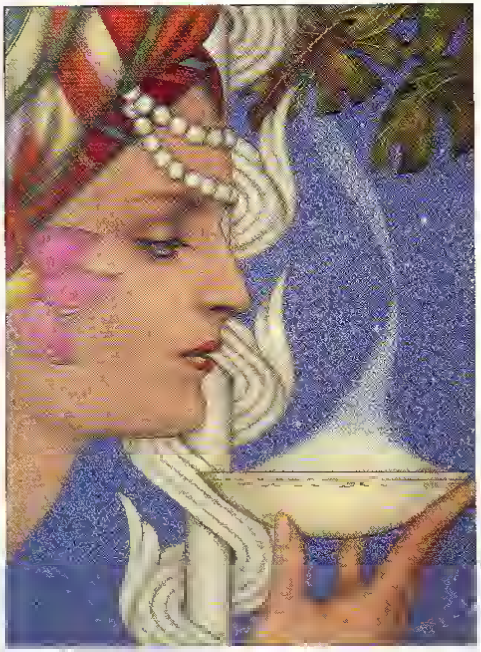

$40,000 PLUS! TREASURE HUNT INSIDE
OMNI
FEBRUARY 1995
BIOCHEMICAL WAR:
THE NEW SHAPE OF DEATH
ARTHUR MILLER:
EYE OF THE BEHOLDER
SQUEEZING ENERGY
FROM A VACUUM
PLUS:
FICTION BY J. G. BALLARD,
MAPPING
BRAIN TRAFFIC,
CHIMPANZEE DOCTORS,
COMPUTER SEX,
AND MUCH, MUCH MORE
$3.50
02
02484
0 778845 1

OMNI

VOL. 13 NO. 5 FEBRUARY 1991



In the world of limitless nonpolluting energy there will be time to reflect on beauty. Artist Mel Odom captures that quality of peaceful reflection in this month's cover, *The Perfumed Garden*. The work combines pencils, dyes and gouache to create a tranquil unity, a vision of a future toward whose restfulness we can aspire.

OMNI (ISSN 0149-8711) is published monthly in the United States and Canada by Omni Publications International Ltd., 1965 Broadway, New York, NY 10023-5965. Second-class postage paid at New York, NY and at additional mailing offices. POSTMASTER: Send address changes to Omni Magazine, Post Office Box 3041, Harlan, IA 51537-3041. Volume 13, Number 5.

OMNI

FIRST WORD

IN THE AYES OF THE BEHOLDERS

With Congress debating obscenity in federally funded art, what will happen to free expression?

Arthur Miller, Pulitzer prize-winner and a distinguished American playwright

The National Endowment for the Arts (NEA) has provided some 85,000 grants over the past 25 years. Three or four have been controversial. Not a bad record.

Last year on July 16, as a one-day lobbyist for the Authors League of America, I met with a group of conservative senators and congressmen in Washington, DC. I tried to convince them that the issue was not smutty pictures but whether our government should get into the business of laying down rules for socially good and bad art. Even Plato gave up trying to do this, but it will have a deathless fascination for political leaders to the end of time.

I read a couple of paragraphs to the legislators from *In Russia*, a book I wrote in 1965. I doubted many lobbyists did literary readings for congressmen, so I figured I might get their attention.

In Moscow, while interviewing a tough Soviet Writers Union apparatchik, I cautiously hinted that a little more freedom from government interference might benefit Soviet art. He replied sternly, "You mean we should spend the people's money publishing the pornography I have seen on your newsstands, books which interest young people in drug addiction, plays which espouse homosexuality, paintings which even your own critics admit are made only for publicity and money? All this you are telling me will be an improvement for Russia? We do not consider that an improvement."

A senator from a Western state, as soon as he caught the gist of this conversation, took on a wryly fascinated look, and for a short moment I thought I had a convert. And so I added that the Soviets in censoring art were unquestionably being political censors, so why was it different when we did the same thing? It took a moment for him to rally from the damning comparison. "There is a difference," he finally stated, "because the Russians control the entire production of art, while we are only interested in the tiny part of it that the government underwrites." He looked relieved, if not surprised, to have come up with this dubious escape, but I wasn't sure how deeply it really convinced him. Unfortunately, I wasn't thinking fast enough to ask whether if the government did underwrite all or most American art would he still favor censoring it.

Another senator was embarrassed by the irony of a Soviet ironpants 25 years ago saying precisely what fundamentalism says today about censoring art. But curiously enough, he added that he had seen a play of mine, *The Archbishop's Ceiling*, a few years back and thought it an "amazing metaphor" for the internal spying going on in the world, not excluding America now and then, and for our relationship to power itself. I thought this was his way of telling me he was indeed troubled by the NEA issue, but that people were really worked up about the NEA and their feelings simply could not be ignored.

It became clear to me that we were all Jesse Helms's prisoners. None of the senators or congressmen referred to their own reactions to this alleged pornographic art but to "their feelings"—that is, the people sending in millions of boilerplate postcards organized by fundamentalist groups.

In talking to congressmen it seemed ironic that by attempting to purify minority art, the kind that aspires to seriousness, we will leave the field more thoroughly cleared for the non-governmentally funded mass junk—the videos, movies, and girlie magazines, and yes, a lot of the TV advertising—on which this country veritably floats. Of course, nobody is ever going to attempt to purify low art, no doubt for the good democratic reason that no politician is crazy enough to mess with the real high-stench garbage that amuses most voters.

It has all gotten twisted. One well-meaning liberal congressman, a supporter of the NEA, penned new language authorizing the NEA to prohibit funding of works that "deliberately denigrate the cultural heritage of the United States, its religious traditions or racial or ethnic groups."

Now we are into religion and culture and race, areas where Congress clearly has no right to legislate, but this only illustrates where this whole far-Right campaign is dragging us—straight into political censorship. No wonder Plato would not let artists into his ideal society—there was just no easy way to keep them in line.

And there still isn't. Not in a democracy. And Congress ought to give up trying to kid itself—laying down orthodox lines of taste in matters of art means censorship. There isn't a graceful way around this. Let Jesse Helms get elected on an issue that doesn't matter this much to the good name of the United States, still the freest society in the world. ◻◻

FORUM

THEY ROLL THEIR EYES AND GROAN
at the mention of science, but with an enlightened approach we can recapture students' curiosity

inquiring minds want to know: Children's curiosity is insatiable, but from the earliest grades students are prodded to perform rather than ask why

An entire generation of students is losing interest in science and scientific careers. Although we hear constantly of the competitive and national security consequences of this decline, science education continues to plummet.

In *Science: The Glorious Entertainment*, Jacques Barzun ruminated on the place of science in our intellectual lives. A quarter century after its publication, the book remains thought provoking and worthwhile. In its title we find a clue to our schools' dilemma in science education and the key to challenging kids' natural curiosity.

Preparation for a scientific career is not the purpose of elementary and high-school science classes. Even in the most scientifically enlightened times most students do not become scientists. They do, however, possess the ability to learn about science and to carry that learning throughout their lives. And an understanding of science and the scientific process is one that will serve an individual well, whatever professional path he pursues.

You don't have to be a particle physicist to be curious and informed about the nature of matter. Few frontiers are expanding as dramatically as those in biology, yet most students express little interest in the fundamental processes of life. The history of science is filled with individuals and events as dramatic as any human endeavor, yet those individuals and events are all but invisible to kids.

Science test scores are declining. Yet those very test scores are at the heart of the problem. From the earliest grades, students are prodded to perform rather than inquire, to get good marks rather than grasp ideas, to recite rather than reflect. SAT and other standardized scores count for far more in the minds of most students—and the minds of too many school administrators—than comprehension.

The mentality that drives the overwhelming emphasis on standardized test performance is the same one that hampers and hamstrings our science teachers. The architecture of too many school systems rests upon compartmentalization, curriculum guidelines that assign so many weeks to physics, so many to chemistry, and so on. In the upper grades, students elect a scientific discipline for a semester or two, then move on, forgetting the facts.

It doesn't have to be this way. Young children have that *scientific* cast of mind that asks constantly, why and how. They want to learn, and for a time their curiosity is insatiable. Our educational process, however, seems designed to squelch that curiosity and replace it with drudgery.

This is not, as a rule, the teachers' fault. They work long hours for low pay, their own excitement and energy sapped by the compartmentalizers. Many science teachers find themselves locked into dull, bland textbooks, required to march through a set number of pages on a predetermined schedule, with little opportunity to innovate, to communicate, to *educate*.

Those same teachers know that science is a process of asking questions, but those questions need to be placed in a context. That context needs to extend beyond the covers of state-selected texts, must extend, in fact, as far as the partnership between teacher and student can go. And the context must spark students' imaginations by showing how science touches their lives.

Broadcaster and geneticist David Suzuki once made a bold suggestion. Since teenagers tend to have sex on their minds, build high-school science courses around biology, specifically around sex and sexuality. From this admittedly interesting starting point, science teachers could move throughout all of the scientific disciplines—holding on to students' interest all the while.

Other inherently interesting contexts offer opportunities: space, athletics, the environment, the information revolution. You could build a broad science course from the lives of scientists. One can envision science courses constructed around the physics of video games, television, the arts, even science magazines like *Omni*. Teachers have their own, doubtless better ideas.

H. G. Wells pointed out that civilization is engaged in a race between education and catastrophe. Today catastrophe seems to be winning, at least in science education. To reverse the trend requires a large effort by individuals, corporations, publications—one that will repay us a thousandfold, and more quickly than we might imagine.

Science *is* entertaining, and at its best, that entertainment is glorious. The challenge is to liberate our teachers from artificial restraints that arbitrarily measure accomplishment, freeing them to show students the glorious entertainment that can be found in science.—Keith Ferrell

OMNIBUS

SUMMONING UP THE ENERGY

We journey into a vacuum, traipsing through a field of pesticides and a mathematical garden

The applications of zero point energy are astounding—from computers and television to powering our cities, homes, and cars. **Owen Davies** ("Volatile Vacuum," page 50) reports on research tapping the properties of a vacuum—or, as some scientists call it, the tranquil void—to produce limitless energy. "If this technology were implemented, the oil-producing countries would have no hold on anybody," Davies says. "What good is oil, other than as a lubricant and chemical feedstock, if you don't need to burn it for energy?" Davies looks at future political and economic changes in *Crystal Globe: The Haves and the Have Nots in the New World Order* (St Martin's Press, June 1991), coauthored with futurist Marvin Cetron.

In "A Poison in Every Caldron" (page 42) *Omni*'s international editor **W. E. Gutman**, examines the proliferation of chemical and biological weapons. "Armies once fought face-to-face," says Gutman, former editor of *NBC* (Nuclear, Biological, and Chemical) *Defense International*. "Now we are talking about weapons of awesome dimensions for which no antidotes have been found."

Describing Bruce Ames as "unflappable and patiently instructive," **Bill Moseley** (Interview, page 74) got lost in the gray areas of the genetic toxicologist's arguments. "His science is accurate," Moseley says. "But the issues are not black-and-white. The lines have been blurred. Nature may not be benign, but it is innocent." When not interviewing scientists, Moseley has found time to appear in the films *Pink Cadillac* and *The Texas Chainsaw Massacre 2*.

The Watson Research Center reminds writer **Gregory T. Pope** (Mind, page 24) of a steel and glass crescent stretching across the countryside. Ironically the interior resembles a huge brain slice. "A supercomputer is at the center, surrounded by individual researchers, or little neurons, all working away in their own areas—and all hooked up to the main terminal," Pope says. "It is a giant neural network."

Omni research editor **Beth Howard** (Animals, page 30) offers yet another argument for saving the threatened rain forests, home to a diversity of species and peoples. "We're learning new, useful things by observing the inhabitants within the forest," says Howard. "Drug companies will never be able to duplicate what evolution has provided plants. Scientists call this 'nature's template.'"

The delicate plant images in "The Mathematical Gardener" (Pictorial, page 65) are the outgrowth of a new branch of mathematics called biomathematics. "Understanding the laws of dynamic processes at work underscores nature's beauty," says *Omni* associate editor **Sandy Fritz**.

Every time *Omni* assistant editor **Mary Glucksman** (Body page 28) wanted to write about John Sabolich's work, the prosthetics designer had already overshadowed his latest breakthrough with yet another radical improvement. "With the Sense of Feel System he has widened his industry's horizons," says Glucksman. "He has set the standard for a new generation of artificial limbs whose sensory feedback will be an integral part of their function."

For international space expert **James Oberg** (Space, page 25), meeting with key people behind the Soviet space program and mapping out joint activities with the United States remains a constant source of satisfaction—as does his "day job" at NASA Mission Control in Houston.

J. G. Ballard is the author of numerous novels, including *Crash* and *Empire of the Sun*. "Dream Cargoes" (page 58) marks Ballard's first appearance in *Omni*. The short story will appear in his newest collection, *War Fever* (Farrar, Straus & Giroux), in April.

Pat Murphy ("Peter," page 82) won a Nebula for her novel *The Falling Woman*. She also wrote *The City, Not Long After* and *Points of Departure* (both by Bantam), a collection of fiction. ∞

Contributors this month include, clockwise from bottom. Beth Howard, Gregory T. Pope, Mary Glucksman, James Oberg.

COMMUNICATIONS

READERS' WRITES
From saving the world to surviving extraterrestrial encounters

Mastering Mysticism
I read with interest Patrick Tierney's article The Mechanics of Mysticism [November 1990] but feel that due to the brevity of the article he shortchanged Dr. R. Keith Wallace. Tierney referred only to the original physiological correlations of Transcendental Meditation. Dr. Wallace, however, has been researching this field for the past twenty years. I applaud Tierney's treatment of the subject and would encourage him to follow up on current research which is yielding more consistent and satisfying results.

Mark Hawkins, M.A.
Ontario, Canada

Star-crossed
Contrary to the article that mentions the lack of thermonuclear reactions of Barnard's star [Space, November 1990], they have been occurring for billions of years. Because Barnard's star is small and dim, the "ecosphere," where a suitable planet could exist, is narrow and close to it. If a planet beats the odds and orbits within the narrow ecosphere, life on that world would be endangered by flares on the nearby star.

Dr. Gregory L. Matloff
Brooklyn

Population Predicament
I applaud and support the efforts of Sally Struthers [First Word, November 1990] to feed the world's hungry and more equitably distribute world food supplies. But, like many, she calls for treating the symptoms over the cause. Slowing population growth is not "one answer"—it is the only answer. The current birthrate cannot continue without catastrophic results. Overpopulation is a global problem and lowering the birthrate is not a question that can be resolved separately by nations, peoples, or individual families.

Thomas Townsend
Corvallis, OR

Calling All Abductees
We were amazed to read [Antimatter, September 1990] that Budd Hopkins is calling his new IF organization the "first nationwide help network for UFO abductees." Fact: Our organization, the UFO Contact Center International, is the oldest in the U.S. specifically for the purpose of assisting those persons who have had an abduction experience by UFOs. Incorporated as a nonprofit organization in 1981, we have grown to 60 centers in the U.S. and Canada.

Aileen Bringle
Director, UFO Contact Center
Federal Way, WA

Higher Order
It's great that *Omni* threw a little exposure on the 12 AA steps, for they have helped many people overcome various addictions. In reading the October 1990 issue of *Omni*, however, I found an error in the *Omni* Arcade Twelfth Anniversary Quiz regarding the sequence of those steps. The first step states that "we admitted we were powerless over alcohol and that our lives have become unmanageable." Reliance on a higher power or God, according to the individual, comes in steps two and three, the reason being, until an individual comes to grips with having no power himself over alcohol, reliance on a higher power is out of the question.

Mike Yow
Greensboro, NC

Minds of Change
Some of the objection of the scientific community to Robert Jahn's psi experiments in "The Dean of Psi" [September 1990] comes from those who fear it would upset their theories. Copernicus, Galileo, and Einstein all had the same problem. Having to change our minds is a bigger threat to many people than Iraq, nuclear winter, or Ted Kennedy for president.

Ted C. Slack
Miami

Great Games—and Gadgets
I am a seventeen-year-old student and have enjoyed reading your magazine for the last few years. I especially enjoy the Games and Star Tech sections. I like to see what new ideas and gadgets people have come up with.

John Towers
Ontario **OO**

THE GREAT TREASURE HUNT

11

7

7

7

The following descriptions and values of the prizes in the 1991 Great Treasure Hunt correspond to the numbered photos on these pages. 1) Grand prize: 1991 Jeep Wrangler, including option package of floor carpet, power steering, and rear seat. 2) First prize: Northgate Computer Systems hardware package. 3) Second prize: Casio electronics package, including Executive B O S S with expansion card, dictionary card and spell checks for financial and medical terms; Casio TV/VCR, mini hand-held color TV, electronic piano, horn, and keyboard; and two sets each of his-and-hers watches. 4) Third prize: Honda Nighthawk 750 motorcycle. 5) Fourth prize: Okidata laser printer. 6) Fifth prize: Mitsubishi 40-inch big-screen television. 7) Sixth prize: Nordic Track workout equipment, including Track Pro, rowing machine, and Fitness Chair. 8) Seventh prize: Electronics package from Uniden, including LCD Fishfinder, mobile cellular telephone with voice dial, radar detector, and Bearcat scanning radio. 9) Eighth prize: Ad Lib package, including an Ad Lib computer sound card, Acoustic Research speakers, and computer games from Lucasfilm Games, Ac-

9

5

10

Now that you know the prizes,
find out what to do next. Use your touchtone phone to
CALL 1-900-773-OMNI or see instructions below *

6

4

8

cess Software, SSI Software, Maxis Software, and Sierra On-Line. 10) Ninth prize: SNK Neo-Geo advanced entertainment system and game cartridges. 11) Tenth prize: Chinon's Genesis III camera outfit with 1.4X converter, WA converter, battery, and carrying case.

PRIZE VALUES: The following are the individual retail values of our prizes in the sixth annual Great Treasure Hunt: 1991 Jeep Wrangler, $11,267, including the base sticker price of $9,910, plus option package of floor carpet, power steering, and rear seat worth $892, and destination charge of $465. Northgate Computer System with 8MB RAM, $10,042. Casio electronics package: $4,346. Honda Nighthawk 750 motorcycle, $3,998. Okidata laser printer: $2,999. Mitsubishi 40-inch big-screen television: $2,399. Nordic Track workout equipment, including Track Pro, rowing machine, and Fitness Chair, $2,067. Uniden electronics package, $1,856.85. Ad Lib package, $1,354.24. SNK Entertainment system, $1,047. Chinon camera outfit, $1,029.75.

To find out more about individual prizes, see the Gift Finder's Guide on the next page.

3

Now that you know the prizes,
find out what to do next. Determine the solution and
CALL 1-900-773-OMNI*

THE GREAT TREASURE HUNT

This month's *Omni* is your map in the 1991 Treasure Hunt, the 12 discs below your clues. Match the clues with their original sources and you could drive away in a 1991 Jeep Wrangler including an option package of floor carpet, power steering and rear seat. Or you could win another treasure—from a Casio electronic products package, an Okidata laser printer, or a Mitsubishi big screen television, to a Honda Nighthawk motorcycle or Northgate Computer Systems Dream Productivity System that includes the Northgate 486 with 8MB RAM, 200MB SCSI hard drive, Omnikey Ultra keyboard, NEC 4D monitor, Oume Crystalprint Series II printer, video 7 VRAM card, MS-DOS 4.01, Windows 3.0 and other features.

Each of the dozen picture discs displayed on this page is a portion of a photo or illustration appearing in an advertisement in this issue. Find the advertisements that match the clues, then note the page number for each ad. For clues on the inside or outside of the front or back cover, count that page number as zero. If there is no page number on the clue page, turn to the next numbered page and use that as your answer. Add up the 12 numbers for your solution to the 1991 Great Treasure Hunt in this issue.

*NO PURCHASE OR PHONE CALL NECESSARY. To enter automatically, call 1-900-773-6664 between February 1, 1991 and May 31, 1991, to give your name, address and daytime telephone number and the correct solution to the 1991 Treasure Hunt appearing in this issue of *Omni*. Each call costs $2.00 the first minute and $1.00 each additional minute or fraction thereof; average call length is estimated to be two to three minutes. You must be eighteen years old to call or have a parent's or guardian's permission before calling. Call as often as you wish; each call is a separate entry.

You may also enter by printing your name, address, daytime phone number and the solution to the Treasure Hunt on a three- by five-inch sheet of paper. Mail your entry to Treasure Hunt, Box 793, Gibbstown, NJ 08027. Enter as often as you wish; each write-in entry must be mailed separately. All entries must be received by May 31, 1991.

The 1991 Treasure Hunt is sponsored jointly by *Omni* magazine and *Compute* magazine; varying creative presentations may be used. Winners will be selected on or about June 30, 1991, from among all eligible entries in random drawings conducted by Power Group, Inc., an independent judging organization whose decisions are final.

Odds of winning are determined by the number of eligible entries received. For complete rules (including the solution) send a self-addressed, stamped envelope to 1991 Treasure Hunt Rules, Box 849, Gibbstown, NJ 08027 by May 15, 1991.

GIFT FINDER'S GUIDE

For more information on products and services in the Great Treasure Hunt, contact the companies at the following addresses: Access Software Inc., 545 West 500 South, Suite 130, Bountiful, UT 84010, 1-800-800-4880; Acoustic Research, 330 Turnpike Street, Canton, MA 02021, 1-800-969-AR4U; Ad Lib Inc., 50 Staniford St., Suite 800, Boston, MA 02114, 1-800-463-2686; American Honda, Dept. 91, Box 7055, North Hollywood, CA 91609; Casio, Inc., 570 Mt. Pleasant Ave., Dover, NJ 07801; Chinon America, Inc., 1065 Bristol Rd., Box 1248, Mountainside, NJ 07092; Jeep Wrangler 1-800-JEEP-EAGLE; Lucasfilms Games Division, 3270 Kerner, San Rafael, CA 94912; Maxis, 415-376-6434; Mitsubishi Electronics America, Inc., 557 Plaza Dr., Box 6007, Cypress, CA 90630; NordicTrack, 141 Jonathan North, Chaska, MN 55318; Northgate Computer Systems, 7075 Flying Cloud Dr., Eden Prairie, MN 55344; Okidata, 532 Fellowship Rd., Mount Laurel, NJ 08054; Sierra On-Line, Inc., Box 485, Coarsegold, CA 93614; SNK Home Entertainment, Inc., 22301 S. Western Ave., Suite 107, Torrance, CA 93614, 1-800-253-6665; Strategic Simulations, Inc., 675 Almanor, Suite 201, Sunnyvale, CA 94086; Uniden, 4700 Amon Carter Blvd., Fort Worth, TX 76155, 817-858-3300.

MIND

WHERE BRAIN AND ELECTRONICS MEET may arise the ultimate thinking machine, the brainstorming computer

A mouse sniffs around a lab late at night while an exhausted researcher slumbers over a supercomputer terminal. Although neither can tell us what's going through his mind, both brains are putting out waves, a quietly reverberating electrical storm that present-day computers can't duplicate.

Unless the scientist is Roger Traub. His computer might be giving off waves, too. To Traub's astonishment, his computer started doing just that last year. Traub devised a program that re-created a 9,900-cell slice of brain circuitry, an anatomically accurate network. When fed simulated sensory input, the brain-slice program responded with a series of artificial theta waves. "It was completely spontaneous," remembers Traub, a neurologist and research fellow at IBM's Thomas J. Watson Research Center in Yorktown Heights, New York.

Individual neurons seemed to fire at random. Yet as a whole, the neural network pulsed in a rhythmic oscillation, doing "the Theta Wave."

For years computer scientists in the neural network field have striven to design machines that can think like brains. But no one knows how brains do it. Brain-scanning tools only measure the collective voltage of millions of firing neurons. Some neurons send excitatory, others inhibitory messages. Both types are interlaced in a labyrinth of connections and feedback. Traub's program is a big step toward mapping this electrical traffic. It also demonstrates how far neural network computers must evolve before they can replicate brain functions.

In the early Eighties, Traub assembled his first computerized model from experiments aimed at understanding epilepsy. At Columbia University, he and colleagues pieced together a model of excitatory connections between cells based on a statistical analysis of recordings from a slice of rat hippocampus—a hot spot of electrical activity. Ultimately, they built a model of a healthy hippocampus. When Traub delivered a sensory-type signal to one of his simulated neurons, the entire network settled into a low-frequency oscillation. A rhythm swept around the network: groups of cells fired in unison, then rested, almost like stadium spectators doing "The Wave."

From Traub's models comes a picture of a brain far more dynamic than suggested by current neural network computers. Computers work by channeling electrical activity into precise, insulated currents. Designers toil to avoid having one transistor generate an electrical field that touches off spontaneous activity in neighboring transistors. Yet that's exactly how the brain seems to operate. Also, data processing in computers involves instantaneous electrical events with no aftereffects. "No part of the brain works like that," Traub says. "There are always aftercurrents that keep a record of past events." His network incorporates these after-ripples.

Traub thinks a paradigm of the brain's functioning may derive from studies of chaos. Physicists, for example, can reduce the turbulence of airflow over a helicopter blade to mathematical values that, charted geometrically, settle into a wobbly but repeated orbit. Such a pattern is called a strange attractor. The rhythmic firings of the hippocampus, Traub suggests, may be a similar manifestation of the underlying chaotic firing of individual neurons.

"If you change the initial conditions, set up different connections and strengths of connections," he notes, "the pattern is disrupted but you still get an oscillation. And that behavior suggests a strange attractor."

A strange attractor could represent a memory, Traub speculates, and different initial conditions could lead the network to settle on different memories. "Of course it could mean nothing like that," he admits. "Maybe if you wire it up this way, the damn thing just oscillates."

Could his research lead to a new computer architecture? "When we understand the dynamics of this thing," Traub insists, "maybe we can find uses for it, but not before."

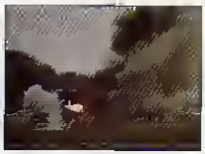
—Gregory T. Pope

SPACE

FAST EXIT:
The Soviets say their ejection system is tops, but is the rest of the world buying it?

At the Paris Air Show in June of 1989, horrified spectators watched as a Soviet pilot bailed out of his jet when an engine suddenly lost power after ingesting a bird. At an altitude of less than 200 feet, the pilot ejected in the wrong direction and fell much too quickly. Yet he survived—thanks in part to the jet's innovative ejection system. A similar ejection system destined for the Soviet Buran space shuttle is now being vigorously marketed in the West by its designer, Guy Ilich Severin.

The K-36RB shuttle escape system has taken Severin from obscurity as the head of a supersecret Soviet military aviation factory to the spotlight. The mechanism is already standard for all Soviet supersonic aircraft. Now Severin is trying to convert his newfound recognition into cash by selling the K-36RB to the United States and Europe. But drumming up sales may prove an even greater challenge than designing the system in the first place.



A Soviet pilot exited his MiG-29 jet at the 1989 Paris Air Show when it took a disastrous nosedive after losing power. He landed safely, due in large part to a new ejection system

Autonomous sensing devices in Severin's system detect spacecraft failures that require immediate ejection. Cables attached to astronauts' heels, wrists, and helmets jerk their bodies into the proper posture for the violent departure. Emergency shutdown commands are sent to all the booster's engines. Just one of the stages incinerate the ejecting crew. Hatches blow off the cabin roof, and mortar shells under the seats thrust the astronauts from the craft.

