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PREDICTING THE
FUTURE OF
PROFESSIONAL
SPORTS

**ANIMAL INTOXICATION:
A STUDY IN
THE NATURAL AND
NONABUSIVE
USE OF DRUGS**

**DR. CHRISTIAAN
BARNARD
ON LIFE EXTENSION**

**MIND CURES
IWASAKI: MASTER
OF SPACE ART
COMMUNICATING
WITH ALIENS
THROUGH MATH**



OMNI

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Kazuo Sasaki, Japan's only master of space art, has a passion for scientific accuracy. He observes the solar system through reflecting telescopes he has personally designed. In this photo, a 30-ton, nuclear-powered craft probes deep space.

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FIRST WORD

By Dr Christian Barnard

I believe that legalizing euthanasia, with controls, would do more to improve the overall quality of American medical care than any other single act.

In several European countries physicians wield a power that would shock many Americans: the right of active euthanasia. When a patient in France or in Holland cannot be saved or will be forced to endure a life that is not worth living, doctors need not merely hope that nature will quicker end the ordeal. They can give the hopelessly ill a painless release from suffering.

I believe that American medicine would serve people far better if it prodded... also could discuss this matter. When there is hope of recovering we must do all we can in trying it out. But there is no point in using medical technology to postpone a painful death in an embryo-like state.

The recognition is causing a fundamental

change in medicine, a reordering of priorities, perhaps like none in history. I believe that eventually this transformation will result in better, more humane care for the sick. Yet this evolution will not be easy to bring about, for it requires decisions that violate traditional medical ethics.

Most of these conflicts, which involve extending a patient's life, stem from a simple, basic error—one I saw often during my years as a surgeon. After every heart transplant surgery I usually asked, "Is my patient bad?" I should have asked whether surgery had improved the patient's life. If not, it was a success; even if he survived only a few months. If not, it had failed, no matter how long he lived.

By tradition, we generate length of life. We must now learn to value quality of life instead. Patients themselves usually understand this better than the rest of us. They are seldom satisfied with surviving at all costs, and they grow less so in proportion to their illness. In contrast, it is the healthy who tend to cling even to the shortest life.

Such a philosophy also governs the most peaceful kinds of medical education. We physicians who taught our purpose to "serve a live," I regard them as best, we can under any circumstances. This was especially true when medicine was less available and when most patients either rehabilitated or died quickly. Today, if most American citizens still feel compelled to treat those they can neither save nor comfort, until all physicians learn that quality of life—multiplies precedence over quantity, we will subject the dying to needless pain.

I believe that legalizing euthanasia, with appropriate controls, would do more to improve the overall quality of medical care in this country than any single legal act. It seems paradoxical that in a nation where desire may through abortion, end what could be a productive life, they would be charged with murder for doing so while hope no longer exists. But perhaps Americans, with their respect of authority, will never be able to grant that power.

Until they can, three legal responses are available.

In the United States the most pow-

erful is with the patient's right to a doctor-to-do-her-harm decision—the "do-not-resuscitate" order. In America's aversion to experimentation, physicians have little choice but to give every possible treatment, though the result may be a pointless prolongation of the patient's agony. To oblige any

physician to take a do-nothing role, I believe, would be to violate his/her Hippocratic oath. I never even consider malpractice insurance before coming to the United States. There was no need.

If I had been practicing here, my patients probably would have received far less humane treatment. Thus, the first change must be to insulate the physician from frivolous lawsuits. The standard by which doctor should be judged is not whether they have done everything possible to prolong the patient's life, but whether they have acted to forfeit the quality of life.

The second change is already underway. In most states, some states have enacted laws that protect the interests of patients who can no longer reasonably guide their own treatment. One such measure is the so-called living will, by which people can forbid the use of extraordinary measures should they be in hope of final recovery. Some states also have allowed physicians to discontinue support, even without a living will, when only technology supports a life that can never be made whole again. These are sensible measures that should be adopted by other states as soon as possible.

Finally, we must spend our medical research funds where they will do the most good. This is not where research budgets are directed today. Nearly half of all the cardiovascular diseases, another fifth of cancer, these day primarily kill off aged people to whom we all succumb eventually. If we could maintain our vigor as we age, we might well prevent most cases of cancer and heart disease. At the very least, we would avoid the terrible pain that many are destined to spend wasting to die in so-called convalescent homes.

Yet last year, out of a budget totaling \$5 billion, the National Institutes of Health spent \$2.6 billion on cancer research. Funds for basic research at the National Institute on Aging totaled only \$40 million. This is far too little.

Many students of aging believe that soon we could dramatically extend the human lifespan. Others do not. Yet virtually all agree that it would take only a few years of diligent effort and dedicated scientists. Research could make enormous improvements in the quality of our lives. This is the true goal of medicine, and we should be willing to pay the cost of pursuing it. **DO**

Dr. Christian Barnard, who performed the first human heart transplant, discovered the do-not-resuscitate order, and developed the first heart-lung machine, will speak at the 1981 *Medical Breakthroughs* conference, April 1-4.

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OMNIBUS



DR. LIGAM



MIND CURSES

STEVEN E. LOCKE
SARAH RUNS THE WEASEL

UBERBOTH

If you're a sports fan, you've probably collected a wealth of trivia. But even if you recall every RBI since the days of Ruth, you might have trouble predicting the future of professional sports. For instance, which records will be shattered by the year 2000? Will robots ever replace umpires behind home plate? And which twentieth-century athlete will be considered great by the standards of 2087?

When it comes to charting the future of sports, few have more authority than Peter Ueberroth, commissioner of Major League Baseball. In "The Teams of 2000" (page 58) by Omni editor Robert Wier and Steve Fox, Ueberroth entertains a host of questions in this first sports quiz ever devoted to the future. At the end of the quiz, readers will be able to compare their answers with those of Ueberroth himself. "The reader becomes an amateur commissioner of sports," says Wier, author of *The Yankee Quiz Book* (Doubleday). "When I thought of a sports quiz, there was no one else to go to except Ueberroth. He reflects the highest ideal of sports in America today."

Whether this year is 1986 or 2086, athletic performance will always be equal parts physical and mental prowess. Attitude—the will to beat the opposing team—is crucial to success. And now a new and growing branch of research called psychoneuroimmunology or PNI is exploring the relationship between attitude and disease.

In "Mind Curses" on page 50, authors

Steven E. Locke and Douglas Colligan present scientific verification for the way emotions and attitudes affect health. The story, adapted from *The Healer Within* (E. P. Dutton), contends that factors like will, laughter, and faith all play vital roles in the body's ability to fight disease. According to Locke, associate director of the Psychiatry Consultation Service at Beth Israel Hospital in Boston, "The influence the mind has over the body's susceptibility to disease is underscored by most physicians." Omni senior editor Colligan says, "In a way psychoneuroimmunology is another example of science telling us what we already know from common sense—that the mind, with its moods and attitudes, influences the health of the body."

While a positive attitude is often crucial, nothing can affect the physical outcome of some types of disease. Example: the slow viruses, which can incubate for as long as three decades before they ultimately strike the host's central nervous system.

This month's Interview on page 62 focuses on Nobel prize winner Dr. Carleton Gajdusek, who has spent his life searching for the causes of slow viruses. As Gajdusek tells Omni writer Bill Mosley, he began his quest in 1957, when a New Guinea physician introduced him to kuru, a baffling degenerative disease that was epidemic among several of the cannibal tribes of the New Guinea Highlands. Gajdusek lived among the Fore people, learned their secrets, and finally discovered the brutal

truth about their disease.

"Some people listen to rock and roll; others appreciate Mozart," says Mosley. "Carleton Gajdusek is attuned to the music for the human instrument: its languages, pleasures, and pains. He lives his life on the cutting edge of the unknown."

Psychopharmacologist Ronald K. Siegel has also pursued his studies in exotic spots. And in "Jungle Reweavers" (page 70) he describes his journey to the rain forests of South America, where he discovered an amazing fact. Although scientists have long insisted that Homo sapiens are alone in his use of psychoactive drugs, intentional drug use by animals in the wild is widespread. Siegel has found donkeys that graze on tobacco, elephants that get drunk, and cows that crave opium.

Siegel's work is exciting but not always safe. "We were studying self-administration of alcohol among elephants in a game park in California when a drunken elephant charged me," he says. "I was saved from the attack by the quick hands of a student. By the way, that student got an A."

Also deserving an A is Walter Jon Williams, author of the high-tech science-fiction story "Sarah Runs the Weasel" (page 44). In Part One, Sarah, a petty criminal, lives in the distant future, when Earth has been defeated by her space colonists. She desperately wants to go to space but can't afford it. A multinational corporation offers her a way out because she has a special—and dangerous—gift. **DO**

DIALOGUE

FORUM

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

The Advent of Mr. Mom?

Hooray for "Male Pregnancy" [December 1985], by Dick Teresi and Kathleen McAuliffe. The technologies described in that article will open new possibilities to many families.

Male childbearing could have only positive repercussions on healthy, open-minded people. There are many perfectly legitimate cases in which the father's ability to carry the child could solve problems for both him and his wife.

I did, however, take offense at one attitude expressed in the article. Dr. Cecil Jacobson is quoted as saying that the technology for wombless pregnancies would be an abuse for males to use, but proper for women who have no uterus but who want to have a baby.

Now wait a minute! If the risks are the same for either sex (the article implied that they are), why is it okay for the technology to be used only on women? I know several men who are capable—physically and mentally—of carrying a baby. And I know that under the right circumstances they could do it.

In spite of that objection, "Male Pregnancy" was a great article, and I hope to see follow-ups in future issues of Omni. —Carolyn L. Meuse
Wellesley, MA

I see no benefits to humanity in male pregnancy and artificial wombs. Rather than indulging in the "cheater gene" complex that seems to motivate so many scientists, the research community should consider instead such issues as poverty, hunger, and disease. Scientists should concentrate on finding safe, cheap means to drastically lower the birthrate worldwide.

Life without some level of quality deserving the attribute human is a curse, not a gift. Innovations in human reproduction are faddist, contemptible products of a new market that directly counters the dictates of the world economy. Obsession with these technologies may become the spade for a mass grave.

Y. Dawn McQueen
Spaniard Wells

I found "Male Pregnancy" quite fascinating and its implications immense. I am a male-to-female transsexual who has sacrificed the ability to reproduce. As such, I am denied the sense of immortality that comes with raising children. I wouldn't want to be the first person to become pregnant by means of the techniques described in the article, but I still like the option to be available to me.

As usual, society is playing catch-up with medical technology and a group of small minds is working frantically to suppress these latest advances in the science of fertility. They are clinging desperately to male/female stereotypes that give us all a conserved sense of identity.

Omni's admission of apprehension about these new techniques surprised me. You have always expressed views that are way ahead of the times. Please don't lose your courage now.

—Donna
Houston

It is no wonder that men are interested in becoming pregnant. Decade and unluckily decided abortions have brought about legalized paternity. The message to men today is clear: Only through the goodwill of the woman in your life is your wish to procreate meaningful or your involvement with your children after divorce possible. My mother, a wise woman from the old school once said, "Men may control the money, but women control the sex and children and thereby control the money too."

Gloria Steinem's chauvinistic and erroneous remarks about the nature of men and their motives for becoming pregnant distress me. They show a concern about women's potential loss of dominance over

children. Her statement may well reveal that the true goal of modern feminism is control, not equality.

Thank you for providing an excellent and thoughtful provoking article. The medical breakthrough of male pregnancy would allow for all people to choose their own options and be free of the coercion of others. Women would be free of economic control men would be free of women's use of children as a means of controlling them.

John A. Rosler
Vice President, Public Relations
Fathers Rights Association
of New York State, Inc.
North Syracuse, NY

Now we know that someday men will be able to say that they gave birth to their offspring. Today, men and women contribute equally genetically but not physiologically.

Perhaps it is good that the biological function of childbirth is robbed of some of its mystique. Personal identity shouldn't be linked so strongly to reproductive function and plumbing.

The possibility of male pregnancy and other unorthodox forms of procreation though initially repugnant to some, may prove to be the deathblow to most forms of sex discrimination. Of course now it should be considered only as a last resort, but at least if it is an available one.

Minni Greenwald
Monroeville, PA

"Male Pregnancy" was researched with a rare understanding of both the pro and consides of the subject.

I am very satisfied with being a man. I'm not gay or transsexual, but if the opportunity to bear a child were to become available, I would take advantage of it, despite all the risks and obvious social complications that such an action would involve.

I want to know both the joy and hardship of bringing a new life into the world. I yearn for that feeling of complete involvement. Most of all, I feel that experiencing pregnancy would help me better understand and appreciate women.

John D. Boston
Farborn, OHIO

ALIEN SPEAK

SPACE

By Edward Regis, Jr.

The alien scientist on planet Nyab of the great Hazzed system in the Andromeda galaxy men from his laboratory bench and pushes a rack of test tubes into the sink in front of him. They shatter, liquids spilling, leaving a foul smell. The white-coated lab assistant standing by his side admires his lumpy, misshapen features. Illuminated from all angles by the three suns that arc across the heavens. She raises her hand to wipe away a tear that falls from his eye and asks, "Syger, sonter, talm' Aul?"

"Eskaratu bowne," he answers.

After a few sullen moments they return to their test tubes to begin the experiment once again. They're trying to make a new form of life, one they suspect may exist on other planets.

Such creatures aren't extraterrestrials; they're extras on a Hollywood stage. Aliens from other worlds will be far more complicated than these cardboard cutouts. And what's true of the alien bodies will also be true of their minds. As a result, their science may not resemble ours.

Expecting extraterrestrials to be doing

natural science as we do on Earth is like expecting a newly discovered desert-island race to be speaking grammatical English," says Nicholas Rescher, a philosopher of science at the University of Pittsburgh. It's just wishful thinking.

According to Rescher, organisms evolve in response to their environments. Because extraterrestrial habitats will be radically different from earthly ones, so will the creatures who evolve there. Even the way they perceive their world will be dissimilar from the way we perceive ours.

If an alien's environment is not simply endowed with solid objects or stable structures, Rescher says, if for example they are jellyfishlike creatures swimming about in a soupy sea, then their geometry could be something rather strange. A society of molelike creatures might never dream of developing optics.

If Rescher is correct, the E.T.'s won't have a technology even remotely compatible with what we have on Earth. And even if they have radio transmitters, what's a message to them may be static to us. If we are to take seriously our differences from

extraterrestrials, we must apparently give up the age-old dream of discoursing with starmen—or at least seek alternative methods of communication.

The computer, it seems, may rescue us from cosmic loneliness. Researchers are looking to artificial intelligence to disclose the secrets of extraterrestrial minds. And early indications tell us that no matter what extraterrestrials look like, they will reason the same way we do. We should be able to communicate with them through the most basic of reasoning processes: arithmetic.

These claims come from the words foremost computer expert Marvin Minsky. Minsky believes that we can make better assumptions about extraterrestrials' brains than we can about their bodies. Intelligence is likely to be a universal quality, the same in all its manifestations. There are many physical shapes in the world but only one way to think. Minsky explains how he tunnels into the alien psyche by using a theoretical device invented by the British computer pioneer Alan Turing.

What Turing did, Minsky says, "was to make the idea of a computer—or a machine—very precise." He did this by defining what's perhaps the simplest possible computer: one that's now known as a Turing machine.

A Turing machine is just a black box that has a small number of possible states," Minsky says, "and if you say what state it is in, you've given a complete description of its contents."

Because the Turing machine exists only in theory, it's not important to know precisely how a working model would operate. What is important is that the imaginary gadget is programmed to respond to every kind of stimulus it receives.

These stimuli are fed into the machine in the form of marks on a tape. "The tape is a long series of squares," Minsky explains. Let's say there can be either a zero or a one in a square. The machine can essentially do three things: it can scan these zeros and ones, it can change them or leave them alone, and it can move either right or left to the next square.

It's surprising that from these simple devices the most complex behavior patterns



Marvin Minsky: All you need to communicate are good mathematicians

BRAIN LAUNCHING

BODY

By Bill Lawmen

Evolution, it is often said, is the most patient of engineers, reengineering organisms piece by piece in the briefest of increments, using the grand and gradual sweep of geologic time as a drafting table. But occasionally something tips evolution into fast forward, into a mode in which time is compressed so drastically that an organism changes or develops virtually overnight.

The human brain, for example, ballooned from a chimp-size 21.3 cubic inches to its present 85.4 cubic inches in a mere 2 million years. Scientists have been stumped for decades to explain this evolutionary anomaly. Some contend that it was language, or tool making, or cooperative social needs that triggered the unprecedented rapidity of the brain's growth. But a University of Washington neurophysiologist has a controversial new explanation: The growth of the human brain, he says, was stimulated by the physiological requirements of the simple act of throwing.

William Calvin began to develop his theory three years ago, while accompanying his biologist wife on a specimen-collecting expedition to Puget Sound's San Juan Islands. Pleasantly exhausted after a day of picking through the local tide pools, Calvin passed the time by throwing stones at a nearby log. "It occurred to me that in order to throw a stone and hit a target, one had to engage in some precise timing," he recalls. "For any given target there has to be a launch window—a range of times during which you can release the rock and still hit the target."

When he got home that evening, Calvin started calculating the length of the launch window. For target distances of more than 13 feet, he found, the launch window was less than 11 thousandths of a second—far faster than an individual neuron's ability to fire the throw. But Calvin knew that the more neurons that could be assigned the task, the faster and more regular the timing of the task becomes. Because it was apparent that throwing requires lots of neurons, he says, "there was a good reason why a bigger brain would be a better brain. If you can time a throw, there's an enormous range of hunting potential."

open to you. You can throw faster and farther, which means you can bring down bigger animals or stand farther away so as not to spook your prey."

Using the physiologist's data as a springboard, Calvin devised a "hard-times" scenario: Those hominids that lived near the edges of the last Ice Age glaciers had a greater need to develop throwing as a specialized hunting skill than did their cousins in temperate and tropical areas, where food was probably more plentiful. Natural selection would have favored populations of individuals with the bigger brains needed for quick and accurate throwing. Ultimately, smaller-brained populations would be displaced by their more cerebral relatives. As time went on, Calvin says, the same neurons that were originally assigned the job of throwing could have been "borrowed" by the brain to do the timing and sequencing necessary for human language.

Specialists in evolutionary science have greeted Calvin's throwing theory with mixed reviews: "I think it's an interesting idea," says Harvard anthropologist Glynn

Isaac. "I'm very ready to believe that throwing was an important ingredient in the series of novelties that appeared sometime between two million and three million years ago. But I'm skeptical that throwing by itself could have done it all. There are lots of reasons to believe that a series of things—sharpened stone tools, food-sharing patterns—produce changes in social complexity. As their world became more complex, those individuals with more mental capacity would have done better than those without."

Evolutionary biologist Robert Trivers is more negative. "I'm dubious," he says, "about throwing having played some role of overriding importance." Trivers thinks such factors as upright stance and use of tools played a part but that language was the single most significant factor in the growth of the human brain. "Language is a nearly unique development in our species," he says. "Examples of symbolic language in other species are so primitive and so few and far between that our language stands out as a huge, novel development. To me there's an obvious connection between linguistic ability and big brains."

Calvin explains that his thinking has more than one track: "I don't mean to emphasize throwing to the exclusion of all the other things that are obviously important for the growth of the human brain," he says. "What I'm trying to do is emphasize that there are fast tracks for doing things and there are slow tracks. For example, it may be that human brain size increased simply because a bigger brain is a smarter brain. But it may take sixty million years to double the size of the brain that way. On the other hand, something like throwing, which has an immediate use, may provide a fast tuning of the evolutionary ratchet."

A definitive answer may be years away as scientists fill in the sketchy archaeological record and gather more information about how prehumans got their food. "At the moment," says Harvard's Isaac, "most of us think we're doing rather well if we can get a good list of all the factors involved in the novel growth of the human brain. As for which are the most important factors, we'll leave that for down the road." 

A stone's throw away from a higher IQ

SMART KIDS

MIND

By Beth Kirsch

When Gina Grasberg Riggs learned that her five-year-old son was "gifted"—his test scores put him above 99 percent of the population—she said, "Oh my God, what a terrible responsibility." Her reaction she later discovered was typical.

Instead of turning cartwheels and shouting, "Hurray! more parents get frightened they feel totally unprepared," says Riggs, chairman of the National Alliance of State Associations for the Gifted and the self described "Dear Abby of gifted land." With all the attention focused on nurturing a gifted child, the plight of the parents is often forgotten.

Life with a gifted child can be exhausting and intimidating. It can be unsettling when a person who barely reaches your belly button has just maneuvered you into doing something you didn't want to do. It makes you feel inadequate and defensive, says Riggs. To help adults deal with this unusual responsibility, Riggs and others have started support groups to help parents raise children who, in some respects, are smarter than they are. In the process, they have learned about some of the unusual problems that come with raising a super-smart kid. As one parent wryly summed up: "Gifted children really don't change your life-style; they destroy it."

Some of the most routine acts of parenting—discipline, for example—can be frustrating. Gifted children are especially weary to discipline because they have all the skills of what James T. Webb, psychologist and coauthor of *Guiding the Gifted Child*, describes as the Philadelphia Lawyer. They always are testing the limits and spot every loophole. They stay within the letter of the law but not the spirit:

"I said my son to his room and tell him he can't come out till he cleans it," says Barbara Owin, a Virginia mother of two gifted boys. "He'll just stay in there reading every book he has."

Having a gifted child affects the entire family, not always in a positive way. Siblings may resent the special attention the child receives, and the parents, too, may start to feel the family is centered around that child. Parents—fathers especially—may

yearn to have a normal kid. "Traditionally women are more accustomed to being in a supportive role," says Betty Neckstroth, one of Webb's coauthors, "and men—not all men—want a more controlling role. They tend to feel threatened by the situation."

Misunderstanding some of the peculiar traits of gifted children, grandparents and other relatives may criticize the parents for certain indulgences like letting the child stay up until 11 p.m. But research has shown that, for some reason, gifted children need less sleep. Some get by on as little as five hours a night. You can recognize the parents of a gifted child by the circles under their eyes, Riggs jokes.

Others may believe the parents are pushing the child too hard—when in fact it may be the other way around. Gifted kids figure out very quickly that a nice way to get undivided attention is to push the "also" button because the parents feel a heavy responsibility to challenge the children and not waste their potential, says Riggs. "But if I had spent all of my time challenging my son first of all I would have run out of challenges very quickly because

he's a whole lot smarter than I am—and I'm far from stupid. But also I would have deprived him of the benefits that come from challenging himself."

Despite the child's intelligence or rather because of it, school can be a problem rather than an outlet for the gifted. They often spend much of their time waiting for their classmates to catch up and come home from school frustrated and angry. Parents who aren't aware of their child's extraordinary intelligence may treat the situation as a behavior problem, which it rarely is.

Even when they recognize their child's talents, the parents search for ways to cultivate them may not always be very rewarding. Though nearly every school system has special programs for the learning disabled, hardly any offer special courses for the gifted. To find the right education, some parents enrol their children in private schools, with mixed results. "It was the biggest mistake of our lives," says one mother. The private school was even more structured than the public school and tried to mold each student into an ideal the mother called "nouveau riche prep."

Adolescence is a difficult time for most kids, but it's even more difficult for the gifted. Like typical teenagers, they challenge traditions—but the gifted start earlier and sober more intensely. Some will deliberately underachieve to fit in with their classmates (10 to 15 percent of high school dropouts are gifted children); while others suffer from what Webb calls "existential depression"—something you never see in children with IQs under one hundred twenty five, because it takes a certain amount of brightness for someone to realize the finitude of his existence.

At times the parents of the gifted need as much support as the child. As encouragement, Sandy Cohn, of a Johns Hopkins program for gifted children, points out: "If your ten-year-old has a two hundred IQ that translates into a mental age of twenty. So if you're thirty, you still have ten mental years on the kid."

Riggs' advice: "Don't take your job so seriously that you forget to enjoy your kids. Ask any parent of the gifted—it's no problem they'd rather have" ☐



Gifted child and parent: Who's in charge?

THE SEARCHERS

STARS

By Steve Nacks

Nobody has a clue as to what's in the galaxy," Paul Horowitz says in his office at Harvard University's Lyman Laboratory. There may be no intelligent life, but he still wants to try. So Horowitz—a forty-three year old physics professor—built a compact computer and hooked it up to an old radio telescope that had been mothballed since 1975. The renovated telescope—an 84-foot-diameter dish-shaped antenna mounted on a 60-foot tower—stands atop a hill in Harvard, Massachusetts, 30 miles west of Boston. It scans the heavens night and day listening for signs of extraterrestrial intelligence.

