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JEFFERSON AIRPLANE

"BATMAN"

DJ JAZZY JEFF & FRESH PRING And In This Core

ACE FREHLEY Trouble Walkin

LOVERBOY BIG ONES

RUSH Presto

ROBERT PALMER

QUINCY JONES

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388-967

387-092

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383.885

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400.937

401-299

401-661

401-695

	1/1
	MICHEL'LE 404-483
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	THE IRON MAN ALLANTIC
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	SIMPLE MAN 400-523
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	BELINDA CARLISLE 400-788 RUNAWAY HORSES
	THE FRONT 400-903
	OZZY OSBOURNE 401-265 JUST SAY OZZY CHE ABBOCIATED
	PAT BENATAR 401-646 BEST SHOTS CHRYBALIS
	CROSBY, STILLS, NASH AND YOUNG OF JA YU ATLANTIC
	JIM CROCE 403-154 Jim Croce Live: The Finel Tour
	ROY ORBISON 377-945 ALL-TIME HITS COL SPECIAL PROD
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ORAN "JUICE" JONES TO BE IMMORTAL	402-784 EOLUMBIA
ZIGGY MARLEY & THE MELODY MAKERS ONE BRIGHT DAY	386-987
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	HERITAGE
	STACY LATTISAW WHAT YOU NEED
6	SEDUCTION Mothing Matters Without Love
F	SAVATAGE GUTTER BALLET
	JOHN WESLEY HARDING
	"FLASHBACK" Original Soundtrack
	JUNGLE BROTHERS Done By The Forces Of Nature
	M.C. HAMMER Please Hammer Don't Hurt 'En
	EDDIE MONEY Greatest Hills/Bound Of Money
	THE FIXX One Thing Leads To Another The Best Of The Fixx
483	NICK LOWE Basher: The Best Of Nick Low
85	MARK KNOPFLER

BRITNY FOX BOYS IN HEAT

KING'S X

TAYLOR DAYNE CAN'T FIGHT FATE

KOOL MOE DEE 384 Knowledge is King

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40

405

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403 40 40

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344-457 340-315

244-459

291-278

291-526

292-326

386-979

ROLLING STONES

CHEAP TRICK AT BUDOKAN

THE DREGS Divided We Stand-The Best Of The Dr

THE KINKS 1315-093 KRONIKLES 395-095

GLORIA ESTEFAN 382-341 CUTS BOTH WAYS

BEASTIE BOYS 383-786 Paul's Boutique	0
SIMPLE MAN 400-523	SINEAD O'CONNOR 405-00
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JIM CROCE 403-154 Jim Groce Live: The Final Your	ALICE COOPER 402-644 SCHOOL'S OUT WARMER BROOK
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MARVIN GAYE 367-565 GREATEST HITS	JONI MITCHELL 367-10.
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JOE COCKER Med Dogs And Englishmen

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405-001 CHRYSALIS	THE BLUE NILE 404-5		
404-376	MINISTRY 404-15 The Mind is A Terrible Thing to Table		
403-584	DON DIXON 403-3		
401-232	ERASURE 400-82 WILD!		
389-940	IAN MCCULLOCH 389-55 CANDLELAND		
389-494	SMITHEREENS II CAPITOLIANS		
388-215	SQUEEZE 388-05		
402-644 WARNER BROS.	OUT OF THE BLUE 400-32		
1376-657 1396-655	JERRY LEE LEWIS *369-10	5	
367-102	TRAFFIC John Berleycom Must Die 364-93		
362-285	GRATEFUL DEAD 358-85	j	

	18 Orig. Sun Hits
	John Berleycom Must Die BLAND
ĺ	GRATEFUL DEAD 358-895 American Beauty
	THE BYRDS 342-501 GREATEST HITS COLUMNA
1	THE BEST OF 327-742 KANSAS COS ASSOC
-	GREATEST HITS COLUMBA
	Greatest Hits 1974-78 290-171
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	JACKSON BROWNE 292-243 THE PRETENDER ASYLUN

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	BEST OF THE DOORS TEET	†357-616 1397-612
	BAD COMPANY 10 FROM 6	341-313 ATLANTIC
	JOE COCKER'S GREATEST HITS	320-911
	VAN MORRISON TUPELO HONEY	210-856 WARREN BROS
	LINDA RONSTADT'S GREATEST HITS	286-740 ASTLUM
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658	GRATEFUL DEAD What A Long, Strange Trip It's Been	₹291.633 391.631
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EPIC	The Disregard Of Tim	nakeeping wro

	BOBBY BROWN Dance! Ya Know lit	402-602
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	SMOKEY ROBINSON LOVE, SMOKEY	404·566
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404·475 ATLANTIC	THE OAK RIDGE BOYS American Dreams	404·434
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	THE BIG F	403-592
84	3RD BASS The Cactus Album	403-436

404-541

402-636

389-551

374-777

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VERY BEST OF POCO

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i	3RD BASS 403-436 The Cactus Album [DEF JAM/COLUMNIA]
ij	QUEEN LATIFAH 403-287 All Half The Queen YOUNDY BOY
	CHUNKY A 402-875
2	NEITHER FISH NOR FLESH 389-726

MBIA		COLUMBIÉ
98	DIVING FOR PEARLS	389-031
57 ACIS	LOU GRAMM LONG HARD LOOK	388-108
51 XTRA	DAVIE EDMUNDS Closer To The Filame	387-126 CAPITOCI
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84 own	TIN MACHINE	383-976 EMI AMERICA
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ı	CHICAGO®	401-166

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170		
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VOL. 12 NO. 11

AUGUST 1990

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First Word

By Art Agnos
Earthquakes could topple
any number of
U.S. cities, so shouldn't
we be prepared?
San Francisco's mayor
Agnos offers
his advice on preventive
measures.

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Forum

Congressman Bob Wise and Compute magazine's Peter Scisco offer their views on computer privacy and the right to access personal data.

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Space

By Joseph Baneth Allen Knitting, weaving, and ceramics—no, these aren't summer camp classes; they're the future of our nation's space program.



Cover art: Stanislaw Fernandes
has received many electrical shocks. His
airbrush-and-watercolor painting
Live captures those thrills of energy—"the
incredible feeling you can
do anything, like skydiving, like riding a
motorbike, like being alive"—
says Fernandes, an international artist.

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Body

By Kathleen McAuliffe
If your ulcer
has been acting up lately,
maybe it's more
than your job that's bugging
you. Medical
researchers have found
a bacterium that
may cause those painful
gut reactions.

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Earth

By Jessica Speart
The cold war: Freezing
eggs, sperm,
and embryos is becoming
the latest tactic
in the battle to replenish
the planet's
endangered species.

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Continuum

Who's certifying that organic produce is 100 percent natural? Out of touch? The English now have scientific proof that physical contact can be pleasurable. The blind leading the blind: Bat sonar for the sight impaired? Caressing, stroking, and other stimuli that stunt growth.

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CORESBY SCOTCH "THE SECRET'S OUT."

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Discover why so many interesting people are coming home to savor the premium malt flavor of 86 proof Scoresby.

THE SECRET'S OUT

SCORESBY SCOTCH

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BLENDED IN SCOTLAND



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Crime Bytes Back

By Linda Marsa
and Don Ray
Kids playing cops
and robbers in the next
century are more
likely to be armed with a
laptop computer
than a gun. Whether it's
theft, espionage,
or sabotage, technology
will change the
way crimes are committed
and the way
they're combated.

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Trouble in Paradise

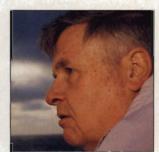
By Peter Gorman
Trips through the Amazon
jungle finally
led Gorman to the Matses,
an Indian tribe
who are still huntergatherers. But
the thrill of finding a
native people
is now dampened—his
enthusiasm was
not only infectious but
almost fatal.

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Fiction: The Catch

By Robert Silverberg
The peaceful new world
seemed too good
to be true. The soil was
rich, the weather
temperate, the natives
unobtrusive. Just
the kind of place you
would want to
settle, or so it seemed.







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Pictorial

Once Upon a Time in America
By Both Berger
American ingenuity is evident in the designs and mechanics of the nineteenth-century palent models.

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Interview

By Bill Lawren
What an adventure to roam
the earth, stand
atop volcanoes, or delve
miles below the
sea, but for geochemist
Harmon Craig
it's all in a day's work.

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Antimatter

Look up in the sky! More than 50 people looked, including a space research scientist. but no one can explain the mystery cloud. Nuts and volts: Will the computer become the crystal ball for hightech soothsavers? The French are leaping from cliffs and bridges-not for love but for fun. Heavenly inspiration: A physician has assembled an entire Bible library on computer disc. because God asked him to do it.

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Games

By Scot Morris
Try and match up famous
people and their
little-known inventions.

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Star Tech

By Joe Aquene Picks from the Consumer Electronics Show.

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Last Word

By Roberto Santiago
Whose grandmother
started those
universal myths about the
horrible things that
happen to kids who use
four-letter words?

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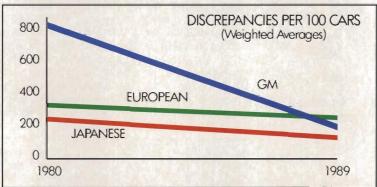
Introducing Omni's new sister publication, Compute. The complete magazine of home computing, Compute offers you news and views, from the latest in software and hardware to notes from the hacker underground. This preview features game reviews, interviews with computer scientists, plus info for Macintosh, Amiga, and DOS users.

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According to one quality survey by Harbour & Associates, GM vehicles are better built than the average European import, and the difference between GM and the average Japanese import is less than one-half of one discrepancy per car. Other studies confirm GM's improvement.



You can count on GM cars for the long term. When J.D. Power studied the dependability of 1985 models, GM was ranked highest in vehicle dependability among all American manufacturers.* No other U.S. carmaker has done the job better in the last five years.

What does this kind of quality mean to our customers? Just ask. After six months of ownership, at least 95% of all Chevrolet, Pontiac, Oldsmobile, Buick, Cadillac, or GMC Truck owners would

recommend a vehicle from that division to a friend.

(*J.D. Power and Associates Vehicle Dependability Index Study.™ In a ranking of the three domestic manufacturers, based on things gone wrong to 4-to-5-year-old 1985 model vehicles in the past 12 months.)

GM's engines are more dependable than those of all other domestic carmakers. Our 3800 V-6 is at the top in engine quality among engines from all makers, foreign or domestic, according to the most

comprehensive customer-based survey in the auto industry.

In the latest evaluation of 1989 engine quality, the 2.3-liter Quad 4 was as problem-free as 2-liter engines from Toyota or Honda after 3 months' ownership. In the latest survey of a full year of ownership (for 1988 models), Cadillac owners reported fewer engine problems than Toyota or Mercedes-Benz owners, a tribute to the 4.5-liter V-8 engine. In 1990, we're dedicated to delivering the quality you demand.

Problem-free Transmissions

Any car or truck is only as reliable as its transmission. Our automatic transmissions are more problem-free than those of most imports, and more problem-free than any domestic competitor.



Today there is a new pride at GM. A new commitment to quality. A clear focus on our customers and on their needs.

People throughout General Motors, the GM Quality Network, are dedicated to continually improving our vehicles. Year after year. Until every model is as good as the best in the world.





All of GM going all out for you.



FIRST WORD

By Art Agnos

€Nearly every U.S. community is vulnerable to natural disaster. Yet local officials, burdened with crises such as homelessness, AIDS, and drug abuse, postpone disaster planning. 9

An earthquake could wreak havoc "on a scale never experienced from a natural hazard in the history of this nation," predicts a recent study by the United States Geological Survey (USGS). The next "big one," seismologists say, may not happen in Los Angeles or San Francisco or anywhere else in California but could occur along a little-known and mostly forgotten fault line in Missouri. The USGS investigation also says that 39 states face the threat of a major quake (from a variety of fault lines running throughout the country). At risk: many big cities, from New York to Seattle.

Nearly every U.S. city is vulnerable to some form of natural disaster. Floods, hurricanes, earthquakes, and forest fires claim lives and threaten property every year. Yet local officials, burdened with daily crises such as homelessness, AIDS, and drug abuse, postpone disaster planning.

Earthquake preparedness has never been a passing fancy in San Francisco. Every April 18—the anniversary of the devastating 1906 quake—police, firemen, and other emergency personnel take part in drills to sharpen their responses in case of a real disaster. In addition, each year San Francisco's fire fighters assist schools and hospitals in conducting evacuation procedures. Throughout the city, firemen also teach citizens first aid, search and rescue techniques, and instruct junior high school students in how to perform cardio-pulmonary resuscitation.

These annual drills serve to override our denial mechanism, to remind us that San Francisco rests between two major fault lines, the San Andreas and the Hayward faults, either of which could violently shift without warning. Though people in other parts of the country may not feel the need to prepare for a natural disaster, as we do in California, loss of life and destruction would be greatly reduced in other cities if some protective measures were taken before the onset of a crisis situation.

Much of the damage to private property in the San Francisco Bay Area from the October 17 Loma Prieta earthquake occurred in the Marina and South of Market neighborhoods. Many brick apartment buildings erected on landfill in the early 1900's suffered extensive damage as the landfill settled during the tremor. Old, unreinforced brick buildings are the structures that usually kill people in California earthquakes. A collapsing facade of one such building killed six pedestrians on South of Market Street last October.

Seismic experts now believe that relatively inexpensive retrofitting or support systems could have prevented the extensive damage in the Marina and South of Market neighborhoods. Retrofitting that can help prevent serious

damage to older buildings includes bolting wood frames to the foundation, adding steel connectors to foundation girders and posts, and adding reinforcement panels to the stem and foundation walls under the structure.

While securing city buildings against earthquake damage, engineers, housing experts, and economists must determine the benefits of each structural alteration against a variety of factors. Will retrofitting an old brick structure ensure its stability against earthquakes of varying degrees? How many lives will be saved by these changes? And what social and financial costs will each upgrade create?

None of these questions would be critical if seismologists could predict exactly when and where an earthquake was going to strike. Unfortunately, though seismic technology has vastly improved since the time of the 1906 quake, scientists still haven't developed instruments to forecast the probability of an earthquake in the way they can predict a hurricane or flood. Seismologists monitoring faults across the country, however, hope to one day discover the warning signs believed to occur before a quake hits.

In the meantime, home owners and renters should examine their buildings for earthquake hazards. Exterior chimneys can be the most dangerous part of otherwise safe residences. Depending on a chimney's location, size, and age, it might need to be reinforced. Water heaters should be secured to a wall to prevent fire and water damage that can occur when a gas line is broken by a falling water heater. Bookshelves should also be bolted to a wall so they don't topple.

San Francisco responded to the October earthquake with selflessness. Automobile and bus drivers got out of their vehicles to direct traffic through intersections without signal lights. Citizens became volunteer fire fighters as they rushed water hoses from the city's fireboat in the Bay to burning buildings blocks away. Strangers helped the injured get to hospitals for treatment. And crime declined.

Public officials like to issue assurances that everyone will be taken care of in the aftermath of a major disaster. In the best of cases that may happen, but it would be irresponsible to create a false sense of security. During a natural disaster people should expect to be on their own for 48 to 72 hours.

We live in an age of 24-hour news, when other people's tragedies come to life across our television screens with regularity, dulling our sense of vulnerability. But disasters don't happen only to other people. They can, and do, happen to us. Be prepared.



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business or entertain ment, conversing in a foreign language will open up whole new worlds to you. And now there's a method that makes learning a foreign language simpler. Painless. And faster than you ever thought possible. The first 15 tapes of this package are the very same tapes used by the U.S. State Department to train career diplomats.

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American managers with language skills open more

Wall Street Journal Editorial July 25, 1988

untapped. And that the best way to realize our potential is by using all our brain - not just the analytical left half. Old

style, repetive teaching only uses the "logic" of the left half of the brain and neglects the more powerful, imaginative right half. Involving both hemispheres of the brain in the learning process dramatically increases the speed-and sharpens the retention—of learning. Originally

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Logic



(the superlearning method is) fascinating . . . the results are extraordinary. Prof. Lawrence Hall

recognizing the incredible benefits of accelerated learning.

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'American ignorance of other tongues has been hurting American business executives in their competition for (overseas) markets.

The New York Times September 5, 1988

phrases in alternately loud whispered, and emphatic intonations, all accompanied by slow, rhythmic music. The effectiveness of Baroque music as a memory aid is well documented and leaves you feeling alert and rested.



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OMNIBUS

From cloak-and-dagger dinners to cannibals and territorial tigers, our writers will traverse the earth for a good story

Contributors, clockwise from top left: Peter Gorman, Bill Lawren, Kathleen McAuliffe, Linda Marsa, and Jessica Speart.

hether they're sifting through investigative reports or exploring previously unknown cultures, Omni writers brave new paths. In "Crime Bytes Back" (page 34), writers Linda Marsa and Don Ray combine forces in their tale of cops and robbers: To uncover the facts, Marsa sometimes dined in dark corners and secluded restaurant booths with highlevel government officials. Being fed "off the record" comments and anecdotes she couldn't use, Marsa says, "I kept waiting for the sky to open up and swallow me."

The irony: Somewhere in its bowels, the FBI has a file on Marsa from her former student radical years. Nowadays, however, the revolutionary child of the Sixties writes on finance, health, and other issues in the pages of Family Circle, Redbook, The Los Angeles Times, and other publications.

Marsa's cohort in crime Ray lives like a true-life detective. Author of *A Public Record Primer:* An Investigator's Handbook (ENG Press) and a reporter for NBC, CBS, and ABC, Ray has instructed LA police officers in the art of creative crime investigation.

Peter Gorman ("Trouble in Paradise," page 40) often goes beyond the usual tourist routes, seeking out landscapes of strange and haunting beauty in South America, India, and other exotic places. While

not living on the edge, Gorman writes for *The Earth First! Journal, World,* and the Organization of American States' *Americas*.

Misadventure seems to find Joseph Baneth Allen (Space, page 18) against his will. While on his first journalism assignment, Allen was mistaken for an international antiques thief and detained for three hours. On another occasion, a close encounter with a female tiger resulted in the feline's spraying urine all over the unsuspecting journalist. Allen has written for Final Frontier, USA Today, and The State.

"Harmon Craig may be the last of the swashbuckling scientists," says Bill Lawren (Interview, page 58), who fondly recalls his exhausting meetings with the geochemist. "He is a force of nature. Asking him a question is like uncorking a hydrothermal vent; the answers flow on and on and on...." Lawren also contrib-

utes to Psychology Today, National Wildlife, and The Scientist.

Sitting in a tiny office in a tiny building, Jessica Speart interviewed the Cincinnati Zoo's Betsy Dresser (Earth, page 22). "And when she went to pour my coffee," Speart says, "we were so immersed in conversation that she almost grabbed the wrong container and it was like, 'Oops!' I didn't even want to know what was in it." Speart is a travel writer who has also been published in *Reader's Digest*.

Where does one go to relieve those gnawing stomach pains known as ulcers? Kathleen McAuliffe (Body, page 20) has come up with her own surefire remedy. "A week's dose of blueberry pancakes and lobster in Maine worked for me," quips McAuliffe. Currently in fine form, McAuliffe has been plagued with an ulcer condition for years-perhaps a result of her being a frequent contributor to Omni? Formerly a senior writer for U.S. News and World Report, McAuliffe has also written for The New York Times Magazine and Reader's Digest.

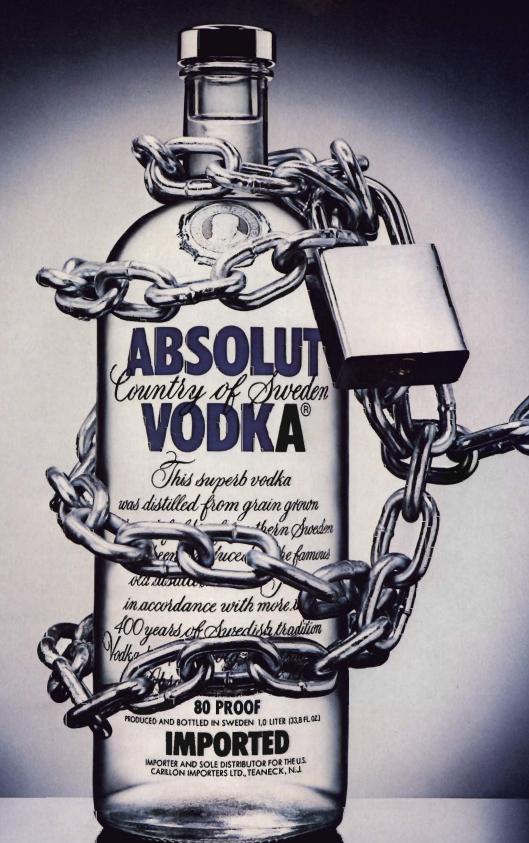
"As a child, I thought my tin can telephone was an original idea," says Bob Berger ("Once Upon a Time in America," page 50). "We all invent things to make our lives easier, but the early patent models are fascinating because they seem so childlike." Berger is a musician and singer as well as a playwright, having won the 1988 Eugene O'Neill award for his screenplay titled Gas.

Five-time Nebula award-winner Robert Silverberg ("The Catch," page 44) has edited the prestigious anthology series New Dimensions (Harper & Row) for many years. He and his wife, Karen Haber, recently also became the coeditors of the Universe 1 anthology series (Doubleday). Silverberg is the author of At Winter's End and The New Springtime (Warner Books).









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AUGUST

COMMUNICATIONS

READERS' WRITES: From the halls of politics to the halls of medicine

Well Worth the Wait

I must tell you that I am duly impressed with your amazing magazine. Omni has fast become one of my true passions. The only problem I have is that I read it cover to cover within two days and it seems like an eternity before the next issue arrives. Your staff of brilliant authors and reporters has guite a knack for grabbing the reader by the brain. The topics are never blasé or passé, which I guess is why I eagerly anticipate the arrival of each issue.

Kimberley Dennis Waterbury, CT

Leave You Laughing

Although Omni is far from being a comic strip, the humor in your magazine is as delightful as a Sunday morning spent with the comics. The sarcastic (and occasionally sardonic) quips in the Continuum section, as well as the cartoons throughout the magazine, contribute to Omni's unique character. Thanks for the laughs!

> Don Carteaux Republic of the Marshall Islands

Microkillers

Cheers to you and Kathleen McAuliffe for "The Killing Fields" [May 1990], an excellent piece of work. I found it very insightful and truly cognizant of a problem of which few are aware. Although we have had many technological advances in the past few decades, as well as advances in medicine and its practice, we have yet to conquer the explosive proliferation of new viruses. I wonder what kinds of advances these once-cultivated diseases have made. Maybe it's time to introduce these diseases to our new advances instead of vice versa.

Julee Lamb Downey, CA

Women Belong in the House and Senate I have always found Omni to be a fascinating, intriguing, and invigorating magazine. The First Word by Representative Claudine Schneider in the May 1990 issue fulfilled my expectations. I was shocked, however, when she said women have "firsthand knowledge

of the day-to-day frustrations of rising costs" and a better understanding of legislation concerning underprivileged children. To propose that on the basis of gender alone women have a more comprehensive ken of these issues is preposterous. Men and women are equally capable in all areas, including politics. As Schneider says, it's high time that more women break into the national government scene. But Schneider must realize that it will be because of women's knowledge in all areas. If she continues to say that women have a clearer understanding in certain areas, she only delays the inevitable acceptance of women in all areas of life.

> Brian Smith Sudbury, MA

Joy Can Come in the Mourning

I was amused but not shocked by the "drive-by body viewing" option of involved funeral parlors [Antimatter, May 1990]. And people thought sliced bread was convenient! What next? When people drop dead, will we be able to view them in the convenience of our own homes via a computer modem? Perhaps those who cannot afford computers will have a telephonetelevision option that will let them dial 1-800-THEDEAD, key in the deceased's Social Security number, and the body will appear on their TV screen. Whoever said saying good-bye can't be fun? Maria J. Pisano Jersey City, NJ

Typos Run Their Course

In reference to your article "FYI, A Superlative Guide to the Hows and Wise" [April 1990], the listing under Colorado Free University- "Art Brut: The Untamed Expression of the Unconscious"-is actually an offering of Archetypos, a Jungian dream study center. Although we have offered the course under the Colorado Free University several times, those interested should contact Archetypos, 807 East Tenth Avenue, Denver, CO 80218.

> Claudine Y. Jeanrenaud Director, Archetypos Denver DO



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FORUM

PLAYING THE DATA GAME:

A congressman and a computer magazine editor choose sides over privacy

verything you charge to your credit cards—along with your buying preferences, residential address, and perhaps your phone number—is stored somewhere on a computer. Should this information be available to anyone who wants it? We asked Congressman Bob Wise (D-West Virginia) and Peter Scisco, editor of Compute magazine, for their views.

CONGRESSMAN BOB WISE

As it becomes easier to gather and manipulate material about people so that you can develop profiles of those people, we was instrumental in stopping the TRW Corporation [a credit bureau] from letting the Social Security Administration (SSA) check the Social Security numbers that TRW had for millions of people. We felt that was not a proper role for the SSA.

I don't think people fully appreciate what is happening in data gathering and data use today. For example, by filling out a routine questionnaire card at the supermarket, they've gotten themselves put into a system that can become part of huge databases readily available on computer reels. You're talking about millions that come up, trying to look at all sides, and advise Congress as well as the private sector. It may be that the advisory board, through its activities, develops legislation that Congress adopts. But at this point, it's not a regulatory board. We're not really talking about constraints as much as trying to establish guidelines.

PETER SCISCO

Two hundred years ago, a few American revolutionaries penned the Bill of Rights. They could not have imagined the forms or intensity of the information that faces us every day. Even so, they understood the power of free access to and dissemination of that information. And they used that understanding to protect themselves from tyranny.

Technological advances have taken us into a new world of information. Computer networks, satellite communications, fax machines-these are the weapons of democracies worldwide. Information has become a valuable commodity of the postmodern age. Legislation should not halt what has become both a standard business practice and a manifestation of our rights.

At the same time, banks, retailers, and local governments are collecting an enormous storehouse of facts about American consumers. The release of those data to sophisticated information peddlers causes just concern and has prompted legislation designed to curb unrestricted access and use of that information. But restricting access on any level could revoke the privileges we enjoy as Americans.

The rise of personal technology is affecting every citizen, calling for the surrender of partial privacy for the bounty of true democracy. Now is the time to see if we can live up to the guarantee we drew for ourselves two centuries ago. DO

Are we in good hands? With more and more information being collected on our lives and stored in



computer databases. should we have the right to control who can access that material?

must ask questions. What is the appropriate balance for the use of federal and, in particular, personal data, and who will monitor the flow of data? There is no one place-or person-in Congress that daily looks at the federal role in privacy and what's happening with federal information.

The federal government not only has more and more access but also the ability to centralize information. The question then becomes, Should this accumulated information be available to businesses? For instance, I think our Government Information, Justice, and Agriculture subcommittee

of names, with more than 100 categories into which people are classified. That's a sweeping accumulation of data.

From a consumer marketing standpoint people may want that, but can this information be used otherwise? For instance, by campaign consultants trying to target people for elections? Would you want that information bought by the FBI? I'm not trying to make a value judgment, but we must look at what we want so we can prepare ourselves.

The Data Protection Advisory Board we are proposing will constantly be dealing with issues



Since you have a copy of Omni in your hands we can predict (scientifically, of course!) that you also have a big interest in the world of computers.

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SPACE

HEAVENLY FEATS OF CLAY: Ceramic composites may help NASA build a better starship

If you can't take the heat, try silica: From the orbiter's heatresistant skin may come hey were weaving the panel using hand-held spinners—about the size of old air-driven jackhammers. From their tips oozed a goopy ceramic fiber, a clay-metal composite that was hard as steel, light, and workable. Just the thought of the first astrohardhats on Freedom, trying to bolt and weld all that metal together, pained the spaceman to imagine. Thank God we don't bend metal anymore, he thought. Nowadays, real spacemen drool goo.

Metal can be too heavy and

propulsion system of the National Aerospace Plane. "We're already exploring the use of ceramic composites in the nozzles and turbopumps of rocket engines to get higher temperatures and much greater lift potential," says Stan Levine, head of the Ceramics Branch at NASA's Lewis Research Center in Cleveland.

