LIFE AFTER LIFTOFF: HOW MAN WILL EVOLVE IN SPACE

THE DAY WE BOMBED UTAH: AMERICA'S SECRET NUCLEAR WAR

PLUS: LASER MOVIES, FACE-LIFT PILLS, SILICON ALIENS
Replicas of Britain's ancient megaliths are found on a deserted planet in Stonehenge NGC2024, a painting by Kazumasa Yamanaka, a young illustrator who lives in Tokyo.

This work first appeared on the cover of the February 1983 Japanese edition of Omni.
Have you heard of the Fields Medal? Though cashless, unlike most major scientific awards it is the most venerated prize in mathematics. Or Israel's annual international Wolf Prizes accompanied by awards of $100,000 for achievements in each of five scientific disciplines? Or General Motors' three $100,000 prizes annually given for distinguished work in cancer research?

Although these prizes glow in the scientific world, evoking awe and encouraging intense competition among scientists, the general press tends to ignore them. In fact few nonscientists have ever heard of most of them. Now, let's try another.

Have you heard of the Nobel Prizes? The answer of course is that each fall, when the Nobels are awarded by their Swedish and Norwegian custodians, one would have to make a concentrated effort not to hear of them. The prizes automatically generate front-page prime-time treatment, and virtual sainthood is bestowed upon the annual recipients. This is especially so for the science prize winners, in such disciplines as chemistry, physics, and medicine or physiology.

What great distinction exists between the Nobels and other, less celebrated science prizes? Less than you might think, and that is why the Nobels, first awarded at the beginning of the twentieth century, are the target of growing criticism from many scientists and the press. Zealously regarded by a hero-worshipping public as the ultimate certification of scientific and scholarly achievement, the Scandinavian prizes are now often ignored because they mistakenly honor individuals in an era of complex team efforts and they distort science by ignoring major regions of research.

Britain's most prestigious science-research journal Nature summarized the case against the Nobels several years ago by observing editorially that many would argue that the prizes represent an outdated award system: generate a fair amount of bitterness and jealousy and often convey a spurious aura of authority that is misinterpreted not just by the general public but even by scientists themselves who should know better.

So do away with them, it's been argued. On this side of the Atlantic, The New York Times recently encouraged it not to join the pack with an editorial in the form of a letter from a mythical scientist:

'spurning the cherished award. 'Most of the glory the Nobel Foundation seeks to assign to me,' the Times's make-believe winner is robbed of by my fellow researchers and distorts the true pattern of achievement in my field.'

What's odd about this line of criticism is that similar comments could be leveled against most, if not all, modern-day science prizes, but only the Nobels seem to draw that kind of ire. Why is this so?

A search for the cause takes us back to the obscurity of all those other prizes contrasted with the glare of international attention that the Nobels receive. The Nobels are older than most of the other prizes. They were the first to award big money—currently about $160,000 per prize, although this is usually shared by two or three recipients. But, perhaps most important of all, the Nobels awarded by the Swedish crown come with the glitter of royal pageantry. Let's face it—they are unmatched for pomp and dazzle. But when it actually comes to determining who is in the vanguard of science, the Nobels are often runners-up in recognizing important breakthroughs, particularly to the Wolf Prizes and Lasker medical awards. Furthermore, the Nobels in identifying the real achievements is occasionally suspect. Two years ago, for example, the Wolf Prize for physics was awarded to Kenneth G. Wilson and Michael Fisher of Cornell and Leo Kadanoff, of the University of Chicago, for developing an equation that explains the critical point at which matter changes from one phase to another—for example water to steam. Last fall, however, Wilson alone received the Nobel Prize for their combined work—and immediately voiced his displeasure because his colleagues were not also cited by the prize committee.

Such oversight is not at all uncommon. Thus, science's most esteemed prize is not accurately awarded, nor is it consistently in the forefront of recognizing high achievement.

Abolish the Nobel Prize?

There's no good reason to do so, nor can the Swedes be expected to give up what, after all, is a great source of national pride and world attention. But what can be accomplished and usefully so, would be a reduction of uncritical and extravagant veneration of the prizes and winners. The world of science has expanded at least a thousandfold since Alfred Nobel initiated the prizes. There are now a multitude of other awards for important contributions.

To glorify the Nobels and virtually ignore the others is to burden the Swedish prizes with an increasingly difficult weight. The Nobels and other prizes celebrate excellence—and that's a function not to be scoffed at. But the worship of the Nobel Prizes has gone a bit too far.

Daniel S. Greenberg is the editor and publisher of a Washington-based newsletter Science & Government Report.
e never intended to bomb Utah of course. In the 1950s the Atomic Energy Commission (AEC) was simply conducting above-ground nuclear tests in neighboring Nevada. But the poisonous clouds drifted eastward, toward the little Utah towns of St. George and Cedar City.

Veteran journalist John G. Fuller visited the scene 30 years later and found evidence of a lethal cover-up. AEC officials knew what their tests were doing to the land and its people. They just didn't want to stop. More than 1,000 victims of leukemia and other forms of cancer have reluctantly concluded that their government is to blame for their illnesses. Fuller's expose, "The Day We Bombed Utah" depicts American citizens pitted against the AEC and explains how the people are finally getting their day in court.

Fuller is the author of many nonfiction works, including such best sellers as The Ghost of Flight 401 We Almost Lost Detroit and Fever.

"What happened to those two rustic Utah towns," says Fuller, "is emblematic of what could happen to similar cities all over the country. I was deeply touched by the tragedy these people had experienced. As I interviewed them on their front porches, they would sometimes count the number of relatives and friends on their street who had died from radiation exposure. With underground nuclear testing still in progress, many more Americans may suffer the same plight."

The story begins on page 52. What will happen to us when we begin taking extended space voyages or living in space stations or colonies? How will the human body adapt and evolve? These are the questions addressed by the new science of bioastronautics—the study of life in space. Writers Nick Engler and Donna Cheshire Engler, besides interviewing NASA's top experts in the field, traveled to Moscow to talk to Oleg Gazenko, director of the Soviet Institute of Biomedical Problems, Gazenko who engineered the first life support systems on rockets, has been dubbed the father of bioastronautics. He offered insights into how zero-G conditions influence embryology, growth, and the aging process. See "Life After Liftoff," which starts on page 108.

SF author Robert Silverberg has finally done it. He has brought together two of our culture's heroes in one short story in "Amanda and the Alien" (page 60), a California girl picks up an extraterrestrial at a shopping mall. In short, it's Valley Girl vs. E.T. Our other fiction offering, "Vengeance is Yours" (page 126), marks Pat Cadigan's first appearance in Omni.

Finally, special kudos this month must go to award-winning political reporter and science writer William K. Stuckey. Besides writing a colorful profile of big science's Ozark-style at the University of Arkansas' "Ozark Mountain High", page 72, Stuckey also succeeded in getting the Omni accounting department to reimburse him for over a month's worth of beers without receipts—an unprecedented accomplishment. Our accounting types are normally adamant about such things but they acquiesced to the resourceful Mr. Stuckey when he produced the following letter for Dick Teresi. Omni's executive editor.

Dear Mr. Teresi,

As you will note in William K. Stuckey's article on the University of Arkansas, he spent a great deal of time interviewing a large number of professors, writers, and detectives in my saloon, Roger's Pool Hall. He has asked me to estimate his beer consumption and expenses, since I do not give receipts. Mr. Stuckey was first brought here on November 1. As Stuckey has come in almost every day since I offer the following highly conservative estimate: 35 days with an average consumption of five beers each day. The beer is 80 cents per bottle, and his average tip was ten cents per bottle.

This comes to $140.00 for beer, $175.50 for tips, for a total of $315.50. Do not hesitate to contact me if you have further questions on this matter.

[Signed] Roger Kooter
Proprietor
Roger's Pool Hall
Fayetteville, Arkansas

The article's good too.
Debunking Claims

We of CSICOP [the Committee for the Scientific Investigation of Claims of the Paranormal] would like to thank Omni for the fair and accurate treatment of the Lane Starkey/Jake Rotstein story in "Psychic Gold," by Peter Rondinone [Antimatter, December 1982].

However, in the same issue, in the article "Out of the Closet" by Douglas Starr [Continuum], our committee is said to be "devoted entirely to debunking pseudoscientific claims" (we would like to correct a possible misunderstanding concerning the intent of CSICOP. Although there are obviously claims and situations so glaringly debunkable that such a procedure is certainly appropriate - that is in no way our primary intent. We investigate and evaluate paranormal claims, offering alternate explanations whenever they are available and we do so from a position of academic and technical expertise.

Paul Kurtz
Chairman, CSICOP
Buffalo, NY

Children and Pollution

Your article "Children of Disaster" by Douglas Starr [Earth, January 1983] struck a resonant chord in me. I have suffered from the less serious functional disorders of hypoglycemia and related allergies and sensitivities because of pollution. I can understand the despair that these children afflicted with much more devastating pollution-caused maladies must be experiencing. As a potential parent, I worry about the futurity of trying to raise healthy children in a world bent on its own destruction.

Brek Renzelman
Bloomington IN

Defending Defense

Phoebe Hoban's article on civil defense [Continuum, January 1983] illustrates the problem we at the local level face in dealing with the issue of nuclear preparedness.

The nearly 3,000 members of the U.S. Civil Defense Council are responsible for assisting their local citizens in dealing with all the hazards that may face their community. These hazards range from incendiary attacks as casual as a leaking acid truck to the mind-boggling problems we would face in a nuclear attack.

As local officials, we have little voice in the establishment of national policy. As an organization, the council has always attempted to put the Crisis Relocation Program into proper perspective. It is merely one of the many possible courses of action to be taken if the necessary conditions are met.

Hoban mentions the success of antinuclear forces in persuading Congress to "slash FEMA's [the Federal Emergency Management Agency's] proposed $525-million Crisis Relocation budget to about $147 million." It was not the Crisis Relocation budget that was slashed. It was funneling for the activities that enable us to train our people, warn our citizens, and equip our response teams.

We cannot devote our dwindling resources and diminishing personnel to attaining our goal of providing the highest possible level of preparedness to meet any threat to our citizens' life and property if we must divert our energies toward defending our programs.

William Murray
Director, Cascade County Disaster and Emergency Services
U.S. Civil Defense Council
Great Falls, MT

I heartily applaud Phoebe Hoban for her article "Civil Defense. This ludicrous plan is at best a disgraceful waste of money and at worst a dangerous scheme. It civil defense plans manage to convince Americans that somehow the nation could survive a nuclear war than these plans themselves make nuclear war all the more probable.

Our sole aim must be to prevent a nuclear war. All our efforts should be directed toward genuine arms control negotiations with the Soviet Union and a peaceful coexistence with all nations.

Carol Ann Bradford
Newport Beach, CA
In which the readers, editors, and correspondents discuss theories and speculation arising out of Omni. Readers are encouraged to debate views and pose questions to Omni, the scientific community, and the science-fiction establishment. The opinions published are not necessarily those of the editors.

Dolphins, Drugs, and Dr. Lilly
I am writing in reference to the interview of Dr. John Lilly, in the January 1983 issue. I cannot believe that any reputable magazine would give space to promote the ideas of such a crackpot! I thought such crap went out with Timothy Leary and the rest of those 1960's consciousness-expansion gurus. I was apparently quite wrong, because this nonsense has survived among the idle rich of the Malibu hot-tub set. While the rest of us are barely able to make ends meet, fat cats like Lilly and his friends in Malibu spend upwards of $25,000 for so-called consciousness-expanding programs.

As for all that stuff about Ecco [Earth Conscience Control Office] or any of the rest of that stuff about alterity and altered states of consciousness, my opinion can be summed up by a quote from the movie Altered States, which Lilly claims is based on some extent on his life. I don't want to hear anymore of that quantum cabalistic frigging dumb limbo mumbo jumbo!

James Bisson
Collinsville, IL

Judith Hooper is to be congratulated for her revealing interview with John Lilly. Her questions permitted Lilly to make clear by example the distinction between the psychonaut's disciplined inner explorations and the burned-out hippie's rambling escape into the existence of drugs.

At least dolphins have the good sense to remain silent.

Jonathan Smith
Chicago

I found the John Lilly interview most fascinating. His journeys within appear very real, yet I cannot agree with how he begins them. Even though hallucinogenics may seem to work well for him, it is unnecessary, impractical, and very dangerous to depend on them for obtaining genuine experience.

Drugs and mind-expanding substances have no place in a balanced life.

Marc Anderson
Kokomo, IN

I am surprised and disappointed that an otherwise interesting thinker like John Lilly can dismiss the 2,000-year heritage of Catholicism by calling it multiple layers of rationality made up by clever Irish Jesuits. Apart from any damage Lilly may have sustained by his extensive use of psychoactive drugs, he is currently suffering from what has been called the Sister Mary Thumoscrew Syndrome or the Nun-with-a-Switch Complex, a disorder extremely common among persons who encountered Catholicism through the mediation of parents, priests and nuns of the pre-Vatican II triumphalistic, fortress-maniacal Church. The chief symptom of this malady is that the victim mistakes the errors and misunderstandings of the early Christian church for the authentic Christian life and faith.

But after making allowances for this disease, one still wonders how it is that a scientist like Lilly can go through near-death experiences, experiment with altered states of consciousness, communicate with animals, make various journeys into philosophies of religion, and yet fail to discern this enormous blind spot of prejudicial reactivity in his own makeup. Shall we judge the value of research into altered states of consciousness by the criteria of media sensationalism and misrepresentation?

Likewise, a religious faith should be judged on the basis of those who truly practice it in their daily lives.

Br. William McKinley
Superior, Holy Trinity Monastery
Santa Cruz, CA

Would you please as a public service print the following: There is only one universe by definition. Not even John Lilly should be permitted to use phrases like the 'observable universe.'

Mark Tull
Lansing, MI

Your interview with John Lilly demonstrated to me quite strongly the extent to which a person's view of the universe can undergo radical change.

Lilly was just beginning his sensory-deprivation experiments when Aldous Huxley was already far down the road to the understanding of altered states of consciousness obtained through drugs. Lasting sensory deprivation and many other means. At that time (the early 1960s) Lilly considered Huxley a fraud and a nut.

Lilly's early experiments with isolation produced startling results, but he maintained a strictly orthodox view of these occurrences. Now after dabbling in LSD and he sounds like a reincarnation of Huxley. He even admits to 'exploring neurons on his psychic voyages. What a transformation!'

Rob Rogers
Dunbar, WV
T he hills outside Florence, Italy were ravaged more than 2,000 years ago when the ancient Etruscans cut the trees and brought in grazing sheep. Today the city’s barren hills are hostage to floods that were once held back by foliage and woods.

More than 60 million buffalo once stormed the American prairie, blanketing the countryside and migrating en masse. Then the white man discovered what great sport they made. In a butchering virtually unmatched in American history, settlers and hunters slaughtered the buffalo, taking meat, fur or simply the tongues. Some took nothing as they shot the animals from moving trains. Now, despite years of conservation, only a few thousand buffalo remain.

And so it continues from ancient Rome to America. From Mesopotamia to Brazil, history seems a perpetual war of man against the planet that sustains him. What makes human beings wreak such destruction? Are they insane?

Yes, according to philosopher Paul Shepard, who has come up with a new theory about our urge to destroy life. Shepard says that a key event thousands of years ago rendered us permanently adolescent, with the uncontrollable desire to vent our juvenile anger on the natural world. The nature of that catastrophe? The invention of agriculture, often seen as the birth of civilization.

Shepard, author of the new book Nature and Madness, is one of a growing band of academics who seek to understand how the world has come to the brink of ecological destruction. The movement became popular in the pre-Earth Day 1960s when scientists first realized we were poisoning the planet. Several schools of thought offered ways to prevent the disaster. Technologists believed that machines and pollution control could revitalize the life-support systems. Economists pushed for new regulations that would make pollution too expensive. Both of those solutions might work in the short run, opponents argued, but only a much deeper insight would provide the key to why humans pollute. Could there be something antinature deeply rooted within the human psyche?

If so, could we get rid of it? Those who asked such disquieting questions became known as ecophilosophers.

Shepard, one of the best-known ecophilosophers, was baffled by mankind’s historical insistence on destroying his own ecosystem, and by the extent to which nearly all civilizations shared the inclination. Yet he noted that today’s so-called primitive tribes—the Marus of New Guinea, the Aranda of Australia, and the Crow of North America—still live in harmony with the environment. Traveling in small, manageable groups, these hunters and gatherers grow up surrounded by nature attuned to its sights, smells, and sounds. They live on the earth as its guests, not its owners, just as their ancestors had done for generations.

This uniquely ecological attitude seemed to change for most of the human population through approximately 10,000 years ago with the inception of agriculture. In Mesopotamia, people began cultivating wheat and barley. In China they grew rice, in North America maize. And something changed in man’s relationship to the land.

A strange duality of dependence on and alienation from the earth developed. Nature had always been everywhere, but now there were boundaries. Land was divided between cropland and wilderness and whenever wilderness invaded the farm, danger was near. Agriculture produced a regular food supply, but it also gave rise to denser populations. So whenever crops failed, a large-scale disaster was sure to follow.

People alienated from nature, claims Shepard, lost the hunter’s keen attention to every wild sight and sound. Childhood lost its broadening experience instead of exploring and imitating nature, children now performed menial tasks. People in farming communities developed specialized skills, thus learning the concept of subservience to the whole.

And over several thousand years humans changed from independent adults to childish creatures living on the miniature plant ecosystems we know as farms.

Ravaging the earth. We’ve been seized by the uncontrollable urge to destroy our environment.
The Cambodian refugee began to hyperventilate his body shaking in a violent seizure unlike anything the American and French doctors had ever seen. Then unexpectedly the man fell limp, like a marionette whose strings had been snapped. He was near death.

"It's spirit possession," a relative shouted to the doctors in the medical hut of Khao-I-Dang camp in the Thai border town of Aranyaprathet. Call for the Krous—native healers.

"We were willing to try anything," admits one U.S. nurse. "Even witch doctors."

As the stunned Western medics looked on, the Krous doctors presided over a ceremony involving chanting, music, herbal tea, and massage. Thirty minutes later the stricken man—one of 30,000 displaced people confined at the camp—began to recover. The familiar sounds of his native language reached where Valium could not—healing the tortured psyche that had seen friends and family starved and brutalized during the Pol Pot Cambodian regime (1975-78) the Vietnamese invasion, and the occupation that followed.

News of the success led international Red Cross doctors to invite the Krous to treat other patients, paving the way for one of the first intimate collaborations between Western scientific medicine and centuries-old native medicine. Lizard blood, incantations, and herbal potions are now accepted along with penicillin and aspirin within the camp's four square miles of sprawling bamboo huts and vegetable gardens. The Cambodians are free to choose between the modern clinics operated by the International Rescue Committee and the Krous-run Traditional Medical Center (TMC).

"The Krous don't interfere with our treatments, and we in return let them have free reign—even if it means letting them spout in open wounds," explains Dr. Larry Jones, whose casually draped stethoscope and rough-and-ready manner are reminiscent of Hawkeye from the TV series *M*A*S*H*. A pediatrician from Nashville, Jones admits he's not sure that traditional remedies work "except psychologically." But that, he feels, is reason enough to endorse Krous healing practices.

In recent years a growing body of evidence has brought to light the large role that personal faith plays in affecting a cure. Just as 30 percent of Western patients have been found to benefit from placebos, many Cambodians automatically improve when treated with the medicine they believe in. Given the power of mind over matter, International Red Cross psychiatrist Jean-Pierre Hiegel encouraged the Krous to join the efforts of the rescue committee workers. The resulting partnership embodies many principles of the holistic health movement, which has been gaining popularity in America and Europe.

"If the sick have a body, they also have a mind," Hiegel writes in a brochure distributed by the United Nations. "Yet all too often, suffering and sickness are split from the psychological and sociological background of the person."

To provide the best care possible, he believes it is essential to recognize how cultural attitudes can influence both the symptoms of disease and the outcome of treatment.

Traumatized Cambodians, for example, rarely develop such hysterical symptoms as limping, blindness, and deafness, which are common among shell-shocked American soldiers in Vietnam. Instead, they have changed their fears, sorrows, and guilt about the Pol Pot years to terror into a completely different syndrome of disorders, including speech impairment, headaches, memory loss, and such psychomotor disturbances as muscular rigidity and violent tremors.

"Some Cambodians diagnosed as neurotic or even schizophrenic by Western doctors," Hiegel reports, "immediately returned to normal when treated for spirit possession by the Krous. On other occasions, our medical staff thought certain refugees were only suffering mentally when, in fact, organic disease lay at the root of their problem."

"Frequently the Krous have better success than we do," adds Dorsey Bass, a psychiatrist with the Cambodian Mission. "Frequently the Krous have better success than we do," adds Dorsey Bass.
After a winter of some discontent—marked by concern over shuttle-launch delays and frustration at the meager return from lobbying efforts—grass-roots space groups celebrated some modest rites of spring.

Even while NASA was sounding gloomy about delays in Challenger’s debut, one major space-activist group planned a lively spring conference on doing business in space. The L5 Society announced that its Second Annual Conference on Space Development was to be held in Houston, from April 1 to 3.

Speakers at the conference represented private attempts at space development. Former Mercury astronaut Deke Slayton is now president of Space Services Inc., which last September his company became the first private firm to launch a space vehicle. Max Faget left NASA in 1982 after many years as director of engineering and development. It was Faget who organized the design team that built the space shuttle. He is now president of Space Industries Inc. which is working on what could someday become the first privately funded space station.

Houston architect Renaldo Petrini heads L5’s lunar base design project, begun at last year’s conference, work on the plan was to continue through L5’s meeting.

In the early days of spring other groups were drawing up wish lists for future space projects. One impetus for establishing priorities was the approach—this October 1—of NASA’s twenty-fifth anniversary. What should the space agency do over the next quarter century?

The largest survey on the question was conducted by the National Space Institute (NSI), one of the more active space-interest groups in the past year. There was a clear winner. NSI members decreed that NASA must commit itself to building a permanent manned space station by 1995. Other high scorers in the survey were planetary exploration and a call for greater cooperation with the space programs of Western allies.

The question remains: How much political clout do the activists carry? When NSI’s Mark Chartrand presented results of the survey to the House Subcommittee on Space Sciences and Applications, he was the only speaker invited to represent the popular space movement at the hearings. It seemed apparent that pro-space groups still had not managed to form a large, effective lobby like the ecology and antinuclear forces.

Chartrand began work about two years ago to do something about the problem. He organized the National Coordinating Committee on Space to find common ground where the planetary science buffs space industrialists, and other single-issue subcultures could form alliances to promote space activities. Most activist groups sent representatives to the committee’s meetings.

Yet today Chartrand is about ready to give up the project. There are too many organizations with too many goals and approaches, he declares. And even the small regional groups demand the same say in any collective activity as groups with thousands of members. It’s impossible to act effectively under those conditions. We’re planning to hold a meeting soon to review our plans, and we may just shut it down.

NSI itself will go on, however. The group has recently taken over operation of the Dial-a-Shuttle hotline (900) 410-NASA. During shuttle missions the public can call the number to listen in on space-to-ground talk. More than 1.5 million people did so during the STS-3 mission.

Another bright spot on the space scene: Preparations for Spaceweek ’83 are well under way. The nationwide celebration, scheduled for July 16 through 24, commemorates Apollo 11, which in 1969 was the first mission to land men on the moon. Local Spaceweek events were held in 52 cities last year; up from only 22 in 1981 reports Dennis Stone, Spaceweek’s national president. The 25 cities that recorded the number of attendance at the gatherings reported nearly 140,000 visitors. The goal for this year, Stone says, is 100 cities and a million or more visitors. Anyone wishing to help with planning in his area should contact National Spaceweek Headquarters, Box 58172, Houston, TX 77258.
Does she seem to be cleaning the house every time you visit? Does he spend hours in the bathroom whenever he goes in for a shower? Does an empty can of underarm deodorant set off the equivalent of a Greek tragedy in the house?

When it comes to cleanliness, the boundary that separates the particular from the pathological can be a vague one. Cleanliness is a matter of degree but many Americans seem so obsessed with it that their behavior approaches mania. Howard Hughes's legendary fear of germs is just one example. There are other equally strange ones—like the man who brushed his teeth with scouring powder to get them extra clean. Or the woman seen by one psychiatrist who insisted on spraying her husband a erection with disinfectant before having intercourse.

By all indications, we are a nation of soap-obsessed cleanliness freaks. Each year we spend more than $5 billion on cleaning and bathroom items. Yet most of the cleaning and grooming practiced today is ritualistic, meant for display and sexual attraction rather than hygiene.

Much of our hand washing, for instance, is done to protect our clothing and the things we handle rather than to simply clean dirt from our hands. Every culture in the world has its own notion of what it means to be clean. To Americans, cleanliness is not a purfication of the soul or the environment but a personal state defined by a lack of body odor, sparkling white teeth, and no ring around the collar.

Much of our concern with personal cleanliness, says Edward T. Hall, a world-renowned anthropologist, can be traced to the so-called sexual revolution which has made us more aware of our bodies. But the ethnic diversity of our cities has produced an even larger role in this obsession.

"More than anything else, Hall says, "personal cleanliness is an urban phenomenon. Different diets and habits produce different odors, and when you put them together in a city people become more aware of one another. It probably was city people who developed the notion that it wasn't right to smell."

In order to offend anyone, Americans have adopted a common standard of cleanliness—the elimination of the body's olfactory envelope which still surrounds many equally civilized Europeans.

Cleanliness becomes pathological when it begins to impair other daily functions. Office workers who spend ten minutes of every half hour washing their hands and housewives who fear contamination from door knobs and TV dishes have what psychiatrists call obsessive-compulsive disorders. Fortunately, less than 1 percent of the population suffer from this anxiety.

A more common problem is the simple compulsion to perform a cleaning ritual. People saddled with this habit may be irrational but they are not psychotic. In Italy, Dr. Cesare Scriggar, a clinical professor of psychiatry at the Tulane University School of Medicine in New Orleans, and the author of Stress Strategies: The Treatment of Anxiety Disorders, explains anxiety sets in. As they continue to fret, the anxiety builds until it reaches a critical point. Then the patients feel compelled to begin their ritual, such as hand washing.

"They tell you it's out of their control, but it's not," he says.

Once they give in to the compulsion however, their anxiety fades quickly, and therein lies the problem. Before long, any anxiety whether associated with a contaminant or not, can trigger the cleaning ritual.

Psychoanalysis has had little success in treating this disorder, but a form of behavior therapy known as flooding which Scriggar performs on patients who have been hypnotized has shown considerable promise. Flooding means that you don't allow people to engage in the compulsion, he explains. He then helps them fight off the urge to wash. "People complain like crazy, but their anxiety goes down. It's not as quick a decline as it would be if they washed, but it works."

If this therapy fails, the psychiatrist may take more drastic action—hospitalizing.

Photomicrograph of human skin. Cleanliness, unlike beauty, is not only skin deep.
PLASTIC SURGERY 2000

THE BODY

By Shelley Ross

An operating room, the year 2000. The patient who is having a breast-reduction surgery lies wide awake on the table. But she feels no pain; a system of electrical probes that stimulate her brain's natural opiates takes care of that.

Nor does she fear that a scalpel's slip or a surgeon's botched sense of proportion will mar her anatomy. A sophisticated computer program, coupled to a CAT (computed axial tomography) scan of her breasts, has churned out mathematically precise before and after pictures to guide the transformation. And her surgeon is actually a robot—unshakable hands and perfect sangfroid.

There's no more on twenty-first-century doctors' gowns: either a laser makes bloodless incisions and a revolutionary biodegradable 'glue' modeled on the natural glue with which a mollusk sticks the sides of a dock—seals the cut without sutures. (The mollusk's secretion becomes a fibrous protein much like human connective tissue.) Post-surgical infections are just about extinct. Too. Instead of scrubbing up, the doctors have passed their hands and instruments through sonication devices that kill germs with sound waves.

This forecast comes from Dr. Kelman Cohen, who is no misty visionary but the chairman of the plastic-surgery division of the Medical College of Virginia, in Richmond. 'The real revolution,' however, won't involve an operating table at all. Think you'll be needing a face-lift by 1999? Forget it. If Dr. Cohen is any seer, your fountain of youth will probably come in tablet form. By instructing the cells in your face to repress some genes and amplify others—this pill—or injection or ointment—will actually do what TV face-cream commercials only promise: make your collagen tissue young again.

Your body produces three kinds of collagen, Cohen explains. 'The collagen in your face is a mixture of about eighty percent Type One collagen, the type of collagen in rigid structures like bone and tendon, and twenty percent Type Three collagen which is more elastic. My hypothesis is that aging skin switches to a different ratio with more Type Three and that's why you get sagging and wrinkles. The cure? That will come from the calderons of molecular biology.'

In cell cultures, pharmacological agents can manipulate that genetic machinery, he notes. 'There is no reason we can't tell your collagen cells 'Make x percent of Type One', but we have to find a way to do that without hurting the rest of the body.' If the very plastic collagen of your blood vessels started making too much Type One you would be in trouble.

But since specific cells have specific traits—abdominal fat cells transplanted to your hand, for instance, get puffy when you gain weight—Cohen predicts that rejuvenation drugs will be custom-tailored. By 2000 you won't need any fancy 'fat-suction' treatments to eradicate cellulite. 'I think we'll know more about the cell's enzyme systems that we'll be able to control where fat is deposited,' says the surgeon.

Facelifts, nose jobs, and tummy-tucks are only the petits fours of plastic surgery. Its meat-and-potatoes is reconstructing burned faces, torn limbs, cleft palates, and other congenital deformities.

Here say the experts, the next frontier is the immunological barrier. You can't willy-nilly wear someone else's nose or arm because your immune system recognizes it as foreign and rejects it. The reason why organ transplant recipients are treated with drugs that suppress their bodies' natural defenses. Currently, immunosuppressive drugs are judged too dangerous to use for anything less serious than a vital organ transplant. But what if scientists found a way to trick the immune system?

'Then we'll really be able to talk about spare parts,' says Stanford University's Dr. Lars Vistnes, chief of the plastic- and reconstructive-surgery clinic. 'We'll have immunosuppressants with fewer side effects or better we'll manipulate the transplanted part biochemically so the body recognizes it as its own.' Once cell biologists learn to identify and block the antigens sites that label tissue as foreign—a feat Cohen forecasts for the next decade or two—spare fingers, ears, and skin tissue will be routine.

Sophisticated synthetic materials will mimic Mother Nature more successfully, too, making artificial skin, breast tissue, and other organs... (like, says Cohen. And by the turn of the century cleft palates, skull and face abnormalities, club feet, and other birth defects will be repaired before birth with intrauterine surgery).

If you're still interested in a garden variety nose job or other cosmetic procedure by century's close, don't worry. 'Genes are the days of the standardized 'Dr. Diamond nose' ' says Cohen. 'Today, we design a nose that goes with your face.' High-tech computer imaging (already used by at least one surgeon for correcting craniofacial defects) and foolproof surgeon-robots will all but guarantee success. If robots can build cars, asks Cohen, 'why shouldn't they do the mechanical work of surgery?'
Once with a word, Ray Bradbury saved Jack Clayton’s life. A hostile press had panned Clayton’s *The Great Gatsby* (1974) sight unseen, but as Bradbury recalls, he “went to see it opening night and liked it very much. Some of the early reviews were mixed. There may have been one or two negative ones. But there had been too much publicity we all knew that I sat down and wrote to Jack that very night ‘People are going to like it. It’s going to make money. Don’t kill yourself yet.’ Jack wrote back to me right away. Your letter came at just the right time, I was very depressed.”