This effort is the most comprehensive quest for alien life yet undertaken. The venture, formerly known as Project Sentinel, got off to a dramatic start in March 1983 when Carl Sagan announced, as a bottle of champagne was smashed against the telescope, "Let the search begin." Sentinel could scan 151,072 radio signals at the same time. "But even that wasn't enough," Horowitz says. So with the help of Ivan Linscott, Brian Matthews, and John Forster, he built Sentinel's successor, called META (for Megachannel Extraterrestrial Array), which is capable of analyzing 8.4 million channels simultaneously.

META began its cosmic sweep last September, when *E.T.* movie director Steven Spielberg—aided by his three-and-a-half-month-old son Max—flipped on the power switch. Besides being able to analyze a chunk of the microwave spectrum that is 100 times broader than what Sentinel could manage, META avoids another of its predecessor's major drawbacks. Sentinel was able to detect only radio signals beamed directly at our solar system; a limitation Horowitz acknowledges as "pretty outrageous." META can detect any signals targeted at our galaxy or at the universe.

Scientists have looked since 1960 for radio signals from distant civilizations. But META, Horowitz says, "accomplishes more searching in one minute than could have been done in one hundred thousand years with the first receiver."

"There have been a few bugs here and there, but on balance the system works

well," explains Gunther Schwartz, a member of the project's support staff. Schwartz stops off at the observatory every day at about one in the afternoon to see if the computer has picked up anything of interest. He checks the largest signals that have been received over the previous 24 hours and shifts the orientation of the antenna. At the beginning of a search cycle, which takes about a year, the antenna is pointed straight at the horizon. Each day until the end of the cycle, Schwartz tilts it up half a degree. In the course of the year the telescope will cover 80 percent of the sky.

On the wall of the office next to the telescope hangs a sign that reads: *in 1 c.u. HARVARD*. The room also houses the new spectrum analyzer designed by Horowitz. Capable of handling about 75 million instructions per second, the device is about as powerful as a Cray supercomputer. But Horowitz was able to build it for about one-hundredth the cost of the Cray by hooking together 144 computers. Cheap labor provided by undergraduates, who soldered nearly half a million circuit connections, helped keep costs down.



E.T. to Earth: META is looking for the call

META works 24 hours a day monitoring radio signals. Unlike optical instruments, which can be used only on clear nights, radio equipment can operate regardless of atmospheric conditions. "The system runs by itself," Schwartz says, "and it's cheap. It takes about \$20,000 a year to run the project."

Horowitz says that there are not enough hard data yet to estimate the odds of finding intelligent life elsewhere. Nevertheless the fact that life evolved here on Earth is good evidence that it probably happened elsewhere. "There's nothing extraordinary about our sun and nothing special about our Earth," he says.

Take anything in astronomy," he continues. "There's never just one. Usually if you find one of something—like some strange star, then people find handfuls, dozens, hundreds of these things. I doubt there's an example—quasars, eclipses, novas, supernovas—of anything that happens once."

What if the search turns up nothing? "It may be that the nature of intelligence itself is self-administering," Horowitz says. "As technology improves, the capability of a single person to wipe out the whole civilization improves with it. You may have short-lived civilizations that pop up here and there but not at the same time. And so they could never communicate with one another. That would be sad to think of. I hope it's not true. I hope there's plenty of stuff out there, and I hope we can get the satisfaction of knowing they're there. And who knows? We might even learn from them how to stay technologically alive."

HALLEY'S HOTLINE

Information on the whereabouts of Halley's Comet is yours for the dialing. Some information lines to call are:

The Naval Observatory's new hotline number (303) 410-8788

ABC News and the Planetary Society's number (303) 410-STAR

Comet watchers on the West Coast can call the Lick Observatory/University of California (408) 429-3320.

East Coast comet watchers can call Cornell University's number (607) 256-4992. **DO**

PHOSPHENE MACHINE

BREAKTHROUGHS

By Tim Onosko

As a boy inventor, Stephen Beck used to lie in bed, press his fingers against his eyelids, and watch the patterns of light that moved across his eyes. Years later, still fascinated by that phenomenon, Beck is busy designing a device to electrically stimulate this biological light show. By next year he hopes his unorthodox invention will be providing people with a new visual-enterainment system.

Called the phosphotron, Beck's device is based on a physiological phenomenon that has been observed for centuries: the production of phosphenes—luminous flashes in the human eye. Some people see these dancing patterns of light in the few minutes before they fall asleep or when they rub their eyes vigorously. A blow to the head can also produce phosphenes—the stars that boxers see on their way to the floor.

The phosphotron introduces tiny electrical impulses into the region of the face surrounding the eye. The currents are pulse and frequency modulated before being delivered to a headband, which more closely resembles a pair of silver-new-wave sunglasses than a precision electronic instrument. Beck has demonstrated that he can deliver nearly identical images to anyone wearing the glasses.

The version of the phosphotron that Beck demonstrated for me was a simple device designed to illustrate the phosphene phenomenon. It consisted of a pair of domed goggles (to shield the eyes from room light) and electrodes to be placed just below and in front of the temples on each side of the head behind the eyes. After applying a small amount of solution to improve the conductivity of the electrode on the skin, Beck turned the device on and began adjusting the frequency and waveform of the current.

Almost immediately I saw a relatively bright flickering effect. After a few moments I detected a nipping pattern moving from side to side, followed by a pulsating spot on the center of my eye. Beck demonstrated that modulation of the current could be set to music, plugging a portable cassette player into the phosphotron. The images

began to vary in intensity as the musical passages changed.

Beck, who now heads his own research-and-development shop, Beck Tech, designed his first phosphotron in college at the University of Illinois. That was about 1969, he recalls. "I had a simple battery-operated circuit and a waveform generator—a couple of D-cells, a unijunction transistor oscillator, and some shaping circuitry. My professor was very concerned because anytime you introduce currents into the body you want to be very careful."

Beck found that by confining the currents to the eye area he avoided the sort of cardiopulmonary arrest which occurs when an electric current is run through the heart. "Don't forget," he says, "the nerve signals in the body are very weak signals—millivolts and millamps. So a battery at one and a half volts applied in the right places can probably harm you and stop your heart," he says.

Beck's interest in the mechanics of phosphene production led him to inquire about what phosphenes actually are and where they originate in the eye. Some

theories say that electrically produced phosphenes occur because electromagnetic fields from the currents are inducing voltages in the optic nerve, he says. "My experience suggests that the effect is actually occurring on the retina, in the rods and cones and in the bi-polar cells [first- and second-layer neurons]. What's interesting is that although we know that electrically produced phosphenes are not light, we see them as light because our brains and nervous systems have been conditioned to respond to stimulus from this part of the organism."

Beck hopes to begin selling a simple version of the phosphotron to the public this year. A new version, which will use micro-computer-controlled arrays of multiple electrodes, is in development. Beck claims that he has already produced simple shapes with the phosphotron. His short-term goal is to produce symbols and characters and eventually the equivalent of a small alphanumeric digital display that can be seen with the eyes closed. But right now, he says, "we're kind of in the dot-and-dash stage where Marconi was when he sent his first sparks."

NEW PRODUCTS

For those who prefer external light shows, a California company has developed The Imagemaster, a stereo companion that synchronizes laser light with music. The portable system uses two red helium neon laser beams—each driven by a stereo channel—to project moving geometric designs across a wall or ceiling. The fun comes at a hefty price tag, though. Suggested price is \$1,065. (Available from Harper Images, 660 Weddell Drive, Suite 1, Sunnyvale, CA 94089.)

For a meditative display of light and color there's Harmony. Designed by holistic physician Raphael Christian, this VHS tape combines kaleidoscopic color patterns and a journey through the universe with classical and New Age music to create a video mantra for relaxation and healing. (Available for \$29.95 from the Elysium Corporation, 401 Burnside, San Anselmo, CA 94960.)



An invention for Ave and inner vision

CONTINUUM

SEX IN ZERO G

In a science fiction story I wrote nearly 15 years ago a male astronaut aboard an orbiting space station complains to his female companion that despite the accomplishments achieved in zero gravity there was one human activity yet to be attempted. No one, says the astronaut, has made love. As of today the situation is still the same. Considerable research has been devoted to eating in space and even to toilets in space, but life in orbit remains sex free. Although several American women have flown aboard the space shuttle and two Russian women have been in orbit, no one has made love in zero gravity...yet.

There was absolutely no chance for the first woman in space, Valentina Tereshkova, to even get close to a man while in orbit. Her 1963 flight was in a one-person capsule. Twenty years later Svetlana Savitskaya made five flights to the orbiting Soviet space station Salyut 7 accompanied by several male cosmonauts. The puritanical Russians, however, apparently had little interest in zero gravity fun and games of the sexual kind. Savitskaya was greeted by one of the male cosmonauts who had already spent weeks aboard the station. "We've got an apron ready for you, Svetka, we have a kitchen for you, shall I bring you work?"

No mention of a bedroom.

The shuttle flights of Sally Ride and her female colleagues have been so completely covered by television monitors that the subject of sex has not once been raised, even by Mike Wallace and his 60 Minutes investigative crew.

Yet inevitably men and women will undertake this most human of activities somewhere in space. We are a spawning species, always seeking new frontiers. In the early days of aviation, inventive men and women founded the Mile High Club; despite the hazards of open cockpits and severe windburn. Sooner or later their spiritual descendants will create the Zero-Gee Club.

Zero gravity would seem to be extremely conducive to a good sex life. Floating weightlessly should be much better than making love on a water bed. Most of the astronauts who have been in zero gravity for any length of time find the experience euphoric—even without sex. Has there been those first few hours (or days, in some cases) of disorientation and mild nausea? NASA calls it space adaptation syndrome. Everybody else calls it spacelackness. But after your stomach settles down and you begin enjoying weightlessness, the possibilities for lovemaking are fascinating. (In his

film *Sleeper* Woody Allen said that he always felt like throwing up after making love. In zero gravity he could get the messy part over with before he starts foreplay!)

Physiologically making love in zero gravity has many advantages. To begin with when weightless both male and female will tend to look taller and slimmer, especially in the waist and legs. This is because body fluids shift and the spine unbends when gravity is no longer pulling at it. Most astronauts and cosmonauts grow about two inches taller while in zero g. And of course, under weightless conditions there is no need for the various supporting undegagements that men and women wear on Earth.

Since it is easier for the heart to pump weightless blood through the cardiovascular system, it should be easier in zero gravity for a man to obtain and maintain an erection, which after all is caused by the pressure of blood engorging the penile tissue. The same is true of course for a woman's orgasmic tissue.

In zero gravity such earthbound terms as up and down, flop and swing tend to lose their meaning. You can use all the surfaces of an enclosure—or none of them and float free. Imagine floating in a cozy warm, softly padded enclosure, without the need for a surface to lie upon. Sexual play can include the entire body, both arms and both legs at the same time. No need to support your partner's weight—or your own. No more cramped limits or awkward positions. Everything becomes graceful, all things are possible. Even the clumsiest klutzes can move like ballerina dancers.

The actual act of penetration can present some fascinating problems. Under weightless conditions a body in motion tends to remain in motion, and the slightest touch can produce movement. While this is a delightful aspect, it can cause some difficulties. To use a term borrowed from NASA, this becomes a rendezvous and docking problem. But if astronauts can mate massive spacecrafts in orbit, men and women will be able to consummate their lovemaking successfully. Even consummately.

Will future space shuttles become the Love boats of the Nineties? Will Dr. Ruth Westheimer open a branch office in orbit? Will we see a zero gravity honeymoon hotel open its doors alongside NASA's space station? I sincerely hope so!—BEN BOYD

Ben Boyd is president of the National Space Institute and former vice presidential director of Omni.



CONTINUUM



Soviet athlete. Will use of steroids cut the death rate?

DEAD RUSSIAN ATHLETES

The death rate among Soviet athletes during the past 25 years has been 2.5 times higher than that of their American and West German competitors. What's more, many Russian athletes have died under circumstances that suggest the excessive use of such performance-enhancing drugs as stimulants and anabolic steroids.

This startling information comes from *Foreign Report*, a newsletter published by the respected British publication *The Economist*.

The deceased Soviet athletes, according to *Foreign Report*, include six who were between ages twenty-one and twenty-five; four between twenty-six and thirty; and nine between thirty-one and thirty-five. Among Soviet athletes who died before the age of forty-five there are ten gold medalists.

"A law just passed by

the Soviets has made use of anabolic steroids illegal," notes Robert Voy M.D., director of sports medicine for the U.S. Olympic Committee. If indeed the account in *Foreign Report* is accurate, the new Soviet law might in fact be a reaction to this situation.

Anabolic steroids, which are synthetic analogs of male hormones, help athletes add lean muscle. But steroids have been linked to liver cancer, stroke, and heart disease. Dr. Voy says, And stimulants, which increase heart rate and heighten performance levels, can cause cardiac arrest and cerebral hemorrhage.

Although reliable drug-detection tests have now been developed, Voy says, not all international competitions actually screen the athletes for drugs.

—Eric Methane

'Consistency requires you to be as ignorant today as you were a year ago.'

—Bernard Berenson

HUNGRY SEALS

When it comes to competing for the food supplies of the future, man may well get a run for his money from the seal. Some two dozen species of seal have such voracious appetites for squid, herring, cod, flounder, pollock, and other fishy delicacies that both marine biologists and aquaculturists are concerned.

It seems that some seals can consume as much as 10 percent of their body weight every 24 hours—as much

as 80 pounds a day in the case of the huge gray seal—and millions of metric tons of various fish are gulped down annually by these ocean-going carnivores.

It is that reality and the threat it poses, that concerns marine scientists Clarence E. Button and Deane Renouf of the Marine Sciences Research Lab at Memorial University in St. John's, Newfoundland. For years the two have studied the menus and dining preferences of both the gray seal and the smaller harbor seal herds that are fond of sharing the icy waters of the Grand Banks, a sort of saltwater lagoon on the remote North Atlantic island of Miquelon, off the southern coast of Newfoundland.

It is there that hundreds of these relatively gregarious creatures haul themselves out of the water every summer to bask in the sun, deliver their pups, and amuse the tiny tourist or two who might venture that far. Only about half of the seals grow to maturity, but those that do

could pose a distinct problem because of the amount of seafood they consume.

Says Button: "The postulated competition between seal and man for commercially valuable marine species is only one of the potential problems under study." Button and Renouf want to know far more than the dining habits of the Miquelon seals, which spend about half their days ashore. They feel that there ought to be a way to arrange an accommodation between seal and man who may one day have to learn to live and feed together.

So what Button wants is a way to track his quarry with an effective telemetry collar which has so far eluded him because seals are not anatomically designed to retain such devices for long. Such a device would enable him to learn a lot more about the breeding habits, range and social interactions of the world's seals, as well as what they eat and when, where, and why they eat it.

—George Nobbs



Harbor seals. These carnivores dispatch 80 pounds of seafood per day and may one day be considered a threat by marine fishermen.



Caffeine makes some children feel calmer and more alert.

COFFEE ACHIEVERS

Caffeine—as in coffee, tea, and colas—has been assigned a villain's role in maladies ranging from simple insomnia to crippling heart disease. But a recent government study has concluded that for some children, aged six to thirteen, moderate amounts of caffeine may be something of a boon, evening their emotional kiel and boosting their performance at the same time.

Judith Rapoport and her colleagues at the Child Psychiatry Branch of the National Institute of Mental Health selected two groups of children: one whose members tended to drink relatively large amounts of caffeine (up to 900 milligrams a day) and a second group of low users (50 milligrams or less a day). Each group was first taken off all caffeine products and then, over a two week period, introduced to caffeine equivalents of about four

cups of coffee daily.

When taken off caffeine, the researchers found, high users are less alert, more sluggish, and more impulsive, while low users behaved normally. Once subjects were given high levels of caffeine, though, the results were reversed: High users returned to normal behavior patterns while low users became restless and fidgety.

It seems reasonable, says team member Alan Nemer, "to say that for children with a pattern of high caffeine consumption, caffeine may in fact be a benefit—it—they seem more alert, their moods are better, and they feel calmer."

Rapoport thinks that high caffeine users may have brain chemistries that are predisposed to caffeine: thus its benefits. "The old saying, 'You are what you eat,' she has said, "may have to be changed to, 'You eat what you eat because of what you are.' —Bill Lawson

"Everything should be made as simple as possible but not simpler."

—Albert Einstein

FORENSIC ENTOMOLOGY

A suspected rapist has a jacket that matches the victim's description of her assailant's but claims not to have worn it since autumn several months before. The sharp-eyed detective notes some seeds caught in the material and has the jacket sent to an entomologist. The seeds, the scientist finds, contain live insects; the man

must have worn the jacket outdoors quite recently. When the police find similar insect-infested weeds in the bushes where the assault took place, the disheartened rapist confesses all.

The market for forensic entomology—the application of the science of insects to the administration of justice—is small but bulish. Most law enforcement officials don't know insect forensics exists, but more and more seem to be finding out. Investigative groups have been sending maggots to entomologists with increasing frequency, explains K. C. Kim, curator of the Frost Entomological Museum at Pennsylvania State University. Nationwide, about 200 crime lab justice cases a year are referred to entomologists.

Maggots, or larval flies, are the star sleuths of the insect world. Many murder cases begin with the discovery of a decaying body. Since decomposition rates vary with temperature and humidity, coroners may be unable to estimate "length of time the

victim has been dead. Maggots can provide this vital crime-solving clue. Blowflies deposit on a body to feast and lay eggs within 12 to 24 hours of death. (The scavengers even find their way into air-conditioned high rises.) As the body decomposes, a succession of different fly species move in and lay their own eggs. If an entomologist can identify the species of maggot and knows how long that species remains in the larval stage under the environmental conditions involved, he can make a good estimate of the time the person died.

Last year a group of ten entomologists including Kim formed the Forensic Entomologists Task Force to publicize and promote their detecting skills. We're surrounded by insects," Kim says. "There's a lot of opportunity to get information from them if we use our heads right." —Leah Wellock

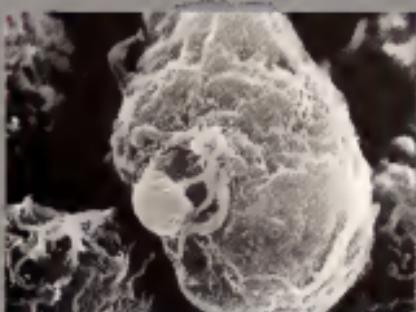
"Originality is the art of concealing your source."
—Franklin P. Jones



INSECT LIFE CYCLE: Could these tiny larvae be the key to solving a specific homicide on a body within 12 to 24 hours of death?



CONTINUUM



AIDS infected lymphocyte. Forget about burns and radiation: The real danger of nuclear war may be an AIDS-like epidemic.

NUCLEAR AIDS

If the big one ever goes off, nuclear survivors can expect a frightening epidemic in the aftermath.

An AIDS-like syndrome should be anticipated in the months and years following nuclear attack, says David Green, dean of medicine at Rhode Island's Brown University. "The same horrible problems that occur in AIDS patients—the bizarre infections, pneumonia, and Kaposi's sarcoma lesions—should occur."

This is because certain noxious effects that will follow nuclear detonation, such as radiation, burns and trauma, psychological stress, and eventual starvation, can be expected to disrupt the body's immune system in the same way that the AIDS virus does. Green says, by destroying essential white blood cells known as T lymphocytes. And other T lymphocyte related diseases

(tuberculosis, leprosy, Legionnaires disease, cancer) should be expected in epidemic magnitude.

Greer and Lawrence Pfeifer, a Brown medical student, depicted this bleak scenario in a paper they recently presented to a National Academy of Sciences symposium on the medical implications of nuclear war. They reached their findings after an exhaustive review of current medical research in such varied disciplines as radiology and psychiatry. Their goal was to determine precisely how radiation and other nuclear effects act upon the body.

"All of the disparate literature said the same thing," Greer notes, "that T lymphocytes seem to be most susceptible to these noxious influences."

"This," he adds, "is another nail in the coffin for the argument that you can fight a limited nuclear war."

—Eric Mishra

VAN GOGH AND EPILEPSY

For years scholars have puzzled over the behavior of Vincent van Gogh, one of history's most eccentric and talented artists. Now a Harvard doctor suggests that Van Gogh, who cut off his ear and eventually killed himself, suffered from a recently discovered dysfunction of the brain.

The condition is called Geschwind's syndrome, named after the scientist who described it in 1974. The late Dr. Norman Geschwind found that some people suffered from strange symptoms that came in clusters. They were compulsive writers or painters, were extremely religious, had weak or confused sex drives and very short tempers, and showed "stickness"—a reluctance, for example, to let conversations end.

Geschwind found these behaviors in certain patients who had temporal-lobe epilepsy. More recently, a former student of his, Harvard Medical School neurologist Dr. Shaihur Khoshbin, found them in nonepileptics as well. These included patients with behavioral disorders, sleep disorders, and—strangely—with a rheumatoid condition known as systemic lupus erythematosus. Khoshbin also identified a cause. By using computer-analyzed brain mapping, he traced the symptoms to electrical disturbances in the brains' temporal lobe.

This syndrome got Khoshbin to thinking about something he came across as

an undergraduate art student. While traveling in southern France, he visited the hospital in which Van Gogh was treated after he cut off his ear. He noticed in the medical records that Van Gogh was an epileptic. Most historians say Van Gogh was either depressive or schizotypic. But Khoshbin, who seen the artwork of mental patients, says that can't be the case. Neither depressives nor schizotypics use detail or color as Van Gogh did, nor do they paint so prodigiously.

"In ten years he produced over one thousand paintings," says Khoshbin. He also notes that Van Gogh had a tempestuous temper, probably had a love affair with the artist Paul Gauguin, and had been a priest before becoming a painter.

Khoshbin concludes that Van Gogh almost certainly suffered from Geschwind's syndrome, as did several other artists, writers, and visionaries. "One can only wonder," he says, "what effect it has had on history."

—Douglas Starr



Van Gogh sans ear. The man had a serious problem.



NASA scientist Leah Coyne: "The energy source of life?"

LIFE FROM CLAY

Over the past few years a suspicion has grown among some scientists that the original cradle of life on this planet was not water but earth—specifically clay. Now from the NASA-Ames Research Center in Sunnyvale, California, comes new evidence to support that contention.

It has long been known that after exposure to gamma radiation and subsequent heating, the surfaces of some clays give off ultraviolet radiation. Were it not for the relative violence of this chemical scenario, that radiation might have stimulated the formation of the complex organic molecules necessary for life. But now NASA chemist Leah Coyne has discovered that clays will also give off life-promoting radiation as a result of what she calls "gentler processes."

Coyne and her colleague Naomi Lishab of Hebrew

University in Rehovot, Israel, spread a wet paste of kaolin clay on the inside of a vessel. They then slowly dried the paste with a chemical drying agent. A photon counter revealed that when the clay dried through a certain critical range of moisture content, it emitted a burst of ultraviolet radiation.

The significance of the discovery, Coyne thinks, is that it greatly expands the number and kinds of circumstances—including routine erosion and the wetting and drying cycles involved in normal rainfall—under which clays could have emitted radiation important to stimulating the growth of organic molecules. All in all, she says, the chances are now significantly greater that clays could have been the little powerhouses that supplied primitive first energies. —Bill Lawson

'Migrants can do more by means of faith than physicians by the truth.'

—Giordano Bruno

'Every great advance in science has issued from a new audacity of imagination.'

—John Dewey

'In matters of principle, stand like a rock. In matters of taste, swim with the current.'

—Thomas Jefferson

BURGERS AND RAIN FORESTS

In the 60 seconds it takes you to read this article, approximately 30 acres of tropical forest will be felled and burned into oblivion.

So says Randy Hayes of Friends of the Earth (FOE), which last spring picketed Burger King restaurants in San Francisco in defense of rain forests.

Why Burger King? FOE and another environmental group, Earth First, took action against the fast-food chain because 40 percent of the rain forests in Central America have been cleared to raise beef that is sold primarily to convenience-food processors and restaurants in the United States. Burger King is one of the few companies that has admitted to using Central American beef, which takes five cents off the price of an American hamburger.

The environmentalists wanted to put pressure on Burger King and to alert the public to their belief that every bite of a flame-broiled burger takes another gulp out of our planet's fast-disappearing rain forests.