NASA considers the lightweight and durable stuff truly promising. Over the next five years, in fact, NASA has plans to give about \$10 million toward ceramic fiber research to the gineer at NCSU's College of Textiles, who leads the ceramic work at the MMRC. To create shapes from the fiber, El-Shiekh and his team are developing machines that weave composites into three-dimensional shapes such as cylinders and cones.

Much of this latest aerobraking research is actually an extension of technology conceived for the space shuttle, says Howard Goldstein, chief of the thermal protection materials branch at NASA's Ames Research Center, Moffett Field, California.

The orbiter's ceramic insulation blankets have worked so well that they've even caught the eye of French and Soviet aerospace designers. "Much of the heatshield work done by the French on Hermes and the Russians on their Buran was based on the shuttle," says Goldstein.

Both the European and Soviet space agencies will undoubtedly be paying close attention to the shuttle again in 1994, when NASA conducts the Aeroassist Flight Experiment (AFE).

"The orbiter will launch a twohundred-seventy-million-dollar aerobrake experiment designed, among other things, to test the viability of new ceramic fiber composite insulations used as part of the aerobrake heat shield," Goldstein says.

Once outside the shuttle bay, the aerobrake satellite, which resembles a lopsided pie in a tin, will begin a series of maneuvers. A solid rocket will ease the aerobrake satellite into a trajectory simulating return from geosynchronous to low Earth orbit. The information from this experiment will eventually allow designers to build aeroassist orbital transfer vehicles. These craft will dip briefly into the atmosphere, where greater aerodynamic loads enable them to change altitude or inclination of the desired orbit.

-Joseph Baneth Allen



engines that run at high temperatures and rustproof materials that need no replacement. bulky for some space applications—especially for thermal protection. So NASA has turned its attention to ceramic fiber—a combination of metal, plastic, and ceramics. In fact, without this material the next generation of manned and unmanned space exploration vehicles may never get off the drawing board. Advanced ceramic fibers will be essential for aerobraking heat shields, for the engines in heavy launch vehicles, and for parts of the airframe and

Mars Mission Research Center (MMRC) at North Carolina State University (NCSU) in Raleigh. At present its team is busy designing the first American manned spacecraft to Mars. The ship will feature two oversize nose cones made of composites. "The cone's ceramic aerobraking shields will be able to withstand speeds of fifty thousand miles per hour and temperatures of at least four thousand degrees Fahrenheit," says Aly El-Shiekh, a mechanical en-





IN THE BELLY OF THE BUG: Ulcer researchers report an unsuspected culprit that

Americans can't stomach—bacteria

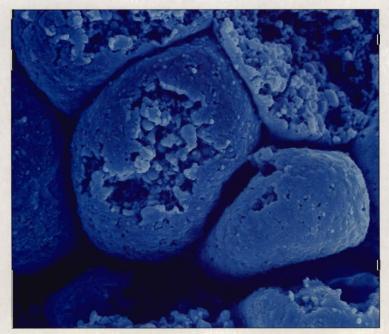
he co-worker you just saw bent over his desk in misery is more likely to be suffering from heartburn than heartache, and chances are the cause of his problem is a peptic ulcer. These painful irritations of the stomach's gastric lining and the duodenum (the entrance to the small intestine) strike 1 out of every 50 Americans each year. In 1987 alone the National Center for Health Statistics recorded a whopping 4,580,000 new cases of peptic ulcer.

Until recently doctors considered ulcers a life-style disease brought on by too much stress or excessive consumption of alcohol, coffee, spicy food, or even aspirin. Ulcer patients got lectures on changing their habits, along with prescriptions for widely heralded "miracle drugs" like Zantac and Tagamet, introduced a decade ago, which work by inhibiting the secretion of stomach acids to give ulcerous lesions a chance to heal. Because ulcers tend to recur, patients who relied on these drugs could generally

expect to do so for a lifetime.

Researchers have now announced a startling discovery that could lead to an outright cure-rather than just a treatment-for ulcers. The most common cause of these stomach disturbances, they say, is a corkscrew-shaped microorganism called Helicobacter pylori, which burrows into the wall of the stomach, making victims susceptible to virtually any irritant. Once research determines the best protocol of antibiotic treatment, doctors should be able to cure ulcers within a few weeks of diagnosis. Further down the line some re-

Vaccinating babies against ulcers would ensure that a healthy stomach (top) stayed that way; an antibiotic cure can be expected soon for the treatment of ulcers (right).



searchers envision vaccinating everyone against both gastritis and ulcers soon after birth.

Robin Warren, a pathologist at Royal Perth Hospital in western Australia, first spotted the germ in 1979 when he took stomach biopsies from patients with a variety of intestinal ailments. Colleagues greeted his discovery with skepticism, however: The standard wisdom held that the stomach was too acidic to support a resident microbe. No one took Warren very seriously until 1981, when Dr. Barry Marshall, a gastroenterologist now at the University of Virginia Medical Center in Charlottesville, confirmed the findings. Marshall isolated Helicobacter and showed that it shields itself from acid by invading the mucus sheathing the inside of the stomach. Once in place, the bug appears to trigger an inflammation of the lining characteristic of gastritis or, in severe cases, an erosion of the wall that develops into full-fledged ulcers. Clearly, Helicobacter pylori was not the only organism that could cause such trauma, but it did seem to be a leading suspect: Marshall extracted the germ from 90 percent of gastritis patients and 80 percent of those with ulcers.

Similar findings emerged from a large study conducted in Ireland in 1988 by Dr. Cornelius Dooley, now an assistant professor of medicine at the University of Southern California. Dooley found *Helicobacter* in 85 percent of patients with ulcers, 80 percent of those with gastritis, and 50 percent of those suffering from an inflammation of the esophagus.

While doctors gradually began to accept Helicobacter's association with gastric disturbances, many believed that it was a cofactor rather than a cause. They argued that the organism might be an opportunist that had simply found an already weakened stom-

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Gabriel Cortez Colombia Age 4

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Philippines, Thailand) AFRICA (Burkina Faso, Egypt, Sierra Leone, Sudan, Togo, Guinea) PLAN INTERNATION	l can't sponsor right now, but I want to help. Enclosed is a contribution to the Children's Emergency Fund for \$	PLAN	Zip eth H. Phillips, Preside International USA Plan Way, Warwick, RI	

EARTH

ANIMAL HOUSE:

Suspended in icy liquid nitrogen, snow leopards, tigers, and rhino wait for life at the Cincinnati Zoo

wo bright-colored industrial drums dominate the former darkroom in a corner of the Cincinnati Zoo's veterinary clinic. But what's developed here will have more impact on the future than a roll of film.

Here eggs, sperm, and developing embryos of endangered species lie encapsulated in straws, floating silently in liquid nitrogen. Held in suspended animation at -383° F, rhino, snow leopards, and Bengal tigers wait in frozen anticipation.

The force behind this frozen

carry only one egg to term at a time, which limits the animals' ability to reproduce. For example, the gestation period for a rhino pregnancy is 15 months. And the rhino won't become pregnant again for another four years.

Once Dresser determines an animal's estrus cycle, she injects the female with hormones that enable it to produce up to 30 eggs. Then the animal is bred naturally or artificially inseminated, and the embryos drop into the uterus. Dresser collects the embryos and freezes them, implanting one in a

from two endangered Indian desert cats whose egg and sperm were placed in the uterus of a house cat.

Because a large number of species are headed for extinction and zoos are hard-pressed to save them all, animals that stand the best chance of surviving are given priority. "We have limited space, limited time, and limited resources," Dresser says. "We targeted animals that were endangered in the wild and that zoos could breed in captivity."

Topping the list is the black rhino, whose numbers have fallen from 60,000 in 1970 to 3,500 today, due to greed and myth. For centuries many Asians have imbued rhino horn with the ability to cure everything from hemorrhoids to heart disease. Because a single horn can fetch \$24,000 on the black market, the slaughter of rhino is a lucrative business.

Some wildlife experts, however, question whether Dresser's work is the best use of precious conservation dollars. "It's better to translocate existing populations," says Bruce Bunting of the World Wildlife Fund, which sponsors programs that emphasize preserving animals in the wild and better antipoaching measures. "Zoobred animals lose that wild edge." (The Center's annual budget of \$320,000 comes from public and private sources.)

Even so, Dresser's efforts in embryo transfer may represent the only hope for some of the earth's vanishing creatures. She envisions shipping frozen embryos to zoos, instead of moving live animals, and even supplementing national parks around the world. "Someday a scientist in Kenya will take a little packet of frozen embryos, knock down a female rhino, and implant her," she says. Replenishing the earth's endangered species could be as easy as restocking a lake with trout.

—Jessica Speart

Prized for its horn, which is purported to be imbued with healing powers,

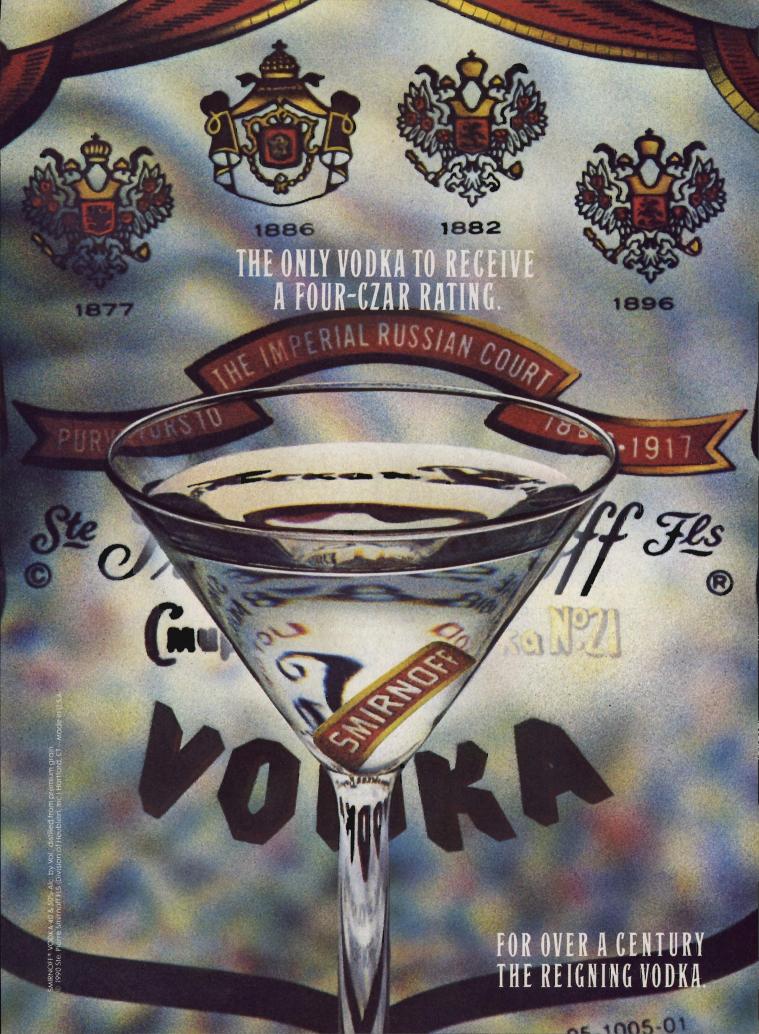


the rhino faces nearly certain extinction. Embryo transfer may hold the key to its future. zoo, the Center for Reproduction of Endangered Wildlife, is Betsy Dresser, a reproductive physiologist devoted to combating the permanent loss of many of the world's mammals. The key to survival lies in her work with embryo transfer, a technique used with domestic cattle. But applying the process to other species, which requires knowledge of each animal's reproductive system, can be cumbersome. For example, attempts to save elephants with the technique have failed.

Although females of any species produce hundreds of thousands of eggs in a lifetime, some

surrogate mother, which will carry it to term. Within a week the animal can be bred again.

Dresser's efforts in embryo transfer go back to 1981, when she first experimented with Bengal tigers. She later initiated the first transcontinental transfer, flushing embryos from a rare African bongo antelope at the Los Angeles Zoo, then returning to Cincinnati with the live embryos in a container taped to her body to keep them warm. Her mission succeeded: Surrogates gave birth to two bongos. More recently Dresser merged in vitro fertilization and embryo transfer, producing a kitten





CITY GUIDE



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CONTINUUM

ORGANIC FARMING

he sun is high and warm over Cate Farm. We're stripped down to shorts and tees, barefoot, bent over the rows of cukes running up the gentle hill. The box is playing, as luck would have it, "Born in the USA," and we're all wailing along with The Boss as we persuade the white-flowered weeds to loosen their grip on the moist Vermont earth. As we bring root systems up through to the surface and shake them, a bunch of dirt critters, disrupted in their agricultural endeavors, tumble down with the clods: worms, bugs, snails—the gamut.

Cate Farm is one of Vermont's 49 certified organic farms. And, Richard Wiswall, who farms these 194 acres that lie 12 miles east of Montpelier, has for several years served on the Vermont Certification Board's Review Committee, a body that helps assess when, how, and why a particular farm is ready to be granted certification by the board.

In light of the ongoing hullabaloo over the contamination and degradation of our food supply by chemical "enhancers" like pesticides and fertilizers, organic farming is becoming increasingly high profile and widespread. According to a recent Harris poll, 84 percent of Americans would buy organically grown food if it was available, and 49 percent would pay more for a tomato that is firm, not pulpy; flavorful, not flat. A tomato or cucumber or carrot that is 100 percent natural—from the beginning. Or is it?

Presently pending in the halls of Congress is the Leahy-Fowler bill, a piece of legislation that essays to set a nationwide standard for what can and cannot be labeled "organically grown." Until such a time if and when this bill is passed, you can't be sure what you're paying extra for. Some states do have laws; others that don't may have an internal policing system such as Vermont's certification program—one of the nation's toughest. There are some states, on the other hand, that allow farms to be "self-declared organic." This literally means that a farmer can decide to hop on the "green" bandwagon, declare, "Tomorrow I'm growing organic," stop spraying and fertilizing one field, but perhaps not all, and slap a few extra cents on every pound he produces. No doubt about it—a sleazy solution.

The Vermont Certification Board, however, waits one year

after chemical fertilizers have been used and three years for chemical pesticides before certifying a farm "organic."

The credo of organic farming is that if you develop good soil, you will grow healthy produce that is resistant to disease and animal pests. Dumping chemical fertilizers and pesticides on a field produces less healthy soil, hence a less healthy crop. The upshot is, not surprisingly, the more chemicals you use on your vegetables, the more chemicals they are going to require. Says Wiswall, "It's like drug abuse: The soil gets addicted to its chemical 'fix' and needs more."

Keeping plants and soil healthy without chemical assistance, however, is much more time-consuming and labor-intensive than pouring or spraying on pesticides. The fields must be weeded, and often, bugs eliminated, by hand, and fertilizer must be made from compost. This is the primary reason organic vegetables cost more to buy: Quite simply, they cost more to produce.

Whether organic produce is worth the extra cost obviously is up to the consumer. Yet there is more to consider than merely the basic price tag on chemically produced fruits and vegetables. "There is a huge lobby in Washington pushing for chemicals," says Wiswall. "We're up against companies like Monsanto, Uniroyal, and Union Carbide, who do their best to get legislation passed to favor nonorganic practices and to keep the cost of nonorganically produced foods down." What we don't pay for at the grocery store, however, we do pay for eventually. "In large-scale commercial farming, the costs are externalized," Wiswall says. The money you save on mass-produced vegetables will be spent elsewhere. "Down the road," he says, "you'll pay the health costs for consuming chemically treated foods. And you'll pay the pollution costs for the production and application of these toxic substances."

So the next time you get a deal on a pound of tomatoes that were grown on a corporate farm, sprayed with manmade toxins, picked before they were ripe, and pumped with chemicals to make them appear appropriately rosy by the time they were shipped 2,000 miles to your grocer, pause for a moment to consider. How much of a bargain are they really?—MELANIE MENAGH



CONTINUUM



Getting picky: When primates preen one another, curious chemicals flood the brain, says a Cambridge University researcher.

THE ROOTS OF GROOMING

Ask anyone who has it done: Getting a manicure can be curiously pleasurable. So can having your hair fixed. If recent experiments with our cousins the monkeys are any indication, the pleasures of grooming may be linked to a change in brain chemistry.

A research team led by Eric Keverne, a neuropsychologist at Cambridge University in England, moni-

tored the brains of a group of monkeys while the animals were grooming one another. The scientists found that during grooming, the monkeys' brains produced increased amounts of betaendorphin, one of a class of chemicals that are often referred to as "the brain's own opium," Endorphins plug into the same brain receptors as such narcotics as opium, morphine, and heroin and produce similar feelings of well-being. When the scientists gave the

monkeys naloxone, a chemical that blocks the brain's reception of endorphins, the monkeys became irritable and increased their grooming, as if to compensate for the ensuing lack of endorphins. On the other hand, when the monkeys were injected with small doses of morphine, grooming behavior decreased, as if the reward for that behavior had already been provided by the narcotic, so that the grooming "fix" was no longer necessary.

Keverne suggests that there may be a biological need for social interaction through nonsexual touching, a need so strong that the brain rewards touching by producing a natural high. "I don't know if this explains why teenage girls like to do one another's hair," he says, "but I do suspect that tactile contact is important for social interaction at all levels."—Bill Lawren

"I'd like to live like a poor man with lots of money." —Pablo Picasso

PHARMACY OF THE PHARAOHS

The ancient Egyptians were well-known as skilled morticians. As it turns out, they weren't shabby physicians, either. They had an impressive array of homemade medicines at their disposal, including an effective antibacterial cream and a contraceptive device much like today's spermicides.

"About a third of the ingredients they used in their drugs had pharmacological

properties," says Dr. J. Worth Estes, professor of pharmacology at Boston University's School of Medicine, who studied some 1,350 prescriptions deciphered from ancient papyrus scrolls. To fight infection, for example, the ancient Egyptians relied on an antibacterial salve based on cupric carbonate, a copper salt found in green malachite. They also used honey, presumably for its germkilling action and special enzymes that transform sugars into antiseptic hydrogen peroxide.

In addition, they developed a contraceptive vaginal suppository made from crocodile dung, sour milk, and acacia gum. "Recently," says Estes, "acacia gum has been recognized as spermatocidal in the presence of vaginal lactic acid."

Still to be examined is the possibility that Egyptians used rye ergot (a natural source of LSD) to combat migraine headaches and prescribed marijuana for a variety of ills.—Jim Hogshire

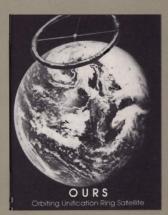


Walk like a prescription: Crocodile dung as a spermicide?

HIGH ART, LOW ORBIT

Many artists struggle to have their work exhibited in galleries. Arthur Woods, on the other hand, intends to put art in orbit, where the whole world will see it. Although this may seem a remarkably clever way to sidestep the politics of the art world, Woods contends that his Orbiting Unification Ring Satellite (OURS) Project is really a celebration of planetary unity. The goal of OURS, Woods explains, is "to celebrate the themes of wholeness and peace with a global collective artwork decorated by artists from every country."

In 1992, the International Space Year, Woods will loft his first extraterrestrial exhibit, a 20-foot-wide ring he conceived with aerospace engineer Marco Bernasconi and made out of an advanced metal fabric that should allow the sculpture, once in space, to expand and harden in the sunlight. The "space peace sculpture" will be assembled and



A halo over Earth or just OUR junk in space?



The husks of good health: Westerners, well-known for their diet of overrich foods, have rediscovered a rice application that could cut back significantly on undesirable fat.

launched from the Soviet Union's *Mir* space station with live television coverage broadcast worldwide.

That same year Woods hopes to dispatch a similar ring from NASA's space shuttle. The rings, which should be visible to sharp-eyed stargazers, will orbit the earth for several days before falling back toward the earth and burning up in the atmosphere.

Woods plans a more durable orbital objet d'art for the year 2000: a much larger ring satellite, perhaps a kilometer in diameter, that will circle the earth at a height of about 500 kilometers. From the ground, the OURS will be one fourth the diameter of the moon and will be visible for about ten minutes before sunrise and after sunset in order to avoid interfering with astronomical observations. After circling the earth for about six months the ring will deploy a solar sail and fly away into the void. "It will stay in space forever," says Woods, "as a monument to our time."-Curt Wohleber

THE RICE STUFF

When Japanese and Indian researchers discovered a few years back that rice bran could reduce blood cholesterol levels, American cereal makers rushed to get it into their products. Now studies at three Massachusetts universities have demonstrated that the oil extracted from rice husks can do the same thing, a finding that could send cholesterol-conscious chefs scrambling for their bottles of rice bran cooking oil.

Eighteen-month studies with hamsters and monkeys at Tufts, Harvard, and the University of Lowell show that the tasteless, odorless oil can reduce overall cholesterol by as much as 40 percent. What's more, says Robert J. Nicolosi, a professor at Lowell's clinical sciences department, it reduces undesirable LDL (low-density lipoprotein) cholesterol without affecting the levels of "good" HDL (high-density lipoprotein) cholesterol.

The Massachusetts stud-

ies were the first in this country to focus on the oil. Although the researchers do not yet know how the oil lowers blood cholesterol levels, Nicolosi believes the effect may be achieved by compounds in rice called unsaponifiables. "These compounds seem to either inhibit the liver's ability to produce cholesterol or block its absorption into the bloodstream," he says. Human clinical trials are expected to begin by year's end. "We want to know more about the mechanisms of the unsaponifiables," says Nicolosi. 'What lets them do this?"

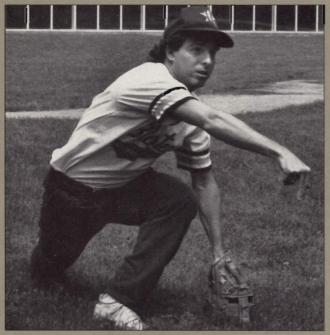
Before rice bran oil becomes a viable alternative to other cooking oils, however, the rice industry must come up with a cost-effective way to produce it. Extraction facilities may be available in Japan, but few American plants are capable of extracting it.

-George Nobbe

"Half the art of inventing consists in knowing what needs to be invented."

—Herman Hollerith





The executioner's song: With its traditional rubber-and-yarn core, a speeding baseball can really do you in.

DEATH BY BASEBALL

For even the hardest of heads, a speeding baseball has the potential to be a lethal weapon. According to the U.S. Consumer Product Safety Commission, 35 kids were killed by baseball blows to the head and chest between 1973 and 1983. Another 16 died from blows to other areas. So much for playing hardball.

Might there be some way to circumvent these unwarranted deaths? Worth, Inc., a sports equipment manufacturer in Tullahoma, Tennessee, says the problem would fade dramatically if the ol' hardball would just soften up. Simply replacing a traditional baseball's rubber-and-yarn core with

an interior of polyurethane foam plastic could reduce the likelihood of serious injury by 70 percent, says Worth president Jess Heald. Weight, size, and aerodynamic behavior would remain virtually unchanged.

Worth's balls, known as Reduced Injury Factor, or RIF, balls, perform like standard baseballs but with one difference. They emit a dull, low-pitched sound when hit, as opposed to the storied crack of the bat.

If the ball makes it into professional parks, critics worry that the game might change. For example, outfielders trained by ear to respond to bat sounds as defensive data may end up, say, mistaking a smash to the warning track for a

routine pop fly. But on the other hand, batters, less concerned about being injured by a pitch, may become more fearless.

—Robert Brody

"Baseball is ninety percent physical, and the other half

-Yogi Berra

SEE OF LOVE

is mental.'

Looking for the perfect love spell? Cast away your necromancy books: A long, mutual gaze is the best way to let Cupid's arrows hit their mark, says psychologist James Laird of Clark University in Massachusetts.

After watching a young couple in a small café, peering deeply and silently into each other's eyes, obviously mad about each other, Laird wanted to "see if we could make people fall in love." He instructed volunteers—men and women who were complete strangers—

to gaze into their partners' eyes for two minutes. It worked like a charm. "Mutual eye-to-eye contact did indeed increase feelings of attraction, interest, warmth, and excitement for each other," says Laird.

To see if mutual gazing was in fact the key, Laird had some of the couples look at each other's hands instead or had one partner look into the eyes while the other looked at the partner's hand. After polling these people, he found that they might as well have been in separate rooms for all the passion they aroused.

Why does mutual gazing increase attraction? Laird believes that when we imitate acts of love, our feelings begin to follow suit. "Generally, the more you act like you're in love, the more you will be in love," he says. "But the gaze must be shared, not just performed. Both must participate."

-Vincent Bozzi



The look of love: When it comes to romance, the eyes have it, according to a Clark University professor.



Young Einstein: Are his love letters relative, too?

MRS. EINSTEIN

Albert Einstein's first wife, mathematician and physicist Mileva Einstein-Maric, did more than keep the house clean while he thought: She actually helped him develop the world-renowned theory of relativity, according to Evan Harris Walker, a physicist at the U.S. Army Ballistic Research Laboratory at the Aberdeen Proving Grounds in Maryland.

Walker bases his claim on a number of recently published letters between Albert and Mileva. In those letters, Walker says, there are at least 13 instances in which Albert Einstein refers to the relativity theory as "our work" or addresses Mileva as though she were an important collaborator. In one letter dated 1901, for example, Albert wrote to his love: "How happy and proud I will be when the two of us together will have brought our work on the relative motion to a victorious conclusion."

Walker's unorthodox assertions have already raised hackles among traditional Einstein scholars. John Stachel, director of the Center for Einstein Studies at Boston University, calls those assertions "pure fantasy. She may have been a sounding board for his ideas," Stachel says, "but she was not a collaborator."

The opposition leaves Walker unshaken. "I'm not embellishing anything Einstein says," he responds. "He says they were collaborators, so I say they were collaborators, and that she was a full equal. It's nothing more than taking Einstein at his word."

—Bill Lawren

PLEASE DON'T BEAT THE DAISIES

You'll never hear plants say, "Ouch," but they eventually show their discomfort at being touched in other ways—namely, by growing shorter and stockier than untouched plants.

Plant molecular biologist Janet Braam and professor of biochemistry Ronald Davis at Stanford University have identified five genes that are activated when a plant is touched or stimulated. The researchers speculate that the genes stunt plant growth in response to

physical stress—a result that can be seen clearly in trees on a windy hill, for example, or when gardeners shake bonsai trees to keep them very small.

Braam and Davis stimulated Arabidopsis (mustard family) plants by gently rubbing leaves and shaking stalks, spraying plants with water, cutting the leaves slightly, and blowing on plants with a blow dryer (cool setting, of course).

Within 10 to 30 minutes, the "touch" genes triggered a ten- to hundredfold increase in the messenger RNA that is the blueprint for a calcium-binding protein, calmodulin. Calcium is essential to plant growth, and when calmodulin is produced, Davis speculates, the two combined may keep the plant short.

Stimulated plants attained only half the height of the untouched ones and were stockier: Davis calls this the bonsai effect. "Plants in the environment are not just sitting there passively," Braam says. "If you even brush a tree, it senses that and actively responds."

Unraveling the mysteries of plant perception may one day help us better protect the environment, Davis says. "We're doing things to the environment, and we don't understand how plants are responding," he says. "People think plants are unreactive, but they are exquisitely sensitive."

-Maura Christopher

"Vietnam was the first war ever fought without any censorship. Without censorship, things can get terribly confused in the public mind."

> —General William C. Westmoreland

"The most important thing about fame is what it means to those who will never have it."

—James Salter



Don't touch me there: Trees and plants are supersensitive entities that really do react to hands-on care.



ECHO VISION

Like bats, which instinctively use their natural sonar to navigate in the dark, humans have an innate ability to orient themselves by interpreting the sounds of echoes. This has led electronics engineer Adam A. Jorgensen of Oakland Park, Florida, to devise a hand-held sonar sensor that could enable the blind to "see" with sound.

Jorgensen's echolocation system works like a bat's natural radar: A hand-held battery-powered instrument, about 18 inches long, emits a stream of ultrasonic signals when aimed in a particular direction. After measuring the time it takes for the signals to bounce back, the device transmits the echo return time to receivers that are worn behind each ear like hearing aids. Because the ultrasonic signals are too "fast" for the human ear to interpret, the device stretches out the echo to a more discernible range by means of an electronic delay inducer.