Strapped to each astronaut is an ejection unit containing a two-stage solid rocket motor that, in seconds, propels the astronaut half a kilometer from the craft. Stored inside each unit, moreover, a self-contained oxygen supply and an automatic parachute system aid the astronaut, even if unconscious or injured, in making a safe touchdown.

According to Severin, the seat and pressure suit combination provides an effective escape from liftoff through Mach 3 at 60,000 feet. (Higher than that, the shuttle would probably be able to glide back to "safe" altitudes where the astronauts could eject.) If an accident occurs near the end of a mission, when the shuttle reenters the atmosphere, the escape system will be usable once the spacecraft's speed has dropped to less than Mach 2.

The Severin system is many times more capable than NASA's current approach. After the *Challenger* catastrophe, shuttle astronauts began carrying parachutes and oxygen systems, using a special slide to throw themselves clear of a plummeting spacecraft. Yet the NASA system is designed to deal with scenarios that aren't the accidents most likely to occur, Severin contends.

However, NASA is unlikely to buy the Soviet design or even a similar system from an American company. For one thing, NASA estimates that installing the system in its shuttles would cost up to $1 billion. NASA also routinely flies crews larger than four, the maximum number that Severin's system is designed to evacuate. Flying larger crews would require placing astronauts on the shuttle's middeck. Severin objects to crews of more than four people because getting them out in an emergency would be extremely difficult.

Severin's claims about his system's performance are "not outrageous," says one U.S. astronaut who met the designer. However, he and most others at NASA are very skeptical that any ejection system could allow safe escape during the first 30 seconds of flight, when there is almost no opportunity for the astronauts to get away quickly from the shuttle and when there may be no warning of an imminent malfunction.

Despite NASA's lack of interest, Severin is now competing with a European team for the European Space Agency's Hermes spaceplane ejection system. One of the somewhat lighter Europe-

an design's chief selling points is that, being locally manufactured, it would encounter less political opposition than Severin's system.

Despite the Soviet system's sparkling performance, there remain nagging questions about its reliability. According to Severin, it has been activated 300 times during flight with "virtually no injury" most of the time. He has stated that he is not responsible for those who use it outside the conditions for which it was designed, implying that deaths have occurred from misuse.

Severin's firm is one of the first Soviet companies to peddle its wares to the West and, indeed, will need non-Soviet customers to survive. If Severin is to succeed, he must first earn the trust of his potential buyers.

—James Oberg

BODY

OUT ON A LIMB:
New technology will help amputees, paraplegics, and fracture patients keep their feet on the ground

In the bottom of the ninth inning, Chuck Tiemann hits a single for the home team, driving in the tying score as he slides into first base. Nothing particularly unusual about that—except Tiemann wears prosthetic limbs. He lost his right leg and left arm after a live wire sent 7,200 volts of electricity through his body. The sports enthusiast expected to never play baseball again, but he's made a comeback—thanks to the revolutionary Sabolich Sense-of-Feel (SOF) System.

The creator of the SOF System, John Sabolich, has been responsible for at least a dozen innovative designs for artificial limbs. His designs allow double amputees, moreover, to walk step over step; children with thigh-high amputations can run, and five-month-old babies can crawl and eventually learn to walk.

Sensors in the sole of his prosthetic foot (right) tell SOF user Chuck Tiemann exactly when he slides into base.

Sabolich's latest contribution, however, uses electrical impulses to trick the brain into projecting sensations to the missing portion of a limb lost to accident or disease or undeveloped at birth. Using the SOF System, patients balance better, walk and run more gracefully, and negotiate uneven terrain more easily.

Placed in the sole of the prosthetic foot and reliable enough to withstand body weight, transducers send electrical signals to electrodes attached to the skin of the wearer's stump. As many as eight electrodes, each connected to a separate sensor, are attached to Sabolich-designed stump sockets intricately contoured to fit precisely against the remaining thighbone, muscles, and tendons. The healthy muscles and nerves in the stump pick up the transducers' signals and transmit them to the brain as if they were coming from a natural foot. The brain interprets the messages as varying degrees of pressure on different parts of the sole, it then produces sensory biofeedback as the foot moves on the ground.

As a result, a patient stepping on a stone, for example, can sense it immediately and compensate with the next step; driving a car, he can feel his foot on the brake or the accelerator. "When the brain interprets the tingly sensations it gets from the floor, it does something we call cerebrally projecting the foot in the patient's mind," Sabolich says. Some amputees even report feeling their toes bending and their heels pushing off the floor with each step.

Although the SOF System will have an enormous impact on the more than 2 million amputees in the United States, Sabolich expects it to have even more extensive uses. Working with new amputees, fracture patients, and paraplegics, physical therapists can manipulate the electrodes' amplitude. Patients can then learn which muscles to use when walking and avoid stressing other muscles. Diabetics who lose sensation in their feet, for example, tend to exert too much pressure when they walk and develop ulcerated sores that often lead to amputations. "You could put a doughnut-shaped electrode over an ulcer on the sole of a diabetic's foot to ensure he knows when he's applying too much pressure on the area," Sabolich says.

While the SOF System already represents a major advance in bionic limbs, Sabolich is hard at work designing circuitry that will do much more. Experimenting with various types of transducers, he hopes to enable amputees to experience temperature changes, tactile sensations like tickling, and even pain—to alert the wearer if the prosthesis is damaged.

The inventor is also adapting the SOF System for the myoelectric arm, a prosthesis that uses electrodes to send bioelectrical energy from residual muscles to microprocessors that operate individual motor parts. Although interference from the arm's electrical signals has proved a stumbling block, Chuck Tiemann recently tested a prototype and could reportedly feel a pencil moving between his fingers. Sabolich hopes to produce a working model, complete with a new Sabolich Socket, sometime next year.

—Mary Glucksman

ANIMALS

APE APOTHECARY

Self-prescribing chimps lead researchers to nature's medicine cabinet

On most mornings, chimpanzees in Tanzania's Gombe Stream National Park climb down from their nests and head for the nearest fruit tree. Occasionally, however, they pass up breakfast and travel up to 20 minutes, seeking a particular multistemmed plant. Instead of stripping the plant's stems clean and munching the leaves, as they do with other plants, the chimps carefully remove only the small, young leaves, which they fold and swallow whole, sometimes grimacing like a child taking castor oil.

For years, behavior associated with consuming the plant, called aspilia, was a mystery to chimp watchers. Recently, however, researchers may have solved the primate puzzle. The chimps are taking care of their health.

At least that's the conclusion of Richard Wrangham, an anthropologist at Harvard University who has meticulously studied primates for almost 20 years.

Aspilia contains thiarubrine-A, a potent compound that appears to help chimps rid themselves of parasites. Chimps, Wrangham says, usually ignore aspilia, even when it is close by. When they are sickly, however, they will go out of their way to find it. Chimps often eat the plant at dawn, when the active compound is most concentrated in the leaves.

As part of her long-term observations of Gombe chimps, moreover, chimp expert Jane Goodall has routinely found intact aspilia leaves in chimp dung. It follows, Wrangham theorizes, that the plant is probably not ingested for its nutritional value or for roughage. Instead the leaves, displaying tiny ruptured glands when viewed under a microscope, seem to release chemicals in the animals' guts.

When Wrangham learned that the local Tongwe people also use various species of aspilia to treat themselves for illnesses, the medication theory began to take hold. In 1984 Wrangham sent whole aspilia leaves recovered from chimp feces to Eloy Rodriguez, a pharmacognocist at the University of California at Irvine. What Rodriguez discovered in the leaves "was like finding water on the moon," he says. "The young leaves contain a chemical not found in older leaves," explaining why chimps select only small leaves. Rodriguez subsequently discovered that thiarubrine-A has strong antibiotic properties.

Studies by other chimp watchers bear out Wrangham's theories about chimpanzees and self-medication. In one study in the nearby Mahale Mountains Wildlife Research Centre, two primatologists watched a lethargic chimp bypass favorite foods to sample another apparently medicinal plant. In 24 hours she was well again.

Chimps taking drugs, Wrangham suggests, reinforces the perception that they are the most intelligent of primates. "What we know comes from several different researchers involving quite different chemicals," he says, "so it is not a response to a particular chemical, it's a response to the effect of the chemical that seems to be important. In other words I think the chimpanzees must learn that the effects are good on their stomachs."

As Wrangham ponders the significance of the primates' behavior, Rodriguez, intrigued by thiarubrine-A's potency, has continued to test the compound. In vitro tests show that it may have tremendous potential as a treatment against cancer in humans.

The possibility of discovering other natural drugs by watching animals has led to a new field of study: zoopharmacognosy. Indeed, Harvard researchers have observed bears rubbing medicinal oils on their fur, and an elephant watcher in Kenya notes that pregnant females about to give birth will often go looking for a plant that induces labor.

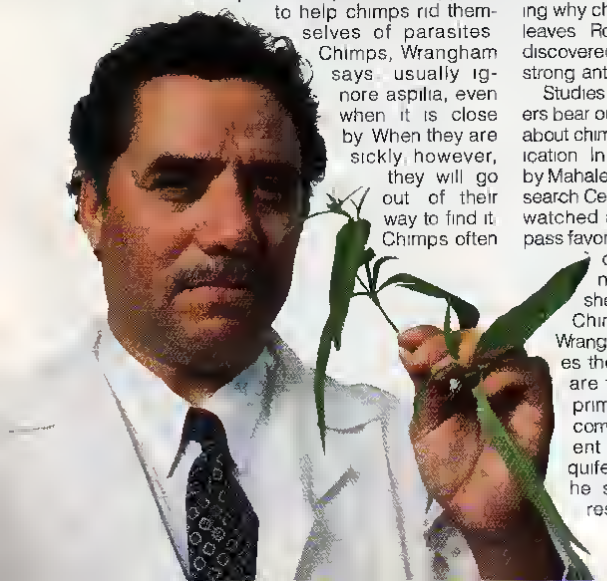
Finding potential natural medicines this way clearly adds fire to environmentalists' pleas to preserve threatened wildernesses. Rodriguez, however, is concerned that knowledge gained from such discoveries be put to use in their countries of origin. Thiarubrine-A could be mixed into the feed of livestock in developing countries, making them less vulnerable to parasites. Or it could protect crops.

"I've also argued for the establishment of regional medicinal gardens in areas where certain lore exists, places where people can just go and get the useful plants," he says.

To encourage others to think responsibly about natural medicines, Rodriguez and Wrangham have filed a patent for thiarubrine-A, earmarking part of the proceeds for the preservation of the chimpanzees' habitat.

"I like the idea of chimps showing us the medicine and then helping to pay for their own conservation," Wrangham says.

—Beth Howard



Monkey do: Eloy Rodriguez says that by eating this plant, chimps are looking out for their health.

CONTINUUM

REBIRTH OF A NATION

School's in, as Czechoslovakia forges lesson plans for the future.
Also: Simulated sex, zapping pollution, and garlic power

Among the horror stories of the hypocrisies of Communism, there is none more poignant than the beginning of *The Book of Laughter and Forgetting* by exiled Czech author Milan Kundera. In February 1948, Kundera recounts, newly installed Communist president Klement Gottwald stepped out onto a balcony in Prague to address the nation. Because of the cold, his solicitous deputy, Clementis, offered his own fur cap to the bareheaded Gottwald. Millions of people saw the picture of them together, with that cap on Gottwald's head.

Four years later, Clementis was hanged for treason. Officials immediately airbrushed him out of all photographs—and hence out of history. "All that remained of Clementis was the cap on Gottwald's head," Kundera wrote.

Since Czechoslovakia's Velvet Revolution of November 1989, restoring the record and rewriting the history books have been a priority of playwright-president Vaclav Havel's government. The new leadership understands that reeducation is the key to assuaging the nation's confusion and fears about the past, current ideological change, and the uncertainties of the future.

Under the Communist system, students endured a hopelessly overwhelming curriculum, including many hours of philosophy lessons a week on Marx and Lenin, and were required to pass all subjects to enter universities. Failure meant retesting or relegation to technical school. Many students simply gave up. Proposals for change include restoring the former system of gymnasium schools, which channel students into technical colleges or groom them for universities. Students will have to *compete* for university placement instead of relying on political connections to matriculate.

Because of a shortage of new textbooks and the need to implement a new curriculum quickly, the department of education plans to launch a series of television programs for the schools, together with nationwide televised debates to reeducate the population. Deputy Premier Joseph Hromadka is realistic about the nation's critical shortages in management expertise, technology, exchange programs, and financial aid, and he hopes for Western assistance. He says, however, that Czechoslovakia is not without its own vital resources. "We have no capital, but we have other reserves—human minds, souls, and the capacity to work." Today, he says, each teacher has the unique opportunity to state the truth, to teach history as it actually occurred—not as the party dictated.

Despite the optimism about improvements in education, there will be casualties, too. Helena Nechlebova, a languages teacher at the University of Ceske Budejovice, is leaving the field after 13 years, emotionally exhausted. "I've had enough," she says. "Today the real problem is apathy. Students think that freedom means freedom from having to learn, freedom from having to go to class and work hard."

And officials are worried, particularly about the very group responsible for the revolution. "Following the student riots in 1968, a lot of kids dropped out," Hromadka says. "We can't let that happen to this generation of kids who fought so hard to gain their freedom."

Sixteen-year-old Prague student Hagir Fathi admits that her classmates are just beginning to appreciate the shortcomings of the Communist education system. "We have never experienced anything else, so we thought it was normal," she says. "Until we have new textbooks, good teachers, smaller classes, better equipment, computers, exchange programs, there's no reason to learn. We have nothing to believe in."—*STEPHEN MILLS*

CONTINUUM

BRIGHT LIGHT, BIG LASER

Using a small solar collector mounted on the roof of a physics building, researchers at the University of Chicago have obtained the most concentrated beam of sunlight ever recorded, 15 percent more intense than light on the surface of the sun.

The device uses a 16-inch telescope mirror to focus light onto a circular area measuring one centimeter. From there the light enters a cone-shaped sapphire funnel, concentrating the beam 100 times.

The physicists found that directing the focused beam through a rod-shaped crystal created a solar-powered laser. Philipp Gleckman, a coresearcher on the project, says they may have bumped into a new method for powering lasers. "The Israeli government is seriously looking into this technique," he says. "But I do not think it's too practical."

—Steve Nadis

A BLOWFISH'S TOXIN IS 100 TIMES MORE POTENT THAN COCAINE. A LETHAL DOSE, ABOUT 1 MG, COULD FIT ON A PINHEAD.

THE MOST DISTANT STARS ARE ABOUT 5 BILLION LIGHT-YEARS FROM EARTH, OR 30 000 BILLION BILLION MILES AWAY.

"I'VE SEEN MORGAN FAIRCHILD... NAKED"

In the film *Sleeper* Woody Allen unknowingly walks into the ultimate sex machine—the orgasmatron—and a little later emerges disheveled but happy. A genuine orgasmatron may materialize in the near future, says Milton Wolf, head of acquisitions for the Getchell Library of the University of Nevada at Reno.

Wolf, who has lectured at robotics conferences on these developments, predicts that computer-induced sexual experiences will be commonplace within ten years—thanks to pioneering work in virtual reality.

People will hook themselves up to a virtual reality program similar to a flight simulator, call up their favorite sexual partner, establish their fantasy, and start going through the motions. Users receive feedback from PC-linked biosensors attached to their bodies and sexual organs, resulting finally in orgasm. "The evolution of man is going to be for many of us a relationship with our machinery that is extremely intimate," Wolf says.

—Paul McCarthy

The stuff dreams are made of: You may never meet Morgan in the flesh, but virtual reality will help make your fantasy seem more real.

DENTAL GLOSS

Want to whiten your teeth? Here's a little-known secret that's bound to be common knowledge soon. Simply put a few drops of carbamide peroxide in a plastic football-type mouth guard. Refresh it with a few drops every few hours and within a month your teeth will be sparkling.

Studies by the University of North Carolina (UNC) School of Dentistry have shown this method to be safe, comfortable, and effective (unless your stains betray an underlying dental problem such as an abscess). At $150 to $350 a treatment, it's a bargain compared with conventional whitening. And since any dentist can fit you with a mouth guard, as thin as saran wrap, the technique should spread quickly.

So who came up with this bright idea? "I've been trying to find its origin since I came across it two years ago," says UNC prosthodontics professor Van Haywood, who ran the clinical studies. So far the trail has led to some dentists in Arkansas and North Carolina who started prescribing the original technique sometime in the Sixties. Whoever can lay a legal claim to the method could sink his or her teeth into a fortune—if the teeth-whitening technique can be patented. That's a big if, says Haywood, because both bleaching solution and mouth guards have been around for decades.—Greg Pope

A little drip in a big pond Cleaning water with electricity

NASA'S ORGANIC SOLUTION

NASA, the agency that gave us the moon, has underwritten an elegant technique that purifies water tainted with organic pollutants such as PCBs and hydrocarbons

Photo-Catalytics, Inc of Boulder, Colorado, spent five years developing a system for NASA that turns shuttle wastewater into drinking supplies for astronauts "There's no reason why this technology couldn't be solving real-world problems by mid-1991," says company president Gerald Cooper.

The key to the water's transformation is a metal oxide powder that reacts with sunlight, converting it into an electrical charge that speeds up the breakdown of organic pollutants into carbon dioxide "You can't just dump the stuff into a polluted pond and expect it to work,' Cooper says 'To optimize the results, you have to pump the polluted water through a reaction chamber '

Cooper says that the technique would cost about 40 cents a gallon, on a par with techniques currently used to treat wastewater

—George Nobbe

ROOT CANALS ON MARS

Space may be the final frontier but it's the last place you want to be if you have a toothache That's why John Young, clinical professor of dentistry at the University of Texas Health Science Center in San Antonio, is developing a zero-gravity dental office

Young's system transforms a section of the astronauts' living quarters—about 50 cubic feet—into a dental clinic After the patient is strapped to whatever is available, the doctor dons a special harness to keep from floating away "You work like a mountain climber, pulling back against the rope to counteract the weightless environment," Young says

Blood, saliva, and other materials are funneled into a container by a jet of air blowing from above the patient's head With longer missions in the near future his zero-gravity dental office will become a permanent implant—Marilynn Larkin

DRACULA'S NIGHTMARE

Garlic's legendary powers range from keeping vampires at bay to curing the common cold Now Penn State scientists have added two more miracles to the list thwarting heart attacks and preventing breast cancer

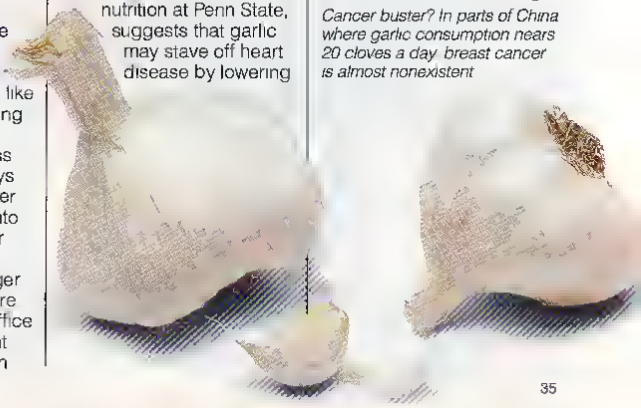
Intrigued by reports of near-cancerless areas of China where garlic consumption can hit 20 cloves a day Dr John Milner, head of the nutrition department at Penn State's College of Health and Human Development, fed rats up to 20 grams of garlic a day (a gram for a rat equals a clove for humans)—along with a carcinogen that induces breast cancer The result? A marked lack of mammary tumors Milner is now searching for the active ingredients in garlic that seem to suppress breast cancer

In a related study, work by Dr Yu Yan Yeh an associate professor of nutrition at Penn State, suggests that garlic may stave off heart disease by lowering blood cholesterol Yan Yeh found that when rats ingested garlic, their levels of "bad" cholesterol (LDL) dropped by 30 percent Although the results are promising, he says that human trials may have to wait two or three years 'There's a real danger of toxicity ' says Yan Yeh "Garlic ingested in very large quantities, like a thousand cloves a day might prove harmful to the system ' No word yet on breath fresheners

—Bob Berger

APOLLO 8 ASTRONAUTS USED A NEW ADHESIVE TO FASTEN DOWN THEIR TOOLS IN ZERO G—SILLY PUTTY

THE OLDEST ROCKS RETRIEVED FROM THE MOON'S SURFACE ARE 4 72 BILLION YEARS OLD—OLDER THAN ANY FOUND ON EARTH



Cancer buster? In parts of China where garlic consumption nears 20 cloves a day breast cancer is almost nonexistent

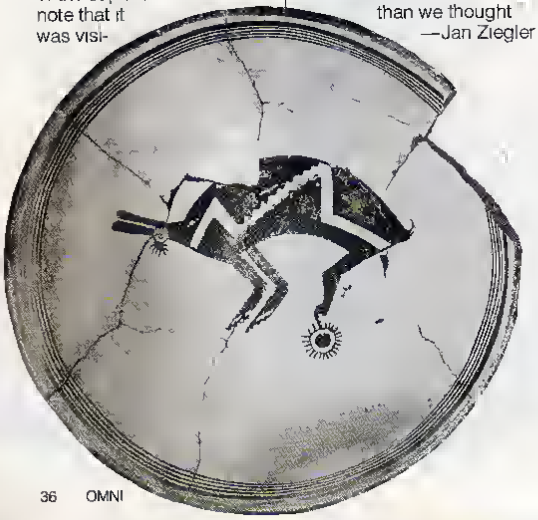
CONTINUUM

RABBIT RUN

A recently discovered Mimbres Indian pottery bowl, depicting a rabbit shaking a starlike object off its foot, is believed to be a record of the A.D. 1054 supernova that created the Crab Nebula.

R. Robert Robbins, professor of astronomy at the University of Texas at Austin, and his former student Russell Westmoreland sifted through a Mimbres pottery collection for clues to Native American astronomy. They found a whimsical seven-inch-wide bowl with its unmistakable lunar symbol: the rabbit and a star. Robbins says that the rabbit and the star are in the same positions as the moon and the supernova during the 1054 event, with the star emitting 23 rays. Chinese observations of the supernova note that it was visible even in daylight for 23 days. "It appears," says Robbins, "that the Mimbres were better astronomers than we thought."

—Jan Ziegler



The suit with an elephant's memory: University of New Hampshire researchers are fitting disabled people into the work place.

VOLT CULTURE

Clothes have always told a lot about the person who wears them—but electrical engineers at the University of New Hampshire have designed some gear that reveals all. Their skintight electronic outfit, known as an actimeter, can remember every move a wearer makes in a 24-hour period. More than just a fashion statement, the suit says UNH graduate student Steven Koenig, will "enable us to place physically challenged individuals in regular jobs. The suit will show either that they are able to do the job or how to eliminate movements they are unable to perform," he says. "Until now, people had to use questionnaires to gather this type of data."

The actimeter uses gravity-driven mercury switches at various key body locations to determine the wearer's movements: on the arms, head, back, hips, upper and lower legs. Wires run from the switches to a microcomputer, about the size of a TV remote control, worn at the hip. The suit memorizes the wearer's body movements and downloads the information into a PC where researchers can analyze the data.

—Tom Dworetzky

THIS JOB IS THE PITS

Some scientists yell "Eureka!" But at Monell Chemical Senses Center in Philadelphia, a major discovery is more apt to make scientists cry "Pyew!" There a research team led by George Preti has isolated the chemical responsible for underarm odor. Catching a whiff of the chemical, called 3-methyl-2-hexanoic acid, prompted one of Preti's colleagues to say, "Jeez! It smells just like my T-shirts at the end of the day."

A group of male volunteers wore underarm pads to collect samples; the sweat was then subjected to gas chromatography to separate the individual compounds before being subjected to a highly sensitive chemical detector—namely, the human nose. "We couldn't use a mechanical detector," says Preti, "because only the nose knows what body odor smells like." The upshot of Preti's work will be more effective deodorants.

—Kathleen McAuliffe

IT'S ONLY THE FEMALE MOSQUITO THAT BITES.
AND A WELL-FED LADY SKEETER CAN FLY CARRYING TWICE HER NORMAL WEIGHT IN BLOOD.
MALE MOSQUITOES NEVER BITE ANYONE OR ANYTHING; THEY FEED ENTIRELY ON PLANT JUICES.

CONTINUUM

HOLY PILLBOX, BATMAN!

During World War II the British government built thousands of pillboxes—concrete miniforts for a handful of soldiers—as a defense against a Nazi invasion. But Hitler never made it to England and now the southeastern county of Surrey is honeycombed with these useless war relics. Thanks to the efforts of the Surrey Wildlife Trust, however, the pillboxes are getting a new lease on life as condominiums for bats.

Britain's bat population, explains the trust's Roger Rammage, has declined by as much as 90 percent during the last ten years due to loss of habitat and the increasing use of insecticides. "We'd been racking our brains trying to think of an appropriate way to help save the bat population," says Rammage. "Then someone realized that the pillboxes would make ideal homes for bats." The trust converted three of them, blocking up the entrances except for one bat-sized hole. And sure enough, the bats moved right in.

Now the trust has developed do-it-yourself conversion kits for the many homeowners in Surrey who have pillboxes on their property. When the pillbox conversions are complete, researchers will tag the bats and keep a population count. Rammage says, "to see if these roosts keep the bats coming back."

—Bill Lawren

CALL OF THE WILD

It's old news that caterpillars of the families *Riodinidae* and *Lycaenidae* often enter into cooperative relationships with various ant species. The caterpillars secrete a combination of proteins and sugars to feed the ants, and the ants, in turn, protect the caterpillars from marauding wasps. The real news: University of Texas entomologist Philip DeVries has discovered that alarmed caterpillars actually send out an audible call to the ants much as a rancher might call to his dogs when wolves are around.

DeVries detected the call after clipping ultrasensitive microphones to a paper-covered lab tray where caterpillars milled about. The communication system operates something like a telegraph. The caterpillars' call travels through the leaves, branches, and bark of a tree rather than through the air. As ants receive the signal—which, when amplified, sounds "like a snare drum played with brushes"—they gather around the caterpillars like a pack of guard dogs protecting their charges. As with man and dog, "these caterpillars," DeVries says, "have evolved a specialized system for maintaining a profitable association with ants."

—Bill Lawren

MATING OCTOPUSES DON'T TOUCH EACH OTHER WITH THEIR GENITALIA. INSTEAD, THE MALE OCTOPUS EJACULATES ONTO ONE OF HIS OWN TENTACLES AND THEN PLACES THE SPERM MANUALLY IN THE FEMALE'S SEX ORGAN.

Madonna wannabes can now try out the material girl look without harming a hair on their heads—thanks to computer artistry.

HAIRDOS ON DISC

Kirk Le Mar of Beverly Hills is on the cutting edge of hairstyling—he's adapting computers for use in hair salons.

Le Mar's New Image Salon System allows clients to try out Cher-style cuts or the Madonna look before deciding which look is right for them. The computer, with a camera attached, stores an image of the customer's face; clients browse through a catalog to select possible hairstyles, and the computer displays the face with the hairstyle attached to it. "Women bring in photos of models and say 'I want to look like that,'" says Jodi Germano-Cataldo, owner of Shear Ultimate in Tewksbury, Massachusetts, who uses the New Image system. "This shows whether they'll look good in that style or not."