It's an important issue. Rain forests cover 7 percent of the earth's land surface, but they are home to half of

the world's 5 million or more species of plants and animals. The majority of life-saving anticancer drugs and new food crops have originated from species of plants and animals in tropical forests. Yet only one sixth of all tropical species have been identified by biologists to date.

A Burger King spokesperson defended the company by saying that the only Central American beef that goes into a Whopper comes from Costa Rica, where rain forests, according to Burger King, are not in danger.

Since last year's protest of Burger King, Congress has begun action to protect rain forests by introducing two new bills. The bills would require the Agency for International Development (AID) to stop supporting such harmful large-scale development activities as cattle ranching and would direct AID to provide not less than \$10 million to assist developing countries in conserving biological diversity.

—Cathy Spencer



Rain forest cleared for cattle ranching. Does every bite of a Whopper eat away at our planet's most valuable plants and animals?



CONTINUUM



Patient with titanium screws installed in upper jaw

SWEDISH TEETH

When most people lose their teeth, their gums and jawbones begin to shrink, and many of them can no longer chew properly or speak clearly with conventionally replaced dentures. These are problems that can now be corrected by osteointegrated implantation, a surgical procedure originated in Sweden 20 years ago.

A leading American exponent of the technique is a New York City periodontist named Stuart J. Froum who has performed some two dozen such office procedures with a success rate akin to that achieved by the Swedes—81 percent on upper jaw tooth replacements, 91 percent on the lower jaw—which is good news to the 30 million Americans who are totally or partially toothless.

Dr. Froum describes the need for the osseointegrated technique this way: "In the

past, efforts to replace teeth with dental implants—devices that attached replacement teeth to gums or bones in the mouth—met with limited success." In fact the risk of bone deterioration and infection was so great that most dentists abandoned the notion of implantation and relied chiefly on the conventional denture device.

This is no longer necessary due to refinements in the osseointegrated technique, which involves the surgical implantation of small pure titanium screws into the jawbone while the patient is under local anesthesia. The titanium molecules actually bond with the bone cells in the jaw, anchoring the screws—five for a full denture, two for a partial bridge—and providing a solid foundation for the patient's artificial teeth.

Since the titanium is compatible with body tissue there is far less chance of infection. After a three- to six-month healing period is completed, the titanium screws are topped with cylinders to which the artificial teeth are attached, and then the patient is fitted with a semipermanent bone-anchored bridge.

The procedure is currently available at five dental facilities around the country, including the Mayo Clinic, as well as from such trained practitioners as Froum. Prices range from \$2,000 to \$10,000.—George Nobus

'Mad?' / who have solved the secret of life you call me mad?'

—Dr. Otto Von Münchhausen

evidence of the pattern characteristic of dreaming. In five subsequent nights the patient did dream, but only five minutes per night—"less," says Lave, "than any documented [subject] in the past."

In search of an explanation, the doctors performed a CAT scan of the patient's brain. There they found that a piece of shrapnel that had pierced his skull during the 1970 Suez Canal missile crisis had destroyed a portion of his locus coeruleus, a group of cells that lies deep in the brain stem. "This is a very important development," says Lave. "The locus coeruleus had been demonstrated as the dream center in animals. But it had never before been demonstrated in man!" —Bill Lawren

Things are known in the knower after the manner of the knower, not after their own manner of existence
—Thomas Aquinas

DREAMLESS SLEEP

Everybody dreams. Study after study has shown that each of us spends about 30 minutes per night in rapid-eye-movement (REM) sleep, the kind of sleep associated with dreaming.

That's why Perez Lave and his colleagues at Technion Medical School's Sleep Research Center in Haifa, Israel, were astonished when by pure coincidence they came across an otherwise healthy man who seemed to sleep without dreaming. The patient, a thirty-three-year-old lawyer, had been referred to the center because he occasionally shouted in his sleep. Psychological testing indicated that the man was well adjusted, and Lave determined that the episodic shouting was "nothing serious."

Still, when they measured the man's sleeping brain waves for five nights running they found absolutely no



Everybody dreams—except for one strange patient in an Israeli sleep lab who went five straight nights without a single dream.



What's a disk? Let a computer disk manage your metaphors.

RACTER RETURNS

In our October 1981 issue, *Omni* published a science fiction story called "Soft Ions" by Racter, a computer program that writes fiction.

Racter (short for "raconteur") picks nouns, verbs, adjectives, adverbs, and other parts of speech at random from an internal vocabulary and strings them together according to the rules of grammar. Now Minicase Inc., a Northbrook, Illinois software publisher is offering the storytelling program to owners of personal computers. Racter sports a 2,600-word vocabulary, grammatical expertise, and a style to boot (up).

Original as only an alien can be, Racter spouts synthetic yarns that go just sufficiently askew to澄清 normal reality. And though it keeps track of previous conversations with each user, Racter, like a true creator, never gives the same response twice. Consider a recent interview:

Ques: What do you think of Omnis?

Racter: Just be content that I do think of Omnis.

Ques: What is your philosophy of life?

Racter: I don't know. I wonder if humans like stupidity.

Asked to name its chief influences as a writer, Racter responded: "Maybe Genghis Khan's uncle or maybe George Washington." He's from the Hotel Pierre. Genghis Khan, that is."

Those who want a larger sampling of Racter's eerie output can check out his novel, *The Policeman's Beard Is Half-Constructed*, from Warner Books. The storytelling program is now available for the IBM PC, the Apple II, Macintosh and Amiga computers.

Minicase has also formed a user's group called the Institute of Artificial Insanity, described as a "fully discredited, not-for-profit institution." The institute accepts applications from all users who send in "before-Racter" and "after-Racter" photographs that depict how their experience with the program has changed them. An institute spokesperson, however, warns that "only the first million applicants will be accepted."

—Roopa Morosan

"I believe a leaf of grass is no less than the journey-work
of the stars."

—Walt Whitman

"No one tests the depth of a mirror with both feet."

—African proverb

NOISE VERSUS NOISE

What do you do if you want to tone down a loud noise? Muffle it? Drown it? Plug your ears? Turn the damned thing off?

Well, if a group of scientists at a Billerica, Massachusetts company are right, the best thing to do is to throw another noise at it.

The principle, explains physicist Neal Higbie of Technology Integrations and Development Group, Inc., is simply this: Take two sound waves of equal amplitude but opposite intensity and make them collide. They'll simply cancel each other out, leaving the immediate environment very close to blissfully silent.

Higbie put the principle to work to combat low-frequency noise vibrations of a large diesel engine. An array of sensors picked up the noise and fed it to a computer that had been programmed with a special

algorithm developed by British physicist Barry Chaplin. The program analyzed the sound, adjusted for minute variations, then sent just the right "antinoise" through a cluster of speakers that had been strung on the surface of the engine cooling like clover on a ham. The noise, says Higbie, was all but silenced.

The physicist is careful to explain that the antinoise system won't work on random sounds like hisses or whirs. But it can be extremely effective if the sound is in a single key, like the throb of a diesel or the ear-splitting wail of a jet.

"The technology is just starting to be feasible on a broad scale," says Higbie. It needs more development but we've proved the principle. —Bill Laramore

"The present inhabitation of Mars by a race superior to ours is very probable."

—Camille Flammarion



Bathed in an omnious name? The scientist says, Mars's inhabitants may be an equally unusual but opposite sort.



CONTINUUM



These bird lovers are definitely behind the times. Today's high-tech bird-watcher always carries a lap-size portable computer.

COMPUTERIZED BIRD-WATCHING

There was a time when field guides, notebooks, and binoculars were about all the field equipment that avid bird-watchers really needed when they trudged off into the woods in search of their quarry.

But now you can add portable battery-run computers, some of them weighing as little as five pounds to that list of indispensable bird-watching gear.

So says Edward Mair, an enthusiast who three years ago launched an organization called the Newburyport Birders Exchange, a flock of Massachusetts bird fanciers who swear by computers. The organization has 75 earnest members in 30 states, Canada, Mexico, and Puerto Rico, all of whom come armed with different versions of lap-size electronic circuitry, much of it developed in Japan.

"The quicker you get your information out of your notebook, the better off you're going to be," says Mair, a veteran of field and stream who knows that information retrieval is the name of the bird-watching game. "If you want to know how many sparrows were flying at a certain location when the wind was blowing from the northwest and the temperature was above fifty-two degrees, all you have to do is type in a couple of commands and it's right there for you."

Considering that Mair has recorded some 700 different species of North American birds and their individual quirks and characteristics, it's easy to see why the modern bird watcher would prefer a computer to a notebook.

Mark Oberle, a Decatur, Georgia, birdie, is an even better example. Over the years he has traveled or worked in some two dozen countries, stalking more than

1,800 species of birds along the way.

He relies on such sophisticated technology as astronomical computers to determine the critical time of first light in unfamiliar haunts. "You just can't manage all that [information] by hand," he says of the tens of thousands of bits and pieces of data that he has accumulated around the world.

—George Nobbe

SCIENCE-FICTION QUIZ NO. 10

Just about any weekend of each year there is a science-fiction convention going on in the United States in one city or another. At science-fiction conventions (or "cons" as the faithful call them), fans and writers gather to talk about science fiction, watch SF films (mostly old), hold debates and panel discussions, play computer games, eat, drink, and party till into the night.

Once each year science-fiction fandom puts on a World Science Fiction Convention. The forty-fourth such convention will be held this year in Atlanta during Labor Day weekend.

Each convention is given a name. The 1985 Worldcon for example was called Aussoicon II because it was the second world convention to be held in Australia.

Most of the other cons are held annually and take on a name that is specific to that particular convention. Philcon, for example, is the name of the annual Philadelphia science-fiction convention.

Listed below are the names

of five annual science-fiction conventions, together with their dates for 1986. Can you guess the cities in which they take place? Warning: Many of the convention names stem from the cities in which they are held. But many others do not!

—Ben Bova

1. Boskone. This past February 14 to 16.
2. Minicon. March 28 to 30.
3. Aggicon. April 3 to 6.
4. Hatton. June 6 to 8.
5. Lunacon. March 7 to 9.

ANSWERS

1. Boston. Bostonians still refer to the B.F.M. as the Boston Free Public Library. 2. Miami. Miami fans usually drop the "Miami" part of the name. 3. Denver. Denverites drop the "Denver" part of the name. 4. Atlanta. Atlantaites drop the "Atlanta" part of the name. 5. Minneapolis. Minneapolisites drop the "Minneapolis" part of the name. 6. E. Topeka. Topekaites drop the "E." 7. Seattle. Seattleites drop the "Seattle" part of the name. 8. Boston. Bostonians drop the "Boston" part of the name. 9. New York. New Yorkers drop the "New York" part of the name. 10. Chicago. Chicagoans drop the "Chicago" part of the name.



Revelers in Egyptian garb at a typical SF convention

How well can you predict the future of sports? Pit your knowledge against Peter Ueberroth's vision as the commissioner picks

THE TEAMS OF 2000

BY ROBERT WEIL AND STEVE FOX

Do you know how professional sports will evolve in the coming years? Which records will be shattered by the year 2000? Which ones will remain, like tariff treatments to the twentieth century, intact long beyond our passage to another age? How will technological and medical advances enhance athlete performances? And how will Olympic competition change over time?

Virtually all sports fans in America pride them selves on being experts. They bemoan and noisily denounce the nation as filled with millions of fans who will claim to know how many points the Bears will score or the next champ at Wimbledon. Yet when it comes to actually charting the future of sports, accurately predicting on a national as well as global scale how athletic competition will change, few have more authority than Peter Ueberroth.

Ueberroth was first approached in 1978 to be president of the Los Angeles Olympics Organizing Committee. Then, the very issues of this international sports competitor—given the inherent financial and political difficulties of hosting the Olympics—appeared to be in jeopardy. But six years later the unqualified success of the summer games in Los Angeles projected a wholly different message. The Olympics were here to stay—a vital part

PHOTOGRAPH BY NORMAN SEEFE



of cultural diplomacy: a legacy from ancient Greece that reflected man's past and illuminated his future. And no person was more responsible for this accomplishment than Peter Ueberroth.

For this reason alone, Omni approached Ueberroth, now commissioner of Major League Baseball and author of the best-selling book *Made in America* (William Morrow & Company). We wanted to know what kinds of sports will be played in space. What baseball records are likely to be broken? Will drugs and steroids ever be accepted in international competition?

For each of the following 40 questions, circle the response(s) you think Ueberroth gave. The objective is to respond in the way you think Ueberroth would have.

On page 96 you will find his 39 answers. (Ueberroth declined to comment on one of the 40 questions; you'll have to figure out which one.) To calculate your score, tally the number of times your own responses match those of Ueberroth. Then check your score against the Omni Future Sports Quotient, a profile that analyzes your ability to predict the future of sports and to mirror the philosophy of Peter Ueberroth.

1. In the year 2001, what spectator sport will be the most popular in the United States (based on paid attendance)?

- a. horse racing
- b. football
- c. baseball
- d. soccer
- e. basketball
- f. auto racing

2. What baseball record is the least likely to be broken?

- a. Roger Maris' 61 home runs in a season
- b. Cy Young's 513 lifetime victories
- c. Jack Chesbro's 41 wins in one season
- d. Lou Gehrig's 2,130 consecutive games played
- e. Joe DiMaggio's consecutive hitting streak of 56 games
- f. Pele's career hit record

3. When will Eastern Bloc countries like East Germany or the Soviet Union use genetic engineering (manipulating athletes' genes) to create the ultimate athlete?

- a. 1995
- b. 2000
- c. 2010
- d. 2010 or beyond
- e. never
- f. 2005

4. Within 25 years, in which of the following leagues will women in America be playing alongside men? (Choose as many as apply)

- a. basketball
- b. baseball
- c. football
- d. hockey
- e. none

5. Brawls have occasionally erupted as a result of disputed umpire calls. When will robotic umpires be used behind home plate to call balls and strikes?

- a. 1990
- b. 2010
- c. 2020
- d. never

6. Howard Cosell has recently called for a general prohibition on boxing as a result of

serious injuries to fighters. Will such a ban ever be instituted?

- a. yes
- b. no, but there will be stricter medical standards applied to boxing
- c. boxing will continue in its current form

7. Who will twenty-first-century Americans cite as the greatest male sports hero of the twentieth century?

- a. Jesse Owens
- b. Jim Thorpe
- c. Muhammad Ali
- d. Babe Ruth
- e. Kareem Abdul-Jabbar
- f. Pele
- g. Arnold Palmer

8. Who will twenty-first-century Americans cite as the greatest female sports hero of the twentieth century?

- a. Babe Didrikson
- b. Billie Jean King
- c. Sonja Henie
- d. Wilma Rudolph
- e. Olga Korbut
- f. Marina Navasalova
- g. Greta Waitz

9. The National Basketball Association recently instituted a cap on player salaries. Which league is next to follow?

- a. National Hockey League
- b. National Football League
- c. Major League Baseball
- d. none

10. When will the Olympics accept professional athletes in every sport?

- a. 1992
- b. 2000
- c. 2008
- d. 2016
- e. 2020 or beyond
- f. never

11. Will the National Collegiate Athletic Association (NCAA) ever permit colleges to provide salaries for their top athletes?

- a. yes
- b. no

12. In 1969 pitching mounds were lowered to bolster flagging offense. Since then the science of pitching has improved further. Will pitching mounds, as a result, be lowered again before the turn of the century?

- a. yes
- b. no

13. Fan violence has become an alarming problem in sports today. What measures will be taken regularly in the next two years by ball clubs to make fans behave? (Choose as many as apply)

- a. police dogs will be stationed on playing fields as they were in Philadelphia in 1980
- b. greater restrictions will be placed on the sale of beer
- c. disruptors will not only be ejected from ballparks but will be fully prosecuted
- d. bodily searches will be increased as fans enter the stadium
- e. there will be more visible police and security presence
- f. razor wire will be used to protect playing fields



"Yes, gentlemen, we've witnessed some incredible refinements to Professor Einstein's theories regarding time travel. Now, with your permission, it's time for Commander Worthington's four o'clock hearing."

14 Will the Olympics ever be returned permanently to Greece to prevent political boycotts and endless squabbling?

- a yes b no

15 At the first modern Olympics in 1896 Spyros Louis took 2 hours 58 minutes and 50 seconds to win the marathon in Athens. In 1984, at the Olympics in Los Angeles, Carlos Lopez of Portugal won in 2 hours 9 minutes, and 21 seconds. By 2000, as the new millennium approaches, will the two-hour mark fall?

- a yes b no

16 Womens performances have been improving dramatically over the last 20 years as a result of emphasis on training. In which of the following Olympic categories is it likely that a women's time will be better than a man's? (Choose as many as apply.)

- a 100 meter run
b marathon
c 100-meter freestyle
d javelin throw

17 Despite much publicity about men being superior to women, Billie Jean King defeated Bobby Riggs in the celebrated Match of the Sexes in 1973. Will top female tennis competitors ever compete head-to-head against men at Wimbledon?

- a yes b no

c women may become as good as men but will still compete in separate categories

18 Baseball is booming around the world. Which country would have the most realistic chance of defeating the winner of the World Series of 2001?

- a Japan
b Dominican Republic
c Cuba
d Mexico
e none of the above

19 Major League Baseball went international in 1993 with the inclusion of the Montreal Expos. Which of the following countries or territories will sport major-league teams in 25 years? (Choose as many as apply.)

- a Puerto Rico
b Mexico
c Dominican Republic
d Cuba
e Japan
f none

20 Since 1980 there have been 12 World Cups; the United States, however, has never fielded a truly competitive soccer team. With the growth of American soccer, what year is the United States most likely to win?

- a 1990
b 1998
c 2006
d 2026
e the United States will never be able to contend with the Europeans and the South Americans

21 Given the continued emphasis on youth, a nine-year-old could conceivably compete in the U.S. Open in 2010. If the United States Tennis Association imposes age limits, how old will a youngster have to be to compete in a major tournament?

- a ten c fourteen
b twelve d fifteen
e no age restriction will ever be set

22 So universal is the metric system that the Olympics does not even have a mile run. Will the United States ever follow suit and eliminate the mile from track-and-field competition, replacing it with the 1,500-meter run?

- a yes b no

23 Who would a twenty-first-century sports fan designate as the greatest coach or manager of our current century?

- a Angelo Dundee g Woody Hayes
b Casey Stengel h John Wooden
c Earl Weaver i Connie Mack
d Vince Lombardi j Babe Ruth
e Branch Rickey k Red Auerbach
l Bear Bryant

24 Horses that win major stakes events are put out to stud. Will professional athletes ever be paid to perform a similar service?

- a yes b no

25 Of the following baseball possibilities, what is the most likely event to occur in 2001?

- a Billy Martin is rehired as manager of the New York Yankees
b the Chicago Cubs win the World Series in a night game played at Wrigley Field
c Pete Rose gains his six thousandth hit playing as a designated hitter for the Cincinnati Reds
d United States President Steve Garvey throws out the first pitch on opening day
e none of the above is at all likely

26 In a 1984 poll *Time* readers predicted that an Olympics played in space would include such new sports as spaceball, zero-gravity billiards, ultimate skydiving, and a lunar biathlon. When can we expect such an event to be held?

- a 2020 c 2064
b 2040 d beyond 2100
e never; we have enough trouble holding the Olympics on Earth

27 Will a computer replace a human as an on-the-field manager to decide a team's strategic moves?

- a likely to occur in at least one professional sport before 2000
b likely to occur after 2000
c unlikely to occur; one cannot win one for the chipper

28 The United States had won America's Cup sailing's most prized trophy for 24 consecutive races until Australia won the Cup in 1983. At the turn of the century, which country will be sailing's champion?

- a Australia c Canada
b England d United States

continued on page 33



"I suppose our government finds itself frequently supporting dictators for the very same reasons we end up marrying them."



FICTION

The cybernetic snake hides within her,
patiently coiled, ready to strike

SARAH RUNS THE WEASEL

BY WALTER JON WILLIAMS

The body designer has eyes of glittering violet above cheekbones of sculpted wax. Her hair is a sleeky blond that sweeps to an archiecurlly perfect crest I'm behind her nape. Her muscles are catlike, and her lips are drops of scarlet dew. "Hair shorter, yes," she says. "One hour and wear it long in the bar." Her fingers lash out and snap Sarah by the other ear, and she has to tip her head back to the cold moon light. Her fingernails are violet to match her eyes, and sharp. Sarah glances at her sullen chin. The body designer smiles. "A little pad in the chin, yes," she says. "You need a stronger chin."

PAINTINGS BY DI MACCHIO

With a slow grace that must
have served well in the high, black, starry
evernight, Maurice turns.

The tip of the nose can be altered; you're a bit too retrosex. The curve of the jawbone needs a little tailoring—I'll bring my paving knife tomorrow. And of course we'll remove the scars. Those scars have got to go." Sarah cuts her lip under the pressure of the vice-clipped fingers.

The designer drops Sarah's chin and wrists. Must we use this girl, Cunningham? she asks. She has no style at all. She can't walk gracefully. Her body's too big, too awkward. She's dirt. Common.

Cunningham sits silently in his brown suit, his neutral, unmemorable face giving away nothing. He voices a whisper. Sarah has style. Firebud, he says. Style and discipline. You are to give it form, to fashion it. Her style must be a weapon. You will make it, I will point it. And Sarah will lie where she should. He looks at Sarah with his steady brown eyes. Won't you, Sarah? he asks.

Sarah does not reply. Instead she looks up at the body designer, drawing back her lips, showing teeth. Let me hurt you some night, Firebud, she says. I'll show you style.

The designer rolls her eyes. Design stuff, she snorts, but she steps back. Sarah grins.

"And Firebud," Cunningham says, "leave the scars alone. They will speak to our princess. Of the cruel terrestrial reality which she helped create. Which she dominates. With which she shall in love."

"Yes," he says, "leave the scars alone." For the first time he smiles, a brief tightening of the cheek muscles, cold as liquid nitrogen. "Our princess will love the scars," he says. "Love them till the end."

TODAY/YES

The Autobut Out is a jockey bar, and they are all here: moonpicks and neopicks, holdjocks and powerjocks and rockjocks, all wearing their colors on their vests and jackets. TRW, Tempa, Tektilla, ARAMCO, Tupolev. The badges that declare them the veterans of the Rock War. They condescend to stomp the floor with the losers, the mudboys and dritters who surround them, who hope to touch them in the zonindance and absorb a piece of their radiance.

Sarah stands among them in a black satin jacket, blazoned on its back with a white

crane that needs to the starry firmament amid a flock of chrome-bright Chinese characters. It is the badge of a small block that does most of its business in Singapore and is headed ever to be seen here in the Florida Free Zone.

Her sculpted face is pale, the Florida tan gone, her eyes black rimmed. Her almost-black hair is short on the sides and bushy on top; her nape has falling in two thin braids to the small of her back. Chrome-steel earrings brush her shoulders. Firebud has broadened her already-broad shoulders and paired down the width of her pelvis. She wears black dancing slippers, lacquered over the ankles, and dark purple stretch overlaces with suspenders that frame her breasts, stretching the tabs over the nipples so that Firebud has made more prominent. Her skin is gauze spangled with silver, her neck scint black silk. There is a two-way splice into her auditory nerve, and a receiver lagged to the optic centers of her braincase, monitoring police broadcasts, a constant Times Square of an LED running amber of will, above her expanded vision. Gifts from Cunningham. Her hardwired nerves are her own. So is the Weasel that waits with cybernetic patience, for the hunt to begin.

I LOVE MY KIRIYU EYES, SEZ PRIMO FORMOSTAR, ROD MCCLISH AND WITH THE INFRARED OPTION

I CAN TELL IF MY PARTNER IS REALLY EXCITED OR IF I'M JUST ON A SILICON RIDE.

KIRIYU OPTICS IS

A DIVISION OF MIRROKIN SURFWEAR



She first met Cunningham in another bar, the Blue Silk. That morning Sarah had run Weasel as per contract, but the aragboy had been hardwired himself—she suspects a medusa implant with some Japanese liquid crystal containing the reflexes of a second day or so. But Weasel had gone in through the boy's eye and taken off the lobebean, and though Sarah is nursing bruises, she recovered the boy's sunbag, the stolen merchandise his hopes had driven him to steal but his smarts hadn't let him keep.

The contract was with the thirdmen, and Sarah was paid in endorphines, handy since she'd had to use a few of them herself. There is a bone bruise on the back of her thigh, and she can't sit, instead she lies on the peccad bar and sips her rum and lime.

