



MARCH 1985 \$2.50

MARS

THE MYTHS AND MYSTERIES

A SPECIAL EDITION

**RACING THE SOVIETS TO MARS: WHY WE MUST WIN
THE PROFESSOR WHO TEACHES PRESIDENTS TO THINK
WAS THERE A CITY NEAR THE FACE IN SPACE? A GREAT
MEDICAL MYSTERY—EXPOSED! 3 NEW SHORT STORIES**



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CONTENTS	PAGE
OMNIBUS	Contributors 10
COMMUNICATIONS	Correspondence 14
FORUM	Dialogue 22
ARTIFICIAL INTELLIGENCE	Computers Peter J. Ognibene 28
FILM	The Arts Mitch Tuchman 30
CONTINUUM	Data Bank 35
MARS: THE MYTHS AND MYSTERIES	
FIRST WORD	Opinion Thomas G. Payne 6
SPACE	Comment Daniel Kagan 26
STARS	Astronomy Terence Dickinson 32
RACING THE SOVIETS TO MARS	Article James E. Oberg 44
THE GODS OF MARS	Fiction Gardner Dozois, Jack Dann, and Michael Swanwick 50
THE CITY NEAR THE FACE IN SPACE	Article 64
RED REPRISÉ	Photoes Pamela Weintraub 76
SAND CITY	Photoes Eric Meola 56
MINOR SURGERY AND A POKER GAME	Fiction M. G. Jacobs 70
THE PROFESSOR WHO TEACHES PRESIDENTS	Interview Edward de Bono Anthony Liveridge 74
A GREAT MEDICAL MYSTERY	Article Sherry Baker 84
HONG'S BLUFF	Fiction William F. Wu 90
ANTIMATTER	UFOs, etc. 96
THE SPIRAL	Phenomena Henry Genthe 120
GAMES	Diversions Scott Moons 132
LAST WORD	Humor Clyde James Aragon 134



Chesley Bonestell, known as the dean of astronomical art, created this month's cover "Mars from Deimos" in 1952. While exploring the potato-shaped outer moon of Mars, astronauts take advantage of the satellite's low gravity to indulge in a bit of play.

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FIRST WORD

By Thomas G. Paine

Instead of flying only robots to Mars, we must also send software—the seeds and blueprints of man's own humanity

The resource-rich planet Mars is man's last and bulkiest hope in space. Yet Gusputin kicked the ball to orbit. Neil Armstrong pioneered mankind's "gentle leap" to the moon. Fulfilling President John F. Kennedy's bold directive, The men and women who will open the high road to Mars are alive today, and so is the new national leader whose vision will direct his country's space resources to Martian settlement.

Technologies critical to the establishment and support of permanent Martian bases are already well developed. Apollo sediments demonstrated effective techniques for exploring other worlds as far back as 15 years ago. Martian landings will prove easier because such techniques as aerobraking can be readily employed. Both the American shuttle and the Soviet Union's giant new Seryozha G launch vehicle, with its estimated cargo capacity of 300 tons, can easily reach low Earth orbit (LEO). Within a decade both the United States and the Soviet Union will have LEO spacecraft capable of assembling, loading, fueling, and launching deep space transports to Mars.

Robotic Viking probes have already transmitted years of environmental observations of the Martian surface, providing us with sufficient design information to construct the first permanently manned Martian bases. And because the Apollo/Skylab shuttle and Salyut/Soyuz programs have effectively used most of the components needed for Martian spaceships, the technology to extend manned operations to Mars rests on our growing boards today. This availability of water on Mars will provide a favorable climate for the development of agriculture and a robotics industry. In fact, we know far more about manned operations on Mars today than we knew about lunar landings when the Apollo program was launched in 1961.

Because of the high likelihood of Mars settlement in the next century, space-development resources should not be expended on one-shot Apollo-type manned expeditions to Mars. Instead, future robotic and manned visits should be designed to prepare the way for permanent settlement and successful colonization. To facilitate such a historic goal, every Mars mission should leave behind materials, sundry supplies, and equipment, with qualified men and women remaining on Mars to work between resupply missions. Instead of flying only hardware and tons of material that can be produced by robots on Mars, we must also send software—the very seeds and blueprints of man's own humanity.

Once we develop economical space navigation, robotic systems, and closed-ecology life-support technologies, both the moon and Mars will become lively areas for settlement for a wide range of reasons.

Industrial and economic motivations will be chief among them. Long-term

investment in now-growth economies, in which high-tech is a relative overcapacity, exhausts natural resources, will initiate widespread economic development throughout the solar system. Access to virgin continents and vast, untapped resources will open an endless frontier that will in turn eliminate the dire Malthusian limits imposed by human aspirations. Currently unimagined research and development bases in low-escape-velocity worlds will provide ideal locations for planetary research, spaceflight development, and the exploration of asteroids and the entire solar system. These industrial frontiers will provide man with the opportunity to build forward-looking technocracies, with advanced social compacts that will place a high value on individual responsibility, bold scientific vision, and cooperative human fellowship.

The spiritual rewards that await colonizers of Mars seem just as significant. The basic desire to preserve life and to formulate deeply treasured human beliefs and cultural heritage to direct descendants will be at the core of our Mars exploration. Opportunities for the dispersal and survival of individual genes, whole families, and entire races in promising new human habitats will abound. So will the promise of a future devoid of disease, ignorance, fear, and earthly prejudices. Preventing territorial warfare between high-tech nations and replacing strife with positive conquests of new worlds for all mankind will be among the loftiest of all our rewards.

Closed-ecology life-support systems on Mars will provide future generations with the experience to colonize other areas of our solar system and, eventually, with an expanding final frontier of remote planets awaiting other stars.

I am convinced that these driving forces will appeal to many pioneers and national leaders. Such expeditions will attract more volunteers than can be initially accommodated. The leaders of the Soviet Union have expressed their determination to colonize the solar system, as in the case of Sputnik, the Kremlin appears to perceive the broad human appeal of space exploration more clearly than many in Washington do. I believe that Soviet cosmonauts will travel to Mars and visit Phobos in the Nineties and that this event will spark a similar determination in the West for Mars exploration. The United States need not wait for the Soviet Union to blaze the trail to Mars, however. We need a bold vision of American space goals for the twenty-first century, with the permanent occupation of Mars as a central theme. **DO**

Thomas G. Paine was administrator of NASA during the last Apollo moon landing in 1969. He is now Thomas Paine Associates, a consulting consultant to the aerospace industry.

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SWANWICK

Red-dirt vistas pockmarked by deep craters, attenuated air charged with icy hues from the shimmering amber sun, polar caps waxing and waning their rhythms ancient and bold. The planet Mars, a world of mammoth volcanoes, dry riverbeds, and global dust storms, has long been shrouded in myth and mystery. But someday soon, human outposts riding interplanetary ships may penetrate the veil, establishing manned bases on the most hospitable piece of extraterrestrial real estate in the solar system.

The value of that real estate is described in *Raising the Soviets to Mars* (page 44) by NASA engineer James E. Oberg. Yes, it would cost a lot to terraform Mars, rendering the sterile world habitable for humans. Oberg says. But the investment—roughly \$300 billion to \$500 billion—would pay off handsomely. The value of Mars alone would come to at least 1 trillion 1985 dollars. Precious metals from asteroids, and water from the two Martian moons would multiply that value. And the value of new human knowledge in fields as diverse as climatology, geology, and medicine would be immeasurable.

As Oberg's article points out, dreams of a Martian mission, dismissed less than a decade ago, have now taken hold. But the bold new plans are just the latest in a series of dreams. In *Red Repulse* (page 78), Orion senior editor Pamela Weintraub examines literary and artistic conceptions of the red planet. In 1894, Weintraub explains, astronomer Percival Lowell postu-

lated an extraterrestrial intelligence after seeing Martian "canals" through his telescope. Science-fiction writer H. G. Wells described the Martians as malevolent geniuses hoping to invade Earth. And in 1938, Orson Welles broadcast a radio play about an imaginary Martian invasion millions were convinced.

If science writer Richard Hoagland's thesis is correct, some of the mythology may yet be proved true. During the Viking mission to Mars, Hoagland says, NASA photograph 35A72 recorded a three-dimensional, facelike image on the planet's surface. Analyzing the picture still further, Hoagland claims in *Melospiza on Mars* (page 64), he found evidence of a city arranged in a grid pattern near the face. There are also too many astronomical alignments, he contends, to be mere coincidence. Hoagland, who was special adviser to Walter Cronkite and is now working on *The Monument of Mars: A City on the Edge of Forever*, a book to be published by Prentice-Hall, adds: Unlike wild claims of ancient astronauts and other modern fantasies, there is one simple, elegant way for the American people to find out whether my theory is correct: Return to Mars. The Russians have recently announced a mission to Mars. They plan to take high-resolution pictures of the surface of Mars itself. If, in fact, there is a planetlike civilization, they will detect it.

Visions of a Martian culture also serve as the basis for *The Gods of Mars* (page 50). This collaborative effort, by science-

fiction writers Gardner Dozois, Jack Glann, and Michael Swanwick, takes us aboard the first manned mission to the fourth planet. After a five-week-long interplanetary dust storm subsides, the NASA leader descends, and the astronauts discover a perplexing dilemma.

Discovery is also the subject of *An Epidemic in Despair* (page 84) by Atlanta-based writer Sheri Baker. In this compelling story, Baker describes the problems faced by Dr. Oran Truss, a medical detective trying to expose a hidden epidemic. Several million people in the United States alone may have undiagnosed candidiasis, a yeast infection. Truss claims. The simple yeast parasite, which ravages the body, may be implicated in conditions ranging from allergies to AIDS.

When I attended the Yeast/Human Interaction Symposium in December 1993, says Baker, "I talked to dozens of physicians about their experiences in treating patients for candidiasis. Over and over these doctors told me how they had at first doubted Truss's theory, but after trying his ideas on patients with unexplained symptoms, they were amazed at the spectacular rate of success."

Finally, we offer two other fiction pieces this month. On page 70, M. G. Jacobus presents *Minor Surgery*, and a Poker Game set on an intergalactic ship in deep space. William F. Wu's story, *Hangs Bull* (page 90), meanwhile, has an Old West setting—except the figures shooting one another are bionic horrors. **DO**

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LETTERS

COMMUNICATIONS

Public License?

