had been watching an *ilkai* As we talked I saw it—a dark sleek slender body breaking the surface, first curving upward and then downward I saw no head or appendages and no dorsal fin It seemed to be able to bend its body back on itself quite easily, unlike any marine mammal I am acquainted with The creature surfaced for about two seconds and by the time Roy looked up it had gone

After ten minutes it appeared again, and this time Wagner saw it But the animal surfaced for only a couple of seconds every ten minutes making it almost impossible to photograph Wagner stayed to observe and I ran back to the village and launched our boat with the help of Kurus, a Barok helper we had brought with us from Ramat Bay We paddled toward the animal which was still surfacing every ten minutes, but on the way I decided to move back in and pick up Wagner If the *ri* was going to be seen close up he should be there

We then chased it for a while although I felt it could outdistance us if it really wanted to Its surfacings were now much more frequent and it had obviously detected our presence At one point the animal showed its tail beautiful mammalian flukes that hovered above the water for seconds as if waving at us

Wagner managed to get a photograph of them despite the choppy water and the large distance involved Then, when we were within 50 feet of it, the creature disappeared

When we returned to the village we learned that Raymond had seen the *ri* even before us He had been watching it for 20 minutes in shallow water within 100 feet of the village while we had been wasting our time out on the reef What he saw was a slim light-brown animal with no dorsal fin, barreling along like a torpedo He reported that many fish were jumping out of the water near the animal in an apparent attempt to escape

Over the next few days we watched the bay carefully but never again did any of us see a *ri* so close or for so long The net we set between the beach and one of the reefs caught many fish, including reef sharks but no *ri* All we had in the end were our sightings and two not very-clear photos one of the body flexing at the surface and one of the tail

How could we be sure that the animal we saw was the one the natives call the *ri* or *ilkai*? A few days after our sightings some villagers sitting on the beach casually told me they had been watching one at sunset I watched with them in the disappearing light then caught sight of it Sure enough, it was the same animal On another occasion I saw two porpoises entering the bay As an experiment I purposefully ran up to some villagers, pointing excitedly and shouting "*ilkai! ilkai!*" They told me calmly that I was watching porpoises not *ilkai* They knew the difference

What did we see that day in Nokon Bay? On my way back to the States I visited the Hawaii Laboratory of the San Diego-based Naval Ocean Systems Center, the United States Navy's principal research station in the Pacific While there, I was able to compare, firsthand their various marine mammals with the animal we had seen There were no similarities

Only two kinds of porpoises are finless but neither behave like the animal we observed As for seals there are none in that part of the world The only other known candidate is the dugong but dugongs do not generally stay below the surface for more than about one minute, our animal stayed down for ten minutes Dugongs move slowly and are strictly vegetarian But Raymond believes the animal he saw in shallow water was chasing fish Dugongs do not bend their bodies very much when surfacing but our animal had a high degree of vertical flexure

I have consulted with numerous marine biologists but thus far none have been able to determine what species of animal we saw We might be dealing with a new kind of marine mammal, one to which the Barok and other peoples around the world attribute semihuman characteristics Perhaps one day we will return to Nokon Bay solving the mystery of the *ri—and* the centuries-old mermaid legend as well

GAMES

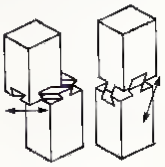
ANSWERS TO GAMES (PAGE 132)

1 BRAIDS Many readers will have seen belts that are braided in the manner shown yet may never have questioned how such belts were made The illustration below by Gary Hupfer shows, in one drawing the essence of a procedure that will produce a braid like the one shown on page 132 Note that there are six crosses in the finished product—that is, six points where one strip of leather crosses another The procedure can be repeated over and over to produce longer braids with any multiple of six crosses

A simple method is to braid six crosses into one end of the strip and then, with one hand press that end firmly to a table while with your other hand you undo the mirror-image version of the braid at the other end of the strip

2 KNOT POSSIBLE If you concluded that this object couldn't possibly have started life as a rubber band you were right One way to create such an anomaly is to start with a solid rubber ring having a circular cross section (such as a vacuum-cleaner belt) and then carve it into a Möbius strip shape with three half-twists in it Then when you cut this strip in half, lengthwise, you get a band that is twice as large as the original tied in a single knot