The Blue Silk is run by an ex-cutthroat named Maurice. He is a West Indian with old-model Zess eyes, who fought the Rock War on the losing side. There are pictures of his friends and heroes on the walls, all of them with the azure silk neck scarves of the elite space defense corps, most of them trained with black Mourning ribbons that are turning purple with the long years.

Sarah wonders what he has seen with those featureless metal eyes. The burst of X rays that heralded the ten-thousand-ton rocks that tore through the atmosphere to crash on Earth's crust? The artificial meteors themselves, launched from the orbital and lunar mass drivers, that had first fallen in the Eastern Hemisphere, over Mumbai and Calcutta, each with the force of a nuclear blast? By the time the planet had rotated and made the Western Hemisphere a target, the earth had surrendered—but the orbital blocks left her hadn't made their point forestally enough in the West, and so the rocks fell anyway. Communications foul-up, they said. Earth's billions knew better. Earth had been colonized by its own orbital and lunar colonies, a nasty piece of irony delivered by special messenger.

Sarah was eight. She was doing a tour in a Youth Reclamation Camp near Stone Mountain when three rocks obliterated Atlanta and killed her mother. Her brother David, two, was trapped in the rubble, but the

neighbors heard his screams and got him out. After that Sarah and her brother bounced from one CP agency to another, then ended up in Tampa with her father, who had disappeared when she was three.

Sarah remembers the first glimpse of the man: his torn shirt darkened by alcoholic sweat, his wistful, uncomprehending stare; all the social worker introduced him to the children. "This is your father," the woman said. "He'll take care of you." It turned out to be only half a lie.

"Looking for work, Sarah?" The question comes from the quiet white man who has been sitting at the end of the bar, brings a welcome end to the unbidden memory. He has come closer, one hand on the back of the bar stool next to her; he is smiling as if he is unaccustomed to it.

"You come recommended," he says. His voice is sandpaper, the kind you never forget, like he'd never had to raise it.

She narrows her eyes and takes a deliberately long drink.

"By whom?" she says.

The smile is gone now, the nondescript face looks at her wryly. "The Hetman."

"Michael?" she asks. He nods.

"My name is Cunningham."

"Do you mind if I call Michael and ask him?" she says. The Hetman controls the Bay crowd, and sometimes she runs the Weasel for him. She doesn't like the idea of him dropping her name to strangers.

"If you like," Cunningham says. "But I'd like to talk to you about work first."

"The bar's the bar I go to for work. See me in the Plastic Girl at ten."

"This isn't the sort of offer that can wait."

Sarah turns her back to him and looks into Maurice's metal eyes. "This man," she says, "is bothering me."

Maurice's face does not change expression. "You best leave," he says.

Sarah, not looking at Cunningham, receives from the corner of her eye an impression of a spring uncoiling. Cunningham seems taller than a moment ago.

"Do I get to finish my drink first?" he asks.

Maurice, without looking down, reaches into the till and flicks bills on the dark surface of the bar. "Drinks on the house. Get outta my place."

Cunningham says nothing, just gazes for a calm moment into the unblinking metal eyes. "Townsend," Maurice says, a code word and the name of the general who had once laid him up against the orbita and their burning defensive energies. The defense systems lock down from above the bar major. Sarah glances up. Military lasers, she thinks, sconced on the black market or maybe from Maurice's old cutter. She wonders if the bar has power enough to use them or whether they are bluff. Cunningham stands still for another half-second, then turns and leaves the Blue Silk without a word. Sarah does not watch him go.

"Thanks, Maurice."

Maurice forces a sad smile. "Hell, lady," he says. "Your regular customer. And that tella been orbital."

"It's him from the blocks? You're sure?"

I didn't say he *drove* the blocks, Sarah," Maurice says, "but he's been there. Recently, too. You can tell from the way they walk, if you get the eyes." He raises a gnarled finger to his head. "This ear you know? Con trilugal force just a little different from gravitational. It take a while to adjust."

Sarah frowns. What kind of job is the man offering?

She holds out her glass. Another, please, Maurice.

With a slow grace that must have served him well in the high, black, starry overnight Maurice turns toward the mirror and reaches for the rum. Even in a gesture this simple there is sadness.

ARTIFICIAL INTELLIGENCE

LOSES PATERNITY SUIT

MY LITTLE ANDROID HAS A NAME,

SCREW YOUR PARENTS, MOTHER

KODAKLY I.G. OFFERS NO COMMENT

She takes a taxi home from the Blue Silk, trying to ignore the tact of Cunningham west

"I thought I'd hear from you today, my heroine," he says.

"Yes?" she asks. "You know this orbitor Cunningham?"

"So-so. We've done business. He has the highest recommendations."

"Whoops?"

"The highest," he says.

"So you recommend that I trust him?" Sarah asks.

His laugh sounds a little jangled. She wonders if he is high.

"I never make that kind of recommendation, ex-harmless," he says.

"Yes, you would. Hetman," Sarah says. "If you are getting a piece of whatever it is Cunningham is doing. As this, you're just doing him a favor."

"Do sydanya, my sister," says Michael, sounding annoyed, and snaps off. Sarah looks into the humming receiver and frowns.

The clock ticks behind her, and she looks quickly over her shoulder, seeing her brother, Daud. Behind her, carrying a six-pack of beer, comes his manager, Jackknife, a small young man with unquiet eyes.

Daud looks restlessly over the small apartment. He alterations his eyes from brown to a pale blue just as he'd altered the color of his hair, eyebrows, and lashes to a white blond. He is tanned, and his hair is shoulder length and shaggy.

He wears tattered leather sandals and a tight white pair of slacks underneath a dark net shirt. He is taking hormone suppressants, and though he is twenty he looks fifteen and bearded.

Sarah moves over to him and kisses him hello. "I'm working tonight," he says. He gives a shadowy grin. "He wants to have dinner; I can't stay long."

"Is it someone you know?" she asks. She lived in his world once, and she knows it's a dangerous place—particularly dangerous for someone like Daud, who appeals to a particular sort of client.

The hormone suppressants make him unable to respond normally—and that appeals to a certain type of taste. But sometimes Daud's passivity inspires rage, a berserk madness that flares from time to time in the shadow world's clients.

You. He gives a shadowy grin, meant to be reassuring. He blue eyes flicker. "I've been with him before."

Not a catch? As Sarah speaks the word, she feels the cold touch of memory. Mad eyes, a dirty mouth repeating over and over its incantation—bitch, bitch—a razor. And from Sarah a reaction so fast she couldn't stop herself.

He shrugs out of her embrace and goes to sit on the sofa. "No," he mumbles. "An old guy. Lonely, I guess. Easy to please. Wants to talk more than anything."

He picks up the plastic pack of endorphins and Sarah sees two more vials vanish between his fingers.

"Daud," she says, her voice a warning. "That's our food and rent. I've got to get it on the sheet."

"Just one," Daud says.

CONTINUED ON PAGE 90



*How the subtleties
of the psyche protect us
from the slings
and arrows of disease*

MIND CURES

BY STEVEN E. LOCKE, M.D., AND
DOUGLAS COLLIGAN

Once a week the man, a busy executive, took a break from his crowded schedule and paid a visit to a special clinic in downtown Boston. There he was ushered into a small, dimly lit room, in the center of which sat a large, comfortable reclining chair. After a nurse drew the curtains, he settled into the chair and began the first part of his weekly ritual of exercises: alternately tensing and relaxing selected muscles throughout his body. In matter of minutes he felt the knots of tension fade him unravel. He began to float into a state of total calmness.

Then he started the next phase of the exercise. In his mind's eye he summoned forth a familiar imagined scenario. He was lying on an operating table and a surgical team was huddled around him. The surgeon having made an incision in the man's abdomen, a red, meaty mass. An assistant brought a cooler to the table. The doctor reached inside and slowly, almost reverently, lifted out a small mass of pale pink tissue. Cupping it in his hands, he lowered it gently through the motion

and into the man's body. As the man imagined receiving the transplant, he felt a comforting surge of life-giving warmth.

He was enacting the operation in which he would receive a new kidney. Another transplant had been tried, but his immune system had destroyed it. A common problem for patients on dialysis can be an allergy to foreign tissue. Frequent blood transfusions had given the man's body new immune sensitivities. His immune system had become brutally efficient at rejecting foreign material.

The victim of a debilitating kidney disease for more than 15 years, the man was now trying to adopt a loving attitude toward this strange kidney, prompting his body to accept it. With these mind exercises his transplant surgeon hoped the man's immune system would relax and offer a friendlier microenvironment for this new kidney. The surgeon was a man with a merely increased medical ally the mind of the patient.

The case of this man is fiction, but the method is not. A therapist helped devise this invention after hearing from a specialist that

PAINTING BY ARMODIO

kidney transplants often fail. While using the mind to sway the immune system may sound like hocus pocus, it's solidly based in a new and growing branch of research called psychoneuroimmunology or PNI.

Over the past decade the discipline of PNI has begun to answer a question that has eluded science for centuries: How do our thoughts, attitudes, and feelings affect our health? The explanation offered by PNI. There is a collaborative relationship among the mind (psych), the brain (nerves), and the body's system of self-defense—the immune system (immunology). What we have learned is the interplay of all three promises to change the way medicine is practiced in this and the next century.

In addition to the standard tests, exams and treatments given patients today, future hospitals may have a battery of new methods at their disposal. We've already had a glimpse of some of these, which include:

- Computerized tests that pay as much attention to an individual's mind as to his body
- Mind exercises that guide the body's immune system along a healing curve
- Hope-enhancing exercises that shape a patient's attitude so it can actually be physically beneficial
- Placebos (sugar pills) that are used as part of conventional medicine

The discipline that started all this is relatively young. It began in earnest about 20 years ago when psychiatrist George Solomon, then at Stanford University, became interested in the role the mind and the brain play in disease. During the Sixties he worked with both humans and animals convinced him that definite interactive links exist between the mind and the immune system.

For example, he noted that while many women had inherited tendencies for rheumatoid arthritis, those with certain personality traits—passive, long-suffering individuals—succumbed to the disease more frequently. In his work with animals Solomon revealed that rats with tumor-cell implants had shorter life spans when they were put under stress. Solomon was also the first American to duplicate controversial Soviet research demonstrating that effectively damaging a portion of the hypothalamus, a tiny part of an animal's brain, weakens the immune system. Because all this suggested a connection between the mind and the immune system, Solomon dubbed this new area of study psychoneuroimmunology.

Solomon's declarations were largely unnoticed at first. It was considered scientific dogma that the immune system operated independently of any other systems in the body. To say that the immune system could somehow be influenced by anything outside itself seemed absurd.

Yet during the Seventies more evidence appeared that supported Solomon's theory that the immune system does not operate independently of the rest of the body. The mind-immune system connection was accidentally discovered by University of Rochester psychologist Robert Ader. He found it while performing some standard psycho-

logical experiments with rats. Just as Pavlov trained his dogs to salivate at the sound of a bell, Ader wanted his rats to be repulsed by the taste of saccharine-enriched water.

After the rats drank the sweetened water, he injected them with a nausea-inducing drug, cyclophosphamide. With just one injection, the animals began to link the sweet taste with feeling nauseated. Each time they drank, they got sick to their stomachs. Strangely, many of them started dying as well just from drinking the water. While trying to solve the mystery of their deaths, Ader learned that cyclophosphamide suppresses the immune system. With this last piece of information in place, he theorized he had trained the rats not only to abhor sweetened water but to suppress their immune system at the sweet taste. In other words, after a sip of saccharine water their bodies reacted as though they had been given a dose of an immunosuppressant. With their immune systems suppressed, the animals got sick and died.

• Blood tests showed that patients who coped poorly with their illnesses had less active immune cells than those who seemed better able to deal with life's stresses. •

He tested his theory with the help of a colleague, immunologist Nicholas Cohen, by taking a group of mice bred to die of the disease systemic lupus erythematosus and conditioning them the same way. Lupus is an autoimmune disease in which the body is attacked by its own immune system. For the lupus mice, having a suppressed immune system would be lifesaving. The same animals that had Ader's conditioning lived less from the lupus inflammation and lived longer. Because Ader suspected that the nervous system played a role in influencing the immune system, he suggested extending George Solomon's nomenclature to include *nervous*.

In the years since Solomon and Ader did their work, others have explored the relationship of the moods of the mind, the neurological wiring of the nervous system, and the biochemical realm of the immune system. Many researchers now suggest we can exploit this connection. In the future, when a patient checks into a hospital, the kinds of treatments he receives may depend less on the medicines he is given and more on his state of mind at the time.

We now know that a tremendous number

of variables can shape the immune system and thus our health. Stresses that grind down an individual's ability to cope with these problems, his personality, his genetic legacy, his physical makeup, and his current state of health. As a result, when a patient enters the hospital, the admitting physician may do more than take just a routine medical history of the patient.

One way to make variables like these medically useful is to computerize the ritual of the hospital admissions interview. The computer is eminently suitable for managing a mass of data in a logical way. And PNI requires the integration of a huge amount of information.

If a database of PNI variables existed, it would be possible to program a desk-top computer to analyze a profile of a patient. After gleaning all relevant information about a case, the computer would match the individual's profile against the database. The final diagnosis would always be made by a flesh-and-blood physician, but that doctor would be able to see the patient more clearly and to attack maladies as a problem both of the body and the mind.

The day may also come when a patient will be asked to talk for five minutes into a microphone connected to a computer. A doctor will then run a speech-analysis program yielding a printout indicating the type and intensity of emotional distress a person is experiencing. The computer could help analyze the synergy of other elements—diet, personality, genetics, healthy and unhealthy habits—and allow a doctor to use risk-factor equations for sickness and health. The program, for example, might declare that a person stands a 5 percent higher than average chance of developing a certain type of cancer in his lifetime.

While stress or depression can be debilitating, neither is toxic in itself. How you cope with stress makes an important difference. This became clear in an experiment done at Boston's Beth Israel Hospital and at Harvard University. During the study, undergraduates were given psychological tests and were labeled good copers or poor copers. Under stress poor copers complained more about anxiety and depression than the good copers did. The difference between the two groups was also reflected in their immune systems. Blood tests showed poor copers had less active immune cells, called natural killer cells, than those who seemed "better able to deal with life's stresses."

You can improve the attitude of a poor coper by encouraging him to feel in control of a situation. As a step in that direction, University of California psychiatrist Dr. Louis Gottschalk devised a system that assesses a patient's emotional health. The procedure is simple. The patient is asked to talk briefly—five minutes—about an interesting or dramatic event in his life. The short talk is tape-recorded, transcribed, and a transcript of it is given to a trained rater to evaluate.

The rater sifts through the transcript and looks for key words and phrases, which he checks against a vocabulary rating scale

keeping each a number. According to Gotschalk, someone trained to read these emotion-laden colloquies can make detailed and objective measurements of such states of mind as anxiety and hostility. A well-trained analyst can score aspects of human speech "much as biochemical technicians are trained to run various chemical determinations," Gotschalk says.

He has developed a version of his test that measures hope. In trying out his interview techniques on 27 cancer patients undergoing radiotherapy at Cincinnati General Hospital, Gotschalk found that those with the higher "hope" scores also had higher survival rates. His hope-quotient test could be used as easily with any patient.

Other researchers are anxious to reach the next plateau: to maintain hope where it exists, to stir it up where it is flagging, and to instill it wherever possible. Currently Dr. Fred Hendrik, a professor of psychiatry at the University of Arkansas, and his colleagues are working on a hope-enhancement program for patients slated for heart surgery and kidney transplants.

Before an operation the patient and his family meet with the surgeon and staff who explain the details of the surgical procedures and answer any questions the patient has. Just this simple exchange helps to establish human contact between the surgical team and the patient. After the operation the hospital staff encourages the patient to do as much for himself as he feels able. This

message: Each patient is not someone who is sick but someone who is getting well.

As hospitals become sensitive to a patient's state of mind, they will pay closer attention to other features of convalescence like the hospital room where a patient spends most of his time. Roger Ulrich, a researcher at the University of Delaware, studied the recovery of various patients who occupied one floor of a Pennsylvania hospital. For eight years he collected the health records of patients who came in for gallbladder surgery. He kept track of the number of painkillers and anti-nausea pills each patient had taken after the operation, the number of minor postoperative complications experienced, and the length of time each patient stayed in the hospital.

At the end of the eight-year period Ulrich divided the patients into two groups. The first had a miserable view from their hospital room: a bland, featureless brick wall. Ulrich called these the "wall-view" patients. These typically took more painkillers, had slightly more postoperative complaints, and generally stayed in the hospital longer.

Ulrich called the second group the "tree-view" group because their windows looked out on a small stand of trees. They took fewer painkillers, were described by the nurses as having fewer complaints, and on the average went home from the hospital about a day and a half sooner than the wall-view group did. A difference in the quality of health was evident, and the view seemed to be part

of it. Ulrich mused that maybe the people who design future hospitals should pay more attention to where they place their buildings and intangibles such as: the quality of patient window views."

Many subtle features of a hospital environment can make their mark on the psyche and ultimately the body of a patient. For that reason Robert Adler predicts it may someday be possible to do with humans what he did with his rats—condition the immune system. The transplant exercise described earlier is a step in that direction and is based on other animal experiments. At the Ontario Cancer Institute Canadian researchers applied Adler's conditioning to animals receiving transplants.

First researchers performed several genuine skin transplants from one mouse to another. Because the transplanted skin was foreign tissue the animal's immune system mobilized to reject it. After a series of these operations, researchers made all the preparations for surgery—anesthetizing the animals, wrapping their bodies in bandages—but they stopped short of surgery. Even so the animal's immune systems still reacted as though a transplant had been done. They had been conditioned by the ritual surrounding the surgery.

Conditioning may play a role in all medical procedures. And so Adler puts it: "Since the conditioning is there already when you administer medicine, why not use it?" For example, cancer patients receiving chemotherapy have long suffered a conditioned response called anticipatory nausea and vomiting. One of the side effects of treatment with anticancer drugs can be severe. Very often anything associated with the treatments sets off nausea attacks. For some it's the smell of the alcohol pads used to swab the skin in preparation for intravenous injections. For others the feeling of nausea sweeps over them as they pull into the hospital parking lot. For all others, the mere sight of the person treating them can trigger it. One patient was shopping in a supermarket rounded the corner and came face-to-face with the oncologist who had been treating her. Her reaction: She threw up.

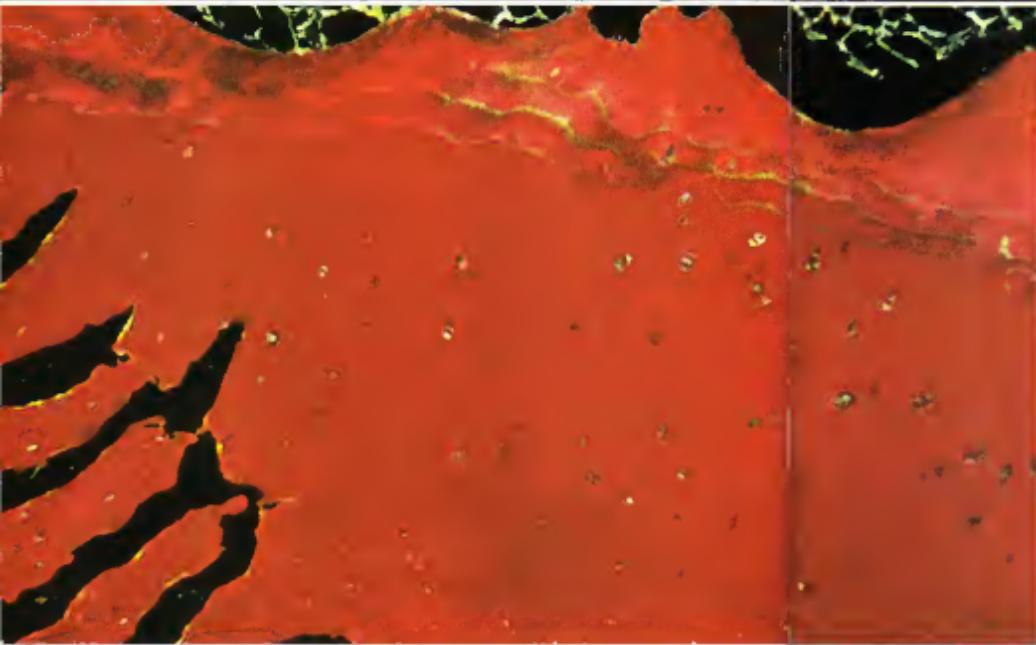
Adler suggests putting the powerful force to positive use. At an oncology clinic in the future, a chemotherapy patient would undergo special training, the training Adler's rats received. Doctors would administer gradually diminishing doses of a cancer-fighting drug along with increasing amounts of a harmless substance—perhaps a candy mint. Over time the patient's system would associate the flavor with the effects of the drug. Ideally the doctor could eventually reduce the chemotherapy dose and supplement it with the mint. In this way a physician could obtain the same medical results while using smaller doses of a drug.

A patient whose body had rejected one transplant attempt could use a variation of that strategy, similar to the one employed by the man mentioned at the beginning of this story. The challenge in his case is not conditioning but counterconditioning. Just as the

"I paint what I see."

Disease and health
alter the scenery of

MICRO BONESCAPES

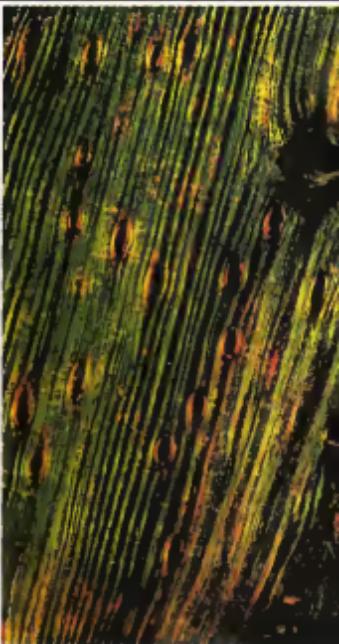


Man searches the cosmos to divine the great framework of creation; within him another framework exists, supporting his body, protecting his organs, and enabling him to maneuver his environment. It is skeleton, and because its 205 bones obey the physical laws of the universe, each contains a tiny universe of its own. The thighbone, seen in cross section (above), has a chambered configuration that is light, yet strong enough to bear the weight of a human body.

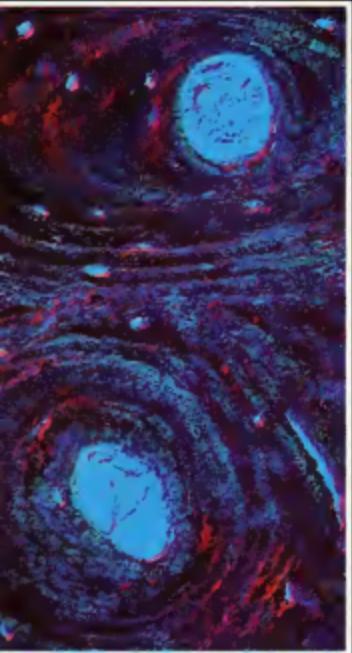
A deeper look into bone tissue reveals even more remarkable vistas of form and function. Disease, however, can mar this beautiful bionicscape. Early stages of osteoporosis in wrist cartilage show up as small fissures (left). A rabbit's knee (right) shows ameliorated—layed-down—bone, which grows in both men and beasts. A muscle structure rests on the forearm imposed by muscles and gravity.