—Steve Nadis

CONTINUUM

WE DON'T START THE FIRE

True or false: Fire ants are useless pests that will wantonly attack anything within their reach.

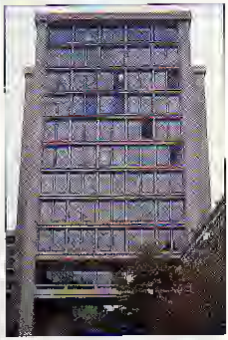
If you live in the Southern sections of the United States that have recently been deluged by fire ants, you probably answered true. But Texas A&M entomologist Kathy Palma sees it differently. Fire ants, it turns out, have a voracious appetite for all kinds of vermin, ranging from fleas to mosquito eggs. In a series of lab experiments, Palma documented fire ants wiping out test populations of fleas in soil and in different kinds of carpet in as little as four hours. As fire ants spread into urban areas throughout the country, they will undoubtedly dine on fleas. "They are extremely good predators, so there's no reason to think they wouldn't eat fleas," says Palma.

Palma doesn't recommend recruiting fire ants to hunt down fleas, but she points out that they prey on a variety of harmful insects including the dreaded harvester ants, ticks, and even mosquito eggs. She hopes that if people appreciate the ants as pest destroyers, it will encourage a live-and-let-live attitude. "I hope my research will help people understand that biological control is happening in our yards," she says. Yet for those humans who steadfastly refuse to coexist with stinging fire ants, Palma suggests putting away the insecticides in favor of boiling water poured into the ants' nests. "Any survivors will take their brood and move," she says.

—Sherry Baker

STUDIES OF FOSSIL CORALS SUGGEST THAT 370 MILLION YEARS AGO A YEAR WAS 400 DAYS LONG.

ISAAC NEWTON DROPPED OUT OF SCHOOL AS A TEENAGER AT HIS MOTHER'S URGING. SHE WANTED HIM TO TAKE UP FARMING.



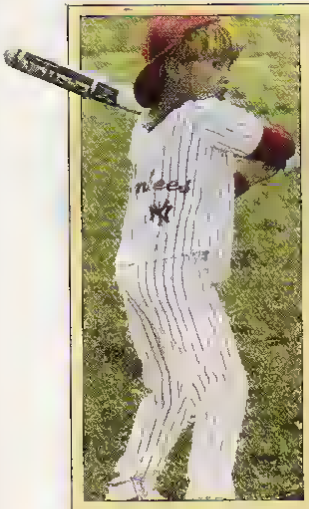
One sick building: EPA's Washington headquarters

EPA, HEAL THYSELF

Ever since the EPA's Washington headquarters was renovated in 1988, numerous employees say they have been choking on toxic fumes. Headaches, burning lungs, and other health disturbances have forced more than 40 EPA employees to transfer to alternative work spaces or quit their jobs. According to Bill Hirzy, senior scientist at the Office of Toxic Substances and president of the union representing EPA employees, a new synthetic material installed on the premises may be responsible. "We suspect the culprit could be a compound in the carpeting called 4-phenylcyclohexene."

Why can't the nation's environmental watchdog keep its own work environment safe? "That's a good question," says Hirzy. "If we can't even save ourselves, how can we save the rest of the country?"

—Kathleen McAuliffe



A southpaw slugger in the making. How old's his mom?

HOW TO GIVE BIRTH TO A BABE RUTH

Women whose biological clocks are ticking, hear this. The older you are when you give birth, the more likely your child will be left-handed.

Psychologist Stanley Coren of the University of British Columbia found that when mothers were between the ages of seventeen and twenty-four, they gave birth to right-handed babies 90 percent of the time. Starting at age twenty-five, however, moms begat 11 percent more southpaws, with progressively higher rates as the mothers' ages increased. When women are forty-plus they are twice as likely to have left-handed children.

Why? Coren speculates that as women give birth later in life, the added stress to the mother's body may influence neuropathways in an infant's brain that give rise to right- or left-handedness. Alan Searleman, professor of psychology at St. Lawrence University in Canton, New York, agrees. "There can be multiple causes" that give rise to left-handedness, he says. "In some cases it's genetic, but birth stress can contribute as well."

Coren says that of all animals, only humans predominantly use the right hand. Cats and monkeys, for example, are apt to use both paws equally, while humans are right-handed 90 percent of the time.

—Paul McCarthy

KING ARTHUR'S EXCALIBUR

WROUGHT OF STAINLESS STEEL. ACCENTS OF 24 KARAT GOLD AND STERLING SILVER. HAND-SET CRYSTAL CABOCHONS. INSERTED IN CRYSTAL-CLEAR ROCK.

KING ARTHUR. Immortal hero of medieval legend, he was the only one who could free the magical Excalibur from stone. And when the most famous King of chronicle and romance wielded this mighty sword, he became invincible.

Now you may own the authorized re-creation. From Europe, its blade is wrought of tempered steel. Its pommel and crossguard sculptured with Arthur's symbol of power — the dragon. Ablaze with fiery red crystals and embellished with sterling silver and 24 karat gold electroplate, Excalibur is to be removed from its crystal-clear rock only by the man destined to possess it. $675.

THIRTY-DAY RETURN ASSURANCE POLICY
If you wish to return any Franklin Mint purchase, you may do so within 30 days of your receipt of that purchase for replacement, credit or refund.

The magnificent hardwood-framed display — shown smaller than actual size of 51½" high x 16½" wide — is included at no additional charge.

Excalibur shown smaller than actual length of 43".

AN OFFICIAL ISSUE OF THE INTERNATIONAL ARTHURIAN SOCIETY

The International Arthurian Society
c/o The Franklin Mint
Franklin Center, Pennsylvania 19091

Please enter my order for the authorized re-creation of King Arthur's Excalibur sword. Crafted of hand-polished tempered steel and embellished with sterling silver and 24 karat gold electroplate. The custom-designed display is included at no additional cost.

I need send no money now. I will be billed in 10 equal monthly installments of $67.50* each, beginning prior to shipment.

*Plus my state sales tax.

Please mail by February 28, 1991.

SIGNATURE _____
ALL ORDERS ARE SUBJECT TO ACCEPTANCE

MR/MRS/MISS _____
PLEASE PRINT CLEARLY

ADDRESS _____

CITY/STATE/ZIP _____

85468-52

A POISON IN EVERY CAULDRON

A new arms race is taking off—this time in the form of chemical and biological weapons, deadly brews that will transform nature into an instrument of war

ESSAY BY
W. E. GUTMAN

Chemical warfare is as old as life itself. It is nature's gift to the weak or vulnerable against threats, real or perceived. Millions of years of evolution have armed legions of plants, insects, fish, reptiles, amphibians and invertebrates with biochemical means of neutralizing enemies or prey by emitting, squirting, or injecting vile-smelling, paralyzing, or lethal substances. This is survival of the fittest in its most elementary form. It is an imperative that, in the animal world, transcends morality because instinct and reflex—not premeditation—regulate animal behavior.

Nature, however, pales beside our inventiveness. Savage brews concocted by humans can spread disease for military goals, make an enemy's air unbreathable and foul, seed clouds with substances that turn rain into liquid death. Humans trained pigeons and bats to deliver "mini" bombs. They bred mosquitoes contaminated with yellow fever, malaria, and dengue. They cultivated fleas infected with the plague. They spawned ticks carrying tularemia and Colorado spotted fever. They sired houseflies tainted with cholera, anthrax, and dysentery. Even mice and migrating geese have been considered as vehicles for the delivery of death. Venomous snakes may be next. These weapons and their creators transform nature itself into an instrument of war.

And we've only just begun, says H. J. McGeorge, president of the Public Safety Group, a Virginia-based international security research organization. "The face of war is about to change in a manner unimagined even ten years ago. The next decade is likely to witness the global use of chemical and biological weapons in conflicts of all sizes." The rationale, says McGeorge, a munitions expert and former Secret Service technical specialist, is that "the use of chemical weapons will not win a war but might prevent the user from losing it."

Equally frightening is the ease with which chemical and, to a certain extent, biological weapons can be acquired. There's now a poison in every caldron. Chemical weapons are now available not only to major powers but to Third World nations as well. A study released by the U.S. Defense Department in 1984 listed 14 countries as possessing a chemical warfare capability, about ten more than had been previously estimated. The number now exceeds 38 (see map). There is strong evidence that yet another 15 to 20 nations are seeking to secure chemical weapons.

No wonder. Chemical weapons are easy to make. They call neither for high-tech resources nor much money. In fact, the manufacturing process and necessary ingredients for nerve agents are similar to those for common fertilizers and insecticides. And their power can be devastating. Minute amounts can become militarily significant, especially in hot or tropical regions where protective clothing severely limits the effectiveness of besieged forces.

Now biochemical technology is entering the weapons field. The same technology that has resulted in so many dramatic improvements in care and cure is now capable of producing new horrors easily transformed into weapons of choice. Genetic engineering will further refine the art of killing with the development of "designer diseases" for which there exists no known cure. New poisons may be produced from once innocuous substances. Even the means to alter and manipulate human behavior and thought are at hand.

A report issued late in 1990 by *BioWorld Today* says that Iraq, which has signed but never ratified the 1972 Biological and Toxin Weapons Convention, is developing a biological arsenal. The convention prohibits the possession of biological weapons but not, sadly, research and development. Indeed, the convention permits research into defensive biotechnology, despite the fine line between defensive mechanisms and offensive weapons. Biological agents capable of spreading typhoid, cholera, and anthrax are said to be in the works at laboratories south of Baghdad, near the village of Salman Pak. U.S. Army Medical Corps scientists themselves must now look to genetic engineering for the means to thwart such threats. In recent years, in fact, only the National Institutes of Health has exceeded U.S. Department of Defense in biotechnology research funding.

The subtlety and sophistication of the biochemical weapons threat continues to grow. But the threat itself is not at all new.

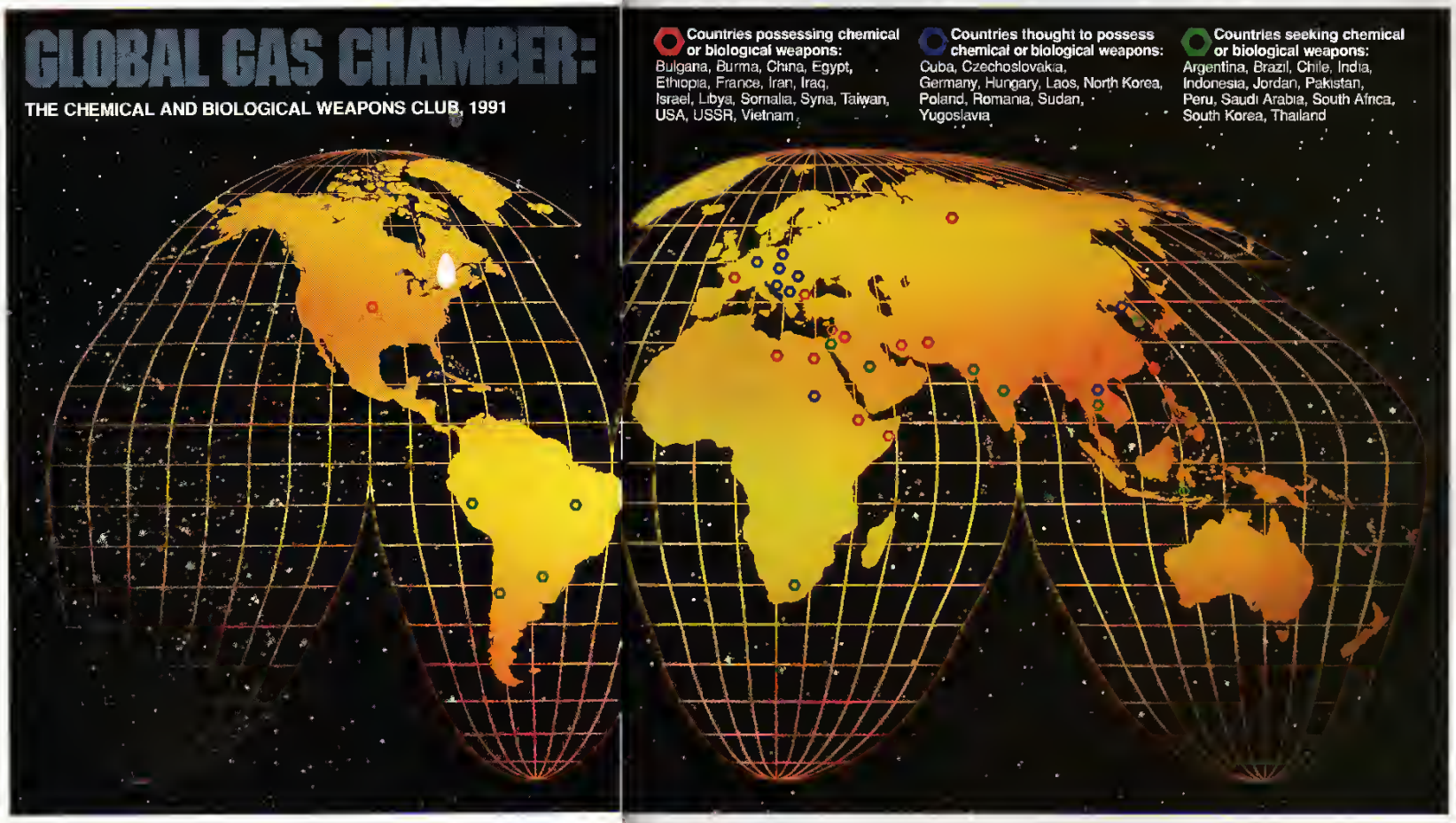
THE ALCHEMY OF AGGRESSION

No one knows how primitive man waged chemical war

EXCLUSIVE TO OMNI

"The proliferation of chemical and biological weapons and the ability to deliver them at long ranges will be one of the most important security issues of the 1990s and of the 21st Century. Three critical issues are at play. First, these weapons are relatively easy to produce, and an increasing number of countries around the world are acquiring them. As many as 20 adversaries already possess them and could use them against the United States and allied forces. Second, there appears to be decreasing prohibition of chemical weapons' use, perhaps even of biological ones. Finally, long-range delivery of systems lengthen the reach of those who might be predisposed to use these weapons of mass-destruction."

—DAN QUAYLE, Vice President of the United States



One can safely assume that flinging excrement at one another, a strategy still observed among primates, might have satisfied our ancestors' aggressive drive—not to mention their need for self-expression. *Homo sapiens* has since refined the art of mudslinging but the message is the same. Chemistry and biology provide us with ways of killing each other.

Around 450 B.C., at the height of the Second Peloponnesian War, the Spartans burned pitch and sulfur to release poisonous fumes under the enemy's city walls. Incendiary chemicals, dubbed Greek fire, were used as early as 1200 B.C. Gradually refined for use on dry land, Greek fire, a precursor of napalm, played a leading role in many battles for more than a millennium.

Civil War general Patrick Gilmore used Greek fire, causing Confederate general Pierre Beauregard to claim that Gilmore had shot "the most destructive missiles ever used in war."

Nor is biological warfare a contemporary phenomenon. During the siege of Kaffa in 1347, the Mongols hurled the bodies of plague victims over the walls of the Genoese defenders. Genoese ships then carried the disease back to Europe, where the Black Death promptly erupted.

In North America in the Eighteenth century, British military leaders, such as Jeffrey Amherst, offered a gift of smallpox-infected blankets to Native Americans, who were particularly susceptible to the deadly disease. This act of malevolence cost thousands of Indian lives.

MODERN MALEVOLENCE

In the Thirties, the Japanese, at war with China, used biological weapons to spread plague and famine. They also tested biological munitions on tethered prisoners.

The first wholesale use of toxic agents took place in World War I when the Germans discharged chlorine gas on French and British troops. French and other forces responded with "blood gases," which prevent the transfer of oxygen from the blood to body tissue. This prompted the Germans to unleash mustard gas, a blistering agent that consumes the flesh. Under attack, U.S. troops retaliated with phosgene, a choking gas. When the carnage ended in 1918, the "war to end all wars" had claimed more than 9 million lives, with more than 100,000 of those deaths officially attributed to gas attacks. The toll is now believed to have been considerably higher.

In 1925, seven years after the end of the Great War, an international agreement known as the Geneva Protocol prohibited the use of bacteriological and chemical weapons—but not production or stockpiling. The Geneva Protocol did not prevent the French from dropping mustard-filled bombs in Morocco, nor did the Italians shy away from deploying mustard gas in the 1935–36 war against Abyssinia (Ethiopia).

In 1939, in search of deadlier, swifter poisons, the Germans also invented two nerve gases, Tabun and sarin, both colorless, almost odorless, both capable of penetrating the skin and causing death in less than two minutes. Deterred because the Allies themselves possessed chemical weapons, the Nazis did not use theirs against Allied forces during World War II. They used them instead to murder millions in death camps.

At war's end in 1945, the Soviets seized large stocks of nerve agents and other raw chemical warfare products as well as a fully equipped—and staffed—Tabun factory, which they transferred to the USSR lock, stock and barrel.

During the Fifties and Sixties, military research produced still meaner nerve agents, including the "V" series nerve agent, produced by both the United States and the Soviets, and dreaded because of its supertoxicity, persistence, and environmental stability. The Fifties also witnessed the development of mentally incapacitating but nonlethal chemicals.

Tear gases and herbicides (defoliants) were also extensively released by the United States in Vietnam. Arguably, these were "nonlethal" and authorized under the Geneva Protocol. Of all the chemicals used to strip

Gassed from the past. Soldiers during World War I line up wearing their protective clothings.

the tropical forest bare, one that created the greatest bitterness was the dioxin-laced Agent Orange.

The defoliant sent vegetation on a self-destructive binge. Plants literally exploded, leaving a surrealistic landscape where weeds had grown into bushes and where trees, fractured and splintered, bowed down by the weight of their fruit, lay rotting in the foul-smelling jungle. The effect of Agent Orange on humans, especially its alleged carcinogenic effect, remains a matter of controversy today.

TOXIC WAR TODAY

By the end of the Seventies, a growing number of intelligence and press reports hinted that chemicals were being regularly deployed by Soviet-supported forces in a "variety of minor conflicts." A particularly nasty batch of mustard gas had already been used by Egypt during the 1962–67 Yemen war, an occurrence that took several months to surface in the press.

Another report claimed that Laotian troops, aided and abetted by the Soviets and the Vietnamese, had been using agents of biological origin ("Yellow Rain") since 1975 against the H'mongs, a tribal people dwelling in the mountainous regions of Laos.

In Kampuchea (Cambodia), Vietnamese forces were reported to have used chemical agents against the troops of "Democratic Kampuchea."

In Afghanistan, strong circumstantial evidence indicates that Soviet and "loyal" Afghan forces waged periodic chemical war against the mujahedeen, the ragtag band of tough, iron-willed nationalist rebels.

Iran reported that between 1983 and 1984 Iraq had carried out more than 31 chemical attacks against Iran. International protest did not prevent Iraq from repeating the deed until the recent break in hostilities. Nor did it discourage Iran from readying to respond in kind.

Iraq's invasion of Kuwait last August and Saddam Hussein's own military proclivities have rekindled old fears. According to a recent communique by the Jaffee Center for Strategic Studies at Tel Aviv University in Israel, Iraq has "emerged as a crucial country of the 90's, not only for Israel but for the area as a whole."

Iraq emerged from its war with Iran with the region's largest and best equipped armed forces, under a firmly ensconced leader who has proven capable of using them ruthlessly. Of all the Arab states, Iraq appears most likely (as it proved in Iran and against its own people, the Kurds) to move the Middle East firmly into the nonconventional arena. [Chemical weapons] are a virtually indispensable component of a renewed Eastern front."

Seventy-two years after the end of World War I, despite the Geneva Protocol and the 1972 convention, a growing number of nations have steadily developed an appetite for higher forms of killing. That appetite is voracious, with new and ever deadlier weapons being brought to the table.

TOMORROW'S TOXINS

We are entering an age of "novel weapons." That seemingly innocuous phrase encapsulates the dawning era of biochemical weapons unparalleled in their viciousness, tenacity and ability to penetrate even the most carefully considered defenses. Careful consideration, in fact, might well lead to the conclusion that there is no effective defense against biochemical attack.

For one thing, effective defense requires that you know what you're defending against. But modern technology is yielding so large and disparate a variety of chemical and biological agents that a uniform defense becomes impossible to achieve.

Gas masks and protective clothing worn to ward off mustard gas, for example, may be useless against new chemical weapons engineered to penetrate even the most tightly woven fabrics, the most impermeable seals and gaskets. Vaccination has long been explored as a possible defense against viral attacks, yet how do we determine which viruses to vaccinate against? How do we develop vaccines to protect us from new viruses developed in weapons laboratories? Suppose a virus is developed that does not respond to vaccines?

As we grow more capable of manipulating genetic and other material, so do the capabilities of biochemical weapons grow more fearsome. Imagine a weapon whose initial symptoms—a rash, perhaps—imply one course of treatment. Upon application of the appropriate treatment, though, the weapon reveals its true nature, unleashing a wholly different variety of systemic attack. How do you defend against such a weapon? You don't, because you can't.

Even detecting the use of biochemical weapons grows problematic. Much effort and research has been applied to the development of "biosensors," materials that use living organisms to detect the presence of chemical agents. In theory, biosensing devices serve as warning beacons, alerting troops in the field to the need to don protective clothing. All of which assumes that the enemy will use weapons the sensors "recognize," and against which protective clothing forms an effective shield.

None of the defenses take into account the sheer impossibility of protecting large civilian populations, suscep-

CONTINUED ON PAGE 111

VOLATILE VACUUMS

Probing the boundaries of physics, a trio of mavericks is tapping the hotbed of force found in vacuum

BY OWEN DAVIES

Imagine a world in which endless, nonpolluting and virtually free energy powers our cities, cars and homes. Envision laptop computers more powerful than today's largest, most sophisticated mainframes, and tiny X-ray machines that can enter the body and kill tumors without harming surrounding cells.

All this and more may be possible within the next ten years, according to physicist Hal Puthoff, currently with the Institute for Advanced Studies at Austin, Texas. The source of these marvels? Something Puthoff calls zero point energy—the abundant power that he says can be found in the vacuum of space. Puthoff's articles on the subject have been published in the prestigious *Physical Review*. And he has attracted heavy-hitting business associates, including Ken Shoulders, the man credited with developing much of the technology for microcircuits, as well as supernch Texas entrepreneur Bill Church. Rumor has it that their new company, Jupiter Technologies, may soon try to manufacture zero point energy machines. There's more. Zero point energy could be the Rosetta stone of physics, ex-

During the Casimir effect in a vacuum, objects come together, producing enormous heat and energy. Another force to be reckoned with: Electronics whiz Ken Shoulders.

plaining everything from gravity to atoms to the origin of the cosmos itself.

In a sense, Puthoff's search for order in the universe started 20 years ago, when he was a freshly minted Ph.D. from Stanford University. One day, the physicist now explains, he was thinking about tachyons, hypothetical particles that appear to travel backward in time. If the particles existed, he reasoned, they might be the "missing link" that allowed psychics—if they were not frauds—to intuit events at distant locations or future times. Puthoff sought funding to study the problem and wound up as head of a new parapsychology research program at the Stanford Research Institute, now known as SRI International. Studying telekinesis and ESP was intriguing, Puthoff says. Yet in 1985, after 13 years at SRI, Puthoff was ready to make a change.

Enter Bill Church. An ex-math major from the University of Texas, Church dropped out of college when his father died. By the mid-Eighties, the trim, personable entrepreneur had made millions with a regional chain of fried-chicken restaurants. Ea-

If visionary physicist Hal Puthoff is proved right, we may soon have a new, nonpolluting energy source. How? By tapping the force of random fluctuations that jostle atomic particles within a vacuum.

"Own the crystal. Feel the power."
JEANE DIXON

"For centuries the crystal ball has been said to foretell the future... to chart one's destiny. And now, this wondrous orb of fable and fortune can be yours. Hold it in your hands. *Feel* its awesome power. Launch yourself on a journey of discovery that will last a lifetime...*if you dare!*"

The Crystal Ball. A unique combination of legendary power and beauty. The crystal hand-polished to glow with radiant energy. Held aloft by the mystical *Three Fates*, spinners of the thread of life. Each figure finely sculpted, precisely defined. Then lavishly coated in 24 karat gold to gleam with magical brilliance. Exclusively from The Franklin Mint. The Crystal Ball. Just $225.

THIRTY DAY
RETURN ASSURANCE POLICY
If you wish to return any Franklin Mint purchase, you may do so within 30 days of that purchase for replacement, credit or refund.

Sculpture shown actual size of approximately 7 ½" high

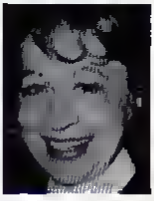
THE CRYSTAL BALL

The Franklin Mint
Franklin Center, Pennsylvania 19091

Please send me The Crystal Ball, presented by Jeane Dixon. Crafted in sparkling crystal and 24 karat gold electroplate. Specially imported.

I need send no money now. Please bill me in five equal monthly installments of $45.* each, with the first payment due prior to shipment of my work of art.

*Plus my state sales tax and a one-time charge of $3. for shipping and handling



Please mail by February 28, 1991.

SIGNATURE _____
ALL ORDERS ARE SUBJECT TO ACCEPTANCE.

MR/MRS/MISS _____
PLEASE PRINT CLEARLY

ADDRESS _____

CITY/STATE/ZIP _____

11723-31

JEANE DIXON

ger for new challenges, the energetic Church vowed to spend his wealth promoting the kind of high-risk, potentially high-payoff research that government and corporate bureaucrats were too unimaginative to fund.

To that end he founded the Institute for Advanced Studies, housed in a two-room office in a new building along the Capital of Texas Highway in Austin. Then he lured Puthoff, also a respected laser scientist, away from SRI.

Soon after Puthoff arrived in Austin, he and Church recruited a third member to their team: star inventor and electronics genius Ken Shoulders. A born tinkerer, Shoulders wanted a new research project, something that would probe the unknown regions at the borders of physics and electronics, where strange and wondrous discoveries might yet be made. He also needed some funding. Puthoff and Church, on the other hand, wanted someone who could turn the theoretical work of the institute into nuts-and-bolts technology. When the three sat down to ponder their first project, they came up with an impressive goal: exploring the vacuum, referred to by some early physicists as "the tranquil void."

The institute trio knew that vacuums were not really empty and certainly never tranquil. In fact, most physicists casting their eyes toward the cosmos believe that the vacuum is a hotbed of forces. Phantom particles flicker into existence and then disappear. "Empty" space itself seethes with what physicists call vacuum fluctuations: vast amounts of energy that suddenly burst forth, jiggling particles to and fro. One fluctuation is not very powerful, but cumulatively they can be intense. In fact, physicists John Wheeler and Richard Feynman calculated that there is enough energy in the vacuum of a single light bulb to boil all the seas.

