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TAMPERING WITH HUMAN EMBRYOS?

**THE DANGERS
OF TIME TRAVEL**

**SPERM FROM
DEEP SPACE**

**HOW TO DESIGN
YOUR OWN DREAMS**

LASER FACE-LIFTS

ANIMAL TELEPORTATION

**THE SECRET
OF LONG LIFE**

**HOW HOMOSEXUALS
ARE CREATED**



OMNI

MARCH 1982

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This month's cover is by American artist Morris Scott Daniels, who says he paints the most beautiful and lonely places of the universe. Daniels, usually self-taught, has produced 2,400 paintings in the past 30 years. Many are in private collections of science-fiction art.

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FIRST WORD

By Ben Bova

There are farsighted congressmen and senators willing to struggle toward a wiser, stronger, more useful space policy.

The space movement is making headway in Congress at last.

For the past several years space enthusiasts all across the United States have been banding together into grass-roots organizations such as the National Space Institute, the U.S. Society, the Planetary Society, and dozens of others. They have formed a National Coordinating Committee for Space, which meets regularly to exchange information and ideas and to plan future activities on a nationwide basis.

The common plaint of the space movement's members, however, has been that neither the White House nor Congress seems to understand the need for a vigorous U.S. space program. This may well be true of the White House, and even of the majority of representatives and senators. But there is a small, active and growing group in Congress now working for a better space program, in the face of their colleagues' indifference and of massive budget cuts.

Senator Harrison Schmidt of New Mexico has, of course, been a space activist since long before he arrived in Washington. A former Apollo astronaut and the only person to walk on the moon, Schmidt not only has been a staunch proponent of the space program but has repeatedly called for our taking a firm position on scientific research and education.

In December 1981 Schmidt sent a letter to Edwin Meese III, counselor to the President, the man regarded by insiders as the most powerful of the President's aides and advisers. The letter begins, "I am becoming increasingly concerned about the apparent misunderstandings or misconceptions in the Administration about science and technology. My concerns are heightened by the apparent lack of recognition of the roles science and technology play in almost all aspects of our daily life and more importantly in the future of this country."

While most of the letter addresses the massive cuts that have been made in NASA's planetary-sciences program where such projects as Galileo (the Halley's Comet probe), the solar-polar mission, and the Venus Orbiter Imaging Radar mission have been either postponed or dropped, Schmidt also makes a powerful statement against the reduction of funds allocated for science education.

"The essence of this country is its number and growth," Schmidt says in his letter. "Our planetary-exploration program represents these positive elements in our society as well as it looks toward [the] future. It represents the highest attributes of a free people."

In the House of Representatives, eight congressmen have formed a bipartisan Congressional Space Caucus, and they have encouraged their colleagues to join them. The congressmen are Dan Rostenkowski of Illinois, Tom Bliley of Virginia, Geoffrey E. Wright of Colorado, Norman Y.

Mineta of California, Newt Gingrich of Georgia, Wayne Gilcham of California, Joe Stearns of New Mexico, and Ken Kistner of Colorado, all space enthusiasts.

In their announcement, they pledge that the caucus will provide legislative support on space issues, serve as a clearinghouse on space information, and assist its members in promoting their common goal of revitalizing America's space program. Proposed activities of the caucus will include special briefings and presentations for members and staff and the publication of a newsletter and of briefs on various issues.

"Space has become a commonplace contributor to an integral part of our everyday life, but this is just the beginning," the caucus announcement continues. "Space offers staggering opportunities for solving major global problems and the development of vital new industries. Federal support for space activities has declined steadily since the mid-Sixties, with a 70 percent drop in constant dollars, while nearly every other government expenditure has increased. Many have more than doubled."

The announcement goes on: "According to one recent poll, the American public is reawakening to the vital role space plays in our nation's economy and security. By joining the Congressional Space Caucus, you can demonstrate your concern and interest in this growing political issue."

Gingrich has gone even further—right to the top. Just before last Christmas he sent a letter to President Reagan, urging a Fiscal Year 1983 budget of \$9 billion for NASA. "We should think about the fact that children born in 1982 will graduate from high school in the year 2000," Gingrich says. "The prosperity of their future is based on the investments of our present."

Gingrich's letter notes that nine billion dollars will allow us to build six space shuttles and a number of orbital transfer vehicles. It will allow us to begin a permanent space station and an industrial park around the earth that will create jobs on Earth by creating jobs in space.

These statements and letters will probably not sway the White House from its single-minded goal of cutting the Fiscal Year 1983 budget. Even in the face of reports that the USSR's satellite, Cuba, is armed with missiles capable of seeking out and destroying other satellites—including the space shuttle orbiter—the Reagan Administration appears totally committed to reducing all nondefense budgets.

But at least there are farsighted men and women in both houses of Congress who are willing to struggle toward a wiser, stronger, more useful space policy. In time they will be joined by others. These are the representatives and senators whom space activists should support, with letters, with enthusiasm, and with their votes come next Election Day. **OO**

CONTRIBUTORS

OMNIBUS



ROSENBERG



COLLIGAN



BASILE



WALFORD

While we are accustomed to playing roles in our dreams, but imagine that we could occupy the director's chair for a change. As we nod off to sleep, an inner voice gives the cues. Lights! Camera! Action! and the internal dramas of our lives unfold according to the script of our choice. In "Lucid Dreams" (page 58) senior editor Douglas Colligan reports on an experimental cadre of dreamers who can precisely control the plot and the action of their nightly perambulations. These unusual powers were first consigned to the domain of parapsychology and later dismissed as waking hallucinations. But, as the author discovered on a recent visit to a sleep laboratory, new evidence has forced scientists to reassess these dreams as genuine. A confirmed night person, Colligan has written a children's book that touches upon the mysteries of dreams: *Strange Energy, Hidden Powers*. And for those adults who are not so endowed, his book *Creative Insomnia* offers the next best alternative.

Gene therapy, once an impossible goal, is imminently feasible. Armed with gene-splicing tools, clinician Mark Cline last year attempted to cure two young women of a fatal hereditary disorder by inserting healthy genes into their defective cells. The trial was not successful and touched off a flurry of protest within the research community, many scientists deeming the experiment dangerously premature. But how soon is too soon?

asks Yvonne Basile in her in-depth analysis of this radical new treatment. Basile's interest in the pioneering work of Cline and other gene therapists stems from her days as a newspaper reporter for the San Diego Union, when she covered the scandal of a researcher who conducted genetic engineering trials on a prohibited virus. Cline's case, following so swiftly on the heels of this earlier incident, took her by surprise. Basile recalls, "I was shocked to learn that genetic engineering had suddenly jumped from the microbial level to men." For the full story of this burgeoning field—its potential and its potential hazards—turn to "Spare Genes" (page 52).

Francis Crick first shook the scientific establishment in 1953, when he and James Watson published their landmark paper delineating the structure of DNA. Today at a sprightly sixty-six years of age, Crick is still making waves. His new book, *Life itself*, espouses the highly unorthodox theory that extraterrestrials seeded prebiotic Earth with the primitive

one-celled organisms that eventually gave rise to the rich diversity of modern-day plants and animals. In this month's Interview (page 74) science writer David Rorick speaks to the founding father of molecular biology about the extraterrestrial origins of life itself, his recently acquired interest in neuroscience, and his sometimes bitter, sometimes sweet relationship with Watson over the years.

Keeping cool may be the secret to a

longer, more youthful existence, says Dr. Roy Walford, an eminent immunologist at the University of California School of Medicine, in Los Angeles. In "Cool Immortality" (page 44), a chapter excerpted from his upcoming book, *Maximum Life Span*, Walford reveals that certain cold-blooded vertebrates, notably annual fish, will live some two to four times longer when reared in waters several degrees cooler than their natural aquatic environment. Of course, we warm-blooded mammals have fixed body thermostats. So positioning yourself lotus-style atop a 320-pound block of ice, as the venerable scientist is seen doing in the article's opening photograph, won't gain you extra years—though your posterior may develop a serious case of frostbite. (Don't miss Walford's adventure-filled quest for immortality, which takes him from the backwaters of Argentina, to the back streets of Bombay, and finally to the back room of a Brooklyn icehouse, where he sat in painful meditation for hours photographing Anthony Wolfe.)

What we extend Earth birds claim on a foreign planet? Ecobiologists puzzle over this mystery in "The Audubon Effect" (page 48), by Scott Sanders. Omni's other fiction offering this month comes from veteran contributor Robert Scharberg (see "The Far Side of the Bell-shaped Curve" page 56). His fans should note the recent publication of *Mycopod Chronicles*, the new companion volume to his celebrated novel *Lord Valerius's Castle*. **OO**

FORUM

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

Veiled Murrah
Spider Robinson's Last Word (December 1981) leaves me in a hushed awe of his uncanny ability to illuminate and clarify complex issues. It really terrifies me to think what other impositions right-wing nuts like the Moral Majority will invent. Next they will be telling us to teach our kids sexual and moral responsibility! Savage them, Spider!

Rob Renaud
Pittsfield, Pa.

Space Cadets:
So NASA's new administrator, James M. Beggs, wants to capture the minds of America's youth (Interview December 1981). How about a space cadet program? (Shades of Robert Heinlein!)

It would cost NASA the weight of 40 to 45 kilps to send along one student per shuttle mission. Any loss of revenue would be more than compensated for by the free such a program would light under the nation's youth. And I can't think of a better way to kill several public-relations birds with one stone.

Pat Kack
Little Rock, Ark.

I was fascinated by the interview with James M. Beggs, and especially by his ideas about getting American youth involved in the space program.

Probably every high school has a science class. If each school were given a special aerospace project in accordance with its capabilities, maybe a stronger space program would result. As Beggs said, "If we can get the kids thinking about the potential and the possibilities, the ideas will come from them."

Deborah Walker
Montclair, N.J.

Calculator Games

I was amused by the push-button fun presented in "Digital Diversions" (Games, November 1981). I decided to create my own number/word story.

I awoke one morning with a 323×5^2 sitting on my $1,643 \times 5$, playing the $2018 + 43^2 \times 2$ out of a 65×66 . At last I was $27,589 \times 2$, but then just a $2482 + 55^2$. So I knocked him into a 463×8 .

Greg Coxon
Renton, Wash.

Deli Omission

The painting *Madonna of Port Light*, by Salvador Dalí, which illustrates "Religion in the Twenty-First Century" (December 1981), was not properly credited.

The proper credit is
Madonna of Port Light
Salvador Dalí
Oil, 1865" x 144"
Marquette University Fine Art Collection,
Milwaukee, Wisconsin.
Omen apologizes for the omission. A photograph of the painting is reproduced below.—Ed



WSF Decks with L-5

As chairman and president, respectively of the Board of Directors of World Space Federation, Inc., we are pleased to announce the consolidation of World Space Federation and the L-5 Society.

We will be working with L-5 chapters to coordinate World Space Observations, July 15-24. We will commemorate the Apollo moon landing, the Viking Mars landing, and the Apollo-Soyuz rendezvous, all of which took place during this time period. To spread the word, we will be working with the science-fiction-fan network, via conventions, for we hope to strengthen a push toward more public support of a viable space program.

For information regarding World Space Observations, or membership in L-5, contact L-5 Headquarters, 1060 East Elm Street, Tucson, AZ 85710. L-5 maintains a phone tree and will call you for support! What important space legislation is pending in Congress.

Stan Newins
Chairman, WSF
Carol Newins
President, WSF

Expert Incredulity

First Word, by Hans Bethe (January 1982), is a shocking example of an expert making unsupported statements. We the public are supposed to swallow them without question. Bethe says nuclear power is "at least as safe as any other form of energy" and that radioactive wastes "can be disposed of without endangering future generations." He does not even acknowledge that controversy exists around these issues.

Bethe further states that a "meltdown did not occur at Three Mile Island." Three Mile Island: Prologue and Epilogue, an in-depth account of the nuclear-plant accident, shows quite clearly that a partial core melting did occur.

These statements, and others made by Bethe, seem to have nothing backing them up except the esteemed Nobel laureate scholar's credentials.

Dennis Campbell
Asheville, N.C. DD

YELLOW RAIN

EARTH

By Douglas Starr

A helicopter skimmed over the lush Laotian landscape as it roared toward the primitive village of Phay Hoi. When it arrived, it released a bomb that exploded in an instant, yellow powder on the people and animals underneath. Villagers who had been standing outside their huts began vomiting and staggered drunkenly to the ground. Some went into spasms, clenching their fists at the end of rigidly held arms, while others spat blood. Chickens jumped spasmodically and pigs foamed at the mouth. By day's end, 22 people and dozens of animals lay dead.

A man named Yang Seng Vang escaped from Phay Hoi in May 1980. Although he suffered chest pains, blurred vision, and weakness, he was able to make his way to a refugee camp in Thailand, where he told his story to American interviewers. Then he vowed to return to Laos.

Vang's tale of horror, one of more than 150 reports collected by the U.S. State Department, is part of an extensive dossier accusing the USSR of waging biological warfare. The Russians are

mass-producing a deadly new biotoxin, the Americans charge, then distributing it to the Communist governments of Vietnam and Laos. Advised and abetted by their Russian mentors, these governments are poisoning thousands of villagers in the anti-Communist pockets of Kampuchea (formerly Cambodia) and Laos.

Serious charges indeed. If true, the Soviet Union is violating every international treaty prohibiting use of chemical (and, more recently, biological) weapons—something not even the Nazis did. Never again could the Russians be trusted to honor international agreements, treaties of any kind, including nuclear-arms control, would have to be subject to the most intensive American verification. And the Americans—seeing the Russians' willingness to develop and use biotoxins—might have to stockpile their own supply.

The question, however, is whether the evidence can support such weighty charges, and that leaves many scientists in doubt. "I haven't seen much factual information at all," complains plant

pathologist Eugene Smiley of the University of Wisconsin, who has been following the U.S. government's case. And I don't see any evidence that you can [use it to] blame the Russians.

Americans became suspicious of the Russians six years ago, when refugees from Laos and Kampuchea reported showers of deadly orange, yellow, and red powders that made a pattering sound as they fell. Because of its appearance, the substance earned the names "yellow rain" or "medicine from the sky."

Then, last fall, the State Department announced that plant pathologist Chester Mirocha, of the University of Minnesota, had identified the yellow rain. After analyzing vegetation, rock scrapings, and water from an allegedly contaminated area of Southeast Asia, Mirocha found four members of the trichothecene family of poisons.

The trichothecenes, he says, came from a group of fungi called *Fusarium*, which turn green lawns yellow and which propagates freely in moist grain and corn. Farm animals that ingest *Fusarium* are wracked by vomiting and diarrhea and eventually die. And the fungi have been responsible for human plagues throughout history. In the Middle Ages, for example, people who ate *Fusarium*-infested bread died after suffering the grotesque convulsions of a disease known as St. Vitus's dance.

Citing Mirocha's findings, the State Department said it had finally proved that yellow rain was being dumped by man, not nature. Its argument? Control samples gathered from areas near but outside the contaminated site contained absolutely no trichothecenes. Man alone, they said, could deposit poison so discriminately.

Although State Department officials won't reveal their other sources, they claim to have overwhelming evidence against the USSR: the pieces of their scientific puzzle they say fit together perfectly. Critics, however, maintain that the State Department's case is sketchy at best. Consider:

- The State Department says that toxins collected on page 116



Are the Russians murdering innocent Southeast Asians with a biotoxin called yellow rain?

VITAL SECRETS

LIFE

By Dr Bernard Dixon

Back in the early 1960s when I was writing my doctoral thesis on the role of biotin in yeast metabolism, there was one undisputed truth about this B group vitamin. It had no medical importance whatever. Unlike vitamins C, D, A, and several others, it was required in such vanishingly tiny amounts that no one ever became biotin-deficient.

So there was no condition equivalent to scurvy, beriberi, pellagra, or rickets. Except for a single, bizarre case. The whole of the medical and scientific literature contained just one report of an eccentric old man who had unwittingly deprived himself of biotin by living on a diet of only white wine and egg white.

Now it so happens that while egg yolks are rich in biotin, the albumen contains a protein that binds the vitamin with extreme tenacity. Indeed, the only way to make rats or mice biotin deficient for experimental purposes is to add masses of egg white to their food. So, interesting as this vitamin may be from a biochemical standpoint, it certainly had no clinical significance.

Or so it was thought. A spate of recent

research papers has brought to light several cases of biotin deficiency in man. *The New England Journal of Medicine*, *The Lancet*, and other major medical journals have published reports showing that young children do indeed suffer some illness when this vitamin is lacking in their diets. Just as vitamin C cures scurvy, biotin cures their condition. In other words, the exact knowledge of two decades ago has had to be severely modified.

It's a curious tale, but one that would be of limited interest had there not been recent signs of new thinking concerning other vitamins, too. Vitamin C, for example, was scrutinized afresh at a symposium held at the University of Warwick. The outcome—again after many years of certainty—was that there is no clear agreement about our daily requirement for this vitamin: several experts felt that present advisory figures are too low. For safety's sake, Britain's recommended intake was set by tripling the 10 milligrams per day which just about prevents scurvy. But, as Professor Ewyn Hughes pointed out, the prevention of illness is scarcely

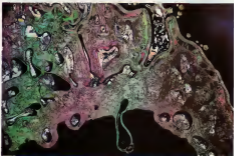
the same as optimizing good health.

One particular reason for reassessing our need for vitamin C is that it inhibits the conversion of nitros and amines into possibly carcinogenic nitrosamines. We are still not sure whether nitrosamines do cause human stomach, esophageal, and bladder cancer, but evidence is mounting.

A second speaker at the Warwick conference, Professor Ronald Anderson from the University of Pretoria in South Africa, described new evidence showing that vitamin C stimulates the body's immune system. Another Dr Thomas Irvin, from the Royal Devon and Exeter Hospital, spoke of its value in wound healing. And Professor Hughes argued that a shortage of vitamin C could restrict the production of carnitine, a substance crucially important in maintaining muscular contraction.

A third substance whose status is being reassessed is vitamin A—essential for the proper functioning of the eye's retina, and perhaps for other sensory organs, too. Dabbling evidence here came from Professor G. Brubacher at an international conference held recently in Tokyo. Based at the University of Basel, in Switzerland, Professor Brubacher has been conducting surveys among various populations to explore the gray area between excellent nutrition and inadequate vitamin A levels, at which eye and skin conditions are apparent. In one study he discovered that no fewer than a third of supposedly healthy young Swiss army recruits fall into this range. Such individuals hover at the brink of illness. With any further reduction in their dietary intake of this vitamin, night blindness, impaired hearing, and other early signs of a deficiency will become evident.

Clearly our knowledge of vitamins is far shakier than we once thought. This disconcerting realization, however, may be the first step toward enlightenment. Perhaps this explains the U.S. National Cancer Institute's decision, after seven refusals, to provide Professor Linus Pauling with a grant to pursue his controversial theory linking vitamin C with cancer prevention. ☐



Vitamin C is one of a growing list of vitamins whose dietary significance is being reassessed

HITCH UP WITH A RED STAR

SPACE

By James E. Oberg

About three years from now an American Shuttle-Spacelab mission and a Soviet Salyut-class space station will be in orbit so close together that the astronauts and cosmonauts aboard would need do little more than reach out their hands to touch one another.

Such a space handshake would be far more productive than the exciting, but largely symbolic, Apollo-Soyuz linkup seven years ago.

A Shuttle-Salyut program was once seen as a logical follow-up to ASTP or Apollo-Soyuz Test Project (Soyuz-Apollo in Soviet history books). But the unfolding disintegration of détente in the late 1970s forestalled any real progress, and there have been no new official negotiations in more than five years. In the meantime the technological logic of such a program has become even more compelling while political and diplomatic realities have grounded serious planning.

The logic is straightforward. Because of different needs for space operational technology the United States and the

USSR have been following different courses in manned spaceflight. The Russians, bedeviled by electronics failures that severely restrict the lifetimes of their unmanned systems, have set their sights on a permanently tended, manned Earth-orbit station, served by a space transportation system based on tested and true expendable launch vehicles. Technologically the Russians are doing nothing we couldn't have done in an evolution of the Skylab program. The United States, seeking a quantum jump in the ease and economy of access to orbit, tackled the much more challenging task of building a reusable space Shuttle and its auxiliary equipment, such as upper stages and the Spacelab scientific module. Near the end of the 1980s both spacefaring nations' paths will probably converge again, as the USSR seeks greater economy in its launches (necessitating its own shuttle) and we establish our own permanent, manned orbital presence.

But for the next five years the Shuttle and the Salyut will be two opposite halves of what could be made into a complete

international space effort—if only the appropriate political decisions are made in Washington, Moscow, and the capitals of the lesser space powers.

Here's one view of how it might happen. Schedules, of course, depend upon budgets, and Soviet progress must be extrapolated from past performance and from the Russians' fairly explicit pronouncements. Sometime in 1984 two Spacelab missions are to be flown while at least one manned Soviet space station is to be operating. The Soviet station—perhaps Salyut 9 or Kosmosgrad 1 (Space City #1)—could be orbiting Earth at an altitude of 230 miles, with an orbital inclination of 51.6°. The current NASA plans for Spacelab 2, meanwhile, call for an orbit at an altitude of 233 miles and an inclination of 50°.

The Spacelab 2 mission is an astro-physical expedition with no paid: cunized module, just a series of pallets loaded with cameras and telescopes in the payload bay. The orbiter could spend a week in space with five or six astronauts on board.

The Soviet space station should have as many as six cosmonauts aboard, working on orbital duty tours of three or four months. It will use a powerful array of scientific instruments attached to various docking units emplaced around the craft.

To conduct a space rendezvous, the Spacelab 2 orbit would have to be changed slightly, with its inclination raised just a tad. That's merely a matter of altering its launch as much from Cape Canaveral from 4°N to the barely more northerly 45°. There would probably be some changes in the mission, caused by the different orbit and the time allotted to carrying out joint activities. But the potential payoff should more than make up for the sacrifice.

Apollo-Soyuz in 1975 was a "proof of concept" of international rendezvous and docking. Shuttle-Salyut might go far beyond mere symbolism. The first mission which for simplicity should probably not include an actual physical linkup, would demonstrate emergency communications channels and rescue procedures



Commonwealth astronaut in space during the 1975 ASTP mission: Is it time to try again?

GAY ORIGINS

MIND

By Judith Hooper

The Joneses weren't so very different from their neighbors. They lived in a banal Ozzie-and-Harriet nirvana of quick-lighting charcoal briquettes, avocado-green kitchen counters and conscientious loving attendance at PTA meetings and Little League games. Why then did their son Johnny, the former Little League star, grow up with a yen for pastel cashmere and Louis Guinze antiques?

Of course, if Johnny had lived in the Age of Pericles, he'd have been just one of the boys. As it was, however, his parents searched their souls for past breaches of Dr. Spock's advice, for obscure parental peccadilloes that might have made Johnny turn out that way.

Such parental self-reconstructions, it now appears, are of no avail. For the old dogies of psychoanalytic theory have virtually nothing to do with Johnny's, or Jane's, penchant for lovers of the same gender according to the newest theories on erotic development. One, the latest Kinsey Institute study looks to dim events before Johnny even came to talk—even before his

birth. The other study by a University of Kansas psychologist traces our sexual preferences to a peculiar alchemy of sixth-grade social life. Both eschew pat (the word may not be apt) the parents of a homosexual child.

What makes Johnny gay is the question lurking behind the just-published Kinsey study *Sexual Preference*, by Alan P. Bell, Martin S. Weinberg, and Sue Kester Hammersmith. After inspecting the minutes of more than 1,000 gay, straight and bisexual lives and slogging through more statistics than most accountants could face with composure, the researchers came up with—well, nothing.

It didn't seem to matter for instance whether a mother was TV-sitcom perfect or Lucretia Borgia reincarnated. While slightly more influential in the Kinsey scheme of things, a father doesn't create a hair-styled son or an Amazon daughter either, the authors conclude. "What about siblings? Birth order? The state of the parents' marriage? Seductive teachers or camp counselors? Juvenile sex play? The latest Kinsey research turns up

only noes and a few tepid maybes.

"Sexual preference is established very early, long before the child even knows he or she has genitals," says Bell, who is a psychotherapist. "You may supply your sons with footballs and your daughters with dolls, but no one can guarantee that they'll enjoy them."

In that case, where does homosexuality come from? The answer, if we're to believe the Kinsey report, takes us back to the most mysteries of intrauterine life. Bell concludes, "I am inclined to think it [homosexuality] is biological." Bell hasn't looked for a gland or a gene that disposes one to be a homosexual, nor does he profess any authority in the realm beyond the couch and the questionnaire. But he points out that other researchers have shown that prenatal sex hormones may predetermine our heterosexuality, homosexuality or bisexuality.

To witness some of the more bizarre forays into the biological underpinnings of homosexuality, you need to look behind the Iron Curtain. Researchers in East Germany claim that male homosexuals, afflicted with abnormally scant male hormones, have a female "neural pattern" in their brains. These scientists say they've used psychosurgery to short-circuit the brain's female center, thereby permanently transforming homosexual men into heterosexuals.

But wait. The bawdy new world of libido control is not yet with us, and not all homosexual researchers believe biology spells destiny.

One notable dissenter is Michael Storms, chairman of the psychology department at the University of Kansas. Just because the Kinsey group hasn't found strong evidence of social factors, he says, there's no reason to assume biology is the only answer.

They haven't even proposed how biology might influence sexual orientation, he continues. "What is the connection between some biological factor that a person is born with and the fact that he or she likes to go to gay bars and pick up members of the same sex? There's a little gap in that reasoning."



Homosexuality may begin when children rarely associate with the opposite gender

SCULPTURE

THE ARTS

By Esther Wanning

Sunday Cardiff-by-the-Sea, California: Ten healthy tan adults span onto the beach, toting large and small buckets. They converge at a spot just below the tide line. Their industriousness is notable among the other souls stretched out on their towels. After an hour of scurrying, a nine-foot-high wedding cake of sand can be seen standing against the horizon. Hours later a chill settles over the beach and the wedding cake is gone. It is replaced glowing in the late afternoon sun by a Norman castle with turrets, parapets, crenellations, a cantilevered spiral staircase, a drawbridge, and a moat. The water line is just behind. The ten play frisked nearby. In another hour the tide has risen to surround the castle. The ten are wading beside it, exclaiming delightedly as a wall cracks, a turret dissolves, the castle sinks. The sun sets. The ocean laps at the beach. Nothing is left to interrupt the horizon.

Gary Kinsella, a leader in the sand-casting movement, lives three blocks uphill from the beach, in a modern

house with a picture window framing the Pacific. Outly-haired, with a handsome cheeked face and cobalt blue eyes, he has a seafaring look. He moved to San Diego County in 1972, after five years as an Air Force jet fighter pilot. Before that he was at UCLA, getting a degree in art, specialty ceramics. He moved southward because Los Angeles had got too crowded. Whereupon he met Norm Krause.

Krause, artist and craftsman, had brought the art of sand-casting beyond anything like it. His constructions were enormous, and they looked like castles rather than like sand, and they were works of art. They were elegant, says Kinsella. "I was just infatuated with them. We used a bulldozer to pile up the sand for the first one I worked on. Norm and I worked together for seven years."

Still good friends, Krause and Kinsella now work separately. Krause favors detailed replicas of known buildings; Kinsella leans toward fantasy, though based on a thorough knowledge of the history and structure of castles. But Kinsella does not work alone. Southern

California sand-casting is a group.

The uniqueness of sand-casting as an art form is dictated by its ephemerality. It is not a form for the lone artist. The more people you have, the bigger and better castles you can build, Kinsella says. And because the final product doesn't linger as a signed piece, the process of creation itself becomes the art as much as the object itself. The camera plays an important role in perpetuating the memories, but the success of a castle lies in the experience. Kinsella compares it to tennis: "You play a great game, but once you leave the court there's nothing left to show for it. And he adds appreciatively, "Your failures don't linger either."

Kinsella is the headman of a trusty band of castle builders. The camaraderie kind of snuck up on us, he says. "All of a sudden we realized what an incredible friendship we had and the sharing that goes on. Taking a complete fantasy and working on it together. People will spend hours on one side of the castle and then walk over to the other side and just be dumbfounded it's so terrific."

The kinship among sand-casters runs deep. On rainy days they hang around one another's house. They are something of a school, like Impressionists or Cubists, inspired by one another, bandying about pronouns such as we and our to an extent rare among modern artists. There's nothing about Kinsella and company to suggest they were drawn to castle building by twentieth-century alienation. But there is a dash of romanticism, a love of purity, a clear-eyed vision, a sense of a higher calling—an unmistakable purpose that shines on after the sea has swallowed the castle. Spends that do not shrink from the elements.

Gary and Norm are leaders of the San Diego school. Meanwhile, up in L.A., one Todd Vander Pluym was doing much the same thing independently. They met recently at a contest. He was working along exactly the same lines, using the same tools and everything. Kinsella recalls: They fell into each other's arms.

Kinsella has a slight messianic zeal about involving more and more people. He



Sand-casting is a twenty-first century art, ecologically correct, with no unrecyclable plastics.

BOOKS

THE ARTS

By M. S. Kaplan

Where are you going to be when the bomb is dropped? Driving the kids to school? Shopping at the mall? In the shower?

Strategic missile takes about 20 minutes to cross the Atlantic. If you happen to be seven miles from a small (one megaton) bomb blast, you have 20 seconds until the shock wave arrives with enough force to lift you right off the ground. Forget about Civil Defense. Most air raid areas haven't been tested in years. Even if you can get to a shelter in time, you'll probably find it lacking provisions and in despair. Highways will be jammed. The stores will have been looted. Gunfire will ring out in the streets. What are you going to do?

Tens of thousands of survivalists know exactly what to do, because they have memorized facts and rehearsed scenarios from a great variety of survival manuals now available. They've read how to estimate the size and type of burst from the thermal and shock-wave pulses and how to calculate their chance of survival. They know that perhaps their best protection from a nuclear blast is to be

underneath a manhole cover. They have a supply of at least two weeks of food in their cellar and plenty of guns and ammunition to prevent other persons from stealing their provisions.

Presidents and generals now think in terms of "clean" bombs: "soft" radiation and controlled nuclear war. Survivalists know that there is a lot more they can do than follow the advice of one Canadian manual to "duck, hide, hope, and pray."

No one says it's going to be pretty. Even a "limited" nuclear attack on just our land-based missiles would result in 15 million deaths and 20 million injuries. But Arthur M. Katz's *Life After Nuclear War* (Ballinger Press) demonstrates that, if there is a nuclear attack, our government will have more on its mind than worrying about the loss of life. A former consultant to the Joint Congressional Committee on Defense Production, Katz analyzes the aftermath of Armageddon from the standpoint of national recovery. Since a majority of our ICBMs are based in states that also produce significant amounts of livestock and food crops, any attack

restricted to those missile sites would significantly disrupt [though not necessarily destroy] U.S. food production and distribution. If an enemy chooses economic targets, Katz's book also provides detailed scenarios for U.S. petroleum refineries and pipeline facilities as well as civilian targets. Today most experts discredit the idea of an all-out debate. They speak of "pulling the trigger" rather than "pushing the button." Katz's book makes it all too clear that many governments are studying how to climb out of the ruins.

For almost ten years now the only information regarding the effects of nuclear weapons has been supplied by U.S. government reports and manuals. But when Dr. Bruce Clayton, author of *Life After Doomsday* (Paladin Press), examined these documents, he found statistical discrepancies and inappropriate assumptions as to weapon strength and target selection. For example, fallout pattern maps derived from a congressional study done in 1959 and widely reprinted, are almost entirely wrong. Dr. Clayton maintains. These maps show the flower of radioactive fallout blossoming in dark areas, from west to east, blotting out most of the eastern coast of the United States. Clayton's "realistic" map of these "windrose" fallout patterns shows a much less alarming picture affecting predominantly North Dakota and South Dakota, Nebraska, Kansas, and Missouri. Some nuclear war scenarios Clayton claims, would leave the nation 80 percent fallout-free.

Life After Doomsday also explains several important little-known phenomena associated with nuclear weapons. Shock waves from an atomic blast are refracted by the upper layers of the atmosphere and then reflected off the earth's surface many miles from the explosion. During the first atomic test at Alamogordo, New Mexico, the shock wave should have been limited to a four-mile radius. Instead, the wave bounced back and broke windows in Gallup, New Mexico, 260 miles away. Another "hidden" effect of a nuclear attack will be the dramatic rise in solar ultraviolet



Anticipating Apocalypse: Shelters range from sewers to Ron Bouwell's underground houses

TELEVISION

THE ARTS

By Michael Cassutt

On the screen a man we've come to know as world-weary TV reporter Grey Conway fumbles toward a studio, hoping to haul in anchorman Arthur Desmond. Desmond is finishing a network newscast just beyond the heavy door, his face smiling in the monitor outside. Unable to wait, Conway ignores the on-air warning light and bursts into the studio, only to find it dark and deserted. Thus begins his descent into a living nightmare.

And thus begins a journey that viewers of network television have not made in many years. The resemblance to a classic episode of *The Twilight Zone* is deliberate, but the show is new. This is ABC's *Dark Room*, an anthology of thrillers in the tradition of *Twilight Zone* and *Alfred Hitchcock Presents*, according to executive producer Peter Fischer. Our stories will explore and expand the boundaries of modern horror and fantasy from period pieces set in eighteenth-century France to stories about our fear of computers and all modern technology.

Horror, of course, means money these

days, both at the box office and on best-seller lists. So it should come as no surprise that television wants a piece of the action. *Dark Room* is just the first of a horde of network horror shows making it to the tube. But aficionados of the genre, unimpressed by dismal attempts at TV fantasy and science fiction in the past decade, have reason to be optimistic, given Fischer's involvement in the series. My very first script for television was a science-fiction thriller called *The Last Child*, which aired in 1971. It was about a young couple in an overpopulated future who have an illegal baby.

Fischer admits quite candidly that he is not a reader of fantasy and science fiction. "My interest in stories of that sort comes from films and earlier psychological-thriller programs like *Twilight Zone*."

Even so, *Dark Room*'s producers are, at least in part, heavily dependent upon stories first published in genre books and magazines. Most of the early scripts for the series will be adaptations of classic tales by such writers as Fredric Brown, Alfred Bester, Cornell Woolrich, Lisa Tuttle

and Michael Bishop. The list is long, and so was the work of screening stories, which largely fell to associate producer Medora Heitron. I read at least a thousand stories last summer, she says. The common element—the only common element—is that they have to be unrelentingly suspenseful.

We want *Dark Room* stories to be unpredictable, Fischer adds. "We want you to feel at the end as if you'd been stretched or teased, without resorting to plain shock or grotesqueness."

Recall the scene above from "Closed Circuit," by Carter Scholz, adapted for television by Alan Brennert. "Closed Circuit" is a story about a TV newsmen who is being replaced by new video technology. Brennert says, "What we wanted to show was a man slowly slipping into a nightmare, where his everyday world collapses, until eventually he's faced with a computer-generated video duplicate of himself that wants him to give up his personality. It's insidious because the duplicate is the reporter. How do you argue against yourself?"

Here, it seems, is the key to presenting horror or fantasy on television. You start with the familiar and the mundane, Brennert says, and from there you move into the alien and the terrible. These aren't just your standard spook shows. We want with real social problems, real characters.