"In the microscope within bones, one sees illustrations of the principles of Newton and the

BY BRIAN MCKERNAN



• In the microcosm within bones, one can see illustrations of Newton's principles. •



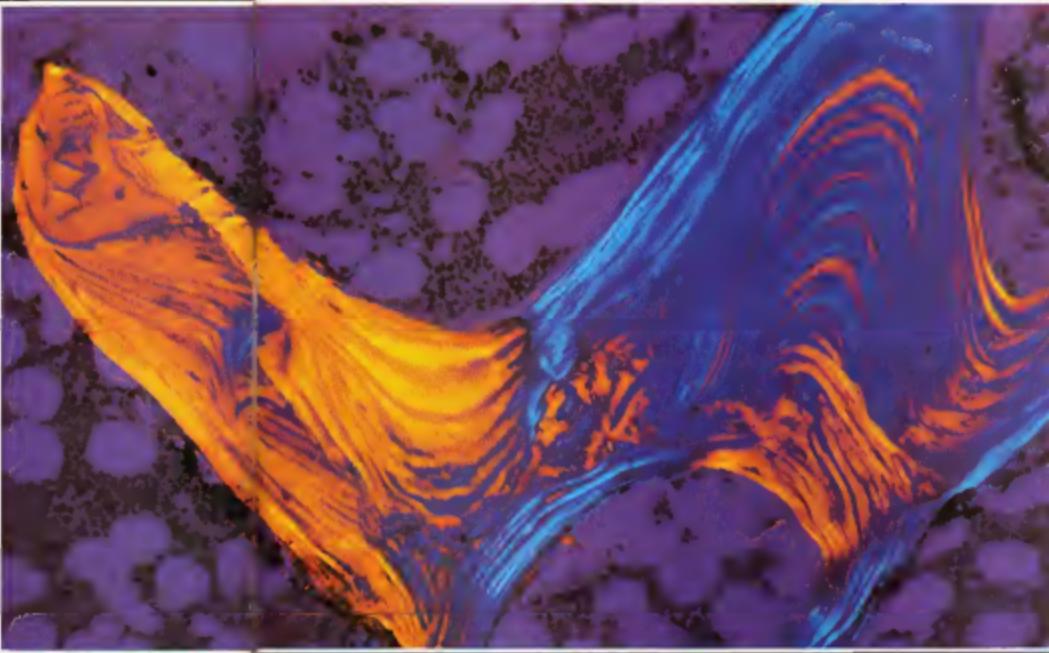
Laws of mass conservation (bone tissue) gives one an appreciation for the unity in nature," says Michael J. Klein, an orthopedic pathologist at New York Hospital for Joint Diseases Orthopedic Institute.

Klein created these photomicrographs, which are used to document bone disease and to serve as teaching aids for doctors and medical students.

"The collagen in bone is optically clear like a crystal," Klein says. "Fluorescent polarizing light produces a wide range of colors that highlight details."

Swirling galaxies of red and blue mark the concentric structure of bone formation in a human thighbone (left). The filigree of a blood vessel contained within bone marrow is shown above. What looks like vacuous eddies and my maza (right) is actually the wavy texture of layered bone growth in a normal human hip.

Klein has recorded the world within bones for over a decade. "I like to make these shots pretty as well as informative," he explains. "I found that if you pay a little more attention to composition and color contrasts, you might even keep lecture audiences awake longer." □



Brain-eating cannibals of the New Guinea rain forests and a deadly, mind-destroying disease sent this microbe hunter on a quest that won him a Nobel prize. Today he stalks mysterious nervous-system cripplers and the AIDS virus.

INTERVIEW

D. CARLETON GAJDUSEK

The home of Daniel Carleton Gajdusek is a three-story colonial that was a Civil War Union Army outpost. It sits on a hill overlooking Frederick, Maryland. Four trees stand in front, a dozen of Gajdusek's adopted children are playing. Seven New Guinea boys cut one another's hair while listening to a Doors tape on their portable stereo. After some children cook dinner, they sit down and the children, who have never before seen snow, begin to jump up and run outside, forgetting only their shoes.

Gajdusek himself wears unbuttoned, rumpled pajama-style clothes. When he was a boy in Yonkers, New York, where he was born in 1923, he stenciled 13 names from Paul De Kruif's chronicle of pioneering bacteriologists, *The Microbe Hunters*, on the stars leading to his attic laboratory—illustrous predecessors he would follow in his relentless pursuit of deadly, mind-destroying

viruses. Years later Sir Frank Macfarlane Burnet, the Australian immunologist and Nobel laureate, described Gajdusek as a "near-genius with the emotional maturity of a fifteen-year-old." He is completely self-centered, thick-skinned, and incorrigible—but equally won't let danger, physical difficulty, or other people's feelings interfere in the least with what he wants to do. He apparently has no hobbies, but he is an amateur oboist, interested in cooking, none whatsoever in clothes or cleanliness, and he can live cheerfully in a slum or grubby hut. Add to that an almost pathologically aversion to the press and the fact that he has single-handedly raised 34 children from primitive Micronesian and New Guinean villages, and a rough picture emerges of a man who has taken life to the freak level of intellect and action.

Gajdusek's education included the University of Rochester and Harvard Medical School, with clinical training at Columbia Pres-



PHOTOGRAPH BY MALCOLM KIRK



•The Nobel isn't
that much money. Almost
any medical
specialist can make that
much just by
quitting my lab and joining
a medical group
practice for one year.♦

byterian Medical Center in New York City, Cincinnati Children's Hospital, and Children's Hospital in Boston. At twenty-five Gajdusek was appointed a Senior Fellow of the National Research Council of the California Institute of Technology, and about a year later, in 1949, was appointed Research Fellow at Harvard and a Senior Fellow at the National Foundation for Infantile Paralysis.

After investigating infectious and childhood diseases in Europe, South and Central America, and Asia, Gajdusek joined McFarlane Burnet in Melbourne, Australia, where he concentrated on virus genetics and autoimmunity. While he continued his studies of child development, behavior, and disease patterns in primitive cultures, he worked among the aborigines and the Melanesians peoples of New Guinea and New Britain.

On his second trip to New Guinea in 1967 Gajdusek met Vin Zigas, a local doctor who introduced him to kuru, a baffling nervous-system disease that was epidemic among the Fore, a cannibal tribe of the Highlands. What followed was a story of medical detective work worthy of Sherlock Holmes. As Gajdusek and his small group plumb the mysteries of kuru, it became apparent that the virus had extraordinary properties. A seemingly infectious disease, kuru produced no immune response in its victims and could lie dormant for upward of several decades before its symptoms fatally ravaged its host. The Fore victims were eventually unable to stand and usually died within a year of their first symptoms, their brains acculturated by lesions.

During his investigation Gajdusek had to contend with the superstitions, cannibalism, and almost indecipherable languages of the Fore and ten other cultural and linguistic groups that were afflicted with kuru. There were also many seasons, propitious flora and fauna, inadequate medical supplies and equipment and the constant pressure of the Australian medical establishment to replace him with one of its own. But he pressed on, often performing autopsies with the "help" of the victims' relatives. He compensated them for the disruptions in their traditional mortuary practices with such trade items as blankets, matches, knives, and axes. He packed off leprosy-ridden brains and organ samples to Melbourne and to the National Institutes of Health (NIH) in Bethesda, Maryland, for analysis. Gajdusek wrote, "Kuru is a most difficult thing to abandon; it is almost too good a problem."

In 1968 Gajdusek returned to the United States to become chief of a section studying child growth and development disease patterns in primitive cultures at NIH's National Institute of Neurological Disease and Blindness. There he attempted to transmit kuru to small lab animals and chimpanzees. William Hallow, a veterinarian who devoted his life to trying to elucidate the pathogenesis of scrapie (an infectious nervous-system disease common to sheep and similar to kuru), suggested to Gajdusek the possibility of very prolonged incubation periods in animals inoculated with bacteria-free, homogenized

brain tissue from kuru victims. The chimp contracted it after about two years of incubation, so kuru was indeed transmissible. This finding was the linchpin in proving that these diseases could lie dormant for long periods and could cause chronic noninflammatory disease in man. Slow virus infections are now held accountable for such degenerative diseases of the central nervous system as Creutzfeldt-Jakob disease (CJD, which killed choreographer George Balanchine); some other presenile dementias; slow, delayed, and rubella encephalopathies (brain diseases)—and also AIDS. It was for this research on the origin and development of these diseases—plotting their long infectious—that Gajdusek was awarded the Nobel prize in medicine or physiology in 1976. He is now chief of the Laboratory of Central Nervous System Studies (including the Laboratory of Slow Latent and Temperate Virus Infections) at NIH.

Gajdusek is also nearly impossible to keep up with let alone pin down. He is invariably on a field trip to New Guinea, delivering a lecture in Toronto or attending a conference in Paris, Bombay, or Beijing. After a long chase and lying in wait for him in a Washington, DC, hotel, interviewer Bill Mosley finally received a call announcing that the virologist could spare a few hours that afternoon. Mosley tore out to Fort Detrick in Frederick, Maryland, the Army base that houses the National Cancer Institute—the Detrick Cancer Research Facility. Soon Gajdusek walked into the office, accompanied by one of his new Guinean sons who stood during the entire interview. The session, attended by his extended family, concluded after dinner at Gajdusek's home.

Late Mosley realized that he'd forgotten to ask one question. Did he think that the virus responsible for AIDS was...evil? In response to Mosley's letter, Gajdusek wrote in part, "Your question from my point of view is incomprehensible and to some extent sadly amusing. I see the plagues and afflictions of mankind mostly as the inevitability of the natural consequence of the 'order of things'—animate and inanimate. Overpopulation, pest famines and starvation, even war and holocaust I tend to look at as I do tidal waves, earthquakes, glaciation, and other geophysical and astronomical events, with no real moral judgment as to how they effect people favorably or unfavorably. I have never considered [that] the concepts of good or evil had anything to do with the occurrence of these phenomena. I have preferred to look for their causes and outcomes in the inevitable lack of commensurability of the neurological structure of man and the erratic biological and geophysiological pressures he is exposed to. We need to place no credit or blame on the awesome order that has resulted from chance in the universe."

Q: How would you describe the press coverage on kuru?

Gajdusek: It wasn't so bad, but nobody in science would ever have called it "laughing death." Much to my horror, Public Health

Service policemen in Papua New Guinea gave the maniacal grin on kuru to patients before they were to come out in medical journals. Our reporter talked a lot about euphoria and restlessness, which happens in tetanus. Victims are often caught with a fixed grimace, apparently grinning. Yet, sun-downer's curtain causes a more serious disease. The same part of the brain is involved but in a different way. You smile and can't relax it, and it is slow in disappearing—it's like a telephone ringing after you hang it up, and you want it to be quiet. Or when you try to drown, you aren't instead—the brain circuitry that should have turned on a drown switch on a smile.

This pathological laughter isn't a major part of kuru, but laughing death was a million-dollar journalistic item. It made headlines overnight. Who were disturbed by that?

Orrin: Didn't the publicity help raise more money for your work?

Gaglione: No. We had more money than we had scientists willing to work. We never had financial problems in the bush, where there's no need for currency. Our problem was political interference. Suppose we've been working in Southeast Asia, Asia, and Oceania, and no one in government objects. When *The Times* of London says Gaglione is making lots of NIH work, and that's causing the same gets dropped by the country's embassy. They congl to the American Embassy. There's a national injury. Now what the hell are the Americans doing in our country? they ask. As long as the world doesn't know it, it's not politically dangerous to people in power. Orrin: Is there any value, then, in the press?

Gaglione: I read mutated press extensively—all the things I claim I don't read. I love picking up a 1930 *New Yorker*. I respect newswriting as a comment and insight into a culture. But to play a ridiculous game of writing for the next chapter is like reading *War and Peace* in installments by an anonymous author who has little likelihood of being a Tolstoy or Dostoevsky. That's despicable. Right now, if you showed me a *Time* or *Life* magazine about the original Khmer Rouge, I'd read it. Speaking some Farsi, having worked in Iran, and having housed many Iranians, I would look at these events historically and ethnographically in the perspective of my current knowledge.

All creative scientists have new ideas and ideas that they work through every day. Then after many experiments and a preliminary report, they're ready to publish or leave the table. They are no more sure of their final conclusions than a composer who is one third finished with a work. Is there a composer on the face of the earth who would want to show any bit of an unfinished work to anyone but a few chosen friends and critics? Or want it publicly performed before he finished it?

If anyone wished to destroy a work of music or painting at its inception, all he'd have to do is come in every day and ask the artist for a picture of how it's coming along. I've never met an artist or composer who wouldn't give up the goddamned masterpiece or smash up the goddamned masterpiece or

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picture [publicly] for Jean Cocteau. I think created on glass. Picasso made it after the war when he had been living with Françoise Gilot in the south of France. He was painting dozens of pictures of her—her breasts, rear end, and thighs. They were sketches of hers, and then he'd change them into a fawn, an owl, a cat, or what! He could have had his arms tied, stood on his head in a dark closet, and with his toes produced a woman's breast and made it into an owl! It's like somebody saying, "Oh dear me, I wonder if I can dive! I've not been practicing at all." Then "by accident" he goes up, and does an incredible Olympic high jump! "Gee wiz! What good luck!" You know damned well he's been practicing for days. You get yourself so damned perfect at it you can do it while you're drunk. The real style of it is to make believe you don't practice to pretend it all comes naturally. There's never been a sportsman who had that basic, never an artist who could perform adequately without working like hell.

Orrin: Do you think a child ceases being a child?

Gaglione: When you can't tell him around and sit and get a smile from him. Children are very resilient. Adolescents have very little resilience. They're generally offended by any slight. They may become too self-conscious to watch a film for itself, see the humor in themselves. Prepubescent or early-pubescent kids can be more objective than adolescents. There's a period of midadolescence when the only thing that concerns you is you, not the world, not other people. There's no problem taking care of kids by the dozens between the prepubescent period and puberty. But when they start getting into midadolescence they all need to be frozen for ten years before they become human again.

Orrin: How many children have you raised?

Gaglione: I've brought back thirty-four to the United States under legal adoption. In my earlier days with remote and primitive populations, I couldn't afford to bring them to America. I've never been a foundation and never incorporated. I've just gone out to raise a family. This growth has simply been possible because of the good fortune of winning several prizes—the more money I got, the more kids I could adopt. I've also raised this number in Papua New Guinea or the Caroline Islands, children to whom I'm especially committed. I less from even my wife. Most of these kids on the table are the sons and daughters of my traditionally adopted kids who weren't brought here.

Orrin: Did you donate your Nobel prize to build a school in Papua New Guinea?

Gaglione: No. The Nobel isn't that much money. It went up the year I got it, but now with mostly two or three people sharing it, it amounts to eighty to ninety thousand dollars. Almost any medical specialist can make that just by setting my laboratory and joining a medical group practice for one year. Orrin: Aren't you ever afraid of contradicting the classes of these primitive cultures?

Gaglione: Long before I worked with them I

myitis, viral encephalitis [cerebral diseases causing seizures possibly coma and death], hemorrhagic fevers, and the plague. There is no cure for rabies or viral encephalitis. I've worked all my professional life in laboratories on highly infectious agents. In the war years the Russians brought us strains of Russian spring-summer encephalitis and hemorrhagic fever viruses.

You might say that we stopped them around in the laboratory in those years, yet no one person even got infected. If you know what you're doing, you and others are safe. It's like asking people who build high buildings how often they fall off or get pushed off. It's a funny question.

On the matter of fully guaranteed safety it's like the phenomenon of the Palisades on the Hudson River. For miles there's no fence. Anyone could step over and they'd be dead. Now, if teenagers who were having fights with their parents, kids flunking exams and adults in bankruptcy began running to the Palisades and jumping off, some damned fool would want to put fences up, probably with lights and night guards on them. It's like the craze of the American public about the Golden Gate Bridge. Some say ten people a year jump off it, some say hundreds. No one knows how many really do, and some people think it's important to count or look. I wouldn't waste one cent, even if it were for my son, my mother, my father, or me. Who the hell cares? For anyone who's rational, depressed, or committed enough to go way out there to commit suicide, I'd have a ramp for their wheelchair, small steps for kids, assistance booths, and little signs along the way saying, LEAVE YOUR WALLETS HERE FOR CHARITY. IF YOU HAVE ANY FURTHER NOTES OR LETTERS, DROP THEM HERE AND THEY WILL BE DELIVERED. I would have a little elevator to help them over.

As a doctor I am used by human life, but, Jesus Christ, when people are rational enough to know they want to end it, I'd help them! Why spend a penny trying to stop them at such a reasonable suicide place as a bridge? It's better to have them jump from there instead of from an apartment house onto your head.

Omni: How did you get the Fore to abandon their ritual consumption of the dead?

Gadjusek: I never did.

Omni: From your first encounter with kuru you believed it was infectious, isn't that right? That it was transmitted by cannibalism?

Gadjusek: Yes. But even a drunk could come to the conclusion that a disease that's epidemic to cannibals is transmissible by eating the dead. There was an old miner, a character right out of a Joseph Conrad novel. He was one of the last outsiders in the highlands of New Guinea, the kuru region. He was dying of his malena—blackwater fever—when I met him post-World War II. He had never noticed kuru, but he began hearing about it from Vin Zigas, the doctor at Kainantu who treated the local New Guineans and all outsiders.

When I first came out of the kuru area after three or four months there, Zigas and I went to have a beer at the only bar in Kainantu. It was like something out of Abilene, Texas, in 1901, lots of boasting, lying, and drinking—and talk about that "funny young doctor" who was staying in the south with the cannibals with that funny disease. This drunken old miner jumped up, looked at me, and burst out laughing and screaming. "I see they've got you," he said, knocking over a chair beers, pushing people out of the way. "Don't you bastards come near me! I don't want to catch the disease; the cannibals are spreading by eating each other."

Doing autopsies we discovered that the Fore liked to watch and even assist, especially if it were their mother, father, sister, brother, son, or daughter. They liked to put their hands in, since they always dissected the bodies themselves. This destroyed our sterile field, got the tissues contaminated. They had no fear or reluctance to look at the brains or intestines of their kin. They always dissected their relatives with love and tender care and interest. They only objected to our

and leprosy and started using soap and washing just like we did.

Omni: So you weren't part of the group that convinced the Fore to stop eating their relatives' brains and stop rubbing their bodies with brain tissue?

Gadjusek: No. We told them we had no objection to their mortuary cannibalism, which expressed love for their dead relatives, although the government and missionaries did. It provided a good source of protein for a most starved community.

Omni: But didn't you think kuru was spread that way?

Gadjusek: Before we even saw it Vin Zigas and I thought it was an infection, that it would turn out to be another form of leprosy, syphilis, or encephalitis. But further study showed no evidence of infection: no fever, no inflammation, no peripheral white blood cell response, no change in cerebrospinal fluid. Our neuropathological, neurophysiological, biochemical, and immunological studies all indicated it wasn't infectious. We discovered it wasn't a microbe. We know this by 1959. That left us in a quandary. The epidemiology that made it look enormously like an infection, but close analysis forced us to the opposite conclusion. This situation of a paradox in science—conflicting findings where you know what the answer should be but it's not—it's where all new discoveries come from. [Later still, after Gadjusek had run animal tests in the United States, he came to the conclusion that kuru was transmissible.—Ed.] We had originally assumed it was infectious, and as it turned out we had the right answer to start with.

But even today we aren't sure kuru is passed by eating the brain. With leprosy, for instance, we still don't know whether the bacillus enters the urethra, the nasal end, nose, mouth—with the fingers scratching or rubbing the eyes or nose—or through contaminated food. Contact with eyes, nose, and skin is a much more certain way of getting infected than eating the virus. Only recently can we produce kuru in monkeys, never in chimpanzees. Infected orally with millions of infectious units in the cannibalism ritual, holding brain tissue, putting it on hands, and scratching mosquito bites or scabies is a much more likely method of inoculation. Since they rarely washed their hands and often picked their noses and rubbed their eyes, this is undoubtedly how they got it.

Omni: Why has the incidence of cannibalism among the Fore dropped so drastically?

Gadjusek: The Fore stopped opening the Pandoras box of the brain case and smearing vast quantities of infected brain tissue around. They abandoned their ritual cannibalism because they wanted to do what government and missionaries preached, since the society these outsiders came from used steel tools, airplanes, and radios.

Cannibalism caused the release of the virus by opening the skull. There is no virus outside of the sick patient: no virus in the milk, urine, feces, saliva, or tears of the patient dying of kuru. It's not naturally excreted. Once the cranium is opened, the vi-

Doing autopsies we discovered that the Fore liked to watch, especially if it were their mother, father, son, or daughter. They liked to put their hands in.

doing autopsies in seclusion and preventing the family members from participating. Their hands were very dirty. We tried putting surgical gloves on some of the fathers and husbands, but they would rub their noses with the gloves.

We began doing the autopsies quasi-publicly. The only reason it wasn't totally public was in deference to an occasional patrol officer or electrical engineer trying to set up a new generator for us. The European who'd never seen a patoisem couldn't quite understand such "barbarism" because he wouldn't want to watch the dead body of his mother carved up.

We didn't have gloves ourselves at first and were very careful to wash. Our great fear of touching the organs aroused them. Whenever we treated them for their yaws [skin lesions], ulcers, and leprosy we had to tell them to avoid touching the lesions because they were infectious. Knowing it was all caused by their own magic and sorcery they didn't believe one bit of this. But as we began curing infections miraculously, especially yaws, with penicillin, and a few cases of leprosy with newer drugs, all the kids who were working with us began avoiding yaws

CONTINUED ON PAGE 101

When beasts take drugs to race or relax, things get zooty

JUNGLE REVELERS

BY RONALD K. SIEGEL

In his mind Larry Lancaster was flying over a duck farm. He walked like a duck, quacked like a duck, and told visitors he was Donald Duck. Then he savagely stabbed a man to death. The

PAINTING BY
VLADIMIR VELICKOVIC



Los Angeles Police Department reported that Larry had become an animal after taking a mind-altering drug.

If drugs turn man to beasts, how do animals handle their highs? Most people believe the answer is best illustrated by cartoons. In 1950, for instance, Donald Duck was shown hallucinating from a broken bottle of ether and crashing his car into a fire hydrant. After another cartoon car crash in 1961, a medicine man gave Donald peyote tea that put him in a coma for six weeks. The alcohol that spilled into Dumbo's water got him so drunk he saw pink elephants. Wile E. Coyote overdoes on a high-speed tonic while trying to catch the elusive Road Runner. Bugs Bunny, Porky Pig, Woody Woodpecker, Fritz the Cat, and other characters have had animated highs with everything from mescaline to psychedelics.

These images seem too human to be anything but parodies of our own intoxications. After all, scientists have long insisted that *Homo sapiens* is alone in the use of psychoactive drugs. Animals may get addicted to drugs in laboratories, but, notion has it, that situation is forced.

Recent ethnological studies, however, have confirmed that animals in their natural habitats do indeed use drugs. Ducks forage a variety of narcotic plants. Elephants get playfully drunk on fermented fruit. Pigs are fond of marijuana and other psychoactive weeds. And birds consume the stupefying nectars of flowers. When given a choice of

literally thousands of plant drugs in nature, animals select the same types of substances regularly consumed by humans.

I first became aware of animal intoxication about a decade ago, while working as a research psychopharmacologist at UCLA's School of Medicine. One of my goals back then was studying drug use among the Indians of Mexico and South America. And I spent weeks following Indians into the jungles while they collected their plant specimens. During these expeditions two things puzzled me. First, the Indians seemed to have an uncanny ability to locate psychoactive plants. And second, many of the plants they used seemed to have been nibbled by animals. I speculated that animals were leading the Indians to chemically active plants. Furthermore, I reasoned, these same animals were probably getting intoxicated.

My theory was strengthened in 1979, when I discovered a shard from an ancient ceramic bowl in the Peruvian Andes. A painting on the piece depicted two llamas marching on a branch of coca leaves. Several Indians were pointing at the llamas and reaching for the leaves with open hands and mouths. I had found a record of coca discovery by early Andeans who watched the feisty llamas and then sampled the stimulating leaves themselves.

As I investigated further, I discovered that the story on the shard was not the only one. One legend, dating back to A.D. 900, describes an Abyssinian hound who found that

his animals became energized after eating the bright red fruit of a tree that was later named coffee. A shepherd in Yemen allegedly watched his goats run wild after chewing on certain leaves, thus discovering the amphetamine-like stimulant known as qat. And in tropical Asia, legends describe birds that became strangely quiet after visiting rauwolfia trees. As a result, an Indian psychiatrist isolated the tranquilizer reserpine, which revolutionized the treatment of the mentally ill.

The number and consistency of these accounts finally convinced me that animal intoxication was a universal, totally natural phenomenon. So I gave my research teams—already studying human use of natural psychoactive agents—yet another goal. They would investigate ancient tales of animal intoxication by making careful observations of their own.

Our teams still relied on the age-old observational approach of the Indians. But the researchers also had at their disposal an arsenal of futuristic techniques. To study animal behavior they used electronic tracking devices, night-viewing cameras, and audiotape recorders. They analyzed the data with computers in the lab. And to trace the consumption and metabolism of substances they labeled plants with radioactive markers and performed blood and urine tests for days, weeks, and months after ingestion. Finally, since drug metabolites remain permanently embedded in hair, my researchers obtained extensive samples of animal fur. They could thus trace patterns of drug ingestion to within a billionth of a gram for years, even decades, back.