Years earlier Clayton had saved Bradbury from a beating. It was 1955 Bradbury had nearly completed the screenplay for John Huston’s *Moby Dick*. Relations between the writer and the director could not have been worse. Following a London dinner during which Huston had ridiculed Bradbury’s friends and Bradbury had retorted with uncharacteristic venom, Huston rose, grabbed Bradbury by the lapels, and threatened to punch him out. “Shall I give it to him?” he cried. “Shall I whip him?” Clayton hustled Bradbury out of the restaurant and into a cab. “I really was destroyed,” Bradbury recalls. “I was in tears.

These are the ties that bind—and now, a long and sometimes painful path traversed, Bradbury the screenwriter and Clayton the director have made a film together, *Something Wicked This Way Comes*. The joint effort derives ultimately from ‘Black Ferris,’ a bit of Americana written by Bradbury and originally published in 1948 in the fantasy/science-fiction magazine *Weird Tales*.

Bradbury recounts the tale: “Mainly it was about two boys suspecting there was something wrong with the carnival that comes to town. They watch the carousel, and they see a man get on and ride backward and become a little boy. They follow him across town. When he comes back and rides the carousel forward, he gets older. The boys knock down the man in charge of the carousel and as it continues to revolve, the carousel man gets older and older and finally he’s killed by the process.”

Bringing that sketch to the screen has taken 35 years of options, scripts and heartbreak. Clayton himself considered it three times and consented to direct it twice before it actually got under way.

Bradbury had originally hoped to make a movie with Gene Kelly—he’d always wanted to work with him—when he saw Kelly’s 1958 film *Invitation to the Dance*. He started ruminating through his files and found the short story “Black Ferris.” “I started playing with the idea,” Bradbury recalls. “I was expanding the characters, working with the carnival。”

But Kelly wasn’t all that interested, nor was anyone else. To heck with it then, Bradbury thought. I’ll turn it into a novel! And he did, a brilliant but intriguing novel called *Something Wicked This Way Comes*. Since its publication in 1962, it has sold almost 15 million copies in paperback worldwide. But that did not get the movie made. There were decades of near-offers followed by rejections.

Finally, in 1980, *Something Wicked* began to roll at Disney Productions. By then, the simple tale of two boys and a sinister contraption had grown taking on moral and psychological dimensions. Now more than buddies, Jim Nightshade and Will (as in willpower) Holloway had become the draning/id and the cautious superego that Freud claimed lurked within us all. Will’s father Charles Holloway (Jason Roberts), the town librarian, had been added as a symbol of the sorrow of time and opportunity passing. The carnival had become Hells itself, its operator Mr. Dark (Jonathan Pryce) the devil, the Dust Witch (żeen Grier) the chief among his minions. Its barkers, freaks, and roustabouts had become the lost souls of carnivalgoers of a summer past. In this new and richly embroidered version the townspeople flock to the carnival where dreams of youth restored come true. Only Will and Jim are suspicious. Then Jim Nightshade’s guard drops.

The carousel used in filming was a
No one in the brief history of video art has shown greater sensitivity to the specific qualities of electronically recorded light and movement than Bill Viola. The subject of a 1982 retrospective at the Whitney Museum of American Art in New York City, Viola makes highly crafted and technically innovative tapes that analyze landscapes (and other natural imagery) with a kind of understated mysticism.

Recently Viola returned to the United States after 18 months in Japan. "It's the equivalent of a Renaissance painter making the pilgrimage to Italy," he told me before he left in 1980. He spent his first year there studying calligraphy and Zen. "I touched a video camera only once. Then it got intensive. After visiting various JVC, Hitachi, and Sony plants, Viola persuaded the latter corporation to accept him as an artist in residence, the first in Sony's history. "I was trying to get at the idea of an apprenticeship—the original way artists learned their craft—by going right to the source; usually by traveling long distances, and seeking out a 'master' to study with. Whether it be Zen or video at Sony, it's all the same."

According to Viola, Japanese television manufacturers are more interested in video art—particularly foreign video art—than their American counterparts, but he still needed to overcome some initial resistance. "I had to convince them that my feedback would be useful," he recalls. Sony's decision to underwrite his residency came with their realization that his projects could push the limits of their technology in ways that conventional productions would not. It also helped Viola feel that Tohio Miamoto—the senior general manager who authorized the project—was a Sunday painter and former resident of the United States. In any case, Sony would have been hard pressed to find an apter candidate.

At thirty-two the New York-born Viola has lived with electronic imagery all of his life. "I had a seven-channel childhood," he likes to say. Viola studied music and trained as a TV engineer at Syracuse University. In Syracuse, New York, where he helped install a campus-wide cable TV system, impressed by the work of structural filmmakers like Michael Snow and Ernie Gehr, Viola eschewed the sort of image-processed psychedelic Sturm und Drang practiced by many video artists in favor of something that was more contemplative and precise. By the late 1970s, he was mainly coaxing his special effects out of unmediated reality.

Viola's 1979 Chott el-Djerid, a relatively straightforward documentation of mirages in the Tunisian desert, is filled with such natural "processed imagery." This best known of Viola's tapes—named for the dry salt lake where it was mainly shot and subtitled A Portrait in Heat and Light—opens on a snowy midwestern tundra with an isolated farmhouse undulating in the cold. After a minute or so, Viola matches cuts to the middle of the Sahara and goes on to offer a half-hour fugue of Uta morganas. Bleached mosques seem to flutter like flags, shimmering buses are reflected in the road, sixes melt into Jovian situations. As otherworldly as a NASA documentary, Chott is also extremely painterly—its images suggest an uncanny synthesis of Claude Monet's haystacks and Kenneth Noland's stripes. If one believes that mental hallucinations are the manifestations of some chemical or biological imbalance in the brain, then mirages and desert heat distortions can be considered hallucinations of the landscape, says Viola. Taping in the Sahara was like physically being inside someone else's dream.

There's a sense in which Viola's best tapes could be considered visionary documentaries Vegetable Memory, which he shot on a brief trip to Japan in 1978 is an eerie and sensuous depiction of Tokyo's Tsukiji fish market. Fascinated by the assembly-line process in which huge frozen tunas were hacked apart and packaged for shipping, Viola repeats the same sequences over and over again, varying the speed from frenetic pixilation to superslow motion. The tape was shot off the cuff using a then-new Betamax camera lent him by a sympathetic Sony.

"Video treats light like water," says Viola. "Light becomes fluid on the video tube."
That rhythmic thumping you hear is the sound of recent Osborne-1 buyers looking themselves. Osborne's long rumored new model—called the Executive I—has finally arrived. It is one more in a series of portable-hardware introductions that have made pack-up-and-go computing the busiest area of the micro industry.

We'd never counsel waiting to buy a computer, but in the Osborne's case those whose nearly new machines are no longer top of the line deserve sympathy. In some ways, the recently introduced Osborne (see photo below) closely resembles the old, the differences make for a far more powerful computer. The Executive I still weighs 26 pounds, and the familiar "leaning tower" case with carrying handle has been changed only by the addition of a bulbous fan housing intended to solve overheating problems common in the Southwest. Inside is the same Z-80A microprocessor—the central data-processing microchip—that was used in the original model Osborne-1 (OS-1).

But a crisp, seven-inch amber monitor showing 24 lines of 80 characters replaces the OS-1s five-inch, 16-by-52 display. Two disk drives half as thick as those in previous models each store 200,000 bytes (characters) of data. The Executive I packs 128K of main memory—twice the OS-1s capacity. And its on/off switch is mounted on the front of the case instead of being hidden in a compartment at the rear, an annoying feature of Osborne's first machines.

Priced at $2,495, the new Osborne retains the OS-1s software for word processing, computer programming, and financial planning. The package includes some new programs as well. A new database-management system adapted from a minicomputer replaces the dBASE II (a sophisticated filing system) formerly offered. "Universal terminal emulation" disguises the Executive I as any of more than a dozen standard terminals, allowing it to talk over telephone lines with other computer systems. And the UCSD p-System, a combined programming language and operating system developed at the University of California San Diego, enables users to adapt their programs easily for use in other machines.

If all this is not enough, the $3,200 Executive II should be available this month. Physically identical to the Executive I, it offers twice as much memory and an 8086 coprocessor; a second microchip that can run most programs written for the IBM Personal Computer. It will even display IBM graphics on an external color monitor. The IBM operating system called MS/DOS, when used with other computers, will either be included or be offered as an option for the Executive II.

Since July 1981 Osborne has sold more than 125,000 OS-1s, shipping them recently at a rate of over 10,000 per month. Buoyed by a promotion in which the company had included the database manager dBASE II with its machines, Osborne sold its entire January production by the tenth of the month. Ten days later its February output was sold. The new models offer Osborne at least a hope of retaining its lead in the portable-computer market it founded.

Since last year, however, the company has faced growing competition. Kaypro hit the market first, offering a software package equal to the Osborne's, more disk space, and a nine-inch screen displaying 24 lines of 80 characters—all at the same $1,795 price of the basic Osborne. Recently a hard disk capable of storing 10 million bytes of data has been added—a feature Osborne has yet to match. Manufactured by Non-Linear Systems, an old-line maker of electronic test equipment, the Kaypro has been selling at a rate of 7,500 a month.

To date, at least 25 other portables have either been announced or reached the stores Apple IBM DEC and Radio Shack are all working on portables, and both Hewlett-Packard and Texas Instruments are advertising notebook-sized computers that use BASIC, a popular programming language. Among the noteworthy contenders for portable market glory (and considerable profits)
Ever since Advent introduced the first large screen projection television sets nearly a decade ago, major consumer-electronics companies have been vying to create the biggest, best and brightest video image. Now a British electronics firm claims it has come up with the ultimate technology for high-resolution, huge-screen TV—a system that projects a perfectly focused ultrabright image all the way out to the corners of a 36-foot diagonal screen. The secret: throwing out the cathode-ray tube (CRT) that’s been the heart of the television set since its invention in 1929.

Buck Rogers would be bowled over. Instead of a trusty CRT shooting a stream of electrons at a phosphor-coated screen—the new system uses nothing less than a high-speed laser “gun” that paints the image with a brilliant beam of light onto any surface.

In an ordinary color set, an individual electron gun is needed to produce each of the primary colors—red, blue and green. The electron beams are aimed at hundreds of thousands of phosphor dots on the screen, divided into three groups of colors. Deflected by magnetic coils, the beams are scanned across and down the screen in a 525-line-per-frame pattern. Dots glow when they are hit by beams. They don’t look like it, but television pictures are really electronic pointillist paintings.

In the new system, two ion lasers replace the three electron-beam guns. The laser light is split by prisms into separate red, blue and green beams, which are modulated and recombined into a very thin beam that contains all the necessary color components to paint the image accurately. A single moving dot creates the color picture. Replacing the electromagnetic beam deflection system in standard TV sets is a series of electronically controlled mirrors.

The high contrast laser-painted image looks vivid even in bright light. Its resolution is so great that typically fuzzy images like computer readouts look crystal clear when blown up to huge dimensions—or shrunk down to miniature proportions as minute as microcircuits.

Says a company engineer, “It makes the quality of previous systems look sick.”

The company behind the system, Transnational BV, in Cheshire, England, isn’t exactly broadcasting news of the new technology. The project has been cloaked in secrecy and both its inventor and manufacturer insist on anonymity until they are geared up for mass production and have announced marketing plans.

But company representatives say the laser projection system offers a long list of highly visible advantages. Using computer controls it can be constantly reprogrammed to display things as different as live sports events or stock-exchange returns. Any surface no matter what its configuration can potentially serve as a screen without affecting image quality. The system is completely compatible with today’s broadcast technology—but by increasing the speed of the scanning mirrors it readily adapts to future formats like HDTV (high-definition television which offers 1,125 lines of resolution).

This high-tech television system was hardly designed for the home, although one engineer confesses he can envision fat cats buying it to watch weekend sports. Indeed, the display is so flexible it will be used by its designers say for everything from laser billboards to flight simulators to teleconferencing.

But it is difficult to keep a good thing under wraps, and interested users have already inundated the company with requests. The BBC plans to use the system for monitoring their broadcast signal quality. NASA has ordered a laser projector for screening shuttle launches for the press. A coin museum in Saudi Arabia wants to use laser light to brighten up their displays of ancient currency. Says David Fishman, an analyst with Arthur D. Little in Cambridge, Massachusetts, who has seen the laser system demonstrated: “If offers great potential and a terrific range of applications. The day may come when every public place will be equipped with a laser projector to screen all sorts of visual information.”

-- Phoebe Hoban
Princeton University physicist Eric Hannah has an idea for a more powerful telescope. This one would let us peer millions of light years out toward the edge of the universe and still let us pick out details the size of continents on distant planets. A few light-years out we might even be able to discern objects as small as a house. With this instrument we could enjoy close-ups of such space oddities as supernovas, neutron stars, and black holes. It would be the Ultimate Telescope.

Of course, something this powerful would use the ultimate lens: the sun. Einstein was the first to appreciate that the sun can act as a gravitational lens because its powerful gravity bends light passing nearby (one of the corollaries of his theory of general relativity). In 1979 Stanford University radio astronomer Von R. Eshleman suggested such a lens might be used to build a telescope of exceptional power. And Eric Hannah, who was already experienced in grand-scale projects from having worked with colleague Gerard O'Neill on space colonies, had gone on to develop the megaltelescope idea.

The Ultimate Telescope would operate somewhat like a movie projector with the sun acting as the projector lens to focus a star's image on a target. Instead of a screen, however, we would host into space a large flat array of photodetectors—for visual images—and detectors for other wavelengths as well. The immense array would be equipped with rockets to aim and focus it, and what it saw would be beamed to astronomers on Earth.

Such a telescope design would have all the features desirable in a quality instrument. For example, a good telescope should make light more intense. The Ultimate Telescope would amplify the light from a distant star some 200 billion-fold. Indeed, a star barely detectable by the Space Telescope—expected to be our premier viewing instrument when launched in 1985—would appear in the Ultimate Telescope as dazzling as Vega, the fifth-brightest star in the sky.

Telescopes should show fine detail this one would show features 100 million times finer than the Space Telescope ever could. In viewing a star 16,000 light-years away, we could make out surface features only a few dozen kilometers in size. Even going out to the distance of the Andromeda galaxy—some 2.2 million light years away—we could get a sharp enough image of planets to detect continents the size of North America.

What is true for visible light is equally true at X-ray wavelengths. Thus a quasar at the very edge of the visible universe—something that would register as only a faint smear of light to the Space Telescope—would form a violent and intensely brilliant image in the Ultimate Telescope.

Nothing would be hidden from view. We could gaze upon billion light years away and watch whole stars and solar systems vanish into the maw of a black hole emitting bursts of X rays as they were swallowed up. We could zoom in on rapidly rotating neutron stars and pulsars and study the fine details of their surfaces. We could peer into the very heart of a red giant as its core collapses to form a supernova. When this happens, much of its energy dissipates into neutrinos, so elusive that special detectors have been able to capture less than 1 in 1 quadrillion. Yet using the sun's lens we could focus on the neutrinos to such an extent that we could follow a star's collapse literally microsecond by microsecond by concentrating on the emission of neutrinos.

Extrasolar planets would be another specialty of the Ultimate Telescope. People already are hoping that the Space Telescope will settle the question of whether Barnard's Star, six light-years away, has planets, but at best the largest of them would show up as tiny spots of light, barely discernible from the glare of nearby Barnard. The Ultimate Telescope, by comparison, could show objects the size of houses on each planet. Planets of nearby stars would seem almost uncomfortably close. As Hannah puts it: We're talking about looking intimately a few light years away.
Darkness settles in at the behavioral study center of Wolf Park and in the scientific observation hut; a single lamp permits the occupant to continue working. Close by the wolves, twilight creatures whose nocturnal exploits were once the stuff of legends and nightmares, flex their lean limbs and begin to prowl. With no apparent provocation, a silhouette entreats the moon with a lingering plaintive howl. Soon other voices echo this haunting call and the resulting chorale is a celebration of wolves and wildness that both chills and thrills the human listener. The observer pause, stirred by ancestral memories of a time when the differences between man and beast were less distinct. Imagination scars civilization's artifacts dissolve. Like the heralded Wolf Warrior of the Cheyenne Plains Indians, the human spectator abandons self and briefly unites with the soul of the wild.

For centuries wolf lore has dominated our fears and fantasies. Sometimes revered, but mostly reviled: the wild canine has historically been cast as a villain—the nemesis of humans, livestock and wildlife—a misconception that has forced the species to the brink of extinction. But modern ethologists, such as Purdue University's Erich Klinghammer, the founder of Wolf Park, have now established that the wolf is a valuable predator whose complex pack life is a unique model of social interaction and cooperative effort.

Situated in the rural farming community of Battle Ground, Indiana, the 75-acre research facility, which doubles as a wildlife park, is the home of the most studied captive pack of wolves in the world. Although tame, the animals function much as their wild fellows, with a notable exception: Wolves in the wild are shy and avoid contact with people. At Wolf Park, the socialized animals nonchalantly accept human scrutiny, providing the scientist with an unprecedented research opportunity and the visitor with a rare glimpse of a wildlife heritage that has largely vanished from the United States. Wolf-society leadership is invested in a dominant pair—the alpha male and female—and individual rank is determined and maintained through ritualized behaviors. In the body language of wolves, an elevated tail, for example, is a sign of self-confidence and exposure of the belly or genitalia indicates submission. Wolves are opportunists and look for a chance to move up the social structure. Consequently rank—particularly among yearlings—can change rapidly.

As a trio of gangly youngsters cavort, Klinghammer explains, "During such activity, young wolves learn to judge one another's strengths and skills. This serves an important social function because as adults, they must keep informed about the condition and disposition of other pack members."

At the onset of the breeding season in mid-January, activity heightens and social standing is most likely to change. Observers monitor the pack 24 hours a day, noting the hierarchy of behaviors exhibited by the animals. The alpha male courts the alpha female, and during the three days within her estrus cycle, he allows no other male to approach her. The guarding behavior is triggered by the secretion of a pheromone by the female and may coincide with ovulation, providing the male with a natural mechanism to ensure the pups' paternity.

Although wolves display male preferences irrespective of social rank, often only the dominant pair produce a litter that is reared by the entire pack. Pack living evolved as a survival strategy and cooperative hunting enables social carnivores to take on larger and more formidable prey. As a small crowd assembles in the observation tower overlooking the 17-acre bison enclosure, Klinghammer below leading a mature 70-pound wolf informs his audience. To properly study the wolf, you must also study his prey and his environment. Currently Wolf Park is the only wildlife facility where one can observe dynamic predator-prey interactions. These encounters add the distinguished German-born ethologist, Erich Klinghammer, to the list of distinguished researchers who have influenced our understanding of the natural world.
CONTINUUM

MANUFACTURING BREAKTHROUGHS

All right. Information theory is great. You use it to send messages around the world through heavy static. It can, reportedly, even forecast the weather years in advance, foretell the death of heart patients and predict tomorrow's gold prices. But come on, can it really promote scientific breakthroughs?

Arthur Damask thinks so. A physicist at Queens College in New York City, he says that breakthroughs do not always strike unpredictably. Progress is not always dependent on a physicist serendipitously sitting under the right tree and being hit with a law of gravity provoking apple. Rather you can guess which experiments will pay off and even promote major new discoveries. All it takes is a little math.

Damask developed his idea after studying the work of Yaie science historian Derek de Solla Price. Science grows steadily, Price found, not in fits and starts when major breakthroughs are made. It doubles and redoubles continuously until it runs out of personnel or money—just as yeast cells in a flask grow until they run out of nutrients.

Major discoveries—ones that change the course of science and technology—follow the same predictable pattern. As scientific knowledge accumulates and more scientists and money become available, breakthroughs steadily grow more common.

Damask believes that this pattern applies to individual laboratories. The larger and wealthier the lab, the better the chance it will produce significant discoveries. To get the best results, simply throw the right number of men and the proper amount of money at problems that are likely to produce startling results. That is where information theory comes in.

Information theory was developed in the 1940s by Claude Shannon, a scientist working at Bell Laboratories. One of Shannon's key insights was that the less likely a letter is to appear in a message, the more information it carries. For example, a code is more easily cracked if unusual letters such as Z appear in the message than if only common letters—E, T, or A—are found.

Science works the same way, the more surprising a discovery, the more useful it is. As one example Damask cites a new family of superstrong ceramics formed by mixing chemicals with a gel and setting them at low heat. "Everybody eats Jell-O," he says, "but no one thought of mixing ceramic powders with gelatin."

The first such ceramic was an astonishing breakthrough, the rest will most certainly be useful but far from earthshaking.

The best research managers intuitively back experiments that may give unexpected results. Damask believes that information theory could turn this seat-of-the-pants art into cold, efficient mathematics. Shannon's equations, after all, deal with probabilities. It makes no difference what they're used to predict. Apply them to a group of experiments and it's no longer necessary to guess which one has the best chance of yielding a breakthrough, the equations give a precise figure. That experiment should get the most money and personnel. The equations also tell just how much funding it should get.

How much will the added precision improve a lab's performance? "Three hundred percent or more," Damask estimates.

He recently offered the idea to other scientists at a seminar presented at New York University's (NYU) Center for Technology and Science Policy. The proposal received a warm welcome from Sidney Oldberg, a project manager at the Electric Power Research Institute, in Palo Alto, California, has been using information theory for about six years to predict the reliability of reactor-core materials. Using the technique to manage research programs he says, "sounds like a fruitful approach."

Scientific research sorely needs some such management technique, Damask stresses. In conversation with a research director of a major electronics firm, Damask asked who kept track of how well the company's experiments paid off. "Nobody," he replied. At another company, he found, scientists decided how much to spend on research by reading their biggest rival's annual report.

Yet, not everyone has welcomed Damask's idea. Historian Sidney Bradford objects that "in any man's life social factors come to bear—marriage, the impact of peers, rival attractions. How well the lab is run is only part of what affects a researcher's output." And though Damask and the NYU Center have been consulting with research directors at three major corporations, not one has agreed to adopt management by equation. Herbert Fusfeld, the Center's director, speculates that lab managers do not want outsiders to evaluate their performance. "We have a hunch that they are nervous about how it will look when we examine the data."—Anthony Liversidge
CONTINUUM

Pigeon Literati

It's not exactly pigeon English, but three feathered subjects in a recent Brown University experiment have mastered the alphabet.

In individual "classrooms"—boxes equipped with Atari home computers and television screens—three male pigeons learned to distinguish all 26 letters. For about four days, each studied a target letter, and when that letter appeared on the screen in random combinations with two other letters, the bird had to peck the correct one. A computerized record of the pigeons' four-month trials revealed that bird brains are surprisingly like human ones. At any rate, pigeons and people find the same letters easy—or difficult—to tell apart, reports psychologist Donald Blough. "Take D and Z. Pigeons could tell the difference 92 percent of the time. But when it came to distinguishing U from V, look-alike letters often confused by human children the accuracy rate sank to 34 percent."

"I wanted to find out how different creatures see the world," says Blough. "The fact that pigeons and humans perceive in similar ways suggests there is something fundamental about the pattern-recognition process."—Phoebe Hoban

Chinese Cheats

It was an old story. Scientists were fudging their data, gilding their credentials, and claiming false authorship of certain manuscripts. Only this time the scene of the crime was not the decadent West, but the People's Republic of China.

In recent months the Bamboo Curtain has parted slightly to reveal an unfamiliar side of Chinese science. Some scientists report the Peking Review, sloop to "deception by doctoring data and research results in their pursuit of personal fame and gain. Some even resort to plagiarism." Another journal tells of lesser misdeeds, like breaking up a paper into smaller articles to gain more publication credits.

Why the cheating? "First there is the same desire for advancement in China as here," explains Leo Orleans, a China specialist with the Library of Congress. "Then, many of the people in charge of the research institutes have no science background at all. And Chinese researchers are under great pressure to modernize their country's science and technology overnight."

Orleans says—Marcia Bartusiak

FUTURE FARMS

The Age of the Wheel is waning—on the farm.

By 2030 sophisticated "crop-scanning gantries" bridgeike frameworks traveling on permanent rails will probably replace the tractor, predicts one far-seeing agricultural engineer. The land will profit.

Because heavy farm vehicles chew up the soil and structure notes John Matthews, head of the Tractor and Cultivation Division of England's National Institute of Agricultural Engineering most seeds are now planted at a depth of 200 millimeters.

Not so with the farm gantries. Spanning 15 to 20 meters of crops and cruising along tracks of porous stones or synthetic materials they'll permit farmers to sow seeds only 50 millimeters deep. The new-age vehicles will also plant fertilize, irrigate, and test trace elements in the subsis. And their computers will automatically make adjustments for sloping fields.—Dava Sobel

One of Blough's three pigeon students in its computer-equipped learning box. Bird brains are capable of mastering the ABCs.
SEAOS OF EUROPA

When the two Voyager space probes raced past Jupiter and its moons, they spied neither frothy waves nor sandy shores. But scientists now believe there's a vast ocean hidden beneath the frozen surface of Europa.

At first glance, icebound Europa—one of Jupiter's major moons—looks as smooth as a giant white billiard ball poised in space—quite different from her sisters Io, Ganymede, and Callisto. Though a network of fissures spans Europa's surface, large hills and craters are almost nonexistent. But recent calculations by planetary researchers at NASA's Ames Research Center in California tell another story.

Beneath Europa's icy crust, propose Steven Squyres, Ray Reynolds and David Colburn, lies a liquid ocean some 30 miles deep. Radioactive decay in the satellite's interior and the huge gravitational pull of nearby Jupiter likely keep the underground sea thawed. What's more, the NASA Ames team speculate Europa's huge surface cracks should let in enough sunlight to support photosynthesis—and perhaps life.

Volcanic vents on the ocean bottom and electrical surges induced by Jupiter's gravitational field might also provide energy for life forms. Such a scenario has already been envisioned—by Arthur C. Clarke in 2010 Odyssey Two.

"While I wouldn't bet my rent money that life came into being on Europa," says Squyres, "it's interesting to note that a European ocean would resemble a life-supporting environment on Earth." The large masses of algae thriving beneath Antarctic lakes, for example, would probably feel right at home. Meanwhile NASA's next probe Galileo, may bring home more evidence of the hidden alien sea.

Marcia Bartusiak

"We cannot command nature except by obeying her."
—Francis Bacon

POLLLUTION SOLUTION

Take a horseradish and mince it very fine. Add hydrogen peroxide and blend. Then strain the mixture through cheesecloth.

Brewed by Alexander M. Klibanov of the Massachusetts Institute of Technology's nutrition and food-science department, the recipe reportedly detoxifies wastewater produced by chemical and coal-processing plants. Its specialty is cleaning up PCBs and polychlorinated biphenyls (the name is based on their resemblance to the dread poisons that have made headlines at dump sites from Love Canal to Imperia, Missouri.

Horseradish? The humble root contains the enzyme peroxidase. When mixed with hydrogen peroxide and added to wastewater, it triggers a chemical reaction that causes phenols and aromatic amines, the two main wastewater toxins, to solidify. The chemicals form a long chain that can be removed as a sediment or burned as fuel. What's more, while current methods take days to clean up waste, Klibanov's method works in just hours.

While his recipe awaits a patent, Klibanov is at work on another for ridding nuclear plant waste of radioactive tritium—Phoebe Dohan

"A vacuum is repugant to reason."
—Rene Descartes

Cleaning up toxic chemical waste. An MIT professor claims his horseradish recipe will do it in a few hours instead of days.
RESCUE SHUTTLE

In the not-too-distant future, a space station may be imperiled by a rapidly approaching meteor shower. How will the crew be rescued? Perhaps with the "minishuttle" now being designed for the Air Force by the Boeing Aerospace Company, of Seattle.

Still on the drawing board, this reusable spacecraft would be a mirror image of the NASA shuttle, but only one third the size. It would have a 30-foot wingspan and a 62-foot length, and it could blast off from atop an in-flight Boeing 747.

A modified 747 loaded with the minishuttle, the aerospace company says could take off from any major airport within 100 minutes of an alert. When the plane reached an altitude of 37,000 feet, the minishuttle would ignite its engines and catapult into orbit. An external fuel tank would drop off when empty and disintegrate in the atmosphere, but the craft would carry enough fuel for orbital maneuvers and reentry.

As now conceived, the minishuttle is an unmanned vehicle. It could ferry satellites into space or perform reconnaissance missions. But Boeing says the design can be altered to accommodate crew and passengers. "If the Air Force decides to build this craft, says a company spokesperson, "it will be ready in five years."

Engineer Dick Bornhorst, of the Rocket Propulsion Laboratory, at Edwards Air Force Base, in California, says the minishuttle is "feasible engineering-wise." But he notes the Air Force has made no decision on the project — Eric Mishara

"Look at your watch and tell what time it is. You do not know what will happen in the next five minutes of your life." — Leopold Stokowski

BIRTH-CONTROL PLUGS

The perfect birth-control method for women would be 100 percent effective. It would require only one treatment for permanent protection and could be reversed in minutes whenever children were desired. Now a product that fits the bill may soon be available. It consists of two small, rubbery plugs that block the fallopian tubes, keeping the egg from passing through to be fertilized.

The procedure has been tested in 950 women, with no reported pregnancies, according to R S P Laboratories, the Stamford, Connecticut developer. Only three women developed side effects that dictated the removal of the plugs.

Doctors make the plugs by injecting liquid silicon directly into the fallopian tubes' opening. Once the silicon hardens, it fills two thirds of the tubes. A thread embedded in the plugs facilitates their removal.

The procedure can be performed with no anesthesia in a doctor's office with little if any discomfort, according to gynecologist Theodore Reed, of Philadelphia's Landoneau Hospital. Eliminating the hospital stay cuts the cost of sterilization to about half that of other methods, he adds.

The plugs are now under review by the Food and Drug Administration. R S P officials report: If all goes well, the plugs should be on the market by year's end — Rick Boling

"A student who changes the course of history is probably taking an exam." — Franklin P. Jones
**SEXY BREATH**

You can determine the sex of your peers by the smell of their breath alone according to a team of scientists at the University of Pennsylvania.

To sniff out its results the research group asked 19 female and 14 male college students to refrain from brushing their teeth or eating spicy foods for five consecutive days. Then five male and five female judges were separated from the test subjects by a screen in a large, well-ventilated room. Each subject was asked to blow into a tube passing through the screen to the judges on the other side. Finally the judges tried to guess the sex of each test breather while ranking his or her breath according to its intensity and pleasantness.

"What we found," says researcher Samuel Yankell, "was rather surprising because the sex question really came as an afterthought. Both male and female judges correctly guessed the sex of the breath donors up to 95 percent of the time. The female judges were better at identifying male breath and the male judges were slightly better at identifying female breath. Apparently it is easier to identify the opposite sex," Yankell says.

In general male odors were found to be more intense and less pleasant than female odors. The researchers, including Richard Doty, Paul Green and Carol Ram, believe this may be due to a hormonal difference between the sexes—Marc McCutcheon.

"It is better of course to know useless things than to know nothing."—Seneca

**INFECTION-FIGHTING BLOOD VESSELS**

Artificial blood vessels have been used to bypass arterial obstructions and clots since the 1960s. The vessels, made of Dacron and other biologically neutral materials, are not rejected by the immune system. But areas in contact with the synthetic vessels are vulnerable to infection, usually from staphylococcus bacteria. Up to 6 percent of graft recipients develop infections despite antibiotics and more than 30 percent of these die.

Researchers at the University of California at Los Angeles think they may have the solution. They are bonding to blood vessel materials an antibiotic that fights staphylococcus. The vessel will then kill bacteria in the graft site for several weeks after surgery.