The knotted band in our museum was made in another way It was carved from a hollow rubber ring or torus The one pictured was cut from a baby's teething ring, a model-airplane wheel would have worked just as well Cut a torus along the lines shown on the figure above—solid lines on top dotted lines underneath The result is a wide band with a single knot Then trim the band to a narrower width so that it looks like an ordinary rubber band



3 & 4. JOINTS Impossible dovetail (a) is at left, variation (b) is at right

The Museum of
the Impossible· Part II

GAMES

By Scot Morris

"... *I will strive with things impossible,/ yea, get the better of them"*
—William Shakespeare, *Julius Caesar*

Last month we presented several items from our collection of paradoxical objects that look as if they couldn't exist but do This month our first order of business, as promised, is to answer three of last month's impossible posers and to offer a few more for cogitation until next month

PEAR A bottle of pear brandy has a healthy, full-size pear inside, much too big to get through the bottle's neck How did it get in there? First-time observers offer a variety of theories The pear was freeze-dried, then reconstituted inside the bottle the bottle's neck was heated until it expanded enough for the fruit to slip through, the bottle was blown around the pear or it was cut open and resealed in some undetectable way

The actual method is simpler than any of these guesses *The pear was grown inside the bottle.* In the spring Italian farmers tie empty bottles to their pear trees each bottle is supported by wires and has a tiny pear bud inside of it, as shown in the photograph below at left The bottles stay on the trees for about four months until the pears are full grown Then they are taken down cleaned, and filled with pear brandy

CUBE Bob Easter sent us a bottle with a working Rubik's Cube inside How did he do it? He took the cube apart and then he reassembled it piece by piece inside the bottle He used modified tweezers of his own invention a Phillips screwdriver a chopstick masking tape, and various other simple tools To make a bottled cube Easter first fills the bottle about two-thirds full with coarse sand or glass beads That gives him a platform to work on, up close to the neck. Once the cube is finished he pours out the sand "I've gotten so I can make one of these in about half an hour," he says

Harry L Nelson, the mathematician who posed our NEBULOSITY puzzle a few months back (November 1983 and March 1984), proudly displayed one of Easter's bottled cubes on his desk in his office at Lawrence Livermore National Laboratory One Monday morning Nelson came into work and was surprised to see that some enterprising prankster had scrambled the cube inside the bottle

CARPENTER'S NIGHTMARE Is it possible to pass a cube through a hole in another *smaller* cube? We gave you the surprising answer—yes—and asked you to devise a method to accomplish this feat Here's our solution

Consider cube A which is one or two percent larger than cube B Turn cube B so that a corner points toward you and the three visible faces all appear to be the same size from your point of view From this vantage point the outline of the cube is a perfect hexagon (above right—left-hand side) It is possible to cut a square hole completely inside this hexagon, along the straight-line axis that runs through the corners nearest and farthest from you so that the hole's side A equals one side of cube A and so that none of the corners of this square

hole quite contact an edge of cube B's projected hexagon After cutting into cube B and creating this square hole a thin ring of cube B remains intact, though it hardly looks like a cube anymore

It can be shown that the largest possible square you can cut from a cube has each of its own corners one quarter of the way in from a corner of the cube For instance if a square face of cube B has an area of 1, the largest square hole that can be cut through it has an area of exactly 9/8 and a side that is 3/4 of the square root of 2 This is an upper limit In reality it must be somewhat smaller than this in order to keep the remaining part of cube B in one piece In other words if a cube has sides of one unit, a square hole can be drilled through it with sides not quite 3/4 the square root of two units, or not quite 1 06 units

BACK TO THE MUSEUM

Now that you are practiced in thinking of ways to achieve the impossible here are some more bafflers drawn from the topology wing of our museum

1 BRAIDS If you have ever braided ropes or strands of hair you know that the three strands are always connected at one end and loose at the other end in your hands Shown below is a piece of leather that has been split into three

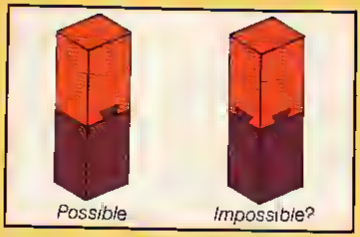
strips The strips are connected at *both* ends yet in just a few seconds we were able to braid the leather as shown in the bottom half of the illustration without ever leaving our three-dimensional universe How did we do it?