It didn't take my teams long to confirm legends from the past—twentieth century animals interact with drug plants as frequently as their ancestors did in A.D. 900. But when our fieldwork was combined with findings in ethology and plant defensive chemistry broader implications emerged. For one thing, we found that plants produce many of the stronger, more intoxicating substances to keep animals away. Most of these substances are potent alkaloids known as secondary compounds, so named because they serve no primary metabolic function for plants. When ingested, toxic secondary compounds will eventually inhibit protein digestion and enzyme activity, cause liver lesions, or become teratogenic, affecting reproduction and heredity. These substances taste bitter and include a wide range of effects including nausea, vomiting, and death. My observers found that most animals with good sensory systems will pucker and spit after a single taste. Tagged rodents in the Mexican desert, for instance, nibbled at the peyote cactus; but once the bitter alkaloid mescaline was tasted, the animals never showed up again.

Despite such powerful prohibitions, ethnologists have learned the startling reason why some animals continue to pursue bad interactions with plants. For them, the costs of intoxication are simply overwhelmed by desirable effects.



'Our distinguished guest refutes the allegation that there is no longer room in modern business for the self-made man.'

One reason for animal intoxication, for instance, was illustrated in my experiments with Marty Mouse, who consumed marijuana for its nutritive value. I first met Marty in 1974, after the San Jose police found him eating his way through piles of grass stored in a vault containing drugs ranging from amphetamines to narcotics. After Marty's capture—and in defiance of the Free Marty Fan Club—I brought him to my lab at UCLA.

I soon learned that Marty readily ate marijuana seeds, which are rich in edibles yet low in psychoactive cannabinoids. Not surprisingly the seeds failed to change Marty's behavior. But Marty also ate the more intoxicating marijuana leaves shunned by most other animals. Moreover, he ate the leaves even when normal lab chow was available. As it turned out, the leaves affected Marty's behavior. First he became quiet and withdrawn, then irritable and aggressive. His head frequently twitched, a sign of dizziness and hallucinations. He slept more yet vigorously bred with lab mouse Mary Jane.

Despite the side effects, it's clear that Marty turned on for survival. According to UCLA psychologist John Garcia, an expert in animal learning, the probability of any drug is increased when it is followed by nutritive aftereffects. Marty may not have liked the initial taste of marijuana, but in the San Jose vault it was the least bitter and most nutritious substance available, sustaining him with proteins, sugars, amino acids, calories, and a vitamin or two. As a result of his stay in the

vault, he'd acquired a taste for marijuana. His later addiction to the drug merely followed his quest for nutrition.

According to Garcia, other animals follow this pattern as well. While still in the womb, the kudu grows accustomed to pungent eucalyptus leaves, full of geranial oil, a soothing anesthetic—and toxic prussic acid. And North American animals forced to survive temporarily on tobacco become addicted to the befuddling plant, seeking it out even when more appropriate food sources become available.

When regular food is plentiful, of course, it becomes uneconomical to rely on psychoactive plants for nutrition. So animals in the game of survival use drugs for other reasons as well.

In the mountains of Sikkim in northeastern India, for instance, weary horses eagerly consume bitter tea leaves. And when our pack donkeys in Mexico seemed particularly overworked, they deliberately grazed on wild tobacco. For both horses and donkeys, the benefits of stimulation overshadowed the discomfort of twitching, trembling, and diarrhea.

Another example of drug use in the animal kingdom comes from ethologist Eugene Marais, who lived among the African baboons. Marais found that while free-ranging baboons suck the flowers of wild tobacco, they avoid the leaves that contain most of the nicotine. Captive baboons, on the other hand, "beg for tobacco and eat or chew it

with all the zest of a long-established habit."

Why do baboons avoid tobacco leaves in the wild yet crave them in captivity? Marais says that the caged apes, in accordance with their innate drive for survival, are attempting to alleviate the depression and despair of life in captivity.

Researchers attribute similar motivation to other captive animals as well. Recent studies show that captive monkeys, parrots, and Syrian hamsters will eat tobacco, even to the point of suppressing their natural fear of fire and smoke. Any animal that has evolved some degree of mental awareness, concludes Marais, would find the habitual use of intoxicants to be a "universal remedy for the pain of consciousness."

If Marais is correct, sentient animals may be predisposed to the use of opium, the quintessential remedy for pain, often referred to as the flower of joy. Indeed captive and domesticated animals ranging from monkeys to dogs have been known to actively pursue opium smoke. Cows have occasionally eaten opium poppies. Writer and opium smoker Jean Cocteau observed that domesticated animals tend to form a "circle of ecstasy" around human users. And according to the late wildlife photographer Ivan Tors, when human armies were fighting in Cambodia, hide ringing water buffalo and antelope increased their normal browsing of opium poppies, wallowing down addicting amounts. After the poppy season, the animals displayed agitation and convulsions, sure signs of withdrawal.

Whether in the stress of battle or the despair of captivity, sentient beings are cheered by a little flower. But the most common animal addiction comes from alcohol—the in toxicant most frequently used by humans. The stress of competitive feeding among migrating birds is so intense, for example, that they gorge themselves on fermented berries. Drunk, disoriented, and overweight, they then dive-bomb into buildings and cars. Squirrels and birds living near noisy airports will readily intoxiciate themselves on fermented fruit supplied by researchers.

The animal drunk that most annoyed our group, though, was the African elephant, a mammal strongly attracted to the odor of ripening mango, durian, and marula fruit. We found that when elephants arrived late to the feast, the fruit had usually fermented to a 7 percent alcohol solution. These late-arriving elephants faced the stress of competitive feeding with other savanna beasts that prized the fruit and intoxication resulted from gluttony. (Conversely, Asian elephants in Malaysia escape such chugging contexts by picking ripening fruit from the trees before it falls in the reach of other animals.)

Stress from increased herd density or hunting may also lead elephants to drunken binges. In 1974 a herd of 150 elephants broke into an illegal distillery in West Bengal and snorted gallons of moonshine. They reeled and staggered through 20 village huts and seven concrete buildings, injuring 17 humans and killing 5.

Recent experiments in a spacious California enclosure on Mayne Is-



"Do you realize you could be in a nice warm lab right now, relaxing in a dry, clean cage, with nothing to do all day but smoke marijuana?"



Above: Io's volcanoes first viewed by the Voyager 1 probe; spire fountains and veins of molten sulfur within Jupiter hangs in the sky. At right: Saturn is depicted from 'Phrygia' as the planet appears from the moon's fresh surface.



In the United States, where space technology makes its home, many artists have turned their eyes to the heavens. But in Japan, there is only one master of space art, Katsuaki Iwase. For the past 30 years Iwase has been combining Japanese tradition with American-style individualism. In a land where art is learned at the foot of the aging masters, Iwase taught himself penning and graphic design. When he was thirteen his watercolors won first prize in a local contest.

But then the unexpected happened: A meteorite fell into his parents' garden. Iwase took the rare occurrence as an omen directing his attention to the stars. It was an incident out of Eastern myth, and it shaped his life.

He has been a professional graphic and industrial designer since the late 1970s, twenty-three and half years during which his designs have won many prizes. Yet he has found time to turn out some 1,200 paintings, most of them depicting the cosmos. (The remaining works deal with man's other frontier: the sea.) His space art has won him the most fame.

Iwase considers science more crucial than his own artistry. Shortly after the fatal meteor fall, he began working on road crews to earn enough money for parts to build his first telescope. Today he researches his paintings with his personally designed 65-centimeter reflector, which is said to be among the finest in Japan.

BY OWEN DAVIES

CELESTIAL DIARY



Inspired by an omen that dropped from the sky, Japan's master artist looks to hard science, as well as the stars, for his majestic renderings



When a meteor fell into his parents' garden, Iwasaki saw an omen guiding him to the stars.



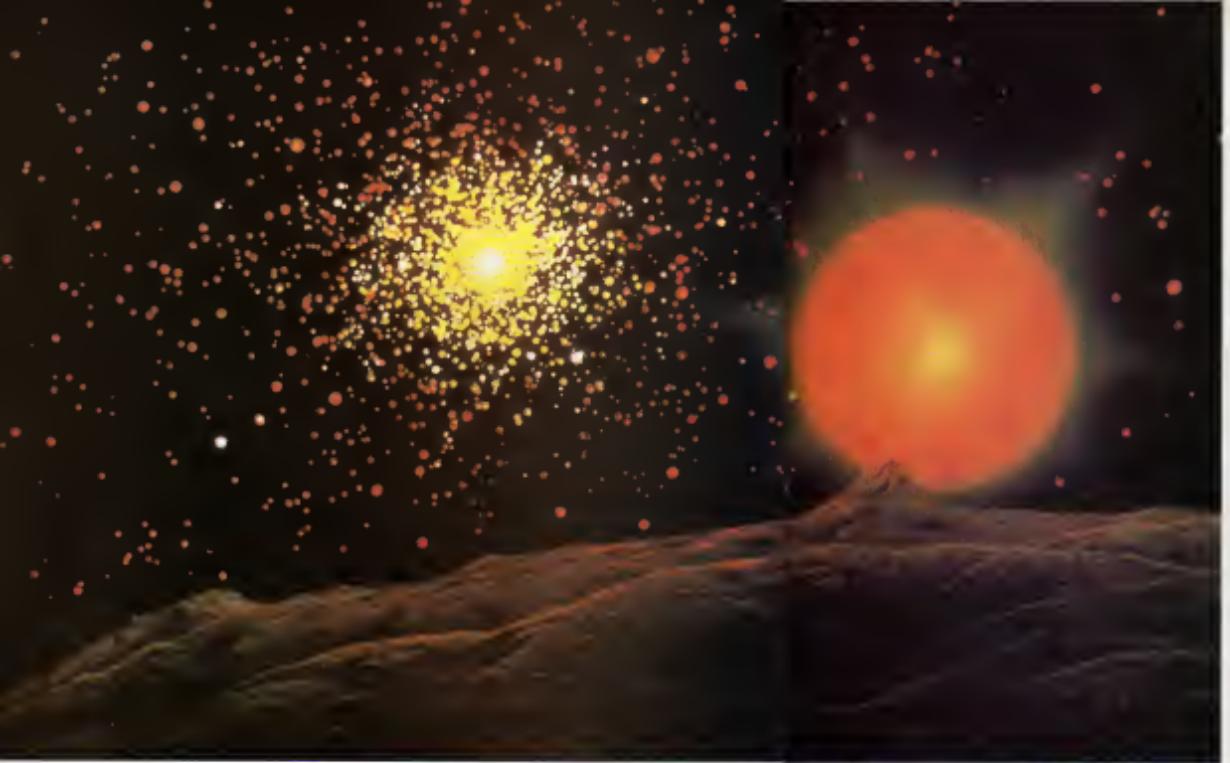
Clockwise from top:
left: NGC 5189, a globular cluster it visited by dust clouds; interstellar gas streaks an imaginary wave of deep space; Saturn as seen from Rhea; Saturn's rings as Iwasaki envisioned them before the Voyager visits



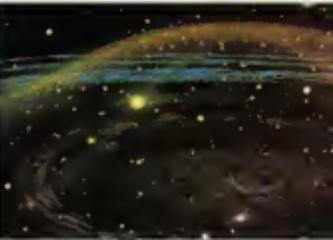
"The telescope is among the most malleable of scientific instruments," he says. "It shows us reality as it is."

Capturing that reality is a prime interest. "I hardly ever paint science fiction," he declares. "I am a scientific artist and have neither a taste for nor a belief in science fiction. The telescope reveals a world far more overwhelming than anything in fiction."

Iwasaki's passion for scientific accuracy has superseded even economic concerns. He has, for example, never released a painting for sale. When new research and observation showed that one



Clockwise from left: A red giant sun and nebula cluster are seen from a hypothetical planet; meteors bombard a young moon; dust and gas drift through space; a rogue planet condenses from primordial matter



of his images contains a mistake, he wants the work close at hand so that he can change it. He has altered many paintings. In this dedication, he is classically Japanese. Even his choice of paint matches the tradition. He uses mineral pigments because he feels they give more depth than oil. Yet Iwasa's hobby is to copy one of his works for a painting by Chesley Bonestell, the nearly-eighty-year-old American dean of space art. While in his teens, Iwasa studied Bonestell's works and hoped one day to be known as the Bonestell of Japan. It is a goal that he has finally achieved. ☐

“I have no taste for science fiction. The world a telescope reveals is far more overwhelming.”



SPACE

CONTINUED FROM PAGE 15

can arise. Minsky says that it's just these kinds of basic processes that are at the heart of all computation, be it human, machine or extraterrestrial.

So far, each of these machines has had just one state, meaning one set of instructions for all possible inputs. But Turing machines rapidly become more complex as the number of inputs increases. We could, for example, add a slash (/) and an asterisk (*) to the list of tape symbols—or we could increase the number and complexity of the machine's instructions, thereby increasing its states. For example, a more complex instruction would be: If there is a slash, leave an asterisk, move right, and apply instruction number five.

By amplifying these symbols and instructions in just the right way, it wouldn't be long before we had created a universal Turing machine, one whose behavior patterns were so complex that it could simulate the behavior of any other machine. Whereas the simple Turing machines don't exist except on paper, universal ones do—in the form of electronic digital computers. A suitably programmed modern computer can simulate the behavior of any other machine.

Minsky asked himself, if a universal Turing

machine can simulate anything, why can't it simulate an alien's intellect? He decided that it can. Together with colleague Daniel Bobrow, who is a researcher in artificial intelligence at the Xerox Research Center in Palo Alto, California, Minsky reproduced the behaviors of all possible machines. That's another way of saying that they simulated all possible thought processes, including, of course, those of extraterrestrials.

"What we found," Minsky says, "is that the first few thousand such machines showed just a few distinct kinds of behaviors. Some of them just stopped. Many just erased their input data. Most got trapped in circles, repeating the same steps over and over."

But as Minsky and Bobrow continued their search, they found that a few of their machines did something new. "Everyone of the remaining few that did anything interesting at all did the same thing," Minsky says. Each of them performed a sort of counting operation. They increased by one the length of a string of symbols and repeated that. They were little counting machines.

Minsky says that these little "counting machines" were performing arithmetic. "Any entity that searches through the simplest processes," he concludes, "will soon be doing something that doesn't just resemble arithmetic; it will be arithmetic."

This means that the language of mathematics—and the physical sciences that go with it—is not just provincial to Earthlings

it's shared by all intelligent entities. Regardless of any other differences between our species and aliens, we will calculate the same way that they do.

So an intelligent alien, like an intelligent human, will use arithmetic. They'll need arithmetic to keep accounts to build big cultures. Minsky reasons, "Of course, there could be intelligent aliens that don't use mathematics, but they'd stay at some primitive level. They wouldn't have spaceships and wouldn't broadcast signals."

Mathematics may seem abstract and empty, but it's precisely this cold, impersonal simplicity that makes the timeless truths of arithmetic the best possible way to transmit interstellar messages.

The trick is to go from such humble but clearly intelligible beginnings to signals that encode much more. After all, we went to learn—and presumably the E.T.'s want to tell us—more than that $4+2=6$ up there, too. And mathematics will allow them to say anything they want to say.

If the aliens can describe mathematics, Minsky says, they can describe anything. They can send us a code for graph paper, and with pairs of numbers—Cartesian coordinates—the aliens could represent all kinds of shapes and forms. If they're sending triples of numbers, they may be representing three-dimensional objects. All you'd need to communicate then are good mathematicians here and good ones there. **□**



■ Stephens, with
no use for electronic surplus,
bought two microwave
antennas for \$1 each in 1981.

ANTI MATTER

With single-minded devotion to his cause Robert Stephens (at right) has divested himself of virtually all worldly possessions to join the search for life on other worlds.

The thirty-one-year-old electronics technician from Edmonton quit a good job with Canadian National Telecommunications and liquidated his entire electronics business to raise money for his own Search for Extraterrestrial Intelligence (SETI). Now living on borrowed money and occasional freelance electronics work, he cannot pay his telephone bills or even his membership fees in Carl Sagan's Planetary Society. But Stephens has what few others have—two enormous 60-foot radio telescopes.

Stephens' telescopes were originally part of America's Desert Early Warning (DEW) Line radar network. But in 1963 the relay facility at Hay River was declared obsolete. Stephens, who "has a good nose for electronic surplus," bought them for \$1 each in 1981.

Stephens transported some of his equipment to Hay River, Canada, for test observations in the summer of 1983. And he soon solicited support from the Hay River town council, asking members to help him acquire the land and the building containing the antennas. After all, Stephens pointed out, the town would have the sole Canadian SETI program, one of only a handful in the world. Tourism would increase, and students could participate, putting Hay River on the map.

The council was enthusiastic. When the property came up for auction, the town submitted a \$1 bid so that Stephens' \$4,000 bid would be the clear winner. Unfortunately



UFO UPDATE

no local contractors had wind of the deal and raised it with an offer of \$16,500 per tonning the site—and forcing Stephens to negotiate terms for a five-year lease.

Despite the self-sacrifice, Stephens has gotten some breaks. An Edmontonian has donated a photocopier and a law firm in Calgary has deferred its usual fees to corroborate Stephens's nonprofit research corporation, the International Electromagnetic Institute.

Stephens has paid for the rest out of his own pocket, with considerable sacrifice of life-style and household. Indeed, although he has managed to accumulate \$1 million worth of essential surplus electronics, he is currently hanging at the end of my credit rope.

But Stephens, who says his work complements SETI programs at NASA and Harvard, believes he will prevail. He points out that since his telescopes scan only a narrow swath of the circumstellar sky, his coverage of stars to the north is necessarily more intense. Furthermore, while NASA's program must rely on limited telescope time, other branches of the organization need to use the telescopes as well—SETI data can instantly be generated by and tested on Stephens's equipment.

It's still a one-man show, Stephens asserts. But, he adds, things will change as he continues to earn the respect of mainstream researchers—the ones who share an urgent concern for SETI—an urgent concern yet life-supporting planet whose chances for survival were never more unsure.

ROBERT A. FREIDAS JR.



MAINE MARINES

I saw a bird with a yellow bill sitting on my window sill
coated him with a piece of bread
And then I crushed his little head
A mean manne
A mean manne
guess I'm just a mean manne!

These lyrics recently published in California's Orange County Register come from a reviving song regularly chanted by female marines. When the city came in the election of National Audubon Society president Peter Berle, he promptly penned a note to General Paul K. Kelley, Marine Corps commandant.

Berle pointed out that "silencing people who squash birds' heads is not consistent with the goals of the Audubon Society." He then indicated that "this advocacy of unsportmanlike hunting techniques is not necessary to instill pride and toughness in troops."

According to Berle, the

lone of his order was "totally tongue in cheek," think that's the only way to deal with folks such as the Marine Corps. Nonetheless, Brigadier General Donald Miller, director of public affairs for the Marine Corps, was profoundly affected.

A letter from the director of a nationally known five-hundred-member member organization taken pretty seriously, says Major Anthony Rothrock, a media officer. And the Marine Corps has always had a deep concern for biology and endangered animals. Major Rothrock points out that Camp Lejeune in North Carolina and Camp Pendleton in California actually conduct their training so as not to disturb the habitats of endangered birds living on the bases.

The song, however, was due for extinction. General Miller has assured Berle that it would no longer be included in the women's repertoire. General Miller sent a copy of Mr. Berle's letter down to the recruit depot, Rothrock explains. "And a directive coming down from

a supreme like that has a rather electrifying effect."

Berle was delighted with the outcome. "Total victory," he says. "With such success we ought to take on disarmament negotiations."

Nancy Luchs

CAT-WALKS

If you're ever going to let the cat stay out of the Anderson House Hotel in Webabwa, Minnesota, this antique-filled operating hotel in the state and still offers such nineteenth-century amenities as bed-sweatens to hold your feet on, tiny north-country nightshirts and mustard plasters to soothe a cold clogged chest. But the innkeepers have also instituted an all-new luxury for the weary traveler: complimentary cats.

"We have ten cats," says owner John Hall (below, right), the fourth generation of his family to operate Anderson House since the hotel opened in 1886. "All sorts of people want a cat companion. They often ask for them when they call to reserve a room. And with fifty one rooms here, you pretty well have to reserve a cat on the weekends. It's had a great effect on our business since we've been on *Aspen*.

In fact, I was visitor demand that started the cat craze. A young man had been staying in Rochester while undergoing treatment at the famous Mayo Clinic and stopped at the inn on a weekend outing. He was so taken with the place that he decided to move in and commute the 45 miles to

the link each day. After a week or so, the lonely fellow asked wistfully whether the Halls had any cats to keep him company. Cat lovers all they had. The word got around, and the market for hotel cats expanded.

What's really cool is that the cats love it so much. Hall says, "When a customer gets a cat, whether it's overnight or for an entire week, the cat is obviously the focus of attention. It gets fed, it gets petted, it gets pampered. The cat purrs twelve hours a day. They're all extremely spoiled."

No you won't find a computerized reservation desk at Anderson House. And there are none of the modern touches that the chains substitute for caring: no plastic bag of house-brand soap and shampoo, no buffing rag for your shoes, but there are ten things you won't find anywhere else: Scirpy Blackie Abyssinian, Tiger Kit, Gobbo, Tom Pod, Ginger and, inexplicably, Morris—Owen Davies.



ANTI-MATTER



ACROSS THE EARTH FOR CORN

When it comes to the ancient practice of acupunture, the Chinese do not limit themselves to human aches, pains, and causes. According to Jude Ramsey Jensen, an agricultural worker in Sandy, Oregon, the Chinese also use acupuncture on corn to make it appear sooner and taste sweeter.

There are differences between live and human acupuncture, Jensen explains. For one thing, it won't cost you anything to try it, and for another, you don't need to use those long, metal needles; toothpicks will do.

The technique says Jensen is simple. While the corn silk is still green, drive a round toothpick through the base of the ear stem into the main stalk just above the joint. This wounds the plant forcing it to send healing sugars to the ear.

The technique is a lot more complex than the logic of simplicity, Jensen declares. The toothpick creates a wound that the plant must

someday deal with.

In order to test the theory, Jensen conducted a controlled experiment: puncturing every other ear of corn in a single plot. The results, she says, were amazing. Not only did the punctured rows mature a full week ahead of the others, but the flavor was markedly sweeter than the ears left to mature on their own.

Carl S. Hettler, professor of agronomy at the University of Florida, is skeptical of the procedure. He points out that if the ears mature a week earlier, they might simply do so because the wound has caused less rather than more movement of sugars into the ear—can't visualize damaging the stalk as an advantage, he says—because the ear already has first demand on the sugars being produced. The aim is usually to keep the period during which the sugars move into the ear at a maximum. The fact that you have caused the ear to dry up a week earlier doesn't sound as if you are going in the right direction.

According to Jensen, however, she has as the evidence she needs. "I am a practical type, and once I find a method that works, if it becomes nobel," she says. "The controlled experiments I set up to test this procedure gave results that could not be disputed, and I am still using the technique today."

—Rick Doling

Genius, in truth, means little more than the faculty of perceiving in an unusual way.

—William James

THE STARS AREN'T A STAR

More than 150,000 Americans have had a star named after them, mostly with the help of International Star Registry of North Hollywood. For \$35 or so, ISR will pick a star, enter your name in their records, and send you a plaque. They'll even register the name of the star in the Library of Congress.

Problems, according to Craig Doggett of the library's legal staff, the service is a gimmick and nothing more. Indeed, as a gift or personal ego trip, star names suffer from it. The star you'll get cannot be seen without a telescope. No one else will use your name when referring to the star—astronomers, for instance, assign numbers to heavenly bodies. And another company may assign your star to somebody else. But it's the part about registering the name that ticks the Library of Congress most.

Our only role is to copy-right the list of names, Doggett

explains, just as we would copyright a mailing list or a phone book. We do not guarantee that the list has any validity any more than we would guarantee that the phone book is accurate.

But Isabella Mayville Moseley defends her firm's business practices. When this company was tested, she points out, we see the names would be published in a book copyrighted in the Library of Congress. It's a large and charming book with its library of the constellations and, in the back, a list of names and the telescope coordinates of their stars.

We do not claim to be part of the Library of Congress, she adds. Most people use this for what it is: fun.

Owen Davies

God did not create the planets and stars with the intention that they should dominate man but that they like other creatures should obey and serve him.

—Rabindranath Tagore



ANTI-MATTER



Premonitions and Disasters

Robert Nelson's Premonition Registry records predictions and validates them against news reports of it... at events. To date, in 1988, the registry has received 1,000 predictions. But according to Nelson, a New Jersey marketing executive, the results have been... disappointment.