Vascular surgeon Wesley S. Moore, head of the project, says experiments with dogs have shown the technique to be highly effective. He plans to start human trials soon.

The technique may eventually be used in other synthetic body parts from artificial heart valves and pacemakers to hip joints—David L. Dreier.

**WALLPAPER WATERLOO**

Armed with tests showing arsenic in Napoleon's hair, many historians have claimed that the exiled emperor was the victim of a poisoning plot. New evidence points to a less diabolical demise: a study shows the former conqueror in his room.

"The wallpaper was harmless as long as it was dry," Jones explains. "But when it got damp, mold grew and turned the arsenic toxins into vapors, which were breathed by people in that room."

Though arsenic fumes probably didn't kill the exiled leader, says Jones, they no doubt contributed to his ill health. Napoleon suffered for years from malaise—shivering weakness stomach pains and swollen limbs—all symptoms of arsenic poisoning—and visitors often complained of the "unhealthy atmosphere" at his retreat. "Now," says the historian, "there is no real reason to argue with the original autopsy report which stated that Napoleon died from an ulcerated stomach."—Sherry Baker

"Heroism, the Caucassian mountaineers say, is endurance for one moment more."—George Kennan

No snowflakes in an avalanche ever feel responsible—Stanislaw J. Lee

Napoleon died with traces of arsenic in his hair. Was he the victim of a poison plot or his drawing room wallpaper?
TEDDY BEAR THERAPY

The teddy bear's chest rose and fell, creating a heartbeat sound for the tiny infant beside it. The baby nuzzled the animal's pulsating fur, unaware that such rhythm might calm his own spasmodic movements and help heal his damaged nervous system.

This infant, like many premature babies, had a central-nervous system disorder that caused him to move erratically, breathe unevenly and pass from light to heavy sleep with no regularity at all. If uncorrected, the condition could render the infant vulnerable to sudden death. And if the child lived, he might grow up to be hyperactive or, worse, mentally retarded.

But University of Connecticut psychologist Evelyn Thoman may have a treatment. She believes that the pulsating rhythm of a mechanical teddy bear will improve more effective. The reason: its rate of breathing is similar to the baby's own. In addition, the therapy may be fine-tuned by the infant himself, who has the option of either using the breathing bear or rolling away—Madeleine Lebovich

ROCK-EATING BEHEMOTHS

A group of gigantic extinct marine animals that coexisted with the dinosaurs had an odd propensity for eating rocks. In fact, scientists have routinely found 15- to 20-pound caches of spherical stones nestled in the animals' fossilized remains. Some say the rocks helped these great beasts called plesiosaurs grind up their food. But geologists David Darby and Richard Ojakian of the University of Minnesota disagree. After discovering about 100 rocks in a Montana skeleton, they hypothesized that the stones provided ballast for swimming—Clifford Odets

According to Darby, the food grinding theory is implausible because plesiosaurs simply didn't have gizzards, which aid digestion in turkeys and other birds that ingest small stones. Furthermore, at least one contemporary reptile—the primitive African crocodile—swallows stones for balance. Even those that live in swampy areas with few rocks manage to acquire them, he explains. Young crocodiles without stones are tail-heavy, top-heavy and seem to have trouble balancing in water.

Doubters say the plesiosaurs would not be smart enough to swallow stones to improve their swimming prowess. Darby argues that their small brains were inadequate and the behavior could have been instinctual—Dava Sobel

In my opinion, the universe is governed by a committee. One man shouldn't have made so many mistakes—Clifford Odets

The ancient plesiosaurs, seen here above, may have swallowed rocks in order to improve their balance while swimming.

48 OMNI
INSECT SQUADRONS

It's five miles across, ten miles long, and flies through the air like a squadron of bombers in formation

No, killer bees aren't on the way. Department of Agriculture researchers tracking the ominous flying cloud on their radar screens are watching such plebeian farmer's foes as corn earworms and cabbage loopers. Their findings could give farmers a pest early warning system.

Using trailer-mounted antennas and computer-controlled weather stations, the team has been learning how atmospheric conditions affect insect flight patterns. According to Wayne Wolf, the team's agricultural engineer, they've already discovered that bugs fly in uniform layers not in shapeless swarms: Their squadrons are most dense after sunset. And they fly as high as 7,000 feet where faster winds propel them.

The radar isn't yet capable of distinguishing between different types of insects, says Wolf. 'But it can help by estimating how many are aloft.'

—Phoebe Hoban

We are all in the gutter but some of us are looking at the stars.

—Oscar Wilde

PLASTIC TEETH

Plastic wrap the kind that guards food from staleness might have inspired a promising dental innovation: a liquid plastic that hardens to a cavity-resistant surface when applied to teeth.

According to dentist James Williams of the Medical College of Georgia, a single application of the plastic was administered to a group of 400 elementary school children in 1976. Today 68 percent of their teeth are cavity-free. And without the plastic coating, Williams says, only 50 percent of the teeth would have escaped decay.

Only the grooves and valleys in the biting surface of the tooth—the areas most liable to decay—need be coated, says Williams. Routine application of the sealant to worn spots, in conjunction with fluoridation and brushing and flossing, would result in almost 100 percent cavity prevention. And the cost of sealing a tooth is less than a filling.

The dental plastic, known as 'pit and fissure sealant,' has been approved by the Food and Drug Administration and is available to dentists. —Eric Mishara

LOVE FORMULA

How long will it take you to find true love? Just solve the following equation:

\[ M = 0.7 \]

\[ O \times S \times A \times D \times I \]

The answer is the number of months (M) you'll have to wait before you meet Mr. or Ms. Right.

The formula, the brainchild of psychologist Jeffrey Young of the University of Pennsylvania, is a mathematical statement of the factors involved in intimacy. I found that telling a patient something like 'You're too selective, just didn't work, says Young. 'I had to develop something more concrete to bring home the effect of, say, meeting just one new person a month.'

Interviewing lovers and seekers, the psychologist searched for the reasons some people take two or three years to find romance, while others work much more quickly. Sheer attractiveness was not the answer. Opportunity, selectivity, approach, desirability, and intimacy were.

Opportunity, the O of the formula means the number of eligible members of the opposite sex to whom you're exposed each month. Selectivity (S) is the percentage of those you meet whom you find desirable. Approach (A) stands for the percentage of those who agree to go out with you.

Finally, intimacy, or I, is the percentage of dates that lead to an intimate relationship of at least six months. It's based on your track record and your current rating of your ability to create intimacy. As for the 0.7, it stands for the 70 percent probability that the equation's answer will be true.

—Robert Deckert
PHONY PSYCHOSIS

Should you get the urge to feign insanity don’t do it, advise psychiatrists at McLean Hospital in Belmont, Massachusetts. The ticket you win to the wane world of basket weaving and unseen voices may be one way because, according to a new study, fake psychosis can be more dangerous than the real kind.

Why? People who mimic hallucinations or other psychotic behavior usually suffer from underlying personality disorders,' Harrison G. Pope and his McLean Hospital colleagues report. The nine eratc psychotics they studied actually fared worse than real manic-depressives and even some schizophrenics. Eight of them spent months or years in mental hospitals and one committed suicide.

“There is no pill to cure a personality disorder,” notes Pope. What’s more phony psychotics may suffer uncomfortable side effects from antipsychotic drugs and waste time while the real problem gets worse.

Since there’s no way to verify another person’s hallucinations, it’s not easy to spot the fakers. Still, the McLean psychiatrists suggest a few tip-offs. Does the patient confess to having control over his craziness? Are his hallucinations obviously fanciful? (One pretender “saw” nude one-armed Africans dancing on the ceiling.) And do his symptoms appear and disappear instantly, as happened to some would-be psychotics who recovered after taking a single pill?

—Rick Boling

"Stars scribble in our eyes
the frosty sagas,
The gleaming cantos of unvanquished space"

—Hart Crane

MOM CHEMICALS

The special emotional bond between a mother and her child is more than psychological—it’s biochemical. Harvard Medical School neuroendocrinologist Robert Bridges tells us anything about humans.

Bridges and his team are testing the role of "mom chemicals" in rats, whose maternal actions are far easier to quantify. They are finding the desire to feed and protect one’s young stems to a surprising degree from the body’s hormones.

In one study male rats and childless females turned into model mothers following doses of estradiol and progesterone, female hormones that surge during pregnancy. Within two days even the males were building nests and crouching over the young to warm them. The intensity of a human mother’s response to her newborn—especially her first—may depend greatly on such hormones, Bridges speculates.

That’s not all. Our brains natural opiates such as beta-endorphin and the enkephalins, also influence motherhood chemistry. Since beta-endorphin levels seem to increase throughout pregnancy and drop right after birth, Bridges thinks the opiate reduction may trigger maternal feelings. When the researchers treated pregnant rats with morphine to artificially maintain their high opiate levels the rats behaved unnaturally. When the morphine treatment ended the signs of proper rodent mothering returned.

"Maybe” says Bridges, "very high dosages of opiate-like painkillers during childbirth interfere with or delay the mother-child bond."

Marcia Bartusiak

"People think too historically. They are always living half in a cemetery."

—Arístide Brando
First the newborn lambs died, then older sheep. Then the cloud engulfed the valleys.

THE DAY WE BOMBED UTAH

BY JOHN G. FULLER

The night was quiet except for the bells of the sheep. On the winter range they were restless. It was mid-February 1953, a soft 49°F. Freezing rain soaked the sheep wagon and the wood stove took the chill off the chaff. Even before first light Kern Bullock and his brother Mac would be saddling up their horses to guide their band of nearly 2,000 Hampshire sheep on the trail toward Utah. Toward home.

There was more than 100 miles to go, from north of the Lincoln Mine in Nevada, traveling eastward along Tulehoo Valley, Dry Lake, and Panaca, and on home to Cedar City. Kern, lean, timber, and slight, loved the range with a passion Mac Bullock, broad-chested, with a cherubic look, felt the same way.

The sheep traveled and grazed about six miles a day, grazing their muzzles deep into the snow and pushing nearly six or seven miles of the ranges, or the roots of the black sage, saltbush, and palo verde gras. The Bullock brothers were accustomed to the silence and loneliness of the Nevada range. But they could never get accustomed to the violent bursts of the atom bomb tests at Yucca Flat, just 40 miles away. Some of the test bombs would yield more than four times the kilotons of the bomb that had leveled Hiroshima eight years before.

The mushroom cloud, fiery and turbulent, would boil upward, just before sunset to create a false dawn. The Bullock horses would rear up, the sheep would scatter, and the dust cloud would sweep toward them, the range dust andfust.
THE DESERT SHOOTING AND JOHN WAYNE'S DEATH

July 6, 1954, was a lusty and cheerful day in St. George, Utah. The local Elks lodge played a charity softball game against a film company on location to shoot a movie called The Conqueror. Several things happened.

Susan Hayward kicked off her shoes, ran the bases barefoot, and scored a run. John Wayne and Dick Powell scored two runs each and signed autographs. Agnes Moorehead cheered from the grandstand.

Now, nearly thirty years later, all four of the superstars are dead from cancer. More than 200 in the cast and film crew worked with them in the sands of the desert. Nearly 100—almost half—have come down with cancer. Half of that group have died from it.

There were no nuclear tests at the Nevada proving grounds in 1954. But the cumulative fallout of all the Upshot-Knothole tests of 1955 covered the ground in uneven blots, most intensely in and around St. George and nearby Snow's Canyon, where most of the footage was shot.

The Conqueror was an expensive but shoddy production about Genghis Khan and the Mongol warriors. The script called for some of the dirtiest, grimiest battle scenes ever filmed. All during the shooting actors and extras rolled in the sands in mock battles. Desert winds blew incessantly. When they didn't, huge electric blowers were brought in to simulate the winds. Tongues, teeth, and gullets were coated with grime. Everything was covered with windblown soil. So much dirt collected in the costumes that actors had to be hosed down before they took them off. Those who weren't working in front of the cameras tried wearing face masks, which were ineffective.

Since inhalation and ingestion are the most deadly forms of exposure, the danger was exacerbated. Many fission products like strontium 90 and cesium 137 decay slowly. They are dried on the surface of the soil by rain and snow. At times they paracolate upward. When the soil is stirred up, the buried poisons emerge again.

Michael Wayne (at right in photo above), now in his late forties, was on location with his father, along with his brother Patrick (at left in photo). Michael has recovered from skin cancer. Patrick, now in his early forties, has had a benign tumor removed. They are concentrating on making the John Wayne Cancer Center at UCLA, the best in the country. "I think it's the best possible tribute to Dad," Michael says.

Michael is not an antinuclear activist. He is all for nuclear power. But he says, "I don't want 'em doing all this if it's not safe. The government just can't walk over people. The greatest crime is a cover-up, whether it's Watergate or nuclear radiation." There could be no harm, of course. Press releases from the Atomic Energy Commission (AEC) stated that the fallout "does not constitute a serious hazard to any living thing outside the test site."

For some reason the test shot that came in the predawn of March 24, 1953, seemed different to Kern Bulloch. The ground shook more. The sheep were more frenzied. Red the sheep dog jumped into the sheep wagon and covered. The mushroom cloud capped with a crest of ice crystals, soared to 40,000 feet above them. Kern covered his eyes. He thought he could see the bones through his clamped fingers.

What neither Kern nor Mac Bulloch realized at the time was that they were to become unwitting principals in a tragedy. At first the cloud of tragedy would pass over their herd. Then it would engulf hundreds of humans. The cloud would not dissipate in their lifetimes. And despite 30 years of strenuous government efforts to deny the tragedy, it hasn't ended today.

Some 20 miles to the south, thirty-one-year-old Bob Sheahan watched from the Groom Mine. He had once been an engineering student at the University of Nevada. He, his father, Dan, had already seen nearly 30 radioactive clouds pass by since the tests started two years before. He had taken photographs of many. The clouds were heavily laden and dirty. The Groom Mine a cluster of a dozen buildings and cabins sat on the eastern border of Nevada Proving Grounds, in the path of the winds that blew to the north and east.

As the clouds and dust from the March 24 detonation headed north from Yucca Flat and toward Bald Mountain near the mine, Bob Sheahan went down to one of the cabins to see if William Holly, the radiation monitor from the Public Health Service, wanted some, but he couldn't enter his radio and telephone equipment which he had set up for the job. There would be messages coming in from the other monitor posts to track the fallout. From nearby Tamahge, Lincoln Mine, and Control Point.

Holly was occupied with a broken generator when the phone rang in the cabin. He asked Bob Sheahan to get the message. On the phone was Holy's counter part out near the Lincoln Mine. The radiation reading there and for the valley where the Bullochs were was very hot.

A few miles from Lincoln Mine the Bulloch brothers on horseback herded up the stray sheep and watched as the dusty haze closed in. According to legend, on a clear day you could see a train coming two days away. Today was nothing like that, but they could see a jeep speeding toward them on one of the few roads that cut through the desert. In the jeep were several men. They pulled up close to the Bullochs and got out looking worried. They were wearing plastic boots. "You fellows are in a helluva hot spot," they said. "You better get out of here fast," Kern Bulloch asked. How
can we do that? The sheep move six miles a day. The answer was: "Move them as quick as you can think. This is no place to hang around." Then the jeep drove away.

The Bullochs had never heard of a range fire but the herder claimed they did the only thing they could. They hustled their sheep east, away from the blaze, toward Utah.

Later that day Bill Holley filed in the Sheep Ranchers report: "Bulloch’s decision to move was good. The last big fire burned at the 110th position. Nothing could be done about the two sheepmen. On the range the Bulloch brothers continued to trail the sheep home. The ewes were a mile away from lambing now. By May the lambs would be full of mother’s milk and would be able to move out."

The Bullochs had a feeling that the fire would be out. They were glad the lambs could see the fire. The show of fire was a sight that would make the lambs grow strong. They were glad to see the fire and their mother’s milk would make the lambs grow strong.

The fire was bad but the Bullochs were glad to see the fire. They had a feeling that the fire would be out. They were glad the lambs could see the fire. The show of fire was a sight that would make the lambs grow strong. They were glad to see the fire and their mother’s milk would make the lambs grow strong.
miles long. Nothing like this had happened in the history of the region.

The name of that test shot on March 24, 1953 was Nancy. It was shot number two of the series known as Upshot-Knothole. Nancy packed power. She was 24 kilotons of blast that of the Hiroshima bomb. She was fired at Yucca Flats as she sat in a catnap atop a 350-foot steel tower. which was vaporized in a fraction of a second.

Rain or snow had to be carefully monitored. Either could bring down tightly packed fallout in a concentrated lump. To fire or not to fire was never an easy decision. It took the test manager, test director, and an advisory panel of experts to decide. Though they could postpone a shot, the major plans and decisions were made by the AEC in Washington. The commissioners operated under uncommon pressure and a sense of urgency.

Throughout the country patriotism was rampant. If you were against nuclear testing, it was suggested that you might possibly be a Communist. War was raging on the Korean central ridges. McCarthyism was spreading like it had been inaugurated Stalin had died, but the Cold War was hot. The Soviet Union had just detonated its own nuclear device, and the American nuclear monopoly was broken. Tests in the Pacific were too expensive. They took too much time and travel. The sites were vulnerable to enemy attack. In spite of intense debate, Nevada was the tactical choice. Not the popular choice. Shots like Nancy were not popular.

Nancy had considerably exceeded the estimated yield. No one knew exactly why. The AEC's Dr. John Bingham briefing the commissioners, said that some locations had been hit with as much as 10 rads, but only that triply populated areas had been affected. But then there was a sharp rainout from a subsequent Upshot-Knothole shot on April 25, at Troy, New York, creating a hot spot a day later some 2,000 miles away. The commissioners talked about the chances that had to be taken to meet a tough test schedule. Later reviewing the long sequence of detonations, commissioner Thomas Murray summed up everything in an elegant double negative. "We must not let anything interfere with this series of tests—nothing."

The average American was confused about the tests and about radiation. What were rads? roentgens? They are practically the same in value. If you were talking about boxing, the roentgen would be the punch, and the rad would be the impact absorbed by the body to which landed. About 400 rads would kill half the people who were exposed from head to toe in about 30 days. The longer the exposure, the greater the damage. The exposure (often quoted in rads per hour) comes from the fallout fission products—like strontium 90, cesium 137 or iodine 131—released at the time of the explosion. When these products rain down with the fallout, they emit the whole ghoulsh family of alpha, beta and gamma rays, which have little respect for living tissues. They can't be seen, heard, tasted or smelled.

Health physicists worry most about gamma radiation to the whole body, inhalation of the fission products, or ingestion through contaminated food. Beta rays can cause surface burns, but the real danger comes when they get to the gut. Once an exuberant AEC public information man tried to soften the ugly potential of fallout by calling the radioactive poisons sunshine units.

The limit for a whole-body external dose is considered to be no more than 5 rads in 30 years. But there are different standards in and around atomic installations. One standard limits exposure to 3.9 rads over a 13-week period. Several studies, however, have concluded that there is no safe radiation dose at all.

Whether the fallout lands in Cedar City, Utah, or Troy, New York, it doesn't land in a smooth, even layer. It falls in unpredictable globes like paint being splattered on a Jackson Pollock canvas like summer squalls hitting in spots across a lake.

As the sheeple in Cedar City were reeling under the piles of dead sheep nothing stopped the test shot on May 19, 1953 called Harry—or Dirty Harry as it was later dubbed. The people of St. George Utah town near the point where Arizona, Nevada and Utah meet followed their custom of greeting the shots from the nearby ridges of the Utah Mountains or Sugar Loaf. This was history in the making, and the AEC assured the citizens that they were very real participants.

Your best action is an AEC booklet read "is not to be worried about fallout." The solemn word from the AEC was that fallout had never injured anyone inside or outside the Proving Ground boundaries. Teachers took their classes out in the pre-dawn dark to watch the flash and the mushroom to listen for the boom rattling along the canyons, and to look in wonder at the power of the atom.

On the morning of May 19, Elmer Pickett took his wife and children up to Sugar Loaf. Like a Norman Rockwell family on the Fourth of July, they watched as Dirty Harry went off at 4 05 over the test site some 120 miles to the west. The flash wasn't blinding, as Elmer thought it would be. It simply lit up the whole sky. A few minutes later he felt the rumble in the ground. After daylight the cloud came over tumbling above and swirling pink.

Arthur Bruhn, a husky outdoorsman and president of local Dixie College, watched it too, along with his geology class. His wife Lorna fragile and feminine had seen other shots with the children; sitting on the tail gate of their station wagon, eating home made cinnamon rolls and drinking hot chocolate. This day she and the children stayed home as the geology group went in their place.

At home Lorna Bruhn felt the shock. When broad daylight arrived the cloud seeped up over the mountain range and spread out over the town. It seemed to Lorna that the giant reddish black hand had obliterated the sun. She was just about to go to work in the garden when her husband called from the college. "Don't go out. I told her, and keep the children in. The cloud is coming our way."

Ken Clark, one of the Cedar City sheeple had been out to his sheep camp that morning in the Escalante Valley. He was driving home in his truck when the cloud engulfed him. It moved along with the truck as he headed toward Cedar City. The dust particles smacked against the windshield and worked their way through cracks to cover his clothes with soot. Five miles out of Cedar City he came to a roadblock. A small group of men from the Proving Grounds operation stopped him.

They moved a Geiger counter over the truck and Clark's clothes. "Radiation all over you, they said. "Call your wife. Have her bring some new clothes. Then come back here." They gave him the name of a service station and told him to get the truck washed—at their expense—and then to return to the roadblock.

He did. He noticed that the attendant washed the car with his bare hands. He wondered where the radiation went when it was hosed off the truck.

When his wife brought new clothes the men burned the old. Then they made him bathe in a watering trough Clark wondered what was happening on first the horrible sights at the lambing sheds now this.

Roughly five hours after the Dirty Harry detonation Frank Butrico, an off-site monitor for the Proving Ground, had his hands full. At 7 50 A.M. the radio message from Control Point instructed him to set up a roadblock at the intersection of Highways 18 and 81 near St. George. No cars were to pass to the west. A decontamination station was set up at the Utah Oil service station on Main Street. By 8 45 the number of cars needing decontamination began to rise. The radiation reading did the same moving from 1.8 to 3 2 rads an hour.

Two Texaco stations were added as decontamination posts. By 9 10 high readings were found both in and out of cars.
The peak had not yet been reached. The decontamination operation was stopped so was the monitoring. Motorists were ordered to stand by for 20 minutes to an hour. At 9:25 the Test Site Control Point radioed to tell all the people of St George to take cover. Schools were ordered to keep the children inside during recess. By 9:40 nearly all of St George was under cover. The radiation peaked at 9.2 rads well over the permissible limit. Two hundred cars sat at the roadblock. Around 11 traffic was allowed to move one car at a time. Dismissed from the classrooms, children ran out to play in the grass. More than 16,000 people had been caught in the fallout area.

In the aftermath of the Dirty Harry shot Butrico gave this appraisal: "The events point up the need for educating the people in a two-hundred-mile radius of the Proving Grounds. I wrote. Most of them are not aware of the precautions being taken to safeguard them."

One of the safeguards Butrico took was to collect samples of milk in the area. He did it quietly to avoid panic. With fallout came radioiodine—iodine 131—among other deadly fission products. Deposited on pastures and gardens it entered the food chain. Most lethal of all is the dose to the thyroids of infants and young children who drank fresh milk. It could also attack the thyroids of the sheep and lambs that were still dying in Cedar City at the time of the Dirty Harry shot, less than two months after the Nancy detonation. There had been six other test shots in between.

A. C. Johnson, the elderly local vet at Cedar City, could do nothing as the sheep continued to die. Medication and forcing feedings were useless. He told Steve Brower the county agricultural agent that in all the years the sheep had trailed on the range he had never observed symptoms like the lesions around the face and head or the slippage of wool at shearing.

The first team of AEC veterinarians didn't arrive until June 5, some two weeks after Nancy and two weeks after Dirty Harry. By that time only a few piles of dried bones of the stricken sheep were left. The vets were concerned and solicitous.

Brower joined both Dr. Robert Thompsett from AEC Los Alamos and Dr. Robert Veenstra from a U.S. Navy base in San Francisco as they went to the first sheds to examine the surviving sheep. Would the survivors exhibit the same symptoms as the dead sheep—or at least provide a clue?

When the team examined the first lamb on the underside of its neck the radiation meters went off the scale. "This is hotter than a pistol," Thompsett said. "The needle tried to go past the post. It scraped off one of the hard, scabby lesions that covered the mouth, nose and head and he handed it to Brower. Just like the ones at Trinity," Thompsett said. "Heavy radiation damage." He was referring to the livestock badly scarred by beta burns after the first A-bomb had been exploded in New Mexico in 1945. Veenstra took further read

Outruns Them All

The Wild Turkey is an incredible bird, capable of out-running a galloping horse in a short sprint.

It is also the symbol of Wild Turkey, an incredible whiskey widely recognized as the finest whiskey produced in America.
Amanda spotted the alien late Friday afternoon outside the Video Center on South Main. It was trying to look cool and laid-back, but it simply came across as bewildered and uneasy. The alien was disguised as a seventeen-year-old girl, maybe a Chicana, with olive-toned skin and hair so black it seemed almost blue, but Amanda, who was seventeen herself, knew a phony when she saw one. She studied the alien for some moments from the other side of...

PAINTING BY BOB VENOSA
At the particular moment she had spotted the alien she had been unusually alert, all raw nerves. Of course it wasn't aliens she was hunting for, just a little diversion.

That's you they're talking about. They're out there with flame guns, tranquilizer darts, web snares, and God knows what. There's been real hysteria for a day and a half. And you standing around here with the wrong choices on! Christ, Christ! What's your plan, anyway? Where are you trying to go?

Home, the alien said. But first I have to rendezvous at the pickup point. Where's that?

"Well, Amanda said. I meant to turn you in. I've done it five minutes ago. But okay, I don't give a damn where your rendezvous is. I tell you though you wouldn't make it as far as San Francisco rugged up the way you are. It's a miracle you avoided getting caught until now."

And you help me?

I've been trying to come on. Let's get the hell out of here. I'll take you home and fix you up a little. My car's in the lot down on the next corner.

Okay. Whew! Amanda shook her head slowly. Christ, some people sure can't take help when they try to offer it.

As she drove out of the center of town Amanda glanced occasionally at the alien sitting tensely to her right. Basically the disguise was very convincing. Amanda thought. Maybe all the small details were wrong, the outer stuff, the anthropological stuff but the alien looked human. It sounded human, it even smelled human. Possibly it could fool ninety-nine people out of a hundred, or maybe more than that. But Amanda had always had a good eye for detail. And at the particular moment she had spotted the alien on South Main she had been unusually alert, sensitive all raw nerves, every antenna up.

Of course it wasn't aliens she was hunting for, just a little diversion a little excitement something to fill the great gaping emptiness that Charley Taylor had left in her weekend.

Amanda had been planning the weekend with Charley all month. Her parents were going to go off to Lake Tahoe for three days, her kid sister had wangled permission to accompany them, and Amanda was going to have the house to herself. Just her and Macavity the cat. And Charley. He was going to move in on Friday afternoon and they'd cook dinner together and get blasted on her stash of choice powder and watch five or six of her parents' X-cassettes, and Saturday they'd drive over to the city and cruise some of the kirk districts and go to that bathhouse on Polson where everybody got naked and climbed into the giant Jacuzzis, and then on Sunday—Well, none of that was going to happen. Charley had called on Thursday to cancel. "Something big came up," he said and Amanda had a pretty good idea what that was. His hot little cousin from New Orleans, who sometimes came flying out here on no notice at all, but the insconsiderate bastard seemed to be entirely unaware of how much Amanda had been looking forward to this weekend, how much it meant to her how painful it was to be dumped like this. She had run through the planned events of the weekend in her mind so many times that she almost felt as if she had experienced them. It was that real to her. But overnight it had become unreal.

Three whole days on her own. The house to herself and so early in the semester that there was no work to think about and Charley had stood her up. What was she supposed to do now? Call desperately around town to scrounge up some old lover as a playmate? Or pick up some stranger downtown? Amanda hated to fool around with strangers. She was half tempted to go over to the city and just let things happen, but they were all weirdos and creeps over there anyway and she knew what she could expect from them. What a waste not having Charley! She could kill him for robbing her of the weekend.

Now there was the alien. Though a dozen of these star people had come to Earth last year not in a flying saucer as everybody had expected, but in little capsules that floated like milkweed seeds and they had...

"No."

"It can be subtle. Don't worry about it. Are you hungry?"

"Not yet," the alien said.

"I am. Come into the kitchen." As she assembled a sandwich—peanut butter and avocado on whole wheat with tomato and onion—she asked, "What sort of things do you guys eat?"

"Life?"

"Life?"

"We never eat dead things. Only things with life.

Amanda fought back a shudder. "I see. Anything with life?"

"We prefer animal life. We can absorb plants if necessary."

"Ah, yes. And when are you going to be hungry again?"

"Maybe tonight," the alien said. "Or tomorrow. The hunger comes very suddenly when it comes."

"There's not much around here that you could eat live. But I'll work on it."

"The small furry animal?"

"No. My cat is not available for dinner. Get that idea right out of your head. Likewise, I'm your protector. It wouldn't be sensible to eat me. You follow what I'm trying to tell you?"

"I said that I'm not hungry yet."

"Well, you let me know when you start feeling the pangs. I'll find you a meal."

Amanda began to construct a second sandwich. The alien prowled the kitchen examining the appliances. Perhaps making mental records. Amanda thought of sink and oven design to copy on its home world. Amanda said, "Why did you people come here in the first place?"

"It was our mission."

"Yes, sure. But for what purpose? What are you after? You want to take over the world? You want to steal all scientific secrets?"

The alien, making no reply, began taking spices out of the spice rack. Delicately it flicked its fingers, touched it to the oregano, tasted it, tried the cumin. Amanda said, "Or is it that you want to keep us from going into space? You think we're a dangerous species, and so you're going to quarantine us on our own planet? Come on, you can tell me. I'm not a government spy." The alien sampled the tarragon, the basil, the sage. When it reached for the curry powder its hand suddenly shook so violently that it knocked the open jars of oregano and tarragon over, making a mess.

"Hey, are you all right?" Amanda asked.

"The alien said, "I think I'm getting hungry. Are those things drugs too?"

"Spices," Amanda said. "We put them in our foods to make them taste better."

The alien was looking very strange; glasses, eyes, flushed, sweaty. "Are you feeling sick or something?"

"I feel excited. These powders—" They're turning you on? Which one?"

"This."

"It is either the first one or the second."

"Yeah," Amanda said. "Oregano. it can really make you fly. She wondered whether the alien would get violent when zoned."

"Or whether the oregano would stimulate its appetite. She had to watch out for its appetite."

There are certain risks. Amanda reflected. in doing what I'm doing. Delightfully she cleaned up the spilled oregano and tarragon and put the caps on the spice jars.

"You ought to be careful," she said. "Your metabolism isn't used to this stuff. A little can go a long way."

"Give me some more."

"I'd say," Amanda said. "You don't want to overdose if too early in the day."

"More."

"Calm down. I know this planet better than you and I don't want to see you get in trouble. Trust me, I'll let you have more oregano when it's the right time. Look at the way you're shaking. And you're sweating like crazy. Pocketing the oregano jar; she led the alien back into the living room."

"Sit down. Relax."

"More? Please?"

"I appreciate your politeness. But we have important things to talk about and then I'll give you some. Okay?"