That much seems to be true. Another Brennert story, an original entitled "Flash Point," deals with book burning in a small town. In Robert Bloch's "The Ropemakers Will Get You," two teen-aged girls disagree as to the exact nature of a new boy in their lives, with unpredictable results. In Bester's classic "Star Light, Star Bright," government agents trail a child who possesses an unexplained and very dangerous power. In each story the setting is recognizable and the characters are people like you and me.

Dramatizing these stories successfully, especially in the restrictive world of TV, is another trick, but Fischer has attracted writers who are capable of doing the job. Bloch has adapted three of his stories for *Dark Room*. Other contributing writers are



Metemorphosis in *Dark Room* nightmare: Her son's war toys come alive as deadly miscreants

EXPLORATIONS

By Phyllis Wollman

Like hungry ants gathering at the only cake crumb in the world, they converged on a clearing in the midst of virgin forestland. Burdened with tripods and metal boxes that protected fragile photographic equipment, they struggled up the rough, narrow path newly gouged out of the hillside, peering up whenever a patch of sky became visible through the treetops.

They were the 500 or so professional and amateur astronomers, men and women of many nationalities and all ages who had traveled thousands of miles to this remote woodland site in eastern Siberia for an opportunity to observe a spectacle that, at the last moment, might be obscured from view by a few stray clouds. The event: a total solar eclipse.

It was July 31, 1981, and for three hours the moon's shadow would sweep the earth in a path from the Black Sea, across Soviet Central Asia, Siberia, and the Pacific Ocean, to a point north of Hawaii. A total solar eclipse occurs only when the centers of the sun, the earth, and the moon lie approximately in a straight line. Because

astronomers are able to compute the precise path and the timing of eclipses far in advance, planning for this day's spectacle had begun two years earlier.

In response to queries that poured in concerning the 1981 eclipse, Soviet astronomers began tackling the problem of site selection. Although meteorological data revealed that sites to the east of the Siberian town of Bratsk offered the longest period of totally regional weather conditions might deteriorate rapidly at the end of July. Also, these sites lacked accessibility and accommodations. So Bratsk, six hours' flying time and five time zones east of Moscow, was chosen as the takeoff spot.

Early—very early—at 4 A.M. to be precise, traveling alarm clocks tinkled in all the rooms of the Taiga Hotel in Bratsk. This was the day, July 31, and no one overslept. A hearty breakfast consisting of cold meats, cheese, eggs and black bread, was consumed in record time, and the mountain of equipment that all but concealed the Taiga's small lobby disappeared into waiting buses.

By 6:30 two boats crammed with passengers and their gear pulled away from the dock and out into the Bratsk Sea for the trip to the specially prepared observation site.

The chill in the air didn't discourage anyone from enjoying the forest scenery. As the sun slowly burned away the mist, the day gave promise of becoming another hot one. (The Soviet Union was in the grip of an unprecedented heat wave.)

By 9:30 the boats tied up at an improvised landing area, and everyone teetered while lugging bulky equipment down gangplanks designed for goats.

The name Siberia was formed by merging two Tatar words: *sib*, meaning "to sleep," and *ir*, meaning "land"—a sleeping land. And it was obvious that Siberia had awakened to give eclipse observers a rousing welcome. In tourist (the government tourist agency) guides directed various groups to reserved sites and they helped to keep photographers and equipment from rolling back down the embankment into the sea. Most appreciated were the foodstands, bars, a cafeteria, and sanitary facilities that had been installed for our comfort. Electrical power lines diverted to this remote corner of the wilderness brought yet another touch of civilization.

Temperament aforas from the shapshlik stand forced many to desert their equipment temporarily for a chance to savor heaping plates of spiced lamb chunks interlarded with roasted onions and peppers. As the sun beat down on the clearing, chilled drinks became more and more popular.

The scene seemed chaotic, but it wasn't. With great precision, tripods were mounted on platforms specially built for the occasion, and cameras—with or without telescopic attachments—were adjusted as the pros and cons of various lens settings were discussed by novice observers and the many veteran eclipse watchers who offered advice generously.

At 10:47:37, the moon enroached on the sun's sphere and blotted out the initial silver. It was the phase of "first contact." The sky was grayish, the air was chilling.



Solar eclipse, 1981. At totally tongueless of hydrogen leap into space, behind the moon's shadow.

CONTINUUM

Edited by Dick Teters

SOMETHING I SAID

After three unusually pleasant years in her employ I have only just figured out what troubles me about Mrs. Meecham. Although she defended me in several trials with our top management, gave me a raise without my asking for one, and never sent me on out-of-town business while my wife was ill, I never really felt comfortable while talking with her. The reason, I now realize, is that Mrs. Meecham doesn't use feeling words. Even when discussing her family or other personal interests, she rarely utters a sentence that begins, "I like," "I hate," or "It makes me mad as hell that."

I owe this revelation to one Walter Wentrub, a psychoanalyst from Baltimore, whose recently published book, *Verbal Behavior*, gave me the tools for analyzing the hidden messages in Mrs. Meecham's discourse. It is Dr. Wentrub's thesis that a ten-minute sample of a person's conversational style contains voluminous information about his or her mental state. For by their syntax alone, he says—the way they string words into sentences and their predilections for certain parts of speech—people signal their unspoken depression, ray of their impulsivity and especially the way they tend to cope (or fail to cope) with their problems. Wentrub spent 15 years researching and devising his technique of speech analysis. In the course of that work, he applied his method to the transcripts of the Watergate tapes and made several intriguing observations about the four principal participants. Richard Nixon, for example, appears to have been clinically depressed at the time the recordings were made, according to Wentrub. And H. R. Haldeman, whose disdain for the first-person pronoun and all feeling words makes my Mrs. Meecham look like a gushing adolescent in love, emerges as a decisive, dogmatic, and extremely negative person with scant concern for questions of right or wrong. No wonder he was referred to, in his day as the Abominable No-man.

Wentrub says the grammatical elements he examines in speech are known to children as young as two years and people of very limited intelligence. He has subjected everyone from kindergarteners through teen-agers, college students, adults, kindergartners, binge eaters and hospitalized groups of alcoholics and psychotics to his experimental protocol. Briefly this entails placing the individual in an unfamiliar room with a tape recorder and an experimenter who refuses to say anything other

having explained that the person is to speak into the microphone for ten minutes on any topic at all. Thus stressed, some very young children and fragile adults fail to express the minimum 200 words needed for analysis. Most people, however, say about 1,000 words. This numerical quantity of speech is the first thing Wentrub looks at, since extreme volubility, he explains, is common in manic, obsessional, and chronically anxious individuals. Then he tallies the number of pauses longer than five seconds, which can be large in several psychiatric disorders, including depression and schizophrenia. He calculates the rate of speech, too, since depression frequently slows the rate below established norms.

The number of nonpersonal references is telling. If an individual uses constructions like "one should" and "everybody does" instead of talking about himself and people he knows, he may be shunning intimacy and responsibility, Wentrub notes.

He counts the words I, me, and we separately since they function differently. Many I's and no we's is a typical pattern among young children, while a preponderance of me's is the mark of a dependent, inactive personality. The sum of all negative words (not, no, never, etc.) can show how vehemently the person may be denying some aspects of reality. And Wentrub looks for vagueness and indecision in "qualifying expressions" such as sort of and I think. Other important scoring categories are retractors that reverse what the person just said: "John is a real pest, of course. He's basically a nice person." These pepper the speech of impulsives, who act too quickly and then feel the need to undo.

People who explain too much, who overuse words like since and because, are out of touch with their desires, Wentrub believes, while those who don't explain at all are dogmatic and insensitive. And speech filled with "evaluators"—judgment words such as good, awful, and worthless—is the hallmark of a severe, tyrannical conscience.

Soon after I had digested Wentrub's philosophy and began thinking about Mrs. Meecham, I got a telephone call. As you might imagine, I almost stopped the flow of my words for trying to count these parts of speech. I let up on myself and then tried to analyze the caller, but I don't think it's possible without the luxury of a recorded playback, and possibly a computer.—MAX GRUBER

CONTINUUM

HOT REAL ESTATE FOR SALE

Looking for an out-of-the-world real estate buy? The Astronomical Society of the Pacific is offering deeds to land parcels on the planet Mercury in return for \$25 donations.

The society promises "a nice recreational site with a minimum of 14,000 acres" at that price in a "pollution-free and also atmosphere-free environment." The society does not specify what kinds of recreation are available, but it does warn prospective buyers that temperatures are somewhat balmy—around 750°F (370°C)—not enough to melt lead.

Grantees receive a deed, a high-resolution Mariner spacecraft photograph identifying the land area purchased, a summary of meteorological conditions on Mercury, and a table of information on the neighbor-

hood—the solar system.

The society is a world-wide, nonprofit scientific and educational organization that provides numerous activities to increase public understanding of astronomy. It also has the disclaimer that it does not actually own any land on Mercury. But, on the other hand, neither does anyone else yet.

—Alan Maurer

There never was an idea started that woke men out of their stupid indifference but its originator was spoken of as a crank.

—Oscar Wendell Holmes

Everything is theoretically possible, until it's done. One could write a history of science in reverse by assembling the solemn pronouncements of highest authority about what could not be done and could never happen.

—Robert A. Heinlein



Picture this: you live a nice 14,000-acre estate on this pretty planet on Mercury. It's available for a mere \$25 donation. —Continuum

CRUELTY TO MONKEYS

A fifty-year-old scientist recently convicted of cruelty to animals contends that his research with monkeys was

hands living in rusted cages caked with their fecal matter. After four scientists surveyed the lab in Taub's absence and signed an affidavit of animal cruelty,



Photographs such as this one, taken by Alex Pacheco, were persuasive evidence in a Maryland animal cruelty case.

"humane," and was meant to benefit humans.

Edward Taub, a physiological psychologist in the Institute for Behavioral Research in Silver Spring, Maryland, sews nerves in a monkey's spinal cord and then tests the monkey's motor abilities. Last year the National Institutes of Health (NIH) gave Taub \$115,000 to use the technique for exploring new ways of rehabilitating human stroke victims.

But last summer Alex Pacheco, a twenty-three-year-old animal rights advocate, infiltrated Taub's laboratory as a volunteer worker. Four months later Pacheco went to the Montgomery County police. He alleged that he found filthy conditions and untreated, hungry, wounded monkeys with oiled bandages and fingerless

Maryland police set a national precedent by seizing 17 monkeys. A network of activists from Pacheco's group People for Ethical Treatment of Animals, sheltered the animals.

Charged with 17 counts of animal cruelty in Maryland District Court, Taub waived a jury trial and pronounced a battery of scientists who testified to the pioneering value of his research. Pacheco exhibited five hours of testimony with 75 photographs and a short color film he had taken of the bleeding, limping monkeys.

Last November Taub was found guilty of failing to provide six monkeys with veterinary care. The NIH has suspended his grant, and six monkeys await a custody hearing. Taub has filed an appeal. —Sandra Dorr

REINVENTED WHEEL

People have tried for centuries to improve the wheel, yet today's model looks very much like the one primitive

as a rigid tire rolls over smooth terrain.

A vehicle fitted with such wheels, Jones says, could easily mount curbs and steps, making it ideal for



The newest wheel: Spokes of elastic spring steel allow it to roll over and around obstacles, rolling over them as if on a cushion of air.

man conceived. At last, however, a retired railroad researcher from Great Malvern, England, has succeeded in reinventing the wheel, and he says that his new version could revolutionize the world of transport.

The new wheel is better, according to inventor Sydney Jones, because its rim folds around obstacles in its path, conforming to their shape and rolling over them as if on a cushion of air. He explains: The spokes of the wheel and its rim, or tire, are made of elastic spring steel. Whenever the wheel hits a sharp curb or step, the elastic spokes absorb the road's impact like a knee, and the tire conforms to the shape of the ground. Thus, he added, the tire can roll over the angular surface as easily

as wheels and stretchers. Because of its ability to negotiate rough or muddy land, the wheel might also be appropriate for tractors or

lunar exploration vehicles. Jones has even installed the new wheel on a motorized wheelbarrow that he hopes will take some of the back-breaking effort out of his gardening. —Ivor Smullen

LASER FACE-LIFTS

Laser light can rub out wrinkles, according to an Overland Park, Kansas, chiropractor. No surgery is needed, and there is no hazard as long as the low-power laser beam is kept out of the patient's eyes.

The new face-lift technique was discovered by John Amaro, who had been treating facial nerves with acupuncture. Instead of stimulating the appropriate acupuncture points with the traditional needles, Amaro used a laser.

He soon noticed that patients treated for the nerve condition looked and felt

better. So he was inspired to develop a laser treatment specifically for getting rid of wrinkles.

About 500 physicians throughout the country now use Amaro's method. They massage the face with laser light during ten sessions. To keep wrinkles away, Amaro recommends three or four or five laser sessions a year, together with exercise, vitamins, and a diet low in sugar and alcohol.

Scientists have yet to explain why laser acupuncture works, and no one has yet tried to convince the Food and Drug Administration (FDA) that laser acupuncture or laser face-lifting is really effective.

However, the FDA can't regulate individual practitioners; its authority is limited to regulating claims made while trying to sell the laser systems used in the treatment. While Amaro concedes that laser face-lifting doesn't work every time, he insists that it can't harm a patient, either.

—Jeff Hacht



Applying the laser to wrinkles: The face is massaged with laser light during ten sessions, with three to four refresher sessions a year.

the first thing that must be asked about future man is whether he will be alive, and will know how to keep alive, and not whether it is a good thing that he should be alive.

—Charles Galton Darwin

In a way, science might be described as paranoid thinking applied to nature. We are looking for natural conspiracies, for connections among apparently disparate data.

—Carl Sagan

CONTINUUM

ULTRASONIC STEAK

The difference between prime and choice steak is a matter of personal preference. USDA meat inspectors use the subjective methods of sight and touch to determine the grade of beef on the hoof, and thus the grade of your steak.

This may change. Paul Gammell, of the California Institute of Technology, working for the Jet Propulsion Laboratory in Pasadena, has developed a way to grade beef scientifically by using ultrasound.

Beef is a mixture of fleshy and fatty tissues. Muscle and fat reflect high-frequency sound waves differently and so different muscles will have different ultrasound-reflection patterns. The less fat in the tissue (that is, the better the grade of beef) the richer the ultrasound

patterns will be.

Gammell used an ultrasound transducer to measure the ultrasound patterns from 40 steaks, 10 from each USDA grade (prime, choice, good and standard). He found definite correlations between grade and sound patterns and concluded it is perfectly feasible to establish a scientific butcheries beef grading system by using ultrasound scanning.

It should even be possible, he adds, someday to grade beef cattle ultrasonically before they get to the slaughterhouse. —Joel Davis

I like people who refuse to speak until they are ready to speak.

—Lillian Hellman

All you need in life is ignorance and confidence and then success is sure.

—Mark Twain



Federal meat inspector grading beef carcass the conventional way. Ultrasound may eliminate much of the present method's subjectivity.

LOCH NESS MONSTERINGS

The underwater television picture glowed eerily from the deepest part of Loch Ness in Scotland. Suddenly a group of mysterious legged crustaceans jerked their way

the Natural History Museum in London.

Greenwood, after examining a computer-enhanced version of the videotape, was fascinated. From the way the creature moves, he said, "It might be a shrimp-like crustacean, though."



Nessie: Still no proof of the monster beast? But two explorers say she has some small crustacean cousins on the loch's bottom.

across the barren, floodlit bottom. No, the swarming mass was not Nessie, the fabled monster of the lake. Instead, it was a cluster of monsterings—whisker-gray creatures about two or three inches long. According to explorers Michael Carne and James Hogan, the creatures had never been seen before.

Carne and Hogan had \$66,000 worth of underwater video equipment aboard their ship, the *New Atlantis*, launched to find a sunken vessel at the bottom of the loch. They discovered the monsterings instead, and they took a videotape of the creatures to Humphrey Greenwood, head of the department of ichthyology at

cannot positively identify it until I have an actual body.

The deeper water of Loch Ness has never been properly sampled biologically, Greenwood added.

Toward that end, Carne and Hogan have brought in a robot-controlled minisubmarine equipped with cameras. Normally used to locate oil wellheads in the North Sea, the submarine will be used to hunt down more of the monsterings.

And it will be hunting something else, too. "On two or three occasions we have come across large disturbances of silt on the bottom that are inexplicable," Carne says. "Might it be Nessie?"

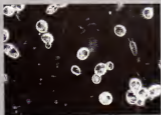
—Michael Jeffries

RANDY YEASTS

The sex life of mutant yeast cells may help uncover the cause of cancer.

Normal yeast cells—used to make beer and bread—usually reproduce asexually simply by dividing in two.

division occurs with frantic rapidity resembling the growth of cancer cells. Just recently David Beach and Paul Nurse, two young scientists from Sussex University in England, showed that the mutant yeast cell turns asexual when a jump-



Brewers' yeast? Mutant yeast cells, according to researchers, can't even frolic, proliferating with the frantic speed of cancer cells.

They go in for sex only when the environment becomes harsh, too cold or too hot. This sexual reproduction allows the ordinary yeast cells to exchange genetic material with one another, producing a healthy breed of robust yeast spores that can survive almost anything. When conditions improve, the spores convert to normal cells and divide asexually.

In contrast, the mutant yeast cells, called *sandy yeasts*, seem to crave sex no matter what the weather. After several generations, however, they convert like repentant Don Juans, abstaining from sex and dividing asexually even if conditions are awful. This asexual

ing, gene hops from one part of its chromosome (a rod of genetic material) within the cell to another. Beach and Nurse believe that some human cancer cells closely resemble the proliferating mutant yeast; they might also result from such jumping genes.

The hypothesis has recently been backed by scientists at the Imperial Cancer Research Fund, in London. They have found similarities between the jumping genes in bud flies and the cancer-causing genes in viruses. Jumping genes control cell division, the scientists say, and wrong jumps probably induce cancer. —John Newell

COLD CLAMP

A Pennsylvania engineer thinks a fancy clothespin may be the long sought cure for the common cold.

Twenty years ago Norman Lake clamped an ordinary clothespin on his nose to keep it from dripping unwanted spots on a blueprint. Not only did it keep his work clean, but it also seemed to banish his developing cold.

So Lake invented the Inductive Nasal Device (IND), which consists of two button-sized knobs connected by a spring. It works, Lake explains, by raising the temperature inside the nose from 81°F, at which viruses thrive, to 98.6° which kills them.

Normally Lake says, the body itself cures a cold in this manner, but it takes a day or two for nose inflammation to shut off the nasal

passages and achieve the same result. The IND speeds up normal body processes," he says.

Tests at Millersville State College and consumer trials have been "very positive," and Lake is seeking Food and Drug Administration approval of the device. "Many people say that after using the IND they haven't had a winter cold for the first time in years," Lake says.

The device is available from Norfolk Labs, in Lancaster, Pennsylvania, for \$10.95. —Alan Maurer

BORN ALTRUISTS

An unhappy infant wailed in his crib while psychologist Grace Martin recorded his cries. When she played the tape back, the baby stopped. But when she played the taped cries of a second infant, the baby cried more loudly than ever.

Martin of Armstrong State College, in Savannah, Georgia, got different results when she studied calm babies: who ignored their own cries, the cries of older children, and the wails of animals. But they vigorously joined in with other new-born infants.

Martin made the observations during a study of infants less than two days old, designed to see whether human empathy is inborn.

Martin interprets the infants' responses to other babies' cries as an inborn potential for altruism. However, she doesn't know why a newborn is calmed by the sound of its own voice.

—Madeleine Lubow



For another brave new device in the fight against colds.

CONTINUUM

CHEMOMETRICS

With an inspired use of analytical mathematics, one University of Washington chemistry professor has helped to found a new subspecies of chemistry and has, among other things, given forensic chemists a way to spot that staple of clip joints: cheap scotch in premium bottles.

Dr. Bruce Kowalski points out that one of the shortcomings of analytical chemistry is that it does not use very sophisticated math to analyze the data it collects. He's trying to correct that with a new branch of chemistry he helped establish, chemometrics. This joins the excellent data-gathering skills of a good chemist with the analytical skills of a good statistician.

Chemometrics is especially valuable outside the laboratory where substances to be analyzed are impure. Dr. Kowalski helped the Wyoming Crime Laboratory come up with a simple test to tell whether inexpensive booze, such as scotch, has been introduced into high-priced bottles.

The problem was tricky since the chemistry of scotch changes if the bottle has been opened or if the liquor has been mixed with water. Kowalski's solution was to take samples of premium and cheap scotch and run them through a gas chromatograph, a device that sorts out molecules according to size.

The tests came up with hundreds of components but, with the help of a com-

puter recognition program that analyzed the results, it narrowed down the cheap scotch/good scotch factor to two chemicals that chemists could look for.

Chemometrics can yield detailed descriptions of a variety of substances, Kowalski notes. His tests can



It's wine or rotgut? The answer is in the molecules.

identify and isolate distinguishing factors in crude and fuel oil, for example, making it possible to decide who is responsible for an oil spill. Aerospace manufacturers have asked him to work up chemical profiles of special materials. And just recently Kowalski matched his technique against a panel of human wine tasters to find out just what it takes to make a superior Pinot Noir. —Douglas Colligan

If you make people think they're thinking, they'll love you, but if you really make them think, they'll hate you.

—Don Marquis

ABORTION SUPPOSITORY

Women who have abortions are often forced to make their private anguish public in a clinic or a hospital. Those who are especially poor or frightened sometimes abort a fetus with dangerous household instruments.

But in the near future women may be able to give themselves safe and inexpensive abortions at home using suppositories developed by Dr. Neil S. Larsen of Mount Sinai School of Medicine. In New York City, Larsen explains that the suppositories, made with a synthetic form of the human hormone prostaglandin, work by causing contractions of the uterus, inducing menstruation.

Today doctors perform early abortions with a suction tube, which removes the tiny fetus. But this procedure sometimes damages the cervix and the uterus, making subsequent preg-

nancies hazardous.

The suppository seems to have no dangerous side effects. Larsen boasts a 98 percent success rate with the drug, which he has tested on 60 women up to six weeks pregnant. One woman who used the drug to terminate an unwanted pregnancy has since delivered a healthy baby, he reports. "We know it works," he said, "but we're looking for the ideal dose."

The suppositories, Larsen adds, might eventually lead to a monthly birth-control pill that would prevent unwanted pregnancies from progressing.

—Sy Montgomery

Science has proof without any certainty. Creationists have certainty without any proof.

—Ashley Montague

Birth, and copulation, and death.

That's all the facts when you come to brass tacks.

—T.S. Eliot



Conventional abortion: A New York doctor claims he has a better way.

GRASS INTELLIGENCE

If you smoked 40 joints of potent Jamaican grass every day, visions in *Day-Glo*—or of galaxies—would be dancing in your cerebral spaces, right?

But for members of the Ethiopian Zion Coptic Church, near Miami Beach, Florida, pot, though a sacrament, is no more phenomenological than Tylenol.

Colebrants of the Rastafarian-inspired sect each day smoke two to four ounces (equivalent to about 40 joints) of the "green herb of the Bible"—tobacco-laced Jamaican marijuana. Astonishingly though, their IQ is appear unaffected by seven or more years of steady ceremonial consumption, according to UCLA neuropsychologist Jeffrey A. Schaeffer.

We were rather surprised, says Schaeffer, a chemical-toxicity expert. Any periodic marijuana user is familiar with short-term memory defects, driving difficulty and so on. But this group (he has refused to identify them, though other investigators have) say they don't even get high. They don't giggle or get bloodshot eyes, either.

Not only have these monks apparently developed a tolerance for the drug, Schaeffer says, but their strict diet and routine activities set them apart from the drive-in burger and rock-and-roll crowd. Then too, they use marijuana as an avenue to the Almighty.

The eight men and two women in Schaeffer's study

all young Caucasians, had an average of 13.5 years schooling and a mean IQ of 128.

Robert Peterson, research director of the National Institute on Drug Abuse, in Bethesda, Maryland, cautions against drawing any conclusions from such exceptional people. Not since

pleaded freedom of religion on the basis of his ministry's sacramental use of marijuana, but he was convicted anyway—Judith Hooper

Make no little plans. They have no magic to stir men's blood.

—Daniel Burnham Hudson
an architect



Jamaican (not belonging to Brother Love's group) enjoys a smoky Coptic religious deity's smoking grass, suffered no ill effects.

Thomas Jefferson sat around talking to himself, says one group had a mean IQ of one hundred twenty-eight. Also, the group's IQ is sure not tested before they began using marijuana.

Moreover, since the magic herb is mingled with tobacco, Peterson doubts that the dropouts actually inhale much THC, marijuana's active ingredient. Schaeffer disagrees, noting that cannabinoids—metabolites of cannabis—were found in the subjects' urine.

The Coptic leader Brother Love (Thomas Riley Jr.) was tried for drug smuggling, he

LONG-LIFE BANANA

Bananas, apples, and pears that stay fresh for months will soon appear on supermarket shelves. Long-life plums, avocados, and mangoes are sure to follow.

The secret is a sugar-based substance called Prolong, recently marketed by Tai Chemicals, a subsidiary of the French sugar giant Tate and Lyle. Bananas or apples are simply dunked into Prolong, which quickly dries, leaving a coat that slows the movement of oxygen and carbon dioxide across the fruit skin. This hinders respiration

and delays the ripening process.

Today bananas are picked before reaching maturity, then shipped throughout the world at 56°F to delay ripening. With Prolong, however, fruit can be shipped in heat significantly above room temperature without becoming the least bit overripe. Indeed, says Tai, long-life fruit will save millions of dollars in electricity now used for refrigeration.

Prolong, originally developed by biologist Peter Lowings, of Cambridge University, is already applied to apples and pears in England and to bananas in the Philippines. It is awaiting Food and Drug Administration approval in the United States.

Tai asks dieters not to worry about its sugar coating. It works out at about one crystal of sugar per fruit. That's not going to give any one galloping tooth decay or an expanding waistline.

—Nicholas Timmins



Soon, a sugar-coated banana.

CONTINUUM

SPACE AFFECTS TIME

If like Gulliver you were to visit the country of the tiny Lilliputians, you might find that two hours seemed like a



Small-scale model showing the internal clock.

day several minutes like an hour. Why? The smaller the scale of your environment, the faster your internal clock.

This conclusion was reached just recently by University of Tennessee architect Alton J. Delong, who tested his newly designed rooms by constructing small-scale models for people to look at. He saw that when those who inspected his models imagined themselves to be inside the small-scale rooms, they could perform a task for 90 minutes to two hours at most.

When Delong asked volunteers to estimate the passage of time, he found that those in a one-eighth scale model guessed that half an

hour had passed after only five minutes, indicating that their internal clocks were running six times faster than normal. People working in one-eighth scale rooms felt time passing 12 times as fast and those in one-twenty-fourth scale rooms felt it rushing by 20 times faster than it really was. Estimates of time in an ordinary room averaged close to regular clock time.

Delong is continuing to explore spatial factors that may affect time perception. Among current projects are a search for physiological changes associated with spatial scale, the influence of color and observation of hyperactive children in different scaled environments. —Jeff Hecht

DIRTY HAZZ

Next time your hair gets dirty and you don't want to wash it, consider donating it to science—or to the well-being of your garden.

Home gardeners have long used balls of dirty hair to repel rabbits. Now scientists in Alabama and Colorado are testing the method in attempts to keep foraging deer away from orchards.

Dr. J. D. Norton of Auburn University in Alabama reported successful use of hair balls in his state to keep animals away from crops. In Colorado Drs. Kenneth Yu and Matthew Fogayak are experimenting with the technique, using hair collected from a barbershop in Delta near the University of Colorado, to discourage deer from entering orchards.

Last year the snowfall here was not good enough for a good test. Dr. Yu said. We are repeating it this fall and hoping for a harsh winter that will bring the deer into the orchards.

At one time or another horticultural researchers have tried just about everything to keep deer and rabbits away from crops, Yu said, including hot Tabasco sauce, which worked for a few weeks, then failed. But dirty scent-laden human hair seems to outperform all other remedies. The animals react to that human scent, Yu said.

—Allan Maurer

KAMIKAZE COMET

On August 30, 1873, a comet rushed toward the sun at 640,000 mph. It left in its wake a trail of dust and gas 3 million miles long. After the comet disappeared, meeting its death in

a collision with the sun, a dust storm surged high above the solar surface. The energy released was probably 1,000 times greater than that consumed by the United States in a year.

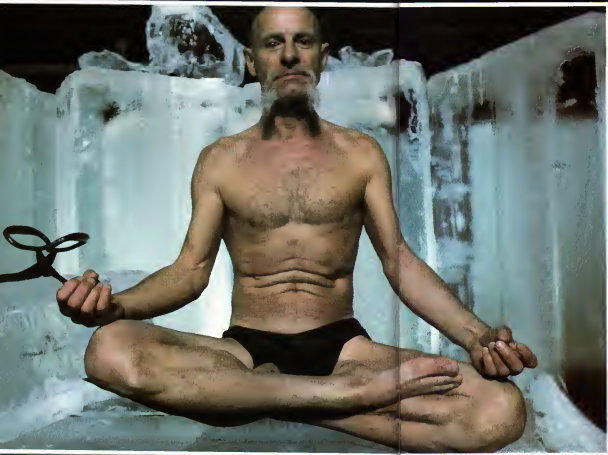
This story, now part of the history of our solar system, was revealed by pictures taken with a Defense Department satellite. The department was studying solar flare activity which disrupts communication systems on Earth. The photos released two years after they were taken, provide us with the first solid evidence of a celestial body colliding with the sun.

If you take a closer look you'll see that the comet was every bit as bright as Venus shown in the upper left-hand corner of the photo. Yet so far no ground-based observations have acknowledged spotting the kamikaze mission to the sun.

—Allan Hendry



Now! Research Lab photograph shows a cometary dust storm above the solar surface 71 hours after the comet hit the sun.



Turn down your body's thermostat, says this immunologist. You'll live longer.

COOL IMMORTALITY

BY ROY WALFORD, JR.

It has been known for some time that fruit flies live longer at a temperature slightly reduced from what they normally experience. This fruit-fly information would be more interesting to us if we, like fruit flies, were insects, invertebrates. But we're not. We're what are known as vertebrates.

Reptile lizards are also vertebrates, with hearts, livers, and guts roughly similar to ours; so when it came to my attention that Reptile Lizards enjoy a life span of two years in the cold climate of New England compared to only one year in palm-fronking Florida, I was more interested than I had been in the effect of temperature on the life span of fruit flies.

To me, it seemed probable that lowering internal body temperature might also prolong the life span in those other vertebrates that, like lizards, are poikilotherms, that is, those whose temperature is the same as their surroundings, because they have no automatic mechanism for controlling internal temperature. The idea needed experimental verification in the laboratory. If that was verified, then I would have to wonder whether the longer life span of the chiller fence lizards and other cold-bloods was due simply to a general metabolic slowdown. That would be the most straightforward guess, but it might be

PHOTOGRAPHS BY
ANTHONY WOLFF

•Perhaps we can't depend
on evolution anymore. We have to adjust
nature ourselves•

wrong. It would have to be wrong or the whole phenomenon would be of no major interest to a longevity seeker like me. After all, who would want to creep through a longer life at only half speed? People would stop you in the street and want to wind you up out of sympathy.

The cause of the expressed life span of cold bloods at lower temperatures could easily be more complicated than general metabolic slowdown. In cold-bloods the speed of many of the chemical reactions involved in metabolism is independent of a single temperature and can happen over a wide range or at different temperatures the animals may simply use different metabolic pathways. They may "metabolically reorganize."

In my quest for answers to these intriguing questions, I found myself some years ago in an airplane heading from Los Angeles toward the horizon separating Brazil from Argentina, passing high over the sun forests of the north-central Amazon, the Guaporé River and the scrub forest of the Mato Grosso. I was on a special kind of fishing trip for a special kind of fish.

The shortest-lived evolutionarily advanced cold-blooded vertebrate in the world is the annual fish and several large species of animals can be found in the province of Buenos Aires, Argentina. I planned to study them in their natural habitat, catch some, bring them back alive to my laboratory in Los Angeles and establish an experimental colony.

When the plane landed in Buenos Aires, I retrieved my gear: a suitcase, two large Styrofoam boxes containing live nets, plastic bags, chemicals for measuring the status of the habitat, tablets that would dissolve slowly in water while giving off oxygen, and other materials. The next morning I went to the Buenos Aires Museum of Nat-



ral History joined my host, fish expert Dr. Rogelio Lopez, and set out with him on a series of splendid fishing days.

Annual fish have apparently evolved a short life span because they live in small ponds or water holes that dry up during the summer. A spawning pair waddle head-down together into the soft mud. She lays eggs he fertilizes. They do this a number of times, with many partners. As the water evaporates, the fish die, but the eggs survive in the slightly damp earth of the dried-up pond and hatch with the next season's rains in the revived ponds.

Fifteen miles south of Buenos Aires, extending along both sides of the highway and between the highway and wide, flat cattle fields, Dr. Lopez and I found long, wide, shallow ponds, muddy half-choked with floating vegetation and containing two species of annual fish, one of which was the Argentine peafish, *Cynolobus belloti*, with which I would do most of my temperature experiments over the next several years. The male belloti is a bright spickled green, the female, a dark speckled brown. Fully grown, both are 1.5 inches long.

We donned chest-high rubber waders and unlimbered Rogelio's seine net, eight feet long, three feet broad, and laced at either end to wooden poles. Each of us grabbed a pole. Standing about six feet apart and holding our poles end down in the knee-deep water in front of us, we

charged forward side by side, the net stretched between us like a giant scoop. From this adventure came the gonatological colony of fish I established in my laboratory back at the University of California at Los Angeles (UCLA). Specimens of *Cynolobus elongatus*, belloti, and *ophry*, along with *Argemonea singamundus*. I shipped some batches of fish by airfreight to Los Angeles, oxygen tablets bubbling in their semisealed containers, but those that survived best were the ones I carried home with me on the adjacent seat during my return flight. I dosed them with oxygen from the plane's own supply courtesy of

Pan American World Airways

At UCLA my colleague Dr. Robert Liu and I raised many successive generations of the handsome fish, allowing them to spawn in peat moss at the bottoms of tanks whose water was carefully controlled to match the original South American habitats as closely as possible. I had been careful to measure the hardness, degrees of acidity and other characteristics of the fishes' native waters in the laboratory they lived their short life spans of about one year even if the water was not allowed to dry up, and they showed signs of true aging before they died. Old annuals developed humped backs, they decreased in length, just as a human's stature decreases a few inches with advanced age, they showed macroscopic changes in the thyroid gland and the liver and had arthritic degeneration of the spine.

But I found all these changes could be delayed, and life spans prolonged, if I kept the temperature of the water and hence of the fish a few degrees colder. At a lower temperature their maximum life span would actually double. Furthermore, fish raised at 59°F grew faster and wound up bigger than those raised at 66°F. Sure evidence that the colder temperature had not exerted its influence simply by a general metabolic slowdown. Finally the chemical structure of the fishes' connective tissue—collagen—indicated that the aging process had been

FICTION

*The whistling
swan was extinct. How could it be flying
over Aton-17?*

THE AUDUBON EFFECT

BY SCOTT SANDERS



Keava heard the eerie whistling and felt the air tingle with their approach moments before she actually spied them. The shorebirds climbed above the horizon of Aton-17, flying in V formation, carving the sky. Wave upon wave of energy rippled before them like the advance of a storm. Their wings blazed white as they banked over the ocean.

"There!" she whispered, pointing a slender arm in their direction.