It was City College physicist Timothy Boyer of New York, however, whose work convinced Puthoff that the vacuum was a good place for the institute to begin. Most physicists, Boyer pointed out, tried to explain the somewhat random movements of atomic particles through the theories of quantum physics. Quantum physics states that even under precise conditions, atomic particles may assume any one of a variety of positions. To determine with greater certainty where a particle could be found, however, physicists developed "probability equations." The equations predicted the likelihood of any given particle landing in any given place.

Boyer held a different point of view. Perhaps, he suggested, the uncertain nature of the subatomic realm was due not to the nebulous mathematics of probability equations but rather to vacuum fluctuations. We could not pin down the location of subatomic particles, Boyer suggested, because vacuum fluctuations jiggled them around.

Puthoff felt Boyer's notion could be used to explain other vexing problems as well. Writing in *Physical Review D*, Puthoff suggested that the zero point energy of the vacuum might prevent atoms from collapsing, allowing the world as we know it to be. "According to classical physics," Puthoff says, "electrons should radiate their energy as they circle in their orbits. Eventually they should drop into the nucleus like a satellite falling back to Earth. Quantum mechanics never really explains why this does not happen."

Zero point energy does. According to Puthoff's theory, electrons *do* radiate their energy away as they circle in their orbits. But they also absorb enough energy from vacuum fluctuations to make up for the loss. Calculations presented in *Physical Review* appear to back him up. Says Puthoff, "It seems that the stability of matter itself depends on the zero point energy sea."

Puthoff's next *Physical Review* paper was even more daring. It attempted to rewrite the theory of gravity proposed by Einstein himself. "Einstein described

"My client continues to invoke the Fifth Amendment, but this time with an exclamation point."

GIVE THEM A HOME.

IF YOU DARE.

THEY'RE WAITING FOR YOUR INVITATION IN THE TWILIGHT ZONE EXCLUSIVELY ON VIDEOCASSETTE FROM COLUMBIA HOUSE VIDEO.

Recognize them? They were last seen in the vicinity of your unconscious playing the starring roles in your nightmares. They're permanent residents of "The Twilight Zone." But that won't stop them from taking over a home like yours.

They've been doing just that since the show was first created thirty years ago by the genius of Rod Serling. One of television's most creative and influential dramatists. Serling helped set the standard for all science fiction to follow. It's no wonder "Twilight Zone" has been consistently hailed for its imaginative and provocative entertainment.

And now you can visit with the inhabitants of "The Twilight Zone" whenever you've got the nerve.

Your first videocassette contains four all-time classic episodes. You'll watch Agnes Moorhead defend her old farmhouse against enemy aliens in "The Invaders." See Ed Wynn pull out all the stops to outwit Mr. Death in "One For The Angels." Witness a robot transformed into a tender human being by Jack Warden's love in "The Lonely." And come face to face with the bizarre standards of beauty in "Eye Of The Beholder."

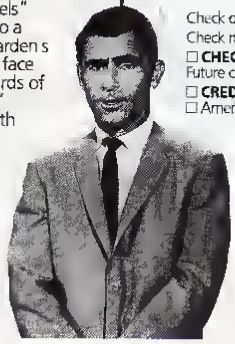
It's all yours for only $4.95 with your subscription to the series.

Then about every four to six weeks, you'll receive another videocassette of four specially selected half-hour episodes. Each is as it originally appeared, complete and uncut. Future episodes will include an unforgettable plane ride with William Shatner. Telly Savalas' fatal encounter with a mere doll. And the grisly twist taken by "To Serve Man." These four episode cassettes have been handsomely packaged and include interesting facts about each of the episodes.

You can dare to invite these characters into your home because their visits from "The Twilight Zone" are risk-free. You have ten days to preview each videocassette. Just pay $19.95, plus shipping and handling, for each one you decide to keep. There's no minimum to buy and you may cancel your subscription anytime.

So order 'The Twilight Zone' today. And give these ghouls a good home.

For faster service, credit card customers may call 1-800-544-4431. Or mail in the coupon below.



10 DAY RISK-FREE PREVIEW

GET YOUR FIRST VIDEOCASSETTE OF FOUR TWILIGHT ZONE CLASSICS FOR ONLY $4.95 plus s & h with subscription

COLUMBIA HOUSE VIDEO Dept. XC5, P.O. Box 1112, Terre Haute, IN 47811

YES, enter my subscription to "The Twilight Zone™" under the terms described in this ad. Send me my first four episode videocassette at the low introductory price of $4.95 plus $2.45 shipping and handling (total $7.40).

Check one ☐ **VHS** ☐ **BETA**

Check method of payment

☐ **CHECK ENCLOSED** for $7.40 made payable to Columbia House Video. Future cassettes billed with shipment. T23

☐ **CREDIT CARD** Charge my series purchases beginning with $7.40 for my first cassette to ☐ American Express ☐ VISA ☐ MasterCard ☐ Diners Club. T24

Account #

Expires Signature

Name (please print) Phone ( )

Address Apt.

City State Zip

Note: Columbia House Video reserves the right to reject or cancel any subscriptions. Canadian orders will be serviced through Toronto. **Applicable sales tax added to all orders.**

gravity as a warping of space–time caused by the mass of objects within it," Puthoff says. To understand Einstein's version, imagine the fabric of space–time as a taut rubber diaphragm. Place any given weight in the diaphragm and it makes an indentation. Roll a marble onto the diaphragm. No matter how the marble is rolled, it ultimately winds up at the weight. This, according to Einstein, is how gravity works. Objects bend space–time just as the weight bends the rubber diaphragm, so two objects "roll together" with a force that depends on the objects' mass and distance.

"This shows how gravity acts," Puthoff says, "but doesn't really explain the mechanism behind it." That's where zero point energy comes in. If two physical bodies are relatively close, he theorizes, the first shields the second from zero point energy coming from its direction; in a similar fashion, the second object will shield the first. The objects will nonetheless continue to be pressured by zero point energy coming from all *other* directions. The two bodies thus move toward each other in what scientists have dubbed the Casimir effect, named after Hendrik B. G. Casimir, the Dutch physicist who first described the phenomenon. Gravity is the result, according to Puthoff.

It is the Casimir effect, Puthoff believes, that may help us extract zero point energy from the void. Puthoff gives an example. Bring two smooth metal plates extremely close together, he explains, and they seem to attract each other so strongly that they are virtually welded to each other. Move them still closer and they collide with a metaphorical boom, generating enormous heat. Use that heat energy, and the conversion of vacuum energy to usable energy has occurred.

This scheme, first proposed by veteran California physicist Robert Forward in *Physical Review*, has a problem. Once the plates collide, they can no longer be used to generate energy, becoming a sort of one-shot device. To recycle the generator, Puthoff explains, "one would have to return the plates to their original positions, that would require as much energy as the machine produced in the first place. As a result, not even break-even operation could be achieved."

His solution: an inexhaustible supply of such devices, each to be discarded after the Casimir collapse. Puthoff concedes this would not be possible with metal plates but suggests that engineers try designing zero point energy machines with a cold, charged plasma, or gas. "The Casimir effect would pinch the plasma together," Puthoff says, "and energy in the form of heat and condensed, charged particles would result."

At least one such device. Puthoff says may be in the works. Moscow physicist Aleksandr Chernetsky has built a plasma generator that reportedly takes 700 watts of electricity from a wall socket and gives back 3,500 watts, creating a little more than three horsepower out of nothing. The Soviet government was impressed enough to back his research with several hundred thousand dollars worth of equipment.

"I went to the Soviet Union to look at Chernetsky's work," Puthoff says. "I couldn't tell in a couple of days whether his equipment really works or whether there is some fallacy in his experimental design. But it is plausible that it might be extracting zero point energy."

Whether or not Chernetsky's power system works, other equipment apparently based on zero point energy and the Casimir effect is under development. The inventor, Ken Shoulders, who hopes to create the next generation of circuits for laptop computers, telephones, and large-screen TVs.

Shoulders hopes to create these new appliances through a phenomenon he has discovered and put to use. Called condensed charge technology or CCT,

CONTINUED ON PAGE 72

"It has come to my attention that your only function here is to operate the snack machine."

A POOR SEAMAN FORGETS HIS PAST, AND FINDS A BIZARRE NEW LIFE ON A POLLUTED CARIBBEAN ISLE

DREAM CARGOES

FICTION BY J. G. BALLARD

ILLUSTRATIONS BY ANTHONY RUSSO

Across the lagoon an eager new life was forming, drawing its spectrum of colors from a palette more vivid than the sun's. Soon after dawn, when Johnson woke in Captain Galloway's cabin behind the bridge of the *Prospero*, he watched the lurid hues, cyanic blues and crimsons, playing against the ceiling above his bunk. Reflected in the metallic surface of the lagoon, the tropical foliage seemed to concentrate the Caribbean sunlight, painting on the warm air a screen of electric tones that Johnson had only seen on the nightclub façades of Miami and Veracruz.

He stepped onto the tilting bridge of the stranded freighter, aware that the island's vegetation had again surged forward during the night, as if it had miraculously found a means of converting darkness into these brilliant leaves and blossoms. Shielding his eyes from the glare, he searched the six hundred yards of empty beach that encircled the *Prospero*, disappointed that there was no sign of Dr. Chambers' rubber inflatable. For the past three mornings, when he woke after an uneasy night, he had seen the craft beached by the inlet of the lagoon. Shaking off the overlit dreams that rose from the contaminated waters, he would gulp down a cup of cold coffee, jump from the stern rail, and set off between the pools of leaking chemicals in search of the American biologist. It pleased Johnson that she was so openly impressed by this once barren island, a leftover of nature seven miles from the northeast coast of Puerto Rico. In his modest way he knew that he was responsible for the transformation of the nondescript atoll, scarcely more than a forgotten garbage dump left behind by the American Army after World War II. No one, in Johnson's short life, had ever been impressed by him, and the biologist's silent wonder gave him the first sense of achievement he had ever known.

Johnson had learned her name from the labels on the scientific stores in the inflatable. However, he had not yet approached or even spoken to her, embarrassed by his rough manners and shabby seaman's clothes, and the engrained chemical stench that banned him from sailors' bars all over the Caribbean. Now, when she failed to appear on the fourth morning, he regretted all the more that he had never worked up the courage to introduce himself.

Through the acid-streaked windows of the bridge house he stared at the terraces of flowers that hung from the forest wall. A month earlier, when he first arrived at the island, struggling with the locked helm of the listing freighter, there had been no more than a few stunted palms growing among the collapsed army huts and water tanks buried in the dunes. But already, for reasons that Johnson preferred not to consider, a wholly new vegetation had sprung to life. The palms rose like flagpoles into the vivid Caribbean air, pennants painted with a fresh green sap. Around them the sandy floor was thick with flowering vines and ground ivy, blue leaves like dappled metal foil, as if some midnight gardener had watered them with a secret plant elixir as Johnson lay asleep in his bunk.

He put on Galloway's peaked cap and examined himself in the greasy mirror. Stepping onto the open deck behind the wheelhouse, he inhaled the acrid chemical air of the lagoon. At least it masked the odors of the captain's cabin, a rancid bouquet of ancient sweat, cheap rum, and diesel oil. He had thought seriously of abandoning Galloway's cabin and returning to his hammock in the forecastle, but despite the stench he felt that he owed it to himself to remain in the cabin. The moment that Galloway, with a last disgusted curse, had stepped into the freighter's single lifeboat, he, Johnson, had become the captain of this doomed vessel. He had watched Galloway, the four Mexican crewmen, and the weary Portuguese engineer row off into the dusk, promising himself that he would sleep in the captain's cabin and take his meals at the captain's table. After five years at sea, working as cabin boy and deck hand on the lowest grade of chemical waste carrier, he had a command of his own, this antique freighter, even if the *Prospero*'s course was the vertical one to the seabed of the Caribbean.

Behind the funnel the Liberian flag of convenience hung in tatters, its fabric rotted by the acid air. Johnson stepped onto the stern ladder, steadying himself against the sweating hull plates, and jumped into the shallow water. Careful to find his feet, he waded through the bilious green foam that leaked from the steel drums he had jettisoned from the freighter's deck.

THE CHEMICALS HAD ETCHED THEIR WAY THROUGH THE HULL.

When he reached the clear sand above the tide line he wiped the emerald dye from his jeans and sneakers. Leaning to starboard in the lagoon, the *Prospero* resembled an exploded paint box. The drums of chemical waste on the foredeck still dripped their effluent through the scuppers. The more sinister belowdecks cargo—nameless organic by-products that Captain Galloway had been bribed to carry and never entered into his manifest—had dissolved the rusty plates and spilled an eerie spectrum of phosphorescent blues and indigos into the lagoon below.

Frightened of these chemicals, which every port in the Caribbean had rejected, Johnson had begun to jettison the cargo after running the freighter aground. But the elderly diesels had seized and the winch had jarred to a halt, leaving only a few of the drums on the nearby sand with their death's head warnings and eroded seams.

Johnson set off along the shore, searching the sea beyond the inlet of the lagoon for any sign of Dr. Chambers. Everywhere a deranged horticulture was running riot. Vivid new shoots pushed past the metal debris of old ammunition boxes, filing cabinets, and truck tires. Strange grasping vines clambered over the scarlet caps of giant fungi, their white stems as thick as sailors' bones. Avoiding them, Johnson walked toward an old staff car that sat in an open glade between the palms. Wheelless, its military markings obliterated by the rain of decades, it had settled into the sand, vines encircling its roof and windshield.

Deciding to rest in the car, which once perhaps had driven an American general around the training camps of Puerto Rico, he tore away the vines that had wreathed themselves around the driver's door pillar. As he sat behind the steering wheel it occurred to Johnson that he might leave the freighter and set up camp on the island. Nearby lay the galvanized iron roof of a barrack hut, enough material to build a beach house on the safer seaward side of the island.

But Johnson was aware of an unstated bond between himself and the derelict freighter. He remembered the last desperate voyage of the *Prospero*, which he had joined in Veracruz after being duped by Captain Galloway. The short voyage to Galveston, the debarkation port, would pay him enough to ship as a deck passenger on an interisland boat heading for the Bahamas. It had been three years since he had seen his widowed mother in Nassau, living in a plywood bungalow by the airport with her invalid boyfriend.

Needless to say they had never berthed at Galveston, Miami, or any other of the ports where they had tried to unload their cargo. The crudely sealed cylinders of chemical waste products supposedly en route to a reprocessing plant in southern Texas had begun to leak before they left Veracruz. Captain Galloway's temper, like his erratic seamanship and consumption of rum and tequila, increased steadily as he realized that the Mexican shipping agent had abandoned them to the seas. Almost certainly the agent had pocketed the monies allocated for reprocessing and found it more profitable to let the ancient freighter, now refused entry to Veracruz, sail up and down the Gulf of Mexico until her corroded keel sent her conveniently to the bottom. For two months they had cruised forlornly from one port to another, boarded by hostile maritime police and customs officers, public health officials, and journalists alerted to the possibility of a major ecological disaster. At Kingston, Jamaica, a television launch trailed them to the ten-mile limit, at Santo Domingo a spotter plane of the Dominican Navy was waiting for them when they tried to slip into harbor under the cover of darkness. Greenpeace powerboats intercepted them outside Tampa, Florida, when Captain Galloway tried to dump part of his cargo. Firing flares across the bridge of the freighter, the U.S. Coast Guard dispatched them into the Gulf of Mexico in time to meet the tail of Hurricane Clara.

When at last they recovered from the storm the cargo had shifted and the *Prospero* listed ten degrees to starboard. Fuming chemicals leaked across the decks from the fractured seams of the waste drums, boiled on the surface of the sea, and sent up a cloud of acrid vapor that left Johnson and the Mexican crewmen coughing through makeshift face masks and Captain Galloway barricading himself into his cabin with his tequila bottle.

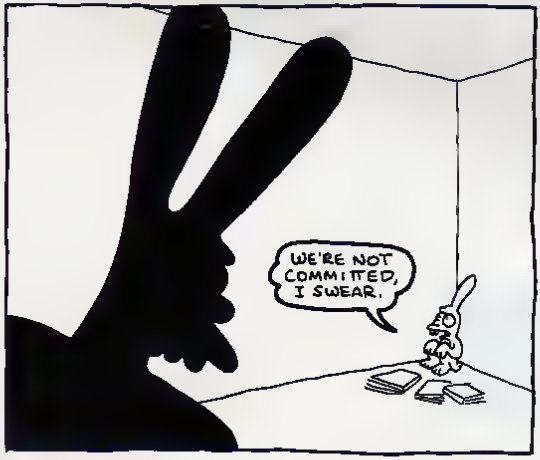
First Officer Pereira had saved the day, rigging up a hosepipe that sprayed the leaking drums with a torrent of water, but by then the *Prospero* was taking in the sea through its strained plates. When they sighted Puerto Rico the captain had not even bothered to set a course for port. Propping himself against the helm, a bottle in each hand, he signaled Pereira to cut the engines. In a self-pitying monologue he cursed the Mexican shipping agent, the U.S. Coast Guard, the world's agrochemists, and their despicable science that had deprived him of his command. Lastly he cursed Johnson for being so foolish ever to step aboard this ill-fated ship. As the *Prospero* lay doomed in the water Pereira appeared with his already packed suitcase, and the captain ordered the Mexicans to lower the lifeboat. It was then that Johnson made his decision to remain onboard. All his life he had failed to impose himself on anything—running errands as a six-year-old for the Nassau airport shoeblacks, cadging pennies for his mother from the irritated tourists, enduring the years of school where he had scarcely learned to read and write, working as a dishwasher at the beach restaurants, forever conned out of his wages by the thieving managers. He had always reacted to events, never initiated any-

WITH QPB, THERE'S NOTHING TO BE AFRAID OF.

*539. "A phantasmagorical, politically charged tale you wish would never end" —*Publishers Weekly*
Hardcover: $19.95
QPB: $9.95

*482. This latest edition of the famous dictionary has 40,000 memorable quotations.
Hardcover: $45
QPB: $18.95

158. Taut suspense set in Russia, from two masters of the spy thriller.
(2 volume set)
Hardcovers: $39.90
QPB: $15.95

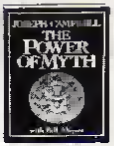


©1990 BY MATT GROENING

*417. The ultimate one-volume collection of the world's most sought-after information.
Hardcover: $34.95
QPB: $16.95

255. Frida was a magnetic personality celebrated as much for her life as for her paintings.
QPB: $13.95

*194. A landmark omnibus collection of 43 of Fitzgerald's best short stories.
Hardcover: $29.95
QPB: $14.95



423. A scholar on mythology tells how myths have shaped our lives.
Hardcover: $27.50
QPB: $15.95

*269. Explore western art, from the ruins of Greece to the post modernists. 350 illustrations.
Hardcover: $35
QPB: $15.95

267. The story of civilization in a unique chart format.
Hardcover: $29.95
QPB: $15.95

268. Let The Simpsons help you express yourself with their hilarious, full-color postcards.
QPB: $6.95

*114. Pynchon's long-awaited hilarious new novel that's all about what it's like to live and love in America today.
Hardcover: $19.95
QPB: $9.95

3 books, 3 bucks. No commitment. No kidding.

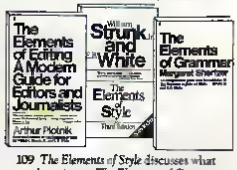
There's nothing scary about joining Quality Paperback Book Club. Because we don't make you commit yourself to buying a certain number of books every year. All you have to do is choose 3 books from this page, pay only $1 each, plus shipping and handling, and enjoy them.

As a member, you'll receive the *QPB Review*, free, 15 times a year (about once every 3½ weeks). In it, you'll discover an intriguing selection of fiction, history, science, biography, humor, horror and much more. QPB softcover books are priced up to 60% less than their hardcover counterparts. And every QPB book you buy earns Bonus Points that you can trade for free books (you pay just shipping and handling).

So, what's to be afraid of? Choose your 3 books for 3 bucks today.

223. Imagine da Vinci using puppies for paintbrushes and you've got Larson's new Far Side book.
QPB: $6.95

*248. New 1991 edition. What to write, how to write it, where to sell it.
Hardcover: $28.95
QPB: $13.95



109. *The Elements of Style* discusses what good writing is. *The Elements of Grammar* gives the rules to follow. *The Elements of Editing* describes what's said best—and what's best left unsaid.
(3 volume set)
QPB: $10.95

273. Explore our planet's past and possible future through these insightful works.
(2 volume set)
Hardcovers: $39.90
QPB: $14.95

*406. "A roller coaster ride over a vast landscape of the imagination" —London *Guardian*. Hardcover: $19.95
QPB: $9.95

321. Stephen Hawking offers a convincing big picture of the origins of the cosmos. Hardcover: $18.95
QPB: $8.95

*QPB Exclusive: The only softcover edition now available.

How QPB Membership Works.

Selection: Each *QPB Review* lists a new Selection. If you want it, do nothing—it will be shipped automatically. If you want another book or no book at all, complete the Reply Form always enclosed and return it by the specified date. (A shipping and handling charge is added to each shipment.)

Return Privilege: If the *QPB Review* is delayed and you receive the Selection without having had 10 days to notify us, you may return it for credit.

Cancellations: You may cancel membership at any time by notifying QPB. We may cancel your membership if you elect not to buy at least one book in any six-month period.

O.K. Send me 3 books for $3. No commitment. No fear.

Quality Paperback Book Club,* P.O. Box 8804, Camp Hill, PA 17011-8804

Please enroll me in QPB and send me the 3 choices I've listed below, billing me only $1 each, plus shipping and handling charges. I understand that I am not required to buy another book. You will send me the *QPB Review* (if my account is in good standing) for at least six months. If I have not bought at least one book in any six-month period, you may cancel my membership.

1-16 | | | *Indicate by number your 3 choices*

Name *(Please print clearly)* QB133-2-0

Address Apt

City State Zip

QPB Quality Paperback Book Club

Prices are generally higher in Canada. © 1991 Quality Paperback Book Club. All orders subject to approval.

THE LAGOON RESEMBLED A CALDRON OF ELECTRIC DYES.

thing on his own. Now, for the first time, he could become the captain of the *Prospero* and master of his own fate. Long before Galloway's curses faded into the dusk, Johnson had leapt down the ladder into the engine room.

As the elderly diesels rallied themselves for the last time, Johnson returned to the bridge. He listened to the propeller's tired but steady beat against the dark ocean and slowly turned the *Prospero* toward the northwest. Five hundred miles away were the Bahamas and an endless archipelago of secret harbors. Somehow he would get rid of the leaking drums and, even, perhaps, ply for hire between the islands, renaming the old tub after his mother, Velvet Mae. Meanwhile, Captain Johnson stood proudly on the bridge, oversize cap on his head, three hundred tons of steel deck obedient beneath his feet.

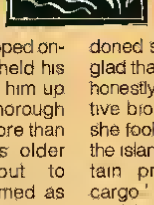
By dawn the next day he was completely lost on an open sea. During the night the freighter's list had increased. Below decks the leaking chemicals had etched their way through the hull plates, and a phosphorescent steam enveloped the bridge. The engine room was a knee-deep vat of acid brine, a poisonous vapor rising through the ventilators and coating every rail and deck plate with a lurid slime. Then, as Johnson searched desperately for enough timber to build a raft, he saw the old World War II garbage island seven miles from the Puerto Rican coast. The lagoon inlet was unguarded by the U.S. Navy or Greenpeace speedboats. He steered the *Prospero* across the calm surface and let the freighter settle into the shallows. The inrush of water smothered the cargo in the hold. Able to breathe again, Johnson rolled into Captain Galloway's bunk, made a space for himself among the empty bottles, and slept his first dreamless sleep.

"Hey, you! Are you all right?" A woman's hand pounded on the roof of the staff car. "What *are* you doing in there?"

Johnson woke with a start, lifting his head from the steering wheel. While he slept the lianas had enveloped the car, climbing up the roof and windshield pillars. Vivid green tendrils looped themselves around his left hand, tying his wrist to the rim of the wheel.

Wiping his face, he saw the American biologist peering at him through the leaves as if he were the inmate of some bizarre zoo whose cages were the bodies of abandoned motorcars. He tried to free himself and pushed against the driver's door.

"Sit back! I'll cut you loose." She slashed at the vines with her clasp knife, revealing her fierce and determined wrist. When Johnson stepped onto the ground she held his shoulders, looking him up and down with a thorough eye. She was no more than thirty-three years older than himself but to Johnson she seemed as self-possessed and remote as the Nassau schoolteachers. Yet her mouth was more relaxed than those pursed lips of his childhood, as if she were genuinely concerned for Johnson. "You're all right," she informed him. "But I wouldn't go for too many rides in that car."



She strolled away from Johnson, her hands pressing the burnished copper trunks of the palms, feeling the urgent pulse of awakening life. Around her shoulders was slung a canvas bag holding a clipboard, sample jars, a camera and reels of film. "My name's Christine Chambers," she called out to Johnson. "I'm carrying out a botanical project on this island. Have you come from the stranded ship?"

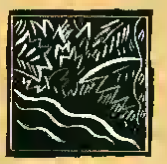
"I'm the captain," Johnson told her without deceit. He reached into the car and retrieved his peaked cap from the eager embrace of the vines, dusted it off, and placed it on his head at what he hoped was a rakish angle. "She's not a wreck—I beached her here for repairs."

"Really? For repairs?" Christine Chambers watched him archly, finding him at least as intriguing as the giant scarlet-capped fungi. "So you're the captain. But where's the crew?"

"They abandoned ship." Johnson was glad that he could speak so honestly. He liked this attractive biologist and the way she took a close interest in the island. "There were certain problems with the cargo."

"I bet there were. You were lucky to get here in one piece." She took out a notebook and jotted down some observation on Johnson, glancing at his pupils and lips. "Captain, would you like a sandwich? I've brought a picnic lunch—you look as if you could use a square meal."

"Well..." Pleased by her use of his title, Johnson followed her to the beach, where the inflatable sat on the sand. Clearly she had been delayed by the weight of stores: a bell tent, plastic coolers, cartons of canned food, and a small office cabinet. Johnson had survived on a diet of salt beef, cola, and oatmeal biscuits he cooked on the galley stove.



For all the equipment she was in no hurry to unload the stores, as if unsure of sharing the island with Johnson, or perhaps pondering a different approach to her project, one that involved the participation of the human population of the island. Trying to reassure her, as they divided the sandwiches, he described the last voyage of the *Prospero*, and the disaster of the leaking chemicals. She nodded while he spoke, as if she already knew something of the story. "It sounds to me like a great feat of seamanship," she complimented him. "The crew who abandoned ship—as it happens, they reported that she went down near Barbados. One of them, Galloway, I think he was called, claimed they'd spent a month in an open boat."

"Galloway?" Johnson assumed the pursed lips of the Nassau schoolmarms. "One of my less reliable

THE ISLAND HAD BECOME A UNIQUE BOTANICAL GARDEN.

men. So no one is looking for the ship?"

"No. Absolutely no one."

"And they think she's gone down?"

"Right to the bottom. Everyone in Barbados is relieved there's no pollution. Those tourist beaches, you know."

"They're important. And no one in Puerto Rico thinks she's here?"

"No one except me. The island is my research project," she explained. "I teach biology at San Juan University, but I really want to work at Harvard. I can tell you, lectureships are hard to come by. Something very interesting is happening here, with a little luck."