The U.S. Army Natick Research and Development Center at Natick, Massachusetts, has an excellent track record. National media, both print and electronic, have attested to that, and I am proud to be associated with the work done here.

My office assisted Bill Lawren in his article "Air-Conditioned Underwear" [Continuum, November 1984]. Lawren did not come here. He wrote the article from information we sent him, and I feel he took liberties presenting that information.

Obviously he is a witty man with more than a fair degree of sarcasm in his soul. I enjoy wit. His having fun at our expense is understandable. His homage to humor, however, leaves much to be desired when it results in such a poor representation of serious work. The work done here sustains America's soldiers. If that's funny, then ignorance is bliss.

Harvey Keene
Public Affairs Officer
Department of the Army
Natick, MA

Mental Floxing

I am holding you responsible for the recent complications that changed my life from joyful to sorrowful. Specifically, I feel that games editor Scott Morris must answer those changes, for it was his hexailexagon [Heaphy, October 1984] that started the whole mess.

I constructed my first hexailexagon back in the early Sixties, after Martin Gardner began his mathematical games column in Scientific American with an article about the strange little folded shapes. I thought they were safe, and so boxes of various sizes were soon scattered throughout my house. This dismayed my wife, who did not understand the paper toys. In order to ease the tension, I showed her how to fix the hexailexagon. Soon she was flexing away for hours a day.

For a while this made me a happy man. Then one day while my wife sat in front of the television, playing with one of the larger flexagons, I had constructed the belt of her faded-blue terry-cloth bathrobe got caught in one of the folds. She continued

to flex, however, and soon flexed herself into oblivion. I didn't panic, because I had already read of a similar occurrence concerning a fellow who had caught his necktie in a flexagon. He later returned to this world when he popped out of another hexailexagon many miles away.

Years passed, my wife was declared legally dead, and I remarried. My second wife was not so easily dismayed as my first wife. She didn't even own a terry-cloth robe. I figured I was safe. After all, no one was folding flexagons anymore. That is, until recently. Within a week after the publication of your October issue, I received a call from a gentleman in South Dakota. He'd been playing with a paper toy that he had cut out of Omni when a "dismayed woman in an old bathrobe" came folding out. She claimed to be my wife. Do you see the trouble you've caused? My life is now filled with accusations of bigamy and wife abuse. And it's all your fault!

Norman Enomoto
Bountiful, UT

Editors: reply. Apologies for any inconvenience and/or legal difficulties our venacious little *hee* may have caused you. We taught Scott Morris to offer you advice, but when we looked in his office, all we found was a hexailexagon on his chair.

Music Bull

Hats off to Bill Moseley for a wonderful report on his odyssey through Stage 15 at MGM/UA, during the production of the motion picture 2010 [Arts/Film, December 1984]. I was pleased to read that 2010 director Peter Hyams said the success of his project lay in creating a film "for those who have no a priori knowledge of 2011."

Moseley's article did, however, contain a small error. The haunting 2001 theme "Also Sprach Zarathustra," was credited to the writing Strauss. Johann Strauss is responsible for "The Blue Danube," used in 2001 to score Kubrick's breathtaking space-to-space station battle and during the film's closing credits. Richard Strauss composed Zarathustra.

James Diehl
Rochester, NY

MAILED

DIALOGUE

FORUM

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

Nuclear Alert

"Meanwhile, Back at the Lab" [Forum, October 1984] brings up several points that need to be discussed carefully.

Sue Stephenson writes that her lab is building a "credible nuclear force" that is a deterrent to aggressive acts by our adversaries. If 1 percent of our present nuclear force is used, almost all forms of life on Earth will be destroyed. The ability to kill everything over and over again is beyond any credible solution and borders on the ridiculous and paranoid.

Stephenson says that the lab employees are "some of the best scientists, engineers and administrators in the world." If they're so smart, why does their January 19, 1984, lab directory instruct all employees that during a nuclear alert they should "Secure all classified matter. Close windows and doors. Turn off all electrical equipment. Immediately take best available cover where you are. Remain under cover until all blast effects are noted. Then proceed quickly to the nearest fallout shelter." And Stephenson has the nerve to call those demonstrating against the lab naive.

She complains about demonstrators who blockaded the laboratory and "broke the law." The demonstrators are always nonviolent and commit only misdemeanors if that. We have every right—in fact it is our duty—to see that the government keeps its agreements regarding the manufacture of mass-destruction weapons.

Marilyn Davis
San Francisco

I remember vividly the Three Mile Island accident in 1979. I was in Middletown, Pennsylvania, at the time, and I recall when several friends who lived at the Penn State

Middletown campus were evacuated and taken to the Hershey Arena to live. I am bitter that General Electric is wasting the taxpayers' money. People should realize that all the nuclear fusion needed exists a very safe 80 million miles away and that the reason solar energy is not more widespread is because the monopolies of the world can't find a way to capitalize on an energy source they cannot control.

Joanne Meier
Lancaster, PA

Freeman J. Dyson [First Word, July 1984] and Ben Bova [Nuclear Threat and Promise, Forum, November 1984] set too much store in technology and too little in the individual. Our problems with the specter of nuclear war do not lie in creating more sophisticated systems to make present ones ineffective. Our central problem is that we have individuals with a Stone Age mentality controlling a Space Age technology. What kind of liberty is it when the price of freedom is the constant fear of nuclear destruction?

To break the death-lock with the Soviets we need an intellectual break with recent history and a return to traditional values. Then we will see that our greatest weapon is people's desire for freedom.

Nicola Calderaro
San Francisco

Ben Bova may know a lot about technology, but his letter "Nuclear Threat and Promise" reveals how naive he is about politics. A star wars program will only escalate the arms race by forcing the Soviets to take countermeasures that in turn will encourage the Americans to explore counter-countermeasures, and on and on. In the end we will only add new layers of complexity to a situation that's already out of control.

For 40 years the military has been promising us that the next weapon will bring us security. Even Bova realizes that no such thing will happen. If our leaders continue condemning us to seek over better military advantages, they will also be condemning us to death.

Don Lago
Columbia, MO

I have admired Ben Bova and his work for many years. It was with utter surprise that I read his views regarding the star wars space-defense system.

The University of British Columbia recently held a conference whose focus was Nuclear War: The Search for Solutions. One of the key speakers was retired admiral Eugene Carroll, of the Center for Defense Information in Washington, DC. Among the topics discussed was Space Defense—Can It Work? Carroll pointed out that the system will cost more than \$1 trillion to develop and will protect land-based strategic missiles, not the civilian population. By doing so, it will retain a second-strike capability in the event of Soviet attack.

There is no defense against nuclear weapons except getting rid of them. Human beings have lived long enough with the threat nuclear devices present.

Beverly Penner
Vancouver, B.C.

I commend Omni and Paul Bagnie for the care that was taken in preparing the article "After the China Syndrome" on the Three Mile Island Unit 2 [September 1984]. Bagnie got a "total immersion" into TMI-2 for three days and left here with a mass of material. He showed balance and admirable attention to detail in sorting through it.

I have only two caveats with the article. In a paragraph on the "cascading malfunctions" that produced the TMI-2 accident, the accident was described as happening "in seconds" with the reactor core reduced to rubble that quickly. Actually, there was a period of about five minutes before the high-pressure injection pumps were turned off. This was followed by a period of more than an hour before we turned the pumps back on. Only after this time lag did the upper third of the core collapse. Also, while the title of the article had fact, it was misleading. The China syndrome refers to an accident involving the meltdown of a reactor's uranium fuel. We had a severe accident at TMI-2, but we have seen no evidence of melted fuel.

Douglas H. Bedell
Manager, Communications Services
Three Mile Island Nuclear Station

SPACE REFINERIES

SPACE

By Daniel Kagan

The skies of Mars glow pink, a breeze swirls the planet's dust upward. The ground shivers slightly. Near one of the dry riverbeds that lace the terrain, a robot has begun to "breathe": its ceramic lung taking in the air around it and expelling it into an adjacent container. The product of this respiration—pure oxygen—is essential to interplanetary flight.

The first thing you want to do in space is to make something that gets you somewhere. That's propellant," says Warren Dowler, a chemical engineer at NASA's Jet Propulsion Laboratory in Pasadena, California. Dowler, along with Robert Ash, professor of mechanical engineering at Old Dominion University in Norfolk, Virginia, has devised a robotic refinery for processing the carbon dioxide on Mars into carbon monoxide and pure oxygen. This is the first step in creating a Martian gas station on the red planet.

The refinery is a rather simple device known as an electrolytic pump. The pump uses an electrical grill, situated between the Martian atmosphere and an oxygen-collection system. The pump sucks in

carbon dioxide and filters out dust, then feeding the gas into a matrix of tubes. Next, the carbon dioxide is heated to around 1000°C; at that temperature, carbon dioxide breaks down into oxygen and carbon monoxide. The oxygen migrates to the ceramic lung, and the lung then "breathes" the molecules into a circulatory system which collects the oxygen, cools it to a liquid, and stores it. A small nuclear reactor or a radioisotope generator powers the machinery.

The small, self-sustaining processor could be sent to Mars a year or so in advance of a manned mission. By the time astronauts arrived, the tanks would be full. Hydrogen, which makes up the other half of the fuel, must be sent along with the processor from Earth.

You just store the hydrogen atoms by mixing them with a little carbon to make methane," Dowler explains. Methane is easy to refrigerate and transport.

Mars is not the only planet whose resources could readily be converted into propellant. Ash is currently working on plans for processing the water ice on the

satellites of both Jupiter and Saturn.

We can now begin to talk seriously about applying the technology described by Arthur C. Clarke in his book 2070 *Odyssey* file," Ash says. "The idea is to use water ice as a source of oxygen for life support and propellant."

Two different machines could gather the ice. One device would have a vacuum-sweeper apparatus that travels over the water ice. Uranium oxide spheres inside the sweeper would generate enough heat to convert the ice into steam, which would then be stored in liquid form. An alternative would be to use a device that quarries the ice, drops it into a hopper, and then changes the ice to liquid.

Both units would channel the liquid into a little electrolysis cell, just like in chemistry lab, where an electric current would be used to separate the oxygen from the hydrogen. The hydrogen could be stored in a gaseous state; the oxygen would condense out as a liquid and would be routed into a different container.

The environment on one of Saturn's moons, Titan, makes collecting and storing the oxygen and hydrogen fairly simple. As you move farther from the sun, the surface temperature drops. On Titan, you can store liquid oxygen without refrigerating it. And refrigerating hydrogen on Titan takes a minimal amount of energy.