"I don't see anything," said LaForest, who crouched beside her among the tangle of reedlike plants in the shallows, peering through binoculars. A sickle-shaped outcropping of rock sheltered this cove from the sea. The muck of the shore smelled almost like a salt marsh on Earth, found and sour, as Keava imagined the original broth of life must have smelled.

Taking LaForest's bearded chin in hand, she delicately aimed his gaze. See how their wings catch the light?

Underneath the binoculars his lips drew tight from the effort of concentration, then relaxed, and finally the lower one dropped in astonishment. "Yes," he murmured. "My God, they're like white fire. There must be a dozen of them, circling this way. And do you hear the whistling? Listen."

Keava put an arm around his waist, entering the bones of his hip through the velvety skin of his thimbersuit. He was trembling. The reedy fronds squeezing against him caught the vibration and shivered with his excitement. She remained motionless and said in an undertone, "Be still. I think they're coming down."

They did come down, wings tilted, fiercely white against the green ocean, plowing to a stop and then floating majestically in the still waters of the cove.

"What in the world are they?" Keava asked. She knew the life fields of many creatures, but these she could not quite place.

LaForest lowered the binoculars and let out a hiss of breath. He turned to her. "They weren't sixty-four light-years from Earth. I'd say they were whistling swans."

"Which they're not?"

"Of course not. They aren't even birds, in any literal sense."

The notswans were feeding, tipping forward and thrusting their long necks into the water, then bobbing upright and swallowing a captured sdsit. Between bites they seemed to be preening, ruining backs along each wing.

Having never seen a live swan, born half a century too late for that delight, Keava possessed no feeling point for them. But



PAINTING BY USHIJIMA YOSHIHIRO

she had viewed swans in films during her training for Project Viva, and in these elegant white creatures aloft on Aton-17 like scraps of sunlight she could see nothing alien.

"Tell me why they aren't swans," she whispered.

Because they can't be. They're simply organisms that happen to resemble birds. This place differs from Earth only in a few parameters. It's just a case of similar environments selecting for similar organisms. Out in the cove the nonwings paddled about in nervous circles, long necks participating, on the alert. "Watch," he said. "I'll prove it."

He drew the netgun from his pack and fired a silent charge at the nearest floating creature. The web instantly settled on the gleaming body and held it frozen in position. Its head bent back to preen beneath a lifted wing. The others swam inquisively around the immobilized one, but did not startle. LaForest began gently reeling in his netted prize.

After a moment the others hushed their chatter. Silence fell over the entire cove. Keava sensed all around her the collective panic of innumerable beasts, and her stomach knotted in sympathy. The hush deepened. Then suddenly there was an explosion of white bodies, wings swatting the water as the creatures scrambled for takeoff. In a few frantic seconds they were airborne, beating away out of sight, all except the specimen LaForest had snared.

"Spooked them," he said forlornly.

Keava put a hand on his shoulder to keep him from rising out of their hiding place among the reeds. "Wait. I feel something else flying huge."

They both tilted their faces skyward. Keava soon found it: an enormous shape gliding on still wings, spiraled upward on a thermal, then descended, rose, and descended, skulking along the coast in their direction. In the alien sunlight its belly looked cobalt-blue, and its wings and back, visible as it wheeled about, seemed an even deeper blue. It was the color of underearth, the smoking blueness of manholes. An immense crested head with hooked beak swung back and forth, surveying the water.

"It's hunting," she whispered, crouching lower until the nipples lapped at her neck. The beast's feeling print made her think of abandoned railway turnouts, crows yawning smoke-blue covadoes. And its hunger is enormous.

LaForest nodded a wag of beard. Swiftly he resumed reeling in the net, and the white beauty he had captured bobbed toward them over the waves.

The motion evidently caught the hunter's eye, for the massive head ceased preening, the wings drooped, and the great body came hurtling down. LaForest dropped the reel and began fidgeting at the reel hand over hand, grunting with each tug. The sky shape swelled rapidly blue and vast like a seah of sky plummeting down, blocking

the light, taloned feet dropping heavily. An instant before it struck the wings spread again large as clouds, and then it snatched the captive animal and began to climb.

LaForest leaped up, shouting, "Let go of my swan! Let go!" He yanked at the netline. The hunter momentarily opened its talons, and LaForest's prize came tumbling down, torn and bloody. He retrieved it while Keava watched the huge blot spiral upward and vanish into the glare.

She gasped and gasped, chest heaving. The beast's hunger had nearly suffocated her. When LaForest staggered back through the shallows, with the gleaming body lying broken across his arms, the argument in his face made her feel a stab of jealousy. "You called it a swan," she said. "I was excited."

Keava took the black-billed head gently in her palm. "It has the face of a swan." She stroked the limp neck. "The feathers and scaly foot."

• Keava sensed
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He shook his head doggedly, a motion that tested his entire frame. "All it lacks is the right planet, the right history."

Skimming the shuttle just above the wavecrests, Keava piloted them back to ward the survey ship, which was anchored a few kilometers out in the bay. They had spent the previous two days cooped up in the ship, swallowing detoxification tablets, studying maps, running scans on the atmosphere. The scans confirmed what the drone films had shown: that the skies of Aton-17 were filled with flying organisms. LaForest had spent the two days pacing from one chamber of the ship to another, skipping the bulkheads, muttering frantic to get outside. In the face of exotic animals and plants he was self-possessed, even coldly rational, but anything vaguely resembling a bird sent him into frenzied excitement. Keava had seen him wade through snake-infested swamps, crawl under thornbushes, dangle in harness from the belly of a hovering shuttle, just to catch a glimpse of a bird.

Returning now to the ship, she glanced occasionally at him, stirred by his passion.

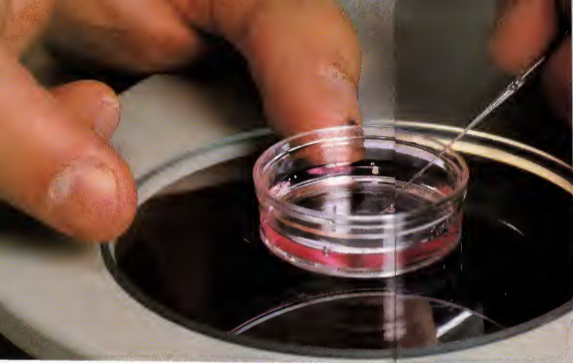
LaForest held the battered creature in his arms the whole way its blood smeared his shimmering. He wore an expression of stunned amazement, the look he always wore moments after warp-transfer or love-making. Keava thought, as if the muscles of his face were totally numb from an excess of emotion.

Since her first encounter with him six years earlier when he had wandered up to her at the Project Viva installation in Colombia with a chirpy greenish nestling cupped in his hands—a Pygmy parrot—he had announced, "the mother abandoned it"—he had been intermittently drunk on birds. It was his passion for the quick pulse of bird life that attracted her to him. Since the gift—or affliction—of snuffing biological birds had been visited upon her in childhood, she had searched for companions in whom the feeling for life's radiant vibration was strong. Such people must have been unusual in all ages, she realized—there were glimpses of the purest type in St. Francis of Assisi and Thoreau of Walden—but they were exceedingly rare in her own time, when all but a tiny percentage of Earth's inhabitants lived entirely within the Enclosure, never leaving the global network of travel tubes and domed cities, never meeting any life except the human variety wandering fower among images of themselves like joy seekers lost in a labyrinth of mirrors.

So when LaForest doled up to her with his handful of squawking parrot, his face aglow, Keava felt a shiver of recognition. Soon they were members of the same survey team, then partners, and eventually descending the rapids of desire, they were lovers. His behavior turned out to be much weaker than her own, but his reasoning was more powerful, like a higher-power microscope that was capable of revealing shapes she could only dimly intuit. Their complementary skills made them a surveying team of genius. Keava locating before-forms and sketching their general pattern, LaForest analyzing her discoveries and fitting them into the known scheme of near-galaxy life. In their first four years of surveying, they produced blueprints for twelve E-type planets. By the time film arrived back from Aton-17, showing skies filled with birdlike motion, she and LaForest were in a position to choose their own survey locations, and of course they chose to go investigate these flying wonders.

This was the dream, she knew that had lured him through the arduous training for Project Viva, through the months of mind-centering in preparation for warp-transfer with the disorienting experience of warp itself, this dream of finding somewhere among the millions of earthlike planets in near-galaxy, creatures analogous to the avifauna that once flourished on Earth.

The bewilderment look on his face discouraged her from speaking until the shuttle was firmly joined on to one of the steps docking ports. Then she began, "LaForest,



Researchers use a slender glass micropipette to place genetic material (blueprints) for protein directly into a single cell (close-up at right).

The conveyor belt of the Central London Hatchery and Conditioning Centre move slowly through the common hallway of the Brave New World, carrying human embryos toward their decending stage. Into various bottles go typhoid inoculants to prepare some embryos for work in the big game. Heat conditioning will make some have the cold. Constant motion improves the sense of balance of future rocket pilots. Oxygen and alcohol levels adjust intelligence.

Half a century after Aldous Huxley's grim prophecies, human intelligence, behavior, and desires still lie beyond our control. But mankind is on the brink of being able to alter his genetic programming with more precision and more selectivity than Huxley ever imagined.

The dramatic impact will come first in medicine, opening up possibilities for correcting tiny chemical quirks in our genes that can cripple our minds and bodies, lower our defenses and sentence us to early death. More than 3,000 currently incurable hereditary diseases will come under attack from pioneers on the dramatic new frontier—gene therapy. Twice in the past ten-year

The needle, piercing a cell, injects

SPARE GENES

BY YVONNE BASKIN
PHOTOGRAPHS
BY MALCOLM KIRK



*Yale scientists are
nurturing mice that carry human
interferon genes*

period physician-researchers have transferred foreign genetic material into young girls doomed to retardation or early death by errors in a single gene. Neither attempt brought any improvement in the patients and heavy criticism speedily ended both projects. However, even critics who called these experiments premature predict that more attempts will be made within two to five years to transfer "good" genes into human beings. By the end of the decade scientists may be able to offer treatment for any of a dozen defective or missing genes.

Diagnosis will move ahead even more quickly than therapy. Researchers armed with new, automated tools of genetic engineering—robots manipulating molecules to make components of artificial genes—will isolate the biochemical mistakes responsible for hundreds of inherited disorders. Within the next ten years machines may routinely scan the genes of a fetal cell for abnormal "fingerprints" which signal problems ranging from color blindness to cystic fibrosis. Heart disease, cancer, alcoholism, aging, and other undesirable conditions or afflictions may also one day be ameliorated by advances in gene therapy. Research now in progress in labs across the country may determine the specific genetic components that are "ingrained" by cholesterol, cosmic rays, viruses, a shift of solvent, or one mislaid hot dog too many.

And what about intelligence, emotion, behavior, character? Are they as sociobiologists contend, at least partially programmed by our genes? Will the knowledge gained in medical therapy inevitably lead some people to try to tamper with the nature of man, either by manipulating genes or by aborning for traits we feel are undesirable?

I've argued for four or five years now that at some point the sociobiologists and the genetic engineers are going to converge," says Sheldon Krimsky, a Yale University philosopher of science who serves as a



member of the federal Recombinant DNA Advisory Committee. The sociobiologists believe you can find genes for altruism or sexism, and so someone will undoubtedly look for them.

But W. French Anderson, of the National Institutes of Health (NIH)—like many molecular biologists—is not ready to worry about such speculation. The scenarios that envision great changes taking place in humans—that might be something to worry about fifty years from now, or even twenty-five years from now, but certainly not in the next decade, he says. "People who want to influence complicated phenomena, like behavior, would have better success with drugs," he adds.

"Until somebody has isolated a gene that has anything at all to do with intelligence or personality or behavior, there really isn't any room for speculation," Anderson says.

Our genes, 50,000 to 100,000 of them—we don't yet know how many—make up our mission-control team. Strung out at their posts along 23 pairs of threadlike chromosomes in the nucleus of the cell, the genes guide the transformation of a single fertilized ovum into the 100 trillion specialized cells that an adult human being possesses. Each gene, composed of DNA, has a single duty: to provide a blueprint for the manufacture of one protein. The blueprints are elaborate. If all the genetic

material—DNA—in just one human cell were removed and unspooled, it would stretch to about six feet in length.

In every cell of an organism, the gene team is the same. But the mission varies. Nerve cells don't make insulin, and skin cells don't make blood proteins. In any nucleus, some genes lie dormant, others may be shifting to new posts, and the rest are busy directing the production of their proteins.

Every member of the team is so crucial to the mission that even a minute aberration can be disastrous. An errant gene may ignore directions and produce too much of its protein, or make it at the wrong time, or batch the odor and turn out an abnormal product. Or it may fail to produce anything at all. Then body secretions may thicken and clog the lungs, red blood cells may become distorted and pile up like a logjam in the capillaries, nerves may degenerate. Bones and facial features may become deformed. Toxic wastes may build up while any one of 100 necessary chemical reactions fails to occur.

Repairing a gene is still in the realm of science fiction. But adding genes to dilute out defective genes in individual cells has become a realizable goal.

The critical steps in such therapy are as complicated as finding and blasting a million needles in a million haystacks. After discovering which gene is malfunctioning, researchers have to isolate it, reproduce millions of copies of a working replacement gene, insert the new genes into appropriate cells, and see to it that the new genes produce what they're supposed to produce in a controlled way.

Not one of these steps was possible 12 years ago, when biochemist and physician Stanley Rogers made a unique attempt to treat patients by using foreign genetic material. Rogers, who had been studying the cells of rabbits for more than 15 years, heard about the affliction of two little German girls. He thought he could see a connection between their cases and his re-

CONTINUED ON PAGE 109

FICTION

THE FAR SIDE OF THE BELL-SHAPED CURVE

BY ROBERT SILVERBERG

Saizayvo

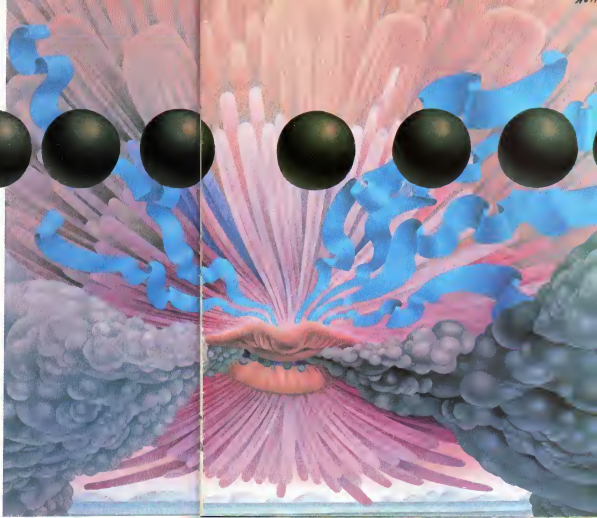
was lovely on that early summer day. The air sparkled, the breeze off the mountains was strong and pungent, the whitewashed walls glittered in the morning sunlight. Reichenbach, enchanted by the beauty of the place and spurred by a sense of impending excitement, stepped buoyantly out of a dark, cobble alley and made his way in quick, virile strides toward the river's north embankment. It was nearly 10:30.

A crowd of silent, sullen Bosnian burghers lined the embankment. The black-and-gold Hapsburg banners fluttered from every lamppost and balcony. In a little while the Archduke Franz Ferdinand, the Emperor's nephew and heir, would come this way with his Archduchess in their open-topped car. They were venturing into dangerous territory into a province of disaffected and reluctant subjects.

The townsfolk stared faintly. The townsfolk mulled. Like puddings, Reichenbach thought, they awaited in a dull, duffel way their future monarch. But he knew they must be seething inside with revolutionary fervor.

Reichenbach looked about him for dark, laud youths with the peculiar bright-eyed look of assassins. No one nearby seemed to fit the pattern. He let his gaze wander up the hills to the dense cypress groves, the ancient wooden houses, the old Turkish mosques topped by slender, splendid minarets, and back down toward the

PAINTING BY WOLFGANG HUTTER



river to the crowd again. And—
Who is she?

He noticed her for the first time, no more than a dozen meters to his left, in front of the Bank of Austria-Hungary building: a tall, auburn-haired woman of striking presence and aura, who in this mob of coarse rough folk radiated such supreme alertness and force that Reichenbach knew at once she must be of his sort. Well! He had come here alone, certain he would find an appropriate companion, and that confidence now was affirmed.

He began moving toward her.
His eyes met hers, and she nodded and smiled in recognition and acknowledgment.

Have you just arrived? Reichenbach asked, in German.

She answered in Serbian. "Three days ago."

Smoothly he shifted languages. How did I fail to see you?

You were looking everywhere else. I saw you at once. You came this morning?

Fifteen minutes ago.

Does it please you so far?

Very much, he said. Such a picturesque place! Like a medieval fantasy. Time stands still here.

Her eyes were mischievous. Time stands still everywhere, she said, moving on to English.

Reichenbach smiled. Again he matched her change of language. I take your meaning. And I think you take mine. This charming architecture, the little mob, the ethnic costumes—it's hard to believe that a vast and hideous war is going to spring from so quaint a place.

A rebuff? yes. And it's for reasons that we make those journeys, *mes-lie pas?*

Unmet?

They were standing quite close now. He felt a current flowing between them, a pulsating, almost tangible force.

Join me later for a drink? he suggested.

Certainly. I am Isabel.

Reichenbach.

He longed to ask her when she had come from. But of course that was taboo.

Look, she said. The Archduke and Duchess.

The royal car, inching forward, had reached them. Franz Ferdinand, red-faced and feline in preposterous comic-opera uniform, waved halfheartedly to the bleakly staring crowd. Omb, pumpt Sophie beside him, absently overdrawn, forced a smile. They were mostly-looking, floundering people rigid and nervous, all but clinging to each other in their nervousness.

Now it starts, he said.

"Yes. The tragedy." She skipped her arm through his.

Not far away a tall, young, sorrow-faced man appeared as if he had sprung from the pavement—wild, hyperthyroid eyes, bobbing Adam's apple, a sure desperado—and hurried something. It landed just behind the royal car. An odd popping sound—the detonator—and then Reichen-

bach heard a loud bang. There was a burst of black smoke, and the car behind the Archduke lurched and crumpled, dumping aides-de-camp into the street. The cortege halted abruptly. The imperial couple, unarmed, sat wearily upright as if their survival depended on keeping their spines straight. A functionary riding with them said in a clear voice, A bomb has gone off. Your Highness.

And Franz Ferdinand, calm, disgusted. I rather expected something like that. Look after the injured, will you?

Isabel's hand lightened on Reichenbach's forearm as the bizarre comedy unfolded: the cars motionless. Archduke and Archduchess still in plain view, the assassin wildly vaulting a parapet and plunging into the shadow over police pursuing, pouncing, beating him with the flats of their swords, the crowd milling in confusion. At last the damaged car was pushed to the side of the road and the remaining vehicles rapidly drove off.

● A gaunt boy emerged from a coffee house not far from the car. He looked dazed, as if he were astounded to find himself so close to the imperial heir. ●

End of Act One. Isabel said, laughing. And forty minutes until Act Two. That drink now?

I know a sidewalk café near here. Under a broad, turquoise umbrella Reichenbach had a favorite. Isabel a mug of dark beer. The stolid citizens at the surrounding tables talked more of hunting and fishing than of the bungled assassination. Reichenbach, pretending to be casually stilled, Isabel hungrily. A cool, keen intelligence gleamed in her penetrating green eyes. Everything about her was sleek, self-possessed, sure. She was so much like him that he almost feared her and that was a new feeling for him. What he feared most of all was that he would blunder here at the outset and lose her. But he knew deep beneath all doubts, that he would not. They were meant for each other. He liked to believe that she came from his moment and that there would be a chance to continue in real time, when they had returned from displacement, whatever they began on this jaunt. Of course one did not speak of such things.

He told her said, "Where do you go next?" "The burning of Rome. And you?"

A drink with Shakespeare at the Mermaid Tavern.

How splendid! I never thought of doing that.

He drew a deep breath and said, "We could do it together. Then, heasted, watching her expression—She did not look displeased. After we've heard Nero play his concerto. Eh?"

She seemed amused. "I like that idea." He raised her glass. "Prost."

Zdravje.

They smoked wreaths, clinked glasses. For a few minutes more they talked—lightly, playfully. He studied her gestures, her sentence structures, her use of idiom, seeking in the subtlest turns of her style some clue that might tell him that they were contemporaries. But she gave him nothing, a shrewd game player like this one. At length he said, "It's nearly time for the rest of the show."

Isabel nodded. He scattered some coins on the table, and they returned to the embarkment, walked up to the Latin Bridge, turned right into Franz Joseph Street. Soon the royal motorcade, returning from a City Hall reception, came rolling along. There appeared to be some disagreement over the route. Chauffeurs and aides-de-camp engaged in a noisy dispute, and suddenly the royal car stopped. The Archduke's chauffeur seemed to be trying to put the car into reverse. There was a clashing of gears. A gaunt boy emerged from a coffeehouse not three meters from the car, less than ten from Reichenbach and Isabel. He looked dazed like a sleepwalker as if astounded to find himself so close to the imperial heir. This is Gavril Princip. Reichenbach thought, the second and true assassin, but Reichenbach felt little interest in what was about to happen. The gun was out, the boy was taking aim. Reichenbach watched Isabel instead, more concerned with the quality of her reactions than with the deaths of two trivial people in fancy costumes. Thus he missed seeing the fatal shot through Franz Ferdinand's pouter-pigeon chest, though he observed Isabel's quick, frosty smile of satisfaction. When he glanced back at the royal car he saw the Archduke sitting upright, stunned, tunic and lips stained red, and the boy lying at the Archduchess. There was consternation among the aides-de-camp. The car sped away. It was 11:15.

"So," said Isabel. "Now the war begins, the dynasties topple, a civilization crumbles. Did you enjoy it?"

"Not as much as I enjoyed the way you smiled when the Archduke was shot."

"Bili."

"The slaughter of a pair of overstuffed simulators is ultimately less important to me than your smile."

It was risky, too strong, too soon, maybe? But it got through to her the right way, producing a faint quivering of her lips that told him she was pleased.

"Come," she said, taking his hand.

Her hotel was an old, gray stone building on the opposite bank of the river. She had an elegant balconied room on the third floor with a river view, ornate gas chandeliers, heavy damask draperies, a capacious chaise longue. The era's style was certainly admirable. Reichenbach thought—lavish, slow rich. Even in a little provincial town like this everything was deluxe. He shed his tight and heavy clothing with relief. She wore her timer high, a pale, but bared just beneath her breasts. Her eyes glittered as she reached for him and drew him down beneath the canopy. At this moment at the other end of town Franz Ferdinand and Sophie were dying. Soon there would be exchanges of self-diplomatic notes, declarations of war by Austria-Hungary against Serbia, Germany against Russia and France, Europe engulfed in flames: the battles of the Marne, Ypres, Verdun, the Somme; the flight of the Kaiser; the Armistice; the transformation of the monarchies. He had studied it all with such keen intensity and now, having seen the celebrated assassinations that triggered everything, he was unmoved. He had had eclipsed the Great War for him.

No matter. There would be other epochal events to savor. They had all of history to wander together.

"To Rome now," he said huskily.

They rose, bathed, embraced, winked conspiratorially. They were off to a good start. Hastily they gathered their 1914 gear: waistcoats and pelisses and boots and all that, within the prescribed two-meter radius. They synchronized their timers and embraced again, naked, laughing, bodies pressed tight together, and went soaring across the centuries.

At the halfway house outside Imperial Rome they underwent their preparations, receiving their Roman hairstyles and clothing, their hypocorisms in Latin, their purses of ducats and sesterti, their plague inoculations, their new temporary names. He was Quintus Junius Valerius; she was Flavia Julia Lepida.

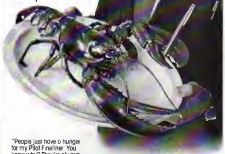
Nero's Rome was smaller and far less grand than he expected. The Colosseum was still in the future, there was no Arch of Titus, and even the Forum seemed sparsely built up. But the city was scorching mean. The first day they strolled vast gardens and dense, crowded markets, stared in awe at crazy Caligula's bridge from the Palatine to the Capitoline, went to the baths, gorged themselves at their inn on capon and stuffed boar. The next day they attended the gladiatorial games and afterward made love with frantic energy in a chamber they had hired near the Campus Martius. There was a wonderful frenzy about the city that Reichenbach found intoxicating. And Heibel, he knew, shared his fervor. Her eyes were aglow, her face gleamed. They could hardly bear to sleep, but explored the narrow winding streets from dusk to dawn.

They know, of course, that the fire would
CONTINUED ON PAGE 96

"Pilot. The pens you have to hold onto with two hands."

—Rodney Dangerfield

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EARTHWAIVES RISING

BY GURNEY WILLIAMS III

The attack continues. Like a crescent-shaped ax, the Indian subcontinent slices into Asia, thrusting the land higher every year, leaving ripples of stress that radiate from the mountains down to the Arabian Sea.

PHOTOGRAPH BY MICHAEL J. SAMMONS



● The new 4000 cc engine is available in any of the four body styles. *Motor Magazine* has named it.





• All these mountains were supposed to disappear and be replaced by a new mountain range.



• The mountains were supposed to disappear and be replaced by a new mountain range.

• The mountains were supposed to disappear and be replaced by a new mountain range.

*Awake to your
dream world. Then watch
what happens*

LUCID DREAMS

BY DOUGLAS COLLIGAN

I am carrying a bundle of bedding and clothes down the street, and then a taxi pulls up and blocks my way. Two men in the taxi and one outside are threatening me with robbery and violence. I see a woman behind the taxi, wearing no skirt, put something into the trunk of her car.



Sometime I realize that I'm dreaming, and I attack the three muggers, heaping them in a formless pile and setting fire to them. Then, out of their ashes, I arrange a mound for flowers to grow on.

Stephen LaBerge (preparing subject Beverly Kacovinski for a dream study above) keeps a notebook and a special pen by his bed to record dreams like this. The pen, a battery-powered number with a built-in light bulb, lets him write down the dream in the dark without waking his wife.

PHOTOGRAPHS BY
CHRISTOPHER SPRINGMANN



He does not record every dream, only those rare, particularly vivid images known as lucid dreams, during which a person realizes he is dreaming. A really talented dreamer like LaBerge can control the action in a lucid dream, much as a playwright or director controls the scenes in a play.

According to LaBerge, a psychophysicologist at Stanford University's Sleep Research Center and other researchers, the therapeutic value of the lucid dream could be staggering. Instead of groping for the meaning of fuzzy partly forgotten dream symbols when he awakens, a lucid dreamer can stop in mid-dream to analyze his confrontation with a dream image. By the time the dreamer wakes, he may well have new insights into many of his unconscious desires and deepest conflicts. Learn to dream lucidly LaBerge says, and you'll have enough control to stop your nightmares before they begin. You may even be able to give yourself a break from mounting daily tension and spend the night on a tranquil Florida beach, for instance in a self-styled lucid dream.

Though the potential of the lucid dream now seems obvious, until recently few researchers even knew such dreams existed. Dream experts who had heard of them dismissed them as hallucinations, strange, dreamlike images that flickered through the mind during a few seconds of waking awareness. A few people did study the oddity of the dream world. In the late 1960s British parapsychologist Celia Green produced a compendium of anecdotes called *Lucid Dreams*, and in the early 1970s U.S. psychologist Patricia Garfield discussed lucid dreaming in detail in her book *Creative Dreaming*. Since those works were considered out of the mainstream of truly scientific research, much of what they said was ignored until the last few years.

In the past five years an energetic group of researchers has rediscovered the lucid dream, subjecting it to thorough scientific scrutiny. At the vanguard of this young group is Stephen LaBerge.

In the late 1960s LaBerge, whose casual dress and boyish appearance are offset by the intensity evident in his eyes, was a graduate student at Stanford, specializing in chemical physics. The impact of California's growing drug culture and a blossoming interest in Eastern philosophy caused him to reevaluate his goals. By the early 1970s his devotion to chemical physics was waning, giving way to fascination with the shadowy reaches of human consciousness. LaBerge was now studying for a doctorate in lucid dreaming.

As part of his doctoral work in this virgin field, LaBerge set out to challenge long-held beliefs by showing that lucid dreaming was not a waking hallucination but genuine dreaming after all. His proof was based on the well-known fact that most dreams occur during a phase called REM (rapid eye movement) sleep, marked by quick movements of the eyes under the eyelids. LaBerge reasoned that if lucid

dreaming were real dreaming, it would happen during REM sleep. And if, as he had read, it were possible to watch your dream as it happened, fully aware of what you were seeing, and to step in and change the dream, it might also be possible to send out a signal to the waking world that you were dreaming.

LaBerge knew that while dreamers are almost totally unconscious, they can still move their eyeballs. Thus, he reasoned, dreamers might easily signal the outside world with some prearranged eyeball movement that might be detected if electrodes were attached to the face.

After deciding to use as a signal a series of left-right/left-right eye movements, LaBerge attached the sleep-monitoring electrodes to his head for several nights in a row. Every time he knew he was dreaming, he tried to give the left-right signal.

He dutifully recorded his progress with the help of a polysomnograph, a lo detector-like device that uses electrodes to

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it happened, fully
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measure, among other things, eye movement during sleep. At night the polysomnograph charted the movements on graph paper with an automatic pen, and in the morning LaBerge scanned the markings. In 1975 he discovered what he had been looking for. In the middle of the short, irregular scribbles on the graph formed during a REM period he found long, sweeping lines of regular left-right/left-right eye movements. He had the lucid-dream signal he was looking for.

When critics pointed out that his signals might be just mere REM movements, LaBerge took his experiment one step further and managed to send out simple Morse code messages by using a complicated series of eye and body movements. In one test run he spelled out his initials with his dream code during REM sleep.

His work was good enough to get him his Ph.D. and, today, at thirty-four, LaBerge feels he has proved that lucid dreams are not merely waking hallucinations. With the help of an experimental cadre of dreamers whom he calls oronasauts (oh-nah-row-naughts), or dream sailors, he has also gone a long way toward learning just ex-

actly what lucid dreams are all about.

He has discovered, for one thing, that truly skilled lucid dreamers can make people, rooms, entire landscapes dissolve into thin air in a second and replace them with something more interesting. LaBerge describes one lucid dream in which he was flying above a spectacular valley. He spotted a small island in a lake and was about to investigate when he realized that he was dreaming. At that instant he decided to visit a teacher friend. He simply soared away and his valley dissolved into thin air.

People who can conjure up lucid dreams at will are rare, composing perhaps 10 percent of the population. According to experimental psychologist Jayne Gackenbach of the University of Northern Iowa, the talented few are less likely to be depressed or neurotic than the nonlucid, and they have fewer problems with self-esteem. And lucid dreamers can't usually have much interest in such mind-expanding techniques as yoga or meditation, even though most lucid dreams seem to have a mystical overlay.

These are people, Gackenbach explains, "who seem to be at peace with their culture and its philosophies and religions."

Another prerequisite to lucid dreaming, Gackenbach notes, is a sense of emotional and physical balance. Dreamers who lose their emotional cool about being in a dream often see their lucidity evaporate. And they need a sense of physical balance to perform a common lucid dream maneuver: flying. Recently Gackenbach asked subjects to walk along a balance beam and found that the better balancers were also more adept dreamers.

Does this mean the rest of us will be shut out from that inner circle of dreamers? Not necessarily, the experts say. If lucid dreaming is a natural ability it is also one that can be learned. "It's like playing the piano," LaBerge says. "By and large anyone who's normal can learn to dream lucidly with a bit of motivation and training. It takes effort and practice."

Researchers have learned that lucid dreams tend to occur more often in the early-morning hours, probably LaBerge says, because there are more REM/dream periods during that segment of a night's sleep. Gregory Scott Sparrow, an experienced lucid dreamer now completing a Ph.D. on the subject at the College of William and Mary in Virginia, says he has most of his lucid dreams early in the morning, about 5 A.M., after he wakes up, mends for ten minutes, and then goes back to sleep.

LaBerge points out that an ordinary dream automatically becomes lucid if the dreamer is somehow made aware of the fact that he is dreaming. Because lucid dreams may be as vivid as the real world, however, even the most experienced dreamers can be fooled. For example, one of LaBerge's star subjects, Mike Kadzinski, a slim, blonde computer scientist, says that she is occasionally misled from a pleasant sleep by a brusque technician

who bursts into her room at Stanford's sleep lab and orders her out. More often than not she experiences a few seconds of uncertainty before she recognizes him as a stranger: a dream character, and moves her eyes to signal the onset of a lucid dream.

LaBerge has also found he can teach his oneromats to dream lucidly with an autosuggestion technique called MILD (mnemonic induction of lucid dreams). In the first part of MILD a sleeper awakens spontaneously from a dream early in the morning—a simple habit to pick up with a bit of memory training. After going over the dream and fixing it in his memory, the person spends about 15 minutes doing something that requires his full alertness, such as reading. Then the would-be lucid dreamer tells himself, "Next time I'm dreaming I want to recognize that I'm dreaming." Finally the person lies in bed, his eyes closed and moving in the REM fashion. His mind replays the dream he had earlier, but this time with the added realization that he is in a dream. If all goes well, within minutes the person should be sleeping and dreaming—lucid-style.

British psychologist and lucid-dream researcher Keith Hoare has come up with yet another way to tell dreamers they are dreaming. He has invented a compact gadget he calls his dream machine. Hoare's gadget detects the onset of REM sleep and jolts the dreamer to awareness with a series of electric shocks.

The machine goes into action, Hoare says, at the onset of rapid, irregular breathing—a phenomenon that accompanies REM. The subject's breathing rate is measured by a wire sensor clipped to a nostril at one end and to the dream machine at the other end. When the rate exceeds about 15 breaths a minute, the sensor signals the dream machine, which sends out a series of four mild electric shocks to an electrode on the dreamer's wrist. A sleeping person is supposed to interpret the four jolts as words: "[olt]. The [olt] is [olt] a [olt] dream."

Hoare is now overseeing the manufacture of a dream machine that he hopes to sell commercially for less than \$100. He says that those seeking thrills through custom-made dreams will probably be among the first buyers, with dream-therapy groups following suit. He is also building a dream machine for use in ESP experiments. When a person hooked to the dream machine has a lucid dream, his rapid breathing triggers an automatic phone dialer which rings the number of a telephonic "message sender" in another room. The sender then proceeds to transmit his message to the sleeper, whose ability to pick up the message, Hoare says, may increase during the dream state.

Scientists training lucid dreamers with MILD, the dream machine, and other techniques hope to build up a large corps of oneromats. When these dreamers catch a bit more experience, they could help researchers explore uncharted regions of the



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dream itself. Indeed, psychologists trying to extract unconscious meaning from a dream today can question the dreamer only after he has woken up and lost the "soul" of his dream. Since the lucid dreamer is essentially awake in the inner world of the dream, however, he could get word out without interrupting his dream experience.

LaBerge has already managed, while dreaming lucidly, to send out his initials as a Morse code signal by using eye movements and hand hand squizes. In the future he hopes to sharpen this signaling technique so that the dreamer can tell in some rudimentary way what's going on in his dream. This can be used to mark the exact time of dream events and even to calculate their duration. In one experiment LaBerge gives his eye signal, counts to ten, and then gives another signal to show he has stopped counting. The purpose is to find out whether ten seconds in a dream is as long as ten seconds in waking life. (It is.) He also has had his onlookers do other things, sing, for example, and signal when they've begun and finished.