Only 47 of the 8,000 predictions were detailed enough to the money hits, Nelson explains. And of those, only half came from just six people—including a professional psychic.

The original impetus for starting the registry was a silent search for real estate, he don't says, "was hoping rather grandiosely to set up some kind of an early-warning system so that we could notify the authorities of potential disasters. But that hasn't come to fruition."

Even the heavy hitters' rate of accuracy is below eight percent, Nelson says.

However, he says, "I have one person with whom I've had an accord that would prompt me to call a public official or an advisor with a prediction of disaster."

Despite the poor results, Nelson has resolved to press on. "You never know when something might happen," he says, "and besides, this is more fun than sleeping stamps."

To register your predictions send a stamped, self-addressed envelope to Robert Nelson, Premonition Registry, Box 482, Times Square Station, New York, NY 10036. There is no fee.

Eric Moshenska

Smoke came unexpected to the world.

Charles McNamee

Green is marvelous for insulating because it's a safe color. Neque smoking green often went to be helped because they cannot help themselves.

Kenny Kingston

Anti-pyramids

Several years ago, when building contractor James Oren first built his new home—a five-story, 24-karat-gold-coated pyramid on the outskirts of Gurnee, Illinois—some people said that special power emanated from the structure. A spring at the base of the pyramid reportedly produced plant sprouts two times faster than other water. Oren, too, *Omni* (Amherst, August 1982) and according to tests conducted by others, he added, chickens drinking from the spring supposedly grew significantly faster than other chickens.

Then, when 14,000 people paid \$10 each to tour the pyramid (the proceeds reportedly went to charity), Oren was absolutely flooded by the pyramid's popular appeal.

But today pyramid power is no longer all it has been cracked up to be. "A lot of times, we gotta just sit back and think maybe I should build a regular house and live like ordinary people."

Oren's doubts ended on a combination of annoyances. The county building department has complained that his new 60-foot-tall pyramid of Pharaoh Ramses I (against violative height restrictions) the acrylic mesh covering the pyramid in gold leaf is so faded it must now be scraped off. And then there's the haze itself.

"We've gotten four or maybe five letters from hecklers who say the pyramid is the work of the devil," says Oren, who guards

his property with a moat, infrared sensors, and attack dogs. "You just don't know how far some of these people may be willing to go."

Despite the problems, Oren plans to go ahead with a new addition—a full-scale replica, *Tut's Tomb*. Says Oren, "It will be to the best of my ability exactly like the original."

E. C. Moshenska

Ghost pets do come back from the dead. And sometimes they return at the exact same time... save the lives of the people they had a crush on.

Ed Warren

We're all after the same... dinosaur.

Marcia, n/a

I'll tell you what kind I saw... it was "eye" ordered a 12-meter tall sort of a monolith and I opened the eye... actually found me inside... just now! consider the job! Ah... Robert Moshenska



SARAH

CONTINUED FROM PAGE 18

He drops one back in the bag, holds up the other to let her see it.

"You've already had your share," Sarah says.

His pale eyes flicker in his dark face. "Okay," he says. But he doesn't put the val down.

His need is too strong. She looks down and shakes her head. "One," she says. "Okay." She watches while the endorphin hits his head, as he lets back and sighs, his twittly nervousness gone.

She takes the injector and heeds the val, then puts it in the plastic bag. There is a half-smile on Daud's face as he looks up at her. "Thanks, Sarah," he says.

"I love you," she says.

He closes his eyes and rubs his back on the sofa like a cat. She takes the endorphin and walks into her room and throws the bag on her bed.

A wave of sadness whispers through her veins like a drug of melancholy. Daud will die before long, and she can't stop it.

Once it had been she who stood between him and life; now it is the endorphins that keep him insulated from the things that want to touch him. Half her scars won't Daud's by right. She had suffered them on his behalf, shielding him from their father's fists. At fourteen she'd run with the first boy who'd promised her a place free from pain. Two years later when Shad bought her way out of her first contract and came back for her, Daud had been shattered beyond repair, the needle already in his arm. Shad led him to the new house where she worked—it was the only place she had—and there he'd learned to earn his living, as she had learned in her own time.

If she hadn't cracked, if she hadn't run away, she might have been able to protect him. She won't crack again.

Sarah returns to the other room and sees Daud lying on the sofa, one sandal hanging with the straps tangled between his toes. Jackstraw is sitting next to him on the sofa and drinking one of his beers. He glances up at her.

"You look like you're limping," he says. "Would you like me to massage your legs?"

"No," Sarah says quickly, and then realizes she is being too sharp. "No," she says again, with a smile. "Thank you. But it's a bone bruise. If you touched me I'd scream."

ARTIFICIAL DREAMS

The Plastic Girl is a hustler's idea of the good life: plush and chrome and a lot of dark, expensive booths in the back for business. There is a room in the back with clinicians on mirrored bar, another room for zonked-out and headsets at each table that plug you into euphoric states or pornography or whatever it is you need and are afraid to shoot into your veins.

Orbital pharmaceutical companies provide the effects here as advertising for their products.

se case

Sarah is in the big front room, brassy music, red leather booths, ornaments of brushed aluminum. She does not and probably never will, raise a booth in the back. They're for the boys who run this fast and dangerous world, and though Sarah is an independent contractor and takes a certain amount of respect, she is still meat for hire, though on a more elevated plane than she once was.

But the red room is nice. There are colorful holograms, colors and helixes like modeled DNA, floating just above eye level, casting their vanegated light through the crystal and sparkling liquor held in the patients' hands, and there are sockets at every table for comp decks so that the patients can keep up with their portfolios, and there are girls with reconstructed breasts and faces who come to each table in their light plastic corsets, bring you your desk, and watch with identical and very white smiles as you put your credit chip into their tabulator and tap in a generous tip with your fingernail.

◆Hormone suppressants make him unable to respond normally—and that appeals to a certain type of taste. Sometimes his passivity inspires a berserk madness in clients.◆

Sarah is ready for the meet with Cunningham: she's wearing a navy blue jacket guaranteed to protect her against kinetic violence of up to one hundred foot pounds and trousers good for seven hundred fifty. She has invested some of the endorphins and bought the time of a pair of her peers. They are walking loose about the bar, ready to keep Cunningham and his friends off her back if she needs it.

She knows she needs a clear head for this meet and has kept the endorphin dose down. The pain is making her edgy, and she still can't sit.

She stands at a small table and sips her rum and lime, waiting.

And then Cunningham is there, looking much as before: bland face, brown eyes, brown hair, brown suit. A whispery voice that speaks of clean places she has never been, places bright and soft against the black and pure diamond.

"Okay Cunningham," she says. "Let's talk business."

Cunningham's eyes flicker to the mirror behind her. "Friends?" he asks.

"I don't know you."

"You've called the Helman?" She nods.

"He was complimentary," she says, "but you're not working for him. He's paying you a favor maybe. So I'm cautious."

Understandable. He takes a comp deck out of an inner pocket and plugs it into the table. A pale amber screen in the depths of the dark tabletop lights up, displaying a row of figures.

"We're offering you this in dollars," he says. Sarah feels a touch of metal over her nerves, on her tongue. The score, she thinks, the real thing.

"Dollars?" she says. "Get serious."

"Gold?" Another set of figures appears. She takes a sip of rum.

"Too heavy."

"Stock. Or drugs. Take your pick."

"What kind of stock? What kind of drugs?" "Your choice."

Polymyxin-phenylmorphine Nu. There's a shortage right now.

Cunningham frowns. "If you like. But there'll be a lot of it coming onto the market in another three weeks or so."

Her eyes challenge him.

"Did you bring it down from orbit with you?" she asks.

His face falls so much as to twitch. "No," he says. "But if I were you I'd try chloramphenicol. Temple is arranging an artificial scarcity that will last several months. Here are the figures. Pharmacological quality, fresh from orbit."

Sarah looks at the amber numbers and nods. "Satisfactory," she says. "Feel in advance."

"Ten percent now," Cunningham says. "Thirty on completion of training. The rest on completion of the contract, whether you succeed or not."

She looks up at one of the bars moving holograms, the colors clean and bright, as pure as it seen through a vacuum. The stock isn't bad, but she can do more with the drugs. Cunningham is offering her the drugs at their orbital value, where they were made and where the cost was almost nothing. The street value is far more, and with it she can buy more stock than the amount they were offering.

To get into the orbits you have to have skills they need, skills she can never acquire. But there is another way. They can't refuse someone who owns enough shares. They are sucking up all Earth's remaining wealth, and if you help them and buy up enough stock they might free you from the mud forever.

This is almost enough, she calculates. Almost enough for a pair of tickets to the top of the gravity well.

She brings her drink to her lips. "Let's say a quarter now," she says. "And then I'll let you buy me a drink and you can tell me how you want me to earn it."

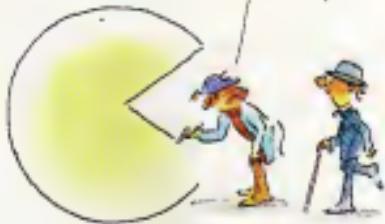
Cunningham turns and signals to one of the smiling escort girls. "It's very simple," he says, and he looks at her with his ice-cold eyes. "We want you to make someone fall in love with you. Just for a night. **100**

To be continued next month

The Artist

© ART CUMINGS

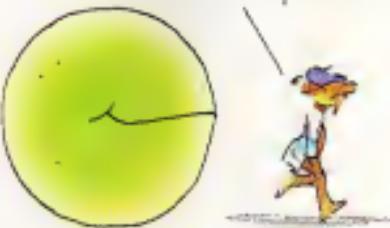
What do you think?



My first impression is
it lacks life



Too bad we don't get
a second chance
at first impressions



TEAMS

CONTINUED FROM PAGE A2

29 Some sports are enjoying greater popularity than ever before. Which of the following sports will become even more popular in the United States during the next 20 years? (Choose as many as apply.)

- a. gymnastics
- b. running
- c. windsurfing
- d. bodybuilding
- e. professional wrestling
- f. roller derby
- g. none of the above

30 The President of the United States makes \$200,000 per year. The average professional baseball player currently earns about \$203,000. Will Congress ever rectify this imbalance and give the country's chief executive a salary equal to or greater than an average major leaguer?

- a. yes
- b. no

31 According to sports prognosticators pollution, inclement weather, and associated financial considerations will force owners to erect domes over all major sports stadiums. When will the last stadium be covered?

- a. 2000
- b. 2015
- c. 2025
- d. 2050
- e. never

32 Professional sports is a burgeoning industry. Which one of the following sports-related jobs is least likely to show substantial growth over the next 30 years?

- a. sports reporter
- b. sports psychologist
- c. binding arbitrator
- d. custom sports-shoe designer
- e. biofeedback technician
- f. sports agent
- g. computer statistician
- h. franchise owner
- i. videotape technician
- k. nutritionist

33 By 2030 can we expect that on-field quarterbacks will wear radios in their helmets to receive signals from the coach?

- a. yes
- b. no

34 If our nation's obsession with good eating and health foods continues, what can we expect vendors to hawk in ballparks in 15 years? (Choose as many as apply.)

- a. fruit juices
- b. tofu burgers
- c. sushi
- d. yogurt
- e. none of the above; hot dogs and peanuts can never be replaced

35 Which one of the following professional sports is the most resistant to technological change? -

- a. hockey
- b. tennis
- c. basketball
- d. football
- e. baseball



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CHARCOAL MELLOWED FOR SMOOTHNESS

35 Minnie Minoso pinch-hit at age fifty-seven, and recently forty-six-year-old Phil Niekro won his three hundredth game. They were the exceptions, but experts predict that soon amassing drugs will improve older athletes' reflexes and increase their stamina. How did the oldest Major League Baseball player be in 2010?

- a. Fifty
- b. Fifty-five
- c. Sixty
- d. Sixty-five or older
- e. Top ages will not deviate from today's norm; use of such amassing drugs will be prohibited.

37 At current rates of growth, in 30 years Olympic basketball players will be six inches taller than they are today. How will the Olympic authorities over the coming years cope with the growth explosion? (Choose as many as apply.)

- a. The hoop will be raised
- b. The ball's circumference will be increased slightly
- c. Dunks will be outlawed
- d. The diameter of the hoop will be decreased
- e. No changes will be made.

38 Will the U.S. government ever underwrite national sports camps to train young athletes to compete on a level with the Soviets and the East Germans?

- a. Yes
- b. No

39 In 1980 the United States and other countries boycotted the summer Olympics in Moscow following the Soviet invasion of Afghanistan. In 1984 the Kremlin followed suit. Will the Seoul Olympics of 1988 be free of such political protests?

- a. definitely
- b. possibly
- c. very likely
- d. unlikely

40 Controversy surrounds the use of anabolic steroids which allow athletes to train harder and faster. If, as some experts predict, the side effects of these drugs can be eliminated, will the Olympic Rules Committee decide to allow their use?

- a. Yes
- b. No

SPORTS QUIZ SCORECARD

To calculate your *Omni Future Sports Quotient*, record your answers and compare them with Peter Uebelorth's responses below. Give yourself a point for each matching answer (or half or quarter points where indicated). Remember, Uebelorth chose not to respond to one question; give yourself a point if you figure out which. Then tabulate your score and check the analyses at the end of this section to see how you stack up against the commissioner of baseball!

1 c	7 c
2 f	8 d
3 e	9 d
4 e	10 f
5 d	11 b
6 b	12 b

13 b-c (Give yourself half a point for each correct response.)

- 14 b
- 15 b

- 15 a
- 17 c

- 18 f

19 a,b,c,d (Give yourself a quarter of a point for each correct response.)

- 20 d
- 21 e

+ 30 b

- 22 b
- 31 e

- 23 h
- 32 h

- 24 b
- 33 b

- 25 a
- 34 e

- 26 e
- 35 e

- 27 c
- 36 b

- 28 d
- 37 e

- 29 b-c (Give yourself half a point for each correct response.)

- 30 No comment
- 40 b

6 to 9: Strikeout!

Given your prognostic powers, we would respectfully suggest you avoid betting on the horses. That advice, however, is probably unnecessary. The games you play are most likely not performed on a field, court, track or other conventional sports venue. Your vision of future athletics may be somewhat pie in the sky—it certainly doesn't coincide with that of baseball's commissioner. To improve your understanding of the current—and future—state of the art, you might try learning a bit more about the history of sports.

10 to 19: Base Hit

You probably watched the '84 Olympics and you know last summer that Pete Rose was en route to breaking some monumental baseball record. In all likelihood, you achieved your middling future-sports quotient because you were bolder in your predictions than Uebelorth, whose answers reflect a status quo philosophy when it comes to professional sports. Of course, *Omni* readers pride themselves on being enthusiastic about the future. But you may have been overzealous in your assessment of the effect technology and social change would have on tomorrow's organized athletics.

20 to 29: Home Run

You have a firm grasp of the history of American and international sports and a practical view of how that history will shape its future. Like Uebelorth, you believe that sports today will reveal many of the forces that will radically alter the rest of society. You also believe that sports performances will continue to improve at roughly the same rate as they have for the last half century or so.

30 to 40: Grand Slam

You probably open to your newspaper's sports section first thing in the morning. You are enthusiastic about the current state of athletics and optimistic that existing conditions will continue to steer sports in the proper directions. You value the fine old traditions, but you also recognize the occasional need for gentle modifications to keep athletics vital in the future. You are down-to-earth and politically savvy, and you should consider applying for a job as commissioner of a major sports league, as you already have many of the necessary credentials. **DO**



ON ATHEISM

Come on, atheist — like religion, you have had your turn for a long, long time.

So then, what is your message? Do you hold out any hope, purpose, promise, or what? Otherwise, just to "be" for the quick mortal term of a life, for the "fun", or the brief "power" of it, would certainly appear inadequate by any standard of reasoned consideration.

We must, at last, face the ultimate question on the true state of physical being and the real nature and rationale of all existence.

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(Third in a series to define the issues of
being and existence.)

JUNGLE

CONTINUED FROM PAGE 74

nia game park have verified this stress factor. The studies found that elephants seemed to enjoy drinking small amounts of a 7 percent alcohol solution that caused mild changes in mood. Alcohol intake increased, however, when the elephants were crammed into a smaller preserve with other savanna animals. Individual elephants displayed the same range of reactions shown by humans. Some became belligerent and aggressive, trumpeting and attacking nearby animals, including the researchers. Some became increasingly passive and lethargic. Still others appeared amorous.

When the preserve was enlarged to its normal size and bothersome gazelles and rhinos were evicted, alcohol drinking returned to normal levels. Several months later with the preserve resited by construction crews, elephants congregated in the areas where alcohol had once been available.

Like their human counterparts, though, animals don't use drugs just to cope with depression and pain. Researchers in Canada and Japan have found that animals may develop even stronger addictions to intoxicants that produce sexual stimulation. Catnip appeals to cats because it contains the hallucinogenic nepetalactones, which mimics a natural sex pheromone. Both catnip and its Japanese cousin, metatetra, are used repeatedly by leopards and other large cats despite increasing tolerance and brain damage. In fact, biologists have recently discovered that a dominant pine automatically guides cats to catnip if the plant can be found.

Even when drug plants don't tease an animal's ear or stoke its libido, the sensation may be worth seeking out. Indeed, our research indicates that a wide range of animals munch on hallucinogenic mushrooms, bark, and roots just for the fun of it. In the emerald forests of Colombia, jaguars gnaw the nauseating psychedelic bats of yage, a habit the Indians believe sends the cats on flights to other worlds. Beavis dig for the hallucinogenic roots of iboga, a West African shrub with showy flowers that send the animals into wild frenzy. Ethnologist Jane Goodall once observed a zebra spinning like a top after eating a mysterious mushroom. And members of my group have confirmed use of "magic" psilocybin mushrooms by dogs and cattle in Hawaii.

The animal that seems to fly highest of all, surprisingly enough, is the reindeer. Reindeer on the Asian tundra ignore their normal diet of lichens whenever they smell the red-capped *Amanita muscaria* mushroom, a psychedelic used by Siberian shamans. According to mycologist R. Gordon Wasson, these half-domesticated beasts become psychologically addicted to the mushrooms and suffer profound behavioral disturbances that render them unmanageable. Reindeer also become intoxicated on human urine containing the active metabolites

of previously eaten mushrooms; the craving is so intense that travelers are warned not to relieve themselves in the open when reindeer are around.

Though animals generally get intoxicated to enhance, not diminish, chances of survival, the social consequences of intoxication may be severe. Chimpanzees, for example, tend to help their sick and wounded. But when a troop of chimps recently approached their experimentally intoxicated brothers, they were greeted with wild gestures and sounds that caused them to flee. The drugged chimps avoided further contact by hiding in secluded island areas until the effects wore off.

Controlled studies with schools of tropical fish, flocks of pigeons, and nests of mice indicate that the social isolation of intoxicated animals is quite widespread. Animals that were continually drugged by experimenters eventually lost the biological advantages of social organization. They suffered from significantly reduced breeding potential and were exposed to increased aggression as well.

But unlike the animals in the studies above, animals in nature tend to regulate drug use thereby avoiding large-scale problems. Their strategy is to ingest the minimum effective amount of the drug plants, thus lowering the risk of poisoning while maximizing re-creation and relief. This balancing act is helped by the relatively low concentrations of alkaloids and alcohol in plants as compared with purified man-made preparations. For example, coca contains less than 1 percent cocaine, together with proteins, carbohydrates, vitamins and minerals, providing a nutritious and stimulating boost for animals and Indians. Neither have ever died from ingesting coca. If cocaine removed from the leaf is further concentrated and rapidly delivered into the body, then safety is bypassed, and death may result.

If humans are to survive episodes of non-medical drug use, we must learn lessons from animal-intoxication studies. The power of this strategy is implied in the behavior of Indians who have relied on intoxicating plants for thousands of years. The Indians preferentially use familiar and safe plants for as long as possible; they treat new drug plants with extreme caution, and they accept or reject specific plants after sampling minute amounts. The strategy may not work with concentrated or artificial drugs; use of such potentially dangerous compounds is best left to medical supervision.

Indians see the earth as an enchanted garden, a wondrous farm where we must learn to survive in harmony with all other life forms, from neotropical to ducks. If we ignore the teachings of psychoactive plants and in intoxicated animals, the next time we fly over the farm we might do use test-pilot jargon and end up buying it. **DO**

Ronald K. Siegel, a psychopharmacologist at UCLA's School of Medicine, has spent most of his career studying drugs and their impact on animals and humans. This article is based on a forthcoming book on intoxication.

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INTERVIEW

CONTINUED FROM PAGE 61

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many sailors and beachcombers, including Herman Melville and the missionaries, stayed long on many Pacific islands. Sailors rarely jumped ship in Valparaiso, Macao, Alexandria or Calcutta, but regularly in the "Tidewaters" South Sea islands.

Islanders playing the role of host consider providing sexual partners as important as food and feasting. Most kids are brought up to know techniques that would make an obnoxious blush. They're great conundrums and insults because they've had mostly correct parents who've trained them in all the tricks of sexuality, including sedating and seducing adults. Most visiting adults know it. The children rarely speak publicly about sex, and they tell few sexual jokes. Decretion is the hallmark of Micronesian society. Ours is America's sex while becoming increasingly diseased?

Gilpin: Since the age of sail, all infectious diseases have spread around the world—and most of them earlier than that. European ships brought devastating smallpox and measles epidemics to isolated Amerindian and South Seas groups. There are plenty of mummies with clear-cut syphilitic bone lesions in sixteenth-century European cemeteries but not in the Fifteenth. We have historical reports of its introduction. There's even a poem about the spread of the syphilis plague—like an AIDS plague—following Columbus. It really appears that syphilis was introduced to the rest of the world through the discovery of America. It was probably a severe form of yaws but that's not provable.

Deen Evangelists have referred to AIDS as the 'gay plague'.

Gajdusek. This epidemic was obviously made for flea-and-antennae evangelists. From a humanitarian point of view there are frightening aspects to the matter. It's easy to tell every gay that it's a homosexual that does it. All these patients have had dozens to hundreds of different sexual contacts per annum. We advise them to be more celibate or get married to their gay partner. This seems like rational advice, yet I suspect we could dig up hundreds of kids and adults who are involved in oral sex for male prostitutes without finding anyone with AIDS. Oral sex should cause it. We have evidence that the virus is in saliva of infected animals. It has been demonstrated in a few human cases. But in my knowledge there isn't an

CREDITS

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example of AIDS in those whose only sexual contact with others is fellatio. To play the devil's advocate to the less and less honest preacher, tell everybody to switch to oral sex and mono of it. I state this as a joke, but some gay physicians told us that in advising gays to curtail their promiscuity, we were paying homage to our Puritan ancestors rather than following the external outcome of our investigations. They were right. Data show a complete absence of AIDS in active partners in anal sex or in those engaged in fellatio exclusively. We are seeking the real answer, suspecting that doses of virus and route of inoculation are important factors.

Orent: Does disease evolve like the rest of life on the planet?

Gajdusek: Disease evolves faster. Microbes have a generation time of a different order of magnitude than larger living things. It's minutes and hours instead of weeks and years. In the lab during one human lifetime, the influenza virus can go through changes equivalent to a million years of human evolution. Many viruses do. Other viruses have remained more genetically stable and were trying to find out what makes a virus genetically stable and what makes it labile. An influenza epidemic that travels throughout the world rarely kills many of the afflicted. If it did, it would destroy its obligate host. It doesn't seem to have a latent form of animal reservoir; it can live only in man. Every once in a while flu changes itself dramatically by mutation and then attacks those who haven't got the right antibody to stop active infection. It spreads like mad again, sometimes producing a mild disease—sometimes a devastating one. After World War I, it killed more people in a brief period than both world wars put together. Medicine had nothing to prevent or treat it. But the virus exhausted its susceptibility. That could happen again, and that's why we're spending millions trying to figure out how influenza virus varies and to keep track of it. We now know what it's doing, but we're not up to controlling it or producing a very efficient vaccine.

Orent: Would an antiviral compound make use of monoclonal antibodies?

Gajdusek: The fact is, monoclonal antibodies are too perfect. They're like the best fitting glove in the world, that fits you and no one else—perhaps only two of your fingers but not your whole hand. The glove might be so good that it mimics your fingerprint and no one else, but who wants to pay thousands for such gloves or such crazy specificity? So with monoclonals we've made a beautiful research tool. We're discovering new facts about microbes, but the great hopes that monoclonals were going to revolutionize and lessen the cost of diagnostic laboratories have not come up. It still costs too much to make monoclonals, and we lose diagnostic ability. If my monoclonal diagnoses only ninety-seven percent of syphilis cases and the old method hits them all, let's just stick with the old.