How far are we from placing refineries in space? A few obstacles must be overcome first, according to John Nehoff, manager of the space-science department at the Science Applications International Corporation, in Chicago. "A fair amount of money has to be spent on testing," he explains. "And there's a question as to whether such systems would be cost-effective. If it could be tied to an evolving mission, the cost could be amortized over a broader range of opportunity."

Ash points out that a comprehensive computer system must also be built into the Martian refinery.

The artificial-intelligence part needs to be developed, but the rest is simple," Ash says. "I'm anxious for people to know what can be done with the present technology. And we can do this right now."



IRS EYES

ARTIFICIAL INTELLIGENCE

By Peter J. Ognibene

We can find no record of your filing a 1984 individual income-tax return (Form 1040, 1040A or 1040EZ). If the Internal Revenue Service (IRS) sends you a letter that begins with the ominous salutation "look out. The tax collector has you in his sights. You apparently are one of the 5 million Americans who should have filed a tax return but did not. Nonfilers cost Uncle Sam about \$3 billion a year in lost revenue. The IRS believes it can find many, perhaps most, of them by using a technique known as computer matching."

It is a beguilingly simple idea. Take two or more lists that have at least one feature in common, and match them by computer. With tax records, the key elements are names and social security numbers.

The IRS routinely compares an individual's Form 1040 against his wages (Form W-2) and any miscellaneous income (Form 1099), such as interest or dividends. But its plans to use computers to match official forms with information obtained from commercial lists have raised concerns about the accuracy of such information as well as the prospect of creating the very sort of national data bank Congress banned in 1974 when it passed the Privacy Act.

The IRS is gathering a potpourri of computerized commercial lists, including data on real-estate transactions, new-car buyers, and licensed plumbers. Those lists will be matched against IRS master tapes, and anyone on the lists who has not filed a return will probably get the letter.

The project began in February 1984 in four areas: Brooklyn, Indianapolis, Milwaukee, and Reno, Nevada. The targets: anyone who appeared to earn more than \$10,000 but did not file a 1982 tax return.

"The IRS is attempting to determine whether commercial lists can supplement a variety of other efforts to identify persons who fail to file returns," says Roscoe L. Egger Jr., the commissioner of internal revenue. "We are seeking only information needed to determine whether there was an obligation to file. Consequently, estimated annual income is of primary interest. But other information, such as age and number

of people in a household, may also be looked at because these factors affect filing requirements."

Robert Ellis Smith, publisher of *Privacy Journal*, argues that it is unfair to use such lists because they are not precise enough for individual enforcement investigations and because the information was provided for a wholly different purpose.

Egger disagrees. Information in commercial lists is available in raw form from public records and documents, purchasing it in this form is more efficient than compiling it ourselves," he says. Moreover, the lists are available to car dealers, furniture salesmen, and numerous other vendors. If this public information can be used to sell everything from aluminum siding to magazine subscriptions, why shouldn't it be available to find tax cheats as well?

Yet Smith's point is well taken. Often, based on little more than guesswork, the information in commercial lists is inaccurate. And computer matching also raises questions that go beyond the quality of

data. When Congress banned the creation of a national data bank a decade ago, it had in mind a huge mainframe computer containing millions of electronic dossiers. With the proliferation of minicomputers and microcomputers that are linked over telephone circuits, however, the notion of a single data bank has become technologically obsolete. With computer matching, a skilled messenger can instantly pull together dozens, even hundreds of independent sources of information. In short, we now have a national data network that can snoop pry into the private affairs of practically anyone.

NEW WARES: HARD AND SOFT

For some people the problem isn't writing; it's finding all of those notes, quotes, and ideas they've jotted down—and then either misplaced or forgotten. Now it's possible to have your file cabinet at your fingertips as you write. Referring an earlier and more expensive program (The Idea Processor \$295, Idea Ware, Inc.) and Paperback Software have come up with two programs that can operate separately or in concert. Executive Writer (\$70) works as a word processor, Executive Filer (\$50) functions as an electronic file cabinet stuffed full of "notecards" that can be cross-referenced ten ways and copied just by tapping a few keys. (Available at computer stores or from Paperback Software, 2612 Ace Street, Berkeley, CA 94710.)

Using personal computers and modems, thousands of employees can stay at home and gain access to their office computer. Unfortunately, the same technology can be exploited by computer vandals. Slouth is designed to counter this threat. It verifies that a caller who logs on with an authorized password is in fact an authorized user. Upon reclaiming a password, Slouth disconnects the incoming call and places a call to the individual's preprogrammed phone number. The system, which can hold 74 names, passwords, and phone numbers, costs \$485. (Available from C. H. Systems, Inc., 8533 West Sunset Boulevard, Suite 106, Los Angeles, CA 90069.) **CO**



Clarton: Computers sniff out tax cheats

THE ARTS

By Mitch Tuchman

Cryptozoologists study what is presumably extinct or what was never more than imaginary. But what cryptozoology lacks as a science, it makes up for as a literary genre of dubious repute. Field reports of expeditions in search of Sasquatch or mokole-membe—a relative of the brontosaurus purportedly extant in Central Africa—are as formulaic as any popular detective yarn or steamy historical romance. The cryptozoologist's report always contains at least one reason why the animal, unknown to science at the outset of an expedition, remains unknown at its end. Witness a 1983 quotation from the journal *Cryptozoology*: "After all my notes were lost in Spanish Guinea when the Pangwa exploded the cannon carrying my few belongings."

When a sighting is claimed as in the case of a recent Congolese expedition, it cannot be corroborated. The emotion and alarm at this sudden, unexpected event [the sighting] disrupted the author's attempt to film the animal [mokole-membe]. The film had been almost totally exposed steadily and the author unfortunately began fumbling with the lens cap on.

Nevertheless, cryptozoologists are nothing if not optimistic, and it is characteristic of the genre to conclude each report with a call for further expeditions, better funded and better equipped.

The almas of Mongolia, the widows of China's Hubei Province, and the nio of New Ireland to name just a few, may be myth. But the myth most diligently pursued by cryptozoologists is the scientific blockbuster: the staggering overnight discovery whose symbol is not the little fruit fly of plodding melanoid classical genetics, but *Nesaeus kingi* sleek and unmistakable from the mats of the loch. This closet romanticism is not inconsistent with the more openly romantic aspects of the genre: the expedition into the heart of darkness to confront the dragon of evolution's dawn.

As metaphor, the dinosaur is instructively contrasted with the teddy bear. Teddy lives in our world and observes its rules festively. But the dinosaur inhabits a world without rules, a world before rules, a world untouched by anything human except

imagination. The dinosaur reveals the sequence of evolution: myth and mystery are banished. But if faith is to be maintained, a residuum of mystery must remain, hence the quest for living anomalies must invariably fail: the shameless excurses are integral to the genre.

There are many cryptozoological movies—*The Thing*, *The Creature From the Black Lagoon*, and *Jaws*, quaffily as do certain episodes of Jacques Cousteau. What makes *Baby*, the new Disney movie, a curiosity is its close-fertilizing of genres: the cryptozoological foray with the anthropomorphic comedy of manners. In brief, *Baby* concerns a family of mokole-membe (Papa, Mama, and Baby), a good paleontologist (Sean Young) and an evil one (Patrick McGovern). In the course of events Papa dies, Mama and Baby survive, at first in captivity later returning to the unfolding jungle. True to its cryptozoological side, *Baby* includes the assumption of living anomalies: the journey to the dark continent, and the gathering of evidence needed to convince a skeptical public. From the teddy bear side, *Baby* features a

family of dinosaurs that intermingle as human specifically American families do.

Monsters in monster movies are used sparingly, conserving the chills, but the psychology of *Baby* is different. The dinosaurs are the major characters. Disney's solution to *Baby*'s special-effects problem was to supplement the man-in-the-rubber-suit strategy with the puppet and the quarter-scale-miniature approach. The cast of dinosaurs is consequently extensive: four Babies—one mechanical, two with people inside, and one driven by remote control—plus two puppet heads for close-ups, one full-scale 60-foot Mama, four mobile quarter-scale Mama minis, two detachable Mama heads and necks, and a body on a forklift for traveling shots of her back; one full-scale Papa, four Papa minis, two detachable heads and one extra tail.

According to Isidore Rapson, who designed and built the dinosaurs, *Baby* had to snarl, smile, cry, be sorry, happy, angry, sick. We used human beings, Rapson continues, "because you can control humans—tell them what to do. The problem was suit to adapt the human's structure to the animal's. We had to find people who would not shift too much when they walked but who walked very straight and solidly. We tried more than one hundred fifty people to find three good ones, and those three had something in common: They practiced karate. The karate made them very coordinated." And in the end the walking *Baby* is at least as convincing as E.T. was: that is to say, convincing enough that we suspend our disbelief and empathize with the character.

This is due partly to Rapson's mastery partly to film editor Howard Smith's judicious cutting of the numerous angles he was provided. Long takes enhance credibility.

Finally, the quality of Rapson's conception and execution was substantiated by the awe it inspired. For example, a village chief who saw Mama lying on a flatbed truck permitted the film crew to cut a road through the nearby jungle to transport her to the location. "Saw the chief a few days later when he viewed the finished road. I didn't know a dead animal could eat so many trees. The cryptozoological side. **CC**



Baby: a cryptozoological comedy of manners

THE CRATER CONNECTION

STARS

By Terence Dickinson

Years of studying something as unremarkable as the shape of craters on the surface of Mars have turned up two significant facts about the planet and its satellites. One is that Phobos and Deimos, the two tiny moons of Mars, may be the last survivors of a family of ancient satellites—perhaps dozens of them—that once whirled around the red planet. The second fact is that the skin, or outer crust, of Mars underwent a dramatic change about 3 billion years ago.

The evidence for Martian moons turned up while planetary geologist Peter Schultz of Brown University was analyzing the shapes of the planet's craters. Of the thousands of craters now found on Mars only a few—170 to be exact—do not have the typical circular crater shape. Instead they are more oblong in appearance, like bathtubs. By doing a statistical analysis of random impacts on a celestial body in our part of the solar system, Schultz has concluded that oblong craters anywhere are extremely rare.