Asked whether this could ever be raised to a level of skill so that the dreamer and say a therapist could communicate across the barrier of sleep, LaBerge thought a bit and replied, "That may be possible, but it would require a kind of cooperation to be awake in our auditory system but not in any other." A dreamer might learn to hear ques-

tions put to him and then signal out his answers. In that case, LaBerge adds, you would have something that technically would have to be called a partial sleep since the body is not as completely shut down as it would ordinarily be.

With a dialogue like this, established, lucid dreamers might well put many of Freud's theories about dreams to the acid test. One area sure to be questioned is Freud's famous array of dream symbols, which Heime calls "just ludicrous." For example, flying in the Freudian lexicon of symbols, connotes intercourse. But LaBerge has found that in lucid dreams flying symbolizes freedom. When lucid dreamers have sexual dreams, the dreams are straightforward, he adds, not shrouded in symbols.

Lucid dreams might even offer alternatives to traditionally Freudian psychoanalysis. There is an almost sacramental reverence for dreams among Freudians, who consider these experiences to be expressions of unconscious desires and urges rooted in the psyche since childhood. Over years of therapy dreams may be analyzed to isolate, and perhaps resolve, the traumas behind the dreams, but the dreams themselves are to be left untouched.

Indeed lucid dreaming has already been used to eliminate one baffling psychological affliction: the nightmare. Spanow tells the story of one female who "was being

pursued down an alley," then realized she was dreaming. "I became aware that much of my dream life was spent running from male pursuers," she told Spanow. And I said to myself, 'I'm tired of this never-ending chase. I stopped running and walked up to the man. I touched him and said, 'Is there anything I can do to help you?' He became very gentle and open, replying, 'Yes, both my friend and I need help.' I went to the apartment he shared with his friend and talked to them about their problems. I felt compassion for them both."

The ability LaBerge adds, may also relieve narcoleptics, who may frequently drop off to a nightmare-filled sleep without a moment's warning. Heime agrees, he is even planning a dream machine to prevent nightmares. When the respiratory sensor detects 25 or 30 breaths a minute, signaling the beginning of a "stereotyped" dream, the machine will sound an alarm.

Inspired by Patricia Garfield's work and by lucid-dream research, New York psychologist Judith Malinud has spent the past six years developing a therapy called Lucidity Training. Its aim is to get people to explore their options in life by taking ordinary dreams and making them lucid while they are awake. If they wish, they can then restructure their dreams to make them more satisfying.

Malinud stresses that lucid dreaming is not central to her therapy. What she teaches in special workshops is the "concept of lucidity": the awareness that we often shape our personal realities unconsciously and that we can also do this consciously in our dreams, fantasies and waking states. In one workshop session she had one person in a group of four share a dream or fantasy with the others. They while awake then "recreated" what the person had shared in different ways.

Yet Malinud's brand of dream therapy might work to modify behavior while the dreamer sleeps. Take the case of one lucid dreamer of Stanford who was having trouble writing her master's thesis. In what seemed like a textbook case of writer's block, she hadn't been able to put even one word on paper.

Then one night she had a lucid dream about herself standing in the middle of a room with her desk and typewriter. She tried to walk to the typewriter but found that her legs were paralyzed. Gradually however she forced herself over to the dream desk and sat in the dream chair. The next day quite awake, she was able to make herself sit quietly in front of her typewriter. Eventually her block dissolved and she wrote her thesis.

LaBerge believes that lucid dreaming may even help us cure disease—real ailments, as well as psychosomatic ones. He has received funding for some of his work from an organization called the Holmes Center for Research in Holistic Healing, and in deference to their interest he plans to test some of the healing powers of the





*When we seek
the origins of life on Earth,
says the Big Daddy
of DNA, we may be looking to
the wrong planet*

INTERVIEW

FRANCIS CRICK

Francis Crick began his scientific career as a physicist and then, in his thirties, clearly switched to the emerging field of molecular biology, winning a Nobel Prize in the process. Today, decades later, still driven by the same eclectic curiosity he is doing brain research. Given the remarkable versatility that serves his protein pursuits, it is not surprising that Dr Crick grapples as imaginatively with the challenges of outer space as he does with those of inner space. Indeed, in his new book, *Life itself* (Simon & Schuster), he grapples with both simultaneously, boldly asserting that the seeds of life on Earth did not spring unbidden from the prebiotic soup—the spontaneous product of chance biochemical events—but, instead, were sent here in a rocket designed on some distant planet by “creatures like ourselves.” Acknowledging that the idea of “directed panspermia”—the willed seeding of life—is imbued with “the stink of science fiction,” he argues, nonetheless, that the theory has about it “a tinge of plausibility” perhaps more compelling than any attached to more

“orthodox” explanations of the origins of life on this small planet.

Crick was born in England in 1916 and earned his doctorate at Caius College, Cambridge University in 1953—the same year he and James Watson launched a “biological revolution” with their discovery of the structure of DNA, the master molecule that contains the genetic code. In prose that was uncharacteristically restrained for both of them, Watson and Crick announced their breakthrough to the world in the April 25, 1953, issue of *Nature*, in an article that began: “We wish to suggest a structure for the salt of deoxyribonucleic acid (DNA). This structure has novel features which are of considerable biological interest.” Behind the scenes, they exhibited less modesty. Within hours of completing their model of the “double helix,” which described in detail the structure of the double-stranded DNA molecule, Crick, according to Watson, was telling “everyone within hearing distance that we had found the secret of life.” The upstart duo—virtual unknowns in the world of biochemistry—bested out the gigantic likes of Linus Pauling



“A civilization capable of sending out rockets could already have come into existence at the time when the solar system was just getting started.”

in the race to solve the DNA puzzle. Suddenly they saw themselves—and not entirely facetiously—in league with the immortal persuading Watson's enter for example, to spend a Saturday afternoon typing up their *Nature* report by convincing her that she would thus be participating in perhaps the most famous event in biology since Darwin's book.

Though he is seldom seen by the public, Crick has acquired in large part because of Watson's characterizations of him in his 1968 book *The Double Helix* a reputation as a brash, brilliant eccentric given to manic bursts of energy, raucous pools of laughter, loud and nipped speech, and an honesty of expression that some find abrasive and others taciturn. In fact, Watson recalled there were those at Cambridge who feared Crick. The quick manner in which he seized their facts and tried to reduce them to coherent patterns frequently made his friends' stomachs sink with the apprehension that all too often in the near future he would succeed and expose to the world the fuzziness of minds hidden from direct view by the considerable well-spoken manners of the Cambridge colleagues.

For their DNA work, Crick and Watson shared the 1962 Nobel Prize for Physiology and Medicine with physicist Maurice Wilkins. Since then, Crick has lectured and taught at numerous institutions, including Harvard University and the Rockefeller Institute. In 1966 Crick, who readily acknowledges his atheism, published *Of Molecules and Men* (University of Washington Press) an attack on "vitalism," which he has described as the belief that there is some special force directing the growth or the behavior of living systems which cannot be understood by our ordinary notions of physics and chemistry.

Today—modest, soft-spoken, decidedly taciturn, and by his own admission somewhat mellowed—Crick apologizes for the weightiness of his present title of Distinguished Research Professor at the Salk Institute for Biological Studies, in La Jolla, California. It was there, in Crick's office overlooking a bluff from which hang-gliders try the air above the Pacific Ocean, that science writer David Rivnik conducted this interview.

Gene: Few events in science have so captured the public imagination as the drama that attended your DNA work. The immunologist Sir Peter Medawar himself a Nobel Prize-winner, called your DNA work the greatest achievement of science in the twentieth century. Do you agree with him?

Crick: I've often told Peter I didn't think that was true, because I think there have been breakthroughs in physics that have been equally important, if not more important. If he had said in biology, there are people who would agree with him.

Gene: You were reported to be unhappy with James Watson's book *The Double Helix*, which begins with the famous line, "I have never seen Francis Crick in a modest

mood" in fact, I understand you once wrote him, telling him that his "view of history is found in the lower class of women's magazines." Do you still feel that way about the book, and how well do you get along with Watson these days?

Crick: We get along fine. I wasn't very keen on the book, mainly because I don't like personal publicity. I think one has to look at the book not really as history but as a fragment of James' autobiography. When you look at it that way it takes on a different complexion. As for my being irked—I think he meant exuberant. And if I've changed my mind about the book, it's because it did a better job than I expected of showing nonscientific people how a certain type of scientific research was done.

Gene: According to Maurice Wilkins, you were in what he called a very difficult position at the time you did the DNA work. You were already thirty-five, you had no secure job, and you were still working for your doctorate. Did those seem like particularly desperate times?

Crick: Curiously, no. Science, in those days, was expanding rapidly and there was always the feeling that if you couldn't get a job here, you'd get one there. If I were now in the sort of position I was in then, I would be much more anxious about my future. But in plain fact, we were enjoying our work so much back then we didn't worry in that way and the prize came by itself very much later. Now Jim implies in his book that he was thinking about the prize, but if he was, he kept it to himself.

Gene: Columbia University biochemist Erwin Chargaff, who was the first to discern and publish upon the equivalences of the DNA bases—an observation you and Watson built upon—once said of the two of you,

"In our day that such pygmies throw such giant shadows only shows how late in the day it has become." Chargaff has over the years made a number of wittily denigrating remarks about you and Watson. Did he feel ripped off?

Crick: Well, it's absolutely true that every time Erwin was at a meeting, there was a new joke at our expense. He did discover the base ratios, but he didn't go on to see what they implied. I think that he feels a little bitter that he missed it. He occasionally writes as if he did see it, but it's quite clear that he didn't.

Gene: In other words, he saw these equivalences, but he didn't realize they were structural.

Crick: That's right.

Gene: What about Pauling? Were you surprised that you beat him?

Crick: It was a surprise to us when he produced a structure that was obviously wrong. He made an elementary mistake in chemistry and put a hydrogen on a phosphate group. I distinctly remember taking the textbook off the shelf to see what the phosphate group was really like, because I don't know a lot of chemistry. And, of course, the irony of it was the text was by Linus Pauling. He also had bad luck in that

he didn't have good x-ray data.

Omni: Might Pauling have beaten you if he had applied himself to the DNA puzzle as vigorously as he had to some others?

Crick: I think that is very possible. I mean, Pauling was very good at this sort of thing. After all, what we did in tackling the structure of DNA was simply to copy the methods that Pauling had used in determining the alpha-helix structure of proteins.

Omni: You have said that from Pauling you learned "boldness" in scientific research. What did you mean?

Crick: When you start in science you are brainwashed into believing how careful you must be, and how difficult it is to discover things. There's something that might be called the "graduate student syndrome": graduate students hardly believe they can make a discovery. People like Pauling see things in a broader way. They are prepared to make assumptions and describe bits of the evidence and go ahead to solve the problem without having to have everything already in place.

Omni: Do you follow the new gene-splicing work and genetic engineering?

Crick: Not so much. Since I came to the Salk Institute five years ago, I have spent more and more of my time on neurobiology, learning about the brain, and much less of my time on molecular biology. All of this new work based on discoveries made after 1966 represents a second revolution in molecular biology.

Omni: Do you believe we might inadvertently create an Andromeda strain with this new recombinant techniques?

Crick: I think everybody agrees now that the dangers were exaggerated. And I think the scientists ought to have good makes for considering that the experiments might be dangerous. But what they didn't realize is that if they the scientists thought the work might be dangerous, the lay public would think it was much more dangerous. That's one lesson we have learned.

As far as we can see from attempts to make organisms under highly contained conditions, the dangers are extremely slight. I think you have to say, however, that any new technology introduced on a big scale is going to have consequences—either medical, social, or economic—and recombinant-DNA techniques will certainly have an impact just as computers or television have had.

Omni: In the past you've been supportive to some extent of the ideas of the late Dr. Hermann Muller, the Nobel Prize-winning geneticist who advocated "germinal choice"—a program that would encourage the combination of only the "best" human ovum and sperm cells. This idea was embraced not long ago by a group that claims to have among its sperm donors some Nobel laureates. What is your opinion of that project?

Crick: Well, I personally have not contributed, although the gentleman who runs the sperm bank to which you refer lives only a few miles away from here. I'm not so sure I

have such a high opinion of Nobel laureates that I want to see them as the fathers of the population. I do think, however, that some thought should be given to the question of who the parents of the next generation should be. I believe that this particular program, though I think it's not going to do any special harm, is only scratching the surface.

Omni: In the past you've in effect said that no newborn infant should be declared human before it has passed certain genetic tests: if it fails those tests, it should forfeit its right to live. Is that your position?

Crick: That's a slight exaggeration, the way you phrased it. It isn't that I strongly advocate that argument. I put it forward as something that people might think about because it has certain advantages in eliminating babies that are grossly unfi-

And, as you know, the medical profession in a quiet way does exactly that. I've come to realize that this is an issue about which people have very strong feelings. There would have to be a lot of change in public opinion in order for what I call "legal birth" to catch on. But it's the sort of idea that, in the long run, should be given attention. I think you have to take into consideration the feelings of the parents. The feelings of the baby at that stage don't really amount to anything.

Omni: Viewpoints like those have earned you the enmity of many religious people, some of whom clearly regard you as being on a par with the Antichrist. Even your new book, *Life itself*, has been characterized as an attack on religion. Miss Elizabeth of the American Museum of Natural History in New York City accuses you of being in-

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FRENCH ROBOTS

BY JASIA REICHARDT

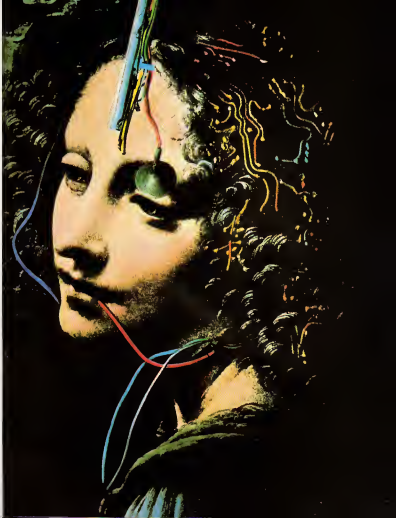
Imagine a robot unlike any now in existence—one with entirely new functions and capabilities. How might it look? This was the bold challenge set before Parisian students at the École Supérieure d'Arts Graphiques—Studio of Met de Penninghen and Jacques d'Amont. The professor in charge of the project, Roman Ondkewicz, asked third-year graphic-design pupils to conceive of a powerful, dexterous, intelligent machine that would have its own

priorities, different in every way from those of human beings. The students' creations could be anything: gastronomical robots, earth and sea robots, optimistic, religious, bloated, sexy, theatrical and punk robots. To open their minds to new possibilities, Ondkewicz encouraged his students to examine the error-free images of history. Leonardo da Vinci's diagrams from zoology and botany, science photography, architecture, and style. As these dai-



ing interpretations demonstrate: a robotic invention need not spring entirely from practical needs. It can also have the ephemeral life of a butterfly, the smartness of a fashion plate, or the irrationality of an alien monster. These designs are different from other conceptualizations of robots. By extending our vision beyond the metallic,

humanoid stereotypes that populate science fiction, they embody the essence of creativity. Through the eye of the artist, today's humble servants have been transformed into inventions of limitless potential—artificial beings whose full range of roles within society is no less varied and complex than that of their human creators. **CG**



INTERVIEW

CONTINUED FROM PAGE 77

sensitive in your treatment of religion. He claims that you are as dogmatic in your way as Jerry Falwell is in his, and that you want to make a religion of a god out of science. Do you care to comment?

Crick: I think what Eldredge means by insensitive is that I say what I think about religion. I don't think I really regard science as a religion. I wouldn't want to see it form an established church, with bishops, and have heresy hunts and do all the other things religions are apt to do. I feel that faith should be based on science. Frankly I'm not very happy having large numbers of people holding beliefs that I feel don't correspond to the facts. I think that's bound sooner or later to lead to conflicts of the sort we have seen erupt so often between people of differing religious views. Nor do I look with favor upon people who are trying to distort the teaching of biology for example in order to accommodate their religious beliefs.

Omn: Has the resurgence of the "religious right" alarmed you? And how do you feel about the politicization of religion?

Crick: I've been surprised and deep pointed. It is getting to the stage where it might be considered alarming.

Omn: Let's talk more about your book *Life*.

Itself. What prompted you to take up the idea that life was sent here by the improbability of another planet?

Crick: Well, the idea first arose at a meeting in Soviet Armenia in 1971 organized by the Russian and American academies of science on the fascinating topic of communicating with extraterrestrial intelligences. At that meeting we discussed the idea that the uniformity of the genetic code makes it look as if life went through a rather narrow bottleneck. In addition I came to realize that sufficient time had elapsed for life to have evolved twice—that is, a civilization capable of sending out rockets could already have come into existence at the time the solar system and the earth got going. Leslie Orgel [a biochemist at the Salk Institute] and I in collaboration came up with the idea of directed panspermia.

Omn: Wasn't your real interest in writing this book lie not so much in trying to sell people on the idea of directed panspermia as in demonstrating the mental exercises required to explore the circumstances that might make the theory both attractive and plausible—that is, to explore the fundamental aspects of life that relate to time and space, the general nature of life, the conditions that existed on the primitive earth, the physics of space travel and so on and so forth?

Crick: Yes, that certainly was what I was trying to put over. I wanted to show how you went

about judging the idea against the background of other knowledge we possess.

Omn: On the other hand, the theory is not at all preposterous as you seek to demonstrate. What are some of the things that make it attractive?

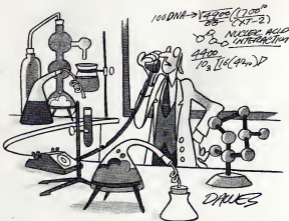
Crick: The easiest way to see that it's attractive is to realize that we might find ourselves doing the same thing a thousand or two thousand years from now seeding life in the same way.

Omn: So as you explain in the book, the apparent arbitrariness and astonishing uniformity of the genetic code and the various conditions that must have existed on the primitive earth—all of these things make it difficult to understand how life could have got started on its own. But aren't there alternatives other than directed panspermia? What about [British astronomer] Fred Hoyle's idea that life was seeded and perhaps still is being seeded throughout the cosmos by prebiotic molecular clouds that become biologically active?

Crick: I know of the idea, and I must say I regard it as very fanciful. It seems to me that such circumstances would make it even more difficult to get life going. And then the experimental data put forward to support the idea are extremely flimsy.

Omn: What about claims of finding microfossils in meteorites?

Crick: Well, you have to worry about whether the meteorites were infiltrated later



Nothing much. What's recombinant with you, Ed?

There really is no reliable evidence one way or the other.

Orin: At one point in your book you turn up by writing, "An honest man, armed with all the knowledge available to us now, could only side that, in some sense, the origin of life appears to be almost a miracle, so many are the conditions which would have had to be satisfied to get it going, by itself. Many religious people would partially agree with you."

Crick: Yes. Well, I rather regret having used the word miracle. I had my pencil poised to scratch out that word, but I thought, "What the hell!" Let's just say that all of these factors present us with a real problem.

Orin: Unless we imagine that life had been sent here by extraterrestrials, in which case the problems are of another order. How would galactic farmers go about getting their seeds to the target planets intact and still viable?

Crick: Generally in deference to the basic laws of physics, I rule out the possibility of space travel at, or exceeding, the speed of light. The journeys I talk about take thousands of years and employ rockets that travel at about one one-hundredth the speed of light. Speeds of that order appear feasible and would put thousands of stars that might have planets capable of supporting life within ten thousand years' reach of us. Either you have the rocket manned with people who can somehow survive all that time through successive generations—not my idea of the good life, by the way—or you need unmanned rockets carrying some other form of life, rockets sufficiently reliable that all the components will still work upon arrival. There are technical problems, but none, I should think, that couldn't be solved by us, for example within a few hundred years.

Orin: What form of life would these galactic Johnny Appleseeds send?

Crick: Before they'd even think of sending anything, they'd first have to believe that there were lots of places in the galaxy where life could flourish, but that sending life was rare and difficult. An event that, in fact, if it hadn't started in most of those places. Then we have to assume that they had some sort of missionary zeal, that they wanted to get life started in these otherwise sterile places. When you look at all of the options, it turns out that perhaps the most attractive one would be to send bacteria. They are small, and can be frozen for long periods of time, and can survive upon arrival under many adverse conditions that would kill more advanced life forms. And of course, they may have used gene-splicing techniques and the like to create bacterial forms best suited for the prebiotic conditions of the target planets.

Orin: If it were Earth they had in mind, instead of another sort of biosphere?

Crick: Well, they would then likely have sent bacteria, or possibly yeast. Yeast would have been tempting. It's a eukaryote—a cell with chromosomes, a true nucleus and so on. Yeast would have had the potential of

greater mobility, would have started things out at a more advanced stage of evolution, and so on. And yeast like bacteria, can survive without oxygen. The trouble is, the fossil records show no sign of eukaryotes until later. But perhaps it was sent, then discarded some of its fancier attributes in order to survive in the beginning.

Orin: On the other hand, you've suggested some reasons why advanced civilizations might decide not to seed the galactic backwoods. What are some of those reasons?

Crick: Well, technology, launching a major space program—all that sort of thing can become very costly and very tedious. People might simply get bored with technology after a while; they might turn completely inward, even become hedonistic.

Orin: Exploring inner space, perhaps with the use of new drugs, rather than outer space?

Crick: Yes. Of course they might also destroy themselves through war or accident.

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before they could get around to such an ambitious program.

Orin: Do you tend to be pessimistic about our own future?

Crick: I have mixed feelings. In the long term, I'm optimistic; in the short term, pessimistic. I think the next, say one hundred years will be rocky, but I doubt that even nuclear war would completely extinguish the human race.

Orin: There was a point you made in your book to which I think a lot of people would take exception. You suggested that meat eaters are more likely than vegetarians to pursue an aggressive space program.

Crick: I presume you are a vegetarian. Orin: An imperfect one. But, in fact, most people who avoid meat do so for health- and science-related reasons, not for religious or mystical reasons. I have a hunch space exploration has far more enthusiasts among science-minded vegetarians than among meat eaters.

Crick: I think I have to say that my remarks on this were a little dated, yes.

Orin: You took some notes in writing a book that even your wife says stinks of UFOs and Chariots of the Gods. Were you worried at

all about being misinterpreted or misunderstood?

Crick: Yes. I was mildly apprehensive in the beginning, when I first started lecturing on the subject. But then I saw that most people understood that I wasn't being fanciful about it—that it was in many ways an exercise, as we discussed earlier.

Orin: You have a few things to say about UFOs. You say even the unexplained sightings are probably without significance. Why do you feel that way?

Crick: Because when there is publicity about sightings that turn out to be explainable, the percentage of unexplained sightings goes up, suggesting that these, too, are caused by something in people's psychology rather than by something that is actually out there. The UFO evidence forms no coherent residue; it never gets better.

Orin: On the subject of extraterrestrial visitations, is it possible that directed panspermia might have been used for something less than purely altruistic reasons? For example, might it have been used to create oxygen environments on planets for later exploration?

Crick: People have wondered whether you could do that—seed the planet with bacteria of the sort that could make the environment such that, at a subsequent stage, higher organisms could come here. It's one version of directed panspermia.

Orin: Then there's the idea that life may have spread all over the universe, but for various reasons, is not apparent to us—that we may even be part of a cosmic wildlife park under constant surveillance by ecologically minded galactic game wardens.

Crick: Yes. That wasn't my idea, but it is also possible.

Orin: You have written that it may be dangerous for us not to know whether or not we are alone in the universe. Why dangerous?

Crick: There's always the possibility that we will be invaded. We'd like to know for scientific reasons, but there might also be reasons of defense.

Orin: So much science fiction assumes that any such visitation would be for our illumination and benefit; that it would be utterly benign.

Crick: I would be surprised if it were totally benign, whatever its nature.

Orin: You have pointed out that, whereas carbon compounds floating in water appears the most likely system for getting life started here, things might be quite different elsewhere in the universe. Silicon might replace carbon, for example, and liquid ammonia might replace water. What sort of life based on a silicon ammonia system, could we expect to see emerge on another planet?

Crick: People have made these suggestions, but no one has made what I would call detailed suggestions. Others have said that these things are not ideal—that ammonia, for example, is not as good a solvent as water and that silicates don't merge with other elements to form the right kind of

molecules as easily as carbon does, and so on. So I think all one can say is that those are possibilities, but they seem rather remote to me.

Geer: But would life from those other systems resemble us?

Crick: It wouldn't look like us, no. But I'm not so sure that it evolved from the present system somewhere else; it would look like us either. The assumption is that if life is going to evolve, it has to evolve by natural selection, because that is the only way you can get a complicated system started from simple chemistry and physics. What molecules might be utilized by life elsewhere in the universe is open to question. Certainly even if it were based on carbon, it doesn't have to be exactly the same type of proteins we have here.

Omni: You suggested indirectly that if the dinosaurs had been left undisturbed, they might eventually have developed science and technology. Is it safe to assume then that scientists do not necessarily have to be mammals?

Crick: No, I don't think they have to be mammals, but I have the funny feeling that the dinosaurs didn't look terribly promising. I was rather trying to suggest the opposite—that the dinosaurs might not have invented science and technology. But, you know that's really guesswork until we know more about just how evolution works, because even though we understand the principle of natural selection—a lot of the

detailed gadgetry—we still don't have a complete understanding of it. We hope to have all that within another generation. It's a little bit curious to have arguments about how something evolved when we don't know in complete detail yet how evolution works today. It's a nice logical to find out how evolution works, and then discuss how an organism evolved. Nobody is going to be as logical as that, however, because it's such fun discussing evolution.

Omni: Are you at all a fan of science fiction?

Crick: Fiction was science fiction not really. I know very little of science fiction. I don't know why. It's just never appealed to me. I tend to stick to Proust. Tolstoy, the classics, though I do dip into a few modern novels as well.

Omni: You have a wife and children, don't you?

Crick: Yes. I've been married twice. I have one son by my first wife and two daughters by my present wife.

Omni: You still go back to England to Cambridge?

Crick: I suffer from jet lag and don't like traveling the Atlantic. So we go just once a year now.

Omni: You've written that a modern scientist, if he is perceptive enough, often has the strange feeling that he must be living in another culture. What did you mean?

Crick: I was referring to *anthropocentric* versus *religious* views, *rational* versus—the fact that even among some educated people

there is hostility toward science. All of this in a sense makes one feel as if one were living in another culture. It can be as simple as going out to dinner, being exposed to a random selection of people, and finding that they do not look at the universe as you do. This is not to say that I insist that everyone agree with me on everything. I'm talking about utilizing the facts we have at hand in formulating a view as opposed to basing that view on faith, superstition, the supernatural, and so on.

Geer: Do you find this cultural discontinuity frustrating?

Crick: I used to find it extremely irritating. I'm afraid I'm becoming more tolerant as I get older—unless it's thrust down my throat. When I was younger and more brash, I would just tell people they were talking nonsense. Yes, I suppose I would prefer to be—I wouldn't say in a homogenous culture, that's too strong—in a culture in which the point of view of people like me was more or less held by the great majority of people.

Omni: What is the nature of your current research?

Crick: I'm interested now mainly in the brain, particularly the mammalian visual system.

Omni: Why the visual system?

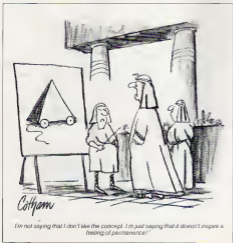
Crick: The brain is a challenge, and I guess I wanted to start somewhere. I'm interested both from the theoretical point of view—trying to work out, for example, what we do to analyze depth and just how it is that we see color—and also in terms of the neuroanatomy, the neurophysiology of vision. Some of this has been worked out in part in other animals. I'd like to see whether those data can be related at all to human vision. Since I don't have a lab of my own, I look at the work of others. My task is in part one of synthesizing things.

Omni: Have you published in this area?

Crick: So far only one paper with two colleagues—about the problem of how one can see in such fine detail in finer detail than one would imagine possible because even though the receptors in the eye are placed close together they are not as close as one would imagine they would have to be for some of the detailed vision that is possible. The idea we offered was that the message gets sampled and then reconstructed in the cortex; we suggested a process whereby that could take place.

Omni: In a sense, brain research is at that embryonic stage where there are still so many exciting possibilities for discovery, rather like the research in molecular biology thirty years ago.

Crick: Yes, I suppose that's part of the attraction. Certainly the subject is in a very primitive state. It's rather like looking at an organism and knowing there must be some instructions in there and not knowing how to unravel them because we still don't quite know what a gene is. With the brain we still don't know the concepts in any detail—the concepts of what things are needed for the brain to operate as it does. **CC**



I'm not saying that I don't like the concept. I'm just saying that it doesn't inspire a feeling of permanence!

AUDUBON

CONTINUED FROM PAGE 10

how do you suppose—

He flared angrily. This bird cannot be here. It can't be anywhere. The last whistling swan died in the Upper Miami Zoo in 2019.

I was wondering about the other one the killer with the hawkbody and the talons and the six-meter wingspan?

He continued brooding aloud. There were swans on the arks they sent up in the 'teens. But those were real-life ships, and even if one had been aimed this way it would take another five hundred or so hundred years to get here.

Did they put oversized hawks on those arks?

"That was not a hawk," he snapped.

A north hawk. Just as our friend here is a nonswan? With delicate plucking motions of her fingers in the air, Keava sketched the leaping shapes the creatures had left in her. But of course he could not read her gestures; any more than he could sense the birdfields.

He stood up brusquely, wobbling under the swan's ungainly weight. Let me get it to the lab and do some tests.

Keava opened the hatch and stood back to let him pass. The bird's limp neck dangled halfway from his arms to the floor. One

lustrous wing caught in the narrow hatchway then wagged free.

The two brightest regions in the lab were the overhead screen, which displayed anatomical cross sections of the whistling swan, *Olor columbianus*, and the glowing holoflux table, on which LaForest was examining his ungainly specimen. He poered up as she entered, his look of bewilderment replaced by one of pensive curiosity. His hands were stained with dried blood of the same rusty color as his beard and hair. How could an extinct Tiberian species turn up on Alon 17?

It's the same bird, and no mistake? she asked.

"Right down to the molecular level!" He wiped sweat from his forehead with a bloodied palm, leaving a rusty smear. A perfect whistling swan.

His beard still smelled like the muck of the seashore. She felt roused by that smell by his obstinacy, by the pale, queenly presence of the swan on the lab table. As she leaned over the bird, stroking its feathered rump, LaForest rushed toward the laboratory door.

Where are you going? she called.

To catch a live one!

Returning to the cove in their shuttle and exploring the meadows and thickets along the shore, they saw no more swans that day

but they found hundreds of other birds. The air was thick with song. Quick shapes darted in the shadows, furtive winging dully a fever of motion. LaForest fired his netgun at everything that flew past. After an hour of frenzied shooting, Keava persuaded him to call a truce.

On their way back to the ship, with the captured birds fluttering in mist cages, Keava watched the scanner for signs of the huge, midnight-bus marauder. When two hawkshapes appeared on the screen, diving swiftly at the shuttle, she threw the craft into an evasive roll. But the hawks were too quick, hammering into the shuttle while it was in mid-turn. The caged birds screamed. LaForest pounced in his harness while Keava fought the controls. There was a scabbling sound, talons raking metal. She fired a mid-voltage through the hull, but the hawks kept pounding. Wings beat against the cockpit window. She upped the voltage. A crested head loomed before her. A great hooked beak slammed into the window as if cracking an egg. Keava shot the maximum charge through the hull, and with a double ear-splitting shriek the hawks fled away. As she rescued the shuttle from its dive, she glanced at the scanner, which showed the hawks circling ominously overhead.

The birds cowered in their cages. LaForest gasped for air.

Center yourself! Keava directed while

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punching coordinates into the warping panel. Ordinarily she would not risk using warp transfer on-planet, but she wanted to get back to the ship before those beasts recovered from the shock. Because passage through warp involved an abrupt dislocation in space, an instantaneous leap from one space node to another like a short circuit. It put a great strain on the mind. Unreasoning beliefs, such as the cargo of birds, could pass through unscathed, but among humans, only those disciplined by months of meditation and neurotreatments could withstand the disintegrating forces. "Carter," she said again, more sternly.

LaForest instantly grew calm. Keeva conjured up her centering mandala and thumbed the button. An instant later they emerged from the warp a few meters above the ship.

"You all right?" she said. The birds were emitting light peeps.

When he recovered his breath, he muttered, "Now I know how the swans felt."

While Keeva watched, LaForest mounted each of the specimens on the holotax table, which projected the bird's structure on the overhead screen. Meanwhile the cyber searched its inventory of life forms to see whether the specimen resembled any known organisms, much as Keeva surveyed her own inventory of biotopments whenever she encountered a new creature. Again and again the cyber discovered an exact match between these birds and Teran originals: ivory-bellied woodpecker, passenger pigeon, saw-whet, owl, orchard oriole, twenty-three in all, in addition to the whistling swan.

LaForest gently placed the last of the birds in a mist cage. Bending near the mesh, he made cooing noises and looked in Keeva's opinion more like a doting father bird than a biologist. The laboratory bench was adazzled with flutings and whistling as each bird tested the invisible mesh of its cage.

"Sonow we have two mysteries," he said. "How they got here and—what?"

Why they're all species that are extinct on Earth.

She contemplated the regiment of birds, their wings beating happily against the mist cages, like a fluttered rainbow. "All of them?"

He nodded grimly. "Vanished."

"How long ago?"

"Most of them since 2000. A few earlier." She bent over the little trilling blue creature that LaForest had identified as an indigo bunting. It was like a force scrup from the enormous predator that had killed the swan. "This one used to live on Earth?"

"Until about 2010."

"And this one?" she asked, pointing to a red-capped bird with needle beak, which he had called a downy woodpecker.

"The last one of those was sighted in Alaska about 2024, just before Enclosure."

She imagined the whole bench emptied of its colorful burden. Who, seeing this

beauty, could bear to have it erased from the universe? Had her ancestor ever imagined it like, concretely—a roomful of the shapes banished forever?

Of course. LaForest mused, our sample may be skewed. We may have stumbled onto the only pocket of birds on the planet. Or there may be hundreds of species and the others may not resemble Earth species. He smoothed his beard nervously, fingers to one side of his chin thumb to the other. We've got to find out how they blundered into shapes identical to Teran models.

"Life doesn't blunder," she said. "Your whistling swan might have evolved here by some astronomical chance. But what of the twenty-three others?"

What are you suggesting? Some galactic ornithologist collected them on Earth and planted them here?

"I don't know," she said defensively. "It's just a feeling the birds give me, some idea that's common to all of them, every spe-

● *The air was thick with song. Quick shapes darted in the shadows, furtive, winging dizzily, a fever of motion. LaForest fired his netgun at everything that flew past.* ●

cies. Like an overtone that I can't define. Can you be more precise?"

It's something familiar, something I've felt before—

"On Earth? With Teran birds?"

No, no. Somewhere else, or between. Eyes shut, skimming on the fields of life energy radiating from the caged birds, she tried to name that familiar overtone of feeling.

For the next five days they were not bothered by the anonymous birds of prey. They often sped the blue hunters looting down near the carbon or spraying high overhead. Every time she gazed up into the sky, Keeva nursed herself for a glimpse of that vast silhouette, prepared to feel the blast of its hunger.

Everywhere on the planet, the two oecologists found bizarre vegetation, looping colonies of airbugs, sizzling legless ground bleats, phosphorescent water skimmers, none of which even faintly resembled anything Teran. And everywhere they found birds. The remarkable ones they netted, but most they merely scanned with the holotax, for the ship was soon crowded

with chattering specimens in mist cages, and the holotax provided all the essential measurements for the cyber.