"It is interesting," Johnson agreed. There was a conspiratorial note to Dr. Christine's voice that made him uneasy. "A lot of old army equipment is buried here—I'm thinking of building a house on the beach."

"A good idea, even if it takes you four or five months. I'll help you out with any food you need. But be careful." Dr. Christine pointed to the weal on his arm, a temporary reaction against some invading toxin in the vine sap. "There's something else that's interesting about this island, isn't there?"

"Well..." Johnson stared at the acid stains etching through the *Prospero*'s hull and spreading across the lagoon. He had tried not to think of his responsibility for these dangerous and unstable chemicals. "There are a few other things going on here."

"A few other things?" Dr. Christine lowered her voice. "Look, Johnson, you're sitting in the middle of an amazing biological experiment. No one would allow it to happen anywhere in the world—if they knew, the U.S. Navy would move in this afternoon."

"Would they take away the ship?"

"They'd take it away and sink it in the nearest ocean trench, then scorch the island with flamethrowers."

"And what about me?"

"I wouldn't like to say. It might depend on how advanced..." She held his shoulder reassuringly, aware that her vehemence had shocked him. "But there's no reason why they should find out. Not for a while, and by then it won't matter. I'm not exaggerating when I say that you've probably created a new kind of life."

As they unloaded the stores, Johnson reflected on her words. He had guessed that the chemicals leaking from the *Prospero* had set off the accelerated growth, and that the toxic reagents might equally be affecting himself. In Galloway's cabin mirror he inspected the hairs on his chin and any suspicious moles. The weeks at sea, inhaling the acrid fumes, had left him with raw lungs and throat, and an erratic appetite, but he had felt better since coming ashore. He watched Christine step into a pair of thigh-length rubber boots and move into the shallow water, ladle in hand, looking at the plant and animal life of the lagoon. She filled several specimen jars with the phosphorescent water and locked them into the cabinet inside the tent. "Johnson—you couldn't let me see the cargo manifest?"

"Captain... Galloway took it with him. He didn't list the real cargo."

"I bet he didn't." Christine pointed to the vermilion shelled crabs that scuttled through the vivid filaments of kelp, floating like threads of blue electric cable. "Have you noticed? There are no dead fish or crabs—and you'd expect to see hundreds. That was the first thing I spotted. And it isn't just the crabs—you look pretty healthy."

"Maybe I'll be stronger?" Johnson flexed his sturdy shoulder. "... in a complete daze, mentally, but I imagine that will change. Meanwhile, can you take me onboard? I'd like to visit the *Prospero*."

"Dr. Christine..." Johnson held her arm, trying to restrain this determined woman. He looked at her clear skin and strong legs. "It's too dangerous, you might fall through the deck."

"Fair enough. Are the containers identified?"

"Yes, there's no secret." Johnson did his best to remember. "Organo..."

"Organophosphates? Right—what I need to know is which containers are leaking and roughly how much. We might be able to work out the exact chemical reactions—you may not realize it, Johnson, but you've mixed a remarkably potent cocktail. A lot of people will want to learn the recipe, for all kinds of reasons..."

Sitting in the colonel's chair on the porch of the beach house, Johnson gazed contentedly at the luminous world around him, a jewel-realm of light and life that seemed to have sprung from his own mind. The jungle wall of cycads, giant tamarinds, and tropical creepers crowded the beach to the waterline and the reflected colors drowned in swaths of phosphorescence that made the lagoon resemble a caldron of electric dyes.

So dense was the vegetation that almost the only free sand lay below Johnson's feet. Every morning he would spend an hour cutting back the flowering vines and wild magnolia that inundated the metal shack. Already the foliage was crushing the galvanized iron roof. However hard he worked—and he found himself too easily distracted—he had been unable to keep clear the inspection pathways which Christine patrolled on her weekend visits. camera and specimen jars at the ready. Hearing the sound of her inflatable as she neared the inlet of the lagoon, Johnson surveyed his domain with pride. He had found a metal card table buried in the sand and laid it with a selection of fruits he had picked for

CONTINUED ON PAGE 93

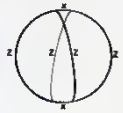
Pictorial

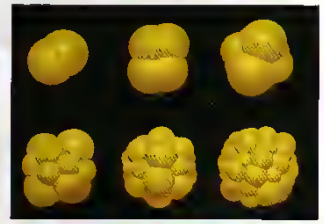
Unlocking
the secrets that bring
plants to life

THE MATHEMATICAL GARDENER

By Sandy Fritz

Left: *Waterlily*, D. R. Fowler, J. Hanan, 1990. Operating at 3 million calculations a second, a Silicon Graphics Iris supercomputer took three hours to create this image. Mathematical formulas representing the overall shape and growth patterns of the lily's petals formed first, followed by the plethora of stamens in the flower's center. Once the plant's algorithms were complete, another program added the 3-D effect. To model the growth of a snail embryo

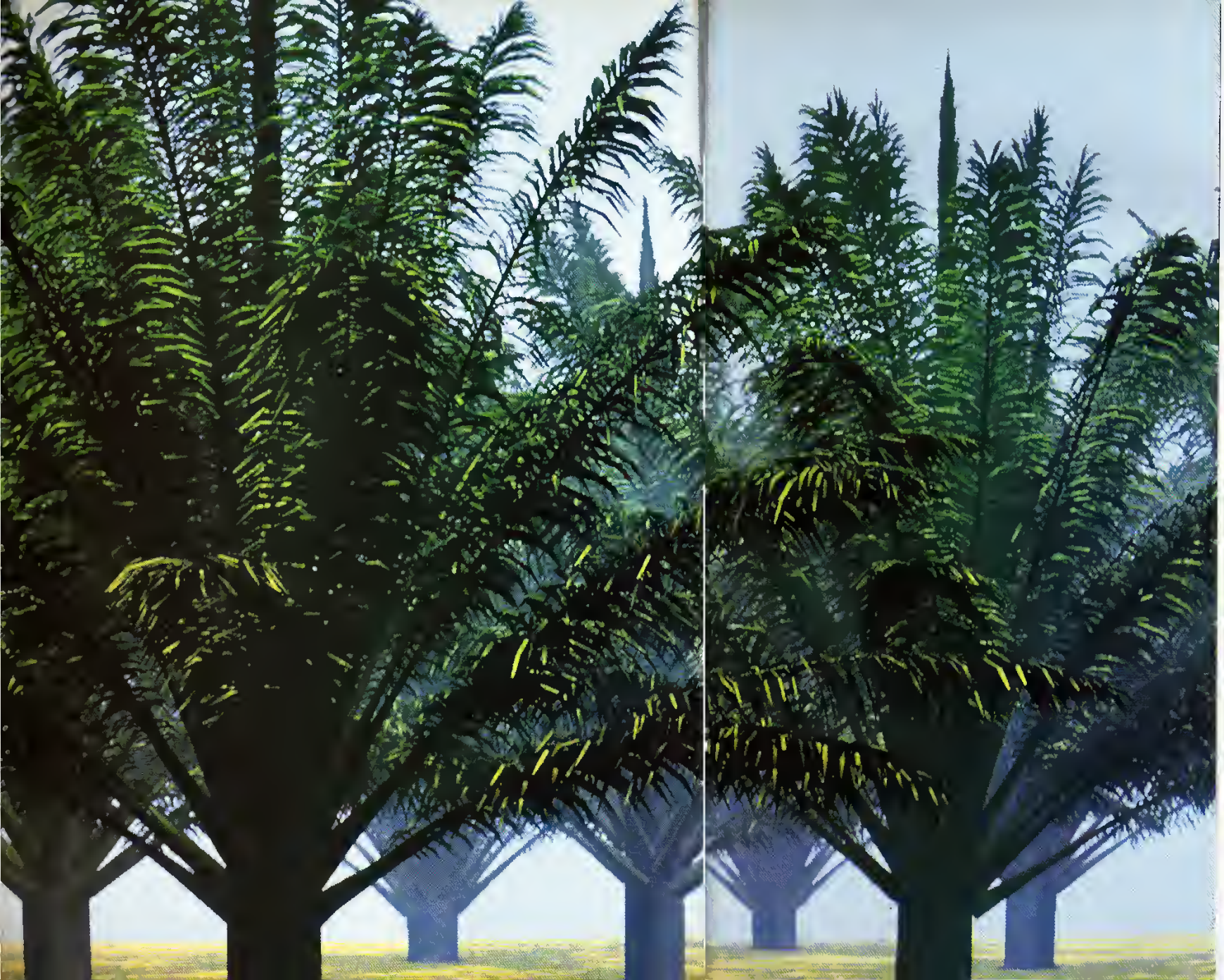




(pictured above, as seen through an electron microscope), computer mathematicians begin by mapping the development sequence (left margin). The basic set of instructions gives rise to the 3-D rendering of a maturing cell cluster (top).

The images on these pages are not mere exercises in trigonometry, which would be equivalent to taking a mathematical snapshot of a plant's exterior. Nor are they generated by fractal-based methods, which simply repeat patterns based on unsolvable equations. Rather, they are the product of a new branch of mathematics. Biomathematics plumbs what could be the mathematical rules governing the development of plant life on this planet by using sets of mathematical formulas not only to guide the description of plants' outer shape but also to duplicate the way plants grow in nature. In many instances, the images begin as tiny plants that "grow" on the computer screen. This technique brings the tiniest details into focus: the tentative branching of a rose leaf, the tightly wrapped terminal bud awaiting its cue to flower, each re-created in a biologically accurate representation of a plant.

The groundwork for this breakthrough was established in



1968 by the late Aristid Lindenmayer to model simple cell division. The Lindenmayer system, or L-system, is based on the premise that plant growth is governed by repeating patterns that can be quantified by specific formulas. The formulas become algorithms or sets of rules to guide a subject's recreation on a computer screen.

Beyond the mathematical formulas, however, a strong human element helps bring the images to life. Modelers must closely observe a plant's fundamental structure, define it, then call on their experience and intuition to develop the formulas that give rise to the plant's basic shape. Experts working in this field have coined the phrase

artificial life to describe the work they do. The implications could be astounding. Processes not observable within living plants can be visualized through computer modeling. Future refinements of the system will enable the computer to animate complete growth cycles, allowing researchers

to sit back and watch, say, the 500-year growth span of an oak tree breeze by in just a few minutes. One of the goals, says Przemyslaw Prusinkiewicz, who spearheads work on artificial life at the University of Regina in Saskatchewan, Canada, is to create an electronic version of the natural world. "We are creating an artificial world," he says, "but not all worlds can be explained by math."

Previous page: ***Oil Palm Tree Canopy,*** **CIRAD Modelisetron Laboratory, 1990. The plantation of trees displays lateral shoots at different stages of maturity. Varying the algorithms used to produce the pineapple (previous page, top) creates realistic pinecones and sedge shoots. Left:** ***Close-up of a Daisy Capitulum,*** **D. R. Fowler, 1988. The tightly clustered flower follows a carefully constructed spiral pattern. Miscalculations of as little as 0.1 degree in the angle governing the spiral's development will result in improbable structures such as the top and bottom patterns to the left. This page, top:** ***Sunflower Field,*** **D. R. Fowler, N. Fuller, J. Hanan, and A. Snider, 1990. Roughly 400 sunflower plants compose this image. Above:** ***Apple Twig,*** **P. Prusinkiewicz, D. R. Fowler, 1990. The side branch of the apple tree terminates in a spray of flowers.**

VOLATILE

CONTINUED FROM PAGE 56

the phenomenon occurs when electrons crowd together much as in Chernetsky's plasma or Puthoff's metal plates. "When electrons are packed densely enough, they no longer repel each other," says Shoulders. "Instead they form charge clusters that hold together even without a wire to carry them. That lets us build circuits from grooves in a sheet of ceramic or plastic. Condensed charges can move through these grooves one thousand times faster than electrons travel through a semiconductor chip." What is more, says Shoulders, it's fairly easy to generate condensed charges. Just make a spark.

His first major trick, Shoulders hopes, will be replacing today's silicon computer chips. If anyone else made so unlikely a claim, few would listen. But the sixty-two-year-old Shoulders, formerly of the Massachusetts Institute of Technology and Stanford Research Institute, possesses extraordinary credentials. In the early Sixties, he made the world's first vacuum microelectronic circuits and the very first prototypes of the equipment now used to manufacture silicon chips.

According to Shoulders, his new circuits will render silicon-based technology obsolete. "It looks like there is nothing in electronics that you cannot do a whole lot better with clustered charge," he says.

For an amiable Texan, Shoulders is remarkably closemouthed about the product he is said to be developing. But he is open about the advantages of condensed charge. "Using beads of condensed charge, we have already made transistor-type switches with speeds of less than one trillionth of a second. That's ten thousand times faster than you can buy, and I think we're going to get a lot faster than that," Shoulders says. In fact, engineers working with conventional chips a couple of inches long are having trouble figuring out how to speed the passage of electrons from one side to the next. With condensed charge technology, however, electrons move so rapidly that a single circuit could be a foot across.

Long, compact circuits working at high speed would enable us to build machines with far less bulk than today's technology. For instance, Shoulders says, we could build "a hundred-horsepower motor no bigger than the shaft it takes to deliver the torque [power] or a flat-screen TV with all the electronics built right into the display. You could use the screen for anything from high-definition TV to computing. Simpler yet, an X-ray machine that fits inside a hypodermic needle. You could put it into the patient's body to irradiate a tumor, say, without exposing the other organs to X rays. We already have companies experimenting with these things."

Perhaps most incredible, CCT may be available soon. Condensed charge devices are astonishingly easy to make, Shoulders says. "We can get rid of the complicated photographic techniques I had to invent to make microchips and use simple etching and stamping. This is really low-tech. Any Third World country can do it."

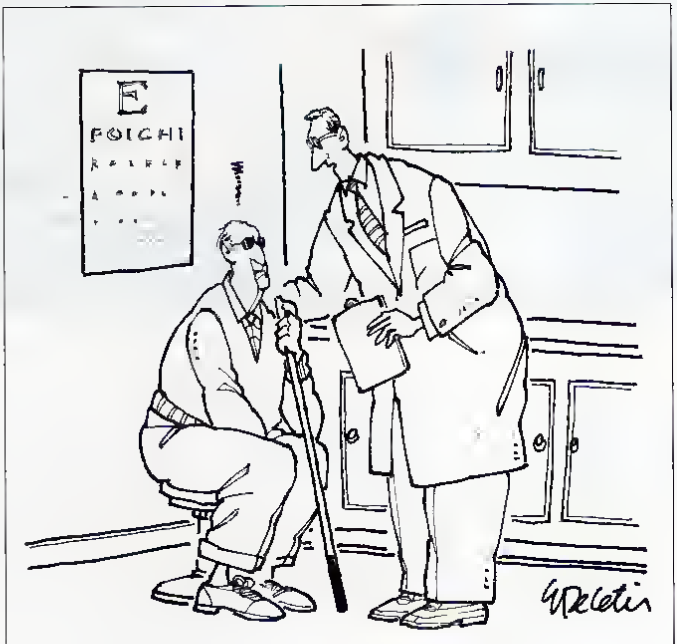
Though Shoulders works closely with Puthoff, he is reluctant to admit that CCT derives from zero point energy for sure. "There are at least four competing theories that might explain condensed charges," he says, "and though zero point energy is a likely candidate, I can't say which theory will turn out to be right."

Other scientists give Puthoff's work on zero point energy mixed reviews. Timothy Boyer, whose papers inspired Puthoff in the first place, for instance, disagrees with Puthoff's explanation of gravity. "As far as I am concerned, the idea is fuzzy and the calculations ambiguous," Boyer says. "To think in terms of the curvature of space–time is a much more useful, extensive idea."

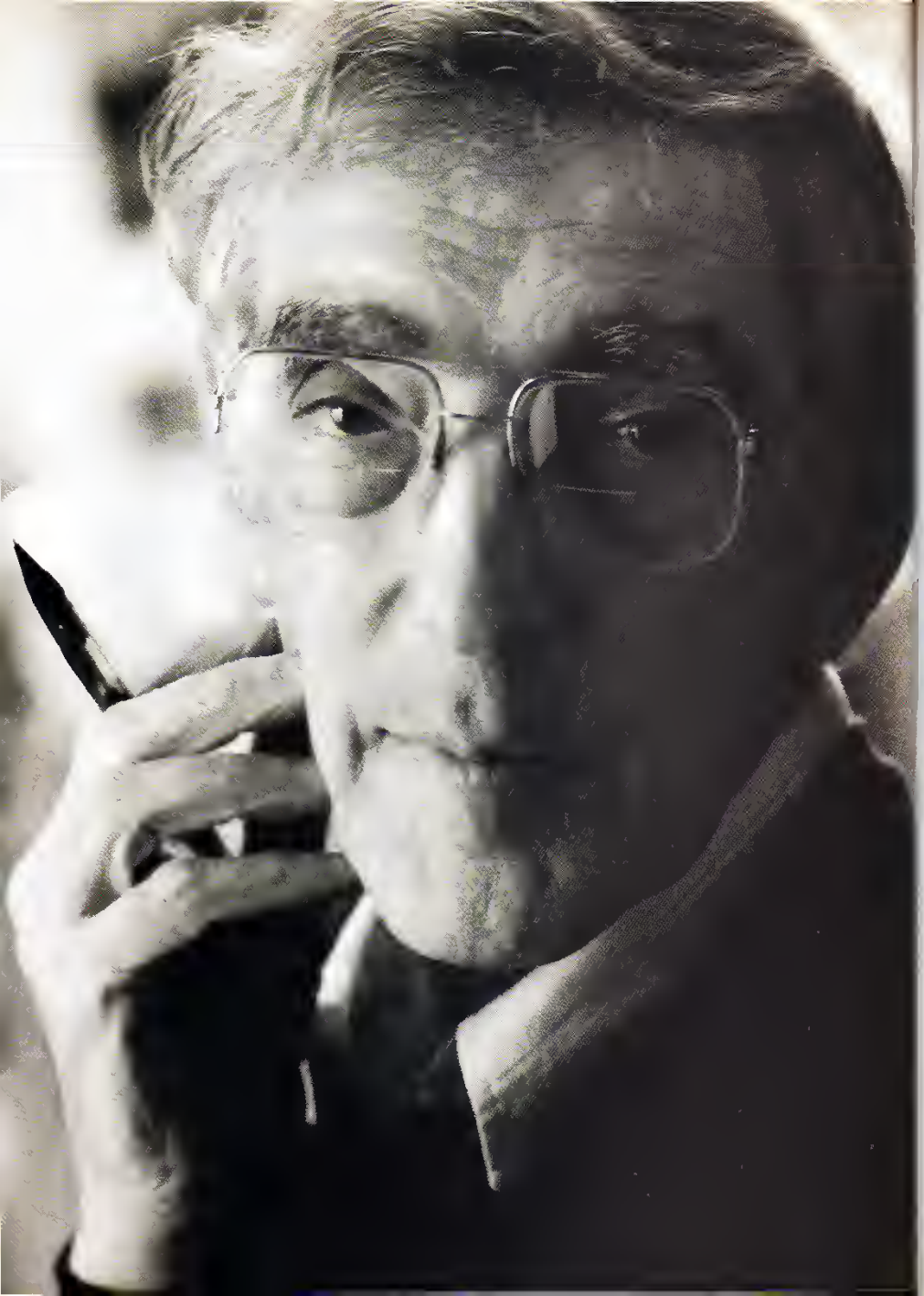
Physicist Alfonso Rueda of California State University at Long Beach, on the other hand, is sympathetic to Puthoff. Rueda studied vacuum fluctuations, using them to explain both the enormous power of cosmic rays and the dense concentration of stars at certain intersections of the universe. Rueda feels Puthoff has presented some powerful evidence for his idea that zero point energy holds atoms together. And he is "impressed with Puthoff's treatment of gravity. I think he is on the right path."

New York University physicist Benjamin Bederson, editor of the respected *Physical Review A*, where most of Puthoff's work has been published, has an opinion as well. "Many articles that appear in *Physical Review* turn out to be wrong," Bederson says. "Like any journal, we rely on the judgment of our referees. Some expressed doubts about Puthoff's conclusions, but they all agreed that it was stimulating work and deserved a wider audience."

As for Puthoff, he is confident indeed. A new series of experiments, he says, should deal with Boyer's criticisms and move his own research along. Meanwhile he looks forward to the day we tap the power in the void, using it to energize our cities and propel starships beyond the solar system without an ounce of onboard fuel. "Only the future," Puthoff says, "can reveal the ultimate use to which humans will put the remaining fire of the gods: the quantum fluctuations of empty space." ◻◻



"In other words, Mr. Campbell, the human eye is like a camera, and you're out of film."



"Plants don't have teeth, claws, or immune systems, and they cannot run away. So throughout evolution they've been making newer and nastier pesticides. They are much better chemists than Dow or Monsanto"

INTERVIEW

BRUCE AMES

Fear of pesticides has manifested itself in a growing demand for 'natural,' 'old-fashioned,' and 'organic' foodstuffs and products. We're willing to pay more for them, easing our chemical apprehension is worth the price, especially if we're responsible, too, for the well-being of our children. Isn't it?

Enter Bruce Ames, professor of biochemistry and molecular biology at the University of California, Berkeley. Ames, a genetic toxicologist, lent the weight of science to the fledgling environmental movement of the mid-Seventies.

Born in New York City in 1928, Ames is the son of a high-school science teacher who eventually became assistant superintendent of schools. Ames went to the Bronx High School of Science and Cornell University, then received a Ph.D. in biochemistry from Caltech. "I was never terribly good at getting A's," he recalls, "but I was always good at problem solving." From 1953 to 1967 he worked at the National Institutes of Health, and he has been at Berkeley since 1968.

His Ames test quickly and inexpensively determined the mutagenicity of chemical compounds. In a celebrated case before the U.S. Consumer Product Safety Commission, Ames showed that Tris, a flame-retardant chemical used in children's pajamas, was a potential cancer causing agent. Based on that evidence, Tris was banned. And so began the hunt for other man-made carcinogens that flourishes to this day.

But what of Ames? Rather than ride an environmental bandwagon determined to call to account an industrial hierarchy many see as motivated by greed and possessed of a devil-

PHOTOGRAPHS BY TOM ZIMBEROFF

may-care attitude toward its customers. Ames stuck with science. He went on to make some startling discoveries. Foremost among them: Not only are roughly half of all man-made chemicals potentially cancer causing, but so are a similar number of *natural* chemicals. And because 99.9 percent of the chemicals we ingest are natural, Ames thinks we should be just as concerned about Mother Nature's toxins as we are about those produced by Union Carbide—if not more so.

But not to worry. The bottom line here is not so much the cancer threat of peanut butter or parsley—though it exists—as that the amounts of toxins we consume are more or less harmless. Even if the salmonella bacteria in his Ames test mutate, or lab rats grow tumors from high-end, or maximum tolerated, doses of these naturally occurring carcinogens, it does not follow, he says, that any tiny amount will produce proportional results. This position is a reversal of his earlier "one-molecule" theory, wherein he posited that one molecule of a given carcinogen was enough to cause cancer.

In fact, Ames now recommends that we buy produce sprayed with synthetic pesticides instead of organically grown foodstuffs. His reasoning: Most man-made chemicals have been tested, as opposed to the untested natural chemicals with which "unaided" plants protect themselves against predators, and organic produce may be higher in natural toxins.

It would be nice to believe Bruce Ames. His optimism about the state of the environment and our overall health is a refreshing change from the doomsday headlines trumpeted almost daily by well-intentioned watchdogs. To Ames, almost everything's coming up nontoxic roses. His is a reassuring voice in what we've come to perceive as a polluted wilderness. To his detractors, however, Ames whitewashes the very real health problems associated with man-made pesticides and pollution. Some, like the Natural Resources Defense Council and *60 Minutes*, have gone so far as to accuse him of being a shill for industry.

The first time I met with him, we walked the short distance from his lab to the Café Pastoral. Spare, silver-haired and patiently instructive, he was unflappable during our conversation, in spite of having lost his father several days earlier.—Bill Moseley

Omni: What have you been doing?

Ames: Running a lab. I have a big, active lab here. And working on my review of natural pesticides. Every plant has forty or fifty pesticides it makes to kill off predators and fungi. There's a big war going on between plants, animals, and insects. Plants couldn't survive if they weren't filled with toxic chemicals. They don't have immune systems, teeth, claws, and they can't run away. So throughout evolution they've been making newer and nastier pesticides. They're better chemists than Dow or Monsanto. They've been at it a very long time.

To the toxicologist, the idea that nature is benign and only man-made things are bad is crazy. Looking at the toxicology of the natural chemicals we eat, you find just as many bad actors as among man-made chemicals. Man-made or natural—are carcinogens. But people looking at human cancer are finding completely different causes: smoking, viruses, dietary imbalances.

Omni: Would you call it hysteria, a cancer witch-hunt?

Ames: Yes. We're starting to unravel the causes of major cancers—such as breast, colon, stomach. They're not all pinned down completely, but epidemiologists are finding these causes have nothing to do with the chemicals they're feeding rats. Pollution, too, is probably almost irrelevant to causes of cancer and birth defects. Air pollution may have a small effect, but chemical pollutants are present at such tiny levels they're uninteresting from the standpoint of cancer prevention. Reducing pollution is desirable for aesthetic and other reasons, but it would have a minimal effect on cancer rates.

Omni: Aren't you overlooking reproductive and neurological effects of toxic chemicals and pollution?

Ames: No. For most substances, even vitamins, there's a safe dose and a dangerous dose, so you don't worry about tiny doses. But we sort of ignored that truism of toxicology with carcinogens. We gave these enormous doses to rats—just below the level that would kill them—every day for a lifetime. Then we said, "Well, let's extrapolate down a millionfold. One millionth of that dose might have a proportional effect." Most toxicologists think that's unlikely to be true, and recent evidence suggests it's not.

All of life is a trade-off. You can build cars that don't put out any pollution. But it would cost an enormous amount. When we had horses, the streets were full of manure. We've gone to nonflammable solvents for dry cleaning. We could go back to flammable ones, but then many buildings would go up in flames. The price you pay for nonflammable solvents is a part per billion of something in the water. The hell with it. Such trivial amounts don't matter.

Omni: What about the cumulative effect? In the United States alone, we dump something like two billion pounds of pesticides a year.

Ames: When you measure what's getting into people, it's a tiny amount.

Omni: But doesn't that accumulate over the years, in nature and in people?

Ames: No. Pesticides get degraded. DDT, the first synthetic pesticide, stayed around for years. But it did save millions of lives; never hurt people, and was ultimately succeeded by much better and less persistent compounds. Nature's using thousands of times more of its pesticides. Many of them also accumulate in body fat. Your tissue contains solanine and chaconine (which kill insects in the same way as the synthetic organophosphate insecticides) because you're eating fifteen thousand micrograms a day from a single potato. And yet you're eating only about fifteen micrograms of the man-made organophosphate pesticides a day. Solanine and chaconine came into the human diet four hundred years ago. They're teratogens causing birth defects in animals. And nobody's worrying about them because they're natural. It's a double standard.