"Different people have different abilities, but with training and practice a blind person can hear the distance as skillfully as reading Braille," says the inventor. "They get a sound image of a surrounding room. It's surprisingly simple, really, like an advanced hearing aid."—George Nobbe

"Beware of the Truth. If you find a Truth it can demand that you make painful changes."

-Frank Herbert



Blind as a bat: Whoever coined that phrase didn't take into account the superb echolocation abilities of the winged mammals.

ASBESTOS ON TRIAL

Ever since scientists linked indoor exposure to asbestos insulation with lung cancer, people have been fanatically gutting old buildings to remove the stuff. But now a cell biologist from the University of Vermont wants to call a time-out: The kind of asbestos usually used as insulation, says Brooke Mossman, "does not present a risk to human health."

According to Mossman, 90 to 95 percent of asbestos insulation is composed of a type of asbestos called chrysotile. Unlike other asbestos fibers, called amphiboles, which are shaped like needles, chrysotile fibers are curly. This, according to Mossman, may make chrysotile asbestos less likely to penetrate lung tissues and cause lung cancer. In fact, when Mossman looked at studies of 387 public buildingsincluding 71 schools-she found that the average level of asbestos (.00024 fibers per cubic centimeter of air) was actually statistically comparable to the level outdoors (.00039) and far less than the .2 safe standard level set by the

Occupational Safety and Health Administration.

Mossman concludes that the asbestos scare is "much ado about nothing. It's a public panic sort of thing," she says. "People are afraid of liability or of not being able to sell their houses."

Is the EPA thinking of revising its standards in light of Mossman's research? "We don't differentiate between types of asbestos," says EPA environmental protection specialist Tom Tillman. "We recognize that there's literature that suggests a difference [between chrysotile and amphibole asbestos], but the evidence has not been conclusive enough." Tillman says, however, that his office is now reviewing Mossman's report. "Our position could change," he says.

-Bill Lawren

"They came, they saw, they did a little shopping." —Berlin Wall graffiti



Asbestos, like Al Capone, may have been framed by the law.

EAVESDROPPING ON KNEES

At one time or another, almost every weekend athlete—whether jogger, hoopster, or tennis nut—has experienced some sort of knee injury. In fact, knee injuries account for as many as one third of all referrals to orthopedic clinics. Diagnosing knee problems usually requires X rays or exploratory arthroscopic surgery.

But now a team of doctors from The Queen's University of Belfast, Northern Ireland, has developed the Knee Screener: a device that's capable of diagnosing torn cartilage—an extremely common form of knee injury—simply by listening to the knee move.

To operate the screener, technicians attach three small sensors around the patient's knee. The sensors pick up the characteristic vibrations made by knee movements when cartilage

5

Squeaky hinges: Just listening will reveal the damage.

is torn. By correlating those vibrations with the position of the knee, doctors can easily locate cartilage tears. The entire diagnostic procedure takes only 15 minutes and, in preliminary trials, has been accurate about 86 percent of the time. The team is now preparing to test the scanner on several hundred more patients.

So far, says Queen's University surgery resident Paul Maginn, there has been some interest from doctors and sports injury clinics in the Belfast area. Will there come a day when knee scanners take their place beside Nautilus machines in every NFL training room? "We're still at an early stage of development," says Maginn. "But that's a nice thought."—Bill Lawren

"The illegal we do immediately. The unconstitutional takes a little longer."

-Henry A. Kissinger

RUNNING ON THIN AIR

Two years ago engineers James Dooley and Philip Hammond were pondering what would happen when oil supplies became scarce again and gasoline prices skyrocketed. Then a way to avoid the problem and cut back on the world's reliance on oil came to them, literally, out of thin air.

Their idea was to build a car that runs on liquid air chilled to -315° F. When added to a little natural gas, the heated, compressed mixture would ignite and the expanding gas would drive



Raw power: Tornadoes are full of sound and fury, and their primary component may make a powerful automotive fuel.

pistons, Hammond says, "just like an old-fashioned Stanley Steamer." A car outfitted like this would have acceleration comparable to gasoline-powered vehicles and would produce no smog. Hammond estimates that the air—gas mixture could be sold at about the same price as gasoline.

The idea is similar to one Dooley and Hammond patented in the mid-Eighties while they were consultants at R&D Associates, a California think tank. At that time they proposed liquid nitrogen as a fuel source, but the team has since determined that liquid air would be cheaper and would provide better mileage.

Despite the soundness of their design, the engineers

haven't had much success persuading the auto industry to take their idea seriously. "They don't want to retool the entire industry," says Hammond.—Steve Nadis

"Men seek out retreats for themselves in the country, by the seaside, on the mountains.... But all this is unphilosophical to the last degree...when thou canst at a moment's notice retire unto thyself."

-Marcus Aurelius Antoninus

"The sun, with all the planets revolving around it and depending on it, can still ripen a bunch of grapes as though it had nothing else in the universe to do."

-Galileo Galilei



CONTINUUM

KIWI WIPEOUT

Kiwi, that tender, limegreen treat, is a most discriminating fruit. It likes summers warm but not too hot and its winters cool but not cold. Change those conditions at all and the fruit will not grow, a fact that has the kiwi industry worried about the greenhouse effect.

Kiwi growers in New Zealand, where a sizable portion of the world's kiwi crop is grown, are especially at risk. The problem, according to agricultural meteorologist Neil Cherry of Lincoln University in Canterbury, New Zealand, is that the average annual temperature in New Zealand has of its own accord already increased 1°F over the past 100 years. When the greenhouse effect kicks in, says Cherry, the very specific climatic conditions needed for successful kiwi growth could vanish.

If predictions are correct, the greenhouse effect will lead not only to hotter summers, which could wither the kiwi on its vine, but also to colder winters, which could freeze it to death. To make matters worse, the warmer summers could engender more tropical cyclones, a serious matter for the kiwi, which is easily damaged by wind.

One possible solution, says Cherry, is to move the crop south to cooler areas, a process that is already under way. The trouble is that in New Zealand, there's only so much south left. Another solution may be to genetically engineer a kiwi that's more



Peewee kiwi: Take a good look at what may be the last of a dying breed if things heat up in New Zealand.

resistant to extreme temperatures. But Cherry says that scientists are having trouble getting the information they need from kiwi growers, who for commercial reasons tend to be very tight-lipped about growing techniques. "A freer flow of information," Cherry says, "might lead to a greater security of the kiwi crop as a whole."

-Bill Lawren

"The greatest happiness of man is to have probed the knowable and quietly revere what is unknowable.

-Johann Wolfgang von Goethe

"Politics is the art of looking for trouble, finding it everywhere, diagnosing it incorrectly, and applying the wrong remedies."

-Groucho Marx

ATTACK OF THE **ZEBRA MUSSELS**

As if our water supply weren't imperiled enough, a new threat comes from an inch-long invader muscling into the aquatic environment. Vast herds of zebra mussels are now spreading across the Great Lakes, colonizing and clogging water pipes.

The mussels immigrated from Europe, stowing away in the ballast tanks of ships. Their microscopic larvae lurk in the water that the ships often flush from their tanks into the lakes. The larvae float with the currents, then affix themselves in thick layers to stable surfaces, where they grow to maturity.

First spotted in Lake St. Clair in 1988, the mussels have since made their way into Lake Erie and Lake Ontario; the other Great Lakes and the Mississippi and Hudson rivers are expected to fall to the zebra mussel hordes sometime in the near future.

Europeans have adjusted to mussels in their water pipes by building water conduits extra wide and extending them into deep, cold water, which the mussels shun. Canadian and American pipes, with smaller diameters and in shallower water, are in danger of becoming mussel bound, say Commerce Department officials. Windsor, Ontario, has already spent more than \$1 million scraping pipes to keep water flowing into the town.

Besides choking off human water supplies, the mussels have barged into the food chain of the Great Lakes with both good and bad results. The mussels, which are filter feeders, are actually clearing up the murky waters of Lake Erie, but in the process they're stripping the lake of plankton and algae, the food for larval fish. On the other hand, the sudden abundance of mussels has encouraged diving ducks from Canada to linger in the neighborhood.

Unfortunately, molluskeating humans will have no chance to eat the invaders out of existence. "There's a rule of thumb," says biologist Thomas Nalepa of the National Oceanic and Atmospheric Administration. "If you don't drink the water from Lake Erie, you don't eat the mussels.'

-Gregory T. Pope

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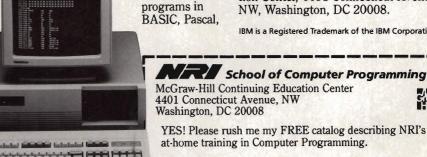
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ARTICLE

In tomorrow's world of high-tech crime, the cops will stake out computers, and the robbers will wear electronic masks

CRIME BYTES BACK

BY LINDA MARSA AND DON RAY

"Wake up, Carlos," Courtney begged again. "Captain Veraldi wants you."

I rolled over and fumbled for the transceiver's OFF button to make Courtney and everyone else go away. But the instant I hit the button, I knew I had screwed up. Sure enough, Veraldi activated the pager—at full blast.

"¡Ay, chingada! ¡Ya me desperté, pues! I'm awake, Goddamn it," I said. I picked up the transceiver and pressed the ANSWER button.

"Authenticate, please," the digitized voice cooed.

I held it near my face and pried open my right eye. "There. Recognize that retina? Recognize all those overworked veins?"

"Authentication completed," the computer voice said. "Good morning, Sergeant Pérez. It's eight-fourteen A.M., Saturday, March twenty-seventh, twenty-ten A.D. You have a call waiting." I wrapped a pillow around the transceiver to muffle Veraldi's bark and hit the ANSWER button.

"Sorry, Captain. Hit the wrong button again."

Joe Veraldi was one of the last of the old-line cops who came onboard back in the Eighties: no real training in computers or sociology—a

sort of dinosaur from the days when there was lots of cash around and the bad guys went face-to-face with their victims. He and others like him had been relegated to desk jobs about the time they retired McRuff and changed the slogan to "Take a byte out of crime." Fighting crime today was a whole new game.

"Someone has hijacked a jetliner by remote control and the Feds've got one hell of an explosive situation on their hands," Veraldi said. "For some reason they think they need your brain. Get on the next bullet train to Palmdale International and meet Agent Ishigaki at the FAA office. She'll give you the details."

It seems that as my reputation as a computer whiz grows, so does the number of agencies that want my help.

TECHNOCOPS AND CYBER-CRIME. In the twenty-first century cracking a tough crime case will still require hundreds of hours of tedious investigative work. Just about everything else in police work, though, will change. Even Dick Tracy could be relegated to a desk job as cops become hybrids of computer wizards and bookish humanists.

And as law enforcers and

PAINTINGS BY KENT WILLIAMS

their crime fighting arsenals change in the coming years, so, too, will their nemeses, armed not with guns but with electronic impulses. "Muggings, bank robberies, and other street crimes will stop in the next century as we move toward a cashless society." predicts Gene Stephens, a professor in the College of Criminal Justice at the University of South Carolina. "Drugs and violent crimes of passion will remain a problem, but most crimes will be technologically oriented." Embezzle-ment, credit card fraud, wire transfer theft, and similar crimes will entail the manipulation of data. Felonies will include tapping into electronic networks for industrial and international espionage. Others will involve sabotaging government, corporate, and lawenforcement computer systems with viruses, worms, and other rogue programs.

To combat such activity, law agents will need degrees in sociology, computer science, or both. Voice-activated computer terminals will link police officers

to patrol cars and the court system. They will hook into vast data banks of fingerprints, genetic codes, holographic images, voiceprints, psychological profiles, and physiological characteristics that will aid in the identification of criminals.

On the street, moreover, Dick Tracy-like two-way wrist radios will keep police officers in constant communication with their command centers. Serving as precinct satellites, patrol cars will be equipped with personal computers and printers, faxlike machines, and fingerprint scanners replacing the inking and rolling of old-fashioned fingerprinting. At crime scenes, pocket-size battery-powered computers, operable by voice and touch-screen commands, will replace detectives' traditional notebooks. Mini-video recording cameras will film and beam images to the FBI, where a panel of forensics experts will direct the investigation.

"The technical ability to do all of this is in prototype or, in a few cases, already available," says Hubert Williams, president of the Police Foundation, a nonprofit research organization headquartered in Washington, DC. In fact, a frontrunner in high-tech crime fighting, Missouri's St. Louis County, began its computerized crime fighting network in 1973. The Regional Justice Information System, or REJIS, now connects police departments, sheriff's offices, prosecutors, courts, correctional facilities, and parole agencies in 100 communities in four Missouri counties and four in southern Illinois, across the Mississippi River, as well as in the city of St. Louis. The law-enforcement officers use REJIS to analyze crime patterns, allocate personnel more efficiently, and share all the available data pertinent to ongoing crime investigations. One of the major benefits of REJIS: decreasing the seemingly endless hours behind a desk and increasing the amount of time officers patrol the streets.

Several counties in California, one in Arizona, and a hand-



6By the year 2025, the ability to tap into people's thoughts may be so highly developed that it may be illegal to even think about committing a crime. ▶

ful of federal, state, and other local law-enforcement agencies have also established computer crime squads. At the primary federal agencies involved in computer crime investigations—the FBI, the Secret Service, and the Internal Revenue Service—agents learn how to investigate high-tech crimes, which include tax evasion, bank fraud, and counterfeiting.

"When agents walk through the door with a search warrant, they have to know how to retrieve electronically stored information that is potential evidence," says special agent Stephen Purdy, in charge of the Secret Service's computer diagnostics center. "We can already download the entire storage contents of a personal computer, decipher the programs, and recover erased data files that may contain illegal data like credit card numbers or access codes.

At the FBI's Forensic Science Research and Training Center in Quantico, Virginia, and other crime labs across the country, scien-

tists are testing sophisticated techniques of gathering and detecting physical evidence. The results so far have enhanced crime-scene investigations immeasurably, for example, with cyanoacrylate, a "superglue" that adheres to the body chemicals in fingerprints, turns them white, and hardens them. The best-known tool among the new technologies is perhaps DNA typing: By matching the DNA patterns in hair, saliva, fingernails, semen, or any other body tissue or fluids left in even minuscule amounts at the crime scene, detectives can identify both the victim and the perpetrator.

But criminals will also benefit from technology. "It will be easier to plant evidence like a strand of someone else's hair at the crime scene," Stephens says. And tomorrow's nimble-fingered technocrooks may be able to break into the data banks and alter the numerical codes of DNA and fingerprints. The intruders will be deterred, however, by security measures that couple the encoding of all the stored information with user-identification techniques like retina patterns, hand-prints, and voiceprints. Only an insider working with the criminals will then be able to compromise the system.

A vast network of telecommunications, image scanning, and artificial intelligence, moreover, will increase efficiency. The Automated Fingerprint Identification System (AFIS) stores digitized images of millions of fingerprints, making an almost infinite number of precise distinctions between prints. And the FBI's National Crime Information Center (NCIC) System currently holds more than 19 million records related to convicted and wanted criminals, missing persons, unidentified victims, and descriptions of stolen articles, vehicles, and guns. A criminal justice database used by 64,000 local, state, and federal agencies, the NCIC averages about 900,000 inquiries a day. By the year 2000 the NCIC will automatically spot interstate crime trends and alert local



police departments about the next likely site to be hit by criminal gangs or serial killers. Virtually foolproof name-searching techniques will abolish the mismatches that often occur today and result in suspects being mistakenly released from police custody.

Another FBI data bank, the Violent Criminal Apprehension Program (VICAP), stores information on murder, rape, child molestation, and arson cases collected from police departments around the country. FBI special agents analyze all these data, hoping to detect patterns that will help police and prosecutors zero in on suspects. In addition to VICAP, the FBI is developing expert systems to emulate investigators' sleuthing skills. While there are several prototypes, two—Big Floyd and Little Floyd-are already online to assist FBI agents in investigations of organized crime and racketeering. "These systems are tremendous tools that serve as a checklist—the way a pilot goes through a preflight checkto ensure that we've conducted a thorough investigation," says FBI Academy supervisory special agent William Tafoya, a top law-enforcement futurist.

The crime-fighting toolbox already includes high-tech hardware at the Los Angeles Police Department (LAPD) and a few other innovative state and local police departments. Surveillance

teams use lasers to amplify window vibrations and convert them to audible sounds. Research teams are developing computerized systems for voiceprint analysis. The LAPD also uses helicopters with infrared scopes to intensify ambient light and locate bodies in the dark, a technology first developed during the Vietnam War.

Technologies initially developed by the military and sounding like they were lifted from a James Bond movie will increasingly make their way into police departments, Stephens predicts. "The military has been using jet packs to fly men over battlefields, and I can see police, protected by body armor, using them during civil disturbances as well as for traffic control and even car chases," he says. "Bionic ears will enable them to hear through walls. Police pilots will telepathically control aircraft by learning how to harness brain waves. And by 2025 the thought police may be a reality. The ability to tap into people's thoughts may be so highly developed that it may be illegal to even think about committing a crime!"

An arsenal of chemically potent police weapons may also come out of top secret research, Stephens adds. Already the military has developed a substance to alleviate soldiers' fears on the battlefield. Similar compounds, mixed with pleasing scents, "like the aroma of

Grandma's apple pie," he says, could be dispersed over crowds during riots or volatile demonstrations or even rock concerts that threaten to erupt in violence. Sealed in pellets and loaded in aroma guns, the chemical mixture could also emotionally disarm rabid criminals. "They're like the soma pills in [Aldous Huxley's novel] *Brave New World*," Stephens says. "We have the technology, and the possibilities for police work are enormous."

FATCAT INFECTION. On the bullet to Palmdale, my transceiver went off while I was trying to get 20 minutes of sleep. It was my assistant again.

"Sorry to bug you, Carlos," Courtney said. "But do you know anything about digital video recorders? Last night I played back a recording I'd made, and suddenly everything started jumping all over the screen. It's happened twice since I bought the DVR a little over a year ago. My mother's meeting me for lunch and bringing the tape with her." She kicked in her little-girl voice. "You'll fix it for me, won't you?"

Somehow in the year she'd been working for Bakersfield Police, Courtney had sort of adopted me as a father or something. Her real dad had skipped out when she was a baby. I had done the preemployment background checks on her myself and knew her mother had divorced the guy before Courtney was out of diapers.

When I got to Palmdale I went straight to the FAA office. The FBI's Tiffany Ishigaki introduced me to three FAA agents and ushered us into a small conference room.

"Here's what we have," Tiffany explained. "A terrorist group has somehow gotten partial control of our FAT-CAT satellite and redirected Pacific Rim Airlines Flight 901. It was supposed to fly directly to the Baja California Free Market Zone in Mexico. Instead, FATCAT's computer is commanding it to circle the mountains above Denver. Our people in Washington received a computer message demanding that the United States government release prisoners we took during the Euro-American trade war three years ago."

"I don't want to come off sounding too embryonic," I said, "but why don't you just override the computer on the satellite or the plane?"

One of the FAA agents tried to hide his embarrassment by answering me in a decidedly poised, self-assured manner. "The Federal Air Transportation Collision-Avoidance Tracking satellite was placed above the North American continent seven years ago to eliminate the human error factor in the air traffic control system. It's empowered to take control of any aircraft in imminent danger of colliding with another aircraft or any stationary object. Its computer is pro-



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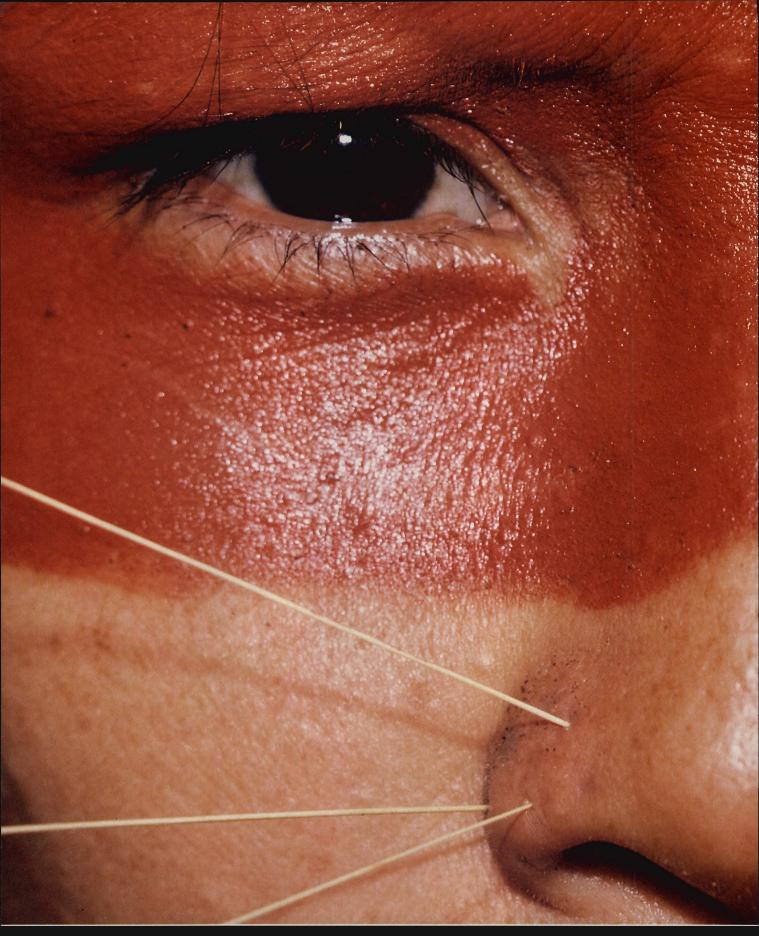
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TROUBLE IN PARADISE

ARTICLE BY PETER GORMAN



The Matses use scare tactics to keep evil spirits away. Could our curiosity kill their culture?

PHOTOGRAPHS BY JEFF ROTMAN

The jungle was thick, the path overgrown and close. Around us were signs of Indian hunting: trees notched with a machete and the notches decorated with bits of animal hair and skin-gruesome totems to the spirits of the animals taken nearby. The path led from a natural clearing in the Peruvian Amazon to the small Matses Indian puebla of our friend Tumi, an irascible old man hardly touched by the twentieth century. There were easier ways to reach his village, but we never used them. This was the route we had cut when we first visited the puebla in 1984, and it had become a sort of ritual to reclear the path whenever we returned. On this trip, however, when we reached the edge of the clearing, we weren't greeted in the customary manner. No bedraggled dogs barked at us; no children shot at us with featherless arrows; none of Tumi's wives ran to welcome us. A few charred posts and some black ash were the only indication that Tumi's longhouse had ever existed. Only the small hut belonging to his eldest son remained. The rest of the village had been abandoned

Six years ago I had known nothing about the rain forest except that it was being destroyed so quickly that if I wanted to see it I would have to do so soon. I flew to Iquitos, Peru, and spent several weeks on the Ucayali River, traveling by riverboat to isolated fishing villages where the locals regaled me with stories of pink river dolphins that transformed themselves into beautiful women at night; of electric eels that created lightning storms as they danced upon the waters; of black crocodiles so large they could swallow whole canoes; of anacondas that grew so long they lost the ability to move, relying on magical magnetic powers to attract food.

The most spellbinding stories, though, were about the Matses, cannibals with painted faces who lived along the streams deep in the jungle. They moved like the wind, spoke with the animals, and roamed the forest in search of blood, leaving piles of human bones to bleach in the sun.

I didn't believe there could still be tribes that had not yet become tourist attractions or case studies for hordes of anthropologists. Even so, a part of me hoped I was wrong. And when I returned to Iquitos, I asked the local jungle guides about the Matses. Some said missionaries had converted the Matses years ago; others told me they had never existed at all. Only one guide told me what I wanted to hear. A short, thick man in his mid-fifties who had spent 30 years in the Peruvian military as a jungle survival specialist, Moises claimed that the Matses not only existed but many still lived the traditional huntergatherer life. "I'll take you into the jungle for four days this time," he said when I asked him to lead me to the Matses. "Maybe next year you will return and meet them."

I didn't know why I needed an introduction to the jungle. But I soon learned that it was like entering a living organism whose defenses all seemed to be geared toward keeping me out. The air was thick and oppressive. The odor of decaying vegetation clung to my clothes and left a sickly aftertaste in my mouth. Stinging insects swarmed by the thousands, their stings festering instantly. I stumbled on the root-covered jungle floor and cut my hands on razor-

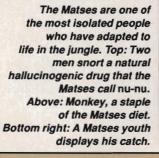
dangered parrots and small game. But even when I carried food, he managed to lose it or give it away. To him the jungle meant killing and being killed.

"Escuche me, Pedro," he said very deliberately. "This isn't Hollywood. The Matses are hunters. They don't know about endangered species. Make a mistake with them and we're finished."

After several weeks Moises got word from a fisherman that he'd seen signs of the Matses' presence, and we set out to find the tribe. We traveled by riverboat for two days on the Ucayali River, until we came to a village where we bartered for a peque-peque, an oversize canoe with a small motor. From there











sharp leaves. Everything I did was wrong, and each time I made a mistake, Moises would explain how the Matses would do it. Afterward I vowed to find the Matses. I wanted to learn everything they knew and find out how they managed to thrive in such an environment.

I took several more short trips into the jungle with Moises. On each occasion we took fewer and fewer provisions, relying more on what we could glean from the forest. The only aspect of our trips that bothered me was the hunting. I tried explaining that I was just a visitor, that we could carry food. I tried to make him understand that he was killing en-

we started up the Auchyako and spent the night in the village of an old man named Esteban, a friend of Moises'. In the morning we started up the Auchyako and paddled for two days until it was too shallow for the dugout. Then we began hiking, using our machetes to slash our way through the thick vines.

I ate only some rice we'd brought with us and whatever we could gather from the forest. I began to get sick and on the fourth day hardly had the strength to get out of my hammock. I finally gave in and stole a bird Moises was roasting on the fire.

"That's the first right thing I have ever

seen you do," he said when he found me eating the bird. "Now you're beginning to understand the jungle."

The next day a young Indian silently appeared at our campsite. He was small and dark-skinned, naked except for an old pair of green swim trunks and carrying a long black bow and a handful of feathered arrows. His forehead and eyes were painted with a sort of red dye. His mouth was outlined in blue, and long, whiskerlike splinters stuck out from the flesh of his upper lip.

None of us moved for several seconds. Finally the man spoke in a guttural language, and to my surprise, Moises responded in the same tongue. He the infant of one of them, atop his head. He rested the gun against a tree, said something, then walked back into the forest. Moises picked up the gun and turned to me. "Let's go, Pedro."

I grabbed our machetes and we followed the Matses, almost running to keep up with him. An hour later we came upon a small field. Just beyond it lay a stand of trees; beyond that, a small puebla. "Don't say anything. Just imitate me," Moises said.

The puebla was little more than a clearing along a stream. Around its perimeter, posts were spaced at irregular intervals; on each hung animal skulls. Along the stream's bank children played with

grabbed the arms of one monkey as he took the legs. They held it in the fire, burning off its fur, oblivious to the animal's screams. Carrying a piece of a machete blade, an old woman crawled out of a low opening in the leaf hut and took the now-dead monkey. She walked to the stream, gutted the animal, cut it into pieces, bundled them in some leaves, and returned with the bundle to the hut.

The old man finally stood, picked up a long black spear, and walked menacingly toward us, bellowing as he approached. "Don't act afraid," Moises whispered. He waited until the old man had almost reached us, then raised his shotgun, aimed at the old man's chest, and began to bellow back. The two of them stood toe-to-toe, weapons poised, yelling at each other fearlessly. They abruptly disarmed, and the old man turned and walked toward the hut. "That's how they say hello," Moises said as he began following the old man.

It was dark and smoky inside the hut, where we sat on the bare ground. An old shotgun and some clothing lay on a raised platform, bows and arrows propped against it. Leaf bags, animal skulls, and other ornaments hung from the ceiling. The rest of the hut was crisscrossed with hammocks, except at the far end, where the fire burned as the old woman roasted the monkey meat.

We sat in silence until the woman took two arms from the fire, placed them on palm leaves, and passed them to the old man, who offered them to us. The meat was sinewy and almost raw, and I had to fight back the urge to vomit. Moises gave me a warning look.

"His name is Tumi, and all of the women are his wives," Moises translated as the old man spoke. "He moved to this place after a jaguar killed one of his sons on the Lubo River. But moving is getting harder because there are so many huts on the rivers. He called for the spirits to tell him if this was a good place. He didn't know because no Matses have lived here for a long time.