Even the most improbable of the captured birds—ones with tails like hatchets, wattles brighter than alarm lights, tails like scissors, leathers in more than twenty colors than a clown's wardrobe—even these proved to be identical with Teran species. And in every case the species was extinct on Earth: whooping cranes, condors, emus, three varieties of eagle, nine owls, a batch of hummingbirds, stork-legged waders, bald scavengers. Keeva, who often regretted having been born into the age of the Enclosure, a barren time for her planet, could not imagine that Earth had ever held such a flying circus.

On the sixth day, waiting in the shuttle for LaForest to emerge from a nearby canyon, Keeva received a breathless call.

"One of our raptors is crashing overhead," he said anxiously. "It looks like it's measuring me for supper."

"Can't you get to cover?" she asked.

"I'm in a dry quitch. Sheer walls all directions but one."

"Seight. I'm on my way!"

The hawk was still weaving about overhead when she landed the shuttle next to LaForest. It circled lazily, wings hanging motionless for long spells, then flapping languidly its great crested head swiveling. The spiraling flight left a burning afterimage in her mind, like a coal of soothing business. Whatever it was, it ruled these skies. With her eyes closed, Keeva felt the incoming waves of hunger.

Dustily from boots to collar, netted birds slung over one shoulder, netgun tilted over the other, LaForest was soon climbing into the shuttle, peering at the while about the hawk and the new birds he had discovered. He was like a child in a joy park, dazzled by the profusion of wonders.

"I've got to get that bird!" he cried.

"I think we're better off leaving it alone."

While they spoke, the hawk swooped sharply, gave several powerful beats of its wings, and climbed rapidly.

Tracking it through the dome of the cockpit with his scanner, LaForest said excitedly, "Chase it! Get me close enough to put a net on it!"

"This is crazy!"

"Go, go, Get it!" He was straining against his harness, almost shouting.

Reluctantly Keeva drew the guide helmet onto her head. The predator's cavernous hunger drowned out all other sensations. She stared upward at the soaring blue shadow, reading her visual field through the helmet. The shuttle roared around to aim at the hunter. Finger passed on the throttle, she warned. Hold on.

The shuttle rose swiftly. Immediately ahead the shadow loomed larger and larger. The feathers on its wings played like fingers, stroking the air as the murderous head shifted round to eye this intruder.

"Catch it! Catch it!"

Keeva fixed her eyes on the smoky

hawkshape. The beast's hunger was so powerful she could not block it. Suddenly the hawk banked, drew in its wings, and plunged toward the canyon. She watched it steadily, and the shuttle rode the beam of her sight, diving with giddy speed. The bird pulled out of its dive a few meters above the canyon floor, leveled out, cruised between the canyon's eroded walls. Keewa followed, not daring to blink, afraid to lose sight of her prey. The canyon walls hurtled by a blur of browns. The beast rapidly banked again, up a side canyon, and with a stomach-sickening lurch the shuttle darted after. Another swerve, another hurtling down narrower and narrower gulches, the bird's wings nearly raking the walls, the shuttle trembling through the abrupt turns. Keewa was scarcely breathing. The hunt possessed her. Hunter Hunted. Bluff leveled up straight ahead, blue wings tilted, the bird climbed swiftly, the shuttle just cleared the stone rim, wallowed dizzily, flipped belly up into open air. In the few seconds it took the craft to right itself, the hawk vanished into one of the neighboring canyons.

Holding back on the throttle, Keewa searched madly to catch sight of it. She wanted to chase down that ravenous beast, pounce on it.

Beside her in the cockpit, LaForest wheezed faintly. Enough.

It can't have gone far.

No, please. I've let it go.

She forced her gaze away from the landscape of canyons toward her mate. His face was pale, the skin drawn tight. Evidently he had come as close to that bird weapon—or to death—as he cared to. I never saw you quite like that before, he said. So I don't know. I'm used to bloodlust.

She released a deep breath, venting some of the pressure that had built up in her during the chase. I never felt quite like that before. She removed the guide helmet, shook her hair to erase the helmet imprint. I guess I was just missing the beast's hunger. It's awesome. Couldn't screen it out. Hunger enough for a hundred creatures that size.

The cyber identified the creature as *Ambystoma incredibile*, a huge, soaring bird of prey that had flourished in North America during the Pleistocene Epoch.

Incredibile was about right. Keewa thought, as she roamed among the cages, feeding and watering the birds. The air was thick with trilling. The flood of sensations in the cramped room made her faintly dizzy. Yet above that roar played a familiar overtones, like the melody of a song she could not quite remember.

As LaForest punched buttons, analyzing scans of the raptor, his elbows jostled nearby cages.

Geoturing at the skeletal view which glimmered on the overhead screen, Keewa said, I wonder how many of those brutes there are.

Let's just see. He fed into the global

MEN WORKING

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scanner information on the bird's wing-span, flight pattern, thermal features, even parameters to distinguish T-vireonids from every other flying organism.

The scanner's findings appeared as an array of dots on the illuminated model of Aton-17, each dot marking the position of a bird. As the pattern unfolded, Keeva's breathing grew shallower. Strings of dots encircled the globe, sweeping along coasts and mountain ranges, all converging like the strands of a web on the canyon region of Continent Three. "There are *thou* sands," she said.

LaForest scratched his beard. "Why the devil do you think they're congregating?"

She imagined that awesome gathering the hawks devouring everything in their path as they swept on toward the canyons. "Maybe we stirred them up, and they're swimming like bees when you disturb their nest."

Fingering the spot on the globe where all the lines converged, he said, "Let's move the ship over there and see whether we're the provocation."

Keeva did not object. If she had craved safety, she would never have studied exo-biology; never have left the Enclosure. The transfer was quickly made, and the ship materialized near the lip of the canyon where LaForest had been working earlier. Dozens of hawk-shapes spiraled overhead, casting great patches of shadow on the dry land. More glided over the horizon, arriving

from all points of the compass. By nightfall several hundred lethal silhouettes whirled in that spiral.

Next day LaForest and Keeva stayed aboard ship to observe T-vireonids. He inscribed all the data they had collected so far onto a warp cylinder for transfer back to Earth, and she kept watch through the domed roof. All day the sky thickened as flight upon flight of birds arrived. She had expected to be overwhelmed by their collective hunger. But instead she sensed a gentler craving. "What did they hunger for now?"

LaForest, do you think it's wise to pipe back all those data when we have any idea what it means? What's the Council going to think when they read that the dominant biotopes on Aton-17 are all extinct T-avian birds?"

"They'll probably think I want to see birds so badly that I'm conjuring them out of thin air," he admitted.

Could you hold up the report and give me a while to play out a hunch? Keeva was running a finger along the seams of her shimmersuit, sealing them.

He turned abruptly toward her, bumping one of the suspended cages, which set the whole cluster to swaying. The lab shrank with dozens of alarm calls. "What's your hunch?" he yelled above the din.

She waited for quiet, then said, "You know that extraordinary hunger I picked up

from the hawks? It isn't coming through anymore."

"So they've gorged themselves." Exactly just like birds before they migrate. And they're milling around, charging themselves up for some move.

He gazed up at the funnel of gliding birds. "What sort of move?"

"That's what I'm going outside to get a fix on." Before he could object, she slipped through a hatch. Without the ship's hull to interfere, she received the full force of the hawks' energy. Tires welled in her eyes.

In a moment the hatch swung open behind her, and LaForest's shaggy head emerged. "This is crazy. Come back."

I'm right! She waved feebly at him.

Any one of them is big enough to carry you away.

They're not interested in me.

Keeva pteased.

Leave me alone! she belowed.

After a brief pause the hatch clicked and she was alone. Standing on the canyon's rim, with thousands of hawks winging in light blue circles overhead, Keeva felt as if she were nesting in the eye of a cyclone. The birds seemed to be gathering energy, winding their collective spring. For what? She glanced skeptically at the ship. It looked flat, like an exposed egg, with murderous shadows swarming over its shell. How presumptuous for Earth to fling these bubbles into space!

Some time later LaForest's head again emerged from the hatch. "They're all here," he shouted to her. The scanner shows every single one on the planet has come to the party, wherever it is.

Keeva pressed a palm against each temple and tried to keep a fix on the looming shapes.

She sat on the canyon's lip, her feet dangling over the dizzy gulf below her. Her mind intent on the tornado of birds above. They circled and circled, building power like a feathered dynamo. Their yearning swirled in her, seared through the afternoon, swept her mind clean of every other sensation. As night fell, the deadly forms overhead grew vague, but their cawing grew sharper, a piercing agony, and suddenly she recognized the shape of their desire.

She screamed a fierce scream of longing. An instant later the sky was empty.

Even with her eyes shut, Keeva realized from the melody of feeling that she was lying in the lab, surrounded by the caged birds. When her eyes blinked open, she discovered his anxious face peering down at her.

"I thought they'd snatched you away," LaForest said with a tense smile.

No danger of that, she replied. They were too intent on traveling.

Traveling where?

To Earth." Keeva sat up with a groan. That's why I screamed. Just before they took off, what they were longing for came into focus—the image of Earth—and suddenly it was my longing I couldn't stand it."



"Lie down another minute," he said. He was gripping her shoulder gently. "Give your head a chance to clear."

It is clear," she protested. "Everything makes sense."

But his gentle pressure forced her down onto her back. She did not really mind. There would be time to explain. And for now she was exhausted. The memory of that blue cyclone still whirled in her

Birds can't fly sixty-four light-years through vacuum. Not even birds with six-meter wingspans. LaForest said patiently.

Keewa was unwrapping herself from the blankets in which he had bundled her the night before. She felt restored, except for the aching sense of loss that the departure of the blue hunters had left in her. They didn't fly.

"They walked?" he asked.

"They warped."

She sat up with the blankets still cradled about her shoulders, hair askew. The midwoman in the morning, she thought wryly. LaForest was studying her cautiously.

"We're talking about birds, sweetheart, not spacelines," he said.

"Look, I can't help it if those creatures went through warp. They just did. I saw where they were going. I felt them slip through the passage. I've passed through too many times myself to mistake the feeling. And every bird in here," she said, gesturing at the rows of twinning cages, "gives off some faint trace of the warp passage. It's in them, in their memory or their genes woven into them. That's the feeling. I've been trying to identify since we netted our swan. They've all been through the warp themselves or their ancestors."

She could see that he was divided between trusting and doubting her. Years of collaboration had convinced him that her intuitions were reliable, but his reason balked. Who could have taught birds how to pass through warp?

"Who taught them how to fly?"

It took us millions of years of evolution to discover the principles of space transfer.

And it took us just about that long to figure out how to fly," she observed. "We still don't understand half of what goes on in migration. We can't navigate as well as a homing pigeon."

He wavered. A painful sense of his belated wisdom washed over her. Birds can't warp," he maintained.

"I tell you they did. I don't know how or why, but they did."

His mouth opened, exactly as it had when he first spied the whirling swans blazing like white fire above the ocean. She knew he was toying with the idea, turning over and over the insight that she had given him, to see what it might yield. His reason playing with her intuitions.

Suppose they can pass through warp.

"Yes, yes," he said with mounting excitement. "Suppose the ancestors of all these birds travelled here from Earth. That could be why they're extinct back home

because they all fed here." He began pacing among the rows of bird cages, prompting a chorus of whistles. "Maybe old Audubon wasn't so domineering after all."

Audubon?

Just this morning, while you slept. I was reading in Audubon's *Luxurio Journal*, the one he wrote in his last years, when everybody thought he was senile. Where is it? Here. Listen. Extinction of species has ever mystified the naturalist. As for birds, perhaps those which vanish are mainly slaughtered. Perhaps the earth, turning hostile, has extinguished them with ice or fire. Or perhaps when sorely pressed by men or circumstances, birds undertake a grand migration to the moon or farther planets. You see why people thought he was crazy?

"Crazy like Hamlet," she said, "only north by northwest and sane in every other direction."

LaForest stopped dead still among the birds. A parrot thrust its enameled bill through the meshes of its cage and took a nap at his shoulder. In a tannetive voice, he said, "If Audubon's right and some prevarication on Earth drove these birds out here—every species with its own level of tolerance, so that different ones abandoned Earth at different times—do you suppose we could have provoked the return migration of T. incandescens by challenging its dominion over Alton?"

Keewa hugged the blankets about her knees. She gazed at the brilliant cages. You mean we could drive all this beautiful back home?

No, we mustn't," he said quickly, and then he caught himself. "Even assuming it's possible, all this interplanetary brightlight."

We'll have to leave, won't we? We can't risk triggering any more migrations. Are you going to say anything about it when you warp back these data?

I transferred the cylinder an hour ago," he said. "Was Controls already has warped a reply, but I haven't looked at it."

Curious what the earthbound scientists would think about this news of whirling swans and pileated woodpeckers, Keewa moved to the console. She touched the display control and a message appeared.

LAFOREST

VERY FUNNY DELIVERY WERE YOU SAM PLING ACH-Y'S SLUSH-ROOMS WHEN YOU MADE THAT REPORT? NOW PLEASE SEND ACTUAL DATA OR PREPARE FOR RETURN. SPREADING OF BIRDS' NERVOUS SWIMON LOST G-BAND TRANSMISSION THIS A M SENT DROVE OUTSIDE TO CHECK AND IT CAME BACK LOADED DOWN WITH THE BODY OF A FLYING MONSTER GREAT BLUE THING. JERARON SCHWENIT BREAKS IT'S A BIRD THAT DIED OUT IN PLEISTOCENE. YES, SANTI VIVAR.

LaForest reached out for her hand, like a man surprised in his sleep while groping for a light switch. "So they really are going home," he suggested.

"Home," she agreed. "I wonder what they'll think of Earth."

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•He raked me with
beams of hatred as strong as
the flash of the
craft supposedly seen by Travis •

ANTI MATTER

Take one haunted young man, a ruthless cowboy, an eccentric professor and a hard-drinking psychiatrist. Throw them together with a bunch of sensation-seeking reporters in the desert heat. Add a spaceship manned by little men with fishbowl heads, and you have the makings of a B movie.

But in November 1975 this situation was real, and it turned into that celebrated piece of UFO lore known as the "Travis Walton case." I was part of this lunacy, and it left me with the whimsical realization that when it comes to bag-bucks

ufology, proof is the last thing anyone cares about.

According to six witnesses, Travis, a twenty-two-year-old forestry worker, had disappeared in the Arizona woods running toward the blinding light of a flying saucer. I was one of a team of reporters from the *National Enquirer* sent to intercept Travis after he reappeared five days later claiming to have been abducted by aliens. Our task: to win the confidence of Travis's cowboy-dole brother.

The cowboy was one of the meanest, toughest-looking men I've ever seen—a rodeo pro, a light heavyweight fighter, Tebort packed with muscle, eyes full of nails, tense, unpredictable. The first time I met him, he leaned against a pickup truck and talked me with beams of cunning and hatred as strong as the flash from the spacecraft that supposedly had terrified his younger brother.

But it turned out that the cowboy could be bought. When he found out the *Enquirer* would offer thousands of dollars to anyone who could prove that aliens had visited our



UFO UPDATE

marshrooms. But the euphonia vanished when we brought in the state's top polygraph operator, who, after questioning young Travis, said it was the plainest case of lying he had ever heard. "I'll never forget the bug-eyed cowboy's screams of rage: 'I'll kill the son of a bitch!'"

Then a psychiatrist flew in from Colorado. He looked himself in a room with Travis, the cowboy and a bottle of cognac. When the three staggered out hours later, he had the story: Travis had been acting out a childhood fantasy nurtured since his father, a UFO cultist, had left him.

As they departed, the cowboy promised that his sick brother would get the care and rest he needed. But as I neared the airport, my radio was broadcasting their amazing tale of an encounter with aliens.

I asked my editors at the *Enquirer* to kill the story of Travis and his coneheads as a warped prank. But a few weeks later it appeared on the front page. And another space hero was born —JEFF WELLS

planet, he agreed to hide out with Travis in our motel room.

A professor we got to come from Berkeley, California, would put Travis under hypnosis. Travis was mute, pale, twitching like a cornered animal. But the professor was cooing: "You are not alone. There are many people more than you could even imagine, who have been chosen to meet them."

Then? We began to worry about the professor.

With history and an offer of \$10,000 at stake, Travis spun a yapping yarn of extraterrestrials with skin that looked like

HAITIAN ZOMBIES

Late-night television is the only place you are likely to see a zombie, one of those mythical human creatures said to have risen from the dead. But now it appears there may be some truth in the legend.

"I am absolutely convinced that zombies exist," says Lamarque Douyon, a physician who has spent the past 20 years attempting to debunk voodoo and related phenomena. "I have seen them for myself." Douyon, chief of psychiatry for the government of Haiti, has examined three zombies, two of whom are still under study at his Port-au-Prince clinic.

What we have here are cases of flesh-and-blood individuals who have succumbed to a state of apparent death brought on by drugs, Douyon explains. "The people are pronounced dead and are publicly

buried, then exhumed and reanimated by the voodoo sorcerers who administered the drugs in the first place. The sorcerers, according to Douyon, are able to enslave most of these zombies for the remainder of their lives by adding minute quantities of the poison to their daily food. On occasion, however, some of them manage to escape.

Although the exact nature of the poison is unknown, Douyon suspects it may be derived from flowers of the genus *Datura*. He has already injected a liquid concoction made from the flower into mice and dogs and has documented a remarkable motor slowdown in their vital signs. This is followed by a comatose state, which lasts anywhere from three to six hours, depending on the dosage administered, after which the experimental animals recover fully.

We still don't have all the

answers. "Douyon laments "but we're trying to unravel this mystery." Mystery or not, the bizarre phenomenon appears to be quite common in Haiti. Indeed, the country's penal code states that turning someone into a zombie is tantamount to murder.

—Pablo F. Fenjua

"He attracted some attention when he found the fourth dimension but he ain't got rhythm. So no one's with him, the loveless man in town."

—Blake Holiday

PHANTOM ANIMALS

If you see kangaroos hopping down your street every so often, you may be crazy. Or you may be witnessing a little-understood scientific anomaly known as animal teleportation.

According to Loren Coleman, of Boston, reports of animals mysteriously "teleported" from one location to another have been increasing for years. In 1980, for example, kangaroos were sighted in North Carolina, Oklahoma, and Utah. A penguin was found on the sand in Monmouth Beach, New Jersey. And several Florida residents said they saw six-foot-long Nile monitor lizards, native to Africa.

"The rational scientist would suggest that these were grown-up lizards brought into the States as babies," Coleman says. "But it's not that simple. There's a random pattern to these things, sometimes these

animals literally come out of the blue."

Coleman, a school administrator and psychiatric social worker, has been studying teleported animals for 22 years. In that time, he says, he's tried to track down hundreds of mysterious animals through conversations with



game wardens, police, and ordinary people. Usually, he admits, the animals' appearance can be accounted for. But 20 percent of the cases have remained total enigmas.

"No one has ever explained the mechanism for teleportation," Coleman notes. "Most of these animals have never even been caught. That's why we call them phantoms."

—Pamela Weintraub

"Our papers are filled with puffs of quackery and every man who can scribble a few experiments to a class of young ladies is called a man of science."

—Joseph Henry, secretary of the Smithsonian Institution in the

1870s





SUPER PAPER

Relax, this is not Super Paper. But if it were, you could be influenced against your will.

On the surface, Super Paper looks like plain white paper. But imprinted on it is a web of invisible suggestions that work subliminally on a person's unconscious mind. If you had to invite someone you hated to a party, you could print your invitation on Super Paper Type 2, which has hidden suggestions like *No! Don't Come!* Or if you wanted to see someone special, you could extend your invitation on Super Paper Type 1—*No!* OK?

How are the suggestions hidden? According to Super Paper inventor Derek Best of Daytona Beach, Florida, the pattern of a woven finish is printed on plain paper with dark ink. Then words and phrases are printed over the dark ink in a lighter shade. The messages, written with

letters about half an inch high, easily blend into the mesh of the fabric finish.

According to Best, the process works. His own career as a free-lance magazine writer, for example, has picked up significantly since he started writing to editors on Super Paper. "If you I make you jump up and act like a zombie," he says. "But it is persuasive."

Best now manufactures 11 types of Super Paper, including sheets that encourage people to buy a product, pay a debt, fall in love, or visit a friend. He has also developed adult Super Paper—with brand names such as French Lace and Black Leather—that contain mature suggestions. And he does custom orders.

—Peter Rondonio

*"When you have eliminated the impossible, whatever remains, however improbable, must be the truth."
—Sherlock Holmes, in The Sign of the Four*

HAUNTED PERSONALITIES

Haunted houses come into existence through the power of the human mind, says D. Scott Rogo, a Los Angeles researcher who's written several books on the subject. According to him, the personality of the main witness in many haunted houses is "basically hysterical, internalized, and either repressed. The repressed hostility erupts in a haunting somewhat the way a kettle gives off steam," he says, and the result is mysterious soundings. Flying objects spontaneously ignited flames, even manlike ghosts.

Sometimes an act of violence, such as a murder, will set up the psychic conditions that provoke strange sounds and visions. Rogo asserts: "When you talk to people in haunted houses, you often find there is a history of trauma in their lives. There do seem to be haunting-prone individuals."

Rogo, thirty-one, says that he lived in a haunted house in Los Angeles in the early 1970s. I began to realize

that you could feel when something was going to happen," he explains. "The house would act up and then die down for a few months. There were a lot of things I would previously have considered fantastical, but I knew they were real when I experienced them firsthand."

Rogo says his latest research indicates that inner human conflicts may account also for UFO abductions and putative apparitions. People who see bleeding statures, he remarks, have probably led traumatic lives. —Dave McNary

*"Science is a lot of guys in tweed suits cutting up frogs on foundation grants."
—Woody Allen*





DRACULA REVISITED

You might take the precaution of pecking a cross, a wooden stake, and some garlic for your vacation this year if you are going to be among the tourists joining a pilgrimage to Transylvania.

This annual tour, organized by the Dracula Society of Upper Upton, England, is a two-week, 1,000-mile journey that starts in Bucharest, where the sadistic real-life Prince Dracula ruled during the 15th century. The expedition later weaves through northern Transylvania, tracing the route of Jonathan Harker, the character who encountered Count Dracula in Bram Stoker's famous novel.

Bruce Wightman, tour leader and chairman of the Dracula Society, claims his intention is not to frighten people with the anticipation of encounters with blood-sucking vampires. Instead,

he wants his tourists to enjoy the trip on a romantic, scholarly, or humorous level. No one on the tour has ever been attacked by a vampire, Wightman adds, although one group was thoroughly unnerved by some mud-throwing Gypsies, who objected to being photographed.

This year, Wightman says there will be a special tour for Americans only.

—Margaret Sacha

DEMONS OF BROOKFIELD

It's the stuff of Hollywood movies: Anne Johnson, nineteen, abducted and killed his friend Alan Bono, forty, on February 16, 1981, in Brookfield, Connecticut. He claims the devil made him do it. In fact, not one devil, but 42.

Before the killing, Johnson was living in the same house as twelve-year-old David Glutznig, his fiancé's

brother. Johnson's lawyer Martin Minella says that David was possessed by demons. So Johnson offered to help an exorcist, Father James Dennis, of Brookfield's St. Joseph's Church drive them away.

During the exorcism, Minella alleges, a devil tried to choke the twelve-year-old to death, and Johnson screamed, "Take me out!" The result: Forty-two devils entered his body and compelled him to kill Bono.

At the trial, however, Superior Court Judge Robert Callahan would not allow the jurors to hear the testimony of priests, doctors, and psychiatrists who made the claim that Johnson was diabolically possessed. Johnson was found guilty of manslaughter.

There is a good chance the whole episode may end up as a film after all. Ron Foster of the William Morris Agency in New York City has the literary rights to the story. Berkley Books is already coming out with a paperback, and movie deals are in the works. —Peter Randione

KILLER COMET

Fasten your seatbelts: Swift-Tuttle, a comet first sighted in 1862, might crash to Earth this summer.

Though the likelihood of a crash is extremely small—about 1 in 2 million—the approaching comet has generated some anxiety among astronomers. According to John Borio, amateur astronomer and author of a comet column in *Sky and Telescope*, a collision with Swift-Tuttle would be the worst disaster in Earth's history. Should it land on the ground, he says, it could burrow a crater 13 miles wide and wreak total destruction for almost 200 miles.

Were the comet to fall into the ocean, it might obliterate the human race. The white-hot comet and the sea would raise a cloud of steam large enough to cover the Northern Hemisphere—for how long, no one can tell.

Still, Bryan Marston, an astronomer at the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts, who has written a paper on the comet, is "not worried." According to his calculations, Swift-Tuttle can hit the earth only if it reaches the vicinity of our sun precisely on August 12, 1992, and the chance of that is remote. And even if it does arrive on August 12, it's still likely to miss the earth by 1 million miles.

—John H. Ingersoll

"You're living in your own private Idaho."

—The B-52s



BELL-SHAPED CURVE

CONTINUED FROM PAGE 24

break out in the Circus Maecenas where it adjoined the Palatine and Caelian hills, and they took care to situate themselves safely atop the Aventine, where they had a fine view. There they watched the fierce blaze sweeping through the Circus, climbing the hills, dipping to ravage the lower ground. No one seemed to be fighting the fire—indeed Reichenbach thought he could detect subsidiary fires flaring up in outlying districts, as if arson were the sport of the hour, and soon those fires joined with the main one. The sky rained black soot, the stifling summer air was thick and almost impossible to breathe. For the first two days the destruction had a kind of fascinating beauty as temples and mansions and arcades melted away, the Rome of centuries being untried before their eyes. But then the discomfort, the danger, the monotony began to pall. Shall we go? he asked.

Well, Isabet replied. The conflagration seemed to have an almost sexual impact on her. She glistened with sweat, she trembled with some strange joy as the flames leaped from district to district. She could not get enough. And she clung to him in tight, feverish embrace. Not yet, she murmured, not so soon. I want to see the Emperor.

Yes. And here was Nero now, returning to

town from holiday in grand procession he crossed the charred city descending from the latter now and then to inspect some ruined shrine or palace. They caught a glimpse of him as he entered the Gardens of Maecenas—thick-necked, paunchy spende-shanked, foul of complexion. Oh, look, Isabet whispered. He's beautiful! But where's the fiddle? The Emperor carried no fiddle, but he was grotesquely garbed in some kind of theatrical costume, and his cheeks were daubed with paint. He waved and lunged coins to the crowd and ascended the garden tower. For a better view, no doubt. Isabet pressed herself close to Reichenbach. My throat is on fire, she said. My lungs are choked with ash. Take me to London. Show me Shakespeare.

There was smoke in the dark Chalcopside alhousa, too, thick, sweet smoke curling up from spattering logs on a denik February day. They sat in a cobwebbed corner playing word games while they waited for the actors to arrive. She was quick and clever, just as clever as he. Reichenbach took joy in that. He loved her for her agility and strength of soul. Not many could be carrying off his tour, he told her. Only special ones like us.

She grinned. We who occupy the far side of the bell-shaped curve.

Yes. Yes. It's a jumble of us to have such good opinions of ourselves, isn't it?

"Probably. But they're well-earned, my dear."

He covered her head with his, and squeezed, and she squeezed back. Reichenbach had never known anyone like her. Deeper and deeper she was drawing him, and his delight was tempered only by the knowledge that when they returned to real-time, to that real world beyond the terminator where all paradoxes canceled out and the delicious freedoms of the jaunter did not apply, he must of necessity lose her. But there was no hurry about returning.

Voices now laughter, shouts, a company of men entering the tavern, actors, poets, parricide, Bursage maybes, Hemlock, Alfen, Cordell, Kemp, Ben Jonson possibly and who was that slender high forehead, those eyes like lamps in the dark? Who else could it be? Plainly Shagspeare, Chapsper Shackspeare, however they spelled it. Surely Sweet Will here among these men calling for sack and malmsey, and behind that broad forehead Hamlet and Mercutio must be tearing Othello, Holapuz, Prospero, Macbeth. The sight of him excited Reichenbach as Nero had excited Isabet. He inclined his head, hoping to hear scraps of dazzling table talk, some bit of new-born verse, some talk of a play taking form, but at the distance everything blurred. I have to go to him, Reichenbach muttered.

The regulations—

Ja me fous the regulations. I'll be quick. People of our kind don't need to worry about the regulations. I promise you. I'll be quick.

She winked and blew him a kiss. She looked gorgeously slutish in her low-fronted gown.

Reichenbach felt a strange quivering in his calves as he crossed the straw strewn floor to the far-off crowded table.

Master Shakespeare! he cried.

Heads turned. Cold eyes glared out of silent faces. Reichenbach forced himself to be bold. From his purse he took two thin crude shilling pieces and put them in front of Shakespeare. I would stand you a flagon or two of the best sack, he said loudly in the name of good Sir John.

Sir John? said Shakespeare, blank-faced. He frowned and shook his head. Sir John Woodcocks, d'ye mean? Sir John Holcombe? I know not your Sir John, fellow.

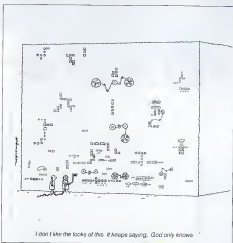
Reichenbach's cheeks blazed. He felt like a fool.

A burly man beside Shakespeare said, with a rough nudge. Methinks he speaks of Falstaff, Will. Eh? You recall your Falstaff?

Yes, Reichenbach said. In truth I mean no other.

Falstaff! Shakespeare said in a distant way. He looked displeased, uncomfortable. I recall the name, yes. Friend, I thank you, but take back your shillings. It is bad custom for me to drink of strangers' sack.

Reichenbach protested, but only fitfully and quickly he withdrew lest the moment grow ugly. Plainly these folk had no use for



his wine or for him, and to be wounded in a tavern brawl here in A.D. 1604 would bring monstrous consequences in real time. He made a courtly bow and retreated. Isabet, watching, wore a cat grin. He went slinking back to her upset, bitterly aware he had bungled his cherished meeting with Shakespeare and, worse, had looked bumptious in front of her.

"We should go," he said. "We're unwelcome here."

"Poor dear one. You look so miserable. The contempt in his eyes—"

"No," she said. "The man is probably bothered by strangers all the time. And you know he was with his friends in the sanctuaries of his own tavern. He meant no personal abuse."

"I expected him to be different—to be one of us, to reach out toward me and drive me to him, to—to—"

"No," said Isabet gently. "He has his life, his wife, his pains, his problems. Don't confuse him with your fantasy of him. Come now. You look so glum. My dear. Find yourself again!"

"Somewhen else."
"Yes. Somewhen else."

Under her deft consolations the sting of his selfishness at the Mermaid Tavern eased, and his mood brightened as they went onward. Few words passed between them. A look, a smile, the merest of contacts, and they communicated. Attending the trial of Socrates, they touched fingertips lightly, secretly, and it was the deepest of communions. Afterward they made love under the clear, bright winter sky of Athens, on a gray-green hillside rich with lavender and myrtle and emerged from shivering ecstasies to find themselves with an audience of mournful scruffy goats—a perfect leap of context and metaphor—and for days thereafter they made each other laugh with only the most delicate pantomimed reminder of the scene. Onward they went to see grim, limping, austere old Magellan sail off around the world with his five little ships from the mouth of the Guadalquivir, and at a whim they leaped to India, staining their skins and playing at Hindu as they viewed the expedition of Vasco da Gama come sailing into harbor at Calicut, and then it seemed proper to go on to Spain in dry hot summer to drink sour white wine and watch ruddy, freckle-faced Columbus get his pitiful fleet out to sea.

Of course they look after lovers from time to time. That was part of the game, too. Easy a treat to forever. In Byzantium on the eve of the Frankish conquest he passed a night with a dark-eyed, voluptuous Greek, who oiled her breasts with musky mysterious unguents, and Isabet made love with a towering, garlicky Swede of the imperial guard, and when they found each other the next day just as the Venetian armada burst into the Bosphorus, they described to each other in the most flamboyant detail the strangenesses of their night's sport—the tall, blond Norseman's fearless belowing of



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lapses in his hottest moments; the Byzantine-startling convulsions, climactic fit almost apologetic in style and, as she had admitted playfully at dawn, mostly a counterfeiter. In Cleopatra's Egypt, while waiting for glimpses of the Queen and Antony they diverted themselves with a dark-eyed Coptic pair, brother and sister no more than children and blithely interchangeable in bed. At the crowning of Charlemagne she found herself a Frankish merchant, who offered her an estate along the Rhine, and he a mysteriously elliptical, dusky woman, who claimed to be a Carolonian Moor but who—Reichenbach suddenly realized—a few days later—must almost certainly have been a jester like himself, playing elegant games with him.

All this lent spice to their love and did no harm. These separate but shared adventures only enhanced the intensity of the relationship they were weaving. He prayed the jester would never end; for Isabet was the perfect companion, his utter match and so long as they sprangled together through the eons, she was his, though he knew this would and when real time reclaimed him. Nevertheless, that moment still was far away and he hoped before then to find some way around the inexorable rules, some scheme for loosing her and continuing with her in his own true time. Small chance of that, he knew. In the world beyond the terminal, there was no time jousting (jousting could be done only in the fluid realm of history) and history was artlessly defined as everything that had happened before the terminal year 2167. The rest was real time, rigid and immutable and what if her real time were fifty years ahead of his, or fifty behind? There was no bridging that by jousting. He did not know her real time locus, and he did not dare ask. Deep as the love between them had come to be, Reichenbach still feared offending her through some unpardonable breach of their special etiquette.

With all the world to choose from, they sometimes took brief solo jaunts. That was Isabet's idea, holidays when their holiday, so that they would not grow stale with each other. It made sense to him. Thereupon he vaulted to the Pans of the 1920s to sip Pernod on the Boulevard St.-Germain and peer at Picasso and Hemingway and Joyce, she in epicurean mask to old Cathay to see Kubla Khan ride in triumph through the Great Wall, he to Cape Kennedy to watch the great Apollo rocket tearing moonward, she to London for King Charles's beheading. But these were brief adventures, and they reunited quickly, gladly and went on hand in hand to their next, together, to the fall of Troy and the diamond jubilee of Queen Victoria and the assassination of Lincoln and the sack of Carthage. Always when they returned from separate exploits they regaled each other with extensive narratives of what had befallen them—the sights, the tastes, the scenes and perceptions, and of course the amorous interludes. By now Reichenbach and

Isabet had accumulated an elaborate fabric of shared experience, a richness of joint history that gave them virtually a private language of evocative recollection, so that the slightest of cues—a goal on a hill, the taste of burned toast, the sight of a loquacious beggar—sprang them into an intimate realm that no one else could ever penetrate, their unique place, furnished with their own things, the artifacts of love, the treasures of memory. And even that which they did separately became interwoven in that fabric, as if the telling of events as they lay in each other's arms had transformed those events into communal possessions.

Yet gradually Reichenbach realized that something was beginning to go wrong.