None of these fears make sense, yet people hate industry. They say industry pollutes because of greed, and we're going to get them. But in the end, modern industrial society is bringing us our health and wealth. The main correlation of health is prosperity. Industry is why our life expectancy gets longer every year. Pollution is a nonissue in terms of public health. Obviously you don't want the air in Los Angeles to be very dirty. It's not aesthetically pleasing, and maybe there's a small health factor. But in terms of the amount of burnt material inhaled, one day of smoking forty cigarettes equals a year of breathing the burnt material in LA smog.

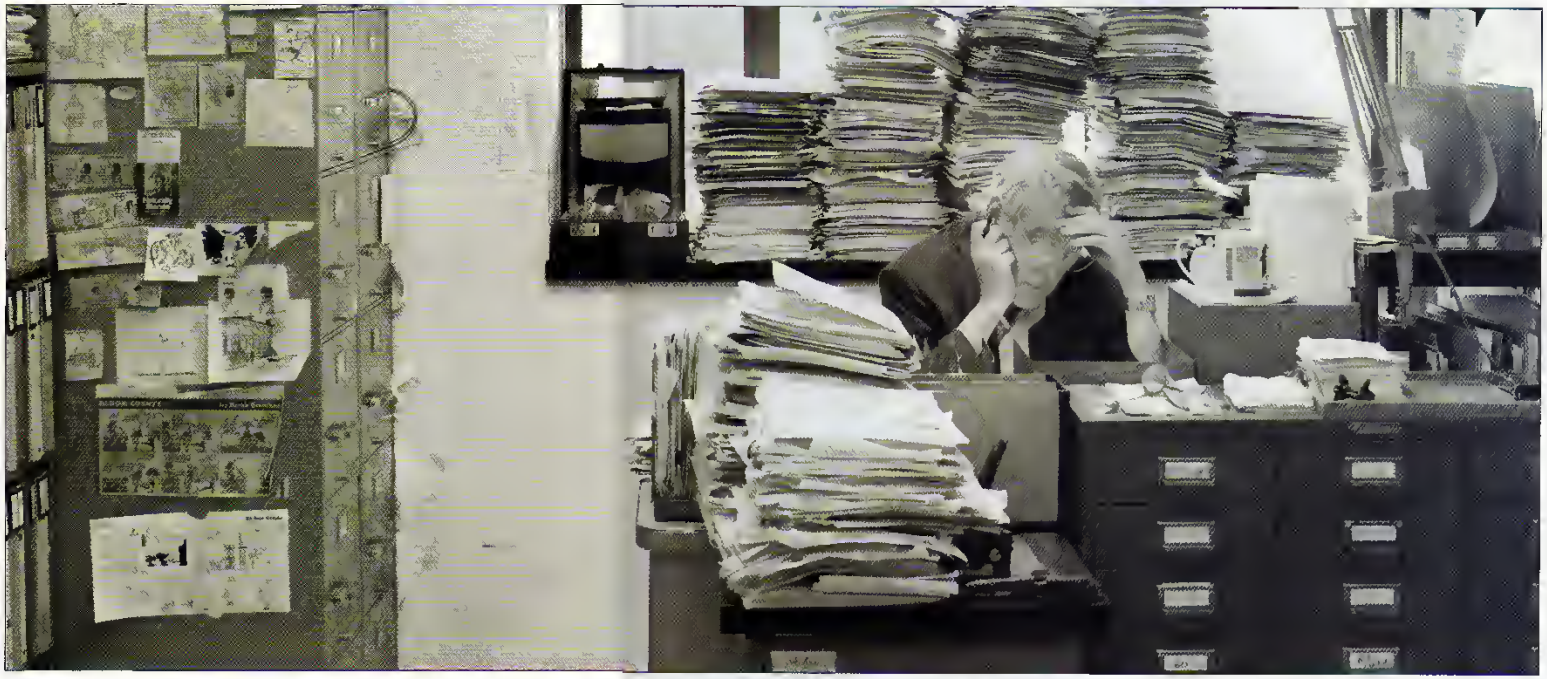
Omni: Wouldn't it be better not to have all that pollution in the air?

Ames: Oh, sure. You can have more purity on whatever you like, you just have to pay for it.

Omni: I still wonder. Don't man-made pollutants have a cumulative effect that is worse than whatever nature puts into the environment?

Ames: There's no science supporting a cumulative effect. People used pesticides before DDT. They used lead arsenate. That's natural, carcinogenic, infinitely persistent, and it was outmoded by DDT. Modern pesticides have constantly made things better. They've made fruits and vegetables enormously cheap, and in general the more fruits and vegetables you eat, the better your health. Pesticides are improving public health and saving lives because they lower the cost of food.

Omni: Do you recommend supermarket over organic produce?



"Man-made pesticides are much safer than natural ones because we're getting lower amounts of them and they've been tested more thoroughly."

Ames: Oh, I can make a case that organic produce is *more* dangerous. First, when plants get stressed they raise their pesticide levels. People complain that produce in the Safeway looks good and produce in the organic stores looks damaged. When it's damaged the plant induces much higher levels of its pesticides. Second, if you drive an extra mile to an organic store your risk of being in a car accident is probably higher than any possible risk from a pesticide residue, which I don't believe constitutes a significant risk anyway. Third, some organic farmers spray untested natural pesticides on their crops. Fourth, different cultivars of plants have different levels of natural pesticides. Organic farmers tend to pick plants that are insect resistant and so higher in natural pesticides. Most celery has about nine hundred parts per billion of two natural carcinogens. But one variety might have two thousand parts per billion, another two hundred parts. Someone just introduced a new celery into the United States with nine thousand parts per billion. The organic farmers love it.

This unreasonable fear of synthetic chemicals is all based on bad science. They give enormous doses of a man-made chemical to a rat and then tell you a tiny dose will do you in. All the while you're getting much larger doses of natural carcinogens in every meal! Parsley and cabbage contain levels of natural carcinogens at thousands of parts per billion; coffee and mustard have even higher levels. Look at a cup of coffee, all that black material, it's full of carcinogens. You're getting tiny doses every time you eat a meal: carcinogens, teratogens, neurotoxics.

Omni: What's the error factor in determining how much of a carcinogen is safe to ingest?

Ames: The risk estimates are based on multiplying a number of worst-case assumptions, but the real risk is much closer to zero. A daily glass of Alar-tainted apple juice is one fiftieth the possible risk of a daily mushroom, one eighteenth the risk from the aflatoxin mold carcinogen in an ordinary peanut butter sandwich. All these hypothetical cancer risks may be negligible.

Omni: How did the Alar scare come about?

Ames: Environmental organizations have an incentive to exaggerate and scare the public. That's how they get their new members. They're not getting very good scientific advice in my view. Alar keeps apples on the trees so they'll all ripen together. This keeps fallen apples from going moldy and they'll have a lot less mold toxins. You use a lot less pesticides if you use Alar. Banning Alar ruined a lot of apple farmers and cost the apple industry $100 million. And making apples more expen-

Counterpoint

Bruce Ames arouses controversy, in *Omni* as elsewhere. We thought we'd share with you the opinions of other scientists and commentators regarding Ames and his views.

PROVOCATEUR

Janet Hathaway, senior attorney for the Natural Resources Defense Council, Washington, DC: One of the biggest concerns public health and environmental advocates have about some of Bruce Ames's claims is his tendency not to distinguish between what he has researched and what he's simply hypothesizing.

In his eagerness to highlight theories and concepts, Ames tends to overstate what is known. Not even a small fraction of all the natural and certainly all the synthetic substances have been tested for carcinogens. Some of his concepts are provocative and play a role in spurring on further discussion and research. But they should not be accepted by the public as fact.

A BETTER RODENT BIOASSAY

Dr. I. Bernard Weinstein, director of the Comprehensive Cancer Center at the College of Physicians and Surgeons of Columbia University in New York City: There is nothing in Bruce Ames's arguments to indicate we should drastically alter the tests used today. Ames never gives us the bottom line. If he thinks rodent bioassays are unreliable, what would he substitute? He's not on the line personally to bear this responsibility. Ames is not providing available alternate strategy. If he came up with a better test than the rodent bioassays, all would be delighted.

A whole range of tests evaluate the carcinogenicity of compounds. All are constantly reevaluated. Research is looking to better understand cancer-causing processes which will in turn lead to new tests. As each new chemical appears as a potential food additive, it should be put through the rodent bioassays and evaluated in other test systems. Sometimes the data are highly convincing, sometimes not at all, sometimes marginal. Often the tests have to be repeated. Even though there are limitations to some methods, we do the best we can.

Concerning massive-dose rodent tests: Compounds are tested in massive doses because you must increase the sensitivity of the test. Otherwise you'd use thousands of mice. Furthermore, there's evidence these compounds are carcinogenic even at the lower doses, often at doses at which toxicity was not seen. So there's not a simple correlation between toxicity and carcinogenicity.

HOW IT PLAYS

David Roe, senior attorney for the Environmental Defense Fund: Bruce claims he doesn't take a dime from industry and I've no reason to think he's at all compromised in terms of financial consideration. Ames is a distinguished scientist. The question comes when one goes outside science to represent the facts to the public and make recommendations on policy. There Bruce is guilty of oversimplification. Industry would certainly like to simplify it more, turn it into advice to "relax and enjoy."

Bruce makes a good point—and he is not the only one to make it. Toxic control policy should be directed at separating the trivial from the serious risks and concentrating on the serious. The oddity is that he was opposed to the innovative landmark law in California—Proposition 65, which was passed four years ago—that does just that. He was appointed to the scientific panel selecting chemicals for Proposition 65 and has consistently opposed fair application of the law in my opinion. It's ironic that when progress is made toward separating the serious risks from the trivial, he doesn't recognize or endorse it.

Ames enjoys being a public man in an area where many companies with a lot at stake have been known to publicize his views. That doesn't mean he's doing it for them, but he's much too sophisticated not to understand some of his own oversimplifications. One such simplification is his saying how tiny one part per billion is. He knows that one part per billion doesn't tell you anything about toxicity, that one part per billion of something can be lethal. I'm not blaming his research. But his public presentation is geared to some things that are misleading. Separating the serious from the trivial requires risk assessment. One part per billion of saccharin, PCBs, or dioxin is not the same. Dioxin causes cancer in parts per quadrillion. None of this is to detract from his development of the Ames test, knowledge of mutagenic and carcinogenic mechanisms, or credentials. It's just how he plays his stuff and allows his stuff to be played.

sive hurt the public and may have increased possible hazards

Rich people may want to buy organic food However, organic food won't decrease—and may even slightly increase—their cancer risk In terms of cancer prevention, poor people are much better off eating more vegetables with man-made pesticides than fewer, costlier vegetables that lack these pesticides The rich are always healthier They have more money to spend on doctors, safer cars, and more varied diets The best thing you can do for the poor is make them rich

Omni: How did you feel about the *60 Minutes* coverage on Alar, when they interviewed you?

Ames: I was pretty unhappy They're selling soap and sensationalism They didn't go to the best scientists, nor did they really want to know what the best scientists thought. They distorted what I wanted to say *60 Minutes* tried to tie me in to industry, as if I were just an industry shill, when I was just trying to present the best science I make it a point not to do any consulting for industry

Omni: Do you have a patent on the Ames test?

Ames: No. I never tried to patent it Every industry in the world that develops chemicals uses it I send out the bacterial strains free We have described how to do it, and everybody with some microbiology training can set it up. In the test you determine if the chemical mutates the genes of bacteria. The test uses a billion salmonella bacteria on a petri plate These particular strains can't grow on that plate unless a gene is mutated upon which the mutated bacteria start dividing, giving rise to a colony you can count To test a chemical to see if it's a mutagen takes about a day. A positive test that a chemical is a mutagen is a warning signal that it's more likely to be a carcinogen However, some mutagenic chemicals aren't carcinogens in rats, and some carcinogens aren't mutagens. But overall, it does fairly well

Omni: Is mutagenicity the first warning sign of cancer?

Ames: Yes most people in the field think that a cell becomes a cancer cell through several mutations in its genes. When chemicals are tested at massive doses they kill cells and cause cell division in neighboring cells. This in itself appears to increase the risk of cancer Depending on the dose, every chemical is toxic. Too much salt for example is probably a human carcinogen One risk factor in Japanese stomach cancers is thought to be too much dietary salt

Animals are designed with layers and layers of defenses against toxic chemicals, natural pesticides and chemicals from burnt material. We eat tens of thousands Our defenses are inducible general defenses If we eat an oxidizing agent (many oxidants are mutagens), we induce all sorts of antioxidant defenses effective against both synthetic and natural oxidants That's why linear extrapolations from massive down to tiny doses don't make much sense Give human cells a little dose of radiation and they become more resistant to big doses, but of course high doses overload the defenses Take ultraviolet light Every time you go out in the sunshine you're getting bathed in a carcinogen. A little UV light induces a tan, a natural defense against UV light The tan protects you against a burn It you're going to roast yourself once a month on the beach, you're probably better off getting a tan With alcohol, five drinks a day is a risk factor for mouth and liver cancer and birth defects One drink a day is the country's average we don't know if it's dangerous or even protective If you're going to drink ten beers on Saturday, it's possible you'd be better off drinking one beer a day to induce your defenses.

Whenever you burn something you make a carcinogen The Sierra Club makes a campfire, it's just putting carcinogens into the air Shall we outlaw campfires? The most polluted places used to be where people burned wood You go to little towns where people are using wood stoves you see the pollution The Sierra Club should understand the cost in pollution of putting a log on the fire. We should be conserving energy and building nuclear power plants But the environmentalists are all against nuclear power If you burn coal a fair amount of radioactivity as well as carcinogens goes in the air

Omni: What about the radioactive waste products in nuclear energy?

Ames: That's not a big problem, from what I hear

Omni: What about a hundred years from now, the environmental 'sins of the fathers,' and so on?

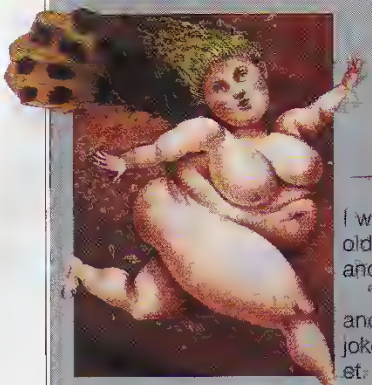
Ames: There was always pollution Thanks to modern science, a hundred years from now our life expectancy will be much longer than it is now You couldn't support today's world population with the technology of the last century The pollution in London a hundred years ago was much worse than now. I was in China visiting factories It's the most polluted place you've ever seen. Worker safety is nonexistent

Omni: What about chlorofluorocarbons [CFCs], suspected of breaking down the ozone layer?

Ames: You might eliminate the CFCs in spray cans, since you don't really need them as propellants. CFCs as refrigerants are really useful. You don't want to eliminate them until you find a better alternative. You may want to re-

CONTINUED ON PAGE 103

"That's one of our satellite offices."



ONE LOST BOY LEARNS THAT YOU CAN'T GO BACK TO NEVER-NEVERLAND.

I went to see Wendy when I was in London. For old times' sake. It's a drag, but she expects it, and what can I do.

"Oh, Slightly, you really are a sight," she says, and smiles as if she expects me to share the joke. "You look so silly in that black leather jacket. And why do you have a hoop in your ear? Do you think you're a pirate?" She laughs girlishly, even though she's over thirty, saddled with a kid, and afflicted with a husband who's never home.

I don't even know why I go to see her. She always insists I stay to tea and serves sweet biscuits and fusses over her kid the whole time. She gets to me. We have what passes for conversation in her household.

"Slightly writes for the newspaper, Jane. What do you think of that?" Wendy asks the kid. Jane looks at me owlishly and says nothing.

"He just got back from somewhere very far away and exotic. Where was it this time, Slightly?"

"Nicaragua," I say. "I was a stringer for the *Times*. Covering the war. You may have heard about it?"

PETER

FICTION BY PAT MURPHY

PAINTINGS BY ANITA KUNZ

Can't get under her skin. She smiles sweetly and I can't bear it. "I suppose it's so far from our little world here."

"Could you please call me Hank," I say, a little testily. "I really prefer it."

"Very well, dear," she says. She looks hurt but covers by busying herself with cleaning up a spot of tea that has dripped from the teapot spout onto the lace tablecover. "I will."

She won't. She never remembers.

Finally, the kid goes out to play, dressed in a little pink frock trimmed with lace. Wendy herself is wearing a housedress that looks a bit worse for wear, but the kid has to have the best. "She's such a dear," Wendy says, and then settles in her chair to reminisce. "I was just her age when I first flew off with Peter."

I don't want to hear about it, but she's off and running. "Remember the lovely little house you boys made for me? Oh, I was so happy there." And then she goes on and on about the sweet little room under the trees and the fun we had chasing the pirates. In her memories, she even likes Tiger Lily, the Indian princess, though I recall at the time Wendy was quite put out by Tiger Lily's obvious interest in Peter.

Wendy's memories are all quite tidy. She remembers the sweet room beneath the trees and doesn't remember that it stank like wood smoke half the time because the chimney didn't draw. She remembers the jolly pirate ship and forgets the death cries of the dying pirates. The deck was slick with blood when we were done. I remember it, even if she doesn't.

They died horribly—two in the cabin at Peter's blade. The rest on deck, mobbed by the lost boys, harried by Peter. I didn't kill any myself, but that doesn't mean I was innocent. I carried the lantern and called to the other boys to follow. I remember flashing the lantern in one man's face—Bill Mullins, I think his name was—and he ran out half blinded, to be cut down by three boys.

Fair play didn't enter into it—we were just kids. Kids with death in our hands and a song in our hearts. The air reeked of blood and we watched Hook leap overboard into the jaws of the crocodile.

Wendy seems to have forgotten all this. She remembers a tidy Neverland. Perhaps she believes the Disney version, where people died neatly, never soiling their pants.

I look around the room as she talks, chattering about fairy dust and Tinker Bell. The arms of the chairs are covered with off-white doilies that are a little lumpy and don't lie flat. Wendy's work, no doubt. The windows are covered with a thin layer of dust, the kind of dirt that hangs in the air of industrial towns, settling on everything. By the door, the carpet is worn; the underlying threads show through. Wendy herself looks worn—tired around the eyes. Her hands are a little chapped; she hasn't been taking care of herself.

Her husband is an actor, or so Wendy says. He gets work now and then—minor parts in minor productions. Never anything big. He's a good-looking man, in a callow, beardless way. I've met him once or twice, and I didn't much care for him. When Wendy's reminiscences slow down, I ask about him. "How's your husband? Getting any work?"

She looks worried. "Oh, he has hopes. He's being considered for a part."

I see. I see all too well. His sort is always being considered for a part. Always having lunch with a producer. Always chasing after the dream and never catching it, leaving his wife to grow worn and tired alone.

"And what about you, Slightly? Are you seeing anyone?"

I've been married three times. And divorced three times; it never takes. The third one was the worst. "I don't mind that you're gone half the time," my wife told me. "I knew that when we got married. But you're not looking for a wife. You're looking for a mother to rock you to sleep."

"I've sworn off marriage," I say. "I'm always gallivanting off to some adventure or other."

WE WERE JUST KIDS—KIDS WITH DEATH IN OUR HANDS AND A SONG IN OUR HEARTS.

"You sound so much like him," Wendy says wistfully.

"No. Don't say that. It's not so." But even as I deny her words, I know she's right. He left his mark on me, just as he left it on her. When all the lost boys came home, I was the one who never fit in. At school, I told the other kids about our adventures with the pirates, the battles with the redskins, the long afternoons by the mermaids' lagoon. When kids called me a liar, I fought back with my fists and got a reputation as a troublemaker, a bad boy. When the other lost boys were promoted to the next grade, I was kept back. But by that time, it didn't really matter to me. I couldn't talk to them anymore. They were busy forgetting the island, forgetting Peter, adjusting to the real world.

Wendy is staring into the fire, ignoring me. I care about Wendy, you know. For all the nasty things I say, I care about her. Though she was just a little girl herself, she tried to be a mother to us all. She tucked us in, she told us stories. And Peter treated her worse than he treated any of the boys.

When he left us here, he promised to come back each spring and take her to Neverland for a week. She was supposed to go help with his spring cleaning.

I found her sitting by the open window the year that he forgot her. She wore a frock that looked too young for her. Though she was only eleven, she was growing up fast.

"What do you think has happened to him, Slightly?" she asked, peering out the window. "Do you think he's sick?"

"He's never sick." I told her. "The bastard just forgot." She slipped his mind. She didn't matter, any more than the rest of us mattered. I put my arms out to comfort her, but she ran away crying. And after that, she grew up quickly.

She looks up from the fire and meets my eyes. "It's almost spring," she says. "I wonder if he'll come this year. I think he will. I have a feeling that he'll come soon. Maybe tonight."

"Forget it, Wendy. Just forget it. Lock the window, for Christ's sake. He's gone."

Though she nods as if she agrees, her gaze returns to the fire. I stay for a little longer, then excuse myself. She smiles and hugs me when I go, but her thoughts are elsewhere.

When I leave Wendy's house, I go to my motorcycle and then hesitate, considering what Wendy said earlier. She's right—there's a feeling in the air, a sense of anticipation.

I wait in the darkness by the window to Jane's bedroom. Wendy's left it open, of course. I knew she would. It's dark, but her husband hasn't come home yet. He'll be home late and drunk, if I know the type. Through the window, I listen to Wendy read a Disneyfied version of Snow White to her daughter and bid her goodnight.

The blind at the kitchen window is up. I watch Wendy take a whiskey bottle from the cupboard and pour herself a glass. I wait in the darkness, watching Wendy drink.

My second wife once asked me about my family. I told her as close

HE LEFT HIS MARK ON ME JUST AS HE LEFT IT ON HER. I WAS THE ONE WHO NEVER FIT IN.

to the truth as I could manage. "My father left me and my mother when I was just a kid." She asked me if I had ever thought about trying to find my father. I said that if I ever found him, I would kill him for what he did to me.

He didn't mean to do it. He didn't know what he was doing. He was cocky, thoughtless, and innocently heroic. And he blighted my life. All my life, I have wanted to be like him. I run from continent to continent, from war to war, writing stories and books and searching for the great adventure that he always promised us. I look for a leader who laughs in the heart of the battle, sublimely confident in the way that only a boy can be.

I don't belong in this place, any more than Wendy does. But he left me here. And there's nowhere else to go.

He'll come tonight. I know he will. And I know that I would fly away with him if I could.

If he took me by the hand and told me I could fly, I would go back to the island with all its joys and terrors. I would follow him and join the lost boys once again.

But I can't go back. I lost my innocence long ago, now I have lost my youth as well.

Though I am only thirty years old, I feel ancient, worn-out, used up. The butterfly knife that I bought in the Philippines fits comfortably in my hand. I have learned a thing or two about fighting in my visits to various war zones. If I take him by surprise, I'll have a chance, I think.

Tonight, it's either Peter or me. And if he wins, he won't think twice. He'll slit my throat without hesitation, never recognizing his old companion. He'll laugh the careless laugh of childhood and fly off on the evening wind, eternally proud, eternally careless, eternally young. ∞

ANTIMATTER

UFO UPDATE.
The near-death experience and alien abduction may both be tied to childhood abuse

Are altered-state experiences in adulthood tied to childhood trauma and stress? Yes, says psychologist Ken Ring of the University of Connecticut in Storrs. Ring's latest study shows that people who report a UFO experience or claim a near-death experience (NDE) as adults are especially likely to have suffered abuse when young.

Ring's study profiled 170 people reporting UFOs and NDEs. Subjects filled out a detailed questionnaire, dredging up information on childhood homes, religious beliefs, and other factors. Ring then compared their answers with those of a control group not subject to altered states. Some results from the study were not that surprising. The survey revealed, for instance, that people reporting UFO abductions were psychologically similar to those reporting merely UFO sightings or NDEs. Ring also found that no matter what the nature of the altered state, those prone to such heightened experiences often became more spiritually oriented and sometimes even embraced a cosmic interpretation of events on Earth.

But the most controversial aspect of Ring's survey is the high incidence of disturbed childhoods—including physical mistreatment, sexual abuse, and neglect—among those reporting UFOs and NDEs. It turns out that these people were also more likely than others to recall psychic episodes from their childhood. Ring has proposed a daring interpretation of these findings.

It's well-known, he says, that children exposed to physical violence, sexual abuse, or a negative home atmosphere are strongly motivated to "tune out" those aspects of their world to dissociate themselves from the source of their troubles. "By doing so," Ring says, "they are more likely to tune in to other realities where they can feel safe regardless of what is happening to them." So this sensitivity to "alternate realities," brought on by childhood difficulties, might actually attune people to UFOs and NDEs as adults. If so, Ring says, their "extended range of perception" could be regarded as a "compensatory gift" for the physical and psychological "wounds" they suffered in childhood.

Ring's interpretation does not sit well with some child abuse experts. "Is it a hyperperception of reality or a distortion of reality?" asks a recognized authority on child abuse who does not wish to be quoted on "outrageous science" topics. "I'm more inclined to see these people as more susceptible to fantasy creation as a strategy of coping with pain, rather than a hypersensitivity to things that are really out there in an objective sense."

Byron Egeland, a professor of child development at the University of Minnesota who has done a lot of research on the causes and consequences of child abuse, concedes only that "it might be the case that somebody who had experienced a lot of hurt as a child is more sensitive as an adult." But the reason these people experience these bizarre phenomena, he says, "is not because they are more sensitive to them, but because they are very confused about what's real and what's fantasy. I can guarantee you that the majority of individuals who have those kinds of experiences are fairly disturbed individuals. I think their experiences are the result of the abuse."

Ring objects. "I do *not* want to pathologize these people," he says. "Survey participants reporting UFOs or NDEs are no more fantasy prone as a group than grocery store clerks or anyone else."—*PATRICK HUYGHE*

ANTIMATTER

REPTILIAN MOVIE PUBLICISTS

Video rental store managers frequently receive publicity packages promoting various movies. Usually the kits contain press releases and posters—not creatures that slither across the floor. But that's just what happened when the marketing department at Cinema International Corporation (CIC) came up with a new way to liven up its publicity campaign for *The Serpent and the Rainbow*, a film about voodoo distributed by the London-based company. CIC sent *live* 18- to 24-inch-long snakes to video rental stores around London. But the publicity campaign backfired when startled store managers and outraged animal lovers didn't find the idea of 700

unwanted snakes around town amusing. "We received dozens of letters of concern," says Royal Society for the Prevention of Cruelty to Animals (RSPCA) spokeswoman Liz Cook. "It did create publicity but it wasn't all good," says CIC's European marketing manager, Alistair Helm. "But we didn't just stick the snakes in boxes. We included instructions on how to care for them as well as a telephone number that people could call if they wanted the snakes picked up."

The silver and gray striped Chinese rat snakes are not poisonous, Helm says, and they were hand-delivered in clear plastic, aerated boxes marked LIVE ANIMALS.

But Atlanta Zoo reptile curator Howard Hunt says, "There are problems with that kind of delivery system. These animals are creatures of their environment. If they are put in the wrong place, left in the sun or cold, they will die." What's more, although instructions accompanying the snakes said that the animals didn't need to be fed for three months, Hunt says waiting that long could have been risky to the snakes' survival. "Three months is stretching it," he says. "And they do need water, too."