"When we first came near," Moises continued, "he thought we were bad spirits and he was going to attack us. But when he saw we were not killing so many of his animals he knew we were good spirits and waited for us. When we didn't come he knew we were lost spirits and he sent his son to bring us here. He knows this is a good place to live if even the spirits cannot find it."

We finished eating and put the bones on the ground. Moises took several shotguri shells from his pockets and gave them to Tumi, who took an animal-tooth necklace from the wall and handed it to me. My hands shook as I held it.

"Put it on. It's a gift," Moises said. CONTINUED ON PAGE 70







Left: According to local folklore, anacondas grow so long they can't move; this one's only 18 feet. Top: A Matses prepares nu-nu in the palm of his hand. Bottom: Child with pet bird; Matses Indians learn early to respect the flora and fauna in their jungle habitat.

handed our shotgun and some shells to the man, who then disappeared into the foliage. "Matses," Moises said, smiling. "I knew they would find us."

Moises, I soon learned, had been in charge of military actions against the Matses after they'd raided river towns in the Seventies. He had learned their language in their camps since then. The Matses' facial markings and the whiskers, he said, imitated those of the jaguar. He had given the man the gun simply because he had asked for it.

When the Matses returned an hour later, he carried two monkeys in a leaf sack on his back and a third, evidently

small bows and arrows. Smoke issued from an opening cut into the walls of a long, low hut made of leaves. Outside, a second fire burned. And in the center of the clearing stood the framework of a longhouse made of saplings. Nearby, an old man and several women were weaving palm fronds into roof sections. They all bore the jaguar facial markings.

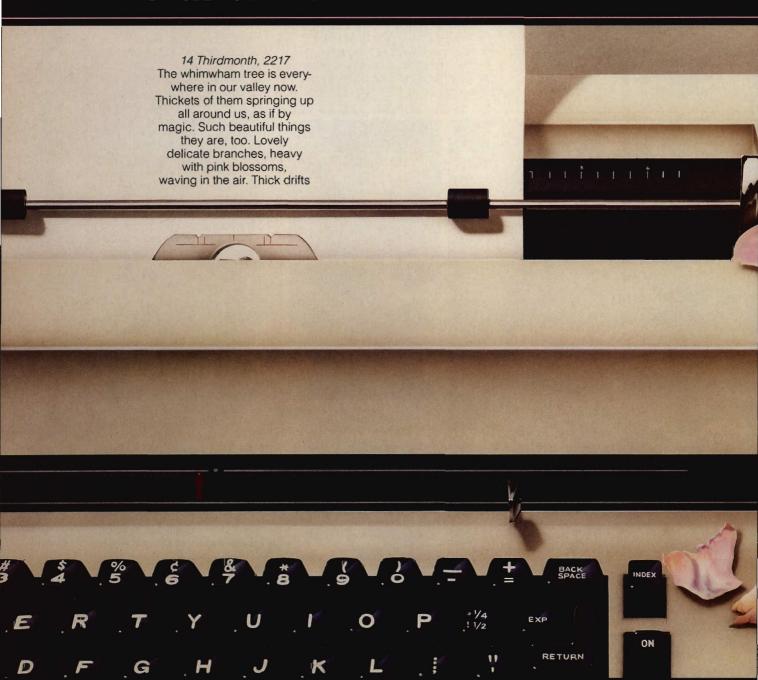
We watched as our guide placed the bloody but still living monkeys by the fire. Nursing a baby, a woman took the monkey infant and placed it against her breast, where it found her firee nipple and began to nurse.

A young girl had also joined him and

FICTION

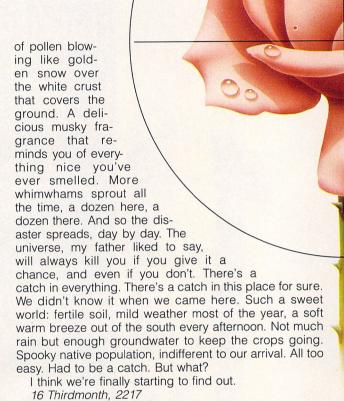
THE CATCH

BY ROBERT SILVERBERG



PAINTING BY DICKRAN PALULIAN





it on worlds where everything is all divided up already. We grub in the raw gray soil here to create the baronies and dukedoms our great-grandchildren will own.

Of course the Ghosties are here, too. But they are very quiet and they don't seem to give a damn about the bar-

We are just quiet farming folk who can't or won't hack

Of course the Ghosties are here, too. But they are very quiet and they don't seem to give a damn about the baronies and dukedoms we dream about for iding on what used to be their world. So we go on pushing the neat linear streets forward in the valley and power-chopping the plains into agricultural turf.

But now—the lousy hidden catch—the whimwhams— The first one in the village was Helene Gannett's doing. Green Thumb Helene: Take a stick and make it bloom.

It was a pretty little vase-shaped bush, about as big around as your hooped arms, about as tall as a tall boy of ten. Sleek slender pink stems with a glowing red core showing within, like one tube of porcelain wrapped around another, and elegant horseshoe-shaped turquoise leaves, and the first budding hints of the glorious flowers to come. Helene had it growing just to the side of her front door, in a place of honor among the forty or fifty other native plants she had gathered and nurtured. Each plant was set deep in the dark sandy ground, with a high rim of earth around it to retain water until it was established. Meticulous gardener, Helene Gannett.

"What do you call it?" my wife asked her.

"Whimwham tree. I planted it on a whim. And wham! Look at it grow."

Quick, all right. She'd started with a tiny cutting, a mere woody slip. It rooted overnight. Three days and it was put-

ting up new shoots. Now, a week later, it grew practically while you watched. The universe's all-time horror plant. Helene had clasped it to her bosom, and ours. The monster bush, the plague that looks like a tree.

"You've got a magical gift," my wife told Helene. "The way you can make anything flourish and grow. A special touch."

"It's just a matter of caring about Helene said. "Of paying attention. Anyone can A few days later a matter of caring about Helene said. "Of paying do it. If you care enough." second little whimwham

sprouted thirty meters away, across the road and up a little, outside Nick and Natalie Wong's place. Cute and dainty, at first. Came right up out of the ground, thrived immediately, grew like crazy. Within a week it was almost as big as Helene's original one. No watering basin around it, no special care: The Wongs aren't the type.

"It must be a runner from mine," Helene decided. "What terrific vitality! Not even two weeks old and already

it's sending out runners!"

Helene's own whimwham, which by this time was three meters tall, was flowering now. It bore its flowers in dense, heavy clusters at the tips of its stems. They looked like swarms of pink fireflies, very intense in color, so rich that they seemed almost to be giving off heat. Even after dark you could still see them a block away, glowing

in the dim light of our three splintery moons.

My wife told me that Helene's whimwham was in bloom, and when I got a chance I went and looked. We work hard here, and there isn't a lot of spare time. Carving a settlement out of the wilderness, it takes work, even on an easy world like this. But when I got a chance I went and looked. A little delegation of Ghosties had drifted into town about this time, and I found them sitting on Helene's porch, visiting the whimwham, too. There were four of them: a male, two females, and an other-over. They gave me that dead-fish smile of theirs. Then they went back to looking at the whimwham. You never know what's on a Ghostie's mind, and it's a bad idea to try to guess. But they seemed fascinated by the bush.

The other-over turned to me after a while and said,

"What you think? Very nice plant, yes?"

"Very nice, yes."

"We think very nice, too."

"That's nice you think it's nice," I said.

"Very pretty flowers. Very very pretty pretty."

"Very pretty, yes."

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I wish I liked Ghosties more. They're gentle, inoffensive things, peaceful and polite. Little slippery creatures, pale green, almost transparent, like squid that walk upright. They aren't what you'd call friendly, but they really didn't hamper us in any way as we began to settle in and then to expand our community across what I suppose had been their territory. Lord only knows what they thought we were. Gods, maybe, dropping down out of the sky in a shining chariot. They simply moved back and found new territories for themselves farther east. Once in a while they come through town, just sightseeing, sometimes making a little chatter with us. They speak pretty fair Anglic: They picked it up naturally, the way you'd pick up the measles.

The Ghosties and I sat there appreciating Helene's whimwham tree for another five or ten minutes. It was full grown now, higher than her house. I was amazed at the way pollen came from it in thick clouds, piling up in mounds. And the aroma of the flowers was astonishing. It smelled to me like a perfume my mother used to wear. Then it struck me it was more like the bouquet of new young wine, bubbling in the cask. Or, maybe, like the warm soft place between my wife's breasts, just as she steps out of her bath.

A third whimwham sprouted a little

while after that, down the block by the town hall. Then there was a fourth, and a fifth, and then we stopped remembering how many there were, because there were too many all at once.

That was when the horrors started. Little horrors first. The whimwhams began to go to seed, producing big bright red pods. On sunny days the pods explode and scatter black pellets, like buckshot with knife-blade edges, over tremendous distances. Where the seed pellets hit, they slice into the ground and begin making new whimwhams. Eleven of us got hit, too, before we started wearing protective gear. Sam Kingston lost an eye.

The old leaves of seeding plants undergo a chemical change that fills them with burning acid. They come loose whenever the wind blows and go whirling through the air like so many little firebrands. If they touch you, the blisters bubble for weeks.

In a few days all the stinging leaves had blown off, and the trees grew new ones. These new leaves are bigger and thicker and drip white crystals from their horseshoe tips. That was when Helene Gannett came running into Town Meeting like a crazy woman. "My whole garden's dying!" she yelled. "Everything but the whimwhams!"

The crystals turned out to be sodium hydroxide: caustic soda, that is. The

whimwhams extract it from groundwater and concentrate it in glands in their stems. As they come showering down from the leaves, the crystals turn the whole area around the tree into an alkali flat where nothing can grow except more whimwhams.

By this time we had hundreds of the things in the valley, all around, in front of houses, along the streets, in our little park. And out in the plains, too, edging into the cropland. You could see the whitened death zone expanding daily around them.

"We've got to cut 'em down," I said. Mike Zhukov seconded me. The vote was unanimous and we got out there with heat spikes and fusion saws. Helene's whimwham was the first to go. In the next three hours we took down twenty others.

Some Ghosties turned up to watch us work.

"They're laughing at us," Bud Glasnik said.

"How the hell do you know?" I asked him. "How the hell do we know what any Ghostie expression really means?"

Whimwham roots, we discovered, are killers. They go down fifty or a hundred meters, right to the top zone of the water table, and drink it bone-dry in no time, and go even deeper. There's no way to go down that far and dig them out. You can cut the trunk off, but the stump will sprout new suckers, often within hours. If you grub the stump out, too, the outlying roots will send up suckers of their own. They come up wherever the roots feel like it, often thirty meters away from the site of the tree.

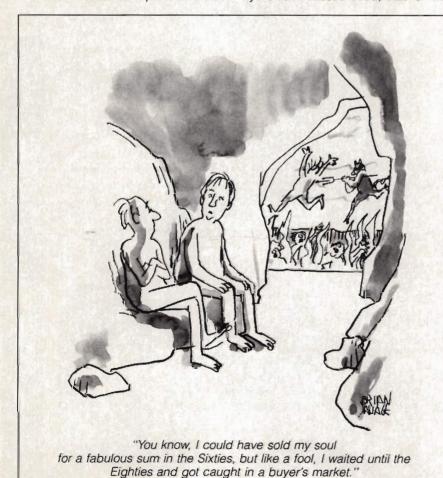
When you haul a cut-down whimwham away, you have to be careful what happens to the pieces. A twig the length of your finger, if it happens to land on a moist patch of ground, will take root right away. Even stray bits of bark can do it. We had to send the kids out on patrol, ripping up the new little whimwhams before they could get their hooks into the soil. Even so, we missed about one out of every five, and by the next morning they were nicely rooted, helping their big brothers and sisters to furn our valley into a desert.

I said to one of the Ghosties, "How come this entire planet isn't covered with whimwhams? What do you do to get rid of them?"

"Is no problem," said the Ghostie. "When whimwham come, we get the hoogoo bug that eats them. Hoogoo love eating whimwham."

Of course "hoogoo" isn't what she actually said. Human mouths aren't capable of reproducing the sounds the Ghosties make. But it was something like that. And it sounded right. Feed the whimwham trees to the hoogoo bug—why the hell not?

Turns out the hoogoo bug isn't na-



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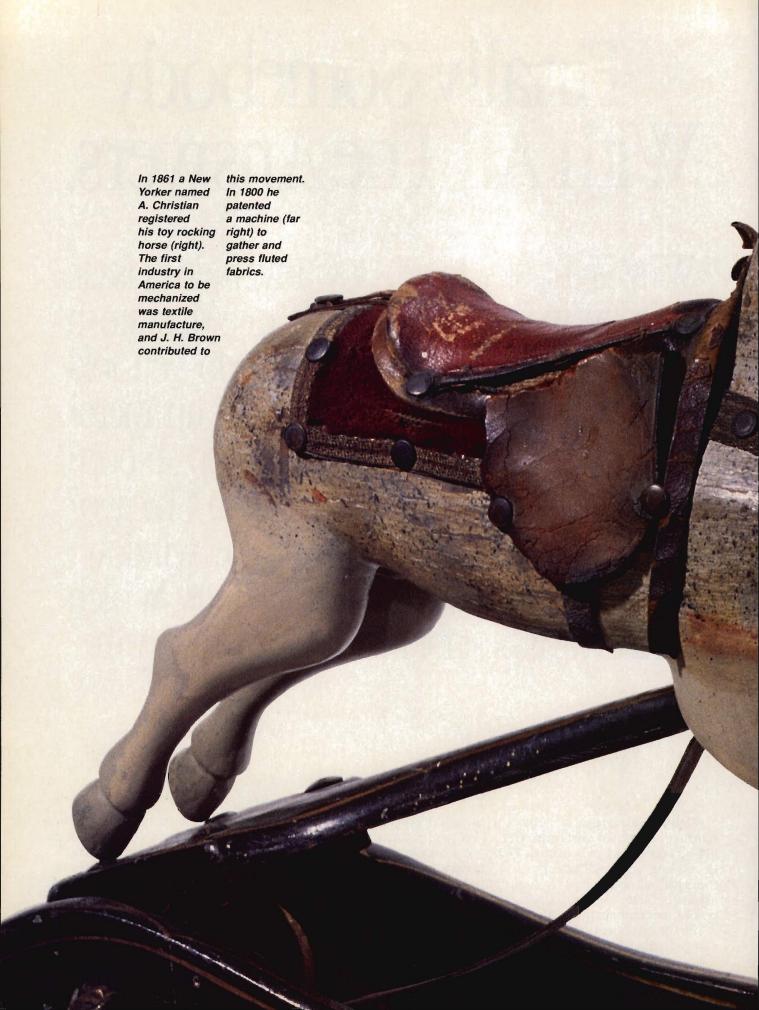
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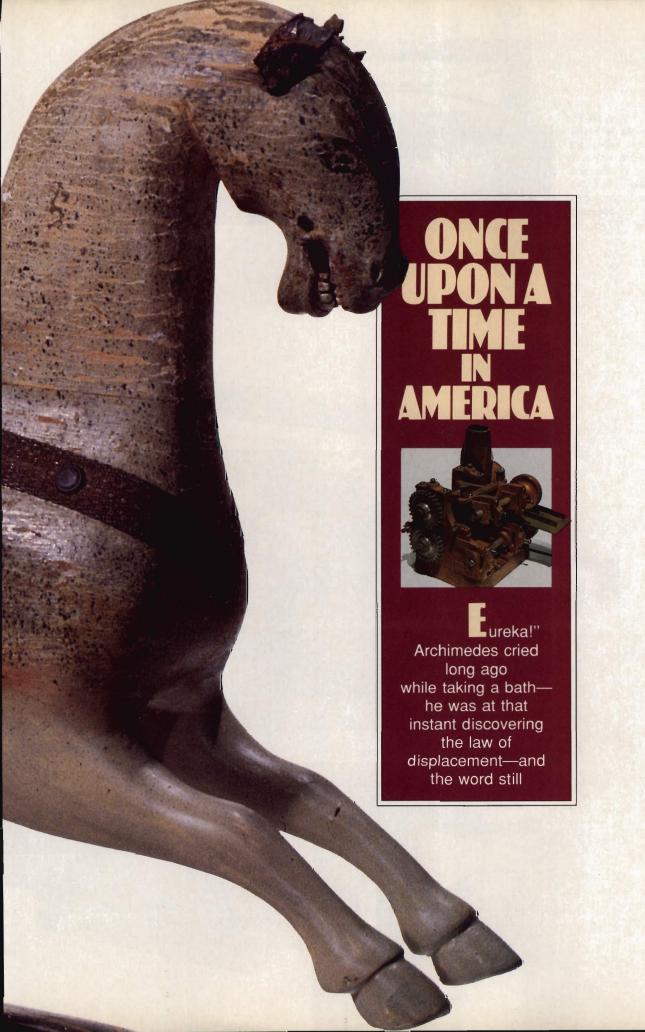
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Household chores made easier and more efficient: N. B. Phelps's hand-operated washing wringer, patented in 1876 (right).



echoes like a clarion call to inventors throughout the ages. Eureka, a light bulb! A pen! Liquid Paper! Though Archimedes' 2,200-year-old statement came down to us, alas, his model to demonstrate the theory did not. Did he in fact construct a model? If he had lived in America in the early nineteenth century he would have been required to, just to apply for a patent. Not only that, but specifications demand-



ed a model "not more than twelve inches square...neatly made, the name of the inventor...printed or engraved upon, or affixed to it, in a durable manner." This part of America's patent law of 1836 caused a burst of creativity, resulting in hundreds of thousands of models—until 1880, when the law was rescinded. The nonprofit U.S. Patent Model Foundation, launched in 1986 by then Vice-President Bush, is now attempting to raise a \$35 million



purse to collect, restore, and house these historical pieces of Americana, pieces that President Calvin Coolidge, in a moment of piqued shortsightedness, chose to auction off in 1926.

he models-100,000 may still exist, though at least an equal number were lost over the years to fire and disrepairare as diverse, cockeyed, and creative as American ingenuity. Some are highly complex (like a tile facing and squaring machine invented by Charles Powers in 1880), with a craftsmanship bordering on the maniacal; others are simplistically constructed (like a portable icehouse, invented by J. E. Lippitt in 1877), as if slapped together with childlike enthusiasm and not much else. Designs can and do leave the realm of judgment altogether, for some are the miniaturized beginnings of American industries: for example, the McCormick reaper, a threshing machine that revolutionized agriculture.

We were and are a nation of inventors, never satisfied with the status quo. After the Civil War inventors submitted 65 different types of clothespins for patent, each accompanied by a painstakingly wrought wooden or metal

Clockwise from left: Tile facing and squaring machine, 1880, by C. F. Powers; G. Westinghouse, Jr.'s steam engine and pump, patented in



example. (Then again, hanging clothes out to dry used to be big business.) In fact, so many Americans were busy inventing and supplying models for every imaginable and supposed benefit to humankind—many with the emphasis on *supposed*—that by the late 1860's, applications were in-

1870; fulling mill, used in the manufacture of textiles, by J. H. Trainor, 1874; vegetable assorter, 1879, designed by H. J. Heinz.





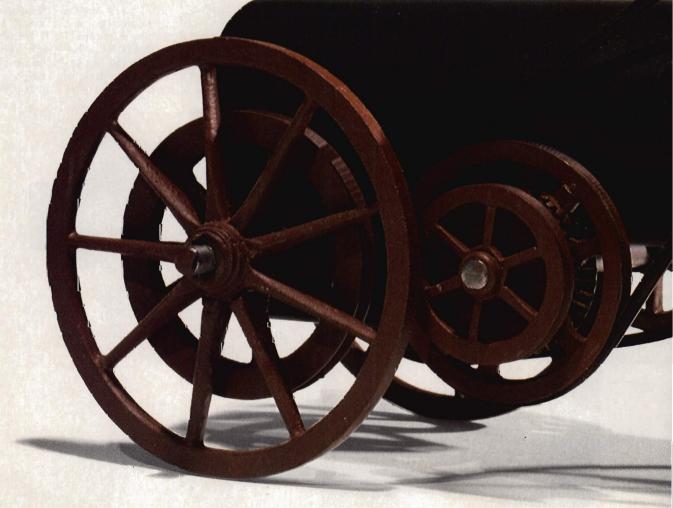




creasing at the rate of 20,000 annually. Patent Commissioner Samuel Fisher was inspired to state, "We may take just pride in our National Museum of the Mechanic Arts, but it is questionable whether this museum can be allowed to grow at the rate of 5,000 square feet per annum."

A fire in 1877 solved some of the space problem; a third of the models were destroyed. Changing the law a few years later solved the rest. But the large number of models that remain re-

veals a cornucopia of inventive fertility. From the perspective of a century away, we may chuckle at what seem incredibly naive attempts to make life easier. But these inventors were dead serious. To apply, they had to fill out numerous forms, pay an outrageous fee of \$30, and mail their contraptions to Washington, DC. Therefore a bedbug trap, a dogpowered treadmill, and an improvement in plates for desiccating eggs were no laughing matter, not to their proud inventors.





any of the models, however, are ingenious and crafted with the skill of a master artisan. Much of our modern industry, in its infancy and miniaturized, can still be seen in a vegetable assorter by Heinz; a hoist-

ing apparatus (that is, an elevator) by Otis; a steam pump by Westinghouse; a carbonizer and a telegraphic printer by our most prolific inventor, Thomas Edison.

The laborsaving device is an American preoccupation, and a plethora of these exist. Dozens of models of washing machines, sewing machines, coffee makers, clothes hangers, and folding beds were submitted for the anticipated gratitude of and remuneration by a burgeoning army of homemakers. Yes, among these were rodent or other animal traps. It is uncertain whether anyone actually beat a path to these inventors' doors, but rest assured, if you own an original model of a better mousetrap or any other nineteenth-century patented model, the U.S. Patent Foundation would like you to beat a



Top row, from left: Lantern made by J. H. Irwin in 1878; 1876 improvement on the telegraph, patented by Alexander Graham Bell; S.F.B. Morse's improvement on his earlier patent for the telegraph, 1849;

Mary Hildreth's iron holder from 1875. Below: The patent office has no information other than the number 267, but presumably it's a locomotive.





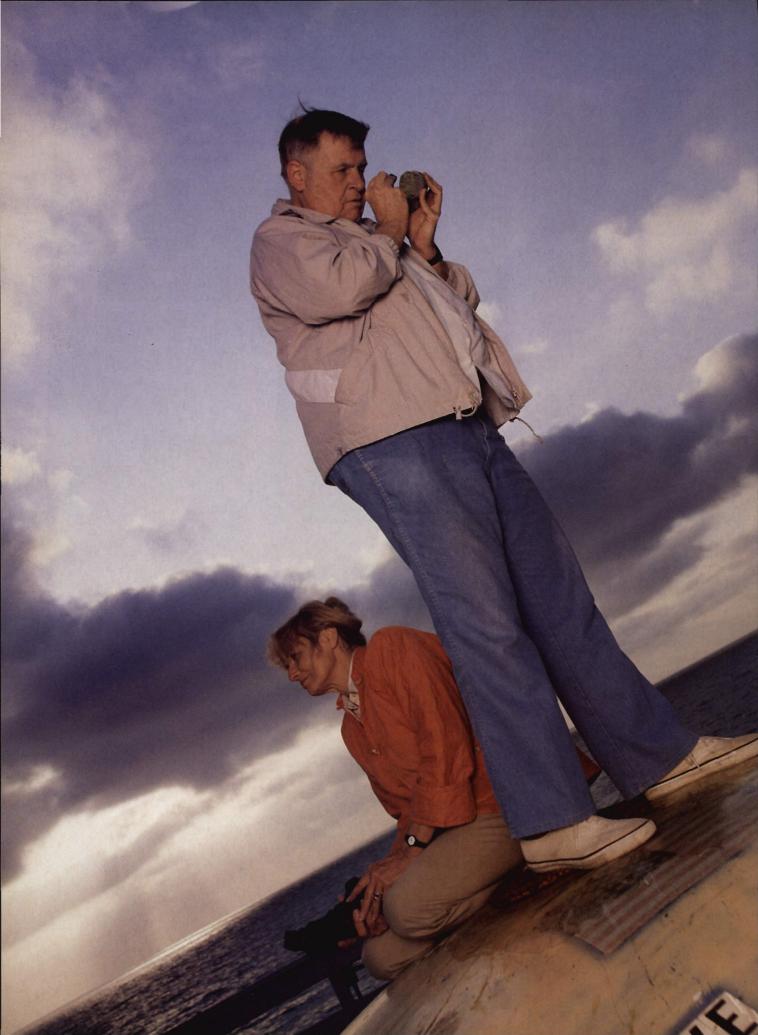


global warming, pollution, overpopulation, disease.

he foundation believes a revival of interest in these models may help reverse the downward trend. It has already recovered more than 35,000 models and plans to purchase privately owned models (the appraised value: \$23 million) to be housed in their own Smithsonian Institution building in Washington. The collection will intermittently go on tour to schools across the nation.

If you wish further information about the U.S. Patent Model Foundation or Invent America!, including how to donate a patent model or make a tax-deductible contribution, write the U.S. Patent Model Foundation, Suite 420, 510 King Street, Alexandria, VA 22314.—Bob Berger







A "hot spot" is not the latest nightclub for this eminent geochemist. He frequents places miles beneath the sea, where holes extending more than 600 kilometers belch primordial material from the hot liquid core of the earth

INTERVIEW

HARMON

n October 15, 1987, the research ship *Melville* from the Scripps Institution of Oceanography was steaming through the South Pacific some 900 miles southeast of Tahiti. As the ship approached MacDonald Seamount, the scientists saw the water beneath them begin to churn and bubble. Loud clanging noises began to issue from the bottom of the ship, "as if," says chief scientist Harmon Craig, "some-

one was down there banging on the ship with an enormous sledgehammer." To Craig the roiling sea and reverberating ship meant only one thing: The undersea volcano Tamarii was erupting, and his vessel was sitting right on top of it.

To most people, such a situation would seem a horribly unlucky accident. To Craig, it was an extraordinary stroke of fortune. As a geochemist—one who puzzles out the workings of the earth's insides by

PHOTOGRAPH BY DOUG KIRKLAND

analyzing the chemical composition of the rocks and gases that it spews forth-Craig has roamed the world, inspecting the volcanic pipes and crevices that provide windows into the earth's heart. He has climbed into volcanic calderas, or craters, in Ethiopia and plucked frozen cores from the Greenland ice cap. He's ridden the famous submersible Alvin two miles down into the abyss of the ocean floor, to places where the very sutures of the earth are stitched in fire and smoke. All this in an idiosyncratic search into the interior of the planet, which Craig characterizes as "wrenching truth from the earth."

The grandson of stage actors who owned a theater in Boston, Craig took his turn behind the footlights. But by the sixth grade he wanted to be an entomologist. He collected rocks, insects, and one-celled animals and scoured the Boston Commons for flints. By highschool graduation he'd settled on the physical sciences, which led him in 1943 to the University of Chicago, where he spent a year before enlisting in the Navy. Ending his naval career aboard a radar test ship in 1946, he returned to Chicago, where Nobel laureate Harold Urey-the discoverer of heavy hydrogen-was beginning to produce a new breed of geochemists.

Craig entered graduate school in geology and spent several summers with his wife, Valerie, field-mapping and sampling granites in Wyoming, intermittently tending bar to help finance his work. He then approached Urey for a thesis subject. Urey made him learn to blow glass and assigned carbon to him, hydrogen and oxygen having already been parceled out to others. Craig became entranced with the study of isotopes, atoms of the same element that differ in the numbers of neutrons in their nuclei. "Isotopes," he says, 'gave me a chance to look at rocks, shells, organic matter, trees, ocean water, diamonds, meteorites-everything on Earth." Indeed, for his Ph.D. dissertation at Chicago he analyzed carbon isotopes in all these diverse substances so thoroughly, according to one colleague, that his findings became "the foundation for the signature of carbon in nature." Craig recalls: "When I went to college I wasn't sure what science I was going to concentrate on. This uncertainty is something that's characterized everything I've done since, because I have the desire to work in different fields-geology, geochemistry, geophysics, oceanography."