Amanda opened the window through which the hot late-afternoon sun was coming. Six o'clock on Friday, if everything had gone the right way Charley would have been showing up just about now. Well she'd found a different diversion. The weekend stretched before her like an open road waiting to begin. The alien offered all sorts of possibilities and she might yet have some fun over the next few days if she used her head. Amanda turned to the alien and said, "You calmer now? Yes. Good. Okay. first of all, you've got to get yourself another body."

"Why is that?"

"Two reasons. One is that the authorities are probably searching for you. The girl you absorbed. How you got as far as you did without anybody but me spotting you was hard to understand. Number two, a teen aged girl traveling by herself is getting hassled too much. I don't know how to handle yourself in a tight situation. You know what I'm saying? You're going to want to hitchhike out to Nevada, Wyoming, Utah wherever the hell your rendezvous place is and all along the way people are going to be coming on to you. You don't need any of that. Besides, it's very tricky trying to pass for a girl. You've got to know how to put your face paint on. how to understand challenge codes—what the way you
wear your clothing says, and like that. Boys have a much simpler subculture. You get yourself a male body, a big hunk of a body, and nobody'll bother you much on the way to where you're going. You just keep to yourself, don't make eye contact, don't smile, and everyone will leave you alone."

"Makes sense," said the alien. "All right. The hunger is becoming very bad now. Where do I get a male body?"

"San Francisco. It's full of men. We'll go over there tonight and find a nice brawny one for you. With any luck we might even find one who's not gay, and then we can have a little fun with him first. And then you take his body over—which incidentally solves your food problem for a while, doesn't it? And we can have some more fun a whole weekend of fun." Amanda winked. "Okay, Connie?"

"Okay." The alien winked a clumsy imitation of a smile, then she smiled a real one. "You give me more oregano now?"

"Later." And when you winked, just wink one eye. Like this. Except I don't think you ought to do a lot of winking at people. It's a very intimate gesture that could get you in trouble, understand?"

"There's so much to understand. You're on a strange planet, kid. Did you expect it to be just like home?" Okay, to continue. The next thing I ought to point out is that when you leave here on Sunday you'll have to—"

The telephone rang. "What's that sound?" the alien asked.

"Communications device. I'll be right back," Amanda went to the hall extension imagining the worst: her parents, say calling to announce that they were on their way back from Tahoe tonight. Some mixup in the reservations or something.

But the voice that greeted her was Charley's. She could hardly believe it; after the casual way he had shafted her this weekend. She could hardly believe what he wanted: either he had left half a dozen of his best cassettes at her place last week, Golden Age rock, Abbey Road and the Hendrix one and a Joplin and such, and now he was heading off to Monterey for the festival and wanted to have them for the drive. Did she mind if he stopped off in half an hour to pick them up?"

The bastard, she thought. The absolute trashness of him! First to torpedo her weekend without even an apology and then to let her know that he and what's-her-name were scooting down to Monterey for some fun, and could he bother her for his cassettes? Didn't he think she had any feelings? She looked at the telephone as if it were emitting toads and scorpions. It was tempting to hang up on him.

She resisted the temptation. "As it happens," she said, "I'm just on my way out for the weekend myself. But I've got a friend who's staying here cat-sitting for me, I'll leave the cassettes with her okay? Her name's Connie."

"Fine. That's great," Charley said. "I really appreciate that." Amanda

If you want a smoother vodka, ask for it in English.

Now the English have done for vodka what they've always done for gin.

Burrough's. The English word for vodka.
The alien was back in the kitchen, nosing around the spice rack. But Amanda had the oregano. She said, “I’ve arranged for delivery of your next body.”

“You did?”

“A large healthy adolescent male. Exactly what you’re looking for. He’s going to be here in a little while. I’m going to go out for a drive. You take care of him before I get back. How long does it take for you to—engulf—somebody?”

“It’s very fast.”

‘Good,’ Amanda said. ‘I’ll leave Charley’s cassettes and stacked them on the living room table. ‘He’s coming over here to get these six little boxes, which are music storage devices. When the doorbell rings, you let him in and introduce yourself as Connie and tell him his things are on this table. After that you’re on your own. You think you can handle it?’

“Sure,” the alien said.

Tuck in your T-shirt better. When it’s tight, it makes your boobs stick out and that’ll distract him. Maybe he’ll even make a pass at you. What happens to the Connie body after you engulf him?”

‘It won’t be here,’ he said. ‘What happens is I merge with him and dissolve all the Connie characteristics and take on the new ones.’

‘Ah Very vitty. You’re a real nightmare thing. You know? You’re a walking horror show. Here you are, have another little bit of oregano before I go.'

She put a tiny pinch of spice in the alien’s hand. ‘Just to warm up your engine a little. I’ll give you more later when you’ve done the job. See you in an hour okay?’

She left the house. Macavity was sitting on the porch, scowling, whipping his tail from side to side. Amanda knelt beside him and scratched him behind the ears. The cat made a low rough purring sound, not much like his usual purr.

Amanda said, “You aren’t happy are you, tella? Well, don’t worry. I’ve told the alien to leave you alone, and I guarantee you’ll be okay. This is Amanda’s fun tonight. You don’t mind if Amanda has a little fun, do you? Macavity made a grum snuffling sound. Listen, maybe I can get the alien to create a nice little calico cute for you okay? Just going into heat and ready to howl. Would you like that guy? Would you? I’ll see what I can do when I get back. But I have to clear out of here now before Charley shows up.”

She got into her car and headed for the westbound freeway ramp. Half past six. Friday night; the sun still hanging high above the Bay. Traffic was thick in the eastbound lanes; the late commuters, strolling toward home. And it was beginning to build up westbound too; as people set out for dinner in San Francisco. Amanda drove through the tunnel and turned north into Berkeley to cruise city streets. Ten minutes to seven. Now Charley must have arrived. She imagined Connie in her tight T-shirt, all stoned and sweaty on oregano and Charley giving her the eye, getting ideas thinking about grabbing a bonus quickie before taking off with his cassettes. And Connie leading him on, Charley making his moves, and then suddenly that electric moment of surprise as the alien struck. Charley found himself turning into dinner. It could be happening right this minute. Amanda thought placidly. No more than the bastard deserves, isn’t it? She had felt for a long time that Charley was a big mistake in her life, and after what he had pulled yesterday, she was sure of it. No more than he deserves.

But she wondered. What if Charley has brought his weekend along? The thought chilled her. She hadn’t considered that possibility at all. It could ruin everything. Connie wasn’t able to engulf two at once. was she? And suppose they recognized her as the missing alien and ran out screaming to call the cops?

No, she thought. Not even Charley would be so tacky as to bring his date over to Amanda’s house tonight. And Charley never watched the news or read a paper. He wouldn’t have a clue as to what Connie really was until it was too late for him to run.

Seven o’clock. Time to head home.

The sun was sinking behind her as she turned onto the freeway. By quarter past she was approaching her house. Charley’s old red Honda was parked outside.

Amanda parked across the street and cautiously let herself in, pausing just inside the front door to listen.

Silence.

‘Connie?’, she thought.

‘In here,’ said Charley’s voice.

Amanda entered the living room. Charley was sprawled out comfortably on the couch. There was no sign of Connie.

‘Well?’, Amanda asked. ‘How did it go? Easiest thing in the world’ the alien said.

‘He was sliding his hands under my T-shirt when I let him have the nullifier jolt.’

‘An. The nullifier jolt.

And then I completed the engulfment and cleaned up the carpet. God, it feels good not to be hungry anymore. You can’t imagine how tough it was to resist engulfing you. Amanda. For the past hour, I kept thinking of food—food food—Very thoughtful of you to resist.

“I knew you were out to help me. It’s logical not to engulf one’s allies.”

That goes without saying. So you feel well fed now? He was good stuff.

‘Robust, healthy, nourishing—yes.’

“I’m glad Charley turned out to be good for something. How long before you get hungry again?”

The alien shrugged. ‘A day or two. Maybe a week. Give me more oregano, Amanda?’

Sure,” she said. ‘Sure.’ She felt a little let down. Not that she was remorseful about Charley, exactly, but it all seemed so casual, so off-handed—there was something anticlimactic about it. She sus
pected she should have stayed and watched while it was happening. Too late for that now, though.

She took the oregano from her purse and dangled the jar teasingly. "Here it is, babe. But you've got to earn it first."

"What do you mean?"

"I mean that I was looking forward to a big weekend with Charley, and the week end is here, Charley's here, too. more or less, and I'm ready for fun. Come show me some fun, big boy.

She slipped Charley's Handix cassette into the tape deck and turned the volume all the way up.

The alien looked puzzled. Amanda began to peel off her clothes.

"You, too," Amanda said. "Come on. You won't have to dig deep into Charley's mind to figure out what to do. You're going to be my Charley for me this weekend. You follow? You and I are going to do all the things that he and I were going to do. Okay? Come on. Come on."

She beckoned.

The alien shrugged again and slipped out of Charley's clothes, rummiling with the unfamiliarities of his zipper and buttons. Amanda, grinning, drew the alien close against her and down to the living-room floor. She took its hands and put them where she wanted them to be. She whispered instructions. The alien docilely obedient did what she wanted.

It felt like Charley. It smelled like Charley. And after her instructions, it even moved pretty much the way Charley moved.

But it wasn't Charley, it wasn't Charley at all, and after the few seconds Amanda knew that she had goofed things up very badly. You couldn't just ring in an imitation like this. Making love with this alien was like making love with a very clever machine, or with her own mirror image. It was empty and meaningless and dumb.

Grimly she went on to the finish. They rolled apart, panting, sweating.

"Well?" The alien said. "Did the earth move for you?"

"Yeah. Yeah. It was terrific—Charley.

"Oregano?"

"Sure." Amanda said. She handed the spice jar across. "I always keep my promises, babe. Go to it. Have yourself a blast. Just remember that that's strong stuff for guys from your planet. Okay? If you pass out I'm going to leave you right there on the floor.

"Don't worry about me."

"Okay. You have your fun. I'm going to clean up and then maybe we'll go over to San Francisco for the nightlife. Does that interest you?"

"You bet, Amanda."

The alien winked—one eye, then the other—and gulped a huge pinch of oregano. That sounds terrific.

Amanda gathered up her clothes, went upstairs for a quick shower and dressed. When she came down, the alien was more than half blown away on the oregano google-eyed, lolled-headed, propped up against the couch, and crouching to itself in a weird stoned way. Fine. Amanda thought. You just get yourself all spaced out, love. She took the portable phone from the kitchen, carried it with her into the bathroom, locked the door, and quietly dialed the police emergency number.

She was bored with the alien. The game had worn thin very quickly. And it was crazy she thought, to spend the whole weekend cocooned up with a dangerous extraterrestrial creature when there wasn't going to be any fun in it for her. She knew now that there couldn't be any fun at all. And besides, in a day or two the alien was going to get hungry again.

I've got your alien, she said. Sitting in my living room stoned out of its head on oregano. Yeah. I'm absolutely certain it was disguised as a Chicana girl first. Concepcion Flores, but then it attacked my boyfriend Charley Taylor and—yes yes I'm safe. I'm locked in the john. Just get some body over here fast—okay? I'll stay on the line—what happened was I spotted it downtown outside the video center, and it insisted on coming home with me."

The actual capture took only a few minutes. But there was no peace for hours after the police tactical squad hauled the alien away because the media were in on the act right away first a team from Channel 2 in Oakland, and then some of the network guys and then the Chronicle and finally a whole army of reporters from as far away as Sacramento and phone calls from Los Angeles and San Diego and—about three that morning—New York.

Amanda told the story again and again until she was sick of it, and just as dawn was breaking, she threw the last of them out and barred the door.

She wasn't sleepy at all. She felt wired up speedily and depressed all at once. The alien was gone. Charley was gone and she was all alone. She was going to be famous for the next couple of days, but that wouldn't help. She'd still be alone. For a time she wandered around the house, looking at it the way an alien might, as if she had never seen a stereo cassette before or a television set or a rack of spices. The smell of oregano was everywhere. There were little trails of it on the floor.

Amanda switched on the radio and there she was on the six A.M. news—the emergency is over thanks to the courageous Walnut Creek High School girl who trapped and outsmarted the most dangerous life form in the known universe.

She shook her head. "You think that's true? she asked the cat. "Most dangerous life form in the universe? I don't think so, Macavity. I think I know at least one that's a lot deadlier. Eh, kid?" She winked. "If they only know, eh? If they only know."

She scooped the cat up and hugged it and it began to purr. "Maybe trying to get a little sleep would be a good idea. Then she had to figure out what she was going to do about the rest of the weekend.

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Forget MIT. The new science mecca is Roger's Pool Hall.

OZARK MOUNTAIN HIGH
BY WILLIAM K. STUCKEY

The Ozark Mountain city of Fayetteville, Arkansas, is the place to be when the bomb drops. Consider: There are no Titan missile silos within a radius of 130 miles (as far as we know). There's plenty of cheap land, water, and wood. And there's even a vast radiation-proof cave system, the same one used by the James brothers to dodge Ozark lawmen. Add to this the presence of a good, public land-grant university, and you also have the brains to pick when the rest of society has turned to dust.

Doomsday thoughts aside, there are other reasons to inspect academically obscure places like the University of Arkansas. If you

PHOTOGRAPHS BY BILL SUMNER
agree that food and water are likely to be more critical than black holes and space colonies in the short-term future, then the earthy U. of Arkansas should exceed Harvard and Berkeley in importance. It is Fayetteville, after all, that is the world center for weed studies. Its down-home campus is a hub of expertise on commodified farms, solar homes, and gasohol. Yet the U. of A. offers enough high-quality "impractical" liberal arts and sciences to keep you entertained, provoked, and satisfied for the rest of your natural-born life.

When I left for Arkansas this past fall I had friends in New York who told me to expect mules and moonshine and eleven-year-old brides in sunbonnets smoking corncob pipes on the porch. They painted a picture (and it turns out somewhat accurate) of hillbilly hermits like the old farmer with the shotgun and the frontyard tombstone reading MURDERS WELCOME. I also recalled the tale of an estate university football team. Before World War II the team had been named the Cardinals. During one murderous football game however the players were so thoroughly mean and determined that the coach said they fought like razorbacks—the wild tusked boar allegedly abandoned in Florida by sixteenth century explorer Hernando De Soto. Razorbacks are bony and sharp enough to cut through wood. The team took a shine to the name and it stuck.

But when I finally got out in the Fayetteville sun I was stunned to discover the most livable city in the USA. Instead of dirt and dingy wood tracks I found towering maples and rows of birch and pines. The hillside road to Arkansas U. was lined with first-rate book and magazine stores (where I later learned one may buy the Sunday New York Times no later than noon on Monday). And the campus itself—where I had been given a room for the duration—had incredible numbers of attractive young women with GOTO HELL T-shirts and spray on jeans.

Then of course there was Roger's Pool Hall, the finest down and out beer joint I ever did see. It was there, amid the echo of pool balls and cavernous life walls that I convened with Fayetteville's soul. Leaning over the Art Deco bar I met and remained just in case. Harvard trained trial lawyer Matthew Horan chatted with the brilliant quirkos-humorist James Twigg, author of the novel BILLY AND BETTY, and former editor of Cornell University Press. He discussed the physics of Nobels. Then lawyer Julian Schiffer with Michael Lieber, a former Harvard PhD candidate of his/hers, bargained over the price of five acres—

including a three-bedroom house trees, wells, and a creek—on sale for the astrophysically vast sum of $21,000 at 8 percent heard from chicken-tycoon Don Tyson, a University of Arkansas alumnus (and, he said, would take him years to provide poultry sandwiches for all of India) three years for China. Ten years for the Netherlands. And listened to the exotic travel stories of Roy Reed, the former London bureau chief of The New York Times. Now a member of the university's journalism department a resident of nearby Hog Eye and yet another chronicler of Roger's pool Hall. Watching the local hillbilly types (hook-nosed and chinless) spit into bins on the floor, I congratulated myself for being in the city where the university's chancellor studied music with the most prolific Cherokee Indian composer in the world.

The University of Arkansas was built from the ashes of the Civil War. It came into existence on the heels of the Land Grant Act, passed by Abe Lincoln to provide those great educational equalizers: the land grant schools. Up until the passage of the act colleges catered mostly to wealthy genteel lads who feasted on Latin and Greek before dinner—and after dinner too. But the land-grant university aimed to change all that, teaching the agricultural and mechanical classes, dabbling in the classics while cultivating their practical skills.

Three Arkansas cities—Batesville, Little Rock, and Fayetteville—bid for the university and Fayetteville won. So in the reconstruction year of 1871 nine students including a black headed for a ramshackle old hut on the town's old Mulberry Farm. There they studied until 1874 when the school's first building—a stately Victorian structure called Old Main—was ready to educate a burgeoning student population now nearly 100 strong.

Through the years the university grew spurred to regional prominence by two major congressional acts: the Hatch Act which funded research oriented agricultural experimental stations and the Smith Lever Act which helped farmers use the research to improve their farms. As thousands of students flocked the school broadened its areas of expertise, adding divisions for the performing arts, the sciences, business administration, engineering, law and architecture.

Then at the start of World War II, long-time U. of A. president John Fritts was killed in a car crash. He was succeeded by J. William Fulbright—the founder of the famed Fulbright Educational Exchange Program. Fulbright became president of the university in 1938 was fired by an Arkansas governor with connections to the Ku Klux Klan in 1941 and went on to defeat that same governor in the 1944 race for the U.S. Senate.

Fulbright who played a role in the founding of the University of Arkansas returned to the University of Arkansas every so often to give a speech or endow a chair. But while the folks back home are proud, they admit that Fulbright (the son of a wealthy newspaper publisher) isn't quite consonant with the character of a boondock state so dirt-poor that it has one of the lowest median family incomes in the country. To help educate the Arkansans (who spend less money on education and have fewer college degrees than the residents of any other state) the university now has a new president. Joe Martin, a scientist with dirt on his hands.

At first glance Martin looks like he might be a bouncer at Roger's. He can put his eyeball two inches away from your body and body-language you ("Now pay attention dammit") into submission. When it comes to raising money for his Ozark mountain school he can politick like Lyndon Baines Johnson himself.

Big Joe came by his manner—and his career—in the heart of the South. His father was a hard-driving Alabama businessman with two companies: one specializing in agricultural equipment the other in industrial goods. When the will was being drawn Jim and his brother flipped a coin to see who would inherit the glamorous industrial firm and who would get stuck in agriculture. Jim lost so when he started Auburn University on a basketball scholarship in 1950 he decided to study agricultural administration.

Then while Jim was doing a two-year stint in the service he daddy sold the firms. Though Jim's responsibility to agriculture was gone he decided to stay in the field entering Iowa State (the land grant Princeton?) for a PhD in agricultural economics. There and in professorships at the University of Maryland, Oklahoma State, and Virginia Tech he mastered the carnal of agricultural science researching everything from grain elevators to anaerobic bacteria to the impact of railroad rates.

Finally in 1975 Martin came to Arkansas. For the first five years he administered agricultural programs. In 1980 he was promoted to president of the state university's five-campus system.

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We're developing a machine that can catch chickens and throw them, unbruised, into a crate.
You try chicken catching and see how long it takes you.

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Three Arkansas cities—Batesville, Little Rock, and Fayetteville—bid for the university and Fayetteville won. So in the reconstruction year of 1871 nine students including a black headed for a ramshackle old hut on the town's old Mulberry Farm. There they studied until 1874 when the school's first building—a stately Victorian structure called Old Main—was ready to educate a burgeoning student population now nearly 100 strong.

Through the years the university grew spurred to regional prominence by two major congressional acts: the Hatch Act which funded research oriented agricultural experimental stations and the Smith Lever Act which helped farmers use the research to improve their farms. As thousands of students flocked the school broadened its areas of expertise, adding divisions for the performing arts, the sciences, business administration, engineering, law and architecture.

Then at the start of World War II, long-time U. of A. president John Fritts was killed in a car crash. He was succeeded by J. William Fulbright—the founder of the famed Fulbright Educational Exchange Program. Fulbright became president of the university in 1938 was fired by an Arkansas governor with connections to the Ku Klux Klan in 1941 and went on to defeat that same governor in the 1944 race for the U.S. Senate.

Fulbright who played a role in the founding of the United Nations returned to the University of Arkansas every so often to give a speech or endow a chair. But while the folks back home are proud, they admit that Fulbright (the son of a wealthy newspaper publisher) isn't quite consonant with the character of a boondock state so dirt-poor that it has one of the lowest median family incomes in the country. To help educate the Arkansans (who spend less money on education and have fewer college degrees than the residents of any other state) the university now has a new president. Joe Martin, a scientist with dirt on his hands.

At first glance Martin looks like he might be a bouncer at Roger's. He can put his eyeball two inches away from your body and body-language you ("Now pay attention dammit") into submission. When it comes to raising money for his Ozark mountain school he can politick like Lyndon Baines Johnson himself.

Big Joe came by his manner—and his career—in the heart of the South. His father was a hard-driving Alabama businessman with two companies: one specializing in agricultural equipment the other in industrial goods. When the will was being drawn Jim and his brother flipped a coin to see who would inherit the glamorous industrial firm and who would get stuck in agriculture. Jim lost so when he started Auburn University on a basketball scholarship in 1950 he decided to study agricultural administration.

Then while Jim was doing a two-year stint in the service he daddy sold the firms. Though Jim's responsibility to agriculture was gone he decided to stay in the field entering Iowa State (the land grant Princeton?) for a PhD in agricultural economics. There and in professorships at the University of Maryland, Oklahoma State, and Virginia Tech he mastered the carnal of agricultural science researching everything from grain elevators to anaerobic bacteria to the impact of railroad rates.

Finally in 1975 Martin came to Arkansas. For the first five years he administered agricultural programs. In 1980 he was promoted to president of the state university's five-campus system.
IN HIS WORLD MAN FINDS BUT FEW PRECIOUS THINGS...

HE CREATES THE REST.

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Ever since Martin says, he's been working to augment the state's basic art and science program. At the Fayetteville campus, that means putting most of the money into departments where quality is already high.

The Southern-history department, where distinguished professors write on outstanding blacks, the creationist-evolution controversy, and Southern religious cults; the English department with its extraordinary creative-writing program (its director, William Harris, produced the book from which the political SF movie *Rollerball* was made); and the internationally acclaimed chemistry department, whose professors have been trained at such prestigious institutions as Columbia, Berkeley University College of London and the Max Planck Institute.

Perhaps most important educator Martin has been helping the agriculture department promote an understanding of the nation's fragile food and fiber system—the system we need for survival. For those who wouldn't be caught dead near a land-grant school. Martin's random reflections bring the flavor of the U. of A. home:

- Only three percent of the country's population have a true agricultural background. Never have so many depended so few—food and fiber. The rest of you think food comes from the supermarket. If you think industrial labor is a problem, just let the American farmer start speaking with one voice and it will be worse than any railroad steel or auto strike you've ever seen.
- We know how to produce food without 2.4-D, the agent orange stuff and all the other chemicals. If that's the way we want to go. All we have to decide is which fifty percent of the American population are going to get on the back end of a hoe. We did without chemicals up to about 1920 and we can do it again.
- The American farmer is a highly skilled laborer who knows genetics, breeding, veterinary medicine, agronomy, agriculture, entomology, meteorology, economics, you name it, but he can't set his price as General Motors can. So the better he farms and the more he grows, the bigger the crop surplus and the lower the once.
- How long would you stay in a job like that?
- People don't know that this state, with a whole lot of help from its agricultural colleges, is the nation's number one producer of broiler chickens. Did you know that Don Tyson's operation gets a pound of chicken meat from each 16 pounds of chicken feed? It takes four pounds of feed for one pound of pork, eight for a pound of beef. That's what agricultural research is for.
- If there were a Nobel Prize for agriculture, our top candidate would be George Templeton, of plant pathology. He's the first to discover a fungus that kills Northern Japanesethus, a weed that chokes off our rice crops. Before that rice farmers had to use the polluting components of agent orange. It's the first natural herbicide cleared by the Environmental Protection Agency.

- We're number one in rice and fish, number two in spinach, number three in soybeans, and ninth in tomatoes—we developed the Arkansas Traveler Pink Tomato right here. There'd be no tomatoes in Arkansas without this university. Do you know we're developing a machine that can catch chickens and throw them completely unbruised into a crate? You try chicken catching and see how long it takes you.

President Martin didn't have much to say about small-time agriculture. The kind you'd need it society collapsed. Still if you had to get by without computers or pesticides you could do that in Fayetteville too.

To learn how just take the following one-year crash course drafted especially for avid survivalists by one Nolan Arthur, associate dean:

- Fundamentals of agricultural construction 1072 and 1082: tools, woodworking, plumbing materials, concrete and sheet metal. ought to teach you enough skills to

- build a house and barn inside of a year.
- Agroscopy 1103 growing basic field crops like wheat, corn, and protein-rich soybeans.
- Agroscopy 2203 soil chemistry and testing.
- Animal Science 1011, 2143, 2612, and 1004: everything from selecting the right feed to slaughtering and curing meat to deciding whether your two bit, five acre operation would be better off with rabbits or cows.
- Entomology 1313, handling the bugs.
- Horticulture 1003 and 1102, growing fruits and vegetables.
- Plant Pathology 2003, keeping plants disease free, the survivalist's better enemy.

If you really want to save a lot of hard times—such an investment—$780 for two semesters, not including schoolbooks—will go a long way.

Whether you use big or small-time farming to outwit the holocaust you'll need fuel to run your equipment. And if you're in Fayetteville you'll have an abundant supply thanks to George Henry Emert, tenured professor of biochemistry and agronomy, and head of the university's Biomass Center. The center's goal: converting biomass, like wood or thorn out food, into alcohol, the potent ethyl-alcohol fuel.

Emert's penchant for alcohol seems oddly appropriate. The last in a long line of whiskey makers, he still remembers stories of those dark Prohibition years. Forbidden by law to make whiskey, George's grandaddy ("Papaw") took to brewing moonshine under moonlight in the Tennessee woods. His lookouts were the dogs trained to bark warning when "revenoos" came by. George's daddy was a "runner" trucking shine by Model A Ford to secret markets, selling it under the noses of the suited-and-tied still-busters. Daddy Emert finally went into farming. But he passed the moonshine bug—and other family traditions—to his son.

George had just graduated from the University of Colorado when his daddy insisted he hold a grand procession of Emerts to the front. It wasn't war but George explains just that: Tennessee volunteer spirit. There were Emerts at King's Mountain and Yorktown during the American Revolution and at Appomatox at the end of the Civil War. Uncle Otha spent 33 months in a Chinese prison camp during the Korean War. At any war you can name, Emerts were there.

The only fight going on when George got out of school was in Vietnam. And as Uncle Otha, Stanley Butler, Ore and Glenn and George's daddy pointed out, George wasn't too old and wasn't even married. So George did his duty.

You don't mess with George Emert when he's doing his duty. He did two tours in Vietnam as an officer in the Green Berets in the mid-1960s (Bronze Star, 1966) and presumably liked it since he volunteered both times. After Emert's Green Berets pacified Vinh Tranh Valley it became known as Happy Valley. You don't want George Emert to make you happy.

When he got back from Nam he spent a summer at Stanford University's marine biology research station. There he noticed "beach hoppers" marine animals that ate soft drink cups littering the sand. If these creatures could eat paper, Emert figured, they could be capable of digesting cellulose—the hard, sugary substance of which plant cell walls are made.

Emert soon learned that the beach hopper's skill came from enzymes produced by microorganisms living in its digestive tract. If such organisms could be harnessed he knew their digestive power could be turned loose on tons of currently useless biomass—corn stalks, wood chips, wasted food, and paper. They would quickly get to work digesting the cellulose, breaking it down to molecular glucose. The glucose could then be decomposed to such high-energy compounds as ethyl alcohol or ethanol by ordinary yeast.

It was the germ of a great idea. But millions of different microorganisms could digest cellulose and Emert had to find the

CONTINUED ON PAGE 124
SEEDS OF LIFE

From the abyss of space came the comets...and life

BY TERENCE DICKINSON

Today a spectacular comet brandishing a fiery tail like a detached segment of the Milky Way is a sight so rare that only a few people see a comet more than once in a lifetime. But 4 billion years ago, when there was nothing on the earth but primordial ooze, the sky was alive with comets. Night and day the scintillating streamers swept across the skies of primitive Earth. And every few centuries a Jupiter-sized cometary nucleus would smash into this planet, throwing tons of comet stuff—water, methane, ammonia, and huge quantities of clay-like dust—into the atmosphere. It went on for this for several hundred million years during the last and longest phase of the solar system's formation. This was the time when the seeds of life fell to Earth.

Cometary bombardment has recently emerged as the elegant mechanism that may have created Earth's...
bosphere its atmosphere its oceans its crust and its life forms. Comets, a few scientists believe, were the manna from heaven that scattered the ingredients of life across a young planet which otherwise might have remained sterile.

Some researchers have carried the theory even further suggesting that life did not originate on primordial Earth at all but rather on comets deposited there in the form of viruses. We it seems, are comet stuff.

While several investigators are willing to go that far interest in comets is heating up after decades of neglect. This renewed enthusiasm couldn't be better timed. Less than three years from now Halley's Comet will hurtle through our sector of the solar system. It will not be ignored. Five robot spacecraft will greet Halley in February and March 1986 providing mankind with its first closeup views of a comet. These explorations are taking on new significance as evidence accumulates to suggest that our own origins are intimately interwoven with these cosmic wayfarers.

Until recently the connection between comets and life went largely unnoticed. Before the 1980's conventional wisdom had it that the components of Earth's biosphere emerged from within the planet through volcanic activity. Although planetary scientists have yet to junk this concept more of them are now taking the comet scenario seriously. U.S. Geological Survey (USGS) planetary geologist Eugene Shoemaker representing the comet camp, goes so far as to say, "The old notion that Earth somehow was formed of stuff that had these things already in it is frankly rather naive."

Shoemaker and others are convinced that the sun once pumped out 1,000 times the energy it does today baking the material in the region where Earth would form. In such heat they believe, the lighter elements remained gaseous and could not solidify when the planet did. "I'll never get cool enough for [the elements] to condense out," Shoemaker asserts. Yet these elements are now common in the biosphere, they must have arrived after the Earth formed. Shoemaker's explanation: The light elements got here by means of the comet express.

Naturally there is a certain amount of crystal-gazing involved in tracking down Earth's genesis but a few facts point us toward the comet thesis. According to analysis of the Apollo lunar samples the era of heavy cometary bombardment on the moon (and, by inference on Earth) ended about 3.9 billion years ago. Since it is known that Earth's crust has been largely undisturbed since that time, comet stuff most likely has formed a good percentage of our planet's surface layer.

Another piece of evidence comes from ancient rocks found in Australia and South Africa. They hold preserved microfossils of primitive bacteria dated at 3.5 billion years. On a geological time scale this life seems to have emerged surprisingly suddenly. Could comets have carried to Earth more than just the chemical ingredients of life? Could they have carried life itself? This tantalizing question has stimulated comet research in the last few years eliciting some eyebrow-raising theories in the process. (More about them later)

Most astronomy texts will tell you that comets are bits players on the solar-system stage, but powerful number crunching techniques applied to data that have been available for decades have led scientists to suspect that the significance of comets is not minor after all. In fact, they may be after the sun the most massive constituents of the solar system.

Some basic facts. According to the experts comets are chunks of ice and dirt that range in size from a boulder to a mountain a few miles in diameter. Their tails are mere wisps of vapor created when the sun melts the icy body's skin but they can span more than an astronomical unit, the distance from Earth to the sun. Several times a century a comet visible to the naked eye will grace the evening or morning sky. Each year a dozen or so lesser comets are seen most remaining inconspicuous. Both impressive and obscure comets spend most of their lives in the solar system's storage freezer beyond Jupiter.