From a solo jaunt to the Paris of 1794, where she lauded the Reign of Terror, Isabet returned strangely evasive. She spoke in brilliant detail of the death of Robespierre and the sad desolation of Notre Dame, but what she reported was misjournalism, with no inner meaning. He had to fish for information. Where had she lodged? Had she feared for her safety? Had she had interesting conversations with the Pans? Shrugs, deflections. Had she taken a lover? Yes, yes, a fleeting liaison, nothing worth talking about, and then it was back to an account of the mobs, the lambs, the sound of the guillotine. At first Reichenbach accepted that without demur, though her vagueness violated their custom. But she remained moody and oblique when they were visiting the Crucifixion and as they were about to depart for the Black Death, she begged off, saying she needed another day to herself and would go to Prague for the premiere of Don Giovanni. That too failed to trouble him—he was not musical—and he spent the day observing Waterloo from the hills behind Wellington's troops. When Isabet rejoined him in the late spring of 1349 for the Black Death in London, though she seemed even more preoccupied and remote, and she told him little of her night at the opera. He began to feel dismay for they had been marvelously close, and now she was obviously voyaging on some other plane. The plague-smitten city seemed to bore her. Her only flicker of attention came toward evening, in a Southwark hostelry when as they dined on grisly lamb, a stranger entered, a tall, gaunt, sharp-bearded man with the obvious aura of a jester. Reichenbach did not fail to notice the rebirth of light in Isabet's eyes, and the barely perceptible inclining forward of her body as the stranger approached their table was evident to him.

The newcomer naturally knew them for what they were and invited himself to join them. His name was Stewanger, he had been on his jaunt just a few days, he meant to see everything, everything, before his time was up. Not for many years had Reichenbach felt such jealousy. He was wise in these things, and it was not difficult to detect the current flowing from Isabet to

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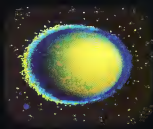
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Stavanger, even as he sat there between them. Now he understood why she had no casual amours to report of her jaunts to Paris and Prague. This one was far from casual and would bear no retelling.

In the morning she said, "I still feel operatic. I'll go to Bayreuth tonight—the premiere of *Godderkennung*."

Despairing himself, he said, "A capital idea. I'll accompany you."

She looked disconcerted. "But music bores you?"

"A flaw in my character. Time I began to remedy it."

The fateful panic in Isabet's eyes gave way to cool and chilling calmness. Another time, dear love, I prize my solitude. I'll make this little trip without you.

It was all plain to him. Gone now the open sharing, now there were secret rendezvous and an unwanted third player of their game. He could not bear it. He made his own arrangements and jaunted to Bayreuth in thick red wig and curling beard, and there she was seated beside Stavanger, in the Festspielhaus as the orchestra launched into the first notes. Reichenbach did not remain for the performance.

Stavanger now crossed their path openly and with great frequency. They met him at the siege of Constantinople, at the San Francisco Earthquake, and at a fête at Versailles. This was more than coincidence, and Reichenbach said so to Isabet. It suggested he follow some of our itinerary.

she admitted. "He's a lonely man, jaunting alone. And quite charming. But of course if you dislike him, we can simply vanish without telling him where we're going, and he'll never find us again."

A disarming tactic. Reichenbach thought. It was impossible for her to admit to him that she and Stavanger were lovers, for there was too much substance to their affair, so instead she pretended he was a pitiful forlorn wanderer in need of company. Reichenbach was outraged. Fidelity was no part of his unspoken compact with her, and she was free to slip off to any era she chose for a tryst with Stavanger. But that she chose to conceal what was going on was deplorable, and that she was finding pretenses to drag Stavanger along on their travels, puncturing the privacy of their own rapport for the sake of a few snug accommodations, was impermissible. Reichenbach was convinced now that Isabet and Stavanger were cotemporal, though he had no rational basis for that idea. It simply seemed right, a final torment, the two of them now laying the groundwork for a real-time relationship that excluded him. Whether true or not, it was unbearable. Reichenbach was astounded by his jealous fury. Yet it was a true emotion and one he would not attempt to repress. The joy he had known with Isabet had been unique, and Stavanger had tainted it.

He found himself searching for ways to dispose of his rival.

Merely whirling Isabet off elsewhere would achieve nothing. She would find ways to catch up with her paramour somewhere along the line. And if Isabet and Stavanger were cotemporal and she and Reichenbach were not—no, no. Stavanger had to be expelled. Reichenbach, a usually stable man, had never imagined himself capable of such criminality, a bit of eldritch regulation bending was all he had ever allowed himself. But he had never been faced with the loss of an Isabet before, either.

In Borja, Italy, Reichenbach hired a Florentine poisoner to do Stavanger in with a dram of nightshade. But the villain pocketed Reichenbach's down payment and disappeared without a care for the fumes due him on completion of the job. In the chaotic aftermath of the looting of March, Reichenbach attempted to finger Stavanger as one of Caesar's murderers, but no one paid attention. Nor did he have luck denouncing him to the Inquisition one afternoon in 1485 in Torquemada's Castle, though even the most perfunctory questioning would have given sufficient proof of Stavanger's alliance with diabolical powers. Perhaps it would be necessary. Reichenbach concluded morosely to deal with Stavanger with his own hands, repellent though that alternative was.

Not only was it repellent, but it could be dangerous. He was without experience at vicious crime, and Stavanger, cold-eyed and suave, promised to be a formidable adversary. Reichenbach needed an ally, an adviser, a collaborator. But who? While he and Isabet were making the circuit of the Seven Wonders, he puzzled over it, from Ephesus to Helicaeum to Gizeh, and as they stood in the shadow of the Colosseum at Rhodes, the answer came to him. There was only one person he could trust sufficiently, and that person was himself.

To Isabet he said, "Do you know where I want to go next?"

"We still have the Hanging Gardens of Babylon, the Lighthouse of Alexandria, the Statue of Zeus at—"

"No. I'm not talking about the Seven Wonders tour. I want to return to Sarajevo."

"Sarajevo? Whatever for?"

"A sentimental pilgrimage: love to the place of our first meeting."

But Sarajevo was a bore. And—

"We could make it exciting. Consider. Our earlier selves would already be there. We would watch them meet, find each other well matched, become lovers. Here for months we've been touring the great events of history, when we're neglecting a chance to witness our own personal greatest event. He smiled wistfully. And there are other possibilities. We could introduce ourselves to them. Hint at the joys that lie ahead of them. Perhaps even seduce them, eh? A nice kinky quirky business that would be. And—"

No, she said. I don't like it."

"You find the idea improper? Morally offensive?"



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Don't be an idiot. I find it dangerous.
How so?

We aren't supposed to reenter a time
where we're already present. There must
be a good reason for that. The rules—

The rules," he said, "are made by timid
old aunts who've never moved beyond the
terminator in their lives. The rules are meant
to guide us, not to control us. The rules are
meant to be broken by those who are smart
enough to avoid the consequences.

She stared somberly at him a long while.
And you are?

I think I am.

Yes. A shrewd man, a superior man, a
member of the elite corps that lives on the
far side of society's bell-shaped curve. Eh?
Doing as you please throughout life. Holding
yourself above all restraints. Rich
enough and lucky enough to joust any
when you like and behave like a god.

You live the same way I believe.

In general, yes. But I still won't go with
you to Sarajevo.
Why not?

Because I don't know what will happen
to me if I do. Kinky and quirky it may be, but
please don't bed with our other selves, but
something about the idea troubles me, and
I dislike needless risk. Do you believe you
understand paradox theory fully?

Does anybody?

Exactly. It isn't smart to—

Paradoxes are much overrated. Don't

you think? We're in the fluid zone. Isabel.
Anything goes. The rule of the terminator. If
I were you, I wouldn't worry about—

I am me. I worry. If I were you, I'd worry
more. Take your Sarajevo trip without me.

He saw she was adamant and dropped
the issue. Indeed he saw it would be much
simpler to make the journey alone. They
went on from Rhodes to the Babylon of
Nebuchadnezzar, where they spent four
happy days, untroubled by the shadow of
Sarajevo. It was the first time they had
had together since Carthage. Then Isabel
announced she felt the need for another
solo muscological jaunt to Mantua in 1607
for Monteverdi's Orfeo. He offered no ob-
jection. The instant she was gone, he set
his timer for the twenty-eighth of June
1914 at Sarajevo, in Bosnia, at 10:27 A.M.

In his Babylonian costume, he knew he
looked ridiculous or even insane, but it was
too chancy to have gone to the halfway
house for proper preparation, and he
planned to stay there only a few minutes.
Moments after he materialized in the fair-
way, a noble pined away, a young
self appeared, decked out in nifty Edwardian
finery. He registered only the briefest
glimpse of amazement at the sight of another
Reichenbach already there.

Reichenbach said, "I have to speak
quickly. You will go out there, and near the
Bank of Austria-Hungary you'll meet the
most wonderful woman you've ever known,

and you'll share with her the greatest joys
you've ever tasted. And just as your love for
her reaches its deepest strength, you'll lose
her to a rival—unless you cooperate with
me to rid us of him before they meet.

The eyes of the other Reichenbach nar-
rowed. Murder?

Removal. We'll put him in the way of
harm, and harm will come to him."

Is the woman such a marvel that the
rival is worth it?

"I swear it. I tell you, you'll suffer pain
beyond belief if he isn't eliminated. Trust
me. My welfare is your welfare, is it not so?"

Of course. But the other Reichenbach
looked unconvinced. Still, why must there
be two of us caught up in this? It's not yet
my affair after all.

It will be. He's too slippery to tackle
without help. I need you. And ultimately
you'll be grateful to me. Take it on faith.

And what if this is some elaborate game
and I'm the victim?

Damn it, this is no game! Our happiness
is at stake—yours, mine. We're both in this
together. We're closer than any twins could
ever be. Don't you realize? You and me,
different phases of the same person's
time-line, following the same path? Our
destinies are linked. Help me now or live
forever with the torment of the conse-
quences. Please help. Please.

The other wavered. "You ask a great deal."

I offer a great deal. Reichenbach said.

"Look, there's no more time for talking now. You have to get out there and meet Lisabet before the Archduke's assassination. Meet me in Paris, noon on the twenty-fifth of June, 1794. In the rue de Rivoli, outside the Hôtel de Ville. He grasped the other's arm and stared at him with all the intensity and conviction at his command. Agreed?"

A last moment of hesitation.

Agreed.

Reichenbach touched his timer and disappeared.

In Babylon again he gathered his possessions and jaunted to the half-way house for the French Revolution. For a moment he dreamed running into his other self there, a reassurance that would be hard to justify but the place was too big for that; the Revolution and Terror spanned five years, and an immense service facility was needed to handle the tourist demand. Outfitted in the simple countryfolk clothes appropriate to the Revolutionary period, equipped with freshly implanted linguistic skills and proper Revolutionary rhetoric, disguised to blend with the citizenry, Reichenbach descended into the terrible heat of that bloody Parisian summer and quickly effected his rendezvous with fate.

The face he beheld was clearly his, and yet unfamiliar, for he was accustomed to his mirror image, but a mirror image is a reversed one, and now he saw himself as others saw him and nothing looked quite right. This is what it must be like to have a

twist, he thought. In a low hoarse voice he said, "She's coming tomorrow to hear Robespierre's final speech and then to see his execution. Our enemy is in Paris already with rooms at the Hôtel Britannique in the rue Guenegaud. I'll track him down while you make contact with the Committee of Public Safety. I'll bring him here, you arrange the trap and the denunciation, with any luck he'll be hauled away in the same tumbrel that takes Robespierre to the guillotine. D'accord?"

"D'accord." A distance came into the other's eyes. Softly he said, "You were right about Lisabet. For such a woman, even this is justifiable."

Reichenbach felt an unexpected pang. But to be jealous of himself was an absurdity. Where have you been with her?

After Saraguro, Nero's Rome. She's asleep there now our third night. I intend to be gone only an instant. We go next to Shakespeare's time, and then—

Yes, I know Socrates, Magellan, Vasco da Gama. All the best still lies ahead for you. But first there's work to do.

Without great difficulty he found his way to the Hôtel Britannique, a modest place not far from the Port-Neuf. The concierge, a pallid woman with a thin-lipped mouth fixed in an unchanging scowl, offered little aid until Reichenbach spoke of the Committee, the Law of Suspects, the dangers of refusing to cooperate with the Revolutionary Tribunal; then she was quick

enough to admit that a dark man of great height with a beard of just the sort that Monsieur described was living on the fifth floor, a certain M. Slavanger. Reichenbach rented the adjoining room. He waited there an hour, then heard footsteps in the hallway, sounds near door.

He went out and knocked.

Slavanger peered blankly at him. "Yes? He has not yet met her, Reichenbach thought. He has not yet spoken with her, he has not yet touched her body, they have not yet gone to their damned operas together. And never will.

He said, "This is a wonderful place for a journey, isn't it?"

Who are you?

Reichenbach is my name. My friend and I saw you in the street, and she sent me up to speak with you. He made a little self-deprecating gesture. I often act as her—ah—go-between. She wishes to know whether you'll meet her this afternoon and perhaps enjoy a day or two of French history with her. Her name is Lisabet, and I can testify that you'll find her charming. Her particular interests are assassinations, architecture, and the first performances of great operas.

Slavanger showed sudden alertness. Opera is a great passion of mine, he said. "Ordinarily I keep to myself when gawking but in the case—the possibilities!—is she downstairs?" Can you bring her to me?

Ah, no. She's waiting in front of the Hôtel de Ville.

And wants me to come to her?

Reichenbach nodded. Certain protocols are important to her.

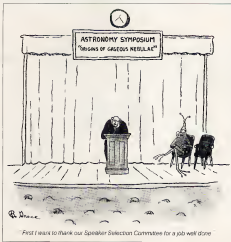
Slavanger after a moment's consideration said, "Take me to your Lisabet then. But I make no promises. Is that understood?"

Of course, said Reichenbach.

The streets were almost empty at this hour. The miasma of the atmosphere in this heavy heat must be a factor in that. Reichenbach thought, and it was midday and the Parisians were at their dinner, but beyond that it seemed that the city was suffering a desolation of the spirit, a paralysis of energy under the impact of the monstrous bloodletting of recent months. He walked quickly, struggling to keep up with Slavanger's long strides. As they approached the Hôtel de Ville, Reichenbach caught sight of his other self, and with him two or three men in Revolutionary costume. Good. Good. The other Reichenbach nodded. Everything was arranged. The challenge now was to keep Slavanger from going for his timer the moment he sensed he was in jeopardy.

Where is she? Slavanger asked.

I left her speaking with that group of men, Reichenbach said. The other Reichenbach stood with his face turned aside, a wise move. Now though they had not released it, they moved as if parts of a single organism, the other Reichenbach pivoting, pointing, crying out, "I accuse that man of crimes against liberty!" while in the same instant Reichenbach stepped



"First I want to thank our Speaker Selection Committee for a job well done."

behind Stavranger thrust his arms up past those of the taller man, reached into Stavranger's loose tunic to wrench his limiter into run with one quick twist and held him firmly. Stavranger bellowed and tried to break free, but in a moment the steel was full of men, who seized and overpowered him and dragged him away. Reichenbach, panting, sweating, looked in triumph toward his other self.

"Hm...!" said the other Reichenbach. Reichenbach blinked. "What?"

"Too late. They had his arms," the other Reichenbach was gaping for his limiter, seizing, tearing. Reichenbach fought ferociously but they bore him to the ground and knelt on his chest.

Through a haze of fear and pain he heard the other saying: "This man is the proscribed aristocrat Charles St. Evremonte, called Darnay, enemy of the Republic, member of a family of tyrants. I denounce him for having used his privileges in the oppression of the people."

"He will face the Tribunal tonight," said one of those kneeling on Reichenbach. Reichenbach said in a choked voice: "What are you doing?"

The other crouched close to him and spoke in English: "We have been duped, you see. Why do you think there are rules against entering a time where one is already present? There's room for only one of us back in real time—is that not so? So then, how can we both return?"

Reichenbach said: "That isn't true! Isn't it? Are you sure? Do you really comprehend all the paradoxes?"

"Do you? How can you do this to me, when I—when I'm—"

"You disappoint me not, seeing these intricacies. I would have expected more from one of us. But you must have been too muddled by jealousy to think straight. Do you imagine I dare run the risk of letting you joust around on the loose? Which of us is to have Lisabet, after all?"

Already Reichenbach felt the blade hurtling toward his neck.

"Wait—wait—!" he cried. "Look at him! His face is mine! We are brothers! Twins! If I'm an aristocrat, what is he? I denounce him, too! Seize him and try him with me!"

"There is indeed a strange resemblance between you two," said one of those holding Reichenbach.

The other Reichenbach smiled. "We have often been taken for brothers, but there is no kinship between us. He is the aristocrat St. Evremonte, citizen. And I am only poor Sydney Carton, a person of no consequence or significance whatever, happy to have been of service to the people. He bowed and walked away, and in a moment he was gone.

Safe beside Lisabet in Nero's Rome, Reichenbach thought bitterly.

Come, up with him and bring him to trial, someone called. The Tribunal has no time to waste these days. **OO**

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IMMORTALITY

CONTINUED FROM PAGE 46

truly decelerated. Thus, the information about cold-blooded animals suggested by the North American fence lizards had been verified in the laboratory with the South American lark.

We were fascinated to discover that the life-span-prolonging effect of lowered temperature was most effective during the last half of life. During the first half it was much less influential. Now the only other proven means to prolong life span is a particular kind of dietary restriction in which total calories are cut severely but the diet is supplemented with vitamins and minerals to achieve a state we can characterize as undernutrition without malnutrition. The dietary restriction is most influential in life span prolongation when it is instituted during the first half of life. We found the effects of the two regimes to be additive. By dietary restriction during the first half, and temperature reduction thereafter, we could increase the life span of our lark finked. During their greatly extended life spans the experimental fish remained just as active and as sexually busy as fully fed younger fish kept at a normal temperature.

But what about mammals and humans, the so-called homeothermic or warm-blooded vertebrates? Except for the special situation of hibernation, scientists have no data at all on the long-term effects of reduced internal body temperature in warm-bloods. There are some data from short-term temperature reduction available for instance from packing anesthetized people in ice for open-heart surgery. Some reports have described adverse physiological effects of hypothermia (reduced core temperature) in humans when their body temperature falls below 95°F, but others have found that patients undergoing hypothermia down to 86°–90°F as part of a clinical treatment remain rational, their mental states varying from fully alert to mildly cloudy. And in 1973 Dr L. K. Klotz and his colleagues at Ravenscroft Medical College in Udaipur, India, carefully monitored a yogi named Satyurm, who underwent an eight-day, foodless confinement in a sealed underground pit. According to their measurements, the yogi brought his temperature down to 86°F without suffering any ill effects, a self-induced hypothermia hitherto unknown to man.

What is the optimal body temperature for humans? Our temperature of 98.6°F was set by evolution as optimal for what we were all doing back in our Pleistocene days, 100,000 or 200,000 years ago: trapping mastodons and dodging saber-toothed tigers on grueling hunting trips. But 98.6°F is not necessarily optimal for today when we're taking the great tips of intelligence and imagination. Perhaps we can depend on evolution anymore. We have to adjust our nature all by ourselves.

Although lowering the temperature of the environment causes fish and fence lizards to live longer by lowering their core body temperatures, it is not possible to do this with warm-blooded mammals. We mammals possess a complicated internal mechanism for maintaining our core temperature at or near a fixed, preset level. Changing the outside temperature alters only our superficial skin temperature.

Our primary controlling thermostat is in a primitive portion of the brain, near the base of the skull, an area known as the hypothalamus. After sensing the temperature of the blood, the hypothalamus fires off the appropriate regulatory commands. If the blood is slightly cooler than the hypothalamus reference set point, shivering results, and this builds up internal body heat. If the blood is warmer humans begin to sweat and dogs to pant. Body temperature can also be altered by information from peripheral nerve sensors. If we enter a cold room, for example, we begin shivering long

very efficiently at a lower temperature.

We do not know how the hibernators adjust their central thermostats but we do know that the hypothalamic mechanism can be influenced by drugs. In experiments with mice Dr. Liu and I found that THC, the active ingredient of marijuana, and also the tranquilizer chlorpromazine could either lower the set-point or turn the switch completely off, depending on dosage. High doses of THC, for example, allow mice to drop their body temperature to the temperature of the environment. Because of their extremely low toxicity, THC or less purified marijuana derivatives might be excellent drugs for lowering body temperature in certain types of surgery but they would not induce chronic hypothermia. We found that upon repeated exposure to the drugs, two to three times in the same month, animals become resistant to the temperature-lowering effects. Its unfortunate that one cannot stay cool by staying high all the time, because the potential reward in terms of life-span extension could be remarkable.

Since drugs capable of resetting the switch are not yet available, I wondered whether bloodedback and/or yogic techniques such as Yogi Satyurm's undoubtedly employed in his sealed underground pit might be more successful. To a certain extent you can learn control over the autonomic, or involuntary nervous system. You can slow your heart rate, cure headaches, render your skin temperature hotter or colder, decrease acid secretion by the stomach, and make your brain waves beat out the alpha rhythm of transcendental meditation—all by bloodedback.

Making the mind go in the right direction is tricky but we are constantly doing it, at least for voluntary responses. Critical to the learning of even these ordinary voluntary responses, as well as the autonomic ones, is the fact that the feedback must be immediate or almost so. If ten minutes had to pass for your arm to go up after you thought *Up!*, you'd would never learn to raise a glass to your lips. If feedback time exceeds even one or two minutes, control of bodily functions can be very difficult to learn.

And even if you could switch off the regulatory thermostat in your hypothalamus completely quite a bit of time would be required for the internal body temperature to fall substantially. As a pathologist, I know that under normal conditions a dead human body cools at the rate of only about 1° per hour. That's clearly too slow (and you can turn off the hypothalamic switch any faster than by dying). It is not likely then that lowering internal temperature could be learned by the usual bloodedback approach. Might there be other methods?

Just to help set some realistic goals, I thought it would be helpful to see whether any of the skilled yogi masters could manipulate their internal temperatures by methods less drastic than tracing out in underground isolation chambers. Tales of surprising physiological feats are continu-

“I wanted to find out whether the longer life spans of the cold-bloods were due to a metabolic slowdown. After all, who would want to creep through a longer life at half speed?”

below our blood runs cold. By these delicate bodily arrangements our internal temperature is kept within a narrow range, hovering around 98.6°F regardless of what's outside. So for humans there is no life-span advantage to living in cold Canada instead of at hot Africa.

If we could control the reference mechanism in the hypothalamus, however, we could control body temperature in warm-bloods. Hibernation involves such control. It does not abandon temperature regulation, but it precisely lowers and resets the central thermostat's set point to conserve energy so we can survive the winter. The fact that many higher vertebrates hibernate—animals that are physically similar to us, such as bears, squirrels, and hamsters—and that they can safely take their body temperature to a point halfway toward freezing suggests that any harmful effects from lowering core temperature in man probably result from an unset hypothalamus's firing off frozen last-chance commands to counteract the fall in temperature. The harmful effects of cooling are not necessarily due to any intrinsic inability of human cells and organs to function

ally coming out of India, Tibet, and the Arab lands of the Sula. Therefore a few years after my South American fishing trip, I found myself once more in an airplane, heading eastward from Los Angeles toward the Land of Many Parts (Nora of Which Fit) the Land of Surprises—India. My intention was to measure body-temperature regulation in Indian yogis.

In New Delhi I watched airport customs agents pack through the gear from my blue Wilderness Experience backpack gear less plentiful and less varied than I had taken to South America—mainly personal effects and a sensitive electronic telethermometer with dermal oral, armpit, and rectal probes. After exiting from the airport into the hot October Indian sun, and escaping the throng of drivers of three wheeled minis, I was clamoring to take visitors somewhere I was feeling loose in my choice of directions. Other than to give a few lectures, I had made no prearrangements about who to do or when to see. I had been informed that the ablest yogis—including those yogis grouped under the generic name of sadhus, derived from the Sanskrit sadhu (he who has attained miraculous power)—were not likely to be hanging around universities. Where therefore should I look for a certain Ramana Mahanishi, who it was said could take a guest inside the hollow hill where the sadhus of all ages meet? Perhaps on the old Pashu—Mahabaleshwar Road, near the big stone belonging to Kanari Darvish, which can be lifted only by the fingers of 11 strong men? I allowed one foot to follow the other.

A few weeks later I found myself in Bombay entering the Kolaba District, to visit a wealthy Parsi. He opened the door to his apartment and conducted me into a huge living room carpeted with rich Oriental rugs upon which rested wide brass stands and blackwood chairs.

The Parsi smoked cigarettes and we drankiced rum. Only a few miles away I knew were the massive square circular Towers of Silence, where the Parsis after death are packed clean by the birds. Zoroastrianism, one of the world's oldest religions, founded by the Persian prophet Zoroaster in the seventh century B.C., survives today mostly among these Parsis of India. They are sun and fire worshippers and at death their bodies are laid out aboveground until the flesh is entirely eaten by vultures, then the skeleton is retrieved. In the last analysis they believe that the whole of creation will enjoy eternal bliss in the presence of Omrad, the Lord.

I told my gracious Parsi host what I was doing in India, and he conjectured I'd have trouble getting cooperation from the yogis. He advised me to seek out the half-naked sadhus around Hardwar and Rishikesh to continue my yogic studies. That would take enormous stamina on my part, because the sadhus often march 20 miles a day and are rather crazy. I thought the Parsi was crazy himself, although there was much half-truth in what he foretold, and I was half-galeful



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Leaving him, I proceeded to the nearby hill town of Poona, where the huge, upstairs, partially roofed-over balcony of an old gray mansion was filled with domestic and foreign devotees of the famous Swami Rajneesh. Most of the devotees wore bright orange cotton dhotis, saaris, lungis, dhosis, or pajama tops and pants. Nodding to and fro like a field of poppies, they waited.

At last he appeared through a side door. Glad in a white shirt, wound towel-like around his well-proportioned body, he mounted the two-foot-high carpeted platform at one end of the room, relaxed into an overstuffed chair, and tapped his index finger on the microphone next to him.

The instrument clicked audibly. The current was definitely on. The poppies popped to attention.

Swami Rajneesh, the Sage of Poona, began the morning's lecture, which was about Jesus. "Jesus asked his disciples: 'Who am I?' Then Peter answered: 'Thou art like a righteous angel.' Then came Matthew's turn. He said: 'Thou art like a wise man of understanding.' Then Thomas said: 'Master, my mouth will not be capable of saying whom thou art like.' But Jesus replied to each of them, 'I am not thy master; for what Jesus and all great people like Him are about is being.'"

The swami's lecture was punctuated by an audible drawing-in of breath by his devotees, the equivalent of right on in another culture.

I tiptoed out. It had been a wonderful sermon, but I could not imagine I would be allowed to put my electronic telethermometer up Swami Rajneesh's respectable rectum.

Most of the big-time or even locally well-known and accessible yogis I met were on quite resplendent ego trips and were not generally able to come off them long enough to be very helpful. Swami Rama, who had visited the Menninger Clinic in Topeka, Kansas, boasted that he could boil water in his naked hand. He held out his cupped hand, but he poured no water into it. In New Delhi Mrs. Gandhi's personal yoga master, Dhoreswara Bhramachari, proudly showed me how he could swallow his tongue, and back it went into his posterior pharynx, after which he was speechless.

Finally decided to follow the Parisi's suggestion and seek out the ashrams, who roam in packs or live on buffalo milk and fruit in little thatched huts in the open air in the forests and bush on the banks of the upper Ganges. These gentlemen were more to my taste and utility. It is alleged that among their ranks are malefactors and fugitives who hide out by assuming the pretense of holiness, but most of the ashrams have simply left their homes in order to concentrate on physical and spiritual disciplines. To become a sadhu is to be set apart. They are hermits keeping vows of poverty and celibacy and depending largely on the charity of householders for their food. I spent several days among

them, sleeping at night under a blanket beneath a tree, but nothing useful came of these experiences for my experiments.

Two characteristics of the most advanced yogis in terms of mastery of techniques are physical inaccessibility and having few or no followers. Look for yogis in the high mountains, in caves, in the deep forests, not near a town or on a podium or a dais. A good place for holy men and advanced practitioners is the area of the Jhirmit Caves, 15 miles from Haridwar. Led by my guide, I tramped up there. The yogis of the caves are a better-educated lot than the sadhus. Involved in heavy spiritual and isolation trips, with day-long periods of meditation, they were receptive once they realized that I was also on a serious quest.

Some could lower their internal body temperature as much as 1° by a combination of meditation and breathing methods. In several days' testing of two of them, Swami Uddain and Ram Dayal, I recorded average internal, or rectal, body tempera-

tures, and Indra had cooled me out. During my stay with Indra my instruction took a fascinating historical turn.

In an ancient medical text, the *Charaka Samhita*, I found written:

"It came about that in the course of time the Rishis became, by taking a city dweller's diet and drugs, luxurious and lewdly in their habits, and for the most part deficient in health. Finding themselves unequal to the observance of the code of obligations that the order entailed and realizing that the blame lay with their urban residence, these Rishis returned to their original dwelling, remote from the evils of city life, namely the Himalayas, which are auspicious, holy, majestic."

One of the original elixirs of life, "Soma" came from these regions, and forms a principal nostrum of the branch of Ayurveda, or Hindu medicine known as Kaya Kalp, the science of rejuvenation. Soma itself belongs to *Mazayana*, the science of poisons, and is made from "sovereign herbs growing in the Himalayas, ripe with potency." These include climbing asparagus, yam, gringos fruit, wild oil, and wild fennel, along with others, including at least one secret herb. But the trick is in the making as much as in the ingredients, and the secret of how to make Soma is not as clear to us today as it must have been to the Rishis.

We would know how to use it, however, if we could ever get any. Its use and benefits are described in another health and medical text, the *Sushruta Samhita*, where we are told that the gods created Soma to prevent the decay and death of the body.

The use of the Soma plant, the lord of all medicinal herbs, is followed by rejuvenation of the system and enables its user to witness ten thousand summers on earth in the full enjoyment of a new and youthful body. Such a person bears a charmed life against fire, water, poison, and weapons and develops great muscular energy.

Ten thousand summers with Soma sounds better than Coca-Cola or Heineken to me, but alas, the *Sushruta Samhita* also informs us: "The Soma plants are invisible to the impious or the ungrateful, as well as to the unbeliever in the curative virtues of medicine and to those spiteful to the Brahmins."

So it's not going to be so easy after all. But at least I learned two things from my excursion into ancient texts and modern India. The quest for rejuvenation was an important part of a very old system of medicine, the Ayurvedic system of India, and of more immediate practical value is the fact that, while becoming a full-time isolated yogi is hardly feasible for a Westerner, the measurements on the yogis in the Jhirmit Cave region showed that a human can induce, and adapt to, a lowered body temperature and still remain mentally alert and active. This suggests that by keeping cool, you would not be creeping through a longer life at half-speed, but would keep going at normal speed for a much, much longer time. ☐

◀ I tiptoed out.
It had been a wonderful
sermon, but I
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telethermometer up Swami
Rajneesh's re-
spectable tagged rectum. ▶

tures of 94° to 95°F. A few yogis—those who live in the Himalayan caves or forests and rely on much meditation and very low-calorie diets—seem to be permanently 3° or 5° colder than normal. These represent a steady-state adaptation but not a type of hibernation, because they were not apathetic or slowed down. My demonstration of low body temperature affords some biological explanation of the stories of yogis who claim extremely long lives, but it is hard to authenticate these claims with reliable birth records, which are rare.

As a final experience, I sought the great yoga master Indra, whom author Wylie Chamberlin later used for a model in his novel *Gates of Fire*. Meeting Indra required half a day's journey through ever smaller, fetid back-country villages, followed by a five-hour walk into tigas, wild pig, and monkey jungles. Finally I arrived in Indra's area of cleared land, planted with rice and corn. He was living in a small mud-brick enclosure with a six-foot-high wall and a high thatched roof, a habitation called an *akara*.

I was unable to persuade Indra to do any temperature experiments with me, but it didn't matter much anymore. I found that

SPARE GENES

CONTINUED FROM PAGE 54

search, he flew to Cologne to see them.

The older child—about five years old then—was having a really tough time walking across the room. Her calls. Both parents had to hold a hand to help her. She was obviously retarded and suffered convulsions. The two-year-old was in pretty good shape. It didn't appear that anything was wrong with her.

But the blood of the younger child—and of a third sister, born a year later—showed the same previously unknown abnormality found in their eldest sister. The blood of all three contained unusually high amounts of an amino acid called arginine, one of the building blocks the body uses to construct protein. An enzyme, arginase, is supposed to keep blood arginine levels under control, breaking down the excess. But the gene for arginase was apparently missing or defective in the girls.

This problem indirectly caused another. The eldest girl's brain damage probably resulted from ammonia intoxication, Rogers thinks. Ammonia is handled by being converted to arginine. Having so much arginine probably inhibits the synthesis of more, and you get a buildup of ammonia.

As head of a cancer-research program at Oak Ridge National Laboratory in Tennessee during the 1950s, Rogers had been using Shope papilloma virus—which causes benign wartlike tumors in rabbits—to study how viruses turn normal cells into tumor cells. Rogers observed that rabbits infected with the virus had low blood arginine levels. He found evidence that the virus carried a gene for arginase. Another surprising finding came a few years later. Half the laboratory workers handling the virus had low blood arginine levels like the rabbits. Until then it had been assumed the virus did not infect man. Could the virus provide the girls with a gene for an enzyme to protect them against ammonia poisoning?

Bravely, Rogers set up a clinical trial—the first of its kind—to find out. He obtained some of the girls' cells, infected them in a lab dish with virus, and found they contained the same protective arginase discovered in the rabbits. He put a vial of highly purified virus on ice and took it to Germany with him. In the first injections, we didn't know how much to give, he says. We gave a dose about the same amount we'd give a rabbit.

Rogers sent more virus over when the third girl was born. Then came a serious setback. When they sent me the virus to test, it had gone to hell," he says. "When I tested it, there was no activity whatever. No matter what the reason was—too small a dose, an inactive virus—the girls' blood arginine levels didn't change.

Anderson at the National Institutes of Health believes Rogers "did everything



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possible to make sure the experiment was as correct, ethical, legal and appropriate as possible, and he was very open about it." But a tidal wave of professional criticism swept over him. His funding withered away. He turned to plant genetics.

Rogers, now past 60 and recovering from a stroke suffered several years ago, expresses no bitterness about the criticism and the cancer setbacks. "It never did bother me much, because I knew that philosophically we had to do it," he says in his Southern drawl. "These kids who have these diseases, they're miserable shape. I think we can do anything to stop their disease. I think we must do it."

The public took little notice of the work Rogers was doing. Genetic engineering was not yet the stuff of headlines. But by the middle of the 1970s the public began to pay attention.

By then scientists had learned how to isolate single genes and use new techniques to produce unlimited clones, or copies, of them. They cut open rings of bacterial DNA called plasmids, with chemical "scissors" and spliced foreign genes into the circle. The plasmid then infected the bacteria, carrying with it the foreign gene. The dividing bacteria became a kind of factory, producing millions of copies a day of the plasmid and the foreign gene. Then the genes could be recovered from the bacteria and purified.

As purified genes became available

through these techniques of recombinant DNA, the next step was to try to insert them into cells. Success came in 1977 to Richard Axel and his colleagues at Columbia College of Physicians and Surgeons in New York City. The procedure—used widely today—turned out to be as simple as kitchen chemistry.

The researcher draws a measured amount of a clear, watery solution of purified genes into a pipette and releases it into a plastic tube containing another clear liquid, a calcium phosphate solution. He waits 30 minutes or so until the liquid becomes slightly cloudy. This indicates that calcium is precipitating out of solution with the genes.

A few drops of the precipitate are added to human or other mammalian cells growing in a watery nutrient medium in a petri dish. For some reason yet unknown, the gene is taken into the nucleus and integrated with the cell's own DNA in a process called transformation.