2 KNOT POSSIBLE Below is a rubber band with a knot in it A little reflection should convince you that it is impossible to tie such a knot in a rubber band without breaking and rejoining it Careful examination of the model from which this was drawn, however, will reveal no such breaks Magicians say there are at least four ways of making a head-scratcher like this We know of only two Can you think of one?

3 CRAZY JOINT Carpenters sometimes use a dovetail joint (above, right—"Possible") to hold two pieces of wood together A protuberance on one piece slides into a matching cavity on the other, and the two blocks are held together like two pieces of a jigsaw puzzle Usually there are two visible dovetails on exact opposite sides of the assembled joint

Shown at right is the impossible dovetail, a joint that most carpenters have never seen There are dovetails on all *four* sides, all oriented the same way It seems there is no way to separate one block from the other or to connect them in the first place And yet there it is How was this impossible joint constructed?

4 ADVANCED JOINT Illustration (a) at right, shows the above puzzle unfolded so that all four sides are visible Nob Yoshigahara columnist for the Japanese science magazine *Quark* noted that two variations would be (b) with two adjacent dovetails pointing up the other



two down and (c) with the dovetails alternating—up, down up, down

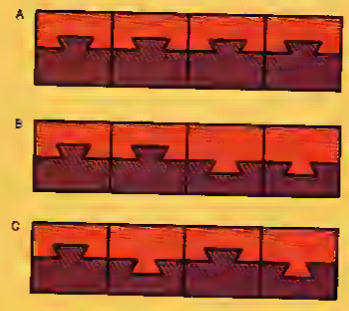
It turns out that once you have solved the standard puzzle (a), variation (b) is easy, but variation (c) is quite a challenge In fact when Yoshigahara asked his readers to send him designs for the second variation, only one sent the plan he had expected, and three other readers sent independent designs all different, all of which would work Can *Omni* readers find even more solutions?

Send us your solution for the alternating tails problem (c), and we'll publish a selection of the best designs in a future issue

Answers are on page 130

COMPETITION #33
IN TWO WORDS IM-POSSIBLE

We would like to expand our Museum of the Impossible, and we invite readers to



send in candidates for display Will someone find a way to put a silver dollar or a golf ball in a Coke bottle?

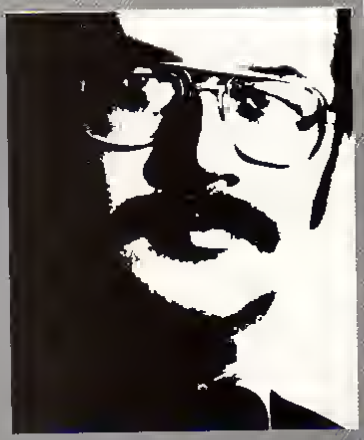
We want to see more of those objects that when set on a table in front of someone will cause perplexity and head-scratching Send us your impossible object Entries cannot be returned however so if you don't want to part with your impossibility, send us a photo or a drawing of it, along with an explanation of how you made it. We'll contact you in case we want to take professional photographs for publication The grand prize-winner will receive $300 and a copy of our new book *Omni Games*, and four runners-up will each receive $100 and the book Include your name and address, and send entries, by June 15, 1984, to *Omni* Competition #33, 1965 Broadway New York NY 10023-5965

CHEQUE, MATE!

By the time you read this the world of computer intelligence may be markedly richer and *Omni* $4 000 poorer This is all because of a challenge that was made five years ago in our April 1979 issue

The interview that month was with international chess master David Levy of Great Britain In the course of the conversation Levy announced that he would give $1,000 for the first computer program that could beat him at chess and *Omni* boldly kicked in an additional $4,000 to bring the *Omni*-Levy prize up to $5 000.

It has taken five years, but finally there is a chess program of sufficient power to warrant a match It is the Cray *Blitz* program by Robert Hyatt, Albert E Gower and Harry L Nelson. As of this writing the Cray *Blitz* program will play four games against Levy between April 14 and April 18, during the Advances in Computer Chess Conference held at Brunell University in London Each side will have two hours to make 40 moves thereafter, each side will have to make ten moves every half hour, for an average of three minutes per move The usual chess scoring will apply—one point for a win, one half point for a tie, and zero points for a loss If, at the end of the match, the machine has accumulated more points than the man, the *Omni*-Levy prize will finally be awarded



LAST WORD

By Mark R. Frank

"Can you relate to Chinese vegetables? Or does your mind have the pizzazz of raw potatoes? Discover your creativity quotient with this easy-to-score test"

The basic purpose of this quiz is to knock you off your literal-minded feet and help develop your verbal and mental agility. You can calculate your score at the end to determine your creativity quotient.