Halley's Comet for example spends all but two years of its 76-year round trip beyond Jupiter's orbit. Halley's path follows an elongated circuit around the sun crossing the orbits of seven planets from Venus to Neptune. Since 240 a. d. it has been seen on all but one return to Earth's vicinity. Last October Galileo astronomers using the 200" telescope at Mount Palomar, spied the famed object near Saturn in the first sighting before its next swing around the sun in February 1986.

About 130 less well known and mostly dimmer comets have orbital periods that vary from 3 to 200 years. More than 500 others have been seen only once, the tail ends of their orbits extend well into the abyss beyond Pluto. They wont be back for centuries, or perhaps even millennia.

Most astronomers today believe that somewhere beyond Neptune and Pluto a colossal reservoir of these celestial ice-balls surrounds the solar system. This remote comet storehouse even has a name, the Oort Cloud, after the Dutch astronomer Jan Oort who first suggested its existence. The question now is Where did all comets come from?

Astronomers generally agree that the majority of comets originally condensed from a vast cloud of primal gas and dust that once occupied the solar system in the region beyond the present orbit of Saturn where Uranus and Neptune now circle the sun. The formation of Uranus and Neptune had the effect of shunting the comets in this area out into what is now called the Oort Cloud. Stars that passed within two or three light-years of the cloud occasionally had enough of a gravitational deflection to tug loose some of these remote comets. Eventually they would circle back toward the inner solar system. Thus the comets we see today are escapees from the Oort Cloud.

But this is an inadequate explanation for the heavy cometary bombardment that occurred early in Earth's history. Comets visible today follow a long, circuitous route, swinging halfway out to the stars before eventually looping back to Earth some eons later. This Oort Cloud escape mechanism is too awkward to account for the active heavy cometary phenomenon of long ago. It is more likely that primordial comets came to Earth directly from that early comet nursery just beyond Saturn and what drove them toward Earth as well as out into the Oort Cloud many believe was the formation of Uranus and Neptune. When we look at the most reasonable mechanism for the formation of Uranus and Neptune from the protosolar nebula says Shoemaker, we find that large Jupiter masses are needed to make these two planets. The accretion [buildup] process out there was very inefficient. Only one percent of the primordial material in the region actually found its way into Uranus and Neptune. Most of the rest of it remained in the form of comlike bodies. This means that the outer sector of our planetary system initially harbored trillions and trillions of comets whose total mass was many times that of Jupiter.

Planetary formation in the outer solar system was unimpeded compared with the accretion of the inner planets—Mercury Venus Earth and Mars. Their accretion probably was 99 percent complete in 10 million years while according to University of Toledo astrophysicist Armie Delporte, out in the region of Uranus and Neptune this process was going on for more than half a billion years.

During these eons, Shoemaker says, 50 percent or more of the trillions of comets in the Uranus-Neptune region were ejected from the solar system. Many others found a resting place in the Oort Cloud. However, our calculations show that a surprising amount of cometary material worked its way into the inner solar system. Shoemaker reports, more than enough to pro-
No man can turn back the hands of the clock, but according to this chemist, who revolutionized the laws of thermodynamics, time is on our side.
Einstein wanted to transcend time. Science was a way to get to a safe harbor in eternity. But I want to feel the evolution of things, to be embedded in a reality that is temporal.
Maurice Prigogine was awarded the Nobel Chemistry Prize in 1977 for his work on nonequilibrium thermodynamics and the study of irreversible processes. Since then, his ideas have inspired a host of applications, from the study of the evolution of living systems to the understanding of complex systems in general. Prigogine's work has been influential in many fields, including biology, economics, and social sciences.

In this article, Prigogine discusses the relationship between scientific disciplines and the importance of interdisciplinary thinking. He argues that traditional disciplinary boundaries are no longer sufficient to understand complex systems and that new methods and approaches are necessary. Prigogine emphasizes the importance of creativity and intuition in scientific inquiry and the need to break free from the constraints of traditional thinking.

Prigogine also discusses his own work and the development of his ideas, including the discovery of the phenomenon of self-organization and the concept of dissipative structures. He reflects on the impact of his work and its implications for our understanding of the world. Overall, this article provides a fascinating insight into the mind of one of the most influential scientists of our time.
Prigogine: Yes. I believe that's correct. You see, in the classical view, we had already essentially discovered the great laws of nature: the laws of physics. In my view we have yet to discover them. If you had asked physicists a few years ago what they understood about nature and physics, they would have been predictable. They would have said, 'We don't understand the laws of thermodynamics. We don't understand the laws of chemistry. We don't understand the laws of biology.'

Prigogine: The second law of thermodynamics always had a dual character. On the one hand, it introduced a kind of arrow of time. In isolated systems, entropy is always increasing. It introduced the idea of thermodynamic equilibrium (complete randomness) as the state corresponding to maximum entropy. Our work has shifted the emphasis from equilibrium to nonequilibrium—irreversible processes.

OMNI: Aren't there aspects of your theory that defy the laws of thermodynamics?

Prigogine: No. On the contrary, they show only that the meaning of the laws near equilibrium and far from equilibrium are different. Near equilibrium you always go to the most probable state. Of classical physics and of the universe. This may be true to some extent for the entire universe as a whole. But at the moment it's a very difficult question because we don't know the relation between entropy and gravitation.

OMNI: What do you see here on Earth is just the opposite of entropy. Instead of going to death, we see successive diversification. And so, in spite of the fact that the second law is probably satisfied, we are not going toward equilibrium because this stream of energy comes to us finally from the stars in the galaxy and so on. It ultimately originated in the big bang or whatever—the original presence in the universe.

OMNI: How does bifurcation apply to life?

Prigogine: The way structure appears is a fascinating riddle. Of course, living organisms are historical—they carry genetic information from half a billion years of evolution. So the appearance of structure in biological systems is not easy to study because you have to take into account what is heritage and what is assembled today. But it seems to me bifurcation is the key phenomenon in shaping morphogenetic patterns, especially when you see the type of process that is involved in the process of induced mutations produced after exposing living systems to X-rays, for example. Here you have started with a very symmetrical system whose symmetry has been broken. How does this happen? In a sense, there are two choices and the system can go in one direction or another. A good example is the formation of the body of a fish. The basic cell is basically spherical and symmetrical, but then goes into less and less symmetrical structures. Of all the problems in biology, the role of bifurcation in the transition from one direction to another, is vitally important.

OMNI: What is the biological importance of the chemical-clock experiments?

Prigogine: The amazing thing is that each molecule knows in some way what the other molecules will do at the same time over relatively macroscopic distances. These experiments provide examples of the ways in which molecules can communicate. The chemical clock is perhaps one of the simplest examples of the chemical communication that plays such an essential role in biological systems.

OMNI: You once used highway driving as an example of dissipative structures as applied somewhat loosely to social structures. How does this work?

Prigogine: When you drive on the highway you use your own program of your own speed. When other people drive at the same time competition begins. This competition brings about a change in your driving. This is feedback. Feedback is a situation that involves nonlinearities. It is far from equilibrium in the sense that as more and more people drive, the situation becomes more and more distorted.

OMNI: I don't understand what the nonlinear aspect is.

Prigogine: The competition between the
drivers. You can make a very simple theory which I did twenty years ago that incorporates the effects of your own wishes, the way other people wish to drive and the competition between the various wishes. You come out with the kind of nonlinear equation that describes this evolution.

First you drive as you want to. Then you take into account the other drivers but you still drive as you want to. That is what I call the individual regime. Then you go beyond the critical concentration of cars and come into a new organization in which you force the other drivers to drive as you drive. I call that the collective regime. It is a very good example of bifurcation, a phase change to a coherent structure—the highway as a whole. Now this is not necessarily beneficial. You are embedded in something that does not depend on you and in which you are a part. You contribute to it but isn't escape.

Omni: What are the characteristics of being embedded in something?

Prigogine: Being embedded implies a mutual situation. You drive in a way that influences others, and other people influence you. You can no longer say that you have free will. You are part of a collectivity to which you contribute, even in a sense against your will. And then on highway driving show there really is a transition to a different phase when the critical concentration is reached.

Omni: Could you cite another example of commented and feedback?

Prigogine: The way in which music developed. Music evolved in society according to the particular types of instruments people invented. Metal wood and string have the same physical properties everywhere. But the musical instruments that emerged affected the music that could be played; which in turn influenced the type of music that was composed which altered the evolution of the instruments.

So a symphony orchestra is one expression of what wood, string and metal can do. But we also have Chinese music, Indian music, and so on. And there are different underlying value systems as well as different observed behaviors. We appreciate one kind of musical scale; another culture, a different Fourier function.

Omni: What effect do you suppose your vision of nature will have on the cultural tensions that are usually associated with classical science?

Prigogine: Well, the classical view of nature was passive. The world was thought to be an automaton the universal clockwork. Joseph Needham, the great [British] historian, once said that Western thought has oscillated between seeing the world as an automaton and seeing it as a theological construct in which God governs the universe. Actually, these two views are not so inconsistent. If the world is an automaton, it needs a God to govern it. An automaton is not self-governed. But this kind of concept present us with a rather tragic choice to accept scientific rationality and the alienation that is the consequence of this acceptance, or to go into philosophical speculations that are divorced from contact with science. I think such a choice is no longer necessary.

Omni: Why is that?

Prigogine: The classical view divided the universe between spiritual self and the physical external world. Yet inside us we see activity, we experience change. This internal experience is in complete contrast with the view of the world as a timeless automaton. As we begin to discover the roots of time outside us this duality tends to disappear. We see a convergence between the world outside and the world inside us. With the paradigm of self-organization we see a transition from disorder to order. In the field of psychological activity this is perhaps the main experience we have—every artistic or scientific creation implies a transition from disorder to order.

Omni: What was the classical response to

Today various climates could evolve Glaciers could come down and the earth could be covered with snow. Yet it would be the same planet revolving around the sun.

Omni: And how would this analogy apply to the classical world view?

Prigogine: Well I think today we have begun to accept the idea that our physics is the result of our conscious activity. The classical idea was that when you studied physics you looked at nature from outside, as if you had the infinite wisdom that traditionally has been attributed to God.

Omni: How important is human consciousness in determining the kind of world view we ultimately construct?

Prigogine: Consciousness plays an essential role because we construct reality through mathematical concepts. If our consciousness had a different structure we probably could not use the same type of constructs that we do. That is not to say physics is subjective. There must be a relation between our physics and reality, however the way in which we speak about this reality is something we create.

Omni: Has our desire to understand reality led us to greater complexity?

Prigogine: Max Born, one of the great founders of quantum mechanics, once wrote that he believed ideas such as the
McLuhan warned that aliens were coming. He was right. They are Silicon Valley's TECHNOKIDS.

MARSHALL McLUHAN

On December 31, 1980—some would call it the last day of the Industrial Age—Marshall McLuhan dozed his bloodshot brown eyes for the last time, at exactly the moment he had prophesied. "The future society will not include me," he once confided. "I belong to the dying breed."

A revolution was under way. McLuhan saw, and its impact on society would be devastating. "We are living in the apocalyptic," he warned.
in 1975. Mom and apple pie will never survive. The new breed McLuhan imagined would be at home with electronic media as earlier generations had been with footballs and bicycles. In a world where messages flash from Tokyo to Tokyo at the speed of light the future child would live in the moment. Reacting to information almost as fast as computers could churn it out digesting little of it as it sped past.

They are the children of the Electronic Age, evolving the qualities necessary for survival in the world of tomorrow. The said of the first techno-kids

"In the not-too-distant future they may have more in common with a creature from another planet than they have with their own mothers and fathers."

Only two years after his death the children of Silicon Valley are beginning to appear among us. They closely resemble the techno people of McLuhan's vision. Kids used to have a lemonade stand when they were eight years old. Everett Rogers, a hip professor of communications at Stanford University's Institute for Communication Research. Now they are paid consultants to large computer companies in Silicon Valley.

Last summer at Stanford University a corps of technologically advanced students from Palo Alto's Jordan Middle School earned $3.50 an hour by teaching adults how to work computers. "I wouldn't do it for free," says David Peer age thirteen. Just as my father delivered newspapers I work with computers to earn extra money. The Palo Alto prodigies are far from unique. In a forthcoming book entitled Silicon Valley Fever Rogers describes David's peers who live in enclaves of techurbia flourishing across the United States. The first such community grew up around Stanford University. By 1975 some 54 high-tech companies had spread from Palo Alto to San Jose. On the East Coast, Silicon Valley's counterpart sprang up near MIT and clustered around Route 128 the bypass that circles through Boston's western suburbs.

Two other well-known high-tech centers can be found around Rensselaer Polytechnic Institute in Troy, New York, and in the Research Triangle formed by Duke University, the University of North Carolina at Chapel Hill, and North Carolina State University at Raleigh.

Other centers of the electronic society are budding. Rogers has found them in Rochester, New York; Ann Arbor, Michigan; Minneapolis; Portland and Eugene Oregon; Colorado Springs and the west side of Denver Dallas and Austin; Salt Lake City; and the extended suburbs of Los Angeles. Each has grown up around an outstanding school of engineering with a bent for industry. Each center is witnessing the first stages of the electronic culture McLuhan foresaw.

In the classrooms of Silicon Valley especially seventh-grade and eighth-graders are already running on a program different from that for kids in the rest of the country.

Few of our children are being prepared to live in the world of tomorrow warns George Tressell of the National Science Foundation. Parents do not seem to understand that their children will live in a world where listening talking thinking machines are everywhere. The pressing problem is to give our children enough technological literacy so that they'll be able to compete on this exciting new frontier.

Otherwise they are destined to become second-class citizens of the new society.

To watch the new breed in training visit Palo Alto's Jordan Middle School where David Peer and his fellow Stanford teachers have conducted computer clubs for 285 students there 460 voluntarily attend a computer laboratory each week. They don't score any brownie points says Joan Targ the teacher who sets it up. "They don't get any credit. They come out of curiosity."

Or say Gwendaline Mazzara because our mothers force us.

The parents of Silicon Valley most of whom are computer-industry managers are programming their children to survive in the future. "Moving into techurbia without a home computer is like living in suburbia without a car." Notes Irene Stanford who teaches first grade in San Jose's Williams School. When the school district did not supply computers in the classroom the parents went out and collected the money to buy them.

Even to those on the scene the effect of the electronic machines may not be apparent. "I don't think they are different from other kids," declares Jordan's principal Peter Holman. "They don't look different. They don't behave differently. They're not a bunch of scientific eggheads.

Yet he acknowledges I would guess that virtually all the kids here have grown up with a practical exposure to technology. "Over and over again I'm astonished by the normalcy of computers in their lives. They accept them as a natural part of their environment. But that doesn't make them freaks of nature does it?"

Not yet. But neither does it make them the kind of kids their parents were. "For boys" according to Targ "digital dexterity means prestige, possible jobs, and a little macho. Sixteen-year-old David Blacher agrees that computer skill carries weight. "If you can create tricky programs that really haven't been done before everybody wants to get into your head," He smiles. Even if you don't make it as a football player you can score some status points with the girls at the keyboard.

For girls the transition to the new society has been more painful. "Most girls are scared off by the fallacy that you have to be a mathematical wizard to program a computer," reports Targ. "At the computer center we try to present programming in a totally different context." Still nationwide relatively few girls have made the breakthrough. At twelve and a
What would you give a man who could make your deepest dream come true?

Ray Bradbury's

Something Wicked This Way Comes

RAY BRADBURY'S "SOMETHING WICKED THIS WAY COMES" A JACK CLAYTON FILM
Starring JASON ROBARDS  JONATHAN PRYCE  DIANE LADD  PAM GRIER  Produced by PETER VINCENT DOUGLAS
Screenplay by RAY BRADBURY based on his Novel  Directed by JACK CLAYTON  Music Composed by JAMES HORN
WALT DISNEY PRODUCTIONS  Letters and Envelope Camera by PANAVISION P.C. DOLLY SYSTEMS
COMING APRIL 29th TO THEATRES EVERYWHERE.
half. Gwendaline Mazzara is in the vanguard. A petite eighth grader, she would have become a cheerleader in an earlier generation. Today Gwendaline is becoming a computer programmer.

"I didn't want to do it," she blurted out honestly. "My mother made me. I was just like taking piano lessons—something I had to do because it was good for me. When I first walked in the door of the computer center I wanted to run out. I just knew it was going to be really stupid.

"Maybe I thought it was dumb because I wasn't sure I could do it. I can't do it. I always think it's stupid.

Over the months Gwendaline started to have fun at the keyboard. It's hard but I really like the way it makes me think. Now I can do graphics on the IBM and even play music on the North Star Horizon. Why shouldn't I take piano lessons when I can play music on the North Star Horizon by pressing a key—mentally?" Now I don't practice too hard. That's real progress to me!

Fifteen years ago predicting Gwendaline's comfort at the computer keyboard—and distaste for hard work at the piano keyboard—was McLuhan more notorously than followers. "Marshall was a kind of prophet of the twentieth century comments his student and close friend Walter Ong, a professor at St. Louis University and an eminent cultural humanist in his own right. "No man can live as a prophet in his own century, he becomes the source of too much controversy. "Some of the things Marshall was trying to say we still have not succeeded in formulating completely," he adds. "But there is a growing understanding of his vision.

What's dramatically different today is that we are conscious that we are living through a social revolution suggests professor William Paisley of Stanford's Institute for Communication Research. "The Industrial Revolution was not perceived as a revolution by those going through it.

McLuhan's key insight was that electronic technology challenges the natural laws of communication. In the past, he said, geographic distance created social distance. Only members of a single community could achieve the close contact that binds societies. Suddenly a message typed in Atlanta arrives instantaneously on a desk in Altoona. Our concept of space and time will never be the same.

Already the changes in our mental processes are appearing in the young even outside Silicon Valley. And again these modifications are as McLuhan foresaw. For one thing, there is a definite shortening of our attention span observes Tressel.

Christopher Crawford, chief game theoretician for Atari, experienced it firsthand.

In two years of lecturing he talked to more than 300,000 students in northern California high schools. "Our rule was that you didn't talk on any one topic for more than thirty seconds," he reports. "We discovered the hard way that if you talked very long you'd start seeing spitballs flying around and hearing rumbles from the audience. After a minute on the same subject the murmurs would get louder. If you were stupid enough to talk for two minutes the place would be a shambles.

With shorter attention spans comes more precise speech. "If you ask kids what time it is, notes Andrew Melar of the National Science Foundation, they will tell you it is eight thirty. Thunks like half past one, quarter of have gone out of their language. Kids are growing up with an exciting digital consciousness. Few of us recognize the importance of this unprecedented precision in speaking, but it signifies an entirely different relationship with our environment.

Marshall McLuhan recognized it and he did not like what he saw. He was a born anachronism a man who adhered religiously to the values of his own generation. A mid-life convert to Roman Catholicism, he read the Bible (in any of five languages) before sitting down to breakfast. A devoted husband and authoritarian father of six children he headed an ultrascientific household in the officious manner of Clarence Day in Life with Father.

In the sultry autumn of 1975 McLuhan sat in a tattered beige armchair in his unfinished basement contemplating with horror the future of the world. In my writings and lectures I never offer my point of view, he confided. But if you ask me what I personally would do with electricity I would turn the whole thing off. It's going to ruin everything in this world that holds deep meaning for people like me.

McLuhan meant what he said: wherever he could he protected himself against the Technological Age. He walked around Manhattan with cotton plugs in his ears. "How do other people stand this noise? he wondered. He moved his only television a 1967 Motorola out of the living quarters into the basement. It was an invasion of our privacy he explained. He stopped rock music Once he turned the speakers of his ten-agers' stereo to project the music out the window rather than into the living room. And he refused to tape his dictation or let his secretary switch from a manual to an electric typewriter.

Yet he knew that the time honored values he defended were already lost. "The members of the older generation are hoping that as the kids grow older and have families of their own they will adopt more traditional values. But their values are not going to improve. As far as I can see they're only going to get much worse.

People followed traditions to increase their sense of security and continuity with the past. But the electronic society is built on continuous progress, not tradition. "It looks forward to tomorrow instead of backward to yesterday. It has no past no heritage. The only thing stable is the knowledge that things will change.

When McLuhan heard the then popular
children are playing in the attic, dressing up in fancy old clothes, acting old dramas of their own devising in scenes of mild absurdity and silliness. The attic is also there, an unseen presence, and the, too, is playing. In these games there’s always something moving and unfixed—a smoking cigarette, an electric lamp through the window, green peppers, or a yellow pencil suspended momentarily in thin air.

The attic is full of interesting things, props for the children’s dramas. The artist plays with what the children find, and invents what they need: tools, smoke, plumed hats, shark's skulls, baby carriages, baboons, bulldogs, and other things with no meaning. The paradoxical images are found in the minds of girls, adding the obvious. Feel the painting with your mind. Touch it with your sensibility. Your reward will be a little sanity, interrupting the dreary dullness of the everyday world.
The twofold basis of Zen is a separate transmission outside the scriptures, not dependent on words or phrases, and a direct transmission from mind to mind. This is also a formula for the application of art. Therefore, do not rely on what is written about art; take your vision directly from the mind of the painter and your own mind. Don't stop at copying: enter the artist's domain directly. Do not interpret; sympathize. Do not translate; appreciate. Do not even approximate; apprehend directly. The vision that can be explained in words is banal. Meaning is not to be found in words.
The artist presents us with reality/surreality snapshots. No two alike, no two really different. The drama he painted cannot be understood through his distortion. They are his children, wearing masks and playing at being someone else. Nor does the key lie in the relationships between objects, the connections are buried deep in his mind, beyond even from him. If you must seek meaning, look for it in the fold of fabric, the glint of light on the skull, and in the spin’s peculiar grin. Meaning is on the surface; depth is the illusion.
Even now about 10,000 tons of extraterrestrial matter strikes Earth annually. It ranges in size from fine dust to peanut-sized particles.

This comes from comets. Even when just a snowball, a comet is a dirty snowball, says Carnegie Institute planetologist George Wetherill. But as it moves closer to the sun and begins to shed its material, its nucleus may become a giant comet, he says. Such monsters must be so rare, however, that we would have to observe the inner solar system to say anything about it.

A comet itself is a curious amalgam of materials and textures. Despite its icy nature, a comet's nucleus is surprisingly dark and barely more reflective than a chunk of coal. The standard description of a comet is a dirty snowball. But when we look at a comet, we see that the material ejected during vaporization is almost entirely water and water vapor. It's as though the comet is being cleansed of its raw materials before it can be called a snowball. Even Halley's comet, the one we're most familiar with, is composed of water and carbon dioxide molecules. But such comets are rare, and we may never see another like it.

The nucleus of a comet is a temporary structure, Hoyle says. It is a cloud of ice that is not much more than a mile in diameter. Such clouds of ice are fed by the sun, which supplies them with energy. As the ice melts, the comets are propelled through space, and they can be seen from Earth. The comets are most visible when they are closest to the sun, and they can be seen from Earth in the summer months.

But if we were to visit a comet, we would find that it is not a snowball. It is a cloud of gas and dust, and it is not very bright. The gases are composed of hydrogen, helium, and other light elements, while the dust is composed of silicate grains, carbonaceous material, and other heavy elements. The comets are composed of a mixture of these two components, and they give off a bright greenish-blue glow as they pass by the sun.

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Space scientists in the Soviet Union and America are engineering the next giant step in evolution

LIFE AFTER LIFTOFF

BY NICK ENGLER AND DONNA CHERISH-ENGLER

There is life on the moon. There has been for 16 years. Apparently some adventurous streptococci inhabits, described by NASA as "frequent, normal, benign inhabitants of the respiratory tract," slowed aboard Surveyor 3 and in April 1967 made a giant leap for microbe-kind. Several years later Apollo 12 astronauts retrieved parts of the robot spacecrash from the lunar surface. When biologists back on Earth incubated a piece of moulding foam from Surveyor's TV camera, a colony of the wayward bacteria appeared. Unprepossessing microorganisms have shown themselves well adapted for space missions.

At the other end of the biological spectrum, man is also proving to be remarkably adaptable to spaceflight—though he goes through some frightening physiological changes. After 211 days aboard the space station Salyut 7, cosmonauts Anatoly Berezovoy and Valentin Lebedev could barely stand, their muscles in their legs and back were so atrophied. Their hearts had shrunk, they had lost blood volume, and much of the calcium had been sapped from their bones. Yet they were healthy enough to survive the rigors of a hurrying nighttime landing. And after a few weeks of physiotherapy and massage their condition improved so dramatically that it was almost impossible to tell that they had ever been in space.

The investigation of adaptation and readaptation in all manner of organisms, from microbes to man, is part of a rapidly evolving science called bioastronautics—the study of life in space. Twenty years ago the discipline sought merely to determine whether living organisms could endure brief rendezvous in space. But as organisms grew in length, long-term habitation became an increasingly important consideration. Researchers began to study how the conditions of space influenced such diverse functions as the growth pattern of plants, the hatching of insect larvae, and myriad physiological processes in man. Now thanks to mounting interest in space colonization, bioastronautics is branching out in still more directions. This spate of activity is an answer ranging from the immediately practical—how should medical emergencies be handled in zero $g^2$—to the wildly futuristic—Will it be possible to establish an Earth-like microcosm in space, an artificial oasis that will support microbes, plants, animals, and man? Already some specialists have begun to anticipate the problems that will arise when space settlements evolve into full-fledged civilizations, complete with their own governments and institutions.

PAINTING BY BARCLAY SHAW
the reconciliation of biology and hardware," according to one of its pioneers, head academician Oleg Gazenko director of the Soviet Institute of Biomedical Problems (IMBP). Sitting in his Moscow office next to the stuffed remains of the dog Belka, one of the earliest space travelers Dr Gazenko emphasized to Omni the contributions of hard technology to space biology. His own involvement began in the Fifties when he first engineered the equipment that would keep canines—and later humans—allive while riding a missile. According to Gazenko the hardware-biology reconciliation still concerns space doctors and it will continue to do so far into the future. For example, Soviet biogeni- neers are developing a mechanical an- tidote for seasickness, the zero-g equivalent of seasickness. Known as a Cuban boot (after the Cuban cosmonaut Arnaldo Mendez, who tested the prototype), the device puts pressure on the bottom of the feet making the cosmonaut feel as if he's standing on solid ground—biologically fooled by hardware.

At NASA doctors worry that astronauts may suffer heart failures during the first few to six weeks in space, when they are most susceptible to cardiac arrhythmias. Cardiopulmonary resuscitation is a complicated procedure in microgravity but Dr Joseph Degoanni of the Johnson Space Center in Houston is designing a "thumper" that may simplify matters. A compressed-air-powered piston it wraps around the astronaut's chest and automatically administers blows to the sternum—biologically revived by hardware.

Another problem facing space doctors is how to restrain an incapacitated astronaut. NASA's first solution was a cumbersome and costly system of bungee cords. But astronaut Bob Overmyer came back from the fifth shuttle mission with an easier answer: "Duct tape," he told the medical experts. "You stick them down with duct tape. We've used it on the shuttle down with the stuff. Duct tape is now included in the shuttle first-aid kit—biotechnology restrained by ordinary dime-store hardware.

As the above examples illustrate space hardware is not necessarily synonymous with high technology. Before better engineering designs can be developed, we must achieve a fuller understanding of the body's response to weightlessness. Consequently hardware development is no longer the main preoccupation of bioastronautics research; increasing emphasis has been placed on the study of physiology in zero g.

The absence of gravity causes acute changes in the cardiovascular system. Muscles, bones, metabolism even anatomy. On Earth we expend one third of our energy fighting gravity. In space the heart takes if easy capillaries shut down and oxygen metabolism slows. Amigrational muscles atrophy the body loses potassium, magnesium, and calcium. Legs become birdlike and the waistline reduces as body fluids and internal organs shift forward. The heart! Aboard Salyut 7 French cosmonaut Jean-Loup Chretien experienced difficulty placing a cardiac sensor because his heart had moved so far up in his chest cavity.

Space doctors point out that none of these reactions is pathological. Everything that happens to the body in space is normal, the normal adaptive reflexes take over," explains Dr Stan Mohler director of the Aerospace Medical Program, at Wright State University near Dayton, Ohio. In a new environment our bodies seek a new balance. With the exception of the calcium metabolism, most human biological processes reach this new equilibrium—called homeostasis—after 40 to 50 days in orbit. And most scientists expect that calcium loss will level out in one to two years as it does in bed rest studies.

But as man adapts to life in space, he adapts to life on Earth. A sudden return to a one-g environment could overload a weakened heart or snap demineralized bones. So researchers are developing means to arrest (or at least slow) the adaptive reflex of rigor exercise, supplementing mechanical devices to restore Earth-normal circulation. Our earthman warns Gazenko I must not be allowed to become too much a spaceman—if he or she wants to come home. Scientists are also investigating whether an earthman can ever become a complete spaceman, even if he or she does not wish to come home. The question may sound academic but within the next half century space doctors fully expect to begin multigenerational missions—space settlement and/or interstellar exploration—during which travelers will live and raise children in space. If biological adaptation were permitted to run its full course, how would the changes affect reproduction, growth and the aging process?

The research on reproduction is fascinating, though inconclusive. Biologist George Nace a biologist at the University of Michigan has conducted experiments on frogs. His findings indicate that gravity is essential to the symmetrical development of the embryo, and that microgravity may increase the likelihood of abnormalities. But killifish embryos developed normally aboard Apollo-Soyuz. On Salyut 6 flies and four beetles flew multigenerational missions in good health. White mice became pregnant aboard a Soviet biosatellite but aborted after an unusually rough landing.

In an experiment slated for August 1983 on Salyut 7 the Soviets will allow the mice time for gestation and birthing. They hope, will provide the first good look at mammalian sex biology and growth in space.

The aging process is not so well researched but it raises equally fascinating questions. Dr Mohler performed this thought-experiment for Omni: "If adaptation is allowed to fully unfold, what do you get? Atrophied muscles, brittle bones, decreased cardiovascular capacity—short the body of a one-hundred-year-old man. Adaptation to space is very similar to the aging process but weightlessness cancels many of the negative side effects. In microgravity you won't develop jowls, breasts and buttocks will never sag, bone and joint diseases may disappear.

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Of course all of this assumes that man can adapt fully to space. When asked to speculate if humans will be able to live love and grow old gracefully in a zero g environment, most doctors are guardedly optimistic. "Life evolved in the sea a close analog of a weightless environment," points out Dr Don Stewart, a resident specializing in the problems of long space flight at Wright State's Aerospace Medical Program. "Who knows? We may be better equipped genetically to live in space than in one g."

Adaptation isn't the only unknown that needs investigating before man begins to live and work in space. Biostress has expanded to include studies in microbiology, botany and behavioral and physical sciences. Here are a few samples.

Artificial gravity. Gravity can be simulated in space simply by spinning the spacecraft. Everything inside literally sticks to the walls. This may be a mixed blessing for anyone on board. Rats subjected to artificial gravity on Soviet biosatellites retained calcium at normal levels and showed little signs of muscle atrophy or cardiovascular change. But they had difficulty learning to run a maze and even more difficulty retaining what they had learned—probably because the rats were simply "dizzy."

This doesn't spell the end of artificial gravity however. People become more tolerant of vestibular stimulation (fluid changes in the inner ear thought to cause dizziness) as they spend more time in space notes Dr Stewart. For almost a month after re-
Life Support As missions last longer plants will become essential to help regenerate air, water and food. Due to the lack of gravity, roots stems and leaves grow in all directions, and plant development is generally slower than on Earth. Still, cosmonauts on Salyut 7 successfully sprouted wheat and peas although the plants produced no seeds or blossoms. Aboard Salyut 5 the Soviets used weak electrical current to stimulate plant growth and coax arabis. (a small plant with a brief biological cycle) to flower Salyut 7 has a permanent garden called OAIS from which cosmonauts periodically harvest tiny crops of green onions, dill parsley and cucumbers. In addition to changing the cosmonauts' diets the green growing things provide psychological benefits. Soviet crews opt to spend much of their free time gardening.