What ever happened to the 700 snakes? "Quite a few shop managers kept them. Others gave them to local zoos, pet shops, or whatever," Helm says. "They are perfectly safe to have as pets."

The publicity campaign for *The Serpent and the Rainbow* may be over, but CIC's snake troubles aren't. The RSPCA, says Cook, has filed charges of animal cruelty against the company. "To me, using snakes for publicity like this doesn't sound like a case of purposeful cruelty," says Hunt. "Instead, it's just one of those thoughtless acts done to snakes and other animals that people don't think much of."

—Sherry Baker

SKEPTICAL RESEARCH

Do parapsychologists implicitly believe in psychic phenomena? A recent survey conducted in Great Britain has thrown doubts on this assumption.

The study was carried out by Dr. Susan Blackmore, a research fellow at the Perceptual Systems Research Centre of the University of Bristol. Interested in studying the beliefs of parapsychologists as well as leading skeptics of the field, Blackmore ended up surveying 38 people from both camps and found that they had more common ground than disagreements. Both groups, for instance, felt that we know relatively little about psi. And both groups cited the lack of replicability in experimental research as the field's most critical problem.

What was even more surprising, however, was that believers and skeptics found themselves becoming increasingly skeptical with time. Especially in Great Britain, Blackmore learned, several psychic researchers became disillusioned with the field when it was discovered that Dr. S. G. Soal—the country's leading investigator in the Thirties—systematically falsified his research results. As one former proponent of the field explained to Blackmore, "I was, along with so many of the wise and good, persuaded by Soal's work that there must be something in it. But the discrediting of that work leaves me taking every study of positive results as a miracle story—to be dismissed on the basis of a knowledge that such things are impossible."

The primary difference between the believers and the skeptics in the Blackmore study concerned the field's future.

"Parapsychologists are more likely to think the findings indicate something about psi and thus are prepared to speculate about the implications," says Dr. Blackmore. "They are more hopeful about resolving the problems, especially if more funding were forthcoming. However, many express skeptical views about the notion of psi and are unconvinced by much of the experimental laboratory work."—D. Scott Rogo

GREAT BRITAIN'S PSYCHIC RESEARCHERS. DISILLUSIONED WITH THE PARAPSYCHOLOGY FIELD

THE THERAPEUTIC TOUCH

UFO abduction researcher Budd Hopkins is hopping mad. Rima Laibow, a New York psychiatrist, is arguing that hypnotic regression and any other therapeutic aspects of UFO abduction research should be handled by mental health professionals, not UFO investigators. What's more, she thinks these therapists should be paid, a new twist in a field that has hitherto relied on volunteers.

Laibow gives Hopkins and other abduction researchers their due but feels it is time for them to move over now that mental health professionals are available. Says Laibow, "The nonprofessional is unqualified to deal with the complex psychodynamic questions that arise during hypnotic regression and after."

Hopkins, however, is not convinced that therapists are the only ones who can deal compassionately with abduction victims or do hypnosis. He does "de facto" therapy, he says, when talking to and calming abductees but refers abductees to therapists when they need professional help. More important, he claims that abductees don't want to be patients, they want to know what happened to them. What worries Hopkins most is that some therapists "are price gougers" who are doing it for the money. "I have already had to drop one psychiatrist from my network for this," he says.

—Paul McCarthy

IN THE STARS

The best way to get a skeptic to embrace astrology may be through a flattering horoscope. That's what psychologist Peter Glick and associates at Lawrence University found when they conducted a test of the Barnum effect.

Barnum statements are generalized personality descriptions such as "Though you are a friendly person, at times you are shy." The Barnum effect says that people tend to find these statements accurate even though they could apply to virtually anyone.

Glick gave either negative or positive Barnum statements to believers and skeptics alike. Some were told these were personalized horoscopes, however, while others were told that the statements were just descriptions that might or might not apply to them.

Both skeptics and believers rated the so-called astrological descriptions more accurate than the same statements not labeled astrological in origin. But surprisingly, skeptics who received favorable horoscopes became significantly more positive in their view of astrology itself.

Psychologist Ray Hyman of the University of Oregon thinks the Lawrence University team should go back and quiz the subjects again. Were the skeptical subjects truly skeptical about all the areas of pseudoscience, or just astrology in particular? he asks. If they accepted even a few mystical beliefs, he notes, that could explain the results.

—Paul McCarthy

The Artist

CARGOES

CONTINUED FROM PAGE 64

Christine that morning. To Johnson's untrained eye they seemed to be strange hybrids of pomegranate and pawpaw, cantaloupe and pineapple. There were giant tomatolike berries and clusters of purple grapes each the size of a baseball. Together they glowed through the overheated light like jewels set in the face of the sun.

By now, four months after his arrival on the *Prospero*, the onetime garbage island had become a unique botanical garden, generating new species of trees, vines, and flowering plants every day. A powerful life engine was driving the island. As she crossed the lagoon in her inflatable, Christine stared at the aerial terraces of vines and blossoms that had sprung up since the previous weekend. The dead hulk of the *Prospero*, daylight visible through its acid-etched plates, sat in the shallow water, the last of its chemical wastes leaking into the lagoon. But Johnson had forgotten the ship and the voyage that had brought him here, just as he had forgotten his past life and unhappy childhood under the screaming engines of Nassau airport. Lolling back in his canvas chair, on which was stenciled COLONEL POTTLE U.S. ARMY ENGINEER CORPS, he felt like a plantation owner who had successfully subcontracted a corner of the original Eden. As he stood up to get Christine, he thought only of the future, of his pregnant bride and the son who would soon share the island with him.

'Johnson! My God, what have you been doing?' Christine ran the inflatable onto the beach and sat back, exhausted by the buffeting waves. "It's a botanical madhouse!"

Johnson was so pleased to see her that he forgot his regret over their weekly separations. As she explained, she had her student classes to teach, her project notes and research samples to record and catalog.

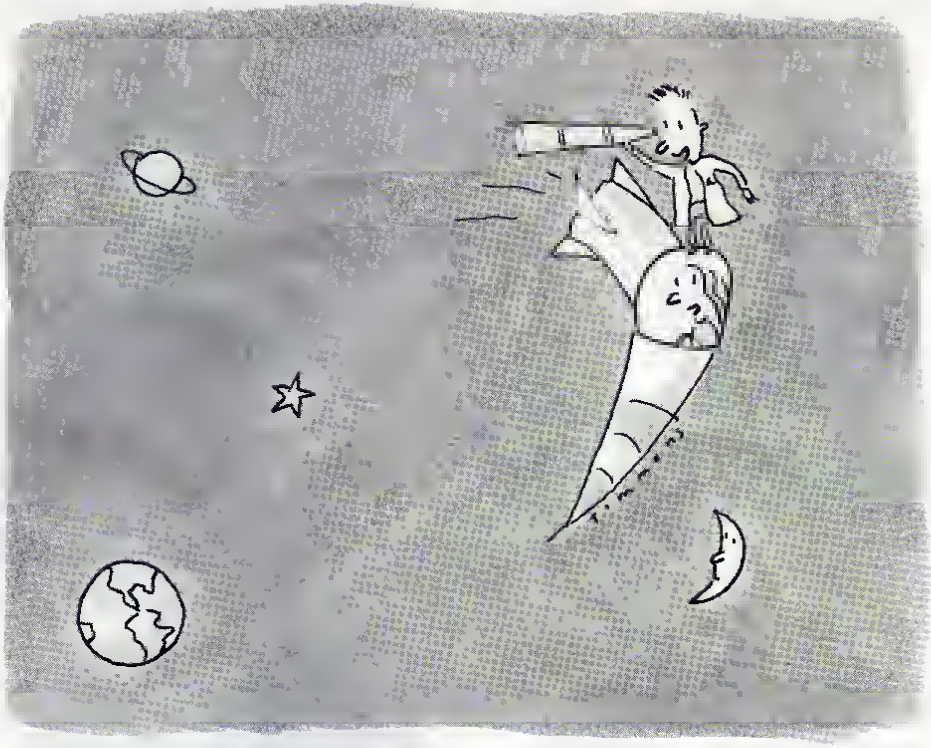
"Dr. Christine . . . ! I waited all day!" He stepped into the shallow water, a carmine surf filled with glowing animalcula, and pulled the inflatable onto the sand. He helped her from the craft, his eyes avoiding her curving abdomen under the smock.

'Go on, you can stare . . .' Christine pressed his hand to her stomach. 'How do I look, Johnson?'

'Too beautiful for me, and the island. We've all gone quiet.'

'That is gallant—you've become a poet, Johnson.'

Johnson never thought of other women and knew that none could be so beautiful as this lady biologist bearing his child. He spotted a plastic cooler among the scientific equipment. 'Christine—you've brought me ice cream . . .'



Consider The News From A Whole New Perspective.

Journey beyond the headlines to a world of news and knowledge on National Public Radio's All Things Considered.

Whether it's a superpower summit or an expedition to the top of Mount Everest . . . we give each story something that's missing from most news broadcasts . . . time.

The time we take makes All Things Considered a different kind of news . . . refreshingly intelligent and insightful . . . with commentary that challenges and ideas that energize.

Take a journey through today's news . . .

ALL THINGS CONSIDERED®

We Think You'll Find The Difference Considerable.

Check local listings for your public radio station or call NPR at (202) 822-2323.

National Public Radio® News

"Of course I have. But don't eat it yet. We've a lot to do, Johnson."

He unloaded the stores, leaving to the last the nylon nets and spring-mounted steel frames in the bottom of the boat. These bird traps were the one cargo he hated to unload. Nesting in the highest branches above the island was a flock of extravagant aerial creatures, sometimes swallows and finches whose jeweled plumage and tall fans transformed them into gaudy peacocks. He had set the traps reluctantly at Christine's insistence. He never objected to catching the phosphorescent fish with their enlarged fins and ruffs of external gills, which seemed to prepare them for life on the land, or the crabs and snails in their baroque armor. But the thought of Christine taking these rare and beautiful birds back to her laboratory made him uneasy—he guessed they would soon end their days under the dissection knife.

"Did you set the traps for me, Johnson?"

"I set all of them and put in the bait."

"Good." Christine heaped the nets on to the sand. More and more she seemed to hurry these days, as if she feared that the experiment might end. "I can't understand why we haven't caught one of them."

Johnson gave an eloquent shrug. In fact he had eaten the canned sardines and released the one bird that had strayed into the trap below the parasol of a giant cycad. The nervous creature with its silken scarlet wings and kitelike tail feathers had been a dream of flight. "Nothing yet—they're clever, those birds."

"Of course they are—they're a new species." She sat in Colonel Pottle's chair, photographing the table of fruit with her small camera. "Those grapes are huge—I wonder what sort of wine they'd make. Champagne of the gods, grand cru . . ."

Warily Johnson eyed the purple and yellow globes. He had eaten the fish and crabs from the lagoon, when asked by Christine, with no ill effects, but he was certain that these fruits were intended for the birds. He knew that Christine was using him, like everything else on the island, as part of her experiment. Even the child she had conceived after their one brief act of love, over so quickly that he was scarcely sure it had ever occurred, was part of the experiment. Perhaps the child would be the first of a new breed of man and he, Johnson, errand runner for airport shoeshine boys, would be the father of an advanced race that would one day repopulate the planet.

As if aware of his impressive physique, she said, "You look wonderfully well, Johnson. If this experiment ever needs to be justified . . ."

"I'm very strong now—I'll be able to look after you and the boy."

"It might be a girl—or something in between." She spoke in a matter-of-fact way that always surprised him. "Tell me, Johnson, what do you do while I'm away?"

"I think about you, Dr. Christine."

"And I certainly think about you. But do you sleep a lot?"

"No. I'm busy with my thoughts. The time goes very quickly."

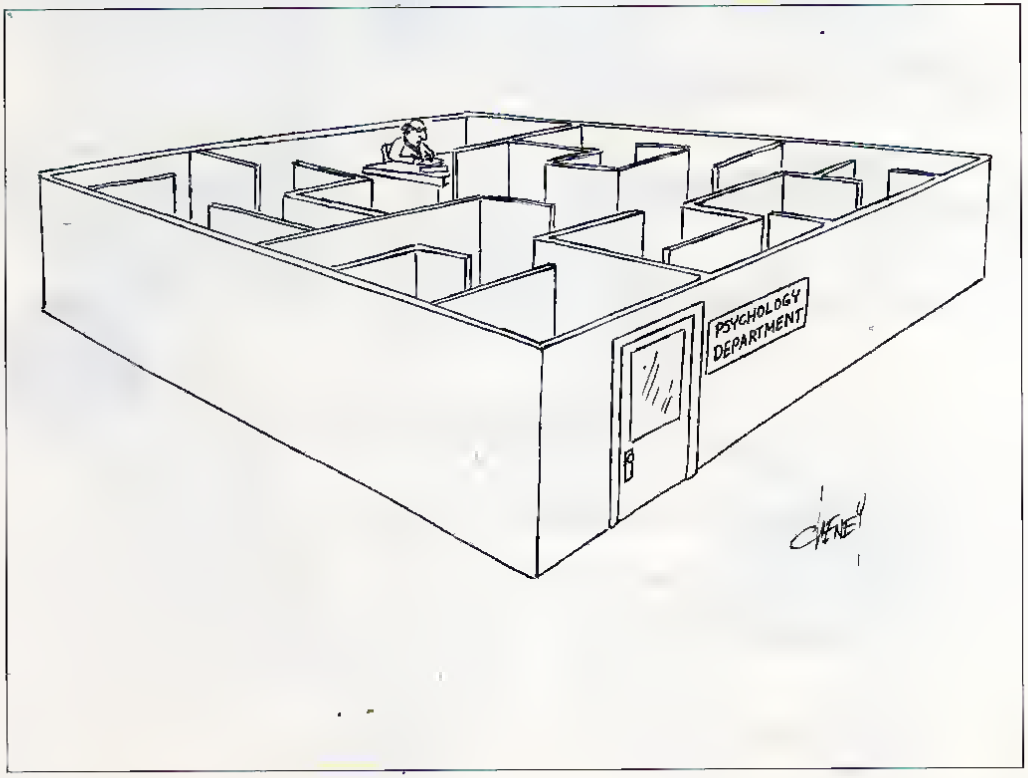
Christine casually opened her notepad. "You mean the hours go by without you noticing?"

"Yes. After breakfast I fill the oil lamp and suddenly it's time for lunch. But it can go more slowly, too. If I look at a falling leaf in a certain way it seems to stand still."

"Good. You're learning to control time. Your mind is enlarging, Johnson."

"Maybe I'll be as clever as you, Dr. Christine."

"Ah, I think you're moving in a much more interesting direction. In fact, Johnson, I'd like you to eat some of the fruit. Don't worry, I've already analyzed it, and I'll have some myself." She was cutting slices of the melon-sized apple. "I want the baby to try some."



Johnson hesitated but as Christine always reminded him none of the new species had revealed a single deformity

The fruit was pale and sweet with a pulpy texture and a tang like alcoholic mango. It slightly numbed Johnson's mouth and left a pleasant coolness in the stomach

A diet for those with wings

Johnson! Are you sick?"

He woke with a start, not from sleep but from an almost too clear examination of the color patterns of a giant butterfly that had settled on his hand. He looked up from his chair at Christine's concerned eyes, and at the dense vines and flowering creepers that crowded the porch, pressing against his shoulders. The amber of her eyes was touched by the same overlit spectrum that shone through the trees and blossoms. Everything on the island was becoming a prism of itself.

'Johnson, wake up!'

'I am awake, Christine . . . I didn't hear you come.'

'I've been here for an hour.' She touched his cheeks, searching for any sign of fever and puzzled by Johnson's distracted manner. Behind her, the inflatable was beached on the few feet of sand not smothered by the vegetation. The dense wall of palms, lianas, and flowering plants had collapsed onto the shore. Engorged on the sun, the giant fruits had begun to split under their own weight, and streams of vivid juice ran across the sand, as if the forest was bleeding.

'Christine? You came back so soon . . . ?' It seemed to Johnson that she had left only a few minutes earlier. He remembered waving good-bye to her and sitting down to finish his fruit and admire the giant butterfly, its wings like the painted hands of a circus clown.

Johnson—I've been away for a week.' She held his shoulder, frowning at the unstable wall of rotting vegetation that towered a hundred feet into the air. Cathedrals of flower-decked foliage were falling into the waters of the lagoon.

'Johnson, help me to unload the stores. You don't look as if you've eaten for days. Did you trap the birds?'

'Birds? No, nothing yet.' Vaguely Johnson remembered setting the traps, but he had been too distracted by the wonder of everything to pursue the birds. Graceful, feather-tipped wraiths, like gaudy angels, their crimson plumage leaked its ravishing hues into the air. When he fixed his eyes onto them they seemed suspended against the sky, wings fanning slowly as if shaking the time from themselves.

He stared at Christine, aware that the colors were separating themselves from her skin and hair. Superimposed images of herself, each divided from the others by a fraction of a second, blurred the air around her, an exotic plumage that sprang from her arms and shoulders. The staid reality that had trapped them all was beginning to dissolve. Time had stopped, and Christine was ready to rise into the air. . . . He would teach Christine and the child to fly.

'Christine, we can all learn . . .'

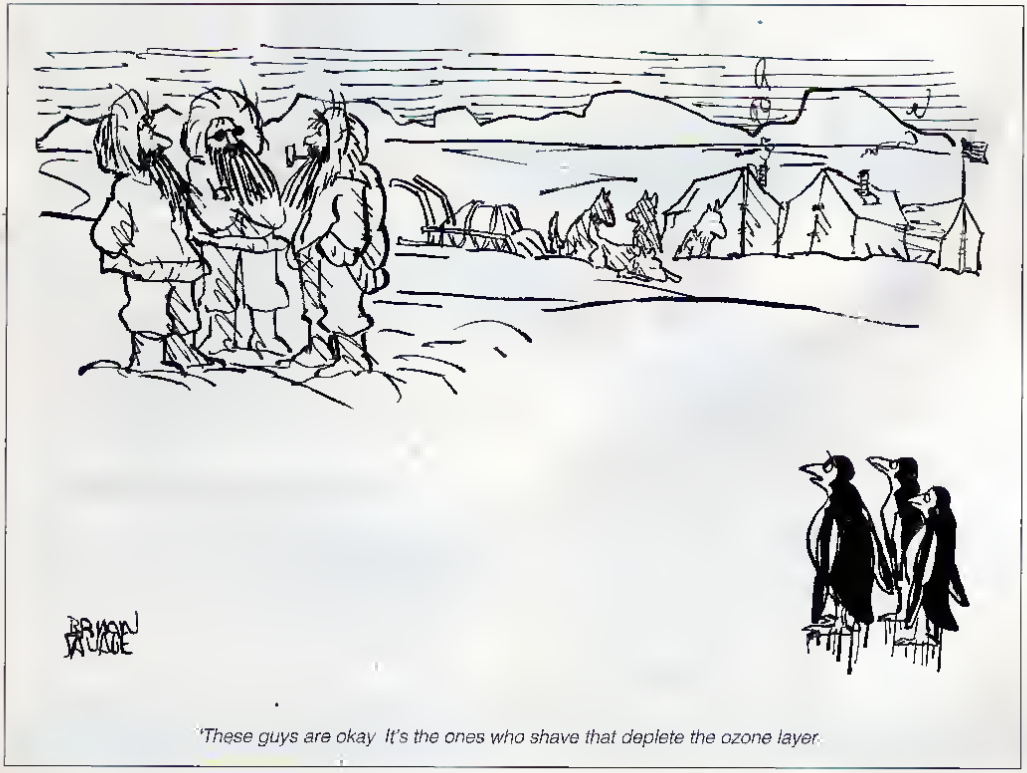
"What, Johnson?'

'We can learn to fly. There's no time anymore—everything's too beautiful for time.'

'Johnson, look at my watch.'

'We'll go and live in the trees, Christine. We'll live with the high flowers.' He took her arm, eager to show her the mystery and beauty of the sky people they would become. She tried to protest but gave in, humoring Johnson as he led her gently from the beach house to the wall of inflamed flowers. Her hand on the radio transmitter in the inflatable, she sat beside the crimson lagoon as Johnson tried to climb the flowers toward the sun. Steadying the child within her, she wept for Johnson, only calming herself two hours later when the siren of a naval cutter crossed the inlet.

"I'm glad you radioed in," the U.S. Na-



'These guys are okay. It's the ones who shave that deplete the ozone layer.'

vy lieutenant told Christine. One of the birds reached the base at San Juan. We tried to keep it alive but it was crushed by the weight of its own wings. Like everything else on this island.'

He pointed from the bridge to the jungle wall. Almost all the overcrowded canopy had collapsed into the lagoon, leaving behind only a few of the original palms with their bird traps. The blossoms glowed through the water like thousands of drowned lanterns.

'How long has the freighter been here?' An older civilian, a government scientist holding a pair of binoculars, peered at the riddled hull of the *Prospero*. Below the beach house two sailors were loading the last of Christine's stores into the inflatable. 'It looks as if it's been stranded there for years.'

'Six months,' Christine told him. She sat beside Johnson, smiling at him encouragingly. 'When Captain Johnson realized what was going on he asked me to call you.'

'Only six? That must be roughly the life cycle of these new species. Their cellular clocks seem to have stopped—instead of reproducing, they force-feed their own tissues, like those giant fruit that contain no seeds. The life of the individual becomes the entire life of the species.' He gestured toward the impassive Johnson. 'That probably explains our friend's altered time sense—great blocks of memory were coalescing in his mind, so that a ball thrown into the air would never appear to land.' A tide of dead fish floated past the cutter's bow, the gleaming bodies like discarded costume jewelry.

'You weren't contaminated in any way?' the lieutenant asked Christine. 'I'm thinking of the baby.'

'No. I didn't eat any of the fruit.' Christine said firmly. 'I've been here only twice, for a few hours.'

'Good. Of course, the medical people will do all the tests.'

And the island?'

'We've been ordered to torch the whole place. The demolition charges are timed to go off in just under two hours, but we'll be well out of range. It's a pity, in a way.'

'The birds are still here.' Christine said, aware of Johnson staring at the trees.

'Luckily, you've trapped them all.' The scientist offered her the binoculars. 'Those organic wastes are hazardous—God knows what might happen if human beings were exposed to long-term contact. All sorts of sinister alterations to the nervous system—people might be happy to stare at a stone all day.'

Johnson listened to them talking, glad to feel Christine's hand in his own. She was watching him with a quiet smile, aware that they shared the conspiracy. She would try to save the child, the last fragment of the experiment, and he knew that if it survived it would face a fierce challenge from those who feared it might replace them.

But the birds endured. His head had cleared, and he remembered the visions that had given him a brief glimpse of another, more advanced world. High above the collapsed canopy of the forest he could see the traps he had set, and the great crimson birds sitting on their wings. At least they could carry the dream forward.

Ten minutes later, when the inflatable had been winched onto the deck, the cutter set off through the inlet. As it passed the western headland the lieutenant helped Christine toward the cabin. Johnson followed them, then pushed aside the government scientist and leapt from the rail, diving cleanly into the water. He struck out for the shore, a hundred feet away, knowing that he was strong enough to climb the trees and release the birds, with luck a mating pair who would take him with them in their escape from time. ∞

From the collection War Fever, *to be published by Farrar, Straus & Giroux, Inc. in April 1991.*

INTERVIEW

CONTINUED FROM PAGE 80

cycle the refrigerator when its lifetime is over. Put a recycling system in your car air conditioner. You keep on nibbling away, making CFCs more unnecessary. However, it's not yet clear CFCs are breaking down the ozone layer. The oceans are filled with seaweed full of organic bromine and chlorine that appear to decay and damage the ozone layer, too.

We don't know that 99.9 percent of the ozone layer damage isn't due to natural sources.

Omni: Won't that rampant pollution catch up with us?

Ames: People will have to start thinking more long-term. When somebody buys a fridge, they're not willing to buy one that costs a hundred dollars extra because it has insulation, even though it'll save five hundred dollars in energy costs over the appliance's lifetime. The country should arrange incentives so that people will invest in things like that.

Currently, regulatory agencies give utilities profits based on how much electricity they sell. It's crazy. They should be giving utilities profits when people conserve energy. We can save a lot of energy. Conservation of energy is the best thing the environmentalists can recommend.

The best way to give rats cancer is to feed them extra calories. Cutting calories by thirty percent almost doubles their life expectancy, and their cancer rate goes way down. Too much fat is bad for you; obesity is bad for you.

People shouldn't worry about minuscule risks. Life expectancy is getting longer. Cancer rates aren't going up except for smoke-induced cancer. The best advice for a long life is to do what your mother told you. Eat a balanced diet. Don't drink too much; don't smoke at all. Eat lots of fruits and vegetables. They're very good for you, despite the fact that they're full of small amounts of natural carcinogens.

Omni: In the early Seventies, your discovery of the mutagenicity of some man-made chemicals helped tighten regulations governing their use. You were the darling of the environmental movement.

Ames: At the time, all of us in the field felt that since there were all these new chemicals coming in, we should give them a hard look. So we started testing man-made chemicals and found many to be carcinogens. Everybody got scared. But when people tested natural chemicals, they found just as many carcinogens.

Now we've learned a lot more about cancer and are more skeptical about extrapolation from high to low doses. We understand more about the body's natural defenses. But some people are still stuck in the ideas of ten to fifteen years ago.

Everything in life is full of one-in-a-hundred-thousand risks. For some cancers there are one-in-a-hundred risks. So if the EPA is spending all its time trying to protect the public against one-in-a-million hypothetical risks—which it's doing to a large extent—then it's spending its time on trivia. Certainly there are reasons for not having every chemical company dump its garbage out the back door, but that's a different matter. We should have reasonable rules but not spend a high percentage of the GNP trying to eliminate that last bit of pollution.

We're spending eighty billion dollars a year trying to control pollution. Although much of this is useful, I think it will have little influence on public health. And we're spending only eight billion dollars a year on all the science in the United States.

Our lab alone is working on three or four risks that might be one-in-a-hundred risks. The EPA is trying to prevent one-in-a-million risks. The answers that will improve public health are likely to come from scientific research, not regulatory agencies.

Omni: Why have the environmentalists turned on you?

Ames: They don't seem to want to know what the scientific community as a whole thinks.

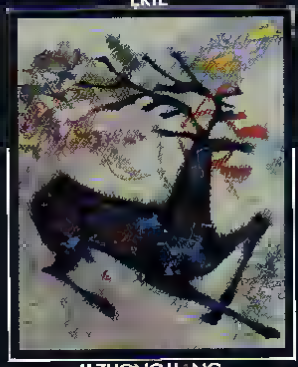
They seem to go to one end of the opinion spectrum and exaggerate it. Per-

ERTÉ

KEITH HARING

RAPHAEL SOYER

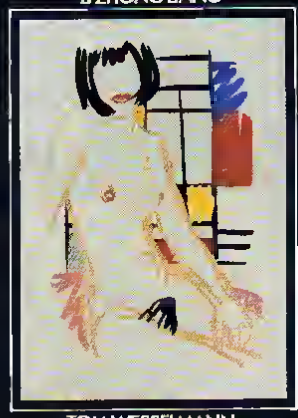
R.C. GORMAN



LI ZHONG LIANG

MARK KOSTABI

BOB GRUEN



TOM WESSELMANN

THOMAS McKNIGHT

CRASH

haps because they have incentives to scare people to get power and more members. The attitude too often seems to be, 'You people in industry are working for greed, and we're working for virtue,' and we know better. Feeling virtuous is a tremendous motivation. The idea that 'we're out for the good of humanity and industry is working for greed' gets a lot of mileage. That's what drove the socialists. And it was all hogwash.