His turn in the Navy left him fascinated by the sea, so when offered a job in 1955 at the Scripps Institution, he jumped at the chance. This fascination, particularly with places where the ocean meets the inner earth, led Craig

to what may be his most important discovery. In 1969 he and Brian Clarke, then a Scripps colleague, found that helium 3, a rare isotope of helium, continually exudes from ocean-floor volcanoes as part of the "degassing" process unfolding since the earth's birth. Since then, Craig has been tracing helium 3 "signatures" at submarine volcanoes and "ocean-island hot spots," particularly along the East Pacific Rise, where the gigantic oceanic plates separate. Craig's analysis of helium 3 in the volcanic gases of Kilauea, a hot spot volcano in the Hawaiian islands, showed that the lavas of those volcanoes come from the deepest part of the earth's silicate mantle.

Craig's global studies of helium 3 and other isotopes have earned him the Vetlesen prize, the highest award in earth sciences, and some colleagues acclaim him as one of the true inventors of modern geochemistry.

Bill Lawren interviewed Craig at his La Jolla, California, home and his Scripps lab, where he often works from three P.M. until the early hours of the morning. "By the time we were finished," Lawren says, "I was ready for a long vacation. But Craig could have gone on forever."

Omni: Is there something archetypal about your urge to get at the earth's deepest secrets?

Craig: Perhaps, but I don't know how to explain it. When I'm at sea, I go out on deck at night when no one's there and experience a deep physical feeling. Sometimes I talk to the ocean. It's the same when I'm climbing a volcano to get samples. I don't have any breath left because of all the smoking I did, so it's a terrible effort to climb things. I feel a certain pride that I've been able to do it.

Omni: How did you end up sitting on the erupting volcano?

Craig: We were in the Austral island chain, which ends in the southeast at an underwater volcano called Mac-Donald Seamount, tracking huge plumes of helium 3 emitted from the East Pacific Rise. The ocean at the seamount was a vivid green, with muddy chocolate streaks throughout. Next we noticed loud noises from under the ship, banging hard enough to make the ship shake. Then we saw huge bubbles, six to twelve feet in diameter, bursting in clouds of steam and gas. Evidently there was an eruption going on.

We put the ship into the middle of the green stuff, and when we saw a bubble coming up, we tried to put the ship over it and send a hydrocast [for sampling water at different depths] down through it-harpoon the bubbles. Bombs of dead-black lava came spewing up, too, and because they were so hot and full of steam, they floated for



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fifteen minutes or so. We managed to net one lava bomb.

Omni: Wasn't this dangerous?

Craig: Myojin, a volcano south of Japan, erupted in 1952 with a shipful of Japanese oceanographers over it, blowing the vessel to bits, killing everyone aboard. Nothing was ever found but a few pieces of wood. Later, records told us that some MacDonald Seamount eruptions had been two hundred times more violent than the one we were sitting on. Some people at Scripps tried to make something out of this when we got back, saying we'd risked the ship. But Myojin is an arc volcano, and these have a lot of water in the lavas, so you get steam blast eruptions and huge explosions, like Krakatoa. The MacDonald Seamount volcano erupts much more quietly.

Omni: What's the difference between hydrothermal vents and hot spots?

Craig: A hydrothermal vent is a fissure along the midocean ridges or other places where seafloor spreading is going on and new ocean crust is forming. Seawater is flowing down into the cracks and getting heated up as it approaches the active magma. Then the hot water rises and flows out.

Now, a hot spot is something else. As the big continental and oceanic plates move—the Pacific Plate, for ex-

ample, is moving northwest—there's a continual source of material at a point deep in the earth's mantle that's punching its way vertically to the surface. This material punches holes through the oceanic crust like a sewing machine needle stitching up the plate and produces volcanoes along a line on top of the holes, as in the Hawaiian chain.

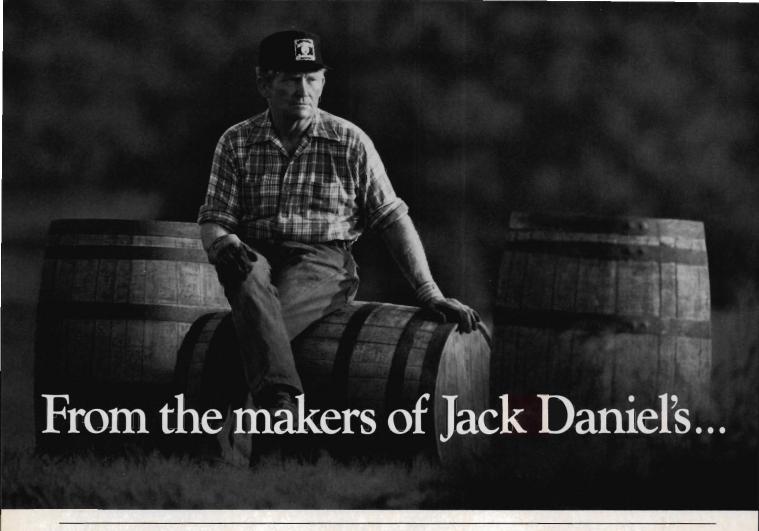
Hydrothermal vents don't go very deep. The active magma that heats up the water is only a few kilometers below the ocean floor. The majority opinion, however, is that hot spots go well down into the mantle, more than six hundred kilometers. Many people now believe these hot spots extend all the way to the boundary between the mantle and the core. That's a depth of about three thousand kilometers, about halfway to the center of the earth.

Omni: How can you tell a hot spot? Craig: Our way is by looking at the isotope ratios of the stuff that comes up: for example, the ratio of helium 3 to helium 4. A primordial isotope stored in the deepest part of the earth at the time it formed, helium 3 has been coming out of volcanoes ever since. Helium 4, on the other hand, is produced throughout the earth by the radioactive decay of uranium. We can compare the ratio of helium 3 to helium 4 at various places such as hot spots where the gas-

es are coming out dissolved in seawater. We get the highest ratios, the most helium 3 compared with helium 4, at places that go deepest into the earth. At Hawaii and in some of the hot spot volcanoes in Iceland, in Ethiopia, and at Réunion in the Indian Ocean, the ratios are the highest, about thirty times the atmospheric ratio. This is the most primordial, pristine material on Earth. It has to be coming from very deep in the mantle. Of course there are a lot of other isotope tracers used to identify these plumes.

Omni: What was it like going down to the Loihi hot spot caldera?

Craig: Strange. Loihi is a living, growing undersea volcano one thousand meters below the sea surface. It's the present site of the Hawaiian hot spot; in fact, it's the place where the next Hawaiian island is being built. From the helium 3 and methane concentrations in water samples, we knew there must be hydrothermal venting down there. Rocks dredged there indicate that Loihi must have been active about five thousand years ago and could erupt tomorrow-or one thousand years from now. But we had no idea what we'd find. We got the Alvin [a deep-sea submersible with robotic arms] to Hawaii and started surveying along the Loihi caldera on the ocean floor. That was



drudgery, moving the Alvin around at a knot or so and finding nothing.

Finally we found rocks completely different from the black, shiny basalt and volcanic glass everywhere else. These were covered with a thick, reddishbrown deposit of iron oxide—a hydrothermal deposit. When we tried to pick up a rock with the arm of the submersible, red powder flew up in every direction. When we finally located the vents, the water coming out was flowing downhill. [In most vents the water coming out is so hot it rises in huge jets.] This water contained so much carbon dioxide that it was denser than the surrounding seawater, and because of the temperature difference, it shimmered.

Omni: You understood this at the time? Craig: Not completely. When you're down there, your mind isn't really thinking in these physical terms. You're enclosed in a tiny capsule, and it's completely dark except where your lights are shining. All of a sudden you come upon this scene: reddish deposits all around and this shimmering cascade of water flowing gently down the hillside; huge basalt columns lying around in great piles. It was like a fairyland or something out of mythology. Ruined cities. It was so beautiful and unexpected that it left us speechless. We were parked in a titanium sphere, sitting on

a column of material that had punched its way up from the boundary between the mantle and the core of the earth, thousands of kilometers below us.

Omni: Where are hydrothermal vents usually found?

Craig: Originally it was thought that all such vents were at major spreading axes, where the plates are ripping apart and new lava is coming up to replace them. But a few years ago we took *Alvin* near the Marianas Trench in a back arc basin, an active arc behind an area where one oceanic plate is diving under another one. We found hydrothermal vents almost twelve thousand feet deep. Now we have found vents in many other back arc basins, which doubles the number of areas where we can expect to find them.

Omni: Describe the vents.

Craig: In the East Pacific Rise vents you see hills of brown and black oxides and sulfides, on top of which are chimneys growing ten to twenty meters high. They look like giant candelabras, so one has the feeling of being in a cathedral. Some of these chimneys have volcanic black sulfide "smoke" spouting out the top like geysers, at three hundred and fifty degrees centigrade. You really feel as if you're sitting on the engine of the earth.

There's lots of life; the vents are oa-

ses. The Marianas vents had little depressions—we call them woks—where thirty-degree water was coming up, and they were filled with hairy snails, shrimp, and fish. It looked like the origin of life, a tremendously fertile, writhing biomass. There are tube worms with red tips, giant white clams, mussels, and barnacles. There are hydrothermal vent fish sucking up all the nutrients that come up. On one dive we brought up about thirty of these hairy snails and had a cookout. They were marvelous. I froze some and gave them to the Explorers Club to serve at one of their banquets. I'll bet they're still in the freezer.

At Loihi, though, there was almost no life, except a very funny fish with a small body, large front legs, and a great huge gaping mouth. It just sits on the bottom, facing the current with its mouth open, and lets all the food flow in. We named it after Bill Nierenberg, director of Scripps at the time, who has a reputation, totally deserved, as having the highest ratio of talking to listening in oceanography.

Omni: The French architect Jacques Rougerie foresees colonies living permanently on the ocean floor. Do you think that will ever happen?

Craig: It could certainly happen, because there are enough people who'd

do it, just as there are those who'd live in space stations. But I don't think they'd do it permanently; they'd go down and live for a year at a time. We'll probably have something like that twenty to forty years from now. I wouldn't want to live underwater for a long time, but a short time would be great. I'd go down there with a word processor and get all my papers written. Loihi will become a great tourist spot. In ten years they'll have submersibles taking people down to Loihi, almost like Yellowstone Park. I already named the area Pele's Vents, and we left an aluminum sign down there. You'll see more signs with hot spring names on them, and the tourists will sail around and see the sights. Omni: What do you think of Jacques Cousteau?

Craig: A very interesting and formidable guy. I've never forgotten seeing him and his son Philippe on the Carson show, when Jacques disclosed that he had been an opium smoker in China. Apparently he had never told Philippe about this. Philippe was so astounded that he almost fell out of his chair. Cousteau has done a lot of living that people are not aware of. I am a Cousteau admirer. Unfortunately, many biological oceanographers have a poor opinion of him, think he does not do hard science and only wants pub-

licity. I don't see that at all. I see him as a man with an almost fanatic mission to explain to people what we're doing to the environment. He's been strongly affected by seeing the Mediterranean contaminated with so much junk that it is essentially a ruined sea. He has been primarily responsible for a lot of funding and support for oceanography. *Omni*: Recent work suggests that the deep inside of the earth resembles the surface. There are "continents," "mountains," and "canyons" at the core—mantle boundary. There's even a suggestion of "weather" down there.

Craig: Right. Harvard and Caltech people using CAT [seismic wave] scans to look at core-mantle interactions believe there's an almost atmospherelike convection around the core, so that molten iron rises in equatorial regions and gets transported to the north and south, where it actually rains down in storms. It may be related to the hot spots: Crustal plates move around all over the earth, while the hot spots are relatively more fixed. So that means the hot spots may originate on the mantlecore boundary. But something determines the initial cracking pattern of the plates. The way South America fits against Africa—the crack between the two continents more or less follows the same line as the chain of hot spots run-

ning along the Atlantic floor. It's almost as if the hot spots were responsible for cracking the two continents apart, possibly fixing the shapes of the plates. Omni: What about the direction of climate change in the next century? Craig: I've been doing research on methane, a greenhouse gas second in importance to CO2. Molecule for molecule, methane has more effect than CO2. Methane in the atmosphere comes from natural sources like swamps and wetlands, and from cattle, rice paddies, natural gas, and burning coal. We used Greenland ice cores to measure ancient methane levels recorded in air trapped as bubbles in the ice. We discovered that about four hundred years ago, when Shakespeare was young, the methane content of the atmosphere suddenly began to increase rapidly and has been increasing ever since. It's now more than double what it had been for many thousands of years in the past, obviously due to production by man and his animals.

We also drilled some ice cores to use large amounts of ice to study the carbon isotopes in the methane. They showed a recent increase in C-13, the heavy carbon isotope. This increase had to be due to burning of wood, the only source of methane that high in C-13. The burning of the world's forests CONTINUED ON PAGE 105



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€The mystery cloud was seen by more than 50 people in five separate cities more than 200 miles apart. 9

AUTI&MATTER

You can't ask for a more qualified observer than Patricia Reiff, senior research scientist in the department of space physics and astronomy at Rice University. Early one night last summer she spotted a small, very bright cloud in the clear western skies over Hickley. Texas. She called it to the attention of her family, and within five minutes the cloud had expanded fourfold and dimmed considerably. More than 50 people in five separate cities more than 200 miles apart saw it as well. Virtually every witness reported an ob-

ject of the same shape and in about the same position—roughly halfway between the stars Arcturus and Spica. Reiff calculated the cloud to be at least 700 miles away and nearly 350 miles up.

The cloud resembled a gas release from a sounding rocket, but a launch, Reiff thought, was unlikely to have been scheduled on a Saturday night with scattered thunderstorms forecast around the country. She called the White Sands Missile Range in New Mexico and learned that no missiles had been fired that night and that a test laser, developed by the star-wars program to shoot down aircraft drones and low-flying rockets, was not functioning at the time. Checks with NASA/Goddard Space Flight Center, Vandenberg Air Force Base, and others failed to resolve the mystery.

"It's also unlikely that it could have been the aftermath of a fireball-type meteor," says Reiff, "since most meteors disintegrate at lower altitudes. But none of the observers



UFO UPDATE

that there was something in the sky, but the question remains: What?"

James Oberg, an engineer in the space shuttle pro-

reported a meteor at

the time. It's clear

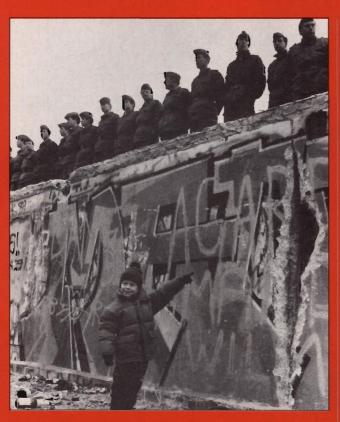
James Oberg, an space shuttle program, has made a second career out of explaining aerial mysteries. But after looking into the Reiff sighting, he, too, has come up empty-handed. "It has all the characteristics of a gas release from a sound-ing rocket," he asserts, "but whoever launched it has not come forward. We checked with those who would know and they have no record of any suborbital

launches. But then, there is no international convention on registering such things. You only find out years later."

Strangely enough, Oberg had his own mystery cloud sighting just a couple of months after Reiff's. Oberg was trick-or-treating with the kids on Halloween when, he says, they saw "quite a strange visual phenomenon. There were a lot of clouds in the sky, and the object looked to me like a spotlight projecting on the bottom of the cloud deck."

Initially other reports from the area confirmed that the object was far away. But then "a very good observer" just north of Oberg said that as he topped a rise in the highway, he could see a refinery burn-off on the ground; it was, he observed, lighting up the clouds directly above.

The story holds a simple lesson. "It stresses the importance of watching for anomalous phenomena," says Oberg. "The more that people come forward, the easier it is to find a solution."—PATRICK HUYGHE



PROPHECY CENTRAL

Ingo Swann is relying on a computer, not clairvoyance, to interface with the future. As the founder and director of the Manhattanbased American Prophecy Project, Swann has combined astrology and numerology with statistical forecasting techniques like cycle analysis to determine whether he can generate a prophecy database. And the results so far suggest his database may be an accurate indicator of political and economic events.

Swann, who publishes a monthly newsletter of his predictions, also issues

periodic "alerts" when significant events are imminent. An alert last fall correctly anticipated a 20-point drop in the stock market on November 20. And three weeks before the government of Romania toppled, his December newsletter noted that "significant social upheavals" would take place "with special reference to Eastern Bloc countries."

Swann's methods and conclusions have yet to convince professional soothsayers like Marvin Cetron, president of Forecasting International, an Arlington, Virginia, consulting firm on future trends. "You can try using crystal

balls and chicken entrails to predict the future," says Cetron. "You can also take five quick drinks and predict anything. But it wouldn't convince our clients. You've got to use quantitative data."

If Swann's database is at all accurate, perhaps Cetron's government and corporate clients should take heed. Swann's predictions for the Nineties include the decline of both Communism and capitalism and the formation of a vast Asian economic community encompassing Japan, China, Korea, and India, as well as most of the Middle East.

-Jeff Goldberg

"The constellations were consulted for advice, but no one understood them."

-Elias Canetti

"Astrology is framed by the devil"

-Martin Luther

LASER DISC BIBLE

When John Ellis found out about a new laser disc for personal computers that could store up to 600 megabytes of information, a supernatural voice gave him a message. "I heard God say, as clear as a bell, 'Do it!" he says. What God was talking about, Ellis claims, was putting a library of Bible translations and research on laser disc.

Ellis, a physician who also sells computers, now publishes and markets the Bible Library, a CD-ROM (readonly memory) disc for personal computers, through his Oklahoma City-



based Ellis Enterprises. The disc contains nine versions of the Bible, nearly 20 reference works and concordances, Hebrew and Greek dictionaries, sermon topics, illustrations, and more. "It would take seven hundred forty-seven floppy discs to hold all this information," Ellis says. "It's the equivalent of a stack of books, three across, that would reach to the ceiling."

Though the Bible Library sells for \$595 and requires a CD–ROM drive, Ellis says that most buyers are laypeople rather than scholars or ministers. "It lets them look up the facts, compare the original languages, and make intelligent decisions," says Ellis, "without depending on some seminary."

Has Ellis personally learned anything new from working with the Bible Library? "Well, the word piss occurs twice in the King James Version, but it's called 'drink of your own water' in other versions. When you look it up in the original language-Hebrew-you realize the only thing you can call it is piss." he says. "So I've fallen in love with the King James Version. It's an honest translation."—Sherry Baker

HUMAN YO-YOS

During the past year, around 9,000 French citizens have perched themselves atop cranes, bridges, and ravines and jumped off. The vast majority survived the leap, saved by an elastic rope tied around their ankles and secured to the top of their jumping spot. But at least nine people have lost their lives when the elastic snapped, according to Roger Bantuk, France's minister of youth and sports.

Why would anyone want to turn himself into a human yo-yo? "The two to four seconds of sheer terror you experience when you throw yourself over an abyss apparently causes an incredible rush," Bantuk says.

French physician Xavier Maniquet has found that jumpers' pulse rates can soar to 200 beats per minute even before they begin their free-fall—raising the possibility that the sport could be deadly for people with heart problems. Warnings about the dangers of becoming a human yo-yo, however, have done little to dampen the popularity of the bizarre new sport. So the French government has moved to regulate the activity rather than ban it.

"We hope to prevent casualties by designating relatively safe places, with set height limits, for the jumpers," Bantuk says. "The elastic rope must be the proper length, and the path of the jump must be free of any obstacles."

And since safety problems have been posed by the huge crowds that come to watch the human yo-yos, the government is banning jumpers from places like bridges, where rubberneckers can cause accidents.

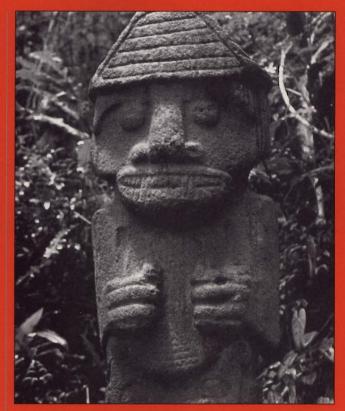
-Sherry Baker

THE LOST RUNES OF COLOMBIA

No one knows who was responsible for sculpting the remarkable stone statues that dot the grassy hills at the Colombian ruins of San Agustín. The sculptors and their civilization disappeared many years before the Spanish conquest.

But now a new twist to the mystery has been added by *Kadath*, a Belgian archaeological journal. In a recent issue, two archaeologists suggested that Vikings visited the site and left their own enigmatic mark.

Among the evidence presented in the 40-page



article on supposed Viking forays into South America is a photograph of a statue at San Agustín on which Nordic-like runes are carved on the headdress.

German archaeologist
Theodore Preuss, who
worked at the site in the
mid-Seventies, says the
markings were graffiti. In his
book *Prehistoric Monumen- tal Art*, he published two
photos of the statue in
question, one with the runes,
the other without, and wrote:
"Some tourists in our time
must have carved the runes
on the statue."

Not in our time, counters Raymond Camby, a coauthor of the *Kadath* article. He notes that a picture of the statue with the mysterious glyphs appeared in *Ruins of the United States of Colombia* by Agostino Codazzi, published in 1863. "If tourists carved those runes, they may have been Viking tourists," Camby maintains.—Rob MacGregor

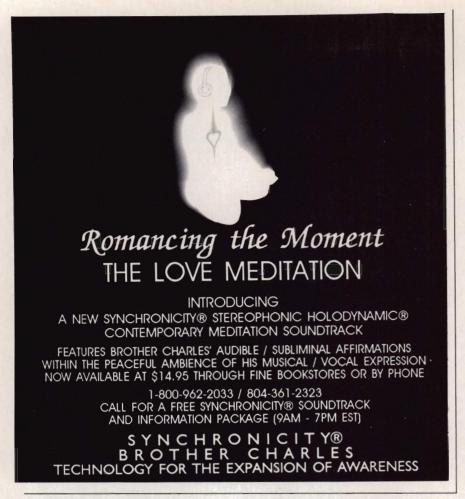
"When you're all alone reading, you wish the author that wrote it was a terrific friend of yours and you could call him up on the phone."

-J. D. Salinger

"A poet's hair is so strong it cuts rock."

-Korean proverb





THE CATCH

CONTINUED FROM PAGE 48

tive to this district. But the Ghosties, though they don't really seem to mind the whimwhams, are saddened that they're blighting the whole local land-scape that we have created, our farms and gardens and so forth. So they agreed to make a pilgrimage to the Holy Land of Glopglip, where the hoogoos live, and bring some back to get matters under control. And no, the name of the place isn't Glopglip, either. I'm trying to find equivalents.

The Holy Land of Glopglip is apparently very far away. The Ghosties are not swift travelers. We've been waiting a long time for our hoogoo bugs.

The whole valley is white with alkali flats. Nothing can grow here now but the whimwham tree. The topsoil is poisoned with caustic soda and the ground has been sucked dry, parched clear down to what used to be the water table. The whimwham has transformed our pretty valley into the kind of hateful environment that it alone loves.

A sea of pink blooms sways gently in the breeze. Smooth branches glow like fine porcelain. Sweet lovable little sproutlings come up wherever you look. It's all terrifically beautiful. It breaks your heart to see it.

23 Sixthmonth, 2217

The pilgrims have returned from Glopglip with the hoogoos, a dozen big wickerwork flasks of them. They are the most hideous insects God ever spawned, as long as your middle finger, with yellow scorpion tails and shining red beaks like razors and huge bulging luminescent green eyes. In the night you can see them crawling around under the whimwham trees like ugly little moving beacons.

The one thing they are besides ugly is voracious. They love to eat, and what they eat is whimwhams. They start with the leaves, and then they eat the stems, and when they reach ground level they follow the roots deep into the earth, chomping on and on until they have devoured every molecule of whimwham they can find. Then they lay eggs, somewhere far down in the ground, and in a few days a new generation of hoogoos comes boiling forth to go in quest of more whimwhams.

In the first week they ate every whimwham along the eastern side of the valley from Boundary Line to Town Hall. Then they started to work up the middle of town, heading westward, a steady swarming army. A second generation of bugs and a third had hatched by then, and they're at work at the edge of the plains, where our farmland used to be. It's frightening to watch them. They take no hostages. When they finish with a whimwham, there's nothing left of it except a fine sandy scatter of orange hoogoo turds that quickly blows away. Whole sectors of town are totally whimwham-free now. When some stray whimwham seedling sprouts in an area that's already been worked over, they come back and get it.

With the whimwhams all but gone, the valley looks strangely bleak and barren. But we have had some rain lately, and the sodium hydroxide crusts are beginning to wash away. Here and there, a few little green blades of normal plants are starting to poke through

the surface of the soil.

Mostly we stay indoors, waiting for the carnage to end. Nobody wants to set foot outside while scuttering armies of huge hideous hoogoos march across the land. We love them for what they're doing to the whimwhams, but you can't help feeling disgusted at the sight of them. And a little frightened. So we wait. Presumably, the hoogoos will die once the last whimwham has been gobbled or else take off for greener pastures, and we'll be able to get back to our farm work. Presumably.

The food supply is dropping pretty low here. We lost our whole season's crop, after all, to the whimwhams. Right now we're doing all right with rationing, but we need to get out there and start planting something soon, now that the rains have come. The question is whether the hoogoos can finish off the whimwhams before famine finishes

off us.

18 Eighthmonth, 2217

The best summer rains since we came here. Terrific weather for the crops, except there are no crops.

The whimwhams are all gone. The hoogoos are still here. And still hungry.

"Didn't you say," Bud Glasnik asked me, "that the Ghosties told you the hoogoos don't eat anything but whimwham trees? So when they've eaten all the whimwhams, they'll go somewhere else?"

"I don't remember the Ghosties tell-

ing me that," I said.

"We assumed it, didn't we?" said Bill Gannett. "You bring in one ecological plague to take care of another, and it goes away when it does its job. It makes ecological sense."

"Yes," I said. "It does. But that isn't

what's happening."

"No," Bud Glasnik said. "That isn't what's happening."

What is happening is that the hoogoos, having completed their whimwham assignment, had eaten all the new summer vegetation that had come up in the places where the whimwhams had been. That didn't last long. But they will eat anything. Anything. They ate some of our livestock

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next, as much as they could get at before we sealed the pens. They ate three cats and most of our dogs. They attacked Mike Zhukov outside Town Hall and slashed his leg badly enough to require surgical repair.

Flamethrowers stop them but don't stop enough of them. Nothing we have seems to poison them. Any lethal dose would probably make our land lethal, too, for years to come. We have become prisoners in our own houses, with swarms of angry, hungry hoogoos crawling up the walls, looking for the way in so that they can eat us next.

Question: Are they eating Ghosties,

too? If not, why not?

The Ghosties must have known what hoogoos are like. They wouldn't have brought the critters from Glopglip and turned them loose so close to their own territory if they didn't have some way of controlling them.

Tomorrow Will Nordlund and Bryce Falk and I will suit up and take the land cruiser and ride across the plains to talk to the Ghosties, if we can find them. And ask them what they think we ought to do to get rid of the hoogoos, now that the hoogoos have taken care of the whimwhams, because we're getting very hungry and we're also pretty scared.

29 Eighthmonth, 2217

"Oh, yes," the Ghosties told us. "The hoogoo has an enemy, indeed, yes. The jubjub bird eats the hoogoo bug."

The jubjub bird? Well, that's not really what they call it. But it'll do as an equivalent. It'll have to do.

I said, "Where can we get some jubjub birds, then?"

"They are also found in the Holy Land of Glopglip."

Will Nordlund pulled out a mapcube. "Show us where Glopglip is," he said.

"Oh, no, how can we? It is the Holy Land."

"We need to go there. We have to get some jubjub birds."

The Ghosties conferred. No, they said, it would be sacrilege for them to tell us where Glopglip is. But they would gladly go there for us and bring back jubjubs for the hoogoos, just as they had brought back hoogoos for the whimwhams. Yes. Gladly.

"When?" we asked.

"At pilgrimage time," they said.

"When is that?"

"When the year has changed," the Ghosties said.

"That's five more months. We can't wait that long. Could you make the pil-grimage now?"

"But that would be sacrilege."