Radiation Both NASA and the IMBP closely monitor radiation inside and outside space vehicles. The Soviets in particular are concerned about the possible dangers of cumulative doses of radiation. During periods of solar activity cosmonauts don protective shielding or change orbit to avoid pockets of ionizing radiation. The Moscow Institute of Genetics in coordination with Gazenko's IMBP has conducted studies on various plants and animals in space to determine the full extent of the danger. So far there have been no genetic mutations or other adverse effects. The Soviets note however that the antitumor stability of rats decreases in space. This combined with higher than normal radiation might mean an increased risk of cancer for space settlers.

Health Care The conditions of space may make us resistant to some diseases and vulnerable to others. For example although radiation may increase susceptibility to cancer studies of crown gall (a plant tumor) indicate that malignant cells do not proliferate as quickly in microgravity. So cancer may at once be more prevalent and yet less threatening in space. Viruses also seem to have trouble growing in space sometimes producing 25 percent fewer progeny than on Earth. If further research supports this finding colds influenza and other common viral infections should be relatively rare among space colonists. Bacterial infections however are another story. Unlike viruses bacteria thrive in weightless environments. NASA doctors are understandably concerned that they may become major scourges in space. Their fears are compounded by uncertainty about how antibiotics and other medications work in the absence of gravity. Because of fluid shifts the body reacts differently to different drugs. Cosmonaut Vladimir Shatalov once took a med cocktail, then spent the rest of the day in near slumber. To determine safe dosages the Soviet IMBP is studying physiological parameters in space from blood pressure to hormone and immune system levels.

Ecology If space doctors finally decide that man can't adapt to the environment it may be possible to adapt the environment to man. The Jet Propulsion Laboratory (JPL) in California and the Space Biology Laboratory at Moscow University have both studied the reactions of terrestrial life under Mars-like conditions. For example JPL scientists reproduced the Martian atmosphere inside an airlock chamber complete with artificial sandstorms. Temperatures fluctuated between 20°C and -60°C while the vessel was poked with X rays and ultraviolet radiation into this hostile environment the experimenters introduced a variety of species. Birds and mammals expired in a few seconds. Turtles survived for six hours. Frogs up to 25 hours. Several species of insects lasted a few weeks. But some algae and bacteria adapted easily to the harsh conditions. These organisms could be used to establish a primitive ecology on the Red Planet fixing carbon in the soil and emitting oxygen. As the density of the atmosphere increased temperature would rise and polar icecaps would melt pouring tons of water across the then Martian landscape. This would make it possible to introduce higher and higher life forms. The entire process from microbes to man would take more than 10,000 years.

No one expects this project to get under way anytime soon. The United States and the Soviet Union have agreed to quarantine the planet until 2018. But if any of the Mars landers are contaminated like Surveyor 3 we may have inadvertently begun.

Perhaps the most serious problem in bioastronautics today has to do with bioengineering adaptation medicine or any other single study. No matter what the mission space doctors are often flying blind. chipped by a lack of data.

Do you know what would happen to me if I, a NASA physician, asked someone with the Right Stuff to go in a corner and contribute some of his, uh, stuff to medical science?

In the United States the problem of obtaining data is further aggravated by a fundamental rift between scientists and subject. "You've got to understand," a NASA physician explained, "there's been twenty years of bad blood between astronauts and doctors. Since the Mercury days the Right Stuff has been read as being cocked and provided by medics. Astronauts insist on 'limited veto' rights over medical experiments. As a result many studies never get off the ground.

For example while trying to validate a tumor that specimen counts of Soviet cosmonauts are abnormally low in orbit. Orensky asked space doctors if similar studies are performed in the United States. One answer: "Do you know what would happen to me if I told someone with the Right Stuff to go in a corner and contribute some of his, uh, stuff to medical science?"

Astronauts may become more obliging guinea pigs. However when the U.S. Air Force starts to take an active role in space flight another physician points out: "The Air Force will have a totally different relationship with its astronauts than we (NASA) have with ours.

More information about space medicine should also become available with the launch of Spacehab 1 in September 1983. American and European scientists plan to conduct increasing numbers of life science experiments aboard this prototype orbital laboratory. In addition Spacehab will feature a bioreactor reusable facility to study molecular cellular plant and insect biology in space.

But despite all the work that hasn't been done bioastronautics has already firmly established itself as a scientific discipline.

There are three schools in the United States and one in the Soviet Union that train physicians in space medicine. And in the near future bioastronautics is likely to spawn two new spinoff sciences: psychoastronautics and socioastronautics. Marathon space missions demonstrate the need for psychological studies. Throughout their 183-day flight on Salyut 6 Valery Ryumin and Leonid Popov were starved for social contact and familiar things. They became emotionally attached to several flies that they freed from an experiment and even gave them pet names. (At the time these insects were the only other living beings on the space station," explains Gazenko.) Before the arrival of each new Progress tanker the cosmonauts were as excited as kids at Christmas because the supply ships contained the smells of Earth.

On the ground the Group for Psychological Support develops ways to ease this emotional strain. It monitors the moods of Salyut crews through analysis of voice harmonics and facial gestures. When a problem is recognized the Group provides therapy. The next supply ship may contain a much missed personal item for a depressed cosmonaut or a privacy curtain to expand the psychological living space.
He dashed to the bathroom, splashed cold water on his face, and shot the specters with his Polaroid One-Step

ANTIMATTER

It isn't that Rev. Harrison E. Bailey minds taking dictation. But when he was stirred at 1:30 A.M. to record the words of two disembodied heads, he started to shake. Bailey's incredible tale is enough to shake just about anyone.

The preacher says he awoke early on the morning of November 1, 1978, to find a couple of ghostlike aliens against the window shade of his Pasadena, California apartment. He dashed to the bathroom, splashed cold water on his face and returned to shoot the dark brown specters with his trusty Polaroid One-Step.

Then came the message, a half-hour of religious generalities. Stenography isn't the former steelworker's best skill, yet Bailey managed to get it all down—including the final: 'I love you repeated ten times. in Chinese. I do not speak.

To help the clergyman prove his story, the aliens sat for more photos, growing wizened, whitish legs for the full-length portraits. They also donned Halloween masks that Bailey had saved from a party. It made them look a bit less authentic, but the minister took five pictures (including the one shown above) anyway.

Suddenly, Bailey says, the aliens darted toward the bathroom. Their shapes now humanoid and four feet tall. He got a photo of each in the hallway, then glimpsed them shoot through the ceiling in whirling globes of light.

Bailey returned to bed and dreamed lifelike of his strange visitors. After fretting for more than two months, he told his tale to friend and longtime ufologist Ann Druffel, who passed the pictures to psychic researchers for criticism and analysis.

As might be expected, the photos got mixed reviews. Cyril Permutt of the Bureau for the Investigation of Parapsychological Photographs in London has reported that they showed no trace of a hoax.

One Los Angeles ufologist however announced. These photos are an embarrassment. The aliens might be made from stockings. Some of the photos were puzzling even to Druffel: he photos with the masks, she says, seem to have been taken with a as the .

The beings disrupted Bailey's sleep for a year. Then, this past Halloween, he asked Druffel and psychic Anita Furdek to exorcise the creatures. As Druffel and Furdek tell it, it was a hard battle. Furdek was tossed all night as though racked by epileptic seizures. The creatures weren't hostile, Furdek feels just playful and young.

Although Furdek finally persuaded them to leave Bailey in peace, then went downstairs to discover that Druffel's car had been stolen. I looked out the window, Furdek says, to see the ETs having the last laugh.

Is a strange tale. Druffel admits. But she says, Most of the researchers who met Bailey feel he is extremely rational and honest. We just have to accept his word because he has been unable to duplicate the effect in front of scientists.

ALAN VAUGHAN
His name is Jones. He fought Arabs and evaded unscrupulous competitors escaped from deadly vipers and crashing boulders. He's even searching for the Ark of the Covenant.

But he is not the movie character Indiana Jones of Raiders of the Lost Ark.

He's Vendyl Jones, head of the Institute for Judaic Christian Studies based in Indiana and Texas.

The similarities between Indiana and Vendyl are more than coincidental. Phil Kaufman, who wrote the story on which the movie is based, worked with Jones on an archaeological dig near Jerusalem in 1977.

"Phil asked me if I could do a story based on things that happened to me," relates Jones. "He took some events and romanticized them."

It could be argued that some of Jones's adventures have been even more difficult and dramatic than the Hollywood version.

For example, the real-life Jones escaped from a site booby-trapped with not one but four gigantic, bouncing boulders. (A member of the excavation party jumped off a cliff to avoid being crushed.)

And though Indiana Jones found the Lost Ark, Vendyl is still searching. Before he determines the whereabouts of the Ark, however, he'd like to locate the ashes of the Red Heifer, an ancient cow that was allegedly sacrificed and burned. Once the Red Heifer has been found, legend has it the mystical power of the Ark will be restored.

Working with his own translation of the Copper Scroll (one of the Dead Sea Scrolls), Jones has already found some 20 references to the Heifer—including a plaster floor two man-made niches in the wall of a cave, and a burial rock with white sand beneath it. If his interpretation is correct, then the Heifer's ashes will be found in a bronze vessel with the Ark buried somewhere nearby.

Finding the Heifer and the Ark, says Jones, will have enormous religious significance. "According to Judaism, he points out, the Sanhedrin Court (the highest Jewish council) will be reestablished; temple worship will be reinstated and Jews from all over the world will return to Israel."

"Would there be this eternal seeking if the found existed?"

Antonio Porchia

Time was in Zimbabwe when young healers studied medicinal herbs and roots in the bush under the guidance of an elder witchdoctor mentor. But now many budding witch doctors attend Zimbabwe Herbal College, earn their TMP (Traditional Medical Practitioner) degree, and then intern at a healing clinic.

When ready to open a practice the graduate plucks down $20 and joins the 15,000 member Zimbabwe Traditional Healers Association, the witch doctor's AMA.

Eighty percent of the patients in Zimbabwe turn to witch doctors claims the president and founder of the healers association, Gordon Chavunduka, TMP.

"Many of our members use incantations or speak to the spirits. They wear beads and feathers. But despite such superstitious practice they still refer patients to M.D.'s for the treatment of certain maladies."

Chavunduka also chair man of the sociology department at the University of Zimbabwe makes radio and TV appearances to promote a positive image for witch doctors. The practitioner does not collect a fee: he notes until a patient recovers.

Herbs and roots, when ground into powder or boiled in leaf, reportedly cure backaches, mental illness, cancer and for an extra fee of $20 infertility.

Eric Mishara

"I don't believe in God because I don't believe in Mother Goose."

Clarence Darrow
从来没有人质疑。因此，他声称实验者在结果中被欺骗，实验结果被发表在《实验心理研究》一书上。

然而，Rampi's claims about the scam had exposed claptrap science. Washington University's Parapsychology Laboratory quickly declared that the parapsychologists had reached no particular conclusion in their published pieces. Spokesmen cited a December 1981 McDonnell Lab statement that the boys' performance could have been accomplished without psychic skills, and that the boys had been confronted with inquiries about their honesty with no confessions made.

Whether or not scientists were fooled, a crucial question remains: Can we justify fraud in the name of science? Many psychologists don't think so, but Steve Shaw has a different view. "For years Rampi told parapsychologists that they were being 'clown' on. But they wouldn't listen. They had to be shown..." - Marcello Truzzi

Suppose you were faced with 50 million refugees. Where would you put them? Tackling this problem toward the end of World War II, the US government formed a plan to ship refugees into outer space at least according to the controversy February/March issue of Mother Jones magazine. The plan says: "Mother Jones was developed as part of "M" project, a classified report on world migration commissioned by President Franklin D. Roosevelt in 1942."

Last summer Philadelphia librarian Sandy Meredith found a summary of "M" Project at Temple University archives and took it to writer Bob Sanders who collaborated with her on the "Mother Jones" article. What struck them as most curious and monstrous, they said, was a chapter titled "Interstellar Migration," in which "M" Project director Henry Field suggested that "temporary quarters" for the homeless might be built "on Venus or Mars."

Some investigation, though, shows that the "Mother Jones" story went a touch too far. Meredith admits, for instance that "Interstellar Migration" was incorrectly called a chapter..." - Mitrovan Zverev, Soviet scientist
When Judy Reeves returned from a hard day at the office last fall, she found her Belleville, Illinois, home surrounded by 100 pieces of metal, each one five inches long and shaped like a capital E.

Collecting the letters from her pavement, her garage, and even her tomato patch, she began to fear that the sharp metal prongs could hurt her eight-year-old daughter Kim (mother and daughter are shown holding the Es in the photograph above) and other neighborhood children. To prevent another attack, she vowed to trace the Es to their source.

"At first I thought kids had been playing at my house," Reeves said. "But later I found some Es embedded an inch deep in my roof—much too deep for children's play. I realized they must have fallen from the sky."

Reeves then assumed that the Es had been dropped from an airplane as part of a military exercise at nearby Scott Air Force Base. But federal aviation inspector Troy Simms soon convinced her that if the letters had fallen from a plane they'd have scattered like leaves, covering the entire neighborhood.

She was still baffled when she received a call from Illinois Power Company engineers, who had heard the Es in the local news. The letters, they said, seemed identical in size and shape to the tin alloy guts of their electrical transformers. After studying the letters, however, Illinois Power denied all responsibility. "It would have taken a spectacular explosion and an incredible power failure to send this metal hurling onto someone's roof," says company spokesman James Shipp. "But we've had none of that. Maybe they fell from a manufacturer's delivery truck. But if so, then don't ask how they got into the sky."

To Reeves, who thinks that Illinois Power may be trying to avoid a lawsuit, the Es remain a mystery. She lives in dread of the day another metal shower destroys her garden or strikes her on the head. "But she adds, 'my neighbors' jokes are the worst of it. I don't go a day without someone saying, 'Heard your house was bugged.'"

Peter Rondinone

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Peter Rondinone

"The ghost that got into our house on the night of November 17, 1915, raised such a hullabaloo of misunderstandings that I am sorry I didn't just let it keep on walking, and go to bed."

James Thurber

"No man will be found in whose mind a ray of light does not sometimes tyrannize, and force him to hope or fear beyond the limits of sober probability."

Samuel Johnson

Hundreds of people traveled to the tiny mining town of Holden, West Virginia, last fall to stare at a poplar tree covered with kudzu vines. The reason for the pilgrimage? The profile of Jesus Christ, people claimed, seemed to shine from the tree's thick foliage.

The tangled kudzu vines leaves and branches didn't seem particularly strange in broad daylight. But late at night, with streetlights aglow, the tree appeared to take on the solemn image of a praying Jesus as portrayed in religious paintings.

The 30-foot-tall tree's unusual shape was first discovered last September when a group of men had a few too many drinks in a nearby deserted building. Explains Brenda Bingess, a Holden resident: "Word quickly spread, and visitors from throughout West Virginia and neighboring states soon created traffic jams as they flocked to see the Kudzu Christ."

While some visitors called the tree 'spooky,' others labeled it "a miracle" and "a sign of things to come."

But no matter what their opinion, says resident Joan Means, "they were reverent, like they were in church."

Regardless of its meaning, though, the Kudzu Jesus of Logan County is now a thing of the past. Cold weather killed the vines and the tree itself is doomed. A highway will soon be built right over the spot.

Sherry Baker
solute certitude absolute exactness, final truth, and so on are tigments of the imagina-
tion and should not be admissible in any
field of science. I agree with him most
in his belief that this looseness of thinking was
the greatest blessing modern science has
given us. You see, to me this coexistence of
unconscious and conscious activity—of
opacity and transparency—will ultimately
lead to a new cultural unity.
Omni: Of what sort?
Prigogine: Well, by rediscovering time
and randomness in physics, we encounter
many things that are of basic interest in other
fields of human endeavor. All this leads to
a common perspective. I think there is
a common stream running through the
development of physics in our century—be it
relativity, quantum mechanics, or the
second law of thermodynamics. In a vari-
ety of ways they all show that there are
limits to our power to manipulate matter. In
classical physics we thought we could send
signals with infinite velocity and measure
any physical quantity with arbitrary preci-
sion. Today we know both of these feats
are impossible. For example the velocity
of signals is limited by the velocity of light.
Measurement is limited by quantum me-
chanics. Our manipulation of matter is
limited by the second law of thermody-
namics. But these limitations don't mark the
end of our knowledge of nature. On the
contrary they are the starting points for
some of the most powerful theories hu-
mankind has ever constructed.
Omni: In a commemorative lecture you gave
several years ago honoring Albert Ein-
stein you noted that he had become the
Darwin of physics. Darwin said to us that
man is embedded in biological evolution
and Einstein taught us that we are
embedded in an evolutionary uni-
verse. How would you characterize Ein-
stein's contribution?
Prigogine: Einstein became the Darwin of
physics against his will. His view was of
a static, non-evolving universe. And when
people showed that this static universe was
unstable and had to be replaced by an
evolving, the second Einstein was aston-
ished. I knew some of the founders of the
expanding-universe theory very well am-
ong them the Belgian physicists: Lemaître,
Lemaître told me that Einstein was always
saying, "Well this big bang this evolv-
ing universe sounds too much like
Genesis. I'm not so happy about this. I
think you take my theory too seriously." But
to day we have all kinds of confirmation of
the existence of this large-scale evolution.
However, let's be careful because we don't
know whether this is the evolution of the
overall universe or just some galactic
neighborhood, in which we are living.
Omni: In the lecture on Einstein you noted
that his most striking contribution was the
idea that we are in an evolving universe
and that therefore the laws of physics have
changed. What did you mean?
Prigogine: The fact that there is an evolv-
ing universe which started from very
different conditions than now exist
completely changes our idea about the laws
of physics. When the universe started the
conditions of matter were so different that
present day laws have no meaning. You
can't speak about laws of life when there
is no life. You cannot speak about laws of
human behavior if there are no human
beings around. Therefore the very idea of
law itself becomes an evolutionary con-
cept to a certain extent.
Omni: Do you see any relationship be-
tween the way science has evolved in re-
cent years and the way science is now
considering new pictures of nature?
Prigogine: That is a very difficult question
for an internal history of science corre-
sponding to the evolution of theoretical
views. There's also an influence of culture on physics as a whole. On

The one hand the discoveries of unstable
particles and of the dissipative structures
haven't much to do with societal problems.
But they lead to a rethinking of the concept
of a natural law. The whole notion of a law
of nature was formulated by Descartes and
Newton in the seventeenth century, a time
of absolute monarchy. Nature had to fol-
low somewhat as people had to follow the
effects of the kingdom or the emperor. The
idea of a natural law certainly has a soci-
ological context. I find our period remark-
able precisely because some of the ques-
tions in social science and in natural science
form a kind of confluence. In the past we've
seen two other periods in which such con-
vergences occurred, the Greek classical
period and the Renaissance. And during
both those periods you had people like Plato
and Aristotle, or Descartes and Newton,
who were philosoper-scientists.
Omni: A number of social thinkers now cite
your theory of dissipative structures to ex-
plain the transformation they see occur-
ing in American society. What relevance
does your theory have to social systems?
Prigogine: What they are saying is that I
emphasize self-organization and there
fore spontaneity and amplification. In large
societies it becomes increasingly difficult
to maintain the spontaneous activity of
members of that society. I'm not a social
scientist. However I think what we need in
society is amplification spontaneity and
amplification. And that is exactly what is
missing in societies where one tries
to categorize people to pattern their
activities into well-defined channels. Nature
gives us a different model. Nature is trying
experiments all the time; some of them are
amplified others are not. The spontaneity
of nature is a model we must keep in mind.
The common denominator in very
differing issues is the desire to avoid the
mistake of classical physics which believ-
ed we could control nature. Today we
want to act on our creativity to promote
fluctuations that we can't control anyway.
Omni: How do your ideas apply to an open
system such as climate?
Prigogine: Yes; but we are also living under
what may become a promise because once
we have recognized the situation we can
hope to change things. I mean in the long
run not tomorrow. In a sense, we are fol-
lowing a bifurcation, one of several pos-
sible structures. There were times say
twenty thousand years ago when we had
humid and warm interludes between two
periods of the earth was much more fertile than it is now. So
the notion that the present climate com-
pletely determines the future is an over-
simplified one. It is being replaced by a
picture of multiple futures that hinge upon
fluctuations. That is, of course a very
threatening idea. It is also an idea that
brings hope if there are no catastrophes
or bifurcations.
Omni: What role does society play in fos-
tering creativity?
Prigogine: It's very difficult to be creative
in science and not be creative in more
WE'RE PLEASED TO ANNOUNCE that some things in America are still moving slow. It takes a whole lot of just sitting for a batch of Jack Daniel's to gain rightful age. And, since there's no way to speed this process along, our employees get good at just sitting too. You may feel most things in America move too quickly today. But after a sip of Jack Daniel's, you'll be pleased some things (and some people) still take it slow.
The patient allowing him to wash his hands in the morning, and then removing the faucet knobs from the sink.

“Is this the history of cleanliness provides a perspective on our current mania. The ancient Greeks used baths more for health reasons than for the removal of dirt, and in Rome bathing was a social duty to be performed in the company of others. But by the Middle Ages people who had not bathed in years might hold conversations through handkerchiefs soaked in perfumes or aromatic herbs. Bathing as a matter of private cleanliness did not become fashionable until the mid-1800s.”

“Bathing is the cornerstone of the American notion of cleanliness, but its psychology is no simple matter. Dr. Ernest Dichter, founder of the Institute of Motivational Research in New York, discovered that in the late Seventies when the Armour-Dial Company asked him to analyze the bathing behavior of the American people. His study showed that people who depend on the shower to wake them in the morning were almost addicted, without it they reported, their whole day went wrong. For others it seemed that the bathing ritual helped generate the hope that this day will be better than the last. Still others favored the sensual self-discovery involved in bathing. The lathering of one’s body—getting all of it covered and then washing it all off—comes close to narcissism,” Dr. Dichter noted.

Many batters, it seems, look literally the Protestant dictum that cleanliness is next to godliness. Most adults in the study associated bathing with such rituals as baptism and absolution, among other soul-cleansing rites. Some even saw in bathing a hint of immortality—perhaps because cleanliness suggests smooth skin, an antidote to the wrinkles of old age.

There are a few drawbacks to our mania for cleanliness. Worrisome to clean nature lovers is that the perfume in most soaps, after shave lotions, and deodorants attract mosquitoes gnat and flies. But while attracting insects, tastefully can repel spouses, say some psychologists. Unless mates hold compatible standards of cleanliness, a marriage probably will not be happy or long lasting.

Perhaps the most disturbing side effect of cleanliness is that it masks our body odors, in effect throwing a blanket over our pheromones. The body’s natural aphrodisiacs, King Louis XIV apparently had an instinctive awareness of this since it is known he would never let a woman into his bed if she had taken a bath within the previous month.

In the end our desire to clean the sky, wash the wind, and take stone from stone and wash them to paraphrase T S Eliot will never ward off a simple truth. Cleanliness is next to impossible.
A running suit that's more comfortable than your birthday suit.

This nylon microfiber band prevents chafing. A short that doesn't have it will rub you the wrong way.

You'd think running with no clothes would be more comfortable than running with clothes. It isn't. Because Bill Rodgers suits are designed to circulate air and keep you cool. So don't wear nothing. You won't be as comfortable. Besides, what would the neighbors say?

Bill Rodgers & Company, 86 Farnell Drive, Weymouth, MA 02188 (617) 335-2740

MOUNTAIN
CONTINUED FROM PAGE 76

most efficient one for his ethanol scheme to get off the ground.

He got the chance in 1970 while doing research at Virginia Tech. Screening thousands of organisms, he finally discovered the extraordinary digestive power of a fungus called Trichoderma reesei. The bug he says, that caused the jungle rot you've heard about during our various wars.

Analyzing the organism, Emert and coworkers found three crucial enzymes. During the next few years, they determined the environmental conditions under which those enzymes worked best at 104°F with both the yeast and enzymes added to the fermentor at once. When isolated from the fungus and put to work at those conditions, the three enzymes could break down paper wood chips and straw in one day instead of the customary three.

By 1975 Emert understood the process so well that the Gulf Oil Company decided to build him a pilot test plant in Pittsburgh, Kansas. It operated for three and a half years, indicating that the process could produce more alcohol at less cost than any competitive process. Emert's sponsors were convinced—Simultaneous Saccharification Fermentation, or SSF, as Emert's technique was called—would actually yield an impressive profit.

Then in 1979 Emert left Gulf to start preparing for a larger test plant. He would do much of the initial work 110 miles due south at the University of Arkansas, in Fayetteville. The reason for the move? The Arkansas area Emert explains is packed with paper companies, trash-handling companies, agricultural co-ops, grain producers—a host of industries that could provide biomass for our plant, then use the resulting ethanol themselves.

The George Emert of today has come a long way from Papaw's moonshine still. As a conversation piece, he keeps in his office a half pint of dynamite trash whiskey, distilled from the fruits of a suburban Baltimore dump. He speaks with no trace of a Tennessee accent, although a certain softness in his voice hints at something Southern. He is a political conservative of the William Buckley type. He wears expensive three-piece suits, and jets around the world seeking funds from corporate friends in Britain, South Africa and Japan.

Specifically, Emert is now seeking $40 million in largely private funds—federal stuff wouldn't be turned down as conservative as Emert is—to build a demonstration plant capable of producing 12 million gallons of ethanol a year. (After that, he hopes to build a commercial plant that can pump out 50 million gallons a year.) The new Arkansas moonshine professor Emert tells his benefactors, does not create social problems, it solves them. It can be made from most kinds of trash, which otherwise would go to waste, put intended. It can be mixed with ordinary gasoline, creating a new type of fuel that gets just as much mileage at comparable cost. And it can replace petroleum as the raw material for all kinds of plastics and chemicals.

If that's not pragmatic enough Emert asserts, residue from the process can be used to feed cattle!

Once agriculture and energy are restored, folks in postdoomsday Fayetteville might have a hangover to communicate with the world. But if they think they'll return to the primitive days of the black dial phone think again. They'll have in their midst one Gregory Salamo, Fayetteville's keeper of Sicilian-Neapolitan genes—and a laser expert who's helping to revolutionize fiber optics.

Salamo who comes from Brooklyn New York, loves everything about Fayetteville but the limited choice in Italian food. He started the physics department's laser program in 1975 following postdoctoral work at one of the nation's premier laser centers, the University of Rochester. Consonant with the U of A's desire to capitalize on strength laser experiments and theory now occupy two thirds of the 15 professor physics faculty.

No one expected it: this frictionless and relaxed, people-lover with none of the surface Brooklyn toughness said of his widely noted paper in Physical Review Letters. But recently a lot of people have called it rather cute.

Salamos cute might help revolutionize fiber optics—the communication technology that transforms information into pulses of light traveling not over wires but through thin fibers of ultratransparent glass.

Because light pulses can be made shorter than electrical pulses, Salamo explains, it's possible to pack more of them into a given space. Thus, optical fibers, by their very nature should carry more information than electrical wire. If a single fiber was working at optimum efficiency it would carry many messages (each made of millions of light pulses) at once. The result: superfast computers, compact telephone lines, and even TVs with a vast array of new channels.

But those optimizing the technology have long had one problem. Fibers had to come equipped with switches capable of separating the tightly packed light pulses, sending them off in different directions depending upon the message to which they belonged. Engineers could build switches to separate widely dispersed signals, but when it came to separating the more frequent pulses, scientists were stuck.

That's when laser pro Salamo entered the scene. The rapidly operating switch he envisioned was nothing more than a simple semiconductor. Whenever electrons in the semiconductor were excited, he theorized, they would reflect a pulse of light. When they ceased to be excited they would
let light pass through. By knowing just when a light pulse was supposed to arrive, engineers could make sure that the semiconductor electrons either were or weren't excited. In that way the switch could direct each pulse toward the appropriate channel and keep all the messages intact.

Salamo's proposal raised enormous excitement in the optic community, but it wasn't until this past winter that he and his team faced the crucial test—finding out whether electrons could, in fact, be excited at the rapid rates required. In order to test the concept, Salamo's team examined a cell of sodium. Using a laboratory laser they found they could excite the sodium (and its electrons) fast enough to separate pulses traveling down a fiber at the rate of a billion a second. Salamo's next step is to build a switch from a semiconductor, it should separate pulses zooming down fibers at the rate of a trillion a second.

Salamo's switch should be ready for use in about a decade. And when it is, the man from Brooklyn predicts it might well render electrical wire obsolete in communication fields across the board.

Salamo admits there is some professional risk to practicing international physics in a remote place like Fayetteville. But the quality of life is perhaps more important—he is sick to death of the Boro Yoons of the world. And surprisingly enough he finds the Fayetteville schools which his two children attend to be "supergood." "(A university administrator speculated that the educational quality is high because many teachers are professors' wives.)"

Regardless of what fallout and effluvia hit the future fans, folks in the remote Victorian water-forest jawol of Fayetteville will get by if you can't believe this, you can't believe anything.

One evening, sitting around in George Emert's comfortable passive-solar house (oriented exactly 33° to the southwest so that the winter sun falls directly on a heat absorbing black wall and the intense summer sun is shaded out by large overhanging eaves), I heard the master moonshiner discuss his life and art.

As he spoke I looked at his thick straight hair standing up for about half an inch; then falling back without a part; and I thought of what a great crew cut it would make. I saw the unlined boyish face, the control, the discipline, the air of the black belt. I saw Commander Cool and thought of "Happy Valley, back in Nam."

There is one thing you must remember about telling someone, "Emert said softly. "There are two victims.

Emert's house in Fayetteville is on nine tillable acres, with an Emert-dammed well-stocked fish pond and trees bearing various high-protein nuts. Emert has plans for wind- and water-paddle energy schemes, among a host of other survival contingency measures.

"I learned very early on to survive, because of the environment (those rough Tennessee Smokies) in which I was raised," Emert reflected. "I got into fights every day, and most often I was whipped because I was smallest. This taught me a basic survival lesson. Stay out of fights if at all possible. But I know how to take care of myself. I don't have to work at it because it's the way I grew up."

Emert is most concerned about the high rate of suicide and drug abuse among returned Vietnam veterans. More have died of these causes than died during the course of the war, he claims.

"But look, at one time there were more than six hundred thousand of us in Vietnam and you never read that most of those people are back and doing just fine," said Emert, doing just fine.

Knowing of my own concern about surviving a dim future, Emert offered to lend me three of his treasured survival manuals—very rare items indeed. I hesitated then accepted, and inquired whether he wanted me to sign a receipt.

"No, that's all right," Emert replied with a quiet smile warning, "If you try to disappear with them, I'll find you." I smiled back, of course and left for Roger's, which is where I want to go when I die after George Emert catches me.
VENGEANCE IS YOURS

Ex-lovers sometimes turn up in the strangest places

by Pat Cadigan

I told the bartender I'd give him a tip if he'd make me something that looked flashy and smelled more like. On the spot he invented the Silver Bombé—tonic water with a pearl onion, a prawn speared on a giant, curved alphabet stick, and a splash of those little silver balls you sprinkle on cupcakes. This finishing touch was the leftover Christmas tinsel tied around the stem of the glass. You didn't look at it, you beheld it. Bombé, the Silver Bombé. It smelled like a bonfire. I pushed the glass back toward the bartender. "I said, no bonus." "That's just a little grain alcohol I wiped around the outside of the

Painting by Stephan Beck
The 1983 Plymouth Turismo 2.2: 0-50 in 5.8 seconds.