In a nation where recombinant DNA had become a household word, the first gene-transfer work hardly seized the public imagination. The get-rich-quick-in-biology fever had largely eclipsed the first fears of "Satan bugs," clones of Hitler and plant/people monsters. Public excitement had focused on the simpler and more profitable feat of putting genes into bacteria for mass production of interferon, insulin and other pharmaceuticals. But the headlines for

gene transfer into animal cells weren't far off. Within two years of the Columbia experiments came the first transfer of isolated genes into living animals and a breathtakingly short time later into man.

One of the most tragic aspects of cancer is that any treatment for it is often as devastating as the disease itself. Powerful cell-killing drugs, such as methotrexate used to fight tumors, also damage normal cells, especially vulnerable bone marrow.

Methotrexate kills cells by inhibiting an enzyme needed in the formation of other essential chemicals. But certain tumor cells eventually develop a resistance to methotrexate by producing multiple copies of the gene for the enzyme. This platoon of genes can turn out more enzyme than the drug can block, and the cell survives. This is, of course, an undesirable trait in cancer cells. But if the ability could be transferred to healthy cells, doctors could give larger doses of methotrexate to cancer patients and their bone marrow would still survive.

In April 1980 nationally known blood specialist Martin Cline announced his University of California at Los Angeles team had transferred this genetic protection to the bone marrow of living mice.

Cline had taken bone-marrow cells from mice and incubated them with the protective genes by using the method developed in Axel's lab. Cline and his colleagues injected all the cells back into mice whose marrow had been destroyed by radiation.

Then the team gave daily doses of methotrexate to the rodents. The cell-killing drug prevented proliferation of the transplanted marrow cells that hadn't taken up the protective genes. The resistant cells flourished. Defended by injections of genes, the mice became immune to the adverse effects of the drug.

Cline announced then that in three to five years, such a system might be tested in human cancer patients to allow them to tolerate higher, more potent doses of anti-tumor drugs. Not known as a man to hang back and wait for the crowd, he wasn't planning to wait half a decade before trying gene transfer in humans. The first disease targeted for gene treatment, though, was not cancer. It was an agonizingly painful blood disorder.

All of the 100 trillion cells in the body depend on the protein hemoglobin in the red blood cells to deliver the oxygen they need to function. The wear and tear of surging through the blood vessels limits the life of a red cell to about four months. Consequently bone-marrow cells are kept busily turning out new red cells at a rate of about 2.5 million a second.

When the genes responsible for making the components of hemoglobin can't keep pace, or when they deliver defective parts, or when they don't work at all, the results can be devastating blood diseases. In sickle cell disease, a chronic anemia that afflicts about 60,000 blacks in the United States, the red cells are rigid and distorted, making it hard for them to squeeze through



tiny capillaries. When they get stuck and block blood flow the result is severely painful "ickie cell crises" often followed by death.

Among the peoples of the Mediterranean, the Middle East, and the Far East, another life-threatening group of hemoglobin defects—the thalassemias—pass from generation to generation. In persons afflicted with beta zero thalassemia, one of the proteins needed to build normal hemoglobin is not supplied because of a defective gene. Red blood cells, made by the marrow, are brittle and shatter easily.

In the spring of 1980, as China was proclaiming the first gene transfers into animals, a woman in Jerusalem was plugging cassettes in her 21-year battle with beta zero thalassemia. Her body in a desperate attempt to make enough replacements for her fragile red blood cells, produced so much marrow that her bones became deformed and her face was distorted with oversized gargoylike features. She had suffered numerous disfiguring fractures which left her with a limp and made walking a painful task.

The billions of red blood cells shattering throughout her body over the years had left behind a deadly accumulation of iron, which was crippling her heart. She had been hospitalized frequently for chronic heart failure. The blood transfusions she needed to stay alive only made the iron overload worse. Intelligent and aware of her condition, she also knew that few victims of the disease live past their twenties.

Glene had been thinking about a way to attack the hemoglobin diseases long before he met the young woman in Jerusalem. Why not remove bone marrow cells from the patient (reel) good genes, and put the cells back in the patients?

An aggressive and self-confident physician, Chiu, forty-seven, was already a recognized world authority on bone-marrow cells. He was a relative newcomer to molecular biology. Nevertheless, he decided the time was ripe for trying the gene transfer.

But there was a major hitch. No one had ever got the genes to work properly in cultured cells. Cline went on to the next experimental step: He tried putting the human genes into mouse bone-marrow cells and transplanting these cells into mice. The genes didn't work there, either.

Still in the spring of 1979 Gine asked UCLA review committees for permission to try gene-transfer therapy in sickle-cell-anemia patients. He also sought permission from hospitals in Italy and Israel to try the therapy in thalassemia patients.

A few months after the announcement of his Mediterranean work in mice, Clima flew to Naples to meet with colleagues at the University Polyclinic. He took along samples of human genes for a component of hemoglobin. And he carried the genes with him when he flew on to Hadassah Hospital, in Jerusalem.

officials notified Cline that permission for human work had been granted. Cline lost no time. By 8 A.M. the twenty-one-year-old victim who was to be the world's first gene-therapy patient had arrived at the hospital.

Two hours later she was given local anesthesia. Her hipbone was pierced with a long needle, and 15 milliliters of marrow (only a fraction of the 10 liters in the body) and blood that was circulating through it were drawn out.

The marrow-and-blood mixture was placed in a dish and a precipitate of calcium phosphate with gelatin was added.

Five hours after it had been removed, the blood-and-marrow mixture was injected into a vein — standard procedure in marrow transplants. The cells — 400 million of them, perhaps 5,000 carrying new genes — circulated in the blood and eventually homed in the marrow.

Within the week, Cline flew back to Naples and performed the same procedure on a sixteen-year-old girl from Tunis. Unlike the Israeli patient, the Italian teenager had no gross bone deformities. But she had been dependent on transfusions since early childhood, and non overload was already harming her heart.

In Los Angeles that same week, convinced that more animal work was needed, the UCLA committee turned down Gins's application to transfer genes into sickle-cell patients.

When news of the human experiments broke in October 1960 a furor erupted in the scientific community. With unaccustomed ferocity researchers throughout the United States publicly accused Cline of leaping blindly and abandoning good scientific judgment in an effort to be first.

"He was hoping against hope the genes would work in humans when they never had in other animals or cultured cells," one molecular biologist says. "That's nonsense. It's like pouring water into your car and hoping it started hope if it work like deadline."

A committee of the NIH later found Cline guilty of violating several federal guidelines, saying he should have obtained permission from UCLA for the work he did abroad. UCLA accepted his resignation as chief of hematology-oncology. By the end of 1981 he remained a tenured professor, although he lost \$190,000—about half—of his federal grants.

As for the two patients, all China will say now is that they are still clinically okay. But reports from Italy and trial indicate blood samples from both girls haven't changed. If the new genes were working, some normal hemoglobin should be present.

Were there any risks in the experiment? Could a new gene bump other normal genes or control mechanisms out of place on a chromosome? Could an improperly regulated gene produce too much of a protein product or wander from the target cell into other cells where it didn't belong?

There are always those possibilities," Gline says. "It may well be that when one begins to introduce large amounts of pe-

[illegible]

netic information with some low but real frequency you will turn genes on that you don't want to turn on." But in the last experiments on patients who already have fatal diseases, he doesn't see the potential risks as serious problems.

Deafened by the affair and somewhat fearful because he didn't follow the rules-without-penalties, Cline still defends the experiments and their timing. Most of his critics were lab scientists, not clinicians, he says, and such people don't see the plight of dying patients.

In the initiation of most treatment for lethal diseases like cancer, a good deal less is known than was known at the time these studies were begun," he says.

He believes someone else would have tried the replacement therapy in a year or two or three at most, if he hadn't. Probably more intelligently than I did, more circumpectly," he admits. "The field has gone fast, extremely fast. And even though studies on humans are temporarily suspended, clearly it's going to be a matter of only a few years."

"I think most people agree that gene therapy is a real possibility in the future. No one I know of has said 'No, you won't be able to replace genes. The criticism has come in the timing and in how much we must know before we proceed.'"

There is almost universal agreement among scientists that one thing we must know before applying these techniques to humans again is how to get transferred genes to work right. Two or three years ago buoyed by the rapid advance in gene isolation, cloning, and transfer scientists—apparently including Cline—were optimistic that they would quickly learn to control genes. But it has turned out to be, as California Institute of Technology molecular biologist Leroy Hood puts it, "a very nontrivial problem."

Anderson sees at least three problems to separate and solve before natural gene controls understood. First, bits of DNA that switch genes on and off, like a light switch placed far from the lamp it regulates, may lie far upstream on the chromosome from the genes they affect. Even if a section of DNA with both the gene and its control element on it can be shipped off and isolated, it might take too long to clone with current techniques.

The two other problems arise in the cloning. A dividing bacterium—better home for nurturing genes—may not be able to equip the gene copies with some specific, important modification they would get if they were being produced naturally in a developing embryo. Finally packaging and position on the chromosomal thread may be important. A "naked" gene, isolated and cloned, may lack the element of control that comes from the coiling of DNA in the nucleus.

Some genes are easy to turn on. The human growth-hormone gene, for example, can be inserted into various kinds of cells. No matter which cell they're in, hormones can control them, Axel says. His lab

has also achieved success with "heat-shock genes" taken from fruit flies. These dormant genes in fruit flies are activated when the temperature rises 12 degrees above normal. Inserted into mammalian cells, these fly genes still go into action when the temperature rises.

Another gene that scientists believe may have a simple on-off regulation is one that directs production of an enzyme called HPRT (hypoxanthine guanine phosphoribosyl transferase). A deficiency in this enzyme causes a horrible form of cerebral palsy called Lesch-Nyhan syndrome. Children afflicted with this disease, if not restrained, will chew off their lips and fingers and bite others who come near them. Many labs are working to isolate the gene.

Researchers are also looking for more efficient ways to get new genes into cells, though none of the methods now being studied appear suitable for immediate use in humans.

One way involves loading genes aboard

Should we try to eliminate genetic diseases from the planet the same way we have tried to eliminate smallpox? Do we have an obligation to do this? Who will make these decisions?

viruses, simple and tiny microorganisms that invade and take over cells. Nobel Prize-winner Paul Berg of Stanford and many other scientists are exploiting the ability of tumor viruses to break through cell walls and command the production of more viruses. Whole tumor viruses are not suitable for human experiments, although stripped-down viruses are now being developed that will not kill the infected cell or turn it cancerous when the virus carries genes into the invaded cell.

Another gene-transport system is deceptively simple. Squirt genes in through the cell wall by using a tiny glass needle. Anderson's team has used this process to insert new genes directly into the nucleus of a single mammalian cell. Other researchers have made rapid advances by using this technique to inject genes into a fertilized egg. Jon Gordon and Frank Rudolph of Yale are nurturing a third generation of mice that carry human interferon genes, although the genes are not working to produce interferon.

The researchers allow mice to mate normally, then a few hours later remove the fertilized eggs from the female. Looking

through a microscope, the scientist pierces an egg with a hollow glass needle only a few ten-thousandths of a millimeter in diameter and releases a spurt of genes.

The work is challenging. Sometimes the cells swell and burst. On our best days we probably kill a quarter of the cells just by putting the needle in," Gordon says.

The researchers can inject from 50 to 100 eggs a day and surgically implant the survivors into female mice. Half the embryos may survive to birth and one embryo may actually carry the foreign genes, Gordon says. Although it sounds tedious and difficult, it's a fairly high-efficiency procedure," he notes.

Thomas Wagner of Ohio University and Peter Hoppe of Jackson Laboratory in Maine advanced the process one step further when they used the same technique to transfer rabbit genes for hemoglobin into mice. Not only have the rabbit genes been passed on to a second generation of mice but some of the mice are actually making the rabbit protein.

Now that human eggs can be fertilized in a test tube and be implanted in women who produce healthy babies, microinjection techniques open up the possibility of gene therapy at the embryo level. But Gordon on Yale we don't want to use it.

If you have prenatal diagnosis so sophisticated that you can identify a bad genetic make-up at the zygote stage, then you can simply not implant that embryo, bypassing therapy, he says.

If injection therapy was used, would a gene inserted into the embryo begin to work in every cell of the adult? It could be a very serious problem if a person was making hemoglobin in his brain or liver or kidney, Gordon says.

We can treat some human diseases with the technology without ever microinjecting a human egg," he adds. Studies of gene function in animals may lead us to better solutions for disease and defects than are now imaginable.

Cline agrees that microinjection may not be ready for use in human embryos for decades or decades if never. But therapy of the type he tried in order to cure diseases caused by single genes is not far off, he predicts.

There's a few or six years of doing this type of work ahead of us to perfect the technology that can get the genes in consistently and in the right place, and get them expressed at reasonable levels," Cline says. But I would guess that within the next five years or so the technique should be widely applied to man.

Automation is speeding the process of identifying which defective proteins are associated with genetic disorders and then tracking them back to the genes.

In Leroy Hood's lab, at Caltech, an automated biochemistry sets the size of washing machines. One is a sequencer. It can take a few millionths of a gram of protein, chemically snip off each amino acid like beads from a necklace, and identify

them by liquid chromatography. The sequence of amino acids spells out the DNA code of the gene that made it.

Armed with the code, Hood can punch it into the keyboard of the other instrument, the gene synthesizer. A microprocessor takes over opening and closing valves systematically releasing multicolored reagents, solvents and chemicals onto a small disc, where a portion of an artificial gene is assembled piece by piece. The end product is a fine white powder, dry-dried genetic material.

The powder is like a copy of a piece in a jigsaw puzzle. It can be used to search for the original piece. Radioactively labeled the synthetic gene material probes the DNA isolated from a cell, then links up with the natural gene from which it was copied.

I would predict in five years that we'll have DNA probes for one hundred or two hundred human genes, many of which are involved in genetic diseases," Hood says.

And he foresees even more sophisticated instruments that might scan fetal genes for defects. Fetal cells removed from the uterus now by amniocentesis can be examined only under the microscope for gross abnormalities in the chromosomes or extra chromosomes that signal diseases such as Down's syndrome.

Someday the DNA from these cells may be broken down into thousands of fragments and be run out on a gel that separates them according to size, Hood says. Then a defective gene responsible for sickle cell or some other disease could be radioactively labeled and added so that a possible match among the fetal genes might be discovered.

There are probably thirty-five hundred human genetic diseases that have been defined, and far fewer than two hundred can be diagnosed by amniocentesis if we use current techniques, he says. The hope is that with recombinant DNA techniques we may be able to look at far and away the vast majority of these.

With anything beyond single gene traits or functions, the timetable for gene therapy becomes fuzzy. As soon as you begin to deal with complex multigene systems, the problems multiply that much more, Cline says. You have to identify all the genes and have them arranged in some way so that they can be controlled coordinately.

But the possible limits of the field don't daunt zealous researchers. I think recombinant DNA is going to be the biggest thing for the next ten to fifteen years in medicine, Hood says. In diagnosis, in therapy, in the potential for understanding at a fundamental level the nature of disease.

The only uncertain thing is the timetable Hood suspects. Clear technical problems remain, he says, but if you take the broader view, there's no question that we'll solve them all.

For some observers, the ethical and social questions loom larger than any technical problems still to be faced. Mistakes and misuse seem inevitable. Says Theodore

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Friedmann of the University of California at San Diego. But he and other scientists don't want to see the pursuit of knowledge hampered by questions about how widely society will apply the fruits of research.

This work is not being carried out by megalomaniacs or crazy people who are doing it just because it can be done," he says. The exciting thing now is that for the first time, one is imagining treating metabolic diseases where the defect is instead of treating only the symptoms.

But how far should therapy go? Should we try to eliminate genetic diseases? Sheldon Krimsky, at Tufts University asks: Are we obligated to do this? Who should make these decisions?

Should therapy be limited to the correction of defects in individuals, or should we attempt to improve the germ cells of people who carry hereditary diseases? Do we want to improve the species? As we learn more about the impact of the environment on genes and about which genetic sequences are associated with longer life spans or a more effective immune system, opportunities will arise to play this kind of genetic-engineering game on a fertilized egg," Krimsky says.

I'm concerned about the programming of the fertilized egg or the newborn with particular characteristics. I worry about the onset of a genetic aristocracy," he says. If I lie, "You must tell me your child does not have genetically engineered into him or her the genes for — and you name it."

Beyond that is the idea that scientists and medical people possess the wisdom to determine what the prototype of a human being is," Krimsky says. It's that area that people are not talking about now because they're really not at that stage. But with the idea of mapping the human genome, it won't be that long, twenty or thirty years, before we begin correlating genetic sequences with a propensity toward certain diseases."

It is a well-meaning but misguided use of science that presents the real danger Krimsky and others believe. Who wouldn't want a perfect baby? But scientists today are universally opposed to tampering with the human embryo.

New articles gladly refer to a future when we will program our cattle to put all their energy into producing milk and we'll engineer our crops to survive on salt water. Will we use our burgeoning knowledge to enhance the individual? Or will we use it to make individuals, like cattle and plants, to suit society's needs?

From the herds of identical semiconformers to Alphaeus with carefully programmed intelligence, most of the characters in Huxley's vision were content. The world was at peace. Rage and passion were tamed. Aging and disease were banished. Fancies and tears, dreams and anxieties — all fattened to a lightning monotony. It is good to remember that the Brave New World was born of benevolent intentions. **DD**

SPACE

CONTINUED FROM PAGE 29

Perhaps the mission should also include a spacewalk ship-to-ship personnel exchange to simulate emergency evacuations. Small packets of equipment could be transferred to the Salyut for long-term operation in space, after which the results would be turned over to American specialists. The Salyut crew in turn could send recent experimental results back to Earth aboard the Shuttle.

One especially rewarding activity could be carried out in the arena of space medicine. In this field even today there exists a vigorous, mutually beneficial exchange of data between the two superpowers. An American astronaut, preferably a physician, could visit the Salyut and spend several hours conducting medical examinations to calibrate U.S. developed space medical-monitoring equipment. Data would provide a baseline for future U.S. long-term space missions and at the same time give the Soviet scientists a different angle on their own space medical observations.

In later missions, which might be repeated at least once annually, personnel could be exchanged for longer and longer periods. American astronaut specialists could conduct materials processing experiments aboard Salyut, with Soviet electrical furnaces, perhaps powered by hookups from the docked Shuttle and its power module. Soviet cosmonauts could make scientific observations with U.S. astronomical equipment. U.S. developed cages containing large animals could be placed aboard Salyut for retrieval up to a year later. Ultimately in the late 1990s, the swapped personnel might even be able to complete their missions and return to Earth in the other nation's spacecraft.

The crew-training procedures for foreign guests have been established in both countries. Nine foreign cosmonauts have already flown in the USSR's spacecraft, and a French pilot will visit a Salyut space station in mid-1987. Two European astronauts have been trained in Houston, and other European payload specialist astronauts are to be sent to the Marshall Space Center in Huntsville, Alabama. This year where they will remain until next year.

Shuttle Salyut has its logic. The Russians can do what the Americans currently cannot do: keep manned platforms operating efficiently for months or even years. The Americans can do what the Russians cannot do: transport large bulks rapidly and easily from Earth in orbit and back to Earth. The U.S. government need not initiate such a mission. In 1984 NASA has scheduled another mission called Spacelab-D-1. A Spacelab module conducting materials-processing experiments for the West German government and for the European Space Agency. The foreign clients are paying cash for the mission and

they specify the flight program. If the Europeans, who will have astronauts aboard Spacelab-D-1, want to make a space rendezvous with the Russians, NASA might have to change their rules for the extra work, but the customers are always right, and it's their money.

The cost of the 1975 ASTP linkup in today's currency was upwards of \$500 million. Similar expenditures in the prevailing budget terms are naturally out of the question. But Shuttle-Salyut would be an add-on mission, sharing overhead costs that are already being borne by the Space Shuttle and Spacelab programs. And most important, the linkup would not require the purchase of a dedicated, single-purpose booster and spacecraft, since they are already bought and paid for. Under such conditions it is hard to imagine how such a program would cost per flight more than a tenth as much as ASTP cost.

NASA's current attitude about the possibility of such a mission is apparently undefined. After ASTP follow-on manned missions were seriously considered. But the Carter Administration discouraged such studies. In late 1978 an internal NASA memorandum was issued to instruct public-affairs spokesmen in how to answer public inquiries about possible future joint missions. A 1977 agreement between NASA and the Soviet Academy of Sciences calls for a study of the objectives, feasibility, and means of carrying out a joint experimental program involving the U.S. Shuttle and the Soviet Salyut. Preliminary discussions on the subject were held in Moscow last year [1977]. No further discussions have been scheduled pending a comprehensive U.S. interagency review of the entire subject. We cannot predict when this review will be completed or what the outcome will be. The discussions in other words were bureaucratically scuttled.

Moscow got the message. On each anniversary of the July 15, 1975 ASTP launching, Soviet authorities issued statements praising the mission as proof of the value of cooperation while criticizing the Carter Administration for cutting off discussions on the next step. Russian cosmonauts often told newsmen how sorry they were that no new cooperative ventures were being undertaken.

Back in Washington meanwhile the suspended negotiations were evidently soon forgotten. After the election of Ronald Reagan, James M. Beggs became the sixth NASA administrator and was sworn in last summer. Under Study Ball asked him:

Do you think that there will be any opportunities for opening up joint Shuttle-Salyut missions maybe when Spacelab gets operational in 1984 or 1985?

Beggs replied: The Russians have made absolutely no overtures to us to open up any joint missions in any of the discussions that I have been privy to or have been informed of. And I don't expect them to because their perception is that they have moved out ahead of us for the moment.

The 1977 official Shuttle-Soyuz bilateral agreement evidently had fallen through the crack of administration transition: the vacuum of institutional amnesia.

Another perception that could hinder such a mission is the widespread public attitude in the United States that the 1975 Apollo-Soyuz was some sort of "space ngiff" in which the Russians stole our secret space technology while exploding a propaganda bonanza by unfairly posing as a "space equal" with an American side that actually did most of the difficult work. Phrases were heard about a "wheel deal in the sky" or a "quarter-billion-dollar space handshake."

Most well-informed observers agree that it wasn't nearly that bad. During ASTP no hardware changed hands. Procedural and management techniques were discussed, but each side already had its own way of doing space business. The institutionalized Soviet fetish for secrecy and compartmentalization probably made it impossible for the Russians to adopt any NASA techniques anyhow. What both sides did give up were misconceptions that each held about the other rather than their own precious secrets.

A mutual familiarity with each other's mental space programs is salutary. The current hysteria in the USSR about the militarization of space brought on allegedly by the Space Shuttle may be partly a hypothetical anachronism. But in large part it probably stems from genuine anxiety and misperceptions. Grossly exaggerated Western press accounts of death rays, space bombs, and satellite kidnappings fan Soviet fears. But these frightening technologies are much far from realization than the Russians pretend. Parallel anxiety has been expressed in the West about Soviet manned military activities, primarily in reconnaissance. If such fears are baseless on both sides, everyone benefits when urinals are exposed.

An American call for renewed manned space cooperation would finesse current Soviet propaganda offensives about an American resumption of Cold War psychoses. And an invitation to meet in space would be in the tactical tradition of President Reagan's brilliant zero-sum European-massive speech made last November. If it works great, and even if it doesn't, the proposal makes a positive impression. Shuttle-Soyuz would graphically demonstrate (at virtually no cost) our willingness to engage in substantive, mutually beneficial negotiations and cooperation despite political differences.

Symbiosis has been a time-tested and valuable trick of the trade for life on Earth, even often between mutually antagonistic organisms. Perhaps that technique can move out into space. The 1980s are going to be a time for learning to operate, both independently and jointly in near-Earth or bits, but lessons learned there could be applied in the 1990s to a new exploratory mood—and Mars is waiting. ☐

DREAMS

CONTINUED FROM PAGE 12

mind. For his first experiment, he intends to make a small scratch on each arm of a group of oneirocnauts, then ask them to heal only one arm during nightly dreams. LaBerge plans to monitor the experiment, and if it is successful, most oneirocnauts will find one arm healing more rapidly than the other. If the mind really does have the ability to heal the body, LaBerge adds, it should be most effective during the dream state, when the stimulation of the outside world is at its minimum and concentration at its maximum.

The crucial word here is *if*. The whole field of truly scientific lucid-dream research, Gackenbach points out, is still in its infancy or at least early toddlerhood. Most of the current researchers in the field have received their Ph.D.s only in the last four years.

Then there's the skepticism of veteran dream researchers such as Dr. David Foulkes, a psychologist at Emory University in Georgia, and one of the pioneers in the psychology of dreaming. Why, he wonders, do we want to change our natural dream accomplishments? Mightn't we be better off trying to observe, understand, and figure out what's going on, rather than immediately trying to change it?

And there are those who question the wisdom of using something like lucid dreaming as part of a therapy approach. A bit premature, worries one experimenter. If you start getting people to question reality while asleep, might it not overtake?

Wafarud admits the dangers of lucid dreaming. It is risky for people who have trouble taking the difference between fantasy and reality. No one should get this brand of therapy, she says, without the proper psychological help and guidance. Nor is lucid dreaming essential. If the dream is running along in a way that gives you satisfaction, I say don't bother to be lucid, she adds.

The challenges and mysteries of lucid-dream research seem limitless, but then that's part of the subject's appeal. You can pick your own problems.

When last interviewed, LaBerge had singled out a brand new problem for himself. He wanted to see whether there was any distinct right-brain/left-brain activity during lucid dreams. So whenever he gets the chance, he or one of his oneirocnauts spends a night in the sleep laboratory with electrodes stuck to the right and left sides of the skull.

To test for brain shifts during dreams, he first counts to ten (a left-brain activity) and then, to elicit right-brain response, sings a song. He started me by suddenly singing it into my tape recorder.

Flow, row, row your boat.
Gently down the stream,
Merrily, merrily, merrily, merrily
Life is but a dream. ☐

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EARTH

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cannot be grown naturally in warm climates, yet Southeast Asian countries lack the technology to produce them artificially. If the toons are not being produced locally, the State Department concludes, they must be smelting in Southeast Asia from factories in the USSR. Biochemist James Bamberg, of the University of Colorado, however, insists that the toons are "ubiquitous around the world," capable of growing in warm climates and cold. Smalley says the spores can survive only in moderate climates, but he adds that Southeast Asians are entirely capable of producing their own supply.

• Richardurt, the State Department's director of politico-military affairs, implies that the attacks were conducted by Soviet aircraft, sometimes identified as AN2s, biplanes used as cropdusters in the USSR. An examination of the department's own compilation of refugee reports, however, reveals only two cases in which an AN2 was used. In contrast, at least 39 reports identify the attacker as a single-engine, high-winged plane known as the LIR. Used commonly in Southeast Asia, this obsolete aircraft was built by an American company, Cessna.

• The reports are fraught with internal inaccuracies. One of the two reports mentioning airplanes says the yellow rain was dropped from 7,000 feet. But a United Nations report issued last November notes that, at that altitude, no effective concentration could reach a target. Based on its own admittedly incomplete investigation, the U.N. team asserted it could reach no conclusion about the use of yellow rain.

Answering the critics, Fred Cole, of the State Department, claims that insecticides have never been found growing naturally in Southeast Asia. Although small amounts can be laboratory-produced, only a complex technology could produce the quantities and mixtures falling on Agent villages. The Russians have such facilities, he asserts, but because the evidence falls within the department's "sources and methods," Cole will not discuss it.

It's that kind of vagueness that disturbs serious investigators. Even the most convincing chemical tests mean nothing if you don't know the source and integrity of the sample. The department says all samples were collected by trained personnel yet it ruined its own credibility when it revealed that one sample arrived via Soldier of Fortune, a magazine for mercenaries.

To Fred Swartzendruber, a former Menominee Central Committee member who lived in Laos from October 1979 to May of last year, the State Department's claims seem "bizarre." While journeying through the affected areas, Swartzendruber often saw Laotian hill people hitchhiking to market in their native garb and openly farming opium—hardly the victims of chemical

genocide. He and others also report a striking absence of market rumors about the attacks—rumors he says the Laotian government would find it impossible to squelch.

Clearly the State Department has more searching to do before it can prove the Russians are committing murder by air. But the evidence does suggest that the 10,000 were man-made. In December an American Broadcasting Company news team offered frightening proof of this assertion in the form of samples collected by Hmong tribesmen—native Laotians who left a Thai refugee camp, then searched the jungles of Laos for two months to substantiate what they claim is a Soviet genocide program. In addition to the deadly toxins, ABC's analysis revealed that the samples contained a dispersant related to polyethylene glycol, a substance never found in nature. Like other investigators, however, ABC must still answer nagging questions about how and where its samples were obtained. The news team after all, did not accompany the Hmongs through the jungles of Laos.

And still there are the refugee reports, these haunting tales of chemicals sniffling from this sky. Experts say a few reports may actually refer to Vietnamese use of tear gas left behind by Americans almost a decade ago; this incapacitating agent causes an immediate burning and choking sensation and in some cases, vomiting and death. All symptoms reported by refugees. Others say local forces may have used bixoxime sporadically. Told and retold in the rich oral tradition of the Laotian hill people, those incidents may have grown to grotesque proportions. And although Soviet complicity hasn't been proved, it cannot yet be dismissed.

If there's a footnote to this whole affair (it's the money that in troubled Southeast Asia such atrocities are nothing new) The National Academy of Sciences has reported there are at least ten villages in which people suffered diarrhea, coughed blood and finally died. The report was issued in 1974. The subject: the effects of American herbicide spraying in South Vietnam. ☐

RESULTS

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TELEVISION

COASTING WITH FROM FROM 35

Brian Clements, an English author best known for his work on the fondly remembered *Avengers*-series, Jeffrey Bloom, writer and director of the movie *Blood Beach*, and, surprisingly—in light of his outspoken criticism of television—noted fantasist Harlan Ellison.

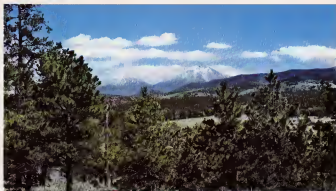
Bringing such a collection of high-powered talents together on one show is rare in TV these days. Perhaps the reason for this is that *Dark Room* is the first serious attempt in years to bring anthology shows back to network television. Anthologies, of course, were a staple of the networks in the 1950s, but they have not done well commercially in the last 20 years—several cancellations in TV history.

Fechter is also trying to break out of the standard TV-series format by using seven different stories in a single hour-long episode. We might use as many as three, lasting anywhere from five minutes to sixty minutes. But the idea is that *Dark Room* stories will take up just as much air time as they need, and not one second more.

Fischer is hedging his bet a little. Part of the problem with the classic anthology format is discontinuity: You can confuse your viewers when you give them a hot courtroom drama one week and follow it with a warm family show the next. You need some central figure. The focal point of *Dark Room* is a mysterious photographer (played by James Coburn) who will introduce each story and provide the necessary narration.

“If anthologies are so easy and require continuing hosts, why bother?” They simply offer the most possibilities for drama,” Fischer says. “I’ve been involved in lots of series, and the trouble with the best of them is that the first few episodes look great, but even the best of them, like *Kojak* and *Rockford*, fade after a while. What we really want to do with *Dark Room* is make miniature movies of the week.”

Dark Atom appears to be quite an unusual development from an industry that has grown increasingly conservative in the past three or four years. Even its road list concept—the project originated with film and TV producer William Sokolheim—to series was unusual. ABC ordered 13 hour-long episodes without requiring the customary pilot film. But the great unanswered question is, Can a fantasy horror or science-fiction series attract enough viewers to survive? It hasn't worked in the past, Ellison says, on the level of *A&A's* *SH*, but *Twilight Zone*, and to a lesser extent *Outer Limits*, have been successful in return. They're still finding an audience, and they always will. The fantasy genre is the only genre that has anything to offer on television anymore. Only a dramatic fantasy anthology can take you into the darkness each week. You don't even know whether the lead will survive. **DG**



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observer. I was surprised that the partial phases that had commanded rapid attention moments earlier now went unnoticed while vodka, rum, and sake were passed around. Members of my group popped corks from bottles of Russian champagne.

My group included about 60 men and women, some experienced eclipse watchers and others like me, comparative novices. The veterans included a meteorologist with the U.S. Weather Service in Philadelphia, a world-renowned eclipse expert from the U.S. Naval Observatory in Washington, D.C., and amateur astrophotographers. They were amateurs, however, only in the sense that their formal professions are law, education, engineering, medicine, and finance; their photographic work is of expert caliber.

Those who were less devoted to eclipse watching were devoted to the eclipse watchers. These were husbands, wives, and children, who tote cases of equipment over hills and across plains, wherever in the world eclipses can be observed.

At Kennedy International Airport, where we gathered on the day of departure, it was evident at once that most of the group had traveled together many times previously in pursuit of eclipses, and always under the aegis of World of Oz, a New York-based agency whose forte is special-interest excursions. The tour leaders were Dr. Fred Heas, professor of physical sciences at the State University of New York Maritime College and a lecturer at the Hayden Planetarium, and Don Tomlinson, a well-known astrophotographer. Prominent telescope designer and photographer Robert T. Little served as an assistant tour leader.

We had been well briefed by Little, who sent each of us a booklet filled with hints about how to photograph eclipses along with Mylar sheets to shield camera lenses from the sun's rays during partiality. Later he distributed strips of processed film, through which we could safely look directly at the sun as it disappeared gradually behind the moon.

Total solar eclipses mean much more than an excuse to take an interesting trip. Eclipses provide scientists with opportunities to study the physics of the corona and the solar prominence, to search for interplanetary dust to study gravity in the earth's atmosphere, and to measure the diameter of the sun.

Astronomy is a uniquely democratic science. Professional astronomers need more eyes on the sky; they understand that amateur stargazers have made important contributions to our comprehension of celestial phenomena. There is always the chance that any one of us might do as much.

UPCOMING ECLIPSES

There will not be a total solar eclipse visible from the United States until August 21, 2017. But eclipse watchers who are willing to travel need not wait so long; they can join eclipse tours to Sumatra in June 1983 and to New Guinea in November 1984. **CC**

EXPLORATIONS

CONTINUED FROM PAGE 32

By 11:30 half the sun's disc was hidden from view, and the expectant hush brought into audible high relief the chatter of birds swooping for cover, confused by the sudden approach of nighttime gloom at mid-day. Plants reacted accordingly too, and daytime blossoms began to close.

Throughout the earth's history the phenomenon of a solar eclipse has disquieted man and nature. The earliest recorded eclipse of the sun, described in the ancient Chinese classic *Shu Ching*, or *Book of Historical Documents*, occurred more than 4,000 years ago, on October 22, 2137 B.C. Then, and for a very long time thereafter, it was believed that unless arrows were shot and drums were beaten to frighten off the monster in the sky, the sun would be devoured.

The attendant rituals have changed. Noisemakers have been replaced by the click of stopwatches or the whir of motorized mounts, and only telescopes and cameras are aimed at the sky. Yet the phenomenon of a total solar eclipse is no less awesome today. A hush rippled through the crowd like wind across a wheat field. Totality is still a sobering reminder that there is no natural light on Earth save that which emanates from our nearest star.

The moon's shadow, racing across the earth at a speed of well over 1,000 miles an

hour, brought swift and startling darkness. Though the sky was slightly brighter than at nightfall, the spectacle was transformed into a celestial drama at high noon. It was 11:59:30, and totality was upon us.