7 Eleventhmonth, 2217

The Ghosties have taken pity. They will set out a month early for Glopglip, and with luck they'll be back here with some jubjubs for us by early spring. May-

be they will. Maybe they won't.

If we haven't starved by then, and it's going to be a close thing, the jubjubs that the Ghosties bring will eat the hoogoos that wiped out the whimwhams, and we will be back where we started from, ready to plant the spring crops and live happily ever after and found our future baronies and dukedoms. And if you believe that you will believe anything. The fierce buzz of hoogoos is all we hear when we poke our heads outside. They're very hungry now, and very mean, and they aren't going away. There's just enough vegetation sprouting now in the dewhimwhammed fields that used to be our farms and gardens to keep them here.

Something occurred to me, a little late in the game, last night. If these jub-jubs and hoogoos and whimwhams are all linked in a food chain, and jubjubs and hoogoos aren't native to this part of Bryson's World, then whimwhams aren't either. So where did Helene Gannett get the whimwham cutting that started all our troubles in the first place?

I asked her that.

"A Ghostie gave it to me," she whispered. Terror came into her eyes. "You won't tell anybody, will you? The Ghostie brought me just a little slip of a cutting, and smiled, the way they'll smile, and said it was a very special gift, for me, because my garden was so nice. And I thought, How beautiful it is, what a lovely plant. And it took root right away. But please don't tell anyone. Please!"

So now we know how a killer tree from far-off Glopglip happened to get loose here. And we know, too, what the big catch here is. The catch is that we are dependent on the Ghosties to keep us alive, because this world is full of dangers that we don't even begin to understand, and the Ghosties do not regard us as friends. They are very gentle and obliging, and they will go on and on that way, bringing us new remedies for the calamities that their earlier gifts have caused, because it is a polite thing to do, and each remedy will be worse than the thing it is supposed to deal with. The Ghosties are willing to go on being helpful forever. It is a cycle that probably will not end until we are gone from this place. I don't think there are going to be any baronies and dukedoms for us on Bryson's World af-

A platoon of hoogoos is scrabbling across the window right in front of my nose as I write this, trying to find the way in to the house.

All right, Ghosties. Bring on your jubjubs. And afterward, I suppose, you'll get us the flipflap rat to eat the eggs of the suddenly terrible jubjub. And so on and so on. I can hardly wait. DQ

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TROUBLE

CONTINUED FROM PAGE 43

"Now give him something in return. Your machete."

Accepting the machete, Tumi turned his back to us.

"Let's go while he still thinks we're spirits, Pedro."

I wanted to ask why but kept silent as I crawled out of the hut behind Moises. Everyone stared at us, the older children holding bows and arrows or spears at their sides, ready. Moises looked slowly across the camp, then started toward the forest. We'd almost reached the edge of the clearing when Tumi's voice boomed behind us. We froze, Moises holding my arm to keep me from bolting, and turned back to the hut. Tumi gave a bow and arrows to one of his sons, who ran to us. "He says you have nothing to hunt with; he wants you to take them," Moises said.

Trembling, I took the bow and arrows from the boy. Then we turned and stepped back into the forest.

Since then I've returned to the jungle several times, ending each trip with a visit to Tumi. I've visited Matses camps on a dozen rivers with Moises. We've always tried to come and go as spirits, not bringing things they don't need or taking things they don't give.

Not all tour guides in Iquitos, however, share Moises' respect for the Matses. When word of our contact got out, other guides began taking tourists to Tumi's camp. A trail was eventually cut from the Auchyako fishing village to the puebla, making access much easier. The tourists took things to tradewatches, calculators, and all kinds of plastic trash the Matses didn't need; they left with arrows, spears, clay cooking utensils. Every year the family seemed more burdened with the objects of "civilization." Every year they seemed less like Matses. I knew I had done the damage with that first visit, but I had no way to undo it. My enthusiasm to see a people in their natural state was now ruining them.

Then we found Tumi's longhouse burned to the ground and the *puebla* deserted except for the young man we'd first encountered in the jungle. He had grown up and built a separate hut, began wearing shoes and long pants, and now went by the name Antonio. We asked what had happened to Tumi.

"My father is crazy," Antonio said in the pidgin Spanish he had learned. "He burned his house and left everything here, all of the things people brought him. He said he wanted to hunt and gather and fish in the jungle, to be a Matses again. He says he now knows you and Moises are bad spirits. You brought the tourists. He should have killed you when he first saw you."

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CONTINUED FROM PAGE 20

ach an attractive site to colonize. It took an unorthodox demonstration to settle the matter. Marshall swallowed a batch of Helicobacter—and promptly came down with an acute case of gastritis. Biopsies showed that his stomach was infiltrated with the bacterium.

Although Marshall made a full recovery within two weeks, another doctor who volunteered his stomach to science was not so fortunate. Three years after consuming a Helicobacter culture, he still had a belly full of the bug. What finally cured him? A whopping dose of antibiotics and a lot of Pepto-Bismol.

The best strategy for eradicating the organism incorporates that time-honored remedy for digestive ills. As far back as 1915 doctors advocated salts of bismuth (the active ingredient in Pepto-Bismol) as a cure for upset stomachs. Although physicians eventually dropped the treatment, their patients continue to rely on it to this day. As it turns out, there's more to the soothing effect of Pepto-Bismol than the "protective coating action" cited in its ads: Salts of bismuth kill Helicobacter.

By itself, however, a salts of bismuth preparation can keep the organism in check only by temporarily reducing its numbers. To completely clear the gut usually requires a course of two antibiotics—tetracycline and metronidazole taken over a two-week period.

Although compounds like Zantac and Tagamet, which reduce the acid content of the abdomen, promote recovery from ulcers, the relief is usually shortlived. The germ invariably flares up again. "Antacid drugs are a treatment, not a cure," says Marshall. "People often have to take these medications on and off for life." The advantage of the one-two combination of bismuth salts and antibiotics, he argues, is that it eliminates the disease at its roots, greatly reducing the likelihood of a relapse.

To prove his point, Marshall recruited 100 ulcer patients testing positive for the bug and randomly assigned them to two treatment groups. He reported the results in the December 1988 issue of the British medical journal Lancet: The group treated with bismuth-antibiotic therapy had an 80 percent cure rate a year later. In contrast, 15 percent of the group receiving only Tagamet were symptom-free after 12 months.

Don't expect your local physician to offer the antibiotic therapy anytime soon, however. For one thing, the only test for Helicobacter currently available requires passing a narrow tube called an endoscope through a patient's mouth and down his esophagus to obtain biopsies of stomach or intestinal tissue. And although blood tests and breath tests to detect Helicobacter exist, they're not expected to become commercially available for two years.

Furthermore, researchers are likely to face continued resistance from mainstream practitioners. "We've spent the last seventy years thinking that excess acid caused gastritis and ulcers,' says Dr. James Barthel, assistant director of endoscopy at the University of Missouri School of Medicine in Columbia. "So the discovery of this germ is causing a tremendous upheaval in common medical thought."

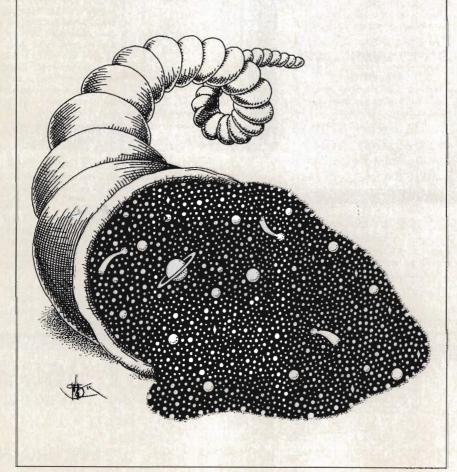
The antibiotic approach is troubling to some physicians because it produces severe side effects-including nausea, vomiting, and diarrhea—in 30 percent of patients. "It's probably worth the risk of an adverse reaction if the ulcer or gastritis is severe and persistent," acknowledges Dooley. "But if symptoms are mild, patients should be forewarned that the cure may be worse than the disease." Yet another drawback of the treatment: It's not always effective. Although antibiotic-resistant strains of the bacteria account for many treatment failures, as-yet-unidentified factors also seem to play a role.

"Antibiotic therapy is still highly controversial," cautions Dr. David Graham, chief of digestive disease at Baylor College in Houston. "Until we have a proven, safe, and effective therapy to eradicate the infection I believe we should stick to treatments that already have a proven track record in helping patients." Graham says he is concerned that prescribing currently available antibiotic protocols to kill Helicobacter infections could backfire by ultimately making some strains resistant to more specific drugs on the horizon.

Undoubtedly, better antibiotics will soon be available. The sheer-size of the ulcer market has made banishing the bug an extremely attractive research target. In the United States alone, 10 percent of the population will suffer from ulcers at some time in their adult lives, and many more will develop gastritis. "It's the most common infection in the

world," says Marshall.

Fortunately, most people have such low-level infections that they never develop symptoms. But the germ clearly exacts a huge toll from aching bellies around the globe. "Once we have developed safer, more effective antibiotics against it," says Barthel, "the next step is to prevent ulcers and gastritis altogether. The ultimate goal may be to vaccinate everyone in infancy—just like we do for polio."-Kathleen McAuliffe



For more information about the process of testing for and treating Helicobacter pylori infections, call the School of Medicine of the University of Virginia at (804) 924-9970.



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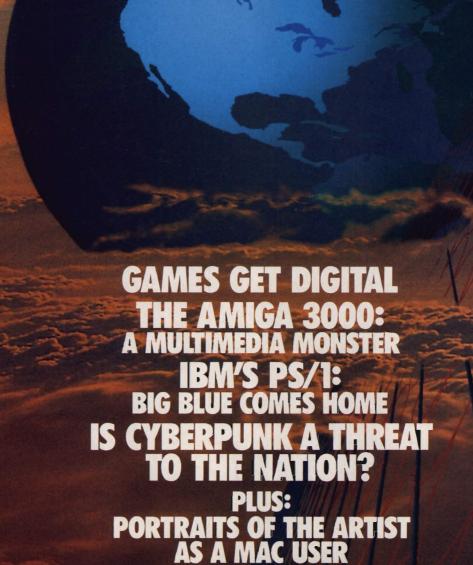
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so, I keep running into things I've forgotten—or never knew."

— Wayne Bulette

"It's a funner way to learn geography," reports 10-year-old Detective Christina Brassey. Eighth-grade sleuth Josh Pedroli agrees. So do reviewers:

"Carmen is a smash hit," reports Newsweek.

"If kids get addicted to a game, it would be nice if it was one like Where in the World is Carmen Sandiego?," says Peggy Charren, President of Action

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VELCOME TO COMPLITE

The complete home PC magazine: From games to business

IBM came home again early this summer with its introduction of the PS/1, Big Blue's first consumer product since the PC Jr. in 1984. The nonstandard design of the PC Jr. made it less powerful than IBM's higher-priced business machines. Consumers found the PC Jr. less useful as well and tossed it over the rail and into the briny deep of home computer history. IBM learned its lesson. On this voyage, consumers get a portal to a sea of information and opportunity.

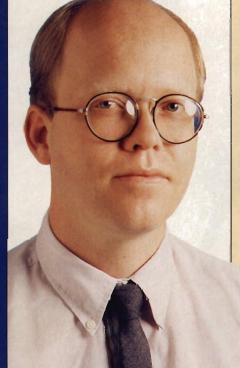
Apple Computer, a home computer pioneer, staked out its own claim in the consumer market in the early Eighties. But eventually the kids from Cupertino, California, abandoned that claim for the

boomtown of the Fortune 1000. That strategy saved the Macintosh but lost the hearts and minds of consumers. Now Apple is faced with the dilemma IBM faced in 1984: how to deliver an inexpensive but fully functional computer that will attract consumers but won't hurt sales to businesses.

The home computer galaxy revolves around this axis of complexity and simplicity. During the last six years, the most dramatic development in personal computer technology has been the rise of incredibly fast and powerful machines that are, without exception, easier to use than their anemic ancestors. An invisible machine, one that brings home a universe of informa-

tion while it brings down the barriers of access, is now more than just a dream.

The power-simplicity connection is also the reason you find this issue of Compute inside Omni. For more than a decade, Compute has informed its readers about the possibilities of home computing, sharing our discoveries, our strategies, and our enthusiasm. We present practical information in language you can understand, with features, reviews, news, and analyses. The publishers of Omni also believe in that mission. In October, Compute will again be on the newsstand and in your mailbox, bigger and better than ever. Because you can come home again.—Peter Scisco



THE COMPUTE INDEX

The 11 top-selling personal computers in the United States: IBM 50Z, IBM 30.286, Commodore 64C, Apple Mac SE, Apple IIGS, Apple Mac Plus, IBM 55SX, Atari 130XE and 65XE, Commodore 128 and 128D.*

The top nine software packages: Wordperfect, Microsoft Word/DOS, Intuit Quicken, Central Point PC Tools, Lotus 1-2-3 version 2.2, Lotus 1-2-3 version 3.0, Microsoft Excel/DOS, Ashton-Tate dBase III Plus, Microsoft Works/DOS.*

The number of PCs worldwide: 72 million in the United
States, 35 million in Europe, 12 million in Japan,
less than 200,000 in
the USSR, 21 million elsewhere.*

The number of computers in the United States used for work at home: 10.3 million.†

Home PC uses in the United States: 59.1 percent for games; 55.6 percent for education; 52.9 percent for database management; 40.1 percent for computer programming; 61.1 percent for word processing; 33.7 percent for electronic spreadsheets; 41.4 percent for making graphs, charts, and tables; 23.4 percent for income tax preparation; 35.7 percent for budgeting and financial management; 9.2 percent for stock and portfolio analysis; 10.7 percent for musical applications.†

Percentage of U.S. PC owners who bought their latest machine during 1989: 18.†

Percent of U.S. PC owners who strongly agree that by 1995 computers will have a greater impact on us than TV: 47.6.†

Percent of U.S. PC owners polled who strongly agree that they are innovators: 28.4.†

Sources: Dataquest (*), LINK Resources (†).

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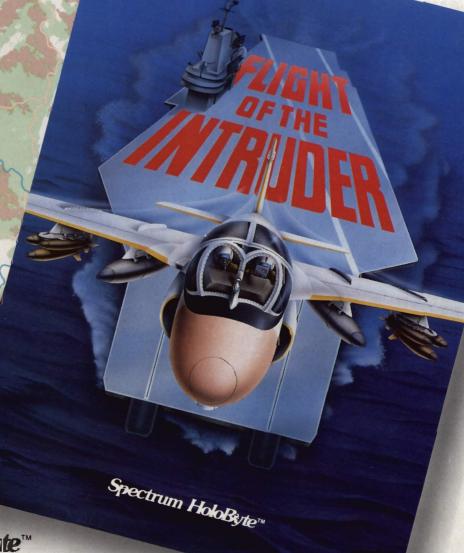
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IN FOCUS

REDDY'S MACHINE DREAMS

Tomorrow's home infotainment center may be less than a decade away

Raj Reddy, a professor of computer science and robotics at Carnegie-Mellon University in Pittsburgh, already has the future well in hand. From his cluttered office at the university, he beams electronic mail to colleagues in Paris, Tokyo, and California. Advances in computer and telecommunications technology, Reddy believes, will foster a multimedia approach to communications that will allow us to send each other text, speech, and pictures from the home. This new hardware will create an integrated information and entertainment center of the future. Compute: What nearterm technological developments will permit the home computer user to become part of a global information network?

Reddy: The first is the development of the so-called 3-G machine. That's a computer that has a one gigaop [a billion instructions] per second processor, a gigabyte of random-access memory, and a gigabyte of data-bus bandwidth. By comparison, today's personal computers are 3-M machines, as were workstations of the early Eighties, such as the Microvax. A 3-G machine is a thousand times more powerful than a 3-M machine.

Compute: How close are we to seeing 3-G machines in the home?

Reddy: Five to ten years away. First we need to break the one dollar per MIPS [million instructions per second] barrier, however. At present the fastest workstations you can buy cost about five hundred dollars per MIPS. This price should fall to three hundred dollars by the end of this year. In five years we will pay ten dollars per MIPS, and



One machine may replace your stereos, TVs, and PCs.

five years after that a MIPS should go for less than a dollar. **Compute:** Once we get such powerful machines, what will we do

with them?

Reddy: People often ask, Who needs a 3-G machine? Under the right circumstances, every man, woman, and child will need this power. In fact, the lower your intelligence or education, the higher power you will need. For example, if you can't type, then you will have to talk or write in longhand to communicate with a machine. This will require a 3-G machine: Cursive script or connected speech takes one hundred to one thousand million operations per second to process in real time.

Today you can purchase a highdefinition monitor and such a machine for one hundred thousand dollars. It should cost about a few hundred dollars by the year 2000, assuming the sales volumes are there—about ten million units per year. At that point you will be able to do things that are impossible today. We will need this new software and infrastructure before the real demand for such equipment develops.

For example, it would be nice if *Compute* were available at home in full color and high resolution—and without shipping it on paper. It would save the trees and also allow me to keep the magazine and to store it in a way that permits me to do instantaneous information retrieval based on its contents.

Right now the factors that prevent me from doing this are insufficient computational power, storage, and bandwidth. Such

a system, however, would also need a much higher bandwidth for sending data between machines connected by telephone lines. By way of comparison, a five-hundredpage novel without photos takes about a megabyte of computer storage. To transmit it using all-digital-64K bit ISDN [Integrated Services Data Network] takes about forty seconds. A publication with pictures and color may take about one hundred times more storage-and then require about four thousand seconds [more than an hour] to ship. This is impractical because I don't want to tie up my phone line for an hour to receive one magazine. We may need a transmission rate of at least 1.5 megabits [T1], the next level in phone line capacity, which you could get for a small connection fee if fiberoptic cable went into every home. You could then transmit Compute in less than a minute.—Tom Dworetzky

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TAITO

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NEWS AND NOTES

Are role-playing games a threat to the nation's security? Plus: A Mac attack

"Heavy icebreakers are kind of funny to deal with, even for the big boys. You know why? Because ice, all the really hard stuff, the walls around every major store of data in the matrix, is always the produce of an AI, an artificial intelligence. Nothing else is fast enough to weave good ice and constantly alter and upgrade it. So when a really powerful icebreaker shows up on the black market, there are already a couple of very dicey factors in play. Like, for starts, where did the product come from?" -from Count Zero, page 78, by William Gibson

Welcome to the weird universe of cyberpunk, where all data reside in a vast global matrix. Knowledge is power and stealing it is big business. To safe-

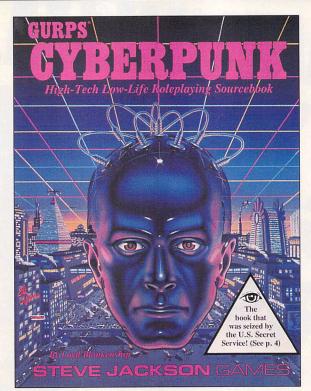
guard informational treasure troves the big boys create ice, a sort of killer software that attacks hackers and destroys their minds—

if they get caught.

This is science fiction, of course, as everyone who knows anything about either the genre or computing understands. Everyone, that is, except your local U.S. Secret Service employees. They appear to think that cyberpunk literature poses a threat to national security.

In March of this year they raided the offices of Steve Jackson Games (SJG), a publishing company specializing in role-playing game software similar to Dungeons and Dragons. The Feds confiscated a number of different items, including computers, peripherals, and cyberpunk-related documents.

At the time of the raid, author Loyd Blankenship was researching



a book entitled GURPS Cyberpunk, a new module for SJG's Generic Universal Role Playing System. While Blankenship did interview a number of computer security experts and self-proclaimed hackers, the book contains fictional background information and statistics useful only to GURPS players.

About a week before the publication was to go to press, the Secret Service raided SJG's Austin, Texas, office, confiscating three computer systems, the firm's electronic bulletin board system, and all hard copies and backups of the manuscript.

"After the raid, they were making comments about the book, calling it a handbook of computer crime," Jackson said. "They very clearly thought that the book was for hacking into computers, which is like saying that Dungeons and Dragons is a handbook for breaking into dungeons. These people didn't understand the technology they were policing.'

Jackson said that the agents later claimed the book was not the target of the raid, but at press time the original manuscript and computers still had not been returned. Assistant U.S. Attorney Bill Cook has declined comment. Sounds like computer ignorance in high places is a greater threat to our national security than cyberpunk.

-Denny Atkin

MAC ATTACK

In a dramatic policy shift, Apple is preparing to deliver cheaper Macintoshes. The company hopes that this new strategy will allow it to capture a significant share of the economypriced computer market.

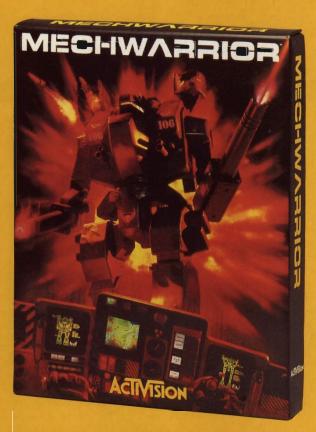
Although official spokesmen for the company refuse to discuss any details of the new Mac, sources close to Apple reveal that one of the new computers is a slotless 16MHz Mac with 256K of ROM, one megabyte of RAM (expandable to four megabytes), and a single three-anda-half-inch floppy drive.

The machine will include a detachable monochrome or color monitor and range in price from \$1,000 to \$1,500. Thanks to a softwarebased emulator, the machine will be able to run old Apple II programs as well as those designed for the Mac. Although there won't be room in the box for an internal hard disk, a built-in SCSI port will allow up to seven peripherals, including an external hard drive. This model is expected to ship in September or October.

-David English

S Ti ロエメ 1

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ENTERTAINMENT

CONNECT THE DOTS

As games get digital, they're sharpening up their screen images

The Hulk lifts his opponent, Randy Savage, high overhead in a spin, whirls him around, and slams him to the canvas. The picture on the screen, although clear and sharp, isn't from a real bout, however; it's the display of a digitized computer game, MicroLeague Sports' MicroLeague Wrestling. Instead of representing the Hulkster and his foes via cartoon characters, this program uses digitized images of real grapplers who throw and punch with lifelike realism.

The software is one of a growing number of new computer games that use photographic-quality graphics to add punch and power to their visual presentation. To accomplish this, developers convert photographic and video images into picture elements, or pixels. "We



spent two hundred to three hundred hours poring over wrestling films, looking for specific moves that certain wrestlers are known for," says MicroLeague Sports president Neil Swartz. "For Hulk

Hogan going against Randy
Savage with an atomic drop, we might look
at ten to twenty different matches to
pick the best one."

Converting video images is not the only way, however, that software developers have added realism to their graphics. Some have turned to still photography of elaborately staged depictions of events in their programs' plots.

Crime Wave, from Access Software, took such an approach. The company built sets, hired actors, and rented powerful movie lights that were synchronized to a 35mm still camera. Photographers then used specially modified Nikon still cameras to shoot actual scenes from the Crime Wave story line, which revolves around ef-

forts to rescue the President's daughter from the clutches of a powerful crime syndicate. "We devised animation sequences, and those were individually digitized," says Access president Bruce Carver.

The game uses more than 300 ani-

mation sequences produced in this fashion. Access's designers projected the 35mm transparencies on a motion analyzer and then recorded them with a video camera. For the digitization process, Carver used a program from Autodesk called *Autodesk Animator*. "It's a really nice tool that allows us to take those im-

ages, combine their palettes, manipulate them, and then put them on the screen, one frame after the other, to get the type of animation

we're after," Carver says. A-10 Tank Killer and David Wolf: Secret Agent, from Dynamix, also make extensive use of digitized animated and still graphic images. In A-10 Tank Killer, Dynamix scanned color photographs to create digitized graphics. "Once the images were in the computer, artists manipulated them to put pilots and planes in front of different backgrounds," says Larry Luttrell, director of marketing at Dynamix. In David Wolf: Secret Agent there's even a sequence in which "we filmed our actors on chairs, lying on their stomachs with their arms sprawled out," Luttrell explains. After the images were digitized, artists electronically removed the

For more information about these products, contact: Dynamix, Box 11806, Eugene, OR 97440, (503) 343-0772 (A-10 Tank Killer and David Wolf: Secret Agent); Access Software, 545 West 500 South, Bountiful, UT 84010, (801) 298-9077 (Crime Wave); Micro-League Sports, 2201 Drummond Plaza, Newark, DE 19711, (302) 368-9990 (MicroLeague Wrestling).

chairs from the scene.

-Tom Netsel





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COMPUTE'S PC

HOME WORKER: THE IBM PS/I

Big Blue's newest low-cost offering. Plus help for the DOS-confused

Almost 75 percent of American households lack computers. IBM hopes to change that with its PS/1 home-oriented machine. Priced at less than \$1,000 (for the low-end model), Big Blue's new offering will be sold through leading retailers like Sears and Dillard's.

Gone is the unfriendly, cryptic MS-DOS interface-replaced by a self-explanatory graphic interface, complete with designs based on familiar everyday items such as file folders, books, and telephones. The mouse that comes with every PS/1 lets you point and click to run programs or respond to question boxes-further simplifying use. Even people terrified of computers should be producing work, making communications connections, and having fun with PS/1 in less than an hour. Upper-end PS/1 models even include hard disks that come already loaded with software. Once you've plugged in the wires connecting the keyboard, box, monitor, and wall socket, you can just turn the PS/1 on and go to work.

By bundling Microsoft Works (which includes a word processor, spreadsheet, database, desktop accessories, and a communications program) with the hardware, IBM has provided the basic applications necessary to satisfy most household needs. The PS/1's communications program also makes it easy to use Prodigy, the consumer telecommunications service owned jointly by IBM and Sears.

Moreover, it's easy to add new hardware features to the computer: Its case slides off with no need for special tools. Expansion boards, designed specifically for the new system, allow users to add joysticks and sound/music capabilities. In fact, the PS/1 housing expands vertically-sort of like a computerized stack of trays-should Big Blue decide to offer enhanced multimedia capabilities or other innovations in the future.

IBM makes no claim to have constructed the long-sought-after "information appliance" that's as simple to use as, say, a microwave oven. However, the company has taken some important strides in that direction. For more than a year, IBM researchers met with consumers, discussed public perceptions of computers, analyzed marketing strategies, and designed equip-"This ment. was 'skunkworks' project," says one IBM executive deeply involved in the development process. "We took everything from ground zero and built machines that answer household needs."-Keith Ferrell

HELP!

What's your DOS IQ? Here are ten questions to test it:

What does DOS stand for? What command clears the screen?

What's the FORMAT switch that makes a disk bootable?

What command displays your DOS version?

What command can display files on your screen?

What command do you use to make an exact copy of a disk?

What command can make your DOS environment larger?

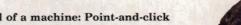
What are the names of the two files that DOS looks for when you boot your system?

What's the XCOPY switch that copies only files with the archive bit set and resets the bit after each copy?

What command tests your disk for lost clusters?

If you know the answers to all ten questions, you're already a DOS expert. For the rest of us, there's DOS Help! (Flambeaux Software, 1147 East Broadway, Suite 56, Glendale, CA 91205; (818) 500-0044; \$49.95). This hypertext tool makes DOS easy to learn and master. Here's how it works:

CONTINUED ON PAGE 94





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AMIGA RESOURCE

TAKING A LOW-BUDGET DIVE

Dressing a Hollywood set isn't risky business for computers. Plus: The Amiga 3000

On the bridge of the submarine the captain glances nervously at the images flashing on the monitors around him.

"Check that sonar reading; I think we've spotted the Soviet sub," he commands the operator.

A close-up of the screen shows the picture of the two subs clearly.

"Sir, we've got him. Range is fifteen hundred yards, running silent."

"What's our antisub torpedo status?" the skipper asks the boat's weapons officer.

"Forward and aft tubes loaded and ready to launch, sir," the officer responds after checking the readouts on his monitor.

In the midst of a perilous mission that could begin World War III, the skipper must depend on the accuracy of the data on his screens.

Off to the side are two men just as nervous as the sub's commander. For them, a problem with screen images could also prove costly—about \$50,000. They are Joe Conti and Richard Lewis, computer artist and director of the midbudget *Dive!* from Warner Brothers. If something goes wrong on the bridge set (such as the above dialogue—which would be out of place in their comedy—adventure flick), they'll have to reshoot the entire scene.