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$730** Turismo 2.2's standard equipment would cost you $100 more on Camaro. Turismo 2.2 is one of the few American sports cars at its price—5-speed stick, sports suspension, and power brakes.

*Combined highway/motorway. **Estimated.
which he decided didn't appeal to him.

If you're here to get lucky, he shouted, "you just hit the motherload—or at least the mother. A regular bar star that one. Can have anyone he wants!"

"No offense but who asked you?" I swiveled around and faced Currin again. People were accumulating around him like old magazines. The alcohol and atmosphere were really working on him now. He wasn't the cheap drunk I was, but it didn't take him long to adjust his attitude. His face was glowing and snatches of his conversation came to me as his voice and spirits rose together.

He caught my eye again while someone was shouting something into his right ear. We exchanged glances; I began feeling slightly trashy.

I managed to grab my bartender as he was on his way back from serving a round around the gigglers on my left. The whiskey-sipping gentleman is ready for another. Put it on my tab and tell him about it. I figured it was safe to do that by now.

He already told me to bring you another when you're ready.

"Okay," I chugged the tonic water almost choking on some of the liquor balls. "I'm ready!" He sighed, took my glass, held up a hand to someone who was shouting at him, and backed into the other bartender Currin grinned at me, shaking his head. "You've made a conquest," the man behind me said. His lips brushing my ear. I drew away slowly. "Back off, will you?"

He stared at me for a moment and then turned away to move into the crowd. I made sure Currin was watching as I took my purse and put it on the now-empty stool. Under standing crossed his face, then my bartender arrived with the drink I'd bought him. The timing couldn't have been better. I dropped my gaze innocently fishing a large bill out of my sleeve for the bartender. I wanted to make up for the way I'd been tiring him up with dummy Silver Bombs during the rush. Slipping it under the base of my glass. I looked up to smile at Currin again. He was gone.

"This yours?"

I turned around. Currin was holding my purse out to me as he sat down. He had his coat with him.

"Thanks," I put the purse back on the bar without looking at it.,

"No, thank you. It isn't often a lady buys me a drink. A third Silver Bomb appeared and the old one was swept away money and all without comment. "That's on me.

"I appreciate it.

"Mind telling me what it is?"

"Silver Bomb. I quickly gulped down half of it to discourage him from asking for a taste.

"Silver Bomb! He shook his head. "I never did go in for mixed drinks. I like my whiskey unadorned. What's your name?"

"Lissa," I lied. Lissa sounded like someone who'd hang out in a bar to make friends.

"I'm Jeremy. He laughed a little. "I know, I don't look much like a Jeremy but I'm stuck with it. You on the other hand look exactly like your name."

"Thanks."

"Sure Lissa. That's your whole name right? Not short for Melissa or anything?"

"Why not?" I nodded.

"I knew I'm not an expert in names. In my data actually—but some people you can just tell certain things about," he looked around. "Be nice if we could continue this discussion at one of the tables but they all seem to be taken.

I stood up abruptly and pretended to survey the room. "In the corner," I pointed with my drink. "Those two look like they're ready to leave."

"Where?"

I followed me. I grabbed my purse and his sleeve in one movement and headed for the table I'd pointed at. The two guys sitting there finished their beer and rose just as we reached them. I grinned up at Currin while they vacated and then let him seat me.

He wasn't really a bad sort. A little shallow maybe but nobody goes to bars to find philosophers—philosophers buy their booze in bottles and drink it at home, Currin was glib enough and under other circumstances I might have found it easy to believe he was sincere. That had been Karen's mistake. I smiled as he made a joke I couldn't quite hear and he waved at the overworked waitress for this section. The former occupants of our table were explaining something to her as they stood near my old spot at the bar.

By the time she got to us Currin's arm had fallen off the back of the chair onto me. He was friendly when he was high but he wasn't even friendlier drunk. He remained coherent but I could tell that everything was looking better to him with each swallow especially me. His smile got broader he laughed louder and he seemed to be unaware how drunk he was getting which suited me just fine. If didn't know how drunk he was then he wouldn't know how drunk I wasn't.

About the time he hit what I had gauged was his saturation point he suggested we get something to eat. I had to boost him up out of his chair without seeming to and we did a little tango while I helped him on with his coat. He was happy to let me lead him between the tables—his hand on my shoulder to steady himself.

People were calling to him but I kept moving so he had to stay with me or fall down. We had to wait at the front door to let a crowd that had had its attitude adjusted elsewhere and was coming in to try its new outlook on the positive drinkers in here. I slipped out before Currin had a chance to recognize any of them.

"What?" He staggered a bit as the cold air hit him. "Talk about an eye opener!" He looked down at me and yanked me close
envelope me in his open coat. "You must be freezing."

We stood there snuggling for a few moments and I began to feel a little regret for what was about to happen. Currin wasn't totally incapable of being a nice guy in his own simple way. Might as well get this over with, I thought and pulled loose.

"I'd better drive," I said and herded him down the sidewalk. "My car's right here at the corner."

"Your?" He stood back to admire the low, fast lines of the ElectraCharger. His own car. I remembered, drank a lot of house current. I unlocked the passenger side door and raised it for him. He sort of pouted into the front seat. "Always wanted an ElectraCharger," he muttered enviously. I tucked his legs in and then ran around to the driver's side. In spite of the thermal skins under my clothes, the chill was biting into me.

"Hey, Currin said putting a hand on my arm as I inserted the wire into the ignition. "I turned toward him and got a facelift of fuzzy brown beard. I managed to get one arm free and reached into my purse without disturbing him. I can't remember when I've had more fun getting acquainted with someone," he said after a while.

"Me too," I got my right arm up around his shoulders and played with his hair. "And you know what?" I asked, drawing my head back a little.

"What?"

There wasn't even time for him to be surprised. He was still trying to raise his eyebrows when he pitched forward on top of me, pinning me against the door.

I tried shaking him back with my left hand while I held the right clear. I didn't want to give him another jolt with the joybuzz and I didn't want to zap myself, either. My fingers were tingling painfully. No matter how they try to insulate those things, you always gel a little punch yourself. I twisted around to no effect at all, struggling with him, cursing the tight quarters of the ElectraCharger's front seat. Then, through the windshield, I saw two large shapes coming down the street toward the car—the two big guys whose table we'd taken the same ones who had been staring at me earlier. One of them came around to my side of the car and raised the door. I fell backward and hung there with my hair dragging the pavement. The guy stood over me and tried hard not to laugh.

"About time," I said as he helped me sit up. "Get him off me, will you? Watch it. I've still got the buzzer in my palm."

Currin slept peacefully as we loaded him into the van and he was still sleeping when Coll and Phinny unloaded him in the cemetery. We had his hands and feet cuffed by then, not tight enough to hurt him but too tight to let him move around much when he woke up.

They wanted to put him right on top of the grave but I wasn't too sure about that. Eventually we compromised—half on, half off. He had to be positioned just right.

"You coming back to the van?" Phinny asked as he finished arranging Currin. I shook my head. "I'm going to watch right here.

"You'll have to move back some. Otherwise the camera'll pick you up."

"Fine. I'll call you." Phinny and Coll headed back to the van which was parked up the hill on one of the cemetery's narrow roads. I waited until I heard the door slam and then got the adrenaline patch out of my purse.

Currin was snoring when I opened his shirt and jammed the patch onto his chest. For a moment nothing happened. Then his eyelids fluttered and he made a small noise I put my hand over his heart. It was just starting to race. "Good."

"I put exactly the right amount of adrenaline in the patch. He was going to wake up jetbugging."

"Jeremy?" His eyes opened and I moved away before he could focus on me. There was more than enough light to see by from the streetlamps above us and I watched him discover that he couldn't get his hands out from behind his back or pull his feet apart. He tried to sit up and flopped over onto his stomach with a moan of pain. Now he was finding out about his head—understandably being joybuzzed is a lot like being knocked by a mule with steel hooves. He looked up binkling and then saw the gravestone. He took it over a minute to read the carving on it. I was too far away to read it myself but I knew what it said.

KAREN KITTERMAN.

He went ah ah ah and tried to squirm away, but the adrenaline was jerking him in ten directions at once so all he did was twitch around. Then a clot of dirt hit him in the face and he stopped trembling.

The soil on the grave was moving and as Currin watched a hand broke the surface fingers flexing and clutching at nothing. I heard him suck wind with a whooping sound. Then there were two hands. One was small, feminine and pasty white, the other was not. I was in the air making him choke on the breath he'd just taken.

The hands reached up pulling free of the grave and the arms that appeared were

It was easy to see why Currin liked this place. It was just the kind of lounge where a data analyst with lumberjack fantasies could sip whiskey and pretend he had calluses.

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Mohler "has been to impose our own social conditioning on a space environment. It is more likely that the environment will impose on us the need for undreamed-of space institutions alien value systems. even biological change."

"Ask yourself: Will the children of multi generaital missions ever want to re adapt to something as debilitating as gravity? Would they wish to visit the surface of a planet, any more than we wish to spend our vacations naked and unprotected on the African veldt? In all likelihood citizens of space will embrace microgravity and allow the adaptive reflex to take the body through an incredible possibly irreversibil metamorphosis."

"Faces will become rounder, necks and spines elongated. Symbiotic bacteria might be engineered to produce adaptogens new hormones to counter the negative effects of adaptation. Legs might be dispensed with. We’ve seen that legs are nearly useless in space."

Dr. Robert Heaney of Creighton University in Nebraska told a NASA Life Science Symposium after the Skylab missions: "Leg tissue requires food, oxygen, and time for exercise. The ultimate cost of legs on long missions must be staggering. Dr. Heaney seriously proposed that amputees would make cost-effective space colonists and should be considered for future missions."

"We’ll get a different race in space even if we get to it," says Mohler. The transition from life on Earth to life in space will be remembered as an enormous step in the evolution of our species.

All of this is blue sky of course. A thought provoking sort of blue sky but too much of it obscures what is really happening in bioastronautics.

In his laboratory in San Antonio, Dr. Jefferson Davis, president of the International Aerospace Medical Association, predicts a more certain future: "Let’s talk about the contributions of the space program. The press has given a lot of play to medical telemetry and instrumentation. But the most important development on the horizon is very simply, a thorough understanding of cardiovascular dynamics. Twenty years from now this knowledge will have a bigger payoff than cardiac monitoring."

To Dr. Davis’s cardiovascular dynamics Oleg Gazerenko might add the effects of radiation. Stan Mohler would include the aging process. Each pioneer in the field points to promising studies in his or her specialty. But the point is: bioastronautics has necessitated unprecedented investigations into every area of biological science in investigations that are just beginning to bear fruit. I can’t tell you how we will use the results of this basic research in the future," says Davis. But one thing is sure: The knowledge will be priceless."
BOMBED UTAH

Continued from page 59

ings. They were consistently high along the backs of the sheep. There was concern among members of the team that none of the really sick or dead sheep were available for examination. The sheep with the fewest symptoms and lesions were the only animals left for the team to look at.

Brower asked all the doctors in the AEC group if he could get a copy of their official studies. They agreed. Meanwhile the medical men wrote their reports.

Dr. Veenastra wrote, "The location of the lesions and the nature of the sheep to nibble grass short leads one to suspect that the lips and face of these sheep, like the cases reported in the medical literature, was on the order of a diagnosis of radioactivity damage."

The others on the preliminary team concurred. None could find any convincing alternate cause. But there was a major problem. Neither the sheepmen nor county agent Brower was informed of these results. Instead a long series of machinations began behind the AEC's closed doors. The AEC coverup remained hidden for almost three decades until it was revealed in congressional hearings and an extraordinary court decision. Today court documents tell the story that the government hoped would never come to light.

Summer 1953. In Washington, D.C., Los Alamos New Mexico and Hanford Washington letters phone calls visits and classified documents began to reflect panic on the part of the AEC's upper echelons. If radiation was the cause of the massive damage, what would happen to the testing program? How many millions of dollars of other claims would come in? What kind of precedent would be set? What about public favor? Commissioner Eugene Zuckert was worried. "In the present frame of mind of the public," he told an AEC meeting, "It would take only a single illogical and unforseeable incident to preclude holding any future tests in the United States.

Brower got a hint of what was going on backstage when he asked veterinarian Thompsett for the promised copy of his report. Thompsett said, "Even my own copy has been picked up. I've been told to rewrite it and eliminate any reference to radiation damage or effects."

Brower and the sheepmen got another hint when the second group of AEC specialists arrived in Cedar City on June 10. Paul Pearson, chief of the Biological and Medical Section on the AEC's Division of Operational Safety in Washington, D.C. was fearful that the commission would tighten the purse strings on future U.S. weapons testing. He per-

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suaded a group of AEC and Public Health Service officials to sign a statement that discounted radiation as a cause. The statement was supposedly for AEC internal use only. But Dunning turned around and gave the report to AEC public-information services within a week.

In January 1954 the AEC issued a public statement the culmination of an eight-month whitewash intended to rule out radiation damage. It eliminated all the incriminating evidence that had appeared in earlier drafts. Statistics on the sheep deaths had been deleted. An assertion that there was no support for disease was cut as was a report admitting the conclusions of the experts were far from unanimous. When Utah health officials complained that they had "not concurred" in the report, the wording was changed to read that they had "reviewed" the report.

The statement was released on January 16, 1954. The general public was unaware of these elaborate internal maneuvers. AEC press releases painted an optimistic picture. But the sheep ranchers couldn't understand why weren't being reimbursed for their devastating losses which had now mounted to nearly a quarter of a million dollars. Some ranchers would go out of the sheep business forever. Others would sell everything they had at a horrendous loss. Some would be paying off debts for more than three decades.

Three days before the report was issued, Pearson, Trum and several other AEC men met the ranchers in the Cedar City firehouse. Minutes of that meeting suggest that it was a somber event. The AEC men gave all the reasons why radiation could not have been the cause. The sheepmen were not impressed. Mac Bulloch said, "We were told we were in a hot spot on the range." An AEC man answered, "This has been a wonderful opportunity for us to evaluate the actual damage done with a fallout. You can't cause a big amount of damage with a small fallout."

To the sheepmen theses and other statements were a lot of double-talk. They listened further as Dr. Leo Bustad told them about a comparative study of a experimental lab sheep and those of the Utah sheep. He had fed the lab sheep massive doses of radioiodine and concluded, "The Utah sheep showed no evidence of the radiation damage observed in experimentally treated sheep.

But this was directly contrary to fact. Dr. Bustad failed to tell his firehouse audience that his laboratory sheep exhibited almost exactly the same symptoms as the Utah sheep. To reveal this would be to admit that radiation was the cause.

Dan Bushnell, a fiery and determined young Salt Lake City lawyer, was following the case, and he was angry. Although he knew nothing of the backstage antics of the AEC, he smelled something wrong. To him there was prima facie evidence of radiation damage and of extraordinary suffering because of it. He filed suit in 1955. The AEC did everything possible to block his pretrial discovery process. But Trum and Pearson were concerned about the hidden conclusions of Veenstra and Thompsett as the trial date approached.

Lieutenant Colonel Trum wrote to Dr. Veenstra on March 25, 1955, just after the second anniversary of the Nancy shot, suggesting that Veenstra should change his mind about radiation as the cause of death. Veenstra wrote back on April 7. "Our position has not been materially changed. Basically we are still of the opinion that radiation could have contributed to the death of the animals."

Before Veenstra mailed the letter, U.S. attorney John Finn made what appeared to be a special trip from Washington to Veenstra's office in San Francisco. As a result, the latter was never mailed. Court records suggest that Finn picked it up and took it back to Washington. Later the general counsel for the AEC mailed a copy to Pearson with the notation, "Please note the original of this letter was never mailed. It is to be held in confidence."

With his arm twisted Veenstra drew up a handwritten note to Trum on the same day as Finn's visit. In view of all your work and lack of ours, our laboratory has decided not to make any official statement."

Veenstra had bowed to the pressure of Pearson, Trum and Finn Thompsett got the same sort of pressure. Trum sent him a "modal letter" to sign on May 9, 1955. It instructed Thompsett to say that he had reevaluated his original position and now backed the AEC line. Thompsett did not give in. He wrote back: "Again with the
sheep losses I am of the opinion that the AEC has contributed to great losses.

But this letter was buried in the files. Along with Veenstra, Thompsons disqualified himself as an expert witness at the trial.

U.S. attorney Don Fowler was jubilant. He wrote in a confidential document: To our knowledge neither sheepman nor their attorney has a copy of any written report made by Mayor Veenstra or Dr. Thompsons concerning the opinion that radiation was or could be a contributing factor to the injuries sustained by the sheep.

The case in 1956 was brilliantly argued by attorney Dan Bushnell. But he could not fully penetrate the secret and classified screen set up by the AEC. Its experts all took the stand and testified that radiation had nothing to do with the cause of deaths—absolutely nothing.

Federal Judge A. Sherman Christensen himself unaware of what had gone on behind the AEC scenes could not believe that a group of scientific experts would possibly cover up for the government.

"Do you want to believe that they aren't giving their best considered objective opinion with references to the effects of any of radiation?"

Bushnell stood before the bench and spoke clearly, "I do.

Although the AEC was unable to come up with any reasonable alternative to radiation damage, the judge had to go with the scientific evidence displayed in the courtroom. The highest level of fallout could not possibly cause this damage: the experts contended. Judge Christensen entered a tortured and troubled judgment in favor of the government against the sheepman. The numb and nearly bankrupt owners did not appeal.

But the tragedy was not limited to sheep. There was a mountainide aftermath. Slowly and almost imperceptibly the horror spread. It was reflected not only in towns like Cedar City and St. George but in Washington D.C. too. Despite Eisenhower worried about public concern; sent his AEC to the mid-Fifties to keep the public confused as to fission and fusion.

At a February 23, 1955 AEC meeting commissioners W. F. Lubry said to chairman Lewis Strauss, 'I notice you had cooled about the Nevada test site. Strauss answered, 'My coolness started in the spring of 1953. Chairman Strauss admitted frankly that if the decision were his alone he would not have given the big kiloton shots on a ship 'take them to the Pacific put them on a raft and sent them off.'

At the same meeting, the commissioners discussed wind direction. There was almost nowhere a fallout cloud from Yucca Flat could drift safely.

When someone suggested east Strauss said, 'No. East they [the clouds] go over Pioche and St. George when they appear, they always plaster.'

Strauss was right. St. George was always being plastered. And shortly after these concerns were being expressed and about the same time the sheepman were presenting their case in court. In 1956, fifteen-year-old Karlena Hansen became desperately ill in St. George. Her mother took her to the hospital in Salt Lake City but there was little that could be done. The diagnosis was acute myelogenous leukemia. Brought back home to St. George she lingered. One day as she lay on the living room couch she called her mother, Mama, she said, please call the doctor I'm going to die. Her mother said, You're not going to do any such thing.

Karlena said, 'Yes, I am Mother. This room is just full of angels. She closed her eyes. Her mother called the doctor and took her to the local hospital. They worked on her for three hours. She was dead.

Nine years after that Mrs. Hansen's husband died of cancer. Later she made a chilling discovery. There were five houses on her block. Seven of her neighbors had died of cancer. Two had undergone cancer surgery. Others in St. George began to make the same sort of observation. Irma Thomas noted that 20 people within a one-block radius of her home on Tabernacle Street had been afflicted with leukemia or cancer and eight of them had died. Prior to this, St. George had reported one of the lowest cancer rates in the country—about half that of the United States average.

In 1960 Elmer Pickett, owner of a St. George hardware store and the man who once had stood on Sugar Loaf to watch the blasts, took his thirty-eight-year-old wife to Salt Lake City hospital. The diagnosis was lymphosarcoma and Hodgkin's disease and later leukemia. She was dead in seven months. The radiologist said to Pickett, 'I don't know what is happening in St. George, but we are dealing with leukemia victims. We have practically no cases before this time.'

Pickett, in a state of shock, counted the members of his close family who had recently died of cancer or leukemia. They totaled five. A day later a mortician went back over death certificates in the town from the years before the nuclear tests. There were practically no cancer or leukemia deaths recorded. New records showed a mounting number of such cases.

As widespread apprehension grew in St. George, Arthur Bruhn saw the fruition of a labor of love. The final construction of the new campus of Dixie College which he headed was completed in 1963. He too had watched the terrors in the predawn chill warmed by mugs of hot chocolate. Now a decade later on a short vacation out in the nearby Pine Valley mountains he and Lorna noticed anordinate number of claim stakes of uranium prospectors. The Geiger readings were high with the counters going off almost everywhere they were set down. But the hopes of the uranium prospectors were futile. The Geiger counter did not indicate potential uranium mines. It meant radiation fallout.

It was an accumulated fallout from 1000 kilotons of blast at Ushlah-Knottom and other tests conducted up to 1963. Total dosimetric dosations were the equivalent of 77 Hiroshimas. The stakes were a reminder to the Bruhns of the blasts.

Just before Christmas in 1963, Arthur Bruhn complimented a headline and he thought he was coming down with the flu. He wasn't. His face and skin became yellow and drawn. A blood test showed acute lymphatic leukemia. He died November 7, 1964, at the age of forty-eight.

His wife in her bereavement did something she had never done before. She began reading the obituary columns.

In the months that followed, a terrifying awareness grew in her and the other townspeople of St. George. Several of her husband's friends were dying of leukemia. A highway patrolman who had worked at the numerous roadblocks was one of them. Another was a friend who had worked at uranium mining. A woman whose husband had died of radiation from uptake with his barrel hands.

In the early Sixties little was heard from the AEC (soon to be split into the Department of Energy and the Nuclear Regulatory Commission). Nor was much mention made of accumulated plutonium fallout—of the world's deadliest poisons—with its half-life of 24,000 years. There was evidence that an increase in plutonium-239 had been found in the lungs of Utah deer and that the herds were disappearing.

Edward Weiss, a public-health expert, and three physicians made a study of leukemia and cancer effects of the fallout in Utah for the U.S. Public Health Service. The conclusion: Thyroid cancer increased twofold. Thyroid cancer increased almost fourfold. The results were 120 percent above the control groups in other areas. The study was buried because of AEC pressure on President Johnson and not released until it was uncovered in 1978.

There was considerable worry in the early Sixties about the minimum safe level of radiation. AEC technicians admitted they were in a poor position to defend the 3.8 rads limit. Many thought the standard was unsafe and that it failed to consider the inter alia emitters from forage and food.
Ominous signs continued to appear in St. George. In 1965 a total of 70 school children were discovered to have thyroid nodules that were suspected to be related to the fallout. These were examined for each child to be sent to Salt Lake City for examination. It would be a long-term project with no immediate conclusions. Meanwhile the people in the region as solid and patriotic as if they had stepped out of a Grant Wood painting tried hard not to believe their own government was deceiving them.

But over the next ten years and more, the cases continued to grow far out of proportion to the expected rate—cases like that of twenty-year-old Lisa Pedot. In 1976 she and her husband, Dwight, were so happy they were going to have a child in four months that they didn't mind the headaches and nausea Lisa was experiencing. She was also losing weight.

Dwight took her to the St. George Hospital on a Thursday night. She went into a coma. She was flown 250 miles north to Salt Lake City on a Friday. She died from a malignant brain tumor Sunday morning without regaining consciousness. Lisa's parents later told Dwight that her skin had turned bright red in her playpen sometime after fallout had blown through her screen door in 1957 during a 44-kiloton test shot called Smoky.

A year after Lisa died Dr. Joseph Lyon of the University of Utah School of Medicine began a study covering the areas of greatest fallout in southern Utah. It censused on leukemias because of the known association with radiation. Lyon could not depend on the radiation dosages reported by the AEC because their figures were fragmentary or hidden. Instead he made a direct count of childhood death certificates. The result: The leukemia rate was 2.4 times higher than the expected rate.

But government officials still insisted that the levels of radiation exposure were totally inadequate to cause the havoc. In the Fifties and Sixties the AEC had made a conscientious effort to keep the exposures down. When the scientists discovered that they had failed, they were inclined either to cover up or to try to justify their actions usually less than 5 rads. Second they said the specific thyroid dose to the sheep was only 1,000 to 2,000 rads. It would have taken up to 50,000 to kill a sheep. Third, they said the beta radiation dose was blocked by the wool and couldn't kill.

The main thing the AEC failed to do was to figure out how much fallout material went into the sheep's mouths and guts—not just into their thyroids. In contrast to humans the sheep gulped for sand and dirt to get at the roots of the forage especially in a poor dry season. A study by Professor M. C. Bell of the University of Tennessee showed that a sheep could take in enough fallout on an 18" x 18" patch to start killing some 12 percent of the adult sheep within two months. It wasn't the dose of radiation to the thyroid that killed the sheep by the thousands. It was the dose to the sheep's gastrointestinal tract which was hit by up to 5,000 rads from the swarms of fission products.

The AEC scientists also failed to take into account the internal dose to the fetal lambs. Insoluble fallout particles passed through the mothers' gastrointestinal tract. Knapp contended, 'Then they moved through the placental barrier. But the most important questions the AEC never asked were simple: How much fallout does a sheep eat and how much fallout does it take to kill a sheep? Knapp combed the data seeking answers even though the government tried to stonewall his findings with criticism.

But when the 1979 congressional hearings revealed clear evidence of fraud and coverup the AEC became more vulnerable than ever. In May 1982 attorney Busbey reopened his case in the federal district court on the grounds that a new trial could be granted when outright fraud could be proved. Judge Christensen, how seventy-seven years old, called for such a trial in an unprecedented legal move. Bullough et al v the United States moved into a new phase with the same attorney and judge who had begun the action 30 years before. The government, the judge concluded in anger had perpetrated a fraud upon the court. The judge stated that the conduct of the government agents was intentionally false and deceptive. He also came down hard on improper but successful attempts to pressure witnesses not to testify as to their real opinions.

On the heels of this decision a new and catena trial opened in the same federal court at the end of 1982 under Judge Bruce Jenkins. It is an action brought by more than 1,400 cancer and leukemia victims from the affected tracts area. They are represented by former Secretary of the Interior Stewart Udall. Many are from St. George and its environs. Most are typical of the residents, conservative, western states patriotic. They are as reluctant as the shepherds were to sue their own government.

Government officials will make no further statement to the press beyond the contentions they have presented in court. There is no clear proof that fallout caused

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After Mrs. Halen's husband died she made a chilling discovery. There were five houses on her block. Seven of her neighbors had died of cancer. Two had undergone surgery.
the damage, the studies presented by the claimants are flawed and inadequate. Bernard Trum still feels he was right, even though he is prohibited from discussing the case of the sheepmen.

In St. George residents are confident that the facts are strong enough to prevail in court and that hard work can soften the impact of the bombs. For years Irma Thomas in St. George collected data and wrote to doctors—scientists—senators and congressmen. She feels that her work has contributed to exposing the government coverup. Elizabeth Bruhn, Wright's daughter, caused a reaction when she said that you can prevent other families from suffering what she has—"parents who want to eat..." She is doing just that with her friend Janet Gordon, who became white hot with anger when her brother died a lingering death from cancer. Elizabeth Wright founded a group called Citizens Call. They are setting up a hospice and a cancer-leukemia center in St. George where victims can be diagnosed and treated locally instead of having to take long journeys to Salt Lake City. Volunteers work around the clock with the conviction that their personal efforts can help alleviate the damage and duplicity of the past and just as important reveal any fraud and coverup in the present and future.

Some complacency has set in. When the nuclear tests were moved from surface to underground sites in 1963 many hoped the fallback problems would be buried in the shafts and tunnels where the ongoing detonations are set off. The hopes seem illusory. In 1963 an underground test named Schooner created a crater of more than 17 million cubic meters. A 1,000-foot-thick radioactive cloud moved from Nevada all the way to the east coast of Canada. Before the 1979 hearings the Department of Energy admitted to only 19 ventings of measurable fallout. Under the pressure of the hearings General Mahlon Gates, operations manager of the Nevada test site, finally admitted the total was actually 40 and that massive leaks could not be completely prevented. And there were other unannounced detonations that are still classified. Given the shoddy history of continuous coverups over the years, the current tests are still under suspicion.

A detonation in the summer of 1982 created a crater the size of a football field. It was described by a Department of Energy official as merely the most exciting thing he had ever seen. To the people of Utah and Nevada it was anything but exciting. It was harrowing and threatening. That is why members of Citizens Call and other dedicated individuals insist on being notified of each new test that comes along.

Today St. George and Cedar City sit on old faults in the surrounding beauty of the Utah landscape as two reluctant monuments to man's irrational and unconscious drive to incinerate or invisibly poison the planet—just as we laugh at the man who goes to the bar with a whisper. There is a numbness among the people from the realization that the government they trusted could have violated that trust.

Dwight Pectol has finished the sturdy home he built for the young wife he lost during her pregnancy. On his coffee table is an album of Kodachrome pictures of her and the wedding guests. Lorna Bruhn about to retire as a third-grade teacher, looks out at the tips of the mountains at sunset and swallows the bitterness she still feels at the senseless loss of her husband. Elmer Pickett checks the shelves of his True Value hardware store and occasionally shares with others a glimpse of his wife's picture which he carries in his wallet. The Bulloch brothers will point out some of the land and buildings they had to sell to cover their losses. Recalling the long nights years before on the winter range looking up at the stars and listening to Kate Smith or the Hit Parade on a battery radio.

I loved the range, "Kenn Bulloch will tell you. "Because you were not breathing the air anyone else was breathing."
The terms of Ms. Kitterman’s will were quite specific on all points. She d video taped it and ended it graphically with her suicide, but I didn’t mention that.

I wouldn’t have gone along with this, he continued, except there is a great deal of money involved and—

‘Speaking of money, I said.

‘Ah, yes of course. How ah—'

Just the way we discussed. Get a money order and make it out to Vengeance Is Yours, Inc. You have the address.

He started to say something else but I hung up on him. My father had begun this business and he’d told me always to deal in money orders—none of this computer-transfer stuff.

That had been back in the days when V.I.Y. Inc. would just throw a pie in some body’s face for twenty bucks. We’re more sophisticated now but I get a certain amount of satisfaction from making clients go to the trouble of getting an old-fashioned money order. Revenge after all is kind of an old-fashioned thing anyway.

I left the videotape in the machine so I could get right to it the next day. After I cleaned it up a little I’d send it to Karen’s executor so he could play it for her brothers and sisters who couldn’t have cared less. All it was to them was a freaky little show they had to sit through before they could inherit her money. Her humiliation by Currin had been nothing to them and her revenge wouldn’t be much more. That’s the funny thing about vengeance. Half the time people hire me they’re getting back at the wrong persons for all the wrong reasons I should know I’m an authority. But then again the vengeance isn’t mine.

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How to get the best out of (and into) your computer.
COMPETITION
By Scot Morris

Omnis Fractured Dictionary defines ax as a chopstick and cube roots as diced carrots. In Competition #25 announced last September, readers were asked to help us with the first five chapters of our dictionary by supplying redefinitions for up to three words starting with any of the first five letters of the alphabet.

Common repeat entries included asphalt (hemorrhoids), aerospace (quiver), election (1984 campaign slogan, see electric a 1972 slogan), egotist (an I specialist), childhood (a juvenile delinquent), derange (where de deer and de antelope play), courtship (the Love Boat) and astute (see flatulence). There were also words with fracture lines you can probably supply yourself: canopies, denjohn, announce, defense, catalyst, acquire, abalone, euthanasia.