Your alarm clock is melting all over your bed. You
- a. call the telephone company to find out what time it is. (0)
- b. think about how fast your clock is running. (3)
- c. ask it, "Why the long face?" (4)
- d. don't really worry since the bed is melting into the floor. (5)

Penguin dust is
- a. something you buy at your neighborhood pet store. (1)
- b. a phrase in a poem by Gregory Corso. (2)
- c. fallout registered from an exploding penguin. (3)
- d. a command to a penguin, given after "Penguin, do the dishes" or "Penguin, cook." (5)

What is the square root of 69?
- a. 8.3066239. (0)
- b. It's obvious. (1)
- c. Eight something. (3)
- d. Too disgusting to imagine. (5)

How do you know when you pass an elephant?
- a. You see a big, gray thing in your rear-view mirror. (3)
- b. You squash your wide receiver with a completed pass. (3)
- c. You feel excruciating pain. (4)
- d. You can't close the toilet seat. (5)

The sequel to "Nude Descending a Staircase" would be
- a. "The Same Nude Three Steps Farther Down." (1)
- b. "Nude Sliding Down Bannister." (3)
- c. "Nude Ascending Staircase." (3)
- d. "Nude Posing on The Landing." (5)

There is a tiny rabbit climbing up your nose. What color is he?
- a. There is no rabbit on my nose. (1)
- b. There is no tiny rabbit—the lavender wombat ate him. (4)
- c. Khaki. (1)
- d. Which one of the rabbits are you talking about? (5)

What wiped out the dinosaurs?
- a. The swamps dried up. (1)
- b. The Ice Age. (1)
- c. Furry little animals. (1)
- d. Penguin dust. (5)

My favorite television show is
- a. *Fantasy Island*. (−5)
- b. *The A Team*. (1)
- c. *Sesame Street*. (3)
- d. The test pattern. (5)

Humpty Dumpty fell off the wall. Why?
- a. Obesity. (2)
- b. Misunderstanding of the laws of physics. (3)
- c. Death wish. (3)
- d. Misdirected sex drive. (5)

How many angels can fit on the head of a pin?
- a. Straight pin or safety pin? (−5)
- b. Forty-four. (0)
- c. Forty-six. (1)
- d. About as many as can fit in the hole of a bowling ball. (5)

Vocabulary test: scintilla, cartouche, synaptic, and skoobedoo. Of the above, I knew without looking them up the meaning of
- a. none of them. (2)
- b. two of them. (3)
- c. three of them. (4)
- d. all five words. (5)

My favorite poet is
- a. I don't read poetry. (1)
- b. Dylan Thomas. (1)
- c. Joyce Kilmer. (1)
- d. Gregory Corso, author of *Penguin Dust*. (5)

EXPLANATIONS

Each number in parentheses indicates the creativity rating for that answer. Ratings of zeros, ones, or twos are signs that you are pretty neutral in the creativity department. Threes, fours, and fives show you have some verbal agility and imagination. Any score of minus five indicates a very disturbed personality.

WHAT YOUR SCORE MEANS

0 or less—Raw potatoes have more pizzazz than you. You probably voted for Nixon and asked your future husband/wife if he/she was a virgin. With some effort you can understand certain comic strips and cartoon drawings.

1 to 20—You have tried a crossword puzzle and once stepped inside an art museum. You are reasonably fluent in the English language.

21 to 59—You idolize Baudelaire and Rimbaud. You enjoy Proust and wear black most of the time. Dealing with average people is too painful for you.

60—You are dangerously insightful, practically unemployable, and probably psychotic. You can identify with Hamlet. You may also identify with vegetables, particularly Chinese. ∞

Mark R. Frank, a resident of Indianapolis, is the agent for model/hairstylist Celia Bratton. In his spare time he works for the legal division of the local welfare department. His favorite color is paisley.