It's more likely that an actor will blow a line, however, than any of the displays will cause a problem. The reason: Five Amigas (four with 68030 and one a 68020 processor) running the monitors give Conti and Lewis unprecedented control over their graphics. "With



Amiga lets Dive!'s producers laugh all the way to the bank.

videotape displays, you set up your timing and you're stuck with it," says Lewis, adding, "Because we have a monitor fed from a video tap coming from the film camera, we can actually see the actors and time our displays to coordinate with what's going on in real time."

Conti agrees. "We can interact with the actors and make the appropriate screens pop up just when they hit the keys," he says. Not only is *Dive!*'s Amiga-based system more flexible than the old-fashioned videotape approach, it's cheaper \$5,000 years \$40,000

pictures of ocean floors in motion, sonar images of missiles and subs flashing status reports, and a readout of the battle's progress. "We're using a tremendous amount of computer graphics right now," says Lewis. At least 25 of the film's 90 minutes will take place on the bridge with continuous graphics in full view of the audience.

"Movies like 2010 had a lot of comput-

er graphic screens, but most were not used for storytelling; they were just video wallpaper. A lot of scenes take place or tie in to the Amiga information on the screens. We tried to have our graphics emphasize and make the plot's points."—Ben and Jean Means

MEDIUM COOL: AMIGA 3000 Combine videodiscs, digital audio, computer graphics, and animation with instantaneous information re-CONTINUED ON PAGE 94





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APPLE APPLICATIONS

THE CRITICS' PIXELS

At the annual PixelPaint Competition, Mac's the name, fame's the game

It may not be the Academy Awards, but last year's Second Annual PixelPaint Art Competition had its share of bright lights and colorful personalities. More than 385 entrants submitted works created with SuperMac Technology's PixelPaint and PixelPaint Professional. The best-of-the-show prize went to Motel Room by Richie Williamson and Dean Janoff.

Williamson: "I combined twelve pictures in one image, which I feel shows that the world is getting smaller and that we need computers to put it all together in one room. The machine is a way to slip new things in the back door. It's only a tool, but a great tool. With it I can do the job of a painter or photographer—painter, artist, and conceptualizer all at one console. Artists should learn to use the machine because it will help them grow even if they don't use it directly in their work."

Steve Lyons won the first-place prize for fine art with *Dancers II*.

Lyons: "I wanted to capture the fluidity of dance in the image. I used the video camera to input a charcoal drawing and then manipulated the image on-screen to give it a pointillistic character, broken down into tiny points of color, which I added on the computer. This gives the impression of movement. Bringing in the computer, I found new inspiration. Excitement was injected back into my work."

The first-place prize for illustration went to second-time winner Ron Cobb for *Skybox*.

Cobb: "I grew up using watercolors, oils, and acrylic. For me, the computer as a medium for painting fulfills everything I ever wanted in terms of control, creativity, and imagination. It's an anvil of light. My work depicts a whimsical, Magritte-like vision of order and chaos, and that's the thin line an artist walks using a computer."

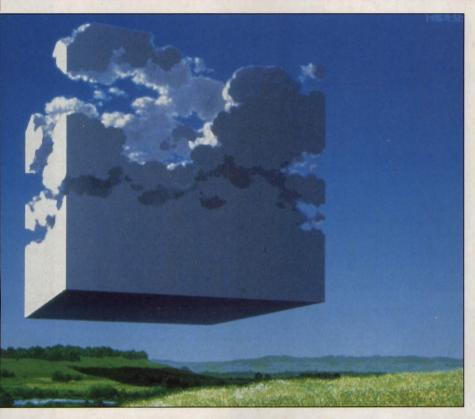


DANCERS II



MOTTEL ROOM

For me, the computer as a medium for painting fulfills everything I ever wanted in terms of control, creativity, and imagination. It's an anvil of light.







INDUSTRIAL MAN

Mike Wiggins was the firstplace winner in the miscellaneous category with *Industrial Man*.

Wiggins: "I've been doing fourcolor digitized images, using sampling, to create a cross between electronic collage and illustration. The computer suits my temperament it has an electronic malleability. Plus every six months or so there's a new set of programs that gives me wider sources to draw from."



LIVING COLOUR

Finally, the top prize for graphic design went to Didier Cremieux for his *Living Colour*.

Cremieux: "I don't like spending time reading manuals. They put me to sleep like the articles in scientific magazines. I was an airbrush artist before I started using the computer, and I find now that working with an airbrush technique on the screen is similar to working with a regular airbrush. The computer has pushed my technique, too. The machine gives me the advantage of a million options when I'm going from point a to point b. It's almost a problem: So many more choices and changes are possible with one click of a button. It's a challenge that involves much more decision making."

-David English

CREATIVITY

ISTING BRAIN POWER

Programs can simulate ecological disasters, teach city planning, and hone math skills

DATELINE: January 23, 1989: An earthquake in the Soviet Union leaves 275 dead and hundreds of oth-

ers injured.

DATELINE: March 24, 1989: The Exxon Valdez spills 240,000 barrels of oil into the pristine waters of Prince William Sound, Alaska, killing 33,000 seabirds, 146 eagles, and 980 otters.

DATELINE: September 17-21, 1989: Hurricane Hugo blasts through the Caribbean and southeastern United States, causing 71 deaths and \$8 billion in damage.

DATELINE: October 17, 1989: An earthquake strikes Northern California, leaving 67 dead and \$7 billion in damage.

While computers can't cure our environmental difficulties, they can

help us understand the forces that cause them. You can buy programs to demonstrate the hows, whys, and wherefores of earthquakes, glacial landforms, habitats, and ecosystems. Other programs offer powerful simulations that let you test your theories about city planning and learn ways to cope with such environmental problems as earthquakes and fires.

Earth science programs, from both IBM and Educational Activities, offer tutorials on ecology. You'll

read about the ring of fire, get to explore the effects of different types of disasters on humankind, and discover the impact of human beings on their surroundings. Informative, though not necessarily fun to play, these drill and tutorial programs can improve your vocabulary and demonstrate the relationships between geological phenomena and people.

Populous (\$49.95), from Electronic Arts, and Brøderbund's SimCity POPULOUS



(\$49.95) take a hands-on approach to the management of man's conquest of nature. Of the two, Populous is distinctly more militaristic-letting you watch your supporters set out to conquer other lands. You can help them along by creating earthquakes, floods, and volcanoes on command-and spy on the opposing side to see how they deal with the destruction.

SimCity brings a more constructive attitude to the art of city management. Should you leave green spaces that keep land values high, or zone things tightly together to keep the costs of public utilities down? If you leave the heavy polluters alone, your population stays employed, but your people complain about the pollution. Get rid of the polluters and the unemployment figures will skyrocket. Just like a real city planner, you'll have to juggle the needs of big business with the day-to-day concerns of your citizens.—Leslie Eiser

SUPER SOLVER SOFTWARE!

WE INTERRUPT OUR REGULAR PRO-GRAMMING FOR THE FOLLOWING NEWS FLASH: The Master of Mischief has commandeered the Shady Glen television station.

> YOUR MISSION: to enter the offices of the station and solve the mathematical equations in order to discover which room hides this villainous vermin.

Quick! Add two plus two to get the clue. Divide by five to open the door to the next room. Finally, multiply to capture the master himself!

Hidden in the cartoonstyle plot of Super Solvers Outnumbered! is a serious intent-to teach math to children in a painless and positive way. The game, from the Learning Compa-

ny, is the \$49.95 sequel to Super Solvers Midnight Rescue!

The Learning Company has included an online calculator for use with the game's problems. The calculator's best feature: It can be turned off-great for convincing kids that they can get the answers by working with pencil and paper. In sum, Outnumbered! presents math to children with a humorous, engaging plot and with the fun of a video game.—Heidi E. H. Aycock

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AMIGA RESOURCE

CONTINUED FROM PAGE 88

trieval, and what have you got? Multimedia. Unfortunately, machines able to handle this exciting mixture of media have come with a five-figure price tag-until now. Commodore's new Amiga 3000 has the horsepower and costs less than \$4,000. Multimedia has the potential to do for Amiga what desktop publishing did for Macintosh.

The Amiga 3000 has both a technological and a price advantage over its competitors. If the market continues to grow, Commodore could find itself with a commanding lead in this new field. That's good news for the Commodore machine because the Amiga has finished last after PCs and Macintoshes in the battle for dominance in the small computer arena. Its biggest problem: many fewer software applications such as databases, spreadsheets, and word processors.

With the introduction of the 3000, however, Amiga has a machine that can fill a unique niche. It boasts capabilities to handle color and video that effortlessly rival those of \$10,000 Macintoshes and PCs.

The Amiga 3000 is based on Motorola's 68030 microprocessor (the same as that of the high-end Mac), running at a blazing clock speed of 25MHz (16MHz on the less expensive model). It has a built-in 68881 or 68882 math coprocessor, a full 32-bit data bus, either a 40MB or 100MB hard disk, and more than a gigabyte of address space. Beyond these features, however, the 3000 is a multimedia wonder due to its custom set of graphics and sound coprocessors. These make up perhaps the most impressive ensemble of animation and audio circuitry in any of today's microcomputers.

The custom chip set enables the Amiga 3000 to simultaneously animate graphics, display text, play digitized sounds, and perform common computer functions, such as reading data from a disk, without slowing down the computer's main microprocessor. Other standard features include a palette of 4,096 colors, high-detail screen resolutions, digital four-channel stereo audio, an easy-to-comprehend graphic user interface, and the ability to run several programs at the same time. For example, you can display a video image from a VCR in one window of the screen, work on an illustration using a graphic arts package in another, run a spreadsheet to balance your books in a third, write a letter on a word processor in a fourth, and play music with a composing package in a fifth-if you've got enough hands.

-Randy Thompson

COMPUTE'S PC

CONTINUED FROM PAGE 86

You can install the software on a hard disk or floppy and run it either as a stand-alone program or as a memory-resident utility.

TO FIND HELP ON A DOS TOPIC:

1. Type HELP at command line.

2. The program's title screen appears, followed by a table of contents.

3. Select your desired subject from the menu, and several screens of in-

formation will appear.

4. Finding this information is great, but we haven't touched on DOS Help!'s real power yet. When you're looking at the first screen of DOS command XCOPY, for example, you'll see the phrase THIS IS AN EXTERNAL COM-MAND in bold.

5. Move the cursor to this phrase and press ENTER. What appears on the screen is an explanation of external commands.—Clifton Karnes

COMPUTE'S SOURCE FILE

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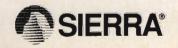
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CRIME BYTES

grammed to maintain control of the aircraft until it is completely out of peril. At no time can the pilot or ground control override the satellite.'

"It looks to me as though someone just did," I said. "What's the satellite's computer telling your people?"

"It doesn't even acknowledge that 901 is up there," the FAA guy said.

I asked them to have the Pacific Rim people gather up the flight manifest and all the passengers' boarding passes and express-ship them all to my Bakersfield office. "And don't let anyone touch the boarding passes," I said. "I want to be able to run them for traces of genetic material."

'So where'd you get your computer training?" Tiffany asked me on the way back to Bakersfield. "MIT?"

"In my bedroom," I told her. "When I was in college at Bakersfield, I used to go exploring—through other people's computers." Tiffany hadn't been around very long and I figured her superiors didn't think it necessary to brief her on my past.

"How'd a hacker end up a cop?"

"One day in '93 I heard about a new CIA supersecure computer. Impossible to get into, they said. Well, me and about twenty thousand other kids made a run at it. I was one of only a dozen hackers who got in and made it into the operating system.'

"You got that far in?

"Well, not really. You see, it was all a sting. Your friends in the FBI jumped out of thin air and arrested all but one of us. It was actually more like extortion. They said, 'You have two choices-go to prison or work for us.' Needless to say, the slammer didn't appeal to me."

"So you joined Bakersfield Police?"

"Not right away. The Defense Department had me designing a virus they could use to knock out other countries' defense systems. Trouble is, the virus was so good we couldn't make our own computers immune to it. When some hacker got ahold of it we had to kill it out completely.

"The Great Crash of '98? You were in on that?"

"I designed the worm that found its way into every computer in the U.S. and crashed them all. It's the only way we could be sure we'd kill the virus."

HACKING AWAY AT CRIME. The greatest threat to computer security is posed by career criminals and their confederates working on the inside of corporations, banks, or any other institution that could be compromised. Because daring acts of technological legerdemain are the forerunners of future crimes, law-enforcement officials are concerned about the paths hackers may take. "Granted, ninety-eight percent of them will be law-abiding citizens," says Frank Milligan, an IRS internal security manager who also cochairs the Federal Computer Investigations Committee. "But what about the other two percent? If sixteen-year-old kids can break into government and military computer systems, what will these kids be like in ten years when they move into positions of responsibility?'

Cyberpunks, the second generation of computer hackers, subscribe to an arcane code of honor and look upon cracking supposedly impenetrable networks as a challenging rite of passage. Illicit forays into credit rating bureaus' confidential files, for instance, have become routine. Like other self-styled cyberpunks, Michael Synergy once mischievously pulled Ronald Reagan's credit record. He found that 63 other requests for the former president's credit

6There's little that can be safely hidden from prying eyes. Nearly every unclassified data network has been penetrated. Even a classified network can be susceptible.

rating, all from dubious sources, had been logged on the same day.

Synergy also recalls roaming through TRW files and noticing a questionable collection of some 700 people who held one specific credit card. It was puzzling, Synergy thought, that a credit card company would issue only 700 or so cards, rather than the usual thousands. "And their credit histories all appeared out of nowhere-like they had no previous existence," says the twenty-three-year-old computer consultant, who legally changed his last name to his computer handle. It suddenly dawned on him that these people were very likely in the federal witness protection program.

Even though he risked being prosecuted for illegal trespassing, Synergy reported his discovery to the FBI, which quickly moved to protect the cardholders' identities. "Otherwise, they all would have started turning up dead," Synergy comments. "But it was sheer luck that I got there first. The names could have just as easily been uncovered by organized crime.'

Swapping inside information, of course, was an accepted part of the computer ethos among hacking enthusiasts in the early Seventies. Today, however, things have changed, and it's not easy to enforce a code of ethics when people are so dispersed. "There's a question of what to do with forbidden knowledge in a technological society," says Steven Sawyer, another pioneering hacker and now co-owner of CJS Systems in Berkeley, California.

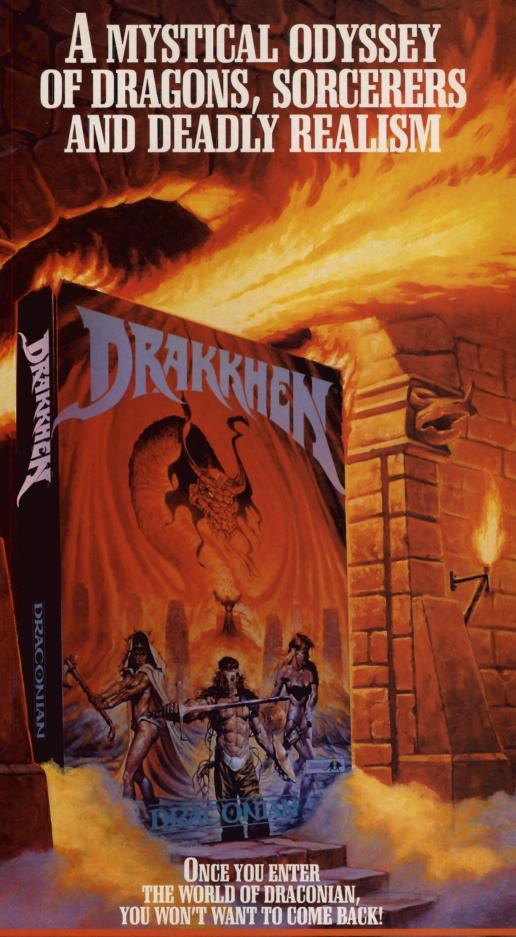
Sawyer and other computer professionals worry that the government will use unauthorized intrusions by young computer pranksters as an excuse for curtailing civil liberties and flagrantly disregarding constitutional rights. "The cyberpunk threat is exaggerated, says Marc Rotenberg, director of Computer Professionals for Social Responsibility's Washington, DC, office. "And if guidelines are not defined, innocent people could be swept up in the gov-

ernment's electronic dragnet."

But what Sawyer calls "forbidden knowledge" could fall into the wrong hands. Convicted and imprisoned for telephone service theft, hacker John Draper, for example, had concocted a device that could be attached to a telephone, allowing him to illegally connect calls and avoid tolls. Nicknamed Captain Crunch, he had calibrated his "blue box" to emit the same tone as the whistle found in boxes of Captain Crunch cereal. While serving his prison sentence, Draper says, "I was coerced into teaching other prisoners the secrets of phone phreaking," or pirating telephone services. They wanted to know how to bury phone calls so they couldn't be traced.

According to William Tafoya, who seems more like the avuncular smalltown cop he once was than the FBI's scholarly resident visionary, organized crime figures use high-tech equipment to detect telephone taps, body recorders, and other sophisticated electronic eavesdropping technology so they can circumvent court-ordered monitoring. Some drug dealers have been known to use digital data formats to encode signals sent out over telephones or aircraft radio frequencies, and decoding devices to monitor radio channels.

Drug cartels, in fact, have become so technologically savvy that in 1987, for example, Colombian drug dealer William Londono eluded prosecution because of a computer scam: A phony "release message" on an internal computer instructed his captors to release Londono from police custody in Los Angeles. More recently, a pilot received confidential information from a Department of Agriculture inspector at the Fort Lauderdale-Hollywood International Airport, the data were obtained by an unauthorized entry into the airport's Customs Service computer.









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Computers could be weapons in an array of crimes. In 1980, for example, an air traffic controller opposed to the Soviet invasion of Afghanistan attempted to down a Soviet airliner by reprogramming its location from one computer screen to another in the control tower at New York's Kennedy Airport. A "chop shop" in Phoenix used an electronic bulletin board to sell and take orders for stolen car parts.

"Computer criminals are usually wellgroomed, intelligent, and articulate. They don't fit the public's perception of a crook," says David Geneson, a former assistant U.S. attorney who prosecuted Jonathan Pollard, a Navy analyst who was convicted of spying for the Is-

raeli government.

Even so, computer crime demographics reflect those of the crime world in general. According to a 1988 survey by the National Center for Computer Crime Data (NCCCD), almost one third of those arrested in California for computer crimes are women and nearly half are members of minority racial or

ethnic groups.

"Our sampling included habitual criminals, petty office embezzlers, vindictive employees, and bank tellers who had run up debts," says Buck BloomBecker, NCCCD director and author of Spectacular Computer Crimes (Dow Jones/ Irwin). "Employees with access to computer systems play the greatest role, and the opportunities for computer crime grow exponentially with the number of people who gain access to central computers. And as the technology becomes easier to use, people who don't understand computers today will be able to steal with them tomorrow."

BLACKBEARD'S BOGEY. It was soon clear that no one was operating the satellite remotely. It had to be a program introduced into the computer.

"That's impossible," the FAA programmer told me from New Mexico. "FAT-CAT can only accept commands from our laser-and it's as secure as ever. The only other information it receives is from the transponders on the planes below. If it detects anything other than identification from any plane, the satellite immediately alerts us and awaits instructions. Within two minutes, the ground computer would instruct the satellite to disregard the unwanted data."

Courtney handed me a note telling me the FAA's express package had arrived from Palmdale. At the bottom of the note she reminded me about her mother and the DVR. Then it hit me.

'Solar washout," I told the programmer. "For a couple of seconds twice a year your laser receiver is precisely aligned with the sun so that the sun temporarily blinds it. The same thing happens to TV satellite dishes."

"There was no need to program for

that eventuality," he said. "Everyone knows the computer link wouldn't be down long enough for any planes to collide. We have more than enough time to pick up the communication.

"Maybe so," I said. "But that's just enough time for an airplane's transponder to send a worm up to the satellite. The satellite would try to relay it to the ground, but in a solar washout the ground would never receive it and would never return a cancellation command. So the worm would be free to go to work inside the satellite's computer.'

The people at NASA helped me to compute when a solar washout at the New Mexico site would have occurred. It was a week ago at exactly 9:14:34 P.M., Greenwich time. I manipulated FAT-CAT's computer to tell me all the planes in the air at that moment and I analyzed the computer's memory. There were traces of the worm in a transmission from Pacific Rim Flight 675

6 Every

week more than a trillion dollars is moved electronically around the world, and more of these transmissions are being intercepted than banks are willing to admit.

from Spokane to Des Moines. Someone had manipulated the plane's transponder to send up the worm at exactly 2:14:34 P.M., Mountain time.

"Tiffany, track down that aircraft and have your lab people search the transponder for any genetic material. Courtney, I love you," I shouted. "Take those boarding passes to the lab for fingerprints and genetic typing. Maybe our guy's on that plane right now.

Another message came in from the hijacker, and I told Tiffany to have them send me the actual raw data as they received them.

A half hour later Courtney gave me an update on the boarding passes. "The lab people say all the genetics tests check out except one they can't match with anyone. They want to know if they should do a national trace on it."

"Hell, yes," I said. "Who knows, he

could be our guy!"

When Washington was ready to ship the raw message, I fed it straight into a program that would look for clues as to how the message was introduced into the FBI computer. It didn't always work, but it was worth a shot. When the program spit out the answer, I couldn't believe what I saw. "This can't be right. Whoever sent this phoned in with verbal commands. That means he left voiceprints.'

"You're right," Tiffany said, as sur-prised as I was. "I'll have our people track down the analog voice recording

and trace the prints.

I continued to remotely probe FAT-CAT's operating system, hoping I could locate the actual worm and break the code. I was beginning to think the plane would run out of fuel before I could find the worm.

"You won't be ready for this, Carlos," Tiffany said when the FBI computer center reported a match on the voiceprint. "Turns out the voiceprint belongs to Humphrey Bogart. But he's been dead

more than fifty years!"

"Our guy has obviously pieced together old analog sound recordings to give the computer real voice commands," I told her. "He knows we'd be able to identify him if he used his own voice.

'Why didn't he do it the old-fash-

ioned way-with a keyboard?'

"Remember the computer sting I told you I got caught up in when I was a kid? Well, the government's computer actually recorded and analyzed the keystroke patterns of thousands of hackers. They were actually able to identify someone by the speed at which they typed certain common words, their syntax, and by the common typos they made. In fact, that's how Blackbeard eluded everyone.

'Blackbeard?" she asked.

"He's the only one who got into the operating system and wasn't nabbed by the FBI. And he did it by recording other hackers' keystrokes. Then he apparently put them all in a database that could call up words he wanted to type on the keyboard-but they would be words that other hackers had typed. He went to a lot of trouble to keep from getting caught.'

"Looks to me like whoever's controlling 901 went to the same trouble. Did it ever occur to you this could also be

Blackbeard?"

What bothered me most was not that she figured it out, but that she figured it out before I did. "Of course it occurred to me. Why do you think I brought it up in the first place?"

ELECTRONIC HIJACKS. Computer virtuosos can make electronic walls melt with the stroke of a key. "Any system that has dial-up capability [telephone access via modem] can be violated by a smart, dedicated hacker," Milligan says. There's little that can be safely hidden from prying eyes. Just about every unclassified data network, including NASA's, has been penetrated at some time or other. Even classified networks

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could be susceptible to invasions, although government computer security officials point out that most of the money for computer security is earmarked for the government's classified networks under the jurisdiction of the National Security Agency.

On May 13, 1988, as many as six conspirators took only 64 minutes to bilk the First National Bank of Chicago of \$68.7 million and dispatch the funds to accounts they had set up under aliases at banks in Vienna. Their virtually foolproof wire transfer scheme nearly worked—until checks started bouncing on accounts from which they had withdrawn funds. If they hadn't been quite so greedy and had stolen smaller amounts, investigators said, the thieves might have pulled the scam off. What really troubled banking and lawenforcement officials: how easy it was for dishonest employees to exploit the flaws in the bank's security system.

"It is truly scandalous how little regulatory controls there are, but security always takes a backseat to utility," says Lance Hoffman, a professor in the department of electrical engineering and computer science at George Washington University in Washington, DC. "Any kid can go out and, for less than a thousand dollars, buy the electronic equivalent of a Saturday night special. With the right computer equipment, he

can hook up to international networks and do a lot of damage."

The potential for major disruptions in the financial system, air traffic control, and telecommunications, for example-is staggering. A recent report by the General Accounting Office reveals serious security flaws even in the Federal Reserve System, which controls the nation's money supply. "The Federal Reserve could suffer monstrous diversions of funds, and a virus could cripple the U.S. economy," admits one frustrated government official. "Yet the government won't spend the money to install the necessary safeguards to protect the Federal Reserve or any other [unclassified] data networks. What's worse, none of us have any idea what kind of connections are being made. So whether they work for the government or for a major bank, people can dial into the various systems from home."

More than \$1 trillion is moved electronically around the world every week, and more of these transmissions are being intercepted than banks are willing to admit. Wire transfer theft is one of the major sources of income for the Palestine Liberation Organization. And in a 1979 case, a Social Security Administration employee, who turned out to be a member of a black militant group, managed to divert nearly half a million dollars to a bogus bank account before

someone spotted the scheme.

It's hard to quantify exactly how much money is being hijacked on the international data highways. Domestically, fewer than 50 percent of such computer crimes are ever reported because companies want to avoid bad publicity. "Often corporations figure the losses are part of the price of doing business," says Earl Devaney, special agent in charge of the Secret Service's fraud division, housed in a discreet suite of offices above a bank in downtown Washington, DC. "It's only when losses reach intolerable levels that companies will institute security features."

Each year \$4 billion is also lost in stolen data and bootlegged software. Illegal use of telephone access codes costs the telecommunications industry at least \$500 million a year. The financial industry admits to \$100 million in illicit electronic fund transfers annually. and credit card fraud climbed to a staggering \$1 billion in 1989. "In the next ten years losses could rise to as much as eight billion dollars annually," says Frank S. Smith III. senior manager for advanced technologies and information security services at Ernst & Young, an accounting and consulting firm in Cleveland. "It wouldn't surprise us if it hit ten billion. And this doesn't include figures for the loss of trade secrets, loss of competitive advantage, and the loss of customer confidence.'

And anytime law-enforcement agencies and corporations implement methods of thwarting criminals in one arealike imprinting credit cards with holograms to make it difficult to forge themthe crooks just hatch other schemes, most involving new technologies applied to criminal endeavors. With each advance in computer technology, in fact, the number of ways to exploit the systems for criminal ends expands. Extortionists, for example, could take control of weather and surveillance satellites. Hit men could reprogram pacemakers or simply commandeer a hospital computer system and reprogram a CAT scan to zap patients for two minutes instead of two seconds, killing them instantly.

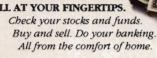
According to Paul Saffo, a research fellow at the Institute for the Future in Menlo Park, California, "We really won't have any idea of what we can do with these systems until we get a bunch of kids playing around with them and pushing the outer ends of the envelope. That's the cycle in any new area of activity. First the explorers go in, then the settlers, then come the crooks, and finally the cops."

THE BEARDED LADY. "Command. Date equals March twenty-seven, year equals twenty eleven A.D. Execute command," I ordered the FATCAT computer via my own.



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Moments later FAA headquarters reported the crew had regained control of 901 and were now landing at Denver. "Nice work," Tiffany told me. "But what did you do?"

"Back in '98 Blackbeard slipped through our fingers by changing the year in his computer's memory," I explained. "The virus we sent to all the computers had a time fuse. As far as his computer was concerned, the correct time never arrived—and so the virus never activated itself. Apparently the program Blackbeard sent FATCAT was designed to execute itself today only. We just made today go away."

"Brilliant. So you must know Blackbeard's identity. Who is he?"

I always hated questions that lacked good answers—especially when they were directed at me. "If I knew that, he'd be in jail right now."

I was relieved when her transceiver sounded before she could crucify my ego. "Great news. Pacific Rim Airlines zeroed in on the plane whose transponder sent up the worm last week. And our lab people found a hair inside the transponder casing."

Within moments they had fed the workup to my computer, which I immediately printed out. Tiffany and I then went to see Kevin Morris, the best genetics person in the Bakersfield police lab. He fed the data from both charts into his computer, and we watched as it superimposed one over the other.