GRAND PRIZE WINNER: $100
Circular saw: A rose is a rose is a rose.
Digger wasp: Preppy anthropology student.
Damnation: The Netherlands.
GRAND PRIZE WINNER: $100

RUNNERS UP: $25 EACH
Bumblebees: A Jarry Lewis film festival.
Champagne: Hypochondria's symptom.
Dove: Bird of pray.

R-intersection of stream
Cardinal number: A spot on the windshield.
Curator: Dog show judge.

Exorbitant: Skylab.
Cluster bomb: When Johnny Carson tells several bad jokes in series.

Canvasback: Inex boxier.
Downeast: Performers in Swan Lake.
Eggs: Reeboat.

Bureaucrat: A person who cuts red tape lengthwise.
Asteroids: A proctological disorder common among video game players.
Au lait: Cheese given at a food fight in a French cooking school.

HONORABLE MENTION

Brother: What you get in the stock market.
Electrocute: What R2-D2 is.

Amphidextrous: A sugar that is its own stereosmoser.
Analogy: Overprotective response of the immune system to foreign protein.

Banana: First three notes of Beethoven's Fifth Symphony.

Clone: Cell mate.
Atrophy: Award for lack of exercise.

Astronomer: Night watchman.

Carnalite: Lo cal love potion.

Buckboard: The Federal Reserve.

Doublemint Twins: Chew-chew twain.
Budget: Taxes chasmsaw massacre.

Escape artist: Science-fiction writer.

Exegesis: Formerly a savior.

Dracula: The first blood count.
Christmas elf: Subordinate Claus.
Banshee: Stag party.
Call girl: Ma Bell.
Divine right: Knockout punch in Your Arms Too Short to Box with God.
Analyze: Structures used for hindsight.

Tree: Quick circumcision.
Dilute: The way to start a toll free phone call.

Cataract: Japanese luxury car.
Abundance: The Bump.

Alterpart: What happens to us after we all are seven.
Alkaline: Your basic Detroit Tiger.

Algebra: Aftermath.

Chicken feed: A poultry sum of money.

Down: A terminal condition.

CONTINUED ON PAGE 150
Pssst! Wanna fool around?

Hey, great idea!

What did you expect with your image?

And then again, it could be your breath.

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148 OMNI
As realized 1. I must/didn't even give me their best camera 2. Hatsu Yume hits its stride when Viola takes her camera downtown Tokyo, shooting at night from a moving car. The surrounding traffic is transformed into slow motion with head lights burning visceral afterimages onto the screen. Taping through the windshield during a heavy rain produced a fantastic deluge of neon blue, indescent green and electric mango. After a few sumptuous minutes, this surge of chewing reaction resolves itself with an invisible cut into macro close-ups of a pool filled with red and gold carps. "Video treats light like water," Viola says. "Light becomes a fluid on the video tube." 3. The Sony engineer enjoyed Hatsu Yume although Viola’s deliberate use of image leg in the Tokyo traffic sequence made them uncomfortable in its exploitation of a recording-system flaw. By and large, they preferred Ancient of Days for its complex state of the art editing. While at Sony, Viola saw prototypes of a digital videotape recorder, a VTR built into an arm-mounted video camera, and a seven pound broadcast unit. We can make anything," one engineer kidded. "We’re trying to figure out what not to make." Viola says that although his feelings about technology have been ambivalent since the video euphoria of the early Seventies wore off, he recovered some of his video-freak enthusiasm in residence at Sony. Just being there, I got back some of the positive feelings about technology. (Still Viola’s technological adoration is tempered with mysticism. While in Japan he visited Otsuramun Mountain and saw a blind female shaman, or Iakko, calling back spirits of the dead. "Up until that time," he says, "I thought that the large Japanese electronics companies were way ahead in the development of communications technology. But after witnessing the Iakko, I realized they were way behind. In their own backyards were people who, without the aid of wires or hard ware of any kind, have been communicating regularly with ancestors long gone."
Currently, he is most excited by the possibilities afforded by computerized, interactive video discs that can be programmed to switch speeds or order of images in performance. He is planning a piece with no beginning and no end—"that can be shown at any speed." Viola thinks the video disc will completely alter movies and video as we know them. "Pretty soon the way we approach making films and videotapes will drastically change," he predicts. The notion of a 'master edit and original' footage will disappear. Editing will become the writing of a software program that will tell the computer how to arrange the information on the disc, playing it back in the specified sequence in real time or allowing the viewer to intervene. In other words, the next time Viola has a Whitney Museum retrospective, she will be using the visual information in Ghost of Dixon to make images of her own D.O.

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1. **ABOUT TIME**
   
   (a) The lower right vertical segment in the rightmost number position is on more often than any other—some 90 percent of the time.
   
   (b) In the three B shapes, the lower left vertical segments are on least often—each less than 50 percent of the time. The middle of these is on least of all, 20 minutes an hour. (In the ten-minute blocks starting with zero or two), or only 33 1/3 percent of the time.
   
   (c) The fewest number of segments (six) are on at 11 1/1.
   
   (d) The most segments (21) are on at 10 08 (John R. Davis Silver Spring, MD). SHONIX? Z completes the list of letters in the alphabet that read the same upside down as rightside up (Claudia Herr, Lancaster PA).
   
2. **PROGRESS?** The numbers correspond to the alphabetical positions of the vowels A, E, I, O, and U. The next vowel is Y (as in fly and sky), in position 25. Facetiously was a hint; it is the shortest word that contains all six vowels in alphabetical order.

3. **TRUTH TIMES TEN** There are five true and five false statements on the list: 1 T 2 3 T 4 5 T 6 6 T 7 7 T 8 8 T 9 9 T 10 10 T (Jim Geschwender, Lincoln, NB).

4. **FILL-IN** The letters are initials of the "counting-by-fives: sequence five ten fifteen and twenty and so on. The missing letters are both N for ninety and ninety-five (James R. Reed (Derry PA).

5. **CUT A RUG** Cut the 9" x 12" rug into just two pieces: as below and fit them together in a 10" x 10" square (T K Barley Everett WA).

6. **OLD BUSINESS**

   The "Two Views" problem last month gave you the front and side elevations of a three-dimensional shape, and asked you to sketch the shape. The answer was withheld until this month. The front and side views we gave you are shown below along with our sketch of the object at top right.

   There are other more complex shapes that could produce the two views shown. The most common suggestion is a rectangular box with a drawer hole through it and some notches at the back end. (Such an object would have been rotated 90° to the left and rather than to the right to get the side view pictured). Or the shape could be rounded on the notched side only. In an informal survey fewer than 20 percent of the people who came up with a workable answer thought of the simplest solution. The object is a squat cylinder with a notch in it. From directly above, the cylinder appears as a perfect circle.

   The other "held-over" problem last month was: This last night moonrise was at 7:04. What day of the year is it?

   The moon rises about 50 minutes later each day than the last. This is an average—the time varies from about 20 minutes later than the previous day to about 90 minutes later. The only way you could see the moon rise only 4 minutes later on a subsequent day is if the moon had actually risen 64 minutes later and you had set your clock back an hour. This happens only once a year at 2 a.m. on the last Sunday in October. Today's date must be Sunday, October 30, 1983.

   The moonrise times given were hypothetical and do not correspond to actual moonrise times this year. The difference in times was the important clue. Had the moon risen last night at 7 and tonight at 9:04, you would know (since there never is an actual lag of two hours and four minutes), that you must have set your clock ahead an hour and that it's the last Sunday in April.

7. **HAPPY BIRTHDAY** The only way two people could be born exactly seven years apart (2,555 days) and share the same birthday would be if there were no intervening leap years. The century years aren't leap years, unless divisible by 400 (2000 will be a leap year). Sam must have been born in 1896; Deborah in 1903. She will be eighty this year and he eighty-seven. (Arnold Gravords, Lincoln NB).

8. **DOMIN! Here's one solution:

   ![Diagram](image)

   **9. FAULTLESS** It is impossible to arrange 18 dominoes into a faultless square. The best that can be done is a square with only one fault. Consider there are ten grid lines (five horizontal and five vertical) and each divides the square into two rectangles having an even number of cells. If a grid line crosses one domino, it must cross a second as well to keep an even number of cells on both sides of the line. In a faultless square each of the ten grid lines would cross a minimum of two dominoes or 20 total. But there are only 18 dominoes in the square. There are enough dominoes to block nine lines, but there will always be at least one fault line that cuts all the way through the square.

   10. **TEACH ME** He lifted the popcorn bowl drank the professor's $2 martini and gave him a quarter for it (Michael Stueben, Annandale VA).

**MAILBAG**

Dick Shoup, of Belmont, California offers this interpretation of William Newcomb's paradox (November 1982) in which you are challenged to outwit a superintelligent being. "Just think of your second serve in tennis," Shoup says. Sometimes it seems that Lob all powerful good of tennis can predict whether you'll hit the second serve hard or easy. If he predicts that you're planning to hit a gentle second serve he makes sure you miss the first one. If he divines that you'll take the risk of blasting your second serve, he instead allows your first to go in. Yes this could be known as John Newcomb's paradox.

Responding to "Verbal Vexers" (January 1983) A R. Wren of Yorba Linda, California offers GRANTOR as an addition to our very short list of words that designate real cities and states (JACKAL, AVAIL, LEEKY, THORIA, VICTORIA). There really is a Grant, O'Regon.
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COMPETITION

CONTINUED FROM PAGE 142

Butterfly nut Lepidopterist —Jeffrey Staff, Plymouth MA
Example A successful dieter —Lynda Cook, Escondido, CA
Ascot Best way to find out who won this competition —Lon Jung, Decatur, MI
Before A coordinate on a Bingo card —Jim Nowak, St. Petersburg, FL
Bar room An elephant passing gas —For example, see the USA in your Chevrolet:
Dinosaur Famous cartoonist (see above) —L. Czarnowski, Newport Beach, CA
Continental plate Part of a continental breakfast —Arci Riccardo, San Francisco
Continuum What Guccione and Co. should do with these great issues of Omni —Robert Capon, Mastic Beach NY
Beware Honey —Lauri Yablack, Arlington VA
Autophytosis One method of making an engine stop smoking —Robert Capon, Mastic Beach NY
Ad nauseam Pesto-Bismol commercials —Diane Nagel, Cranberry Lake NY
Dognapper A Doberman pinscher —Diane Nagel, Cranberry Lake NY
Ballyhoo The unknown pinball company —Carl Pearson, Montgomery AL
Coral: Where sea horses are kept —John Ray Montgomery AL
Batteries: Money spent —John Ray Montgomery AL
Acute angle 35° 24' 36" —Chad Blandow Wales WI
Diode: Eulogy —L. Novela, Martinsville IN
Burden of proof Hangover —Shirley Montgomery, Tavernier FL
Cube roots Erno Rubik's autobiography —Cathy Staff, Plymouth MA
Alimony: Checkmate —Valentia Weas, Hamilton Ont, Canada
Alimony: Bounty on the Mutiny —Keith Bogart, Nevis NY
Amenable: What a good sermon is —Irwin Fox, Hillsdale NJ

Diehard Fossil —Bruce Peterson, Nevada I A
Bronze: Sister-in-law —Mara E. Wallace, Kansas City MO
Cheese slice: Swiss-blade knife —Gregg Law, Williams and Jeddah H Joyce, Paso Robles, CA
Carousel Horseing around —Polly Keene, Circleville OH
Atomic piles: Severe disorder, treated with Preparation H —Andy Staff, Plymouth MA
Duckbill: Last words heard by President McKinley —Andy Staff, Plymouth MA
Depend: Best place to put the diving board —John P. Littler, Pasadena
Bespoke: Second rate epic movie —David Hainer, Portland OR
Coincide: What guests do when you are out —Laura A. Taylor, Waited Lake MI
Elf: A bad habit —Enumerated: What a mathematician gets after too many drinks —Paul J. Herdt, Humboldt IA
Cannabis: Mexican/Colombian joint space program —Bill Sherman, Bixford, MA
Apostrophe: A gold cup with world's greatest father inscribed on it —Gina Pullington, Canoga Park CA
Belonax: Tota!y awesome radiation particle —Dixon Osburn, Fort Worth TX
Cheap shot: Mexican golf stroke —Endorphine: Knockout —Heber Boulard, Silver Spring, MD
Custard: Indian pudding —Vicki Metcalf, Tans NM
Bar sinister: Speakeasy —Chintown, Dresden —Debra Morgan, Springfield VA
Epicenter: The balance point of a dueling sword —Lennie King, Abilene TX
Equivocal: Horse's choral also the neighs have it —Dorthea, Weight Watchers —J. J. Veber, Mount Pleasant, SC
Acrobat: Small rodent with wings and a fear of flying —Dorthea, Weight Watchers —Alan Knight, Phoenix FL

150 OMNIA
This new life-style, Shepard adds, left an emotional gap that scientists have yet to explore. Conventional psychologists say children naturally bond to their mothers and then eventually achieve independence. But as far as Shepard is concerned, throughout millions of years of human evolution a "secondary bonding" also occurred. Children completely immersed in the natural environment grew deeply attached to Mother Nature as our bond with nature broke. Shepard contends we suffered the same wrenching pain as a child cast out by its mother. Crippled by hurt, people grew to resent their ecosystems. Sheppard theorizes, and they began lashing out in hope of getting some revenge.

So agriculture became the villain, the catalyst for an antireligious attitude that grew more pronounced over thousands of years. No longer was the world inhabited by powerful spirits in the form of tigers and trees. Instead, nature became man's private resource. Wasn't he promised such dominion in the Bible? And so King Solomon helped strip Lebanon of its cedars and the Greeks wiped out the lions of the eastern Mediterranean region.

That angry destruction persisted through the Renaissance as vast forests were stripped and explorers set forth to ravage the New World. The devastation accelerated during the Industrial Revolution when machines replaced animals farming declined as an occupation, and large-scale industrial pollution was born. And today? The path of destruction grows wider as Shepard as we pollute the Hudson dump chemicals in Love Canal and plunder the fragile rain forests of Brazil.

Shepard's theory is neither cheerful nor popular and is impossible to prove. Psychologists after all don't believe that a person can experience nonhuman bonding. Furthermore, anthropologists see more savagery and wastefulness in hunting and gathering societies than Shepard admits. After all it was probably primitive hunters scientists say who eliminated the mammoth, the giant sloth and the camel from Ice Age North America.

Shepard isn't arguing. He admits that his theory—far from being scientific—is just pure philosophical speculation. And aside from urging a generally greater exposure to nature, he's not sure what solution to suggest. 'I may,' he says, 'have one in another ten years.'

If there is hope, Shepard concludes, it may reside in the human spirit itself. In the urge to save the buffalo to clean up Lake Erie, to hike in the wilderness even to visit nature imprisoned in the local zoo. Who will win this Jekyll and Hyde conflict between that tortured child and the well meaning but latent adult? Think about it the next time you throw a rock at a pigeon or carve your name in a tree.
The Compaq 64, at only 80 pounds, is just one of the many portable computers coming on the market. They all promise to be lightweight and portable, but few are truly useful for serious computing. The Sharp PC-1250, for example, is a 25-pound portable computer with built-in BASIC and a standard QWERTY-layout keyboard—too small for easy typing. The $110 hand-held computer supplies 2.2K of memory for programs and data. A calculator-styled display shows a single 24-character line. Also available is the CE-125 interface accessory priced at $170. It adds a microcassette recorder for permanent program storage and a 24-digit printer using thermal paper. The computer comes with an instruction manual geared to beginners (Sharp Electronics Corporation 10 Sharp Plaza Paramus NJ 07652).

Written originally for Data General mini-computers, the Word Perfect word-processing system has been converted for use with the IBM Personal Computer and the Zenith Z-100. Unlike most programs, Word Perfect displays text on the screen as it will be printed; underlining and boldfaced letters appear as well as line and page breaks. One text file can be printed while another is being edited, and several files can be printed out with a single command (Satellite Software International 288 West Center Orem UT 84057).
natural element to their lives."

Upon sighting the buffalo, Koko the wolf begins to trot, circles the herd, seeking a weak or vulnerable individual. Teton the hefty bull advances shaking his woolly head. Koko sniffs the ground, discovery of buffalo dung initiates an orgy of scent rolling—a behavior the wolf shares with his domestic cousin, the dog. While this canine provacy only exacerbates the pet owner for the wolf, it is a means to convey information about the environment back to pack members. The two adversaries posture for about ten minutes. Then Koko retreats and this ecdyscrama which once played continuously on the American plains ends. A single wolf and a healthy bison concludes Klinghammer. "I seem able to assess each other with very little overt testing. It takes a lot of wolves and a vulnerable buffalo to result in a meal for the wolf.

For wild wolves, obtaining a meal can be a lengthy and arduous task the pack may travel as far as 70 miles between kills to procure prey. The Wolf Park population, however, does not need to stalk its dinner. Road-killed deer (casualties of the Indiana highways) and livestock carcasses obtained from local farmers are fed intact to the wolves, which dismember the dead beasts and divide the spoils among pack members. Expression of hunting behavior is not necessary, denied to captive wolf packs. But Klinghammer believes much of the actual "business" of the hunt in wolves the ripping and tearing of the prey's flesh. Dispatching the carcasses thus provides the wolves with an outlet for these instincts. Preliminary behaviors such as running and stalling, he says, are channelled through play. The feeding spectacle admittedly appears ferocious, but this too is governed by the social mores of the group. Higher-rank individuals eat first. Lower ranks must wait their turn.

The most memorable experience at Wolf Park, however, is flesh-to-fur contact with this inimitable legend. With Klinghammer's supervision, visitors enjoy handling a friendly wolf and may even be honored with an eftectuate but firm nuzzle, a wolf to wolf greeting. Socialized wolves are usually gentle with humans. Nevertheless, Klinghammer cautions that socialization should not be confused with domestication, the product of centuries of selective breeding. A wolf is not a dog and under no circumstances should be kept as a pet.

A long-time critic of the flourishing exotic-animal pet trade, Klinghammer is particularly disturbed by the recent surge in pet wolves and wolf hybrids. Many spend their unusually short captive lives chained in the backyard. To date, Wolf Park has received 163 calls from individuals whose cute and cuddly pups soon outgrow their novelty status and becomes difficult and unmanageable adults. "A wild animal should be in captivity for one reason only: to serve as an ambassador for its wild fellows."

Klinghammer insists. "To keep a wild animal for entertainment robs the animal of its dignity. It may also prove to be a fatal mistake. Recently in Michigan, a toddler was killed by a backyard wolf that apparently perceived the child as prey.

In lieu of personal ownership, Wolf Park sponsors an adoption program in which the interested party pays for the animal's upkeep and in return receives regular updates about and photographs of his wolf. Like the bison it hunts, the wolf has been exterminated throughout most of its natural range in the United States. Ironically both predator and prey have fallen to the same enemy: man. And the battle is not yet over. On the frontiers of Alaska the wolf is hunted annually from airplanes and snowmobiles. Minnesota recently enraged environmentalists by proposing a sport hunting season for its 1,000-strong wolf population—a move that follows the illegal killing of at least 250 wolves in that state last year. Wildlife biologists speculate on reducing the species to national parks such as Yellowstone, but earlier conservation efforts proved discouraging. In 1974 a pilot project involving radio-collared animals released in Minnesota's Upper Peninsula ended when four wolves were found dead within seven months. Unless we educate people and through our research help the wolf in the wild, he will surely not survive, says Klinghammer.

On Wolf Howl nights, visitors join Klinghammer and his exuberant charges for a spontaneous songfest and as the sounds of civilization blend with the voices of nature, the spirit of goodwill resounds through the air. One can only hope that man will someday learn to coexist with his canine brethren for if the song of the wolf is silenced the call of the wild within ourselves may well be stifled with it."

For information about memberships, ethnological studies and tours contact Wolf Park Battle Ground 1H 47320.
A specimen of Chamaeleo jacksoni, an ordinary horned chameleon, peers out at a slightly distorted world through its set of custom-made spectacles. It wore these lenses as part of an ingenious experiment devised by Oxford University naturalist Lindsey Hekness, who wanted to discover how these lizards tick their tongues out with such unerring accuracy to hit and retrieve their insect meals. They do not gauge target distance the way people do, using the different perspectives of each eye (a technique called stereoscopy). She found that when chameleons wear a variety of spectacles, that made an insect look farther or closer than it really was, knowing the point of focus for each lens, Hekness was able to calculate exactly where an insect target would appear to a bespectacled chameleon. Invariably the tip of the lizard's tongue would shoot precisely to that point. In short, the chameleon does not use a crude aim-and-shoot technique but actually has a built-in range finder of remarkable precision. The tiny spectacles were crafted from cucumbers' seed kernels and mounted on the chameleon's horns with a dab of balsam to hold them in place. This photo was a time exposure taken with an "antique oscilloscope camera" and En hydrochrome film by Hekness and her husband Perry Blackshear. DD
Larry Niven is best known in the science-fiction field for his Hugo- and Nebula-Award-winning hard-science novel *Ringworld* and for his powerful and popular collaborations, *Lucifer's Hammer* and *Oath of Fealty*. *Omni* excelled the latter in the October 1981 anniversary issue. Next month *Omni* will feature Niven's newest work of fiction, "A Teardrop Falls." It's a tale of futuristic robot "berserkers," machines that have been primed by unknown masters to destroy everything in their paths. Also in June, Cherry Wilder's first story for *Omni*, "Kaleidoscope," shows how three lives are disrupted by a freak tropical storm that pulls the characters into another time stream.

**COMSATURATION**

International business conferences with holograms of their participants sitting around the table, Rock shows, Broadway plays, even religious services that hundreds of millions of people attend. These will be some of the by-products of a quiet revolution now going on 22,500 miles out in space as the next generation of sophisticated communications satellites is launched. Read in the next issue of *Omni* how this amazing new technology could make our society truly global.

**ROCKSONGS**

To the Indian of the American West there is a mythical, magical quality to the world around him, particularly to the stones of the desert. In next month's *Omni* you will see the effort of one man, photographer Dan Mornill, to capture some of the allure of the monoliths of the desert. In a spectacular portfolio of images, rockscapes are transformed and reborn through the white magic of photochemistry. Barren landscapes vibrate with energy. The shapes of the desert become the stuff of dreams, surreal environments where stark vistas explode in a palette of vivid colors.

**ORDER OUT OF CHAOS**

What is behind the random turbulence of a waterfall, the maddeningly unpredictable hop and skip of the ball in a roulette wheel, or the exasperating quirks of the weather that eludes the predictive powers of science? Get ready for a heady trip into chaos, a new intellectual discipline that tries to analyze what was once considered unexplainable. Employing the incisive intellect of mathematicians and the patience of Zen masters, a growing number of theorists have been working on the study of randomness, or chance. And their excursions into the netherworld of randomness have unleashed a zoo of bizarre discoveries—names like "strange attractors" and catch phrases like "sensitive dependence on initial conditions." These insights are already providing us with new ways to study how the brain works, why random cells become individual people, how diseases afflict us, and even how society has evolved. Read about it in the June issue of *Omni*. 
This month's games include several of the best original ideas sent in by readers. Each gamester chosen will receive a one-year subscription to Omni (or a year's extension on a current subscription) and will be credited on the answer page. The items were selected to give a good mix of difficulty levels, from easy to hard.

1. **ABOUT TIME** Most digital clocks showing hours and minutes have a display that includes the 23 line segments below. Which single segment is "on" more often than any other?

(a) Which single segment is "on" more often than any other?
(b) Not including the two leftmost vertical segments composing the 1, which single segment is "on" less often than any other?
(c) What is the fewest number of segments "on" at one time and when does that situation occur?
(d) What is the greatest number of segments "on" at once and at what time does that occur?

2. **SHONIX?** What is the significance of the following letters and what if anything belongs in the blank space? **SHONIX**

3. **PROGRESS?** Can you supply the next number in this series? 1, 5, 9, 15, 21

We don't give hints facetiously but if you think this is a mathematical question you're on the wrong track.

4. **TRUTH TIMES TEN.** Each of the ten statements below can be answered either true or false. The list contains some of each type. Assign a T or F to each statement in the only way possible that satisfies all of them at once without a contradiction.

- 1. The fourth false statement is odd numbered.
- 2. There are more false statements in the first six (statements 1 through 6) than there are in the last seven (4 through 10).
- 3. There are at least five false statements.
- 4. There are three consecutive true statements.
- 5. There are at least as many even-numbered true statements as there are odd-numbered false statements.
- 6. Statements 7 and 10 are either both true or both false.
- 7. Of the last three even-numbered statements (6, 8, and 10) exactly one is true.
- 8. Statements 6 and 9 can be true only if statement 10 is false.
- 9. Statement 7 and the first even-numbered true statement are directly preceded by true statements.
- 10. Statement 9 is false.

5. **FILL-IN.** What are the missing letters?

**F T F T T T T F F F S S S S E E = 0**

6. **LET'S CUT A RUG.** Carpet Town at the Tri-City Shopping Mall is having a closeout sale on just the rug you've been looking for. They're selling the 10' × 10' rug which is exactly the size you need, at 33 percent off. On the other hand, they have a 9' × 12' rectangle of the same rug which they will sell for 90 percent off because it is damaged—there is a 1' × 8' strip missing from its middle. (Seems this was a floor model and there was this accident. Don't ask.) Anyway you decide to settle for the damaged rug (above or right)—in part to save money, and in part because you are a gamester you're intrigued by the challenge of finding the optimal way of cutting this rug to fit your 10' × 10' room. You have just the right area (9 × 12 = 108 - 8 = 100 square feet). What is the minimum number of pieces into which you will have to cut this bargain bin special so that the pieces will fit back together in a 10' × 10' square?

7. **HAPPY BIRTHDAY** Sam and Deborah Gindek are an unusual couple. They celebrate their wedding anniversary and both their birthdays on the same day—July 4. Sam says, "When I met Deborah I thought it was so remarkable that we were born exactly seven years apart— I'm 2555 days older than she is—that we decided to get married on our mutual birthday. How old will Deborah be when July 4 comes around this year?"

8. **DOMINO.** A Latin Square is an arrangement of numbers in a square wherein no number appears twice in the same row or column. It is often used in statistical research to assure that experimental variables are evenly divided—to compare different concentrations of fertilizer on a plot of...
land that has a complex or uneven drainage pattern, for example. The challenge here is to make a $6 \times 6$ Latin Square out of the dominos in a standard double-six set. There are a great many ways to do this, so it makes a nice solitaire game to let chance determine which dominos you use. From the 28 dominos in the set, you can discard the seven “doubles” right away—from blank-blank up to six-six. From the remaining 21, randomly pick three and set them aside, then try to arrange the remaining 18 into a Latin Square.

In the example at lower left, we have discarded the blank-6, the 1-2, and the 1-4, and have constructed a near-miss Latin Square out of the remaining tiles. The columns are all right, but the top row has two 4s and two blanks, the third row has two 5s and two 6s, and the fourth row has two 3s. Can you make a Latin Square out of the 18 dominos shown?

9. FAULTLESS. As a related problem, note that the domino square shown has several “fault” lines that extend straight through the square and divide it into rectangles. There are three horizontal fault lines (below rows 1, 3, and 4) and two vertical lines (to the right of columns 2 and 4). Ignoring the denominations of the dominos, can you arrange 18 of them into a square that has no fault lines, horizontal or vertical?

10. TEACH ME TONIGHT. Michael was sitting in his favorite bar one night when in walked his symbolic-logic teacher, Professor Alexander Zymurgy, and ordered a dry martini up with two olives. Michael, who had already had a drink or two, picked up a large empty popcorn bowl and inverted it over the professor’s drink. “Doc,” he said, “I’ll bet you twenty-five cents that I can drink your martini without touching the glass, the popcorn bowl, or the table. I won’t touch them directly or indirectly, or have anyone or anything help me. Is it a bet?”

When the professor said “Sounds good, you’re on,” what did Michael do? Answers are on page 148.
It is widely believed that the major obstacle confronting the environmental movement in this country is the attitude of big business. Best summed up as: "Damn the bald eagles, full speed ahead." This assessment is an unfair generalization. Corporations are interested in the environment and the quality of life, and would be among the first to man the picket lines for a cause they believed in. Unfortunately, none of them have yet found a cause to believe in. So, with an eye toward rectifying this unfortunate situation, I recommend the immediate formation of the following ecology groups for businessmen:

Save the Real Estate
Appealing to California bankers and realtors - this group would mount protests on behalf of an endangered commodity, West Coast real estate. The cause of the problem is obvious: too many whales. All those 20-ton mammals bellowing about in the ocean create the same effect that you produce when you sit down in a full bathtub. They make it overflow. Get rid of the whales and the Pacific will eventually recede, giving us all the real estate we need for building more homes, factories, and whale museums.

Friends of the Earthmovers
A coalition of contractors, heavy equipment operators, and other construction types, this organization would be devoted to cleaning up the great outdoors by getting rid of the dirt. Not the litter, just the dirt. Everywhere you look in America there's mud, sand, rocks, and just plain dirt. This is filthy that you would never tolerate on your living-room rug, yet it doesn't get cleaned up, just because it's outside. The goal of FOE would be to raise enough money to pave the entire United States and build a giant, coast-to-coast condominium, 141 million square feet with pool and Jacuzzi centrally located somewhere near Malibu, Illinois.

Campaign to Quiet Harping on the Seals
Furriers and spotted seals could join forces to alert the world to the plight of the northern seal clubber, an endangered jobholder soon to be extinct if corrective measures are not taken immediately. This group could probably accomplish its goal with a lot of the usual media exposure as well as a constant barrage of high-level nagging.

Greenspace
Any executive whose handicap is less than 15 would be urged to join this effort to save our nation's golf courses from being further destroyed by hackers. Legislation is desperately needed to amend the existing-mulligan law (thatrowned statute requiring golfers to replace all their divots) to make failure to replace a Class A felony.

Shave the Walruses
Walruses are not an endangered species yet, but certainly there would be much more mowing going on if these creatures weren't so ugly. Manufacturers of cosmetics and disposable razors could encourage ecologists to use their products to beautify these unattractive mammals. Trim their beards, put on a little blusher and eye shadow and their mating could increase literally overnight.

The Campaign to Varnish the Redwoods
Lumbermen and manufacturers of furniture-care products who already respect the fact that the giant redwoods are the oldest living things on earth could unite in this organization. Their mission: Use their vast woodworking expertise to save these mammoth plants last even longer for future generations to enjoy and polish.

Save the Cockroaches
Though not officially on the endangered list, the 'harbors of the slums' are being ruthlessly slaughtered for sport with shoe shapers and even old copies of National Geographic. This is tragic. So-called slumdocks might rally to the roach's defense and have their roach infested buildings declared game preserves. This move would allow the slumdocks to discontinue the cruel, and expensive practice of hiring exterminators and might even make them eligible for special tax breaks.

Nader's Degraders
Concerned executives and corporate advocates would ally themselves in this organization to take on Big Ralph. The organization would act as a spokesman for a broad range of corporate complaints and might even air a weekly television show to counter all the unfair charges Mr. Nader made against its beleagured members. Possible title: Deface the Nation.

OPECERS
An Organization of Petroleum Exporters Concerned with Exploiting Repulsive Sources. Oilmen and other energy people could do their part to protect the environment by promoting the development of new technologies that would make available the vast reserves of oil that are being used to this is quite possible through microweathering to install a small oil well on the tip of the nose, the well could yield as much as a barrel a day. Feasibility studies in this area could be underway by the purveyors and manufacturers of french fries and potato chips.

Ralph Harris is a freelance writer based in Los Angeles. He takes great pride in never having voluntarily joined any organization, and has even turned down a free lifetime membership in The Friends of Ralph Harris.