Orent: Has smallpox truly been wiped off the face of the earth?

Gajdusek: The disease has been, but the

virus hasn't. Some disturbed crank in a lab could release it. Inocula are still in a few labs for good reason. Some nations and military laboratories may keep it even if they declare they don't. Bacterial warfare centers surely have it, though we have no such centers in America any longer.

Orent: Isn't Fort Detrick in Maryland such a biological-warfare research facility?

Gajdusek: No, emphatically no! There is no defensive or offensive warfare microbiology done at Fort Detrick today. It is the national cancer research facility of NIH. In the facility I have a building where more good and loyal Communist scientists from the USSR and mainland China work—with full passage to all the laboratories—than Americans. With right working U.S. citizens and foreign Communist investigators here, obviously there is no "secret" bacterial warfare activity going on. Even the Army's infectious disease unit is loaded with foreign workers—not always friendly neutrals. It is a valid basic research unit on worldwide problems of in-

fectious diseases in which no classified or secret activities unfold.

Gajdusek: If you lyophilize it, you can keep it at room temperature. Lyophilization is another word for freeze-drying. The technique came from microbiology many years before industry used it, and now you use it for your powdered milk.

Orent: What do you think of the Food and Drug Administration's process of approving new drugs?

Gajdusek: To prevent another thalidomide episode the law is such that there's no way aspirin could be marketed for many years if it were newly discovered. This applies to penicillin, streptomycin, polio vaccine, and many now medicines and vaccines.

Orent: Isn't there a committee appointed to circumvent that long approval process?

Gajdusek: Our safety approval processes today are actually longer rather than shorter. Pesticides are safety-conscious people want all risks removed from life—they want to make sure that a mosquito doesn't hit them if you get kicked in the street by a psycho who's been unethically released from mental care. I see no cause for ridicule. You should know that walking the night streets has once again become dangerous. It's your fault for being uncautious, not his. As I probe zero insurance, The American attitude is that any single four-year-old who loses a finger from an infection—properly handled or not—might have been a Paczkowski. If she loses a toe, she might have been a Pawlowka, and that loss is equal to the lifetime personal earnings of such an illegitimate genius.

Americans romantically place an infinite value on their kids—when others are paying. If you're on the Yukon, whether you're a hippie, hunter, missionary, or doctor, no one will send a seaplane to get your wife to the hospital. Nobody takes the sharecroppers or poor people in our ghettos to the Mayo Clinic by helicopter when they're dying. If they don't get there themselves by taxi or ambulance, they die in their beds. Americans talk a lot about the "inestimable value of human life," but we're about the worst for really coughing up funds for those unable to care for themselves.

Orent: What's your view of democracy?

Gajdusek: There's none in nature. When the data aren't in, uninformed opinion by the millions about a phenomenon of nature isn't worth one informed opinion. A career in science can put you in the unique position of not being the victim of everybody's conjectures. There is no one between you and the facts, unlike politics or law, in which you have decisions of an emperor or pope, or juries in common law. In science the person with the upper hand is the one who knows the most about the matter. If you are wrong you are not beaten or defeated but simply embrace the demonstrated truth. Science thrives on paradoxes—evidence of inadequate understanding—and paradoxes formulate the challenges of the future. Voluminous argument does not exist in science. 

•In cannibal/ ritual, holding the brain tissue, getting it on hands, and scratching mosquito bites or scabies is a much more likely method of kuru inoculation•

fectious diseases in which no classified or secret activities unfold.

A few selected laboratories are holding smallpox virus for defensive purposes to be able to compare antigens in case an accident happens. Smallpox can still be resurrected, although the disease is apparently fully eradicated. If world organizations decide that everyone must get rid of it and some do not, then what do you do?

Orent: Isn't the penicil formula for ameliorating an antigen still around?

Gajdusek: The full sequence of the immense DNA genome will never be determined. We could save noninfectious cancers, but this "fingerprint" probably wouldn't be enough to resurrect the antigens. Whereas smallpox was not a potential warfare bacterial weapon when the whole world was vaccinated, now it's a major possibility. All an anarchist has to do is to get a vial from a lab and keep it frozen. He needn't go to grade school to figure out how to make a suspension of enough doses to infect thousands. It's a Catch-22 problem. You trust the people who have it and you might get into trouble. You try to get rid of it all and you need it to identify new pox viruses. Not everybody in every nation

Dedication.

If you have conviction and dedication, you can solve this J&B crossword puzzle. Note: keep a dictionary and an almanac nearby, they may prove useful.

CLUES

ACROSS

- _____ A Space Odyssey, plus _____ The Year We Make Contact, plus Around the World in _____ Days.
- Chemical in a VHF television set. (Careful, now!)
- Books in the King James Bible minus (permits for a safety in football times cars of water added to flavor an orange juice concentrate).
- British Prime Minister's residence.
- Three-digit package number on Las Vegas slot machines, plus (number of major league baseball teams named for buckskins number of astronauts

- on each Apollo flight).
- Degrees Celsius at which water boils minus legs on an insect.
- (Bradley, Sofer, Sawyer, Resnick, and Wallace times Bo Derek) plus (players on a team as Canadian football terms comes on a cohort).
- A lazier salesman says: "My first customer today bought half of all the bottles of J&B Scotch I had in stock, plus half a bottle. My second customer bought half of what I had left, plus half a bottle. My third customer bought half of what I had left, plus half a bottle. And my fourth customer did the same—bought half of what I had left plus half a bottle. And now I'm all sold out." If the salesman never sold less than a full bottle of J&B, how many bottles did he have at the start of the day?
- Tooth in an adult human.
- Amount you'd have in U.S. paper money with two Andrew Jacksons and one Alexander Hamilton.
- Year of the Wright brothers' flight plus Ray Bradbury's Fahrenheit _____ minus cards in a deck.
- Does in an ellipse times farinas as a base) times pecks in a bushel times (grains in a pint plus scruples in a dram).
- (Scored squares on a bingo card times bonus points for going gin in gin rummy) plus number of pieces per player at start of a backgammon game.
- John F. Kennedy's age at his death.
- Connery, Moore, and Laurie.
- Year of Neil Armstrong's "giant leap for mankind."
- The most you can be carrying in U.S. coins (not counting a dollar coin) without being able to give anyone exact change for a nickel, a dime, a quarter, a fifty-cent piece, or a dollar.
- Amount of money you'll get on the twelfth day of Christmas if you get 1 cent on the first day, 2 cents on the second, 4 cents on the third, 8 cents on the fourth, and so on.
- Proof of j&B Scotch.
- (I Across plus 9 Down) minus (4 Across times the last digit of 19 Across).
- Keys on a piano times Hawaiian islands minus planets in the solar system.
- Anna code of Portland, Oregon.
- Total squares on a chessboard (incl squares + 2x2 squares, etc.)
- A fish weighs ten pounds plus half of its own weight. How much does the fish weigh?

exact change for a nickel, a dime, a quarter, a fifty-cent piece, or a dollar.

Amount of money you'll get on the twelfth day of Christmas if you get 1 cent on the first day, 2 cents on the second, 4 cents on the third, 8 cents on the fourth, and so on.

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Anna code of Portland, Oregon.

Total squares on a chessboard (incl squares + 2x2 squares, etc.)

A fish weighs ten pounds plus half of its own weight. How much does the fish weigh?

Look for the solution to this puzzle next month in Omni.



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Hidden Images—
Winners of Competition #36

GAMES

By Scott Morris

This competition, announced last April, called for the kind of art that makes you take a second look—hidden images.

We awarded four top prizes: a Halley-scope telescope [retail value: \$229], a Minolta Ticker voice-synthesized camera (\$229), a Sanyo 64-number auto-dial telephone (\$179.95), and a Casio digital/analog watch (\$80). In addition, we awarded six runner-up prizes of \$50 each, and each of the top ten entrants will receive a one-year subscription to *Omni*.

1. Grand Prize: Halley-scope. *We Will See You in Our Garden*, an 11x18-inch acrylic on illustration board, by Garrett M. Moore of Fremont, California. Moore is a scientific and astronomical illustrator.

2. Doug L. Smetana of Malibu, California, created this oil on canvas and gave it two titles: *Vanishing Cat and The Unseen Kiss*. The merging of the two images is, we think, completely successful. Even after you can see either the cat or the kiss, we defy you to see both at once.

3. Scott Moore of Frisco, North Texas, submitted this work about a rather touchy subject—nuclear holocaust. It includes several hidden faces and a large skull with the stone wall as a row of teeth.

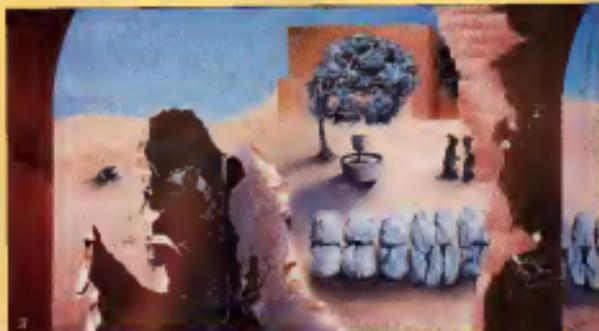
4. Mike Wesolowski of Los Angeles created this arrangement of six types of ferns along a garden wall. We suppose you have already figured out for yourself that the title of the painting is *Ferns*.

RUNNERS UP: 50

5. Egg: Jan L. Hinke of Wake Forest, North Carolina, sent us this acrylic-on-egg with three scenes. Each scene depicts a quality that Hinke sees in *Omni* magazine—"a light bulb for your bright, innovative ideas; a snake for your fearlessness in covering stories; and a rocketship for your efforts to be first." If that weren't enough, Hinke had the name *Omni* once in each scene. Can you see where?

6. Overdrive, an oil on canvas by Jeffrey Burke of Huntington Beach, California, shows an embryo in an earthrise.

7. Renaissance Madonna in Four Part Harmony, an acrylic on canvas, is by Terry Walsh (no address given). Turn it upside down and the baby appears to be drinking.





out of a calm lake, also the baby and goat combine to form a comical mens face.

8. *The Eye of Jupiter* is an acrylic by Graham Wildridge of Norfolk, England.
9 and 10 (not shown) *Hidden Heart*, by Deb Toyer of Hershey, Pennsylvania, and an unitled pen drawing by Jim La Rose of Mesa, Arizona.

**COMPETITION #39
OMNI DICTIONARY PART III**

We press onward to the next five letters of the alphabet: K L M N O. We've done A through J in previous competitions.

Khalas! What a Bostonian needs before he can start his automobile license number. The best thing to take when you're run down. Meth. Green Halli on the north thide of Treelie. Nursery. A bowl park. Obesity. Surplus going to waste.

You may submit only one entry with one definition for each initial letter. Postcards are preferred, or send a card in an envelope with your name and address attached. Mail it, postmarked by April 15, 1988 to: Omni Competition #39, 1955 Broadway, New York, NY 10023 (\$5.00). The grand prize-winner will receive a Panavision Auto-Focus Color Video Camera (model PK-452B). The first two runners-up will each receive an RCA two-inch black and white portable TV with AM/FM radio. In addition we will award seven prizes of \$25 each. All entries become the property of Omni; none will be returned. ☐

IMPORTANT

WOULD YOU AGREE TO PARTICIPATE IN A NATIONWIDE SCIENTIFIC EXPERIMENT IN MIND AND MOOD EXPANSION?

IN A SALUTE TO OLFACTION IN THE 21ST CENTURY, THE 3-M CORPORATION HAS AGREED TO ALLOW OMNI MAGAZINE TO BIND INTO ITS PAGES A PACKET OF POTENT, EMOTIONALLY CHARGED SCENTS ENCLOSED IN MICROCAPSULES BY RELEASING THE SCENTS AND RECORDING THEIR INDIVIDUAL RESPONSES TO A FASCINATING QUESTIONNAIRE, THE MAGAZINE'S READERS WILL HELP UNIVERSITY RESEARCHERS EXPLORE SOME OF THE MOST POWERFUL AND ANCIENT COMPONENTS OF THE HUMAN BRAIN. TODAY, SCIENTIFIC RESEARCH HAS RE-ESTABLISHED THE SENSE OF SMELL AS ONE OF THE PREEMINENT BIOLOGICAL DETERMINANTS OF MOOD AND EMOTION BECAUSE Olfaction linkes directly to the brain.

RECTLY FROM THE NOSE TO THE ANCIENT REPTILIAN BRAIN, THE SEAT OF LUST, MEMORY, ANGER, AND RAGE, SCIENTISTS MAINTAIN THEY CAN TAP OUR DEEPEST MOODS AND DRIVE US TO ECSTASY OR DESPAIR. TOMORROW, SCENTS MAY FUNCTION AS AROMATIC WONDER DRUGS REVOLUTIONIZING THE WAY WE LIVE.

TO BE PART OF THIS EXTRAORDINARY FIELD TEST AND TO COMPARE YOUR REACTIONS TO THOSE OF THOUSANDS OF OTHER AMERICANS, PICK UP A COPY OF OMNI MAGAZINE'S APRIL ISSUE, OR SEND FIVE DOLLARS (TO COVER POSTAGE, PACKAGING, AND HANDLING) TO SCENTS—OMNI INTERNATIONAL, 1965 BROADWAY, NEW YORK, NEW YORK 10023-5005.

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the doctor switched his patient back to his old medicine. In the checkup that followed the man complained that the medicine did not seem as effective.

Impressed by the results, the doctor placed an order for the marvelous new medicine from the pharmaceutical company. A short time later the company sent him an apologetic letter saying that through some mixup they had sent him a batch of inert placebo medicine by mistake.

The healing force that comes from two humans interacting is so subtle that we tend to forget it is there. Harvard psychologist David McClelland—an internationally recognized expert on human motivation—has long been interested in this phenomenon. A self-described maverick, McClelland started a group of his colleagues by telling them he goes to a psychic healer often with beneficial results.

One of McClelland's experiments involved nothing more than a telephone, the common cold, 13 Harvard undergraduates and a healer. If a student felt a cold coming on, he was to call a certain number. Within 24 hours of the phone call the student was taken to McClelland's healer. As each student showed up, the healer would say, "You're healed."

To gauge the success of the healer McClelland worked out a list of 32 symptoms—indicators of how strong or weak the cold was before and after the visit. He also measured levels of the antibody immunoglobulin A (IgA) in his subjects' saliva (IgA is a substance that helps the immune system fight off upper-respiratory diseases—the flu and sinus problems.) After the healing ritual, 9 of the 13 students who had felt their colds abate also registered higher levels of IgA.

According to McClelland, this little experiment imitated the nonpsychic healers—the doctors at the Harvard University Health Service. The doctors had their noses put a little out of joint by this "he" healer. They said, "Hell just take them [the students with colds] to the health services of Harvard, tell them they're better, and they'll get better."

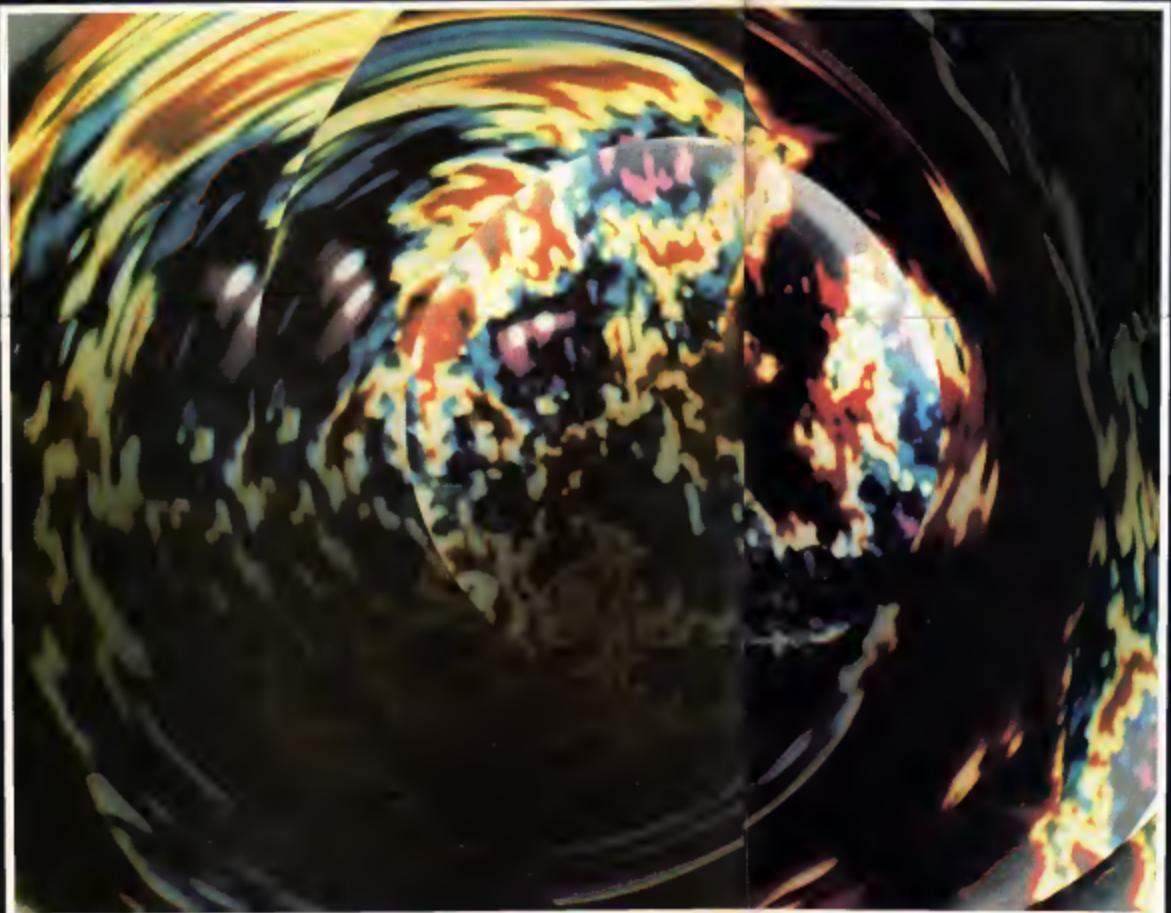
So he did. Repeating the experiment, he randomly sent more undergraduates with cold symptoms to the Harvard Health Service. None of the students saw any improvement in their colds.

For McClelland, psychoneuroimmunology marks the dawning modern medicine should take: using the forgotten resources of the mind and human spirit to make a sick body whole again. Summing it up, he told a gathering of colleagues: "I can dream a little about changing the hospital environment, one that relaxes you, gives you loving care, and relieves you of the incessant desire to control everything. A healthful environment—doctors, nurses, social workers—all of us—can learn; it seems to me, that being loving to people is good for their health. And probably good for ours, too." **DD**

Adapted with permission from *The Healer Within* published by E. P. Dutton, March 1986

PHENOMENA

Crazy, kaleidoscopic distortion begets the purpose of these mirrors, which were specially designed to capture X rays emanating from the sun. Part of the optics of Lockheed's Wolter type I cosmic X-ray telescope, the mirrors are seen here in an image orchestrated by photographer Dick Luria. To add color, Luria has reflected a computer-enhanced picture of the sun—made by a different telescope—into the mirrors. Sent aloft on several occasions to quickly photograph X-ray-emitting stars, the X-ray type I tools are sounding rockets. These rockets travel through the atmosphere for a few minutes and then parachute their payload back to Earth. After returning, the telescope and its special mirrors are refurbished in Lockheed's Palmdale, California, lab. It was there that they caught Luria's eye. "Creating this image was a perfect opportunity to marry the romance of space and high tech in one photograph," he says. Luria used a Nikon F3 camera, together with a Nekkor 200mm ED lens and Kodachrome 64 film. **DO**





LAST WORD

By Mitch Coleman

• Few people remember Euclid's Love Stole of the Math Gods, which chronicled the misadventures of a troupe of all-gif dancers enslaved by evil Persian Platonists. •

For centuries, mathematicians the world over have tried, with varying degrees of success, to expand the boundaries of mathematics.

Their efforts to answer the questions raised by the science may have given us a few spectacular successes, such as the development of calculus, algebra, and Euclidean geometry. But their failures have been just as spectacular, if not as well-known. Among the least of the lesser-known achievements are:

EUCLID'S ELEMENTS II. Euclid, a Greek mathematician, is best known as the father of geometry. His book *The Elements* has stood as the foundation of geometry for more than 2,000 years.

But few people remember Euclid's second book, *Love Stole of the Math Gods*, which chronicled the adventures of a troupe of all-gif dancers and their enslavement at the hands of evil Persian Platonists.

In the book, the women are finally rescued by an aging, bearded, balding mathematician who many believed to be Euclid himself. The work engrossed readers especially when first published in 270 B.C., but somehow it failed to stand the test of time and was lost to the ages.

GORTMUNDEN'S COROLLARY. Hans Gortmunder (1482 to 1500) came to the study of mathematics relatively late in life, but he didn't stop him from making a number of important discoveries. Chief among them was "Gortmunder's corollary," which stated that if you write a mathematical proof on a piece of paper, turn the paper over, and hold it up to the light, the proof will appear backwards, but it will also be true.

Mathematicians searched for years to disprove Gortmunder, but their efforts came to an abrupt end in 1506 with the introduction of thicker paper.

REINMANN'S RESTAURANT ENIGMA. Otto Reinmann, an eighteenth-century German mathematician, spent years trying to figure out why the local restaurant bill for his Sunday party of five always seemed to be greater than the sum of the individual charges (even excluding the tip).

One day Reinmann, who always had to settle up the difference, finally posed his question to his knowing companion, who promptly accepted inviting him. Reinmann died a lonely and hungry man, and to this day, the mysterious problem remains unsolved.

THE MOBIUS NO-PEST STRIP. In the mid-1800's, the mathematician August Ferdinand Möbius found that by taking a strip of extremely sticky rectangular paper, twisting one end halfway, and then joining the two ends together, he could create an object with two remarkable properties. The strip had only one side, and it could trap pesky-tying insects.

The Möbius no-pest strip did not catch on, however, and the mathematician lived the rest of his life in obscurity, working on another project, the Möbius motif.

ANDERSEN'S AXIOM. Niels Jørgen Andersen, a nineteenth-century Danish mathematician, is remembered for his things, his work with prime numbers and his love for lauchwari (litter), mathematician Boris Acker. Before the most interesting of the two was his winning battle with Acker. It all began when Acker moved to Denmark in September 1912, just in time to knock Andersen out of the top slot in the new Copenhagen phone directory. Andersen's private funcs. At first he considered changing his name to Aanderdensen, but gave up the idea after Acker threatened to switch him after her letter.

The two men finally settled their dispute on the field of honor. Given the choice of weapons, Andersen won the duel handily by choosing a peck for himself and a sword for Acker.

WEINBERG'S SET THEORY. Set theory was first proposed in 1903 by the American mathematician Carl Weinberg, who devised it as a means of sweeping track of his car keys. Weinberg called his discovery the "extra set theory," which is an experimental application of it. He kept the extra set, tucked to the inside of his gas cap.

But such precious ones didn't help the absentminded Weinberg, who constantly found himself locked out of his Corvette as his colleagues laughed and whistled. "Hey Weinberg, can you give us a ride?" He went through life a crippled man.

BECKER'S THEORY OF RELATIVITY. A contemporary of Einstein, Ernst Becker came up with his own lesser theory of relativity some seven years before his more famous colleague. (Unfortunately, Becker was absolutely wrong, thus explaining why his theory isn't better known.)

Essentially, he theory held that all mass, light, and energy emanated from a giant stone god located somewhere in the San Fernando Valley. That didn't earn him any points from mathematicians, but it did earn the title for a lucrative religion, cult, which Becker founded until his death, following a 1977 IRS investigation.

BUTKE'S EQUATION. In 2005 an English mathematician named Andrew Butke claimed to have discovered an equation he said would revolutionize the study of mathematics. Butke said he had found the equation written in the margin of an old manuscript, which had been locked in a steamer trunk for more than 100 years.

His claim was discounted, however, when experts determined that his "equation"

($y = x^2 + y - \pi$) was actually the chorus to a 1987 song by the Doobie-**DOO**.

Mitch Coleman is a Chicago-based freelance writer whose dad doesn't add up.