Most craters are made by asteroids and comets traveling in from elsewhere in the

solar system. The angle at which they strike (almost a right angle) makes the standard circular indentation. To gouge out the kind of oblong mark that characterizes the peculiar Martian craters, the impacting body would have to strike at an angle less than 5°. Schultz notes: And that would be a rare trajectory for a comet or asteroid. What could make such a mark, he suggests, is a moon of Mars spiraling down toward the planet from a decaying orbit. What made the craters, he suggests, was either debris from a single large satellite or at least 150 miles in diameter from several Martian moonlets, or from a swarm of smaller satellites.

In any case, most of the elongated craters are ancient—3 billion years old or older. In about 10 billion years another one will be created when Phobos, now orbiting Mars in a deteriorating orbit, eventually plunges to the planet's surface and blasts out an elliptical basin about the size of Houston.

Equally intriguing is another finding that came out of examining how those elongated craters are oriented. The truly ancient ones are situated along a north-

south axis, and the newer ones (formed during the last 3 billion years or so) are aligned on an east-west axis. Did something happen 3 billion years ago?

Schultz and other Mars experts think so. It was around that time that the planet was going through massive geologic upheaval. The Tharsis plateau, a huge deposit of lava on one side of that world was being born.

Today rising above the plateau are Olympus Mons (a 15-mile-high volcano estimated to be the largest in the solar system) and three other volcanoes that helped form the plateau. The theory is that the enormous amount of lava extruded onto the Tharsis plain by Olympus Mons and the other volcanoes built up such a huge amount of material that it made the planet top-heavy and caused the entire crust of Mars to make a dramatic shift.

The crust of Mars is one solid piece, unlike Earth's, which is made of several plates. Once the Tharsis plateau was formed, it caused the entire Martian crust to slide sideways. The phenomenon was comparable to rotating the skin of an orange without changing its interior. Eventually the momentum of this shift slowed and then stopped when the slab of volcanic material positioned itself near the Martian equator. By then the skin of the planet had been rotated 90°.

The laws of celestial mechanics predict that all Martian moons should stabilize in near-equatorial orbits within a few million years. Thus, when gravity determines their doom, each moon should spiral down to eventually hit the planet at its equator. This in fact is what has been happening throughout the history of the red planet. If the Martian crust reoriented itself, as Schultz and the others suggest, then the bathtub-shaped craters that formed after the 3-billion-year upheaval should be at right angles to the earlier ones. And that is exactly what has been seen.

Although it all ties together rather nicely, Schultz is the first to admit that the theory's true test will come after future spacecraft have done more detailed reconnaissance of the Martian surface, which will tell us more about the planet's past. **DD**



The Martian satellite Phobos. Bathtub craters on Mars suggest it is the last of a dying breed.

CONTINUUM

WHO OWNS THE IDEA?

Stephon Wolfram was disgusted. A brilliant young theoretical physicist—an Oxford graduate at eighteen, a California Institute of Technology Ph.D. at nineteen, a prestigious MacArthur Foundation fellow at twenty-one—Wolfram had taken a faculty job at Caltech, where, among other things, he helped develop a commercially valuable computer-software package called the Symbolic Manipulation Program. But a proprietary dispute developed among Wolfram, the company he helped form to market the program, and Caltech itself, with each faction claiming ownership. When Caltech refused to abandon its claim, Wolfram left the university and is still considering taking the matter to court. "According to Caltech's own by-laws," Wolfram maintains, "I own the damned thing."

The Wolfram case is the cause célèbre in what has become a series of acrimonious disputes between university faculty and administration over the issue of intellectual property. Basically the question is: If in the course of his research, a university scientist develops an idea that has commercial value, who owns that idea? Is it the researcher themselves, who provide the ingenuity and the labor, or is it the university, which presumably provided (or helped provide) the equipment and the money?

Millions of dollars a year are generated by products developed by university faculty, and these products usually fall into one of two legal pigeonholes: patents, which traditionally cover outright mechanical inventions or physical processes, and copyrights, which until recently covered only textbooks and educational materials. In each case, the policies of most universities were clear-cut: in general, patents belonged to the university, with the inventor sharing in the profits on a percentage basis; while copyrights for books were owned solely by their faculty authors.

All this was fine until computer software came along. "Software," says spokesman Robert Byers of MIT, "falls somewhere in the cracks between copyright and patent. It's not quite a machine, but it's not quite a book either. But despite a 1979 Supreme Court ruling that temporarily placed computer programs under copyright law, Byers—and other university administrators—are beginning to argue that software looks more and more like 'hard' inventions. "What makes a piece of software different from a book," says Byers, "is that to write it, you generally need mainframe computers, which universities have and individuals don't."

Many researchers are taking the opposite position. Stanford computer scientist Brian Reid—who was involved in an ownership dispute with Carnegie-Mellon Institute over the Scribe program he developed while a graduate student there—calls the "mainframe" argument "vacuous. I could have written a program like Scribe on a good personal computer in about the same time."

In any case universities are now scrambling to redefine their ownership policies on live software. In the wake of the Wolfram debate (which Caltech now declines to discuss), the university is reviewing its stand on intellectual-property policy. At present," says Caltech attorney Don Fowler, "we are treating computer programs like any other copyright item. But some of our people think it will end up being treated like a patentable item—meaning that the university will retain ownership. Carnegie-Mellon, MIT and the University of California are also reviewing their positions, and MIT at least seems to be leaning in the same direction as Caltech."

Stanford is considered by many to be the bellwether institution as far as intellectual-property policy is concerned. (Stanford owns patents on both gene splicing and cloning, which produce more than \$2.5 million a year in licensing revenues.) Its software stance is the first enunciated policy that treats computer programs as patentable. In Stanford's case the university assumes ownership of software, then shares royalties on an equal basis with the inventor, his department, and his school. "I've heard very little talk from the faculty over the new policy," says Director of Graduate Studies Gerald Lieberman. "My impression is that they are satisfied."

Apparently Lieberman hasn't been listening to his own computer scientists. Reid calls Lieberman's assertion "a pile of crap. I don't know anybody here who works with software who thinks the policy is anything but a disaster."

Perhaps the most interesting aspect of the intellectual-property dispute is what can in some cases be a wide gulf between university policy and university practice. "When I left Caltech and started considering other job offers," says Wolfram (now at the Institute for Advanced Study, in Princeton), "one of my stipulations was a letter stating that my future employer would have no rights at all to any intellectual property I generated. At almost every university—even those who had their policy was to assume ownership of intellectual property—they said that in my case they would be perfectly willing to overlook their own policy." —BILL LAWREN

CONTINUUM



If a certain microbe has its way, oil shortages may go the way of the dinosaurs. In fact, oil reserves may multiply five times.

OIL GLUT AHEAD?

Landlords and other oil users may be singing love songs to a certain bacterium in years to come. The microbe excretes a polymer that lets oil companies exploit crude-oil reserves five times more effectively, offering a long-term supply of oil.

Heavy crude oil is five times as plentiful as light crude. Most of it, however, is left in the ground by drillers because it is too thick and sluggish to pump. If mixed with water, the tanks of empty separators and floats on top, so in solid dressing unless so many costly chemicals are added that the whole operation becomes uneconomical.

The microbes have come to the rescue, however, with a polymer that is an emulsifier. Mixed with other chemicals and added to an oil-water mixture, it coats every oil droplet to form an encapsulating seal. This prevents the oil from coagulating. The result is a slurry that is easily pumped along pipelines and that can be burned in as little

ordinary furnaces.

Genetically engineered at Tel Aviv University, it is being marketed in the United States by a small firm called Petroform Fuels. The biopolymer may be useful as well for removing unwanted oil from tanks or for dispersing oil spills from the surface of the sea.

But it's the promise of multiplying oil reserves as staggering five times that has marketing manager Greg Wilson excited. "We could be an extremely large, multi-million-dollar company in a very short time!"

—Anthony Lewis/dp

All creative effort—including the making of an omicron—is precluded by destruction.

—W. Fu Tsun

No one can forbid us the future.

—inscription on the base of Poyu's monument to Leon Gambetta

"Perhaps the best thing about the future is that it only comes one day at a time."

—Dean Acheson

VOICE CONTROL

"Open the pod-bay doors, Hal." The astronauts in Arthur C. Clarke's 2001: A Space Odyssey were able to talk to their spacecraft's computer and the electronic "brain" understood them.

Astronauts aboard NASA's space station will be able to do much the same. Voice-actuated automation is being designed into the space station.

There will be times when a crew member will be too busy that he'll need a third hand," says Al Wettstein, the NASA engineer in charge of the space-station crew-control mockup at Johnson Space Center, near Houston.

That's when voice-actuated systems will be necessary. Imagine a crew member working at the space station's control center, using both hands to guide the remote manipulator arm (like the Canadian of the space shuttle) as it delicately repairs a malfunctioning satellite.

Move the actuator to the left," says the astronaut, his hands already busy guiding other remotely controlled instruments. The arm is joined and moves slowly leftward. "More, more, stop."

And the arm stops at the astronaut's command.

Voice-actuated systems are in their infancy today. Computers are usually controlled through a keyboard or a mouse or by a touch-sensitive screen.

It is a job to teach the computer to understand an individual's voice," says Wettstein. "Each person

speaks a little differently. But by the early Nineties when the space station is scheduled to begin operations, voice-actuated computers will be available. Wettstein is convinced.

The space station will carry more computer power than any previous NASA vehicle—at least 16 megabytes of memory capacity. By contrast, the space shuttle Columbia carried only 64 kilobytes on its test flights.

Although the station is being designed today, NASA will probably establish 1987 as the cutoff time for new technological developments which means the station will start operations with the newest hardware available.

But that is only the beginning. NASA expects the station to remain in operation for 25 to 30 years, and the engineers will be upgrading the equipment aboard it constantly.

Does that mean that, like the astronauts in 2001, the space-station crew members may one day lace a computer that can mutiny?

That's where we part with science fiction," says Wettstein. —Ben Bova



2001 astronauts had Hal. The 1990 model will be more benign.



The rock life style has spelled disaster for many performers. And in rare cases, the music itself can bring seizures as well.

ROCK-AND-ROLL EPILEPSY

For most of us, music is what Longfellow called the universal language. But for a few people, some kinds of music are literally bad vibes. They are victims of musicogenic epilepsy, a condition in which seizures are triggered by music. Fortunately, there have been fewer than 100 reported cases of musicogenic epilepsy since the affliction was formally named in 1897.