"It's not what you were expecting," Kevin said, "but it's interesting. The person on the first chart has to be the offspring of the second."

"Do you have enough data for a national identification check?"

It would only work if the two people had previously had their data placed on file. There were still a lot of people who were not genetic-typed at birth and had never been arrested or applied for sensitive jobs. But it was worth a shot.

We walked back to my office to wait for the results. About 20 minutes later Kevin walked in and closed the door behind him. He talked in a whisper. "I couldn't find a record on one of the charts, but the other one comes back to...Courtney Kiser."

"She probably got her fingerprints on one of the boarding passes when she opened the package from Palmdale," Tiffany said.

"That's obvious," I said. "But the genetic code says she's the daughter of whoever tampered with the airliner's transponder. Blackbeard's daughter!"

I called Courtney in and asked her to sit down. "Courtney, when did you last hear from your father?"

"On my fifteenth birthday," she said. "He sent me a card and his picture. Why? Is something wrong?"

"Not sure. You have the photo?"
"I'll get it," she said. She walked to

the outside office and brought back a small holographic snapshot of a friendly-looking blue-collar type with a dark, well-groomed beard. The inscription on the back read: "For thirteen years I've searched for you in all the gin joints in all the towns in all the world. Glad I found you. Here's looking at you, kid. Love, Dad."

I carefully handed the hologram to Kevin. "You know what we're looking for. Let's hope there's still enough to get a genetic typing."

"Something doesn't add up, Carlos," Tiffany said, turning to Courtney. "Is your dad a Humphrey Bogart fan?"

"Tiffany," I said sarcastically, "how would she know that if she hasn't seen him since she was a baby? Her mother's coming by in a few minutes to meet her for lunch. Why don't you wait and ask her?"

"My guess is her mother's not coming for lunch, Carlos. Right, Courtney?"

It's hard
to quantify exactly how much
money is being
hijacked on the international
data highways.
In this country less than 50
percent of such
crimes are ever reported.

"Yeah, she just called a couple of minutes ago. How'd you know?"

Sounded like a good question to me. "Yeah, how'd you know?"

"Carlos, you may be a computer genius, but you sure don't know people. If Courtney's father were really Blackbeard, it wouldn't have taken him till her fifteenth birthday to find her. Courtney," she went on, "your mother collects old-fashioned videotapes, doesn't she?" "Uh-huh."

"And how'd you come to work for Carlos here at Bakersfield Police?"

"My mother heard about the opening and she..."

"And what does she do for a living?"
"She works for some large European corporation that installs equipment on airplanes."

"What kind? Transponders?"

Kevin suddenly burst into the office with the test results and confirmed what Tiffany had already figured out.

COP AID: The police are the first to admit that smart criminals are quite agile and will always be at least one jump

ahead of the law-enforcement agents. Even so, a symbiotic relationship exists between the two groups of foes. "The cops and the robbers depend on each other," Saffo observes, "The robbers keep the cops in business, and the cops keep the robbers on their toes. Technology has allowed all of them to run down a more interesting path."

Effectively policing an increasingly diverse and technologically sophisticated society poses a real challenge to traditional law-enforcement agencies. And many experts believe that without cooperation from the community, the cops will be trampled by the robbers. "The myth is that the police-as crime fighters, emphasizing militarism, centralization, and control-can do it all," says the FBI's Tafoya. "But in reality, they can't. Keeping the lid from blowing off in the future requires that law enforcement build bridges with the communities it protects and serves, which will help make neighborhoods safer places to live.

Indeed, the partnership between the police and potential crime victims, the premise behind the idea of community oriented policing, or COP, is an even more potent weapon in combating crime than any high-technology strategy. In order to win the confidence of the community, however, the police themselves have to change. "Police officers will have to be more effective in interacting with people, understand the dynamics of communities, and develop new styles and new philosophies," says Hubert Williams, echoing the views of other progressive law-enforcement of-"The types of background. skills, education, and experience for the new breed of police will be very different from what we see today. The hardline macho types will have to be replaced by a more professional force that is college educated and adept at problem solving.

EPILOGUE. It wasn't easy telling Courtney about what was in store for her mother. It was even harder telling her what I could now piece together about her mother's past. Genevieve Kiser had apparently kept her avocation as a hacker a secret even from her husband and her daughter. She had used Courtney to keep tabs on me, the one person who had come closest to nabbing Blackbeard in the past.

"Can we do this after lunch?" Tiffany asked when we sat down to start entering our reports

"Why not." I said. "How bout I buy?" I grabbed my overcoat and my transponder holster and told my office door to open.

"Carlos," she said in a muffled voice. I think this is the beginning of a beautiful friendship."

It was worth a shot DO

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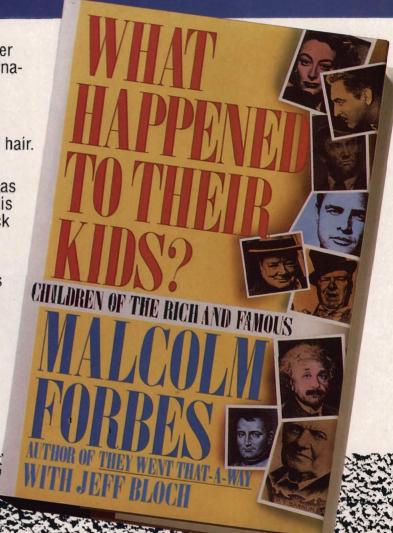
Marlon Brando's son put out the fire in Michael Jackson's hair.

Al Capone's son quit his job as a used car salesman when his boss wanted him to turn back the odometers.

Benjamin Franklin's son was arrested as a British spy.

Mozart's son used Salieri as a job reference.

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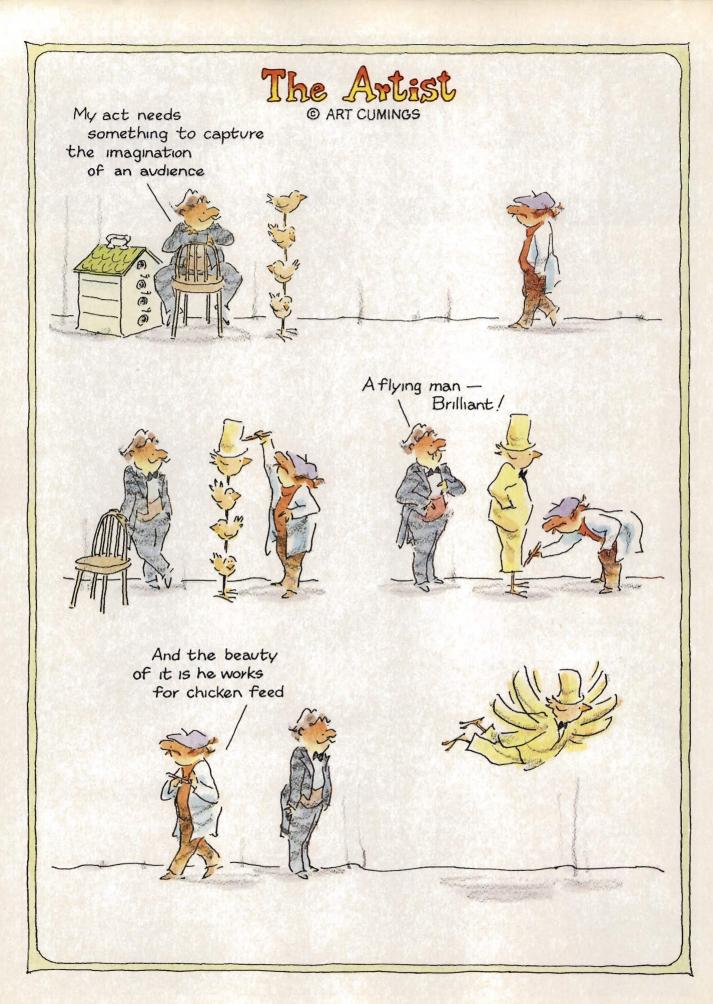


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by humans is producing methane at a rate of forty liters per day for every person in the world.

Omni: Have geologic processes had anything to do with the origin of life? Craig: I haven't looked at it in any detail, but I think life might have originated due to an asteroid impact, the same phenomenon that people think is responsible for the extinction of the dinosaurs. Nobody can find a mechanism to make the protein molecules that combine to make DNA. Stanley Miller here at UCSD [University of California, San Diegol and others have re-created the earth's original atmosphere and sent electrical charges through the gases and made amino acids. But they can't make DNA that can replicate itself. An asteroid impact might have a larger effect in putting energy and organic molecules into the atmosphere to manufacture these complicated molecules. There might be a nice symmetry here: The asteroids hitting the earth made life, and then after life proliferated, the impact from asteroids began to destroy it. A life giver and life taker in one mechanism-something that comes down and bangs the earth at regular intervals. Of course the "origin of life" people all believe life was created only once, successfully, at least: a sort of deist philosophy. But there could have been a lot of "creations."

Omni: What are the latest things you've been working on?

Craig: Several things that are rather nice. One is that the primordial neon iso-

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CREDITS

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topes picture is beginning to fall into place like the helium isotopes: There is a "crustal neon" and also a "mantle neon" component. Another nice thing is we found air that shows the effects of gravitational stratification. A number of physical chemists thought this could happen in gases in the ocean or Lake Baikal [in the Soviet Union] and searched for it without success. But recently I found that gravitational separation of air components—exactly as predicted by J. Willard Gibbs, who invented thermodynamics at Yale in 1876, despite the fact that they refused to pay him for itactually takes place at the surface of the earth, in the firn [snow cover] over

polar ice caps. We've now seen that the rare gas krypton can be enriched up to two percent in snow just above the ice layer at the Russian Vostok site in Antarctica. So we have to correct all the isotopes of old air in ice samples for these effects.

The other work of interest is the revelations the helium 3 plumes in the Pacific are giving us about the deep circulation of the ocean. In 1981 I published a paper with John Lupton, then of Scripps, showing that there's a huge helium 3 plume from hydrothermal vents, emitted on the East Pacific Rise, that can be traced westward all the way across the Pacific, some eight

thousand kilometers at a depth of twenty-five hundred meters. This flow was in the opposite direction to that predicted by physical oceanographers and showed that prevailing ideas about deep ocean circulation were quite wrong. Recently a major volume on ocean circulation—hailed by the publisher as "setting the current research literature in context"—appeared, edited by two of my colleagues at Scripps. And although the expeditions we carried out to map the oceans more than fifteen years ago verified the helium 3 plume, not one word about the plume and its meaning appears in that very expensive volume: sixty-nine dollars. In fact, the same old story appears in chapters by two other Scripps colleagues, Aristotelian scholars whose assumptions replace observations to the bitter end! However, the man who invented the original theory and who is by all estimates our greatest oceanographer, Henry Stommel—who makes Woods Hole number one in oceanography simply by his presence—immediately recognized the significance of the helium plume in the South Pacific. He published a new theory incorporating these results in 1982. His theory is also completely ignored by my colleagues in the volume on "new concepts" of ocean circulation.

Recently I finished measuring a similar ocean section in the North Pacific,

between theoreticians and people who make measurements is not strong in oceanography. This is probably because the theoreticians have no welldeveloped theory that can be honed with measurements but instead have a lot of ego about turf infringement by nonclub members. They are like the Bandarlog who harassed Mowgli until the snakes came along. [The Bandar-log are monkeys in Kipling's The Jungle Books who danced and shouted about all the great things they were going to do and promptly forgot them. The boy Mowali was kidnapped by the Bandarlog and saved by the snakes.]

But second, and more important, is

Max Planck's famous dictum that new truths in science are established not by convincing living scientists but by waiting for them to die so that a generation can grow up unfettered by the intellectual shackles of their predecessors. Unfortunately, this makes things slow going for students, who at any rate should be advised not to invest large sums of money in books such as this Springer-Verlag "up-todate volume.

Omni: Did it bother you when a colleague suggested you settle down and become a theoretician?

Craig: No. In a way it's a compliment. But to me the appeal of science is participating in the adventure, taking the

samples and doing something good with them. Like the experiences we had when Val and I lived on a boat on Lake Tanganyika: At night we'd suddenly be surrounded by hundreds of fishing boats with lanterns on them, bobbing up and down, and people playing drums softly and singing. In the background high up on the Rift Valley walls, there were tremendous thunderstorms with huge flashes of lightning, like a war going on above the world. It was like all the magic you ever dreamed of as a child when you read King Arthur or Beowulf. It's the same thing up in the Himalayas or down at the bottom of the ocean in Alvin. You can't match that in any other way.





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and behold: There is a precisely similar plume in the North Pacific extending westward across the Pacific, north of the equator. So there are *two* huge jets of deep water flowing westward across the Pacific, just north and south of the equator. This is a finding virtually ignored by most oceanographers.

Omni: Why do so many scientists ignore new discoveries?

Craig: I think the problem of "recognition" of new findings is due to two effects. One, specific to oceanography, is that most of the so-called physical oceanographers don't go to sea. So the understanding of the circulation is more a mathematical "exercise" than "truth-wrenching" business. The rapport

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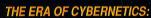
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CELEBRITY MATCHES: Can you pair up these famous folks with their patents?

ast month we looked at inventors who've sought that chimera perpetual motion, and presented a quiz on the topic. (Answers appear on page 109.) This month we salute the two hundredth anniversary of the first U.S. patent and the ingenuity of celebrities or the relatives of celebs who have acquired patents but never received due recognition for their inventions. (U.S. patents are granted only to individuals, never to corporations or for computer-aided designs.)

Not everyone's a Thomas A. Edison. He received a total of 1,093 patents (four posthumously), a rate of approximately two per month throughout his adult life, and he became famous as

> the prototypical American inventor. Other inventors have had only one idea that became a reality. Fred Waring gave us an electric drink mixer,

the Waring Blendor. Who was Waring? Bandleader of the Pennsylvanians, a popular orchestra. Likewise, people have used the Jonny Mop, a tool designed for cleaning toilet bowls, without knowing that its inventor was Dorothy

Rodgers, the wife of composer Richard Rodgers.

The following quiz will test your knowledge of celebrity inventors. Match the people in the first list at right with the inventions below. There are more contraptions than inventors because at least two of the celebrities have received more than one patent. Einstein and Orville Wright, who are on the list, garnered their patents in unexpected fields. The answers appear in the third column of this page. If you answer five correctly, your knowledge of patents is

about average; ten is good;

12, very good; 14, excellent.



- 1. John Dos Passos (novelist)
- 2. Albert Einstein
- 3. Bette Nesmith (mother of Michael Nesmith of The Monkees)
 - 4. Harry Houdini
 - 5. Danny Kaye
 - 6. Hedy Lamarr
 - 7. Abraham Lincoln
 - 8. Herbert "Zeppo" Marx
 - 9. Julie Newmar
 - 10. Lillian Russell
 - 11. Edie Adams
 - 12. Mark Twain
 - 13. Lawrence Welk
 - 14. Paul Winchell (ventriloquist)
 - 15. Orville Wright

THE INVENTIONS

- A. A heartbeat alarm to be worn on the wrist
- B. Liquid Paper, typewriter correction fluid
- C. Two design patents on lunch boxes
- D. An adjustable strap for the back of vests
- E. A child's mask in the shape of an upside-down face
- F. Ring-shaped cigarette and cigar holders
- G. A toy pistol that blows soap bubbles
- H. Inflatable chambers for lifting boats over shoals
- I. A secret communications system for torpedo control
 - J. An artificial heart
- K. A party noisemaker or "blowout" that unrolls in three directions when a person blows into the mouthpiece
- L. A self-pasting scrapbook with adhesive pages
- M. A spring-powered doll that flies through the air, does a somersault, and catches a swinging frame with wire arms
- N. A game to help players remember major historical dates
- O. Travel trunk that turns into a dresser, with drawers, pull-out mirrors, and storage space for theatrical supplies
 - P. Deep-sea diver's suit with

quick-release mechanism

- Q. Panty hose to push up and emphasize the buttocks
 - R. Refrigeration apparatus

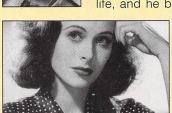
ANSWERS: INVENTORS

Dates and patent numbers, where known, are listed.

- 1-G. Dos Passos is listed as coinventor of the soap-bubble gun in a 1959 patent.
- 2-R. In 1930 Einstein was a coinventor of patent no. 1,781,541.
- 3-B. Bette Nesmith created typewriter correction fluid and called it Liquid Paper. The Gillette Corporation bought her company for \$47.5 million in 1979. When Nesmith died in 1980 she left half her fortune to her son Michael and half to charities.
- 4-P. Houdini received his patent for a diver's suit (no. 1,370,316) in 1921.
- 5-K. A patent for Danny Kaye's noisemaker, no. D.166,807, was awarded in 1952.
- 6-I. Lamarr, famous for movies such as *Ecstasy* (1933) and *Algiers* (1938), with Charles Boyer, received patent no. 2,292,387 with composer George Antheil in 1941. The invention: a classified communications system for submarines to control torpedoes (by intermittently and simultaneously switching radio frequencies between transmitter and receiver to prevent the enemy from monitoring the signals).
- 7-H. In 1849 Lincoln, then an Illinois congressman, whittled the model for his patent of a boatlifting device himself. No. 6,469 is now in the collection of the Smithsonian Institution.
- 8-A. Zeppo Marx patented his heart alarm in 1969.
- 9-Q. Actress-dancer Newmar's patent (3,914,799): "cheeky derriere" panty hose, in 1975.
- 10-O. Russell, the Gay Nineties operatic soprano, patented a dresser-trunk in 1912. Her patent number: 1,014,853.
 - 11-F. Adams was listed on her











1965 patent as Edith A. Kovacs.

12-D, L, and N. Twain, as Samuel Clemens, received three patents. The first, in 1871 (no. 121,992), was for an adjustable, detachable back strap for vests. The scrapbook was patented in 1873; the history game, in 1885.

13-C. Welk designed two lunch boxes in 1950 and 1951.

14-E and J. In 1964 ventriloquist Paul Winchell made a child's mask (no. 3,129,001). Of greater significance, however, was his patent of a plastic heart pump in 1963. Tested at the University of Utah School of Medicine, it reportedly kept a calf alive for 94 days after its own heart had been removed. Winchell's design, a contender for the first human artificial heart, lost to Robert Jarvik's model.

15-M. Orville Wright assigned the 1925 patent for a flying doll to the Miami Wood Specialty Com-

pany of Dayton.

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LAST MONTH'S ANSWERS: PER-PETUAL MOTION

Here are the answers to July's quiz on perpetual motion.

 OVERBALANCED WHEEL. In the most common perpetual motion scheme, heavy balls on a wheel shift position so that they are far from the center of the wheel on the downswing, and closer to the hub on the upswing. Because one side of the wheel supposedly always outweighs the other, the wheel should theoretically rotate forever. But there are inevitably more balls on the ascending side, so the clockwise and counterclockwise torques cancel each other out. The moment provided by a ball is the product of its weight and its distance from a vertical line drawn through the axle. There is no way to design a wheel so that the sum of the moments on one side is always greater than the sum on the other side. Drawings may look persuasive if they show the wheel at the instant when it is temporarily overbalanced, but this state lasts for only part of a revolution.

2. WATERWHEEL. It's possible for the waterwheel described to raise some of the water back to the top (by way of an Archimedes' screw) but not enough to refill the wheel with sufficient weight to turn the screw again.

3. MAGIC MAGNETS. If the magnet is strong enough to pull the ball up the ramp, it will be strong enough to pull the ball over the hole. That seems obvious, but Howard R. Johnson of Blacksburg, Virginia, got a 1979 U.S. patent (no. 4,151,431) for a magnet-powered motor that suffered from the same problem. A patent officer, asked how such a device could get official certification, said only that "mistakes do sometimes get through."

4. HEAT PUMP. The Stewart pump is called a perpetual motion machine of the second kind, because it violates the sec ond law of thermodynamics, which says that some energy is always lost in converting heat into work. The 3 Btu of energy (theoretically obtained by cooling a pound of water 3° F) is not recoverable to do useful work. The water won't lower its temperature unless it's in contact with a colder body. And the energy that is required to power

Freon to cool the water will beguess what?-always more than 3 Btu. PERPETUAL CLOCK. James

ered as providing "free energy"

for human use. Because it relies on an outside source of energy (the sun), it isn't classified as a perpetual motion machine.

DUNKING DUCK. This is another case in which the machine works without fuel provided by people, but it does rely on an outside power supply-namely, the cooling effects of evaporation.

7. SCHADEWALD GRAVITY EN-GINE. Even if it worked, the engine described last month wouldn't be a perpetual motion machine, because power is derived from an outside source, namely the decline in gravity. "My description was a subtle deception," Schadewald told me. "The velocity of the moving weight will never exceed what it was when it passed the bottom, dead center, the first time, even if there is no friction. The weight may pick up speed

at the top, but nev-

Some celebrities have created more than just names for themselves. Page 108, top to bottom: Edie Adams, Hedy Lamarr, Lillian Russell. This page: Paul Winchell with dummy Jerry Mahoney.





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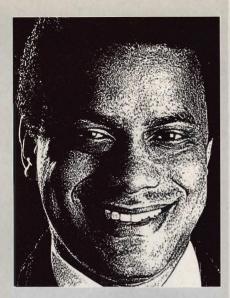


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By Roberto Santiago

6Ah, that's not the power of myth," my friend Kwame says. "That is the power of quilt. The power of guilt is what made Einstein go into physics instead of into dentistry! "I just can't get enough of Joseph Campbell's The Power of Myth," says Kwame, my longtime African friend. He smiles and looks around at the other patrons seated in the restaurant, who also patiently seek their waiter. He turns to me. I can see his eyes ticker-tape with the heroic tales that Campbell recited to Bill Moyers on the six-part PBS series. No doubt he'd like to re-create that setting in this restaurant.

"Myth was an important part of my rearing," he says. "Was it true for

you in Puerto Rico?"

"It sure was," I say, swabbing a roll with butter. Kwame smiles and excitedly leans forward on the table, resting his chin in the palm of his hand as

I begin my tale.

'After I acted up one day, my grandmother told me the story of this kid in Puerto Rico who, after arguing with his grandmother, raised his hand at her in a striking fashion. She didn't slap the kid's hand—as grandmothers in Puerto Rico were supposed to do to correct this lack of respect-and instead let him continue angrily out the door and on his way to school.

"Needless to say, he was hit by a truck minutes later while crossing the street. After the hospital pronounced him a goner, he was taken to the morticians for preparation, but, try as they would, they couldn't get his arm to stay down. For some reason it was frozen in a perpetual wave, as if he were about to hail a cab or whack a handball.

"This presented problems for the morticians, who for hours were slamming his arm with sledgehammers and jumping on it as if it were a tree limb that had to be snapped. The dead boy's parents didn't know what to do, so they dressed him in his Sunday school suit and sawed a hole through the top of the coffin to allow for the stiff arm. Two days later, during the funeral, his grandmother finally arrived and, after seeing the weeping family surrounding the box, squeezed her way past them and smacked the arm, causing it to go down. 'Excuse me,' she said, returning to her seat. . . .

Kwame's jaw drops down to his chest. He looks the way Bob Dylan looked after hearing Tiny Tim play one of his songs. "Puerto Rican myths sure

differ from African myths," he laughs.
"They sure do," I say. "They kind of remind me of Lenny Bruce's old joke: 'I had a traditional New York upbringing: It wasn't until I was eight that I realized my name wasn't Shut Up.'

Kwame leans back and wags his finger. "Ah, that's not the power of myth," he says to me. "That is the power of guilt!"

'Forget what Campbell says about myth," I say. "The power of guilt is what inspired Alexander the Great to conquer the world!"

"That gave the Roman Caesars the impetus to govern!"

'That made Jesus give up carpentry and go into preaching!"

'That made Einstein go into physics and not into dentistry!'

"Do you think Moyers would ever do a special on the power of guilt?" Kwame bites his lower lip.

"You know, he should," he says. "But it would really be a downer for viewing audiences to realize that it was our mothers' chiding stories-not ancient tales of heroism-that are the root of genius. Remember the one to remind us we shouldn't eat sweets?"

'Sure. Which one is your version?"

"My grandma once told me that tiny worms lived in the sacks of raw sugar that were brought into our home. And one time when she caught me tasting some sugar, she told me to drink a glass of water at once to drown the billions of worm eggs that I had just swallowed from tasting that sugar."

"Did you do it?"

"I didn't have to," he says, finding a roll. "Grandma said that my vomiting as fast as I did got rid of the eggs."

"What about the ship that sailed around the world, endlessly looking for little children who would not eat every-

thing off their plates?'

"Yes! We had that one!" Kwame shouts. "I was told that if I didn't finish my beets, spies from the ship would dock nearby, and I would be put on that ship and Mom would have to bring home a kid who looked just like me who would eat his vegetables."

'Mom said that I would be dropped off in Biafra. What about you?"

'Detroit." Kwame takes a deep breath and makes the sign of the cross. "I swear, I wound up even eating the beets off my sister's plate." Kwame pauses, looks for the waiter, and continues: "How about saying bad words? Did you have floating letters?"

"And how! If I would say the F word. Mom would say that a giant F would pop out of my mouth, float around like a bee, and slap me across the forehead."

"My mom said that if I said a bad word, a man who had no face would pick me up on my way home from school and make me lick the sun.'

Kwame and I look at each other. Would Moyers ever touch it? Naw!

"Moyers should touch a real universal myth," I say.
"What's that?" Kwame asks.

"That waiters appear at your table when you want them."

"I never heard that one," he says.

"I heard it once," I say.

Kwame shakes his head. "Now, Roberto," he says, "let's not go confusing myth with fantasy."

Roberto Santiago is presently a staff writer at Emerge magazine.



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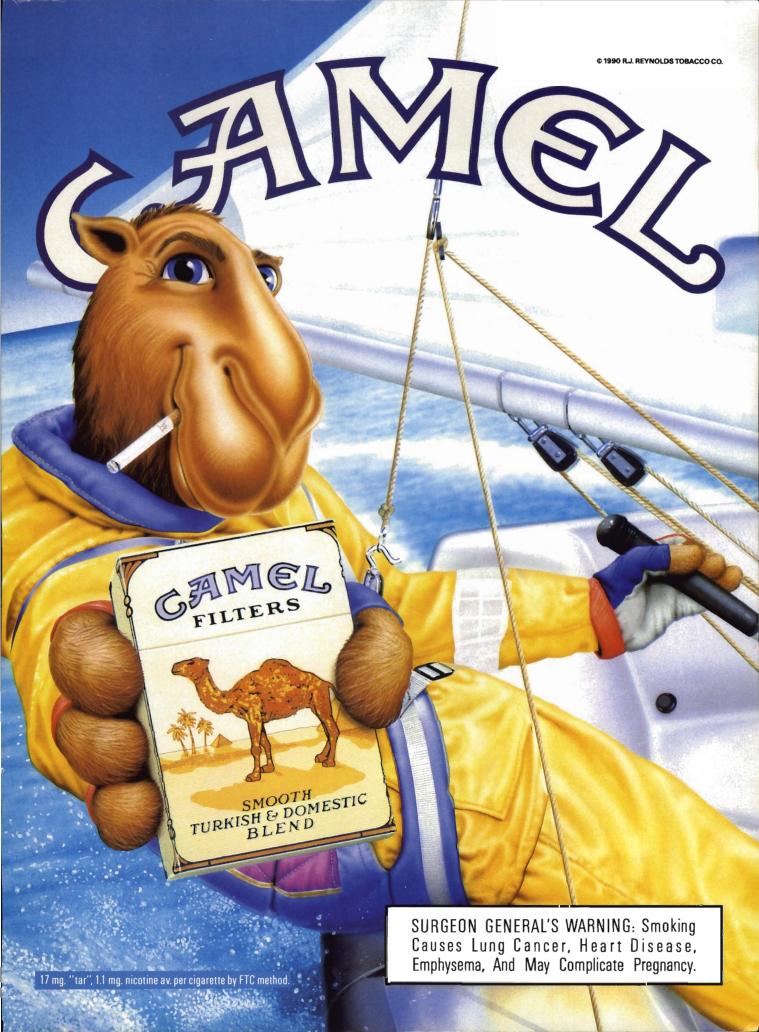
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