The corona of the sun occupied the center of the darkened sky—a shimmering diadem of light, encircling the inky blackness of the moon. No sound broke the silence of intense concentration as scientists monitored equipment and photographers tried to capture such evanescent glories as Bailey's Beads, a necklace of light shining through the valleys of the moon's rim. Just before and after totality rays of sunlight, aptly named diamond-ring flashes, sparkled through the irregularities of the moon's rim. Then, too, there were the prominences—tongues of incandescent hydrogen gas leaping tens of thousands of miles above the face of the sun and appearing at the edge of the visible disc that was the moon. Totality lasted 110 seconds, a relatively brief period because totality can last as long as 7.5 minutes.

And then it was over. A crescent of sun signaled that the phases of partiality had begun in reverse.

The silence was shattered by jubilant shouts. After all, clouds had not obscured the event, and experienced photographers knew they had the pictures they wanted. Even the infourist guides were so moved by their first eclipse, for once, statistics were stilled on their lips. As a first-time eclipse

SCULPTURE

CONTINUED FROM PAGE 28

has printed up instruction sheets for beginners to take to the beach and has taught sand casting at the San Diego Extension of the University of California. The public is often invited to pitch in and help with his projects. It is not an elitist art, but there is a hierarchy among artists: architects must carve journeyman and water carvers. Most of the upper ranks have had previous callings as artists. Although Kinsella says the skills learned from other forms don't carry over the familiarity with design concepts, space, and the flow of artistic creation are key.

A company headed by Kinsella, Sand Casting Inc., is now available for hire at shopping centers and fairs. At Christmas, they built a sand Little Town of Bethlehem in a shopping center, a smashing success. It has more appeal than any other art form I've ever been involved in," Kinsella asserts.

The central motivation for building sand castles, he believes, is a primordial desire to subvert the forces of nature. You start by building a wall against the incoming tide. Behind the wall you build a castle. The bigger the better. Because the beach is flat and sand granules innately wish to be undifferentiated, you confront earth by building skyward. Sand casting owes the most to Romanesque and Gothic architecture, which having developed the arch, could aspire to height. Mont St. Michel, a Krause work, rose to 24 feet.

The sand castles that Kinsella builds today are much smoother and more detailed than his early ones. But the technical end of it hasn't advanced much. We know for a long time that the sand required compaction with water. To do that well takes skill rather than more innovative ideas.

Sand-casting is a twenty-first-century art insofar as it's ecologically correct—no seckering, unrecyclable plastics, no heavy metals, producing painters' toxic no solvents seeping into the skin, and no artistic statement stuck forever to planet Earth.

The technique is basically Stone Age. Sand is everywhere," Kinsella points out. And cheap. Not just by the ocean side, but by rivers, in pits and quarries and deserts. On the beach basically all the dirt and dust have been washed out so all that's left is a lot of teeny-weeny rocks. Often when we work on the beach, we just flood the sand with water. You know how hard the sand is right near the water. Even beach sand will remain compact for up to five to six days. The sand is tight. So unlike water evaporating from a sponge, sand will hold moisture for a long, long time.

"Sand casting is removal sculpture, like sculpting in stone or wood. We pile up a bag load of sand and then carve into that. Most people, when they think of sand casting, think additive—take a bucket of sand and turn it over, pull a little scoop or Dows

cup on that, and stick a flag on top. We take plastic trash cans with no bottoms, fill them with sand, saturate the sand with water and remove the can leaving a cone shape to carve into. (One does not fill a trash barrel and plan to invert it.) Such a barrel weighs almost a ton." Kinsella also uses five-gallon kosher del-pickie barrels, cut off PVC pipe, and eight-foot-long boards for forms.

The sculpture is adjusted to suit the sand available. With some sand the builders can't build as vertically as others, and the archways and flying buttresses may have to be less delicate, more massive. Dirty sand is sticky and durable. A project built in a St. Louis shopping center using quarry sand was still intact six weeks later when management finally had to raze it.

The finesse of recent years has produced a tool kit, consisting of masons' hammers for rough work, steak knives for the small details, scoops for digging, melon scrapers for scalloping, chisels for windows. Waverly french fry cutters for tie texturing, windshield scrapers for smoothing walls, den tubes for chimney molds, and a host of other improvised instruments, many of them gourmet kitchen shop merchandise.

Castle carving begins at the top. The edge is shaved away with a towel. Straight walls emerge. ledges are roughed in. Windows, doorways, and arches are chiseled out by carving deeply enough so that the back ends are black and hollow looking. Farther down the sand pile ramps and stairs are squared off, then steps are chipped out. It takes vision.

An alternative method to formlining is to make an outer rim of sand, with or without the help of a bulldozer and flood the center. That lends itself to the larger projects, such as Windsor Castle, a Krause work 23 feet high and 80 feet long, which used about 1,400 tons of sand. For projects like this a surveyor sometimes lays out the design with a transit. But most of Kinsella's projects aren't preordained.

"It's pure fantasy. That's what I like about it. I don't want to be tied to blueprints. Sometimes I forget I'm not actually building the castle to protect the forces of good against evil.

As anyone, these castles need to be protected. When Kinsella and his friends are doing a big project, they get permission from beach officials to sleep next to the castle. There's something about a sand castle that makes one want to kick it down.

It has recently become possible to transform the ephemeral nature of sand-castle art with a chemical compound called Polar-Crete, which, when sprayed on, lends permanence to the creation. How much permanence is still in the experimental stage. Although one might fear that such a process would introduce greed and other ills of possession, Kinsella insists that will be only one more aspect of casting, a commercial addition. It still wants to go down to the beach on a fine afternoon and play in the sand. **CC**

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COMPETITION

By Scot Morris

Our twentyninth outing asked for prose cartoon ideas. Though several readers sent in sketches — some quite professional looking — we stuck by our original challenge for “left-brained cartoons” in which the gag is explained entirely in prose.

The most common repeats “voice from the shuttle...I thought you had the keys...” or “Why didn’t you think of that before we left?” Allens to each other as Earth ship lands. “Well, there goes the neighborhood.” There were aliens playing a video game called Earthling and several predictable “illegal alien” gags. Special acknowledgment to Guin E. McDaniel for 26 alphabetical entries.

Since it was a prose cartoon contest we allowed some entries that would be very difficult to illustrate.

We can’t guarantee that none of these ideas have ever appeared before, but to the best of our knowledge these are all original. Thanks to all for entering, and to Bob Guccione for his assistance in picking the winner.

GRAND-PRIZE WINNER: \$100

The ambassador from Earth, along with his wife, prepares to meet the extraterrestrial and his mate. The aliens have a completely different body type, yet both females are wearing the same outfit.

—Alicia Poland, Oklahoma Park, MO

RUNNERS UP: \$25

Doctor to patient: after physical examination...in my professional opinion you are healthy. Remember though, use this opinion for comparison purposes. Personal health may vary depending on conditions not under my control. California estimates of health may be lower.

—Paul E. Staeski, Berkeley, Mich

On a hill stand a man in biblical dress and an accountant holding a clipboard. They are overlooking a valley where lions are seen pursuing and consuming other figures. The accountant complains “They’re eating up all our prophets.”

—J. R. Wilson, Urbana, Ohio

A customer has just bought a new calculator. The salesman points toward the door and says, “Go forth and multiply.”

—Anne Frasier Malone, Chicago, Ill

Frame 1: Lady approaches vacuum cleaner.

Frame 2: Lady vacuums.

Frame 3: Lady walks away.

Frame 4: Vacuum burps.

—Lisa Sargeant, Clinton, N.J.

An inventor and his friend stand in a workshop, admiring the inventor’s latest gadget: an incomprehensible mess of gears, plumbing, dials, and wires. The inventor says, “I don’t know whether it has any practical application, but I figure it’ll hang on a long enough. Dave is bound to run a competition for which it could win first prize.”

—Michael E. Brown, Orlando, Fla

Guy picking up a girl in a disco: “Hi, what’s your hemispherical dominance?”

—Greg Jefford, Clearwater, Fla

A parking-lot space with that sign for HANDICAPPED ONLY PARKING (the wheelchair outline). The space is filled with empty wheelchairs.

—Carole Deeds Wickers, Mayaguez, PR

A half-naked, mighty-throated warrior is hewing his way through a troop of soldiers to get at a cowering princess and her serving girls. A warrior in the foreground is saying to his partner, “What I can’t stand about Conan is his more barbaric-than-thou attitude.”

—Henry Enberg, New York, N.Y.

Spaceman on moon, surrounded by hundreds of round, floating breasts. He’s radioing “Hello, Houston. We’ve found what seems to be a silicon-based life form.”

—Paul Maxeen, Lake Zurich, Ill

HONORABLE MENTION

Two scientists in front of an open door. A sign above says, RECOMMEND DNA LAB. Authorized Personnel Only. Through the

door we see a pimply old witch stirring a bubbling cauldron. One scientist says to the other, “She’s from the old school, but she really knows her stuff.”

—Greg Jefford, Clearwater, Fla

In the background is a sizable pile-up of cattle. Gazing calmly at the animals and lazily chewing a shaft of wheat, one farmer says to a second, “Cow magnets.”

—D. R. Mason, Spokane, Wash

A postman with an evil-looking smile on his face is sitting in a locker room. He’s trying on a new pair of boots that have a rubber-stamp sole reading...

—Geoff Nichols, Montreal, P.Q., Canada

Puzzled Patent Office official, looking at strange-wrapped package, says to inventor, “You say this is a solar-powered sunlamp?”

—Brian Blight, Flint, Mich

A medieval tavern with armored knights arriving on horseback and a couple of raty-looking battered fellows, one leading a riderless horse away and the other standing by a sign that reads VARIET PARKING.

—Richard V. Woodward, Delmont, Pa

A baby is seated on a living-room carpet, facing a computer terminal, and over the baby’s shoulder we can see the words own own on the screen. Mom is talking to Dad, just home from work and still holding his briefcase. “Look, dear, Baby just entered his first program.”

—Natalie Fischels, Stone, Mass

It’s the famous Custer’s Last Stand battle scene, with guns, arrows, and tomahawks all around. But nobody’s fighting. Everybody appears to be listening to General Custer, who says to an Indian, “Well, my broker is E. F. Hutton, and E. F. Hutton says...”

—Paul J. Hewitt, Humboldt, Iowa

On a table are two lab flasks and an open box. One flask is chemistry set, labeled JUNIOR CHEMISTRY KIT. On the floor is a small

NEXT OMNI



FUTURE FASHION



FICTION



RECAP

ROBERT REDFORD AS HIMSELF—Drop that shooting schedule! Forget the Sun dance Kid and Gatsby and Brubaker. Robert Redford has a lot of other things on his mind. From the use of natural resources to the rights of Hopi Indians to the art of Rerun. He remembers climbing mountains as a boy ("more excitement than going to a movie"). He finds death in nature. He mistrusts the press ("too many accounts of what color my boots were rather than what the hell I was talking about"). To discover what the hell he is talking about, read next month's illuminating profile.

TIGER TALK—When *Men in Groups* was published in 1969, asserting that women's hierarchical inequality can be traced to the sexist hierarchies of our primate ancestors, the outrage this hypothesis sparked among feminists nearly led to a full-fledged riot as author Lionel Tiger tried to defend his views. Since then the Rutgers professor of anthropology has continued to provide not provoking analyses of the social goings on of the imperial animal. Today, at work on a new book dealing with evil. Or Tiger pauses to survey the contemporary scene from his special anthropological, sociological, zoological perspective. His comments in April's *Omni* interview are guaranteed to raise hackles—as well as eyebrows.

VITAMIN POWER—"Western man is in danger of losing his legs," says Rockefeller University's Michael Colgan. "He doesn't exercise, take food with little nutritive value, and ingests a large number of toxins into his system." Colgan is attempting to refine nutrition into an exact science. His unique ten-year research has allowed him to develop a highly sensitive, individualized supplemental program that helps to correct for the nutritional sins of the flesh. Filled to your biochemical profile, Colgan's regimen promises to enhance mental and physical performance and fight pain, diseases, and the ravages of time. Next month *Omni* sports firsthand on how a scientist masterbuds superpeople through vitamins and minerals taken only

FUTURE FASHION—Heat molded body suits will come with solar collectors to keep us warm. Men will wear makeup, and women will don paper dresses specially designed by computer; after a day's wear and tear, women will throw them away. And the super-rich, the makers of the race, will dress in expensive, dermaged costumes made of silver and gold. These are the speculations of some of the world's top fashion designers, including John Galiano and Scott Barrie. To examine their spectacular future fashions in detail, pick up your copy of next month's *Omni*.

SCIENCE FICTION—Harrison Elston makes another appearance in April with his story "When Auld's Accompaniment Is Forged," about a man desperate to rid himself of a painful memory, a Galactic troublemaker is ordered to aid a rather unlikely race of aliens, in *Come Fly's* story. And *Also Much Cattle*, and Nebula winner Howard Waldrop tells an inventive tale of music and politics in "He of the Mole."

pyramid, with eyes, nose, and whiskers and possessing a cat's tail. Nearby a small girl is yelling "Mommy!" Jimmy's put Frisky into the fourth dimension again!

—Richard Wentz, Ann Arbor, Mich.

Several types of dinosaurs are being herded up the ramp of a giant spacecraft. In the foreground are two alien creatures. One says "It's not stopping. Vasek. We'll return them in sixty-four million years."

—Robert Hederman, Lanoka Harbor, N.J.

Dozens of flying saucers landing, disgorging platoons of ray-gun-wielding aliens. Farmers lose their burning houses in the background. A nervous TV reporter under the cool eye of an Air Force major recites, "Absolutely the most incredible effect of ball lightning this reporter has ever witnessed!"

—Lars Beck, Loveland, Ohio

The scene is a dueling field. On one side is a man in a cowboy outfit and mask, accompanied by an Indian. On the other side is a man with a crossbow in an Alpine outfit, accompanied by a boy with an apple on his head. In the center is a referee, saying, "Remember the winner of this duel gets full possession of the theme song."

—Theodore Miller, New York, N.Y.

One torturer in a dungeon is holding a suit with elongated arms and legs and is addressing a second torturer: "Do you like it? It's just something I got off the rack."

—Peter David, New York, N.Y.

Two white rats in a lab cage. "Personally, I'm hoping for the saccharin program. I'm bored with mazes."

—John Schwaninger, South Bend, Ind.

Two little boys on a playground. One says, "Yeah? Well, my microcomputer's smarter than your microcomputer."

—Martin J. Hweat, Fort Lauderdale, Fla.

The man with the towel around his waist is M. C. Escher. We know this because he's drawing a bathtub, with a pencil, and he already has one foot in it. His housekeeper looks on annoyed and says "Mr. Escher, you don't have to draw your own bath. That's my job."

—Michael E. Brown, Orlando, Fla.

On the surface of the moon is Haniel A's Used Space Vehicles. A1, in a space suit, is speaking to a customer also in a space suit, and pointing to a Lunar Rover. "This baby was used only once by a pair of guys on a golf weekend."

—John Clements, Lake City, Fla.

Chief Justice issuing an opinion from the Supreme Court. It is the opinion of the Court that human life begins the moment the couple decides to move to the back seat.

—Paul Maxson, Lake Zurich, Ill.

A Doctor of Christian Science (according to diploma on wall) on phone to clients. "Read two chapters of Science and Health and call me in the morning."

—Paula T. Stover Pasadena, Tex

Greek laughing at Pythagoras—who has a triangular plan marked $A^2 + B^2 = C^2$. The man says: "It's a cute formula. Pythagoras but come off it! Who's gonna want to live in a three-sided house?"

—A. Wineem, Glendale, Calif

Robin Hood and a few giddy followers are setting up a tactical missile. Maid Marian watches, depressed, and says: "Effective-ness isn't everything. Robin! The bows and arrows lent a certain romantic elan to the movement."

—Nora Scott Walker, San Diego, Calif

Doctor talking to patient: "Frankly, Mr. People, a brain transplant is out of the question. Why don't you stick it out at Evelyn Wood's for another week?"

—Peter Williams, Vancouver, B.C., Canada

A woman stands in the aisle of a drugstore, reading a box she's pulled from the shelf. The aisle is labeled HOME REMEDY AIDS. All the boxes on the shelves have rabbit ears protruding from their tops. The box in her hand also has a bunny tail sticking out the back.

—Catherine Kinney Chicago, Ill

A single can of Campbell's Premordial Soup.

—Everett Coates, Plymouth, N.C.

A crippled beggar with crutches and a cup stands on a street corner, wearing a T-shirt that reads "I went to Lourdes and all I got was this lousy T-shirt."

—Polly Stone, Stanley, N.Y.

Space-suited humans stand around a U.S. flag, facing a group of Martians. The human reader is reading a document and the teeny guaranteeing you hell of Mars shall endure as long as the sun shines and the glaciers flow.

—No name, Lubumb, N.C.

A teen-aged daver parked in front of a gasoline pump, advertising gasoline. Attendance says: "Let's see some identification."

—Christopher Nowakowski, Florence, Mo

In a museum a patron is looking at a sign picturing the Milky Way. An arrow points to a spot on one of the spiral arms and says: "You are here."

—John E. Seth, Colorado Springs, Colo

The starship Enterprise (of Star Trek) passes the climactic Death Star battle at the end of Star Wars. Captain Kirk's voice, from the Enterprise, says: "No, we'd better not get involved."

—Kerry M. Kinspot, Shreveport, La. **CC**

MIND

CONTINUED FROM PAGE 22

If Storm's theory has nothing to do with inborn gayness or straightness, it doesn't neatly state Freudian theories, either. And it sounds disarmingly simple. During late childhood, Storms says, most of us socialize with friends of the same sex. Recall the "I-hate-girls" or "yech-yech-boys" stage at schoolchildren that psychologists refer to as "homosexual bonding."

Say a boy reaches puberty. Storms explains, and feels the first stirrings of sex while still in the homosexual phase. Could imprinting link his emerging eroticism to other boys? And could the same apply to early-maturing girls?

Several studies, including the original Kinsey report (in 1949), found that homosexuals had in fact frequently reached puberty early in life. Another researcher reported that college athletes, presumably early bloomers, were twice as likely to be gay as their nonathletic peers.

And forget the caricatures of gay men walking beribboned poodles or of lesbians astride motorcycles. "Unlike many researchers," says Storms, "I simply do not believe homosexuality has anything to do with being like the opposite sex."

If Storm's is right, and a fatal coincidence of social development and physical maturation defines sexual preference, what happens when you lump up with adolescent social life? Do British public schools or the Arab culture, with a laissez-faire attitude toward youthful homosexuality, breed more gays than Middle American educational institutions? May be future research will tell.

Meanwhile, are homosexuals born or made? It isn't farfetched to imagine that the chemicals that inform our brains and ganglia might color our sexuality. And yet we certainly don't know how prenatal hormones might shape a fetus's future sexual preference. If they do, German reports made no clear-cut homosexuality crouch has shown up in our heads.

Most attempts to adjust sexual preference, of course, have used behavior modification instead of scalpels. For example, sociologists William Masters and Virginia Johnson claimed to be able to turn at least 50 percent of willing gays into straight. Fringe groups, such as Aesthetic Realism of New York City, send converts into the streets—and onto popular television shows—reporting their gay ways and extolling the superior joys of their newfound heterosexuality. Both Bell and Storms argue that a person's sexuality is too complex to be tinkered with in this way.

In the natural order of things, Bell says, some people aren't going to be gender conformers. "I've no doubt if the motivations are great enough, you can change the behavior. But your sexual orientation is at the very core of your being. That's harder to change." It's even harder to attribute to a single cause. **CC**

Your Other Selves



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There is more to you than you suspect. Self goes far deeper than surface consciousness. Man is not fully conscious—that is, using the whole potential of his awareness—until his dormant psychic energy is developed.

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BOOKS

CONTINUED FROM PAGE 28

(UV) light. The enormous amounts of nitrogen oxide present in the superheated air of the lethal cloud will significantly reduce the ability of atmospheric ozone to protect us from the hazards of UV radiation: skin cancer, the scalding of crops, and the probability of genetic damage. Clayton speculates that for several years after an explosion like in the blast area will be restricted to nighttime activities when the effects of UV radiation are less potent.

Each survivalist faces one basic decision upon which all others depend: Would you rather evacuate or stay put? If you have decided to evacuate, Nieman offers advice on planning an escape route from high-risk areas. If you have chosen to take your chances at home, you'd better have a shelter waiting for you in the basement. Everett Moore's *Nuclear Survival* (Desert Publications) contains a long chapter on shelter designs, complete with blueprints, a list of materials, and detailed instructions on how to build shelters ranging from the steel igloo to the basic sand-filled lumber lean-to. Moore's book also explains concisely what fallout is, looks off the principles of radiation detection and tells what tolerable human doses are. Radiation is particularly insidious because repeated sublethal

doses are cumulative. Moore extensively discusses ways to monitor radiation and to measure doses and dose rates. By neglecting to master a handful of simple calculations, survivalists might never know when it is safe to leave their shelters.

Survivalists are not easily categorized. There are the "hard" survivalists, who fill their swimming pools with potable water and spend their weekends studying do-it-yourself surgery. And there are those, soft survivalists, who draw the line at storing food and growing their own vegetables. The emphasis is on self-sufficiency, preparedness, and the possession of reliable information. The best book for all-around survival ideas is *The Survival Resource Book*, edited by M. A. Henderson (St. Martin's Press). It's a survivalist's Yellow Pages, with listings of more than 400 suppliers and manufacturers of such products as freeze-dried foods and survival vehicles. *The Survival Resource Book* also has an excellent chapter on guns by the late Neil Tappan, renowned firearms expert and onetime editor of *Guns and Ammo* magazine. Tappan describes which guns are best suited for hunting (air guns are good for small game) and which wicked-looking assault rifles and shotguns will discourage a mob from poking your house to peltage.

When the discussion in these manuals finally turns to guns and personal safety, survivalism rears its paranoid head. Some

authors make the assumption that after the blast society will undergo a breakdown of law and order. Tony and Joanne Lissos's *Checklist for Survival* (Desert Publications) suggests purchasing guns illegally so that they can't be traced, and cautions your own bullets from the wheel weights of automobiles. The authors also endorse embezzlement, theft, and a host of other felonies so that the survivalist can obtain the materials he wants and needs. They write with such zeal and glib enthusiasm that you'd think they were talking about Christmas morning. Some authors, notably Kurt Saxon, whose book *The Poor Man's James Bond* is a guide to homemade bombs and explosives, make you wonder what kind of society survivalists are going to create from the debris of a nuclear catastrophe. Will they be better off?

Survivalists have made some tough and unpleasant decisions regarding their lifestyle, their values, and their family well-being. In some cases it has made them a little resentful that the world hasn't managed to blow itself up by now. After all, it's only human nature to expect a fair return on your investment. But if drilling each other on evacuation runs seems a bit far-fetched, survivalists are quick to bring up Aesop's fable about the ant and the grasshopper. When the black rain begins to fall, and you're outside banging on their shelter door, don't expect them to answer. **DD**



PHENOMENA

Two interested British spiders (*Micrommata virescens*) engage in a courtship ritual that confounds John Cooke, photographer and arachnologist. I was surprised to witness the male actually plunging his fangs into the female. "Normally, if one punctures a spider, it bleeds to death because of high blood pressure and a thin body wall. But this routine behavior, immediately before copulation, fails to kill the female spider, and the reason for this is unknown." He sticks his fangs right into her abdomen, and blood droplets appear," Cooke notes. He photographed this mating encounter in an elaborate laboratory setup that mimics a spider's natural habitat. With an Edca camera and a 195mm lens, Cooke shot the impassioned spiders on Kodachrome film. OO

GAMES

By Scott Morris

We often come across unusual products that would be of interest to *Omni* readers except they aren't available in most stores. This month we are pleased to call your attention to a collection of curious items that can be obtained through the mails. Prices quoted include postage for single orders within the United States. Write to the distributors for prices on multiple orders or foreign mailings.

SPACE PET

The plastic shape shown below is about four inches long and is flat on the top. I set it on its rounded side on a smooth tabletop and gave it a spin. As it turns, I ask whether you believe in psychokinesis. For example, do you believe that by the power of my will I can make this piece of plastic stop and reverse its direction of spin? Being a rational, scientific-minded person of course you say you are skeptical.

I pick up the game and hold it to my forehead. "I know Lin Geller personally, however," I say, "and he has given me the power." I then spin the thing again, and at the appropriate moment I grimace and project all my psychic powers onto the device. Obeyingly it stops, rattles up and down, and begins spinning in the opposite direction.



There is no magic here, as most people soon figure out, but there is some very strange physics at work. What we have here is a plasticized version of the "rattleback" or rattlecock. Originally these were called clogs because their curious properties were first discovered by archaeologists studying prehistoric axes and adze called clogs. The rocks, strangely, had a "preferred" direction of rotation. Spin them the other way and they

will stop, hook up and down on the long axis, and then reverse their spin. Research disclosed that the round edge, optimally, is an ellipsoid with its axis aligned at an angle of about five to ten degrees from the main axis of the dome. Angular momentum is conserved, but it doesn't look it. For an essay on the rattleback, see Jean Walker's "The Amateur Scientist" column, in *Scientific American*, October 1979.

The plastic rattleback pictured here "wants" to spin counterclockwise and is marketed under the name Space Pet. To get one, send \$1.75 to Liskoy Inc., 6444 Telegraph Road, Toledo, OH 43612.

After studying this curious toy an *Omni* reader will perhaps take up Walker's challenge to build a rattleback big enough to ride on. If you could build one with a vigorous spin reversal," he writes, "riding it would be like riding a bucking bronco."



GOZINTA BOXES

Picture this: On a table you place a blue plastic box, about two inches on a side, and remove the blue lid from its base. Inside is a white box. Take the white box out and open it. Inside is a magic penny, which, you explain, makes everything smaller. To prove it, you drop the penny into the base of the blue box, put its blue lid on, and then calmly slip the whole thing inside the white box! A strange, surprising illusion. For a set of gozinta boxes (each "gozinto" the other), send \$4 to Flossie's Magic Company, 304 West Thirty-fourth Street, New York, NY 10001.

ZIPPURSE

The last time our friend Mel Stover of Winnipeg, was in town, he showed us a neat magic trick with a cut-up card. When it came time to reveal the missing piece



he pulled out a strange-looking coin purse and began unknopping it. We immediately forgot all about the card trick and became more fascinated with the prop. It kept zippering—until there was nothing left but zipper! We're not in the habit of carrying coin purses around, but we'll make an exception for this one. Magic, Inc., 5082 North Lincoln Avenue, Chicago, IL 60625, will send you one for \$7.50.

JUMPING KNOTS

Joel Langer, a professor of mathematics at Cleveland's Case Western Reserve University, has taken his knowledge of knot theory, a branch of topology, and produced three unusual puzzles. Open the square envelope and drop out the coil of wire from inside and it immediately jumps into a pleasing three-dimensional shape. Your job is to collapse the wire flat again and return it to its envelope. "The jumping knot," Langer says, "is nothing more than a straight length of stainless steel wire, which has been appropriately knotted and carefully bonded together at the two ends. This done, the wire's shape



is determined by its natural tendency to minimize energy.

As a puzzle, the jumping knot is unique in that the challenge begins when you open the envelope and the puzzle sports neatly uncoiled itself before your eyes.

Send \$10.00 to Why Knots, Box 635
 Aptos, CA 95003, for a set of three
 different jumping knots. The easiest of the
 three, the figure-eight, is one commonly
 used in sailing. The Chinese button knot
 formed of thread, is used throughout
 China to make buttons for nightclothes.
 The most difficult of the three, the
 mathematician's knot, is described this
 way in *Knot Theory*, by Crowell and Fox:
 $w(R^2-K)=[(x^2y^2-y^2x^2)z^2-y^2x^2z^2]$
 $x^2z^2-y^2x^2z^2-x^2z^2-y^2x^2z^2-y^2x^2z^2]$

MARRAKESH

Prince Joë Karsil has invented more
 than a dozen games, including the
 popular two-hand bridge game *Bridgette*.
 His best, we think, is *Marrakesh*, a fast-
 paced board game that is the perfect
 blend of backgammon, poker, and EBP. It
 has the potential to become a classic
 game.

Roll your six dice and place your six
 chips on the corresponding points for
 "bearing off," as in backgammon. Deal six
 cards to each player from the special
 decks containing the ace through the six
 of each suit. Players simultaneously play
 cards, and the winning suit determines
 who gets to bear off (spades beat hearts
 and diamonds, hearts beat diamonds and
 clubs, diamonds beat only clubs, and
 clubs beat only spades). The card
 numbers, like dice rolls in backgammon,
 tell how many points the winner's chips
 may move.

"The rules and concepts in *Marrakesh*
 have been extremely well thought out,"
 says Martin Gardner. "Many players are
 going to find it more fun than backgam-
 mon itself, for not only is there a subtle
 blend of luck and skill, but there is the
 extra factor of outguessing your
 opponent."

We'll add that Karsil has put together a
 sturdy handsome set here: The board, the
 dice cups, the cards, all have a quality feel.
 Only two stores sell *Marrakesh*, and both
 are in Hawaii. If you live elsewhere, you
 have to order by mail. It's available, airmail
 postage paid, for \$34.95 from Karelou
 Laisine, Box 10 Q, Honolulu HI 96816.

Inversions by Scott Kim

INVERSIONS BY SCOTT KIM

One of the most popular competitions
 we have run in *Omni* was #9
 "Designatures," a search for calligraphic
 wordplay that turns upside down or
 exhibits other kinds of symmetry. The
 competition was inspired by the work of
 Scott Kim, a Stanford University graduate
 student. We ran several of Kim's original
 designs in the September 1979 issue, in
 kicking off the contest. The results were so
 impressive they ran in two issues: April
 and May 1980.

Systema

Now for those of you who want more,
 there's a new collection of Kim's best
 designs, *Inversions* by Scott Kim. All the
 delightful designs that appeared in *Omni*
 are here, plus dozens more. "Merry
 Christmas" appears with three types of
 symmetry: top-bottom symmetry in which
 the five-letter "Merry" becomes,
 remarkably, a mirror image of the
 nine-letter "Christmas." Left-right
 symmetry, in which the front halves of

ASIMOV

each word mirror their back halves, and
 rotational symmetry, in which the whole
 phrase turns upside down.

In the excerpts on this page, "Inversions
 by Scott Kim" and "Rainov" both have
 upside-down symmetry. "Mirror" and
 "Systema" (a disorder that causes people
 to get left and right mixed up) show
 left-right or mirror-image symmetry.

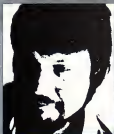
At a Book Fair in Manhattan last fall, Kim
 sat in a booth on Fifth Avenue while people
 stood in line to have him do their names.
 He impressed nearly 150 designs for
 people that day. "I was able to do about

mirror

ninety percent of the names people gave
 me," he said. For a look at this remarkable
 talent, order *Inversions* from Byte Books,
 70 Main Street, Peterborough, NH 03458.
 You'll receive a copy postpaid for \$9.70.

CUBOLOGY

It's hard to keep track of all the Rubik's
 Cube spinoffs—the tetrahedron (Mellert's
 Pyraminx), the sphere (cubes with raised
 dots for the blind), the nude cube, the
 globe, the song "Mr. Rubik," by the Boston
 Knights. David Singmaster is keeping
 track. Order his free catalog from 66
 Mount View Road, London NW4 4JR,
 England. Incidentally, *Omni* awaits the
 announcement that some cubemaster
 can study a mixed-up cube for a couple of
 minutes, then solve it blindfolded. ☐



LAST WORD

By B. A. Realist

• *Scientists assume the reader is fascinated by the pearls of wisdom that ooze through their barnacle-laden sentences.* •

HOW TO WRITE A SCIENTIFIC PAPER

Abstract: An in-depth look at the traditional academic paper is considered. We discuss the way scholars really read scientific papers. This paper itself is written in the new method herein proposed. Studies among the author's friends indicate that reading time for most scientific literature can be reduced threefold by use of this method. For some papers, reading time approaches zero.

Everyone knows that scientists write badly—everybody, that is, except scientists. They think they're merely being precise and orderly, and everyone else on the planet is either (a) illiterate, (b) sloppy, (c) a humorist, or (d) all of the above. (Ref. 1.) In some cases, of course, the individual scientist is not well acquainted with the English language. (In the opinion of English scientists, this explains the frequently unintelligible papers of Americans.)

The scientist is, by his reliance on the passive voice, hooked leading to sentences like this one, in which the subject is acted upon with lumpy nouns without ever saying exactly whom the action is done by, so that the sentences get longer and longer as you read and never seem to end, even when there is clearly nothing more to say in the sentence, at which point the reader sometimes gets a meager little semicolon, this gives him a real, so that he can go on and read another long phrase without really learning anything more, because the writer's hand has kept on moving even though his brain has long since been disengaged.

What to do? Trying to strengthen a scientist's syntax is like trying to unscramble week-old spaghetti: with some exceptions (see Ref. 2), it is far better to change the packaging of the sentences. Scientific papers are written like elaborate ad reports—first A, then B, on to C, plodding on to the conclusion. Such papers assume the reader is fascinated by the pearls of wisdom that ooze through the barnacle-laden sentences. The sad truth is that hardly anyone ever reads a paper all the way through. A study by a British physics journal shows that the average number who finish the whole paper is 0.5—and that includes the author. Apparently, most scientists can't bear to reread their own work, much less read anyone else's.

In this paper a new scheme for paper organizing is proposed. It does not rely on weaseling scientists away from the passive voice construction, like that last one. Instead it relies on the way scientists actually read and on their motivation for reading papers.

While reading a scientific paper, scientists are led by two needs: (a) ego

and (b) desire for information. Our research shows that Need (a) always dominates. The entire paper should be organized to satisfy this. The preferred approach, one that makes the most of these insights, is as follows:

1. TITLE
2. AUTHOR'S NAME
3. REFERENCES: These must contain a broad spectrum of sources, mostly to ensure the greatest probability of naming the reader. Use as many multi-author papers as possible to maximize the number of people who can be mentioned. A scientist will always pay greater attention to colleagues who cite him, if only to find where in the text he gets mentioned. Thus, the best strategy is to cite everybody you can, but then place the citations in the most unlikely places in the paper. Then the scientists have to read all or most of the paper carefully to find mention of them. They might even discover what the paper is about. A really high-risk alternative is to cite someone in the list of references but not in the text. Then he will read the whole paper twice. The disadvantage, of course, is that he will be kind with rage and frustration by the time he finishes.
4. ACKNOWLEDGMENTS: An important ego-feeding ground. Thank the big names in your field, even if your sole contact with them was over coffee at some conference three years ago. That should be lavish, implying close connections with the movers and shakers, but avoid mentioning dead people. They can do you no more good, and their rivals are still around. Finally, if space permits, include those who actually helped you. This part of the acknowledgments is purely optional.
5. GRANT REFERENCE: Your grant-monitoring officer will always look for this. So stick it in early. Also, others will want to know what agency got suckered into paying for this stuff, so they can hit up for grant money themselves.
6. INTRODUCTION: Here you explain what you plan to do. Promise a lot. Few will actually read the MAIN TEXT (see below) to find out whether you actually do it. Fewer still will care.
7. CONCLUSIONS: Always overstate your results. Claim certainty where you have only the vaguest of suspicions.
8. MAIN TEXT: With any luck, there won't be any need to write this section. Everyone will have turned to the next paper to resume the search for his or her own name.

References

1. "Professional Pathology," by E. U. Reka, A. B. Burd and I. M. Redant, *Journal of Academic Backstabbing*, Vol. 3, 1980.
2. Explaining Airmov (12 volumes), by the National Academy of Sciences, 1961. □

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