One recent example is a thirty-one-year-old Japanese man who had what could be called rock-and-roll epilepsy. The man complained of pain on the right side of his face combined with involuntary eye blinking whenever he listened to rock music played on a tape recorder. The pain, he said, was like an electrical shock radiating up the side of his face. The blinking and pain disappeared when the music stopped, and daily doses of an antiepilepsy drug also ended the symptoms.

Even stranger is the case

of a two-year-old boy who suffers epileptic seizures whenever he sings to himself or talks in rhymes. These are the only triggers of his unique form of musicogenic epilepsy, hearing his own tape recorded singing, oddly enough, does not cause seizures. Doctors have not been able to cure him yet.

Singing and listening to rock music are not the only culprits in musicogenic epilepsy. There's even a published report of a minister who had epileptic attacks whenever he played "Now Thank We All Our God" on the church organ—Joel Davis.

What a time? Leave Now for days and Ages? Man has forever

—Robert Browning

'Evolution is what it is: The upper classes have always died out, it is one of the most charming things about them.'

—Gertrude Greer

"I find that I am at two with nature"

—Woody Allen

CHILD-SEX VICTIMS

He was a pillar of the community, a fifty-four-year-old man who had received an award for dedication as coach of a Little League baseball team. On the side though, the coach was running a sex ring for pubescent boys, inviting them to his house, then emerging in a sexual outfit and engaging them in sex acts that ranged from mutual masturbation to sodomy and sadism.

Psychiatric nursing professor Ann Walbert Burgess of the University of Pennsylvania has recently completed a study of the aftereffects of 11 such sex rings on 66 child victims. A few of the children she found had managed to emerge from the experience with no lasting traumatic effects. The majority though, underwent changes in behavior that bordered on the terrifying. 45 children were troubled with vivid dreams, flashbacks and violent nighttime fears. 41 showed what Burgess called "diminished responsiveness to others and to the environment." (I want to wear a paper bag over my head.)

said one child.) Among other victims, there was an increase in fighting and in such risk-taking behavior as jumping from roofs, weaving bicycles through heavy traffic, and holding onto the bumpers of moving cars.

Perhaps most surprising was the tendency of some victims to identify with the adults who had exploited them. These kids resented the intrusion of authorities and felt sorry for the adult who was arrested. In fact, at least one boy became an exploiter himself, raping a girl who refused his advances then brutally beating her with a hammer.

To date, none of these children have had psychiatric treatment. "We can only hope," says Burgess, "that therapy will someday allow them to return to a normal life." —Bill Lawless

"Some people say that the heart is the organ with which we think and that it feels pain and anxiety. But it is not so. Man ought to know that from the brain and from the brain only arise our pleasures, joys, laughter, and tears."

—Hippocrates



I want to wear a paper bag over my head, said one victim of a child sex ring. Victims were also prone to excessive risk taking.

CONTINUUM

ROBOT NOSE

The human nose recognizes up to 1,000 different smells and identifies combinations of those smells as such familiar odors as Chi near food or Thanksgiving turkey dinner. This keen olfactory sense is actually accomplished with a handful of gas-sensitive nasal sensors; the olfactory receptors which send off signals that are processed and then stored by the brain.

A robotic nose, based on the human model, is now being developed at the Robotics Institute of Carnegie-Mellon University in Pittsburgh. Our ultimate goal is low-cost, mass-produced, all-purpose noses that can be used anywhere and that are trainable. Carnegie-Mellon robotic-nose researcher Paul Clifford says:

Instead of human olfactory receptors, the Carnegie-

Mellon robotic nose consists of a bunch of tiny gas-sensitive semiconductors (actually bits of various corroded metals wired with microcircuitry) that detect a given smell by reacting to its gases. In the presence of a specific gas, certain semiconductors send electric impulses to a computer, the brain of the robotic olfactory system. Depending on which semiconductors emit an impulse, the computer can determine the gas (or gases) present.

The trouble arises whenever there is a complicated environment with many different gases," Clifford admits. But even though the still flawed robotic nose has a long way to go, Clifford says, it will someday make an ideal air pollution watch dog and will revolutionize mass-production methods for drugs, chemicals, and processed foods. And he says the robotic nose will enable robot servants to cook without burning meals.

—Eric Mashara

"You died, and watched the night revealing the thousand sordid images of which your soul was constituted."

—T. S. Eliot

"The concept of entropy is by no means restricted to mechanical situations. The unfortunate fate of Humpty Dumpty is an example of a drastic entropy rise of quite a different system. His demise from a highly organized whole egg to one that was completely scrambled was also highly irreversible."

—Robert John



We know salmon are in good shape when they splash their way back upstream. But do they need aerobic exercise earlier in life?

JOGGING SALMON

Salmon, like people, seem to benefit from exercising regularly. It may at least help them swim to the ocean and escape from predators.

For three years, University of Washington fisheries professor Lynwood Smith has been giving a workout to hatchery-raised coho salmon on the Oregon coast. The purpose of the experiment is to increase the number of adult fish that eventually return to the hatchery after their journey at sea.

In 1982 Smith made 40,000 smolt exercise by placing them in small ponds equipped with recirculating pumps. For two-hour periods twice daily, the pumps forced the fish to swim in order for them to stay in place. A control group was not exercised. After ten weeks, tests showed that the exercised fish had more swimming stamina and increased appetite.

After three more weeks of exercise, all the fish were released in a pond with moving water. The exercised fish all swam downstream

in the bottom half of the pond, as if heading out to the ocean. By contrast, the control group swam at all levels of the pond, with half of them going upstream and half downstream.

Smith believes if the fish had been released into an estuary, the exercised fish would have headed out to sea immediately and more would have survived, while the controls would have stayed in the estuary for at least a week, rendering them vulnerable to predators.

The ultimate measure of survival couldn't be gauged accurately because only 20 salmon out of the 40,000 returned to the hatchery in the winter of 1983. "Presumably the fish starved to death because of warm water conditions," says Smith.

Experiments by Scandinavian scientists, however, demonstrated that the return rate of Atlantic salmon could be doubled through exercise. Smith and his colleagues are awaiting the return of 50,000 coho released in the spring of 1983.

—Joel Schwartz



Decker cybernetic noses will improve your robot's cooking.

SCREAMING DENTAL ROBOTS

Life-like dental robots that have rubber skin, plastic teeth, and bleeding plastic gums are the latest innovation in dental education.

"These dental simulation units will make it possible to train better, more experienced dentists," Emory University dentistry professor Frank Faunce says. He developed the robots with Stanley Rowberry and Douglas Strain, also dentistry professors at Emory, in Atlanta. "Because of the reduction in dental decay and periodontal infection during the last few years," Faunce says, "enough real-live patients on whom students can practice their skills have just not been available."

Each of the dental robots actually consists of three separate heads mounted on a single, portable pedestal. Students can perform restorative dentistry (fill cavities, insert crowns or caps) and do gum surgery, as well as remove impacted wisdom teeth. The blood (actually aqueous dye) that spurts from each robot's gums adds to the realism.

Within two years, Faunce says, each robot mouth will be outfitted with electronic sensors. This will make it possible for a computer to quickly analyze and critique the student's dental technique. And it will allow for audio feedback (the robotic equivalent of a human scream) that immediately signals the student as to how the dental procedure is going. —Eric Mahara



Cougars can be hunted legally as sport or to protect sheep. But using radio collars to track them down has created a controversy.

COUGAR OUTRAGE

When a hunter from the New Mexico Department of Game and Fish killed a cougar and her two kittens because they had destroyed a rancher's sheep, federal officials and environmentalists were irate.

A radio collar had previously been put on the cougar so National Park Service researchers could track its movements, as part of an ecological study. The New Mexico Department of Game and Fish is supposedly cooperating in the study, but last May its hunter homed in on the radio's frequency to track the cougars down.

"It was an unethical thing to do from a scientific standpoint," laments animal ecologist Milford Fletcher of the National Park Service in Santa Fe. "We're conducting a science experiment with the rabbit game and farm people," he says, "and with our collars they're surreptitiously running down these lions and killing them."

Cougars are not an endangered species, and in New

Mexico they are hunted as sport game. One cougar sanctuary, the Guadalupe Mountains National Park, is adjacent to a number of sheep ranches, and the cougars that the hunter killed had destroyed sheep just yards outside that park.

This agency is charged with the responsibility of responding to sheep depredation by mountain lions, explains wildlife scientist Wan Evans, assistant director of the New Mexico Department of Game and Fish. "The particular way this specific situation was resolved, to my understanding, violated our agreement with the Park Service and won't happen again. But we will continue to pursue mountain lions by traditional means," he says, "whether they're wearing radio collars or not. That means using dogs or traps when we have to."

—Eric Mahara

"Technology makes it possible for people to gain control over everything, except over technology."

—John Tudor

BACKACHE RELIEF

Chiropractors, those nonmedical doctors best known for manipulating the spine, are sometimes denounced by the medical community as quacks who just like to make people's bones go snap, crackle, and pop—offering little more than hand-holding comfort and glib words of assurance. The orthopedist, most of us are told, is the back specialist.

But a recent survey of some 500 back sufferers nationwide showed that chiropractors outperform orthopedists in relieving many kinds of back pain, as reported in *Backache Relief* (Times Books, 1985).

Participants in the survey saw a total of 422 chiropractors and 429 orthopedists (as well as many other kinds of practitioners). Their problems included chronic lower-back pain, ruptured disks,



A recent survey gave high marks to chiropractors.

CONTINUUM

neck pain, spinal osteoarthritis, and various spinal anomalies such as scoliosis.

For lower-back pain, disk chiropractors had more to offer their patients than orthopedists did. But manipulation alone was rarely the major reason for their effectiveness. The successful chiropractors used the gentlest forms of manipulation and augmented their hands-on healing with advice about exercise, life style (particularly stress management) and nutrition.

Unfortunately, spinal manipulation often proves disastrous for anyone in the throes of acute pain from a ruptured disk, giving orthopedists the edge here according to the survey. Overall, such rehabilitation specialists as physiotherapists (doctors of physical medicine) offer the most help to disk patients.

Chiropractic manipulation works well on neck pain, the study found, despite some risk of injury from the treatment. More than half of the chiropractors consulted for neck pain brought their patients relief, while only one tenth of the orthopedists could do the same, even temporarily.