Omni: When you say environmentalists, does that include the Natural Resources Defense Council?

Ames: Yes, they're one of the worst.

Omni: Are some environmentalists willing to listen to you?

Ames: I'm an environmentalist. Everybody's an environmentalist. We'd all like to see less air pollution and a more healthy public. Nobody wants the world to warm up. It's just a question of tradeoffs and how you get from A to B.

Omni: Why did you agree to testify against Tris?

Ames: The government made a rule that kids' pajamas could not be sold unless they contained a flame retardant. Of course they hadn't done any testing on the flame retardant. They just wanted something that wouldn't burn due to excessive CO_2. They might have been happy with everyone in an asbestos nightshirt. But the main reason houses catch on fire is that parents have some beers and fall asleep with a cigarette burning. Putting kids in asbestos nightshirts is not the way to solve that. I'm not sure I necessarily favored a ban on Tris. I just don't think it's the government's job to coerce parents into putting their kids into pajamas laden with flame retardants they'd never tested.

Omni: In your ranking of various cancer risks, one you've rated fairly high is air in mobile homes. Why?

Ames: You breathe in twenty thousand quarts of air a day. You drink one quart of water a day. So if there's a part per million in the air and in the water, you're going to get many times more from the air. In a factory, if there's a chemical in the air, a worker breathing it in can get a pretty big dose in a day. It's pretty hard to poison yourself with water. The little bit of formaldehyde from the insulation in mobile homes can be a problem because you breathe in a lot of air.

Omni: Since that time you've drifted scientifically and ideologically away from the environmental groups.

Ames: Some of the ones I know are socialists. I tend to believe in markets. With the right incentives, with choice and competition, you're better off in everything. In any case, people on the Left tend to distrust business, especially if it's making a profit. They tend to be distrustful of industry producing pollution. My view is that we should charge industry for producing pollution, rather than having air and water free.

Omni: What risks are you working on?

Ames: We're doing work on antioxidant and folic acid deficiencies and other dietary imbalances. One reason people are not getting enough of these is they're not eating enough fruits and vegetables. Folic acid deficiencies cause chromosome breaks. We're working on several other things, but I don't want to talk about them until we know more.

Omni: Were you wrong when you agreed with the "one-molecule" theory, the concept that ingesting one molecule of a mutagen could cause mutation in an organism's cells?

Ames: We've all learned a lot since then. Every cell in your body is filled with hundreds of thousands of molecules of carcinogens, just naturally. The one-molecule theory isn't even true for radiation. You can give a human cell little doses of radiation and it becomes resistant to high doses. For many chemicals, such as saccharin, it's the high dose itself that's causing the cancer, not the chemical at any dose. I wouldn't be where I am in science if I weren't always questioning myself and rethinking assumptions.

So is that about it? I'd like to get back to my lab. I'd really like to solve aging before my neurons go out.

Omni: Is that why you're so pressed for time?

Ames: Well, I'm working on things that are real risks to the public. And I don't like to take away from that.

Omni: In the preface to one of your papers you describe your field, genetic toxicology, in Dante-esque terms as being in the "dark wood" of its development. Is that still true?

Ames: The science has been pretty murky. What causes cancer is not an easy problem. We thought DNA damage was the whole story, but it's turning out to be only part of it. One thing we can be optimistic about is that life expectancy is going to get longer faster—because there are so many good scientists all over the world working on the problem. Every good-sized country that becomes rich, like Japan, contributes another hundred thousand scientists. South Korea's starting to contribute scientists. So there are more and more people interacting, processing this knowledge and turning up things. Life is changing faster and faster, and that's what people are a little nervous about. They want to go back to a life they remember when they were young. But I'm a believer in progress. A few hundred years ago, even royalty led short lives. Now just about anybody in the developed world can have a long, happy life if they don't do themselves in. **OO**

POISON

CONTINUED FROM PAGE 48

tible to biochemical attack through water supplies agricultural products or food processing plants

Nor does an escalating biochemical arms race take fully into account the environmental devastation that could be unleashed as a result of the use of biological agents On a theoretical level at least perhaps the most appealing biological weapons are those that can be tailored to reside in common bacterium especially bacteria that are common to human physiology

Design and produce for example a toxic bacterium that lives quite comfortably in the human stomach Because the cause for which you fight is just tailor the organism so that it can reproduce Use it against your enemy As the weapon wreaks its havoc it also makes more weapons a vicious cycle necessary to ensure victory for your cause

But isn t there a flaw in that argument? Isn t there the possibility that the multiplying weapon will wend its way back behind your own lines, attacking your own population?

There may be a way around that Target your weapon to attack and kill only specific genetic signatures That way you can eliminate whole ethnic groups, without worrying too much that your attack will backfire

None of these weapons exist yet, and they may never be produced Genetic research is costly and complex It s one thing to imagine a designer weapon, quite another to design and build it It may in fact be easier to build nuclear weapons than to tailor genetic bombs Many scientists feel that highly sophisticated genetic weapons will remain theoretical concepts rather than battlefield tools On the other hand it might well be easier to build a large arsenal of biochemical agents than a huge nuclear stockpile

More likely though, is a scenario in which traditional biochemical weapons—toxic gases or diseases such as anthrax—are enhanced in the laboratory made more powerful and harder to stop

Research into the enhancement of known toxins and biological agents is widespread today and will spread farther tomorrow

Virtually every developed nation is currently funding research in areas that can easily be adapted to produce weapons Much of that research is justified as necessary for defensive purposes, or even as medical science

"How do you know what's going on in a biological research center?" says H J McGeorge "Most nations have dozens of them How do you know if someone is doing biological research on a disease in order to find a cure for that disease, or if they are trying to figure out how to package that disease? This conundrum has haunted all attempts to arrive at a comprehensive ban on biological and chemical weapons research

And so a new arms race seems about to burst into full bloom even as we discuss the abandonment of the nuclear standoff Pandora's box gapes once more, with chemical and biological weapons pouring out Because of their nature, these modern plagues may prove harder to stop and more difficult to ban than any weapons previously employed

TERRORISM AND THE BIOCHEMICAL CONNECTION

From 1968 to 1980 the CIA recorded 22 terrorist incidents around the world in which "exotic pollutants," including chemical radiological, and biological materials, were used Apparently none involved weapons per se and they accounted for a very small fraction of all terrorist acts during that period Of these incidents, most occurred in 1978

and involved the injection of mercury into Israeli and Spanish citrus fruit. Discovered throughout Europe, the poisoned fruit caused injury and illness. No one died.

But inspired by the panic these incidents had caused, terrorists—not to mention misfits, lunatics, and extortionists—knew they had stumbled on a formidable new instrument of political coercion and intimidation.

Bolstered by early successes, terrorists soon returned and added fresh victims. In the spring of 1985, scores of SmithKline Beecham's (formerly Smith-Kline Beckman) Contac, Teldrin, and Dietac capsules were contaminated with warfarin, an anticoagulant and the active ingredient in rat poison. (Johnson & Johnson's Tylenol capsules had also been tampered with, causing several deaths.) A few days later, not surprisingly, the U.S. and British press reported a sharp rise in copycat threats. Most were hoaxes. Many were not. In March 1985, perhaps as 24,000 pints of Northern Dairies (UK) brand milk was contaminated with gasoline. The adulteration was discovered only after tainted milk had been distributed to three communities. Miraculously, no one was injured. UK police maintain the contamination was deliberate.

A new high in perversion, ingenuity, and sophistication marked the celebrated court appearance of two followers of Guru Bhagwan Shree Rajneesh in 1986. Sheela Patel and Diana Onang were accused of attempting to influence a county election in Oregon by infecting four restaurants in the town of The Dalles with the bacterium *Salmonella typhi*. Onang, a Filipino nurse, manufactured *S. typhi* in a laboratory that the cult maintained on its Oregon ranch. Patel and Onang pleaded guilty to attempted murder and tampering with consumer products.

Terrorism is the ultimate psychological weapon. Like a rattlesnake, it first uses noise and if intimidation fails, it strikes. Growing political convulsions around the world, the relative ease with which chemical weapons can be produced, and the advent of genetic engineering have reawakened fears of a new type of one-two punch assault on food, medicine, drinking water, and crops. There is even talk of "ethnic specific" biochemical agents "programmed" to disable certain races.

The Public Safety Group of Woodbridge, Virginia, which has recorded at least 250 incidents involving the threat to use, or actual use of, biochemical agents—including salmonella and tularemia—has disclosed that the German Red Army Faction and the French Action Directe were once involved in the preparation of botulin, a toxin that causes acute and sometimes fatal food poisoning.

There has been and continues to be in contravention of U S rules much research involving genetic manipulation Designer genes are spliced to alter a harmless organism by making it lethal to increase the lethality of other organisms and to produce organisms resistant to diseases such as cholera Reliable sources have told *Omni* that a clandestine laboratory on a yacht plying the waters off the coast of Algeria may now be producing undisclosed toxins ostensibly for use by Algerian terrorists

Could this happen closer to home? Could attempts be made to poison our water supplies to turn golden grains into deadly crops to saturate a large urban center with fast-spawning virulent microbes? Unlikely

Although the means exist to do so under controlled lab conditions, the amount of an agent needed, say to infect a reservoir or contaminate basic staples would have to be astronomically high To sow the seeds of panic and to reap the fruits of paranoia, as we have seen is easier Terrorists have honed the practice to an art The biochemical connection broadens the menace and adds to the vulnerability ☒

CREDITS

Page 6 top left: Deborah R Fowler, Przemyslaw Prusinkiewicz 1989. **page 6 top right:** Patrick Aventurier/Gamma-Liaison; **page 6 bottom center:** Anita Kunz; **page 10:** Inge Morath/Magnum Photos; **page 14:** John Stuart **page 16 clockwise from top left:** John Stuart, John Stuart, Mark Weinstein, Gary Lilien **page 24:** Stanislaw Fernandes **page 25:** A Nogues/Sygma **page 28:** Sabolich Prosthetic Research Center **page 30:** John Bennett **page 33:** ©1990 David Turnley/Detroit *Free Press*/Black Star **page 34:** Randee St. Nicholas ©1985 **page 35 top:** Martin Dohrn/Photo Researchers; **page 35 bottom:** ZAN Productions; **page 36 top:** Dan McCoy **page 36 bottom:** Dr R Robert Robbins/University of Texas; **page 3a top:** Stephen Dalton/Animals Animals **page 36 bottom:** John Roca/LGI Photo Agency **page 40 top:** Gary M Hopkins **page 40 bottom** Donna Day **page 42:** Hans Jurgen Burkard/Bilderberg **page 43** Don Jones/Gamma Liaison **page 44 top left** Terry Arthur/Gamma Liaison **page 44–45** Masterfile **page 46** Brown Brothers **page 50** Jana Brenning **page 51** Zigy Kaluzny **page 52 top** Jana Brenning **page 52 bottom** Zigy Kaluzny **page 65:** Przemyslaw Prusinkiewicz 1988 **page 66:** Deborah R Fowler James Hanan 1990 **page 67 top** F David Fracchia Aristid Lindenmayer Martin J M de Boer 1989 **page 67 center** W J Dictus University of Utrecht **page 68–69** CIRAD Modelisation Laboratory **page 69 top** Deborah R Fowler Allan Snider 1990 **page 70** Deborah R Fowler 1988 **page 71 top** Deborah R Fowler Norma Fuller James Hanan Allan Snider 1990 **page 71 bottom right** Przemyslaw Prusinkiewicz Deborah R Fowler 1990 **page 71 center left** Deborah R Fowler Przemyslaw Prusinkiewicz 1989 **page 89** Joanie Schwarz **page 90** James Marsh **page 91** Stemer Lund **page 114–115 clockwise from top left:** ZAN Productions Franklin ZAN Productions Masterfile ZAN Productions Ascom Communications Inc **page 116 top:** ©Nintendo of America/Hitt & Knowlton Inc **page 118 bottom:** ©Tengen Roger & Associates **page 120** Randy Mayor **page 122:** ©1990 Martin Traider

STAR TECH

ACCESSING THE FUTURE

BUT CAN IT TYPE?

The Intelligent Dialer stores schedules and dials numbers automatically. Contact: Sony, Park Ridge, NJ; (201) 930-1000. Cost: $64.95.

FINDER OF WORDS

Is the word you're looking for on the tip of your tongue? The Speaking Wordmaster can help you find it. The electronic thesaurus can supply 487,000 synonyms and pronounce 50,000 words. Contact: Franklin Electronic Publishers, Mount Holly, NJ; (609) 261-4800. Cost: $149.95.

NAME CALLING

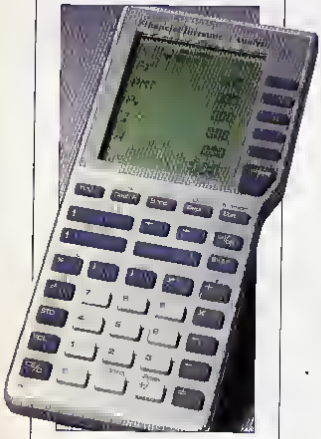
With the Voiceprint telephone, you don't even need to let your fingers do the dialing. Just say who you want to call, and the Voiceprint telephone automatically. The Model 200 (shown) can also screen incoming calls and keep a record of the last 50 calls received. Contact: ASCOM Communications, Lodi, NJ; (201) 470-5706. Cost: $249.95.

TICK, TOCK

Does changing time zones make you tired and irritable? Taking Bioclok will help conquer jet lag. The compact computer tells you when to expose yourself to light or dark to adjust your inner clock. Contact: The Marketing Clinic, Keene, NH; (800) 388-9836. Cost: $99.

SMART INVESTOR

Keep track of your money's ups and downs and evaluate new financial opportunities with the Financial Investment Analyst. Contact: Texas Instruments, Dallas, TX; (800) 842-2737. Cost: $150.



OH, JAMES...

If you've always wanted the ultimate high-tech house, the Butler-in-a-Box Series II is the gadget of your dreams. It gives you voice control of many appliances. Contact: Mastervoice, Los Alamitos, CA; (213) 594-6581. Cost: $3,995.

CHOOSE YOUR FUTURE

MIND MACHINE

Expand your knowledge – and your understanding – with the magazine that takes you to the frontiers of modern science and beyond. Health. Technology. Space. Society. Human relationships. Science fiction. The exploration of mind. *Lowest possible price! One year, only $17.97 – save $24.03 over what you'd pay at the newsstand!*

If you've got a computer at home, you're leading the most exciting consumer technological evolution since TV. Every month – how to make your home office more productive – discovery software to light your kids' imaginations – the hottest new games, new products – and more! Separate sections for IBM compatibles, Amiga, Commodore 64/128 and Mac users. *Only $12.97 for 12 jam-packed issues!*

OR BOTH

YES! I want the future now!

HNMN6

Please send me one year (12 issues) of –

☐ Omni for only $17.97! That's a savings of $24.03 (57%) off the newsstand rate of $42.00!

☐ Compute for only $12.97 – a full $22.43 (63%) off the newsstand rate of $35.40!

☐ **BOTH!** Omni and Compute, every month, for an unbelievable $30.94. I'm saving a whopping $46.46 off the combined newsstand rate of $77.40!

Name_____

Address_____

City_____ State_____ Zip_____

Send no money now. We'll bill you later!

The regular subscription price for 12 issues is $24.00 for OMNI and $19.94 for COMPUTE. Canada and elsewhere add $4.00 per subscription, payable in U.S. funds only.

Mail to: Omni/Compute, P.O. Box 3026, Harlan, Iowa 51593

VIDEO GAMES

BEST OF THE YEAR

Battling monsters or becoming God is easier than choosing the most outstanding video games

Last year saw a turning point in video game technology—a decisive decline of the eight-bit Nintendo Entertainment System (NES) and the rise of a new generation of upscale 16-bit game systems with superior sound, graphics, and sophistication. A few Nintendo cartridges rose to the top, but overall, the hottest video games of 1990 were created for the Sega Genesis and the NEC TurboGrafx-CD Player.

Genesis achieved an early lead in the electronic marketplace, but the NEC TurboGrafx-CD conveyed a video game vision of the future with incomparable compact disc musical scores, spoken dialogue, and rich graphics.

Also, because the portable TurboGrafxExpress uses the same cartridges as the TurboGrafx-CD, NEC became the first video game company to take superior at-home game quality "on the road."

THE VIDEO GAME OF THE YEAR *Super Mario Brothers 3* (Nintendo for NES). Sure it's just another jump-and-dodge platform game, but *Super Mario Brothers 3* is done to perfection and probably the most influential and widely loved video game since the heyday of *Pac-Man*.

THE BEST ARCADE GAME *Castlevania 3: Dracula's Curse* (Konami for NES) claims some of the best graphics ever to appear in a Nintendo cartridge. As the changeling hero, you become involved in nonstop action as well as an intriguing supernatural story line.

THE BEST SHOOTER *Monster Lair* (NEC for TurboGrafx-CD). On the face of it, *Monster Lair* is just more of the same: colorful monsters, unusual weapons, a cartoonish "little man" who dodges an army of evildoers. But this little man hops to a great California jazz-style musical score that adds immense appeal to his arcade action. Even if I didn't like the game itself, *Monster Lair* would make my charts for its terrific music.

THE BEST ROLE-PLAYING GAME *Ys Book 1 & 2* (NEC for TurboGrafx-CD). With a majestically atmospheric score, beautiful graphics, spoken narration and fast-paced MTV-like editing, *Ys Book 1 & 2* (commonly known as *The Ancient Land of Ys*) starts like an interactive music video. The game that follows is a fascinating, mind-twisting role-playing game of epic length, not quite as opulent as its introductory sequence but no less involving.

THE BEST PUZZLE GAME *Klax* (Tengen for NES, Genesis, Lynx, TurboGrafx-CD) is *Tetris* for the Nineties. Colored tiles ride down a conveyor belt and drop into a hopper. Catch them, rearrange them and create horizontal, vertical and diagonal patterns for big points. It sounds less than thrilling, but just give it five minutes and it's all over, buddy. You'll be there for the next two hours. The best versions are for Genesis and Lynx.

THE BEST STRATEGY GAME *Populous* (Electronic Arts for Genesis). One of 1989's best computer games became a video game in 1990, a thinker's game that translated perfectly to the graphics quality of Genesis.

THE BEST SPORTS GAME *Super Monaco GP* (Sega for Genesis). Here's a real Genesis showcase and one of the finest driving games ever released. Not only do the point-of-view visuals translate perfectly to the home system, but the addition of a championship mode adds breadth and strategy to this pedal-to-the-metal actioner.

THE SPECIAL ACHIEVEMENT AWARD *Bonk's Adventure* (NEC for TurboGrafx-CD) isn't punishing, it's enchanting. It isn't brutal, it's inviting. And its charm is reinforced by clever cartoon graphics and humorous animation. There may have been bigger, harder, faster video challenges in 1990, but nothing can beat this terrific arcade game for sheer fun. Coming next month: the best computer games of 1990.—Bob Lindstrom

GAMES

BAR EXAM:
Wet your whistle with these mixed-up drinks, then create your own recipes in Competition #52

Bartending you might think is a pretty easy job Just keep the glasses filled and be ready with a few sympathetic comments about the Cubs chances next year But a good mixologist also has to know a great many drink names and recipes—and be able to recall them like a computer retrieving long-lost files There are words with specialized meanings—like *up, draw neat,* and *sweet*—and all those brand names and nick names that swirl around the brain like a cockeyed cocktail, shaken not stirred A bartender who is just learning the terms must have dreams about meeting people with names like Margarita Alexander, Harvey Collins, and Tom Wallbanger

Drink names, of course, have always had a colorful side Rusty Nail Side Car Velvet Hammer Singapore Sling, and Zombie for example Lately they seem to have gotten weirder and even downright raunchy Kamikaze Vulcan Mind Press Sex on the Beach, Screaming Orgasm For the customer the problem with these drinks is getting up the nerve to ask for them with a straight face

All this naturally leads to yet another joke form There have been knock-knock jokes, good news/bad news jokes, elephant jokes and light bulb jokes Now there's the mixed-up drink joke For example What do you get when you mix vodka and orange juice, then add a dose of milk of magnesia? A Phillips Screwdriver, of course

If you mix gin, lemon juice and club soda you get a Tom Collins but what do you get by adding a smear of mascara and a pound of wrinkle-remover cream? A Joan Collins Other mixed-up drinks include Tequila Mockingbird (Jose Cuervo and birdseed) and Alexander Haig (brandy scotch and milk)

I first introduced the mixed-up drink joke a few years ago in another magazine and asked readers to submit their own examples Among the best (and cleanest) ideas *Bloody Awful* vodka and ketchup *Hickory Daiquiri Duck* aged Kentucky bourbon rum, strawberries crushed ice, and Cold Duck, *Cocoa Vin* Nestle's chocolate and Chablis, *Little Dickens* A martini with an 'olive or twist' *Fraternal Twins* Crown Royal and Royal Crown *Absinthe of Malice* Pernod and bitters *Truth and Justice* sodium Pentothal on the rocks

STEP UP TO THE BAR

Once the ingredients are listed, some of the best mixed-up drinks are so self-evident that a little thought should easily bring the name to mind How many of the following drinks can you identify?

1 Genitol and tomato juice
2 Bourbon sweet vermouth and heavy water
3 Jim Beam, 7-Up, and scotch
4 Lamp oil and mescal
5 Ginger ale grenadine, and India ink
6 Neat beer and Swiss Miss chocolate
7 Champagne and gun powder

8 Hazelnut liquor, crushed saltines, and sugar
9 Beer and nitrous oxide
10 Mead, goat's milk, and Southern Comfort
11 Schnapps and rice wine
12 Beefeater's and Grizzly beer

If you were unable to come up with more than two or three names for these drinks, try matching the recipes with these names

A Peppermint Paddy
B Beam me up Scotty
C Brouhaha
D Glow worm
E Manhattan Project
F Near Miss
G Nutcracker Sweet
H Piltdown Comforter
I Gin and Beer It
J Shirley Temple Black
K 357 Magnum
L Tired Bloody Mary

Answers: 1-L, 2-E, 3-B, 4-D, 5-J, 6-F, 7-K, 8-G, 9-C, 10-H, 11-A, 12-I

WHAT'LL IT BE, BOYS?

Create your own original mixed-up drinks and submit them in Competition #52 Our grand prize-winner will receive $100, nine runners-up will each receive $25 All finalists will also get a copy of my book *The Emperor Who Ate the Bible and Other Strange Facts and Useless Information* (Doubleday)

Enter as often as you wish, but each entry must be mailed separately on a postcard (or on a three- by five-inch sheet of paper) Send them to Competition #52 Drinks, c/o *Omni* 1965 Broadway New York, NY 10023 5965 All entries must be received by March 15, 1991, and become the property of *Omni* magazine none will be returned Winners will be chosen on the basis of cleverness and originality and the judge's decisions are final

—Scot Morris

LAST WORD

OIL CHECK:
Looking for help in multicolored swirls of Quaker State and Valvoline

Page after page, *The Harmonic Yellow Pages*, billed as "the Complete Guide to New Age Health," is full of listings for psychics, healers, gurus, and other purveyors of spiritual enrichment—including exterminators. One such firm, Roaches Reincarnated, Inc., advertises with the slogan "Out of your life—and into another."

According to *The Harmonic Yellow Pages*, the New Age has arrived at all sorts of established enterprises, ranging from farms to factories. The Good Time Watch Company, for example, has changed its motto from "Stay on Time" to "Be Here Now."

Receiving my own copy of the yellow pages, I randomly opened the book, whirled myself around to get dizzy, covered my eyes, and plunked my right index finger down on the page. My finger landed upon a small ad that read, "Rainbows in the Gutter—Sylvia O'Peck will read your motor oil drippings." Curious, I picked up the phone. The Gutter Guru, as she is known by her clients, graciously agreed to meet with me in her comfortable Beverly Hills home.

Sylvia, who appeared to be around forty-five, greeted me in a tie-dyed bikini and Birkenstocks, smudged with oil around the edges. As we sat by the pool and ate shrimp cocktails, she explained the scientific basis for the rainbow that appears in spots of motor oil on streets after it rains.

"It's the same principle as rainbows in the sky," Sylvia said. "Light refraction and reflection. The oil leaves a film on the water. Light rays come down and hit the oil and bend. As they bend, they reveal different colors of the spectrum. Every rainbow is different. This is where my interpretation comes in." Pressed for more details, she explained that her work is "just like reading tea leaves, but I'm dealing with petroleum and there's no teacup."

For $359.95, Sylvia comes to your home and reads the oil spots in your gutter. You need not be present, but Sylvia must have your exact address, as you wouldn't want your neighbor's reading, of course.

Each client gets a two-part reading. Part one is holistic and reveals the state of your health, including your gallbladder, kidneys, and sinuses, as well as your spiritual well-being, vocational aptitudes, and financial future. Part two shows the condition of your car, including the drivetrain, cooling system, and rocker panel molding. This is guaranteed for 30,000 miles or 30 days, whichever comes first.

For those lucky clients whose oil spots are on their driveways, and not in the gutter, Sylvia throws in an additional complimentary reading on the condition of the driveway. (Sylvia's brother-in-law, it turns out, happens to repair driveways.)

"I saw my first oil rainbow on the mean streets of Newark," Sylvia told me. "It was from an old Packard with a real bad oil leak." As a small child, Sylvia was poor and spent a lot of time on the streets. After it rained, she'd sit on the curb and stare for hours at the oil rainbows in the gutter. "I found my rainbow in the gutter," she said.

That convinced me to give it a try, and I handed Sylvia my Visa card. "We don't need to wait for rain," she said as she poured her scotch and water on the oil spot my car had left in her driveway.

She pondered the glossy slick for a moment. Then she told me that my glove compartment door needed adjusting and that I would live a long and happy life, but that I should watch the traffic around Anaheim.

Returning to the patio, she popped another jumbo shrimp into her mouth and said, "Gutters have a bad reputation. But look where my curbside contemplation got me. Who says oil and water don't mix?"

She went on to brag that at some of the most chic parties from Bel Air to Malibu, Carmel to Pismo Beach, Petaluma to Camp Pendleton, people are excitedly discussing their latest motor oil rainbow readings.

Sylvia now offers group rates for such gatherings, although you're advised not to participate if you came in a rented limo, your reading may be confused with that of the previous user.

And there's good news for the rest of the country. Sylvia and a major oil company have been negotiating a franchise deal. Be on the lookout for a white van with a rainbow-hued oil spot airbrushed on its side. When the latest metaphysical craze sweeps across the nation, automotive oil spots will no longer be perceived as simply ugly stains to be covered over with cat litter. DO

Helen McKenna has a '66 Mustang convertible that routinely leaks its power steering fluid all over her driveway.