For osteoarthritis, neither the chiropractor nor the orthopedist did much to help the patient. The same was true for pain associated with the spinal curvature called scoliosis. Survey participants with these problems found help from other kinds of specialists, including yoga instructors and physical therapists. —Dana Sobel

BEYOND PLUTO

The solar system doesn't end at the orbit of Pluto, nor even at the edge of the more distant Oort Cloud of comets. In fact, its boundaries can be said to stretch at least 1.5 light years out—nearly half the distance to the nearest star.

This is the conclusion of two astronomers: Florian Smoluchowski, of the University of Texas, and Michael Torbett, of Murray State University in Kentucky. The two used computer simulations to determine how far into space the sun's gravitational influence would reach.

The two discovered that the galaxy's center and occasional passing stars or molecular clouds would be the only serious gravitational disturbances to a huge zone of stability surrounding the solar system. Depending on an object's orbit, it and distance, that zone

can reach as many as 9 trillion miles from the sun, or more than 15 light years. The nearest star, Alpha Centauri, is 4.3 light years distant. So the gravitational fences of the sun and Alpha Centauri, says Dr. Torbett, lie pretty close together.

Torbett adds that his and Smoluchowski's results also strike a serious blow against the so-called Nemesis hypothesis, that a star circling the sun occasionally drops comets into the inner solar system, causing periodic extinctions on Earth.

This work, applied to that hypothesis, suggests that Nemesis would be in an unstable orbit, Torbett explained. —Joel Davis

Now and string things are belittled because if they are not belittled, the humiliating question arises: Why then are you not taking part in them?

—H. G. Wells



That solar system includes nine planets, but its gravitational influence may extend nearly half the distance to Alpha Centauri.



Are you ready to build yours, composed of never-ending?

PLASTIC SKYSCRAPERS

A backyard inventor has worked out a way of making plastic so strong that it can be used to make skyscrapers, aircraft, spaceships, bridges, dams, and even battleships.

Robert A. Florentine developed the method in his garage. He makes plastic twice as strong as steel in all three dimensions by weaving ropelike strands of glass-fiber yarn in multi-dimensional patterns on a special loom. The shapes are then extruded or dipped in liquid resin, heated and dried in a microwave oven.

Beams can be spun rapidly at the rate of 300 feet per hour. The white or yellow material is a quarter the weight of steel and will cost about half as much to use, Florentine estimates. A two-inch-thick rod used as a whip would shatter a wooden desktop, he says. I don't want to sound like a snake-oil salesman, but its potential is mind-boggling!

His MagnaWeave process can produce almost any shape industry demands from I-beams to entire aircraft wings. Boeing is building a test aircraft with 120,000 pounds of the plastic structural parts in the fuselage.

You could have a luxury-size car with the light weight of a compact," says Fiorentine. Armor plate made out of the material would be strong enough for battlefields. Prefab bridges in remote parts of the Andes "frown in by airplane, are another possibility." "You could build a space station by throwing up a loom and a pultrusion machine and weaving the shapes in space," claims Fiorentine.

Skyscrapers made of the plastic beams would not wilt like candelas in the sun or catch fire easily, according to Fiorentine. "It's drapes and furniture that make a towering inferno. Vinyl furniture burns at 200°F and aluminum begins to soften at 750°F. But the composite is inert and even if uninsulated it won't char till 700° or 800°F. Steel melts at 1000°F," the ex-General Electric aerospace-research engineer points out.

Florentine owns his patients and looks set to become the plastic industry's Carnegie. "We're talking maybe fifteen million to twenty million tons of structural steel a year that can be replaced with lightweight material." But the only change at home to date is that his workshop has moved from the garage to the basement. "My wife is asking when the money will start rolling in," he laughs.

—Anthony Livingside



The computer in the 1957 movie *Casablanca* is old-fashioned. But government computers may not be much more advanced.

GOVERNMENT COMPUTER WASTE

The U.S. government, which has a \$12-billion per-year automated data-processing budget, owns more computers (17,000 in all) than anyone else in the entire world. But because many of the computers are antiquated, billions of taxpayer dollars may be wasted unnecessarily.

The average age of computer systems in private industry is less than three years," management consultant Lyman Dennis says, "but we found that in the federal government the average age is nearly seven years and in certain instances the age is nearly twenty years." Dennis, a vice president of Whitaker Health Services, Inc., in Los Angeles, analyzed the government's computer problems for the President's Private Sector Survey on Cost Control, which was organized by a group of corporations to advise the president on how to save money.

Obsolete computers cost much more to maintain than new ones, Dennis explains, because they break down frequently and are no longer repaired by manufacturers, so the government must do all the maintenance itself. And bulky old computer systems require a lot of expensive floor space and costly climate controls that can often be avoided with new, efficient models.

Cost-conscious bureaucrats actually believe they save money by not buying new computers, Dennis says, and even when they do cough up the money to make a purchase, the replacement is often a discontinued model (bought at a bargain-basement price) that is obsolete by the time it is in service.

"Our recommendation was that the government replace all computer units over five years old," Dennis says. By junking all the obsolete hardware, he claims, the government would save a whopping \$4 billion over three years. —Eric Mishara

SAFEST TIME TO DRIVE

Each morning Monday through Friday you sit stewing in your car, caught in the rush-hour traffic jam. Well, relax, that heavy morning traffic prevents you from becoming a highway fatality.

"Traffic moves slowly, and the drivers are alert during the morning rush hours, so there is less chance of a fatal accident," says Sherman Stein, a mathematician professor at the University of California at Davis. Indeed, the morning rush hours (6 to 9 A.M.) are the safest times of the week to drive, according to the results of Stein's recent traffic-safety study. The most dangerous time is when the bars let out (between 1 and 2 A.M.). "One minute of driving at that hour," he says, "is as dangerous as a whole hour of driving during the morning rush."

Stein, a self-described "defensive driver," had a personal interest in learning the safest and riskiest times to drive. So using government statistics, he compared the total traffic fatalities for each hour to the number of cars driven (or traffic flow) at each hour. Then he computed the "risk factor," or fatal accidents per car on the road for every hour of the typical week.

Daylight hours are relatively safe, Stein says, but the evening rush hours are several times riskier than the morning rush hours, with fatalities continuing to climb through the evening until the 2 A.M. peak. "I try to avoid being out after midnight," he says. —Eric Mishara

CONTINUUM



Harper at the bat. The secret is to take your eye off the ball, then pick it up again as it comes within swinging range.

KEEP YOUR EYE OFF THE BALL

Keep your eye on the ball. That's the advice given to hitters by every coach from Little League to the pros. But now along comes University of Arizona engineering professor A. Terry Bahill to tell us that not only is it impossible for a hitter to track a baseball from the time it leaves the pitcher's hand until it crosses the plate, but that most hitters take their eye off the ball in mid-flight.

Bahill set up a series of laboratory experiments in which a plastic White ball was thrown at speeds up to 93 miles per hour (about the velocity of a Nolan Ryan fastball) to a series of batters who were equipped with special sensors around their eyes. The hitters ranged in skill from non-baseball-playing college students to Brian Harper, of the Pittsburgh Pirates (now with the St. Louis Cardinals).

Predictably Harper did the best job of tracking the ball, but even he lost sight of it at a point about five and one-half feet from home plate.

"The human eye," concludes Bahill, "is simply incapable of tracking a fastball over the entire path of sixty feet—six inches [the distance from the pitcher's mound to home plate]."

How then, does anyone ever hit the damned thing? Bahill suggests that the better hitters train themselves consciously or unconsciously to take their eyes off the ball at some intermediate point, then pick it up again as it comes within range of the bat. He says that Hall of Famer Ted Williams, who claimed he could actually see the ball hit the bat, must have had a big jump in eye movement.

Several big league clubs have expressed interest in using Bahill's test to screen minor leaguers for hitting potential. In the meantime, Bahill says, "I'd like to run tests that compare the tracking abilities of a control hitter like Rod Carew against a power hitter like Reggie Jackson." —Bill Lawton

Manic depression is a frustrating mess.

—Jim Hendrix

ZETAS, SQUARKS, AND WINOS

Particle physicists push their powerful accelerators to increasingly higher energy levels in their search for traces of such exotic subatomic particles as quarks and gluons. Recently though they've begun to see evidence for subnuclear creatures that shouldn't exist—at least not according to standard theories of physics.

An international group of scientists calling themselves the Crystal Ball Collaboration (named for the particle detector they use at the DESY accelerator in Hamburg, West Germany) recently announced the discovery of a subatomic particle they're calling the zeta. It was the unexpected result of a pretty standard investigation of an already known particle the upion meson.

The zeta doesn't fit anywhere in the standard subatomic zoo, but some physicists think it might be explained by the emerging theory of "supersymmetry." Crystal Ball member Elrod Bloom, of Stanford University's Linear Accelerator, is still hesitant to talk about the zeta's significance. "We're right in the middle of another run of experiments, and I think we should wait until those results are analyzed."

Wino particles have also been detected at the CERN accelerator in Switzerland. At least 11 inexplicable incidents have shown up in the last year. Physicists are calling them "anomalous events," but recent Nobel Prize-winner Carlo Rubbia is

sure they are real. There is no sensible way to explain the missing energy by known particles," he was quoted as saying in *Science News*.

Rubbia, too, invokes supersymmetry theories to explain the strange CERN results. The anomalous events may actually be the first sightings of a whole new class of creatures in the subatomic zoo, with the zeta particles being joined by selectrons, squarks, photinos, zunos, and yes, winos.

—Joel Davis

"Language is a waste from outer space."

—William Burroughs

"To live alone one must be either a beast or a god."

—Aristotle

"Producers are always pleasant company when they are off duty."

—Mark Twain

"Once there was a way to get back homeward."

—John Lennon



CERN: 11 weird incidents in the course of a single year.

The fourth planet is the gateway to the mineral-rich asteroids and the superpowers' next frontier

RACING THE SOVIETS TO MARS

BY JAMES E. OBERG

In 1901 a group of Panamans offered a reward to the first person who made contact with beings from a distant world. Communication with Martians did not count; the committee organizing the contest felt this would be too easy. And 30 years from now we may well be speaking with creatures on Mars—Earthlings who have set out to colonize a new world. Over the coming centuries, the blood-red planet could be transformed into a gleaming, green-tinted jewel, reflecting the spread of human life across its surface.

Recent events have made such a vision more feasible than ever. After steadily working out the frozen budgets and icy political dimities of the Space Race, the modern explorers of space have reason to hope. The success of the shuttle, President Reagan's support of an orbiting space station, and even rumors of a new Soviet push deeper into the solar system bode well for a renewed U.S. commitment to Martian exploration.

Mars is a sensible objective for several reasons. It represents a substantial management goal that would organize the development of space for a long time to come, says engineer Thomas P. Mayer, president of the Boulder Center for Science and Policy in Colorado. Mars is the gateway to the asteroids, a likely source of minerals in the future. It is also the most habitable of the other planets.

The natural resources of Mars could be turned into air and water in substantial enough quantities to make life a lot simpler for future inhabitants. The land would first have to be transformed (made suitable for human life). Though this could cost hundreds of billions of dollars, resulting real estate would be worth at least several trillion dollars by current standards.

It's possible that metals, and even diamonds, will be found on Mars. Such

PAINTING BY ATTILA HEJJA



mining, however, is unlikely. It would be more feasible to use Mars as a home base for a richly profitable asteroid-mining operation. But there are other scientific and practical reasons for a manned expedition. Science is not idle curiosity; it's the search to understand the operating rules of the planet, solar system, and universe. The rolling hills, steam vents, dry riverbeds, and polar caps on Mars contain unique records of the relatively recent past.

Among the questions a Mars expedition might answer are some of the details of weather formation and the cause of ice ages. Because Earth, and probably the rest of the solar system, passes periodically through ice ages, such knowledge may prove crucial to human survival in centuries to come.

The drive toward the red planet has never enjoyed a steady hand on the throttle. Between 1960 and 1966 NASA awarded some 60 contracts to study a Mars mission. By 1971, however, the word had gone out from Washington headquarters: Don't even mention Mars. Any type of proposal for planetary exploration could jeopardize more immediate goals. The fear was that NASA's advancement in Congress would then claim that the space-shuttle program was just a foot in the door for more ambitious projects. The shuttle—and perhaps even NASA itself—would then be in danger.

As a result, early in 1976, when NASA's Outlook for Space Study Group outlined space-development goals for the rest of the century, its three-volume report devoted only a single paragraph to manned exploration of other planets.

"Several years ago, we were having so much trouble making headway with existing projects that it didn't seem worthwhile to consider more ambitious programs," says Jeff Brings, head of NASA's Solar System Exploration Committee. "But there were a lot of people around who remembered the way things had been in the early days of the space program and hoped that the enthusiasm might return again. The dream of Mars exploration was kept alive by a tiny band of pioneers from the University of Colorado, in Boulder. Called the Mars Underground, this handful of graduate students insisted that a manned expedition would 'provide a focus for the growth of American science and technology.'

This grass-roots movement began during some lunchtime discussions in 1977. "Charles Barin, of the Laboratory for Atmospheric and Space Physics, agreed to sit in with us," explains Carol Stoker, then a Ph.D. candidate in astrophysics and now a research scientist at the National Center for Astrophysical Research. "He forced us to calculate the energy required to turn Mars into a habitable planet. And that convinced us it would be quite some time before we could develop the technology."

Three years later Stoker and a small group of other enthusiasts had created broad outlines for a Mars journey. Encouraged by representatives from several aerospace organizations, the core group selected papers for

a scientific meeting titled The Case for Mars.

The conference, held in April 1981, was a success even though—or perhaps because—it lacked any official sanction from notables in the space community. In a slightly carnival atmosphere, participants wore small red buttons labeled *WASU* (We Are Scientists). Nearly 100 people attended workshops and panel discussions on mission strategy, spacecraft design, life support, materials processing, and the social and political preparations that would be needed for a major Mars program.

In the past three years, the movement has burgeoned, partly because of NASA's successes in space and partly because of other events. Geologists have found a meteorite that is probably a piece of Mars itself. The powerful Planetary Society, led by Carl Sagan, has put aside long-standing ideological qualms about manned spaceflight and set up a Mars Institute to sponsor classes and research on topics relevant to a Mars expedition. The society cosponsored a

● *Science is not idle curiosity; it's the search to understand the rules of the universe. The polar caps and dry riverbeds of Mars contain unique records of the relatively recent past.* ●

and Colorado conference, held last July.

Some headway has been made in Washington, too. For example, Congress approved start-up funding for an unmanned polar-orbiting satellite called the Mars Geology/Orbital Observer (MGOO). And recently completed studies show that an unmanned sample-return mission could be accomplished for about \$2 billion by the end of the Nineties.

Not everyone favors a Mars mission. Many scientists and astronauts would prefer to see a thorough conquest of the moon before beginning a foray to Mars. If we are to put a permanent base on another part of the solar system, the moon has a lot to recommend it. It's easier to reach than Mars, easier to resupply, and its scientific importance is overwhelming.

"But if you try to do a really extensive science program on the moon," Stoker says, "you could soak up so much money that it would block a Mars mission for many years."

Ultimately, Mars may appeal more to our pioneer spirit. Says Arthur C. Clarke, "The moon, though an essential stepping-stone to space, is only an offshore island of Earth. But Mars—a planet nearly as large as our

own in terms of land area—is the first of the new worlds."

One undertaking need not exclude the other. According to Michael Duke, head of geosciences at NASA's Johnson Space Center, in Houston, a lunar base could provide us with the confidence we need to build a self-sustaining Mars base. Duke suggests using the moon as a test site for developing technology to be used later on Mars.

It seems that the greatest boost for a manned Mars mission may come, inadvertently of course, from the Soviet Union. Cosmonauts have pushed on with long missions in space. Valery Ryumin has made two six-month flights in quick succession. A trip to Mars would take only ten months.

Furthermore, a new Soviet superbooster, called the *Saturn*, is ready for use. USSR spokesmen predict the appearance of nuclear-powered upper stages, similar to NASA's NERVA program (nuclear engine for rocket vehicle application), which was aborted in 1973. Two separate Soviet space-shuttle programs are in progress. One involves a small two-man spacecraft, the other a Columbia-class orbital freighter dubbed the *Shuttleok*.

Soviet scientists have also unveiled new successes in the development of life-support technology. Spacecraft will carry plants to provide air and food for far-voyaging cosmonauts. Only a Mars mission or some equivalent requires this kind of self-contained system. With such efforts gathering steam within the Soviet space program, we could be seeing manned expeditions to Mars by the end of the century and permanent bases shortly thereafter.

Are American space enthusiasts challenged by these developments? Apparently so. When the Underground conducted a five-day meeting last summer, the space establishment joined in NASA in a spirited debate, even sent an official delegation to brief the conference and cheer it on.

Humboldt Mandell, a budget expert from the Johnson Space Center, was among those who paid tribute to the success of the Mars Underground. "These conferences do far for NASA what NASA cannot do for itself," he declared. "They help give direction to efforts [now under way]."

Tom Paine, a former NASA administrator, went even further. "What we need above all is a flexible, evolutionary, technically sound, long-range plan—just what this conference can best develop."

To derive the most information from a visit to the red planet, humans, as well as robots, must do the exploring. Douglas Blanchard of the Johnson Space Center, recently designated an exercise in robot-versus-manned planetary sampling. NASA scientists look at an example: the Apollo 16 landing site at Hadley Hill. The astronauts had driven seven miles, stopped at five spots, and collected 70 samples—all in eight hours. A hypothetical robot sampler designed to duplicate those accomplishments would have taken more than two months of activity. The exercise provided a strong argument for getting

CONTINUED ON PAGE 72

FICTION

*The first men on Mars
were solid scientists, but that didn't stop them
from wanting to dream*

THE GODS OF MARS

BY GARDNER DOZOIS, JACK DANN, AND MICHAEL SWANWICK

They were outside unfasting the Mars lander when the storm blew up.

With Johnboy and Woody crowded against his shoulders, Thomas snatched the last lashing. In careful cadence, the others straightened. Along the ends free of the lander. At Thomas's command, they let go. The metal lashing scared away, flashing in the henth sunlight, twining like a wounded snake, dividing as it fell below and behind their orbit. The lander floated free, led to the Plovershare by a single arm umbilicus. Johnboy wrapped a spanner around a hex bolt over the top strut of a landing leg and gave it a spin. Like a slow, graceful spider leg, it untwisted away from the lander's body. He slapped his spanner down on the next bolt and yanked. But he hadn't braced himself properly, and his feet went out from under him in a slow somersault. He spun away laughing, to the end of his umbilicus. The spanner went skimming back toward the Plovershare, struck its metal skin, and sailed off into space.

"You moriballs!" Thomas shouted over the open intercom. The radio was sharp and peppery with sun static, but he could hear Woody and Johnboy laughing. "Cut it out! No skylarking! Let's get this done!"

"Everything okay out there?" asked Commander Ridenbough from inside the Plovershare. The commander's voice had a slight edge to it, and Thomas grimaced. The last time the three of them had gone out on EVA, practicing this very maneuver, John-



boy had started to horse around and had accidentally sent a dropped lug nut smashing through the source-crystal housing, destroying the laser link to Earth. And hadn't the commander gotten on their asses about that?

NASA had been really pissed, too—with the laser link gone, they would have to depend solely on the radio, which was vulnerable to static in an active sun year like this. It was hard to blame the others too much for cutting up a little on EVA after long, claustrophobic months of being jammed together in the Plovershare, but the responsibility for things going smoothly was his. Out here, he was supposed to be in command. That made him feel lonely and isolated, but after all, it was what he had sweated and strived for since the earliest days of flight training. The landing party was his command, his chance for glory and he wasn't going to let anybody or anything run it.

"Everything's okay, Commander," Thomas said. "We've got the lander unshipped and we're almost ready to go. I estimate about twenty minutes to separation. He spoke in the calm, matter-of-fact voice that tradition demanded, but inside he felt the excitement building again and hoped his pulse rate wasn't climbing too noticeably on the readouts. In only a few minutes, they were going to be making the first manned landing on Mars! Within the hour, he'd be down there, where he'd dreamed of being ever since he was a boy. On Mars.

And he would be in command. How about



PAINTING BY ERNST FUCHS

that Pops Thomas thought) with a flash of irony. *That good enough for you? Finally?*

Johnboy had pulled himself back to the Plovershore.

"Okay then," Thomas said dryly. "If you're really still got back to work, you and Woody get that junk out of the lander. I'll stay out here and mend the store."

"Yes sir," Johnboy said with amiable irony, and Thomas sighed. Johnboy was okay, but a bit of a fake—you had to sit on him a little from time to time. Woody and Johnboy began pulling boxes out of the lander; it had been used as storage space for supplies they'd need on the return voyage, to save room in Plovershore. There were piles cracked about how they ought to let some of the crates of flash-frozen frog that NASA straight-facedly called food escape into space, but at last, burdened with boxes, the two space-suited figures lumbered to the air lock and disappeared inside.

Thomas was alone, floating in space.

You really were alone out here, too, with nothing but the gaping immensity of the universe surrounding you on all sides. It was a little scary, but at the same time something to savor after long months of being packed into the Plovershore with three other men. There was precious little privacy aboard ship—out here, alone, there was nothing but privacy. Just you, the stars, the void, and, of course, Mars.

Thomas relaxed at the end of his tether, floating comfortably, and watched as Mars immersed and nudged, turned below him like some huge, slow-spinning, rusty red top. Mars! Lazily, he let his eyes trace the familiar landmarks: The ancient dead river valley of Kasei Valles, impact craters puckering its floor

—the reddish brown and gray of haze and frost in Noctis Labyrinthus, the Labyrinth of Night, the immense scar of the Valis Marineris, greatest of canyons, stretching two thirds of the way around the equator, the great volcanic constructs in Tharsis, and there, the Chryse Basin, where soon they would be working.

Mars was as familiar to him as the streets of his hometown—more so, since his family had spent so much time moving from place to place when he was a kid. Mars had stayed a constant, though. Throughout his boyhood, he had been obsessed with space and with Mars in particular, as if he'd somehow always known that one day he'd be here, hanging disembodied like some ancient god over the slowly spinning red planet below. In high school he had done a paper on Martian plate tectonics. When he was only a gangly grade-school kid, ten or eleven, maybe, he had memorized every available map of Mars, learned every crater and valley and mountain range.

Drowsily, his thoughts drifted even further back to that day in the attic of the old house in Whitfordown, near McGuire Air Force Base—the sound of jets taking off mingling with the lazy Saturday afternoon sounds of kids playing baseball and yelling, dogs barking, lawn mowers whirring, the rusty smell of pollen coming in the window on the

mid-spring air—when he'd discovered an old, dog-eared copy of Edgar Rice Burroughs's *A Princess of Mars*.

He'd stayed up there for hours reading it, while the day passed unnoticed around him, until the light got so bad that he couldn't see the type anymore. And that night he'd supernaturally found it in bed, under the covers with a pencil flashlight, until he'd finally fallen asleep, his dreams reeling with giant four-armed green men, thicks zhidars, long-second-swinging heroes, and beautiful princesses, the Twin Cities of Helium, the dead sea bottoms lit by the opalescent light of the two hurling moons, the nomadic coverings of the Tharks, the barbaric idlers draped with glittering jewels and rich indigo silks. For an instant, staring down at Mars, he felt a childish disappointment that all of that really wasn't waiting down there for him after all, and then he smiled wryly at himself. Never doubt that those childhood dreams had power—after all, one way or another, they'd gotten him here, hadn't they?

● *The storm slowly and relentlessly blotted out the entire surface of the planet. The lesser features went first, then the greater ones. Finally even Olympus Mons disappeared.* ●

Right at that moment the sandstorms began to blow up.

It blew up from the hard-pan deserts and plains, and as Thomas watched in dismay began to creep slowly across the planet like a tarp being pulled over a work site. Down there, winds moving at hundreds of kilometers per hour were racing across the Martian surface, filling the sky with churning, yellow-white clouds of sand. A curtain storm.

"You see that, Thomas?" the commander's voice asked in Thomas's ears.

"Yeah, Thomas said grimly. "I see it."

"Looks like a bad one."

Even as they watched, the storm slowly and relentlessly blotted out the entire visible surface of the planet. The lesser features went first, the scraps and hills and stone fields, then the greater ones. The polar caps went. Finally even the top of Olympus Mons—the tallest mountain in the solar system—disappeared.

"Well, that's it," the commander said sadly. "Soaked in No Landing today."

"Son of a bitch!" Thomas exploded, feeling his stomach twist with disappointment and sudden rage. He'd been so close.

"Watch your language, Thomas," the

commander warned. "This is an open channel." Meaning that he mustn't shock the West Listening Audience Back Home. Oh, horrors, certainly not!

"I'd just waited a couple more hours, we would have been able to get down there—"

You ought to be glad it didn't, the commander said mildly. "Then you'd have been sitting on your hands down there with all that sand piling up around your ears. The wind can hit one hundred forty miles an hour during one of those storms. I'd hate to have to try to sit one out on the ground. Relax, Thomas. We've got plenty of time. As soon as the weather clears, you'll go down. It can't last forever."

Five weeks later, the storm finally died. Those were hard weeks for Thomas, who was as full of useless energy as a caged tiger. He had become overcast with the surroundings of the pervasive, sour human smell of the lander's meiotic tanks of the air. It was like living in a jungle gym factory, all twisting pipes and narrow, cluttered passages, enclosed by metal walls that were never out of sight. For the first time during the long months of the mission, he began to feel seriously claustrophobic.

But the real enemy was time. Thomas was acutely aware that the inescapable clock of celestial mechanics was ticking relentlessly away, that soon the optimal launch window for the return journey to Earth would open and that they would shape for Earth, then or never get home at all. Whether the storm had lifted yet or not, whether they had landed on Mars or not, whether Thomas had finally gotten a chance to show off his own particular righteous stuff or not, when the launch window opened, they had to go.

They had less than a week left in Mars orbit now, and still the sandstorms raged.

The waiting got on everyone's nerves. Thomas found Johnboy's morose energy particularly hard to take. Increasingly, he found himself snapping at Johnboy during meals and, happy hour, until eventually the commander had to take him aside and tell him to loosen up. Thomas muttered something apologetic, and the commander studied him slowly and said, "Plenty of time left, old buddy. Don't worry. We'll get you down there yet." The two men found themselves gnawing at each other. Commander Redoubt was a good officer, a quiet, pragmatic New Englander who seemed to become ever more plegmatic and unflappable as the tension mounted and everyone else's nerves frayed. Johnboy habitually called him Captain Ahab. The commander seemed rather to enjoy the nickname, which was one of the few things that suggested that there might actually be a sense of humor lurking somewhere behind his deadpan facade.

The commander gave Thomas an encouraging squeeze, then launched himself toward the communications console. Thomas watched him go, being back a sudden biller surge of words that he knew he'd never say, not up here, anyway, where the walls literally had ears. Ever since Sky-

fab, astronauts had flown with the tacit knowledge that everything they said in the ship was being saved, dropped, covered, evaluated by NASA. Probably before the day was out somebody back in Houston would be making a black mark next to his name in a psychological-fitness dossier, just because he'd let the wailing get on his nerves to the point where the commander had had to speak to him about it. But damn it, it was easier for the rest—they didn't have the responsibility of being NASA's token nigger in the Sky, with all the white folks back home waiting and watching to see how you were going to buck up. Had felt like a third wheel on the way out here—Woody and the commander could easily fly the ship themselves and even take care of most of the routine schedule of experiments—but the landing party was supposed to be his command, his chance to finally do something other than be the obligatory black face in the NASA photos of Our Brave Astronauts. He remembered his demanding, dominating, hard-driving father saying to him, hundreds of times in his adolescent years, "It's a white man's world out there. If you're going to make it, you got to show that you're better than any of them. You got to lace yourself down their throats, make them need you. You got to be twice as good as any of them." Yeah, Pop. Thomas thought, you bet! Pop, thinking as he always did, of the one and only time he'd ever seen his father stinking, sobbing, falling down drunk. The night the old man had been passed over for promotion to brigadier general for the third time, forcing him into mandatory retirement. And they got to give you the chance, Pop, he thought, remembering, again as he always did, a cartoon by Ron Cobb that he had seen when he was a kid and that had haunted him ever since: a cartoon showing black men in space suits on the moon—sweeping up around the Apollo 58 capsule.

Well—losing Houston again, Woody said, "I just can't keep this signal." He turned a dial, and the voice of Mission Control came into the cabin, dropped up and nearly obliterated by a hissing static that sounded like dozens of eggs frying in a huge iron skillet. "read?" not read you. "Roughness losing." Sunspot activity had been unusually high for weeks, and just a few hours before, NASA had warned them about an enormous solar flare that was about to flood half the solar system with radio noise. Even as they listened, the voice was completely drowned out by static; the hissing noise kept getting louder and louder. "Weh-yi!" Woody said glumly, "that does it. That solar flare is screwing everything up. If we still had the laser link—here he flashed a sour look at Johnboy, who had the grace to look embarrassed—"we'd be okay, I guess, but without it—weh-yi, shit, it could be days before reception clears up. Weeks, maybe."

Irretrievably Woody flipped a switch, and the hissing static noise stopped. All four men were silent for a moment, feeling their suddenly increased isolation. For months, their only remaining contact with Earth had been

a faint voice on the radio, and now abruptly even that link was severed. It made them feel lonelier than ever and somehow farther away from home.

Thomas turned away from the communications console and automatically glanced out the big observation window at Mars. It took him a while to notice that there was something different about the view. Then he realized that the uniform, dirty yellow-white cloud cover was breaking up and becoming streaky, turning the planet into a giant, molten Easter egg, allowing tantalizing glimpses of the surface. "Hey!" Thomas said, and at the same time Johnboy crowed, "Well, well, lookie there! Guess who's back boys!"

They all crowded around the observation window, eagerly peering one another.

As they watched, the storm died all at once, with the suddenness of a conjuring trick, and the surface was visible again. Johnboy let out an exulting, rebel yell. Everyone cheered. They were all laughing and joking and slapping one another's

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shoulders, and then one by one they fell silent.

Something was wrong. Thomas could feel the short hairs prickling erect along his back and arms, feel the muscles of his gut tightening. Something was wrong. What was it? What? He heard the commander gasp and at the same time realization broke through into his conscious mind, and he felt the blood draining from his face.

Woody was the first to speak. "But..." Woody said, in a puzzled, almost petulant voice, like a bewildered child. "But... that's not Mars."

The air then on Mars. So then it went held up, clut in suspension unless the wind is blowing at enormous speeds. When the wind dies, the dust falls like pebbles, fast and all at once.

After five weeks of storm, the wind died. The dust fell.

Revealing entirely the wrong planet. The surface was still predominantly a muddy reddish-orange, but now there were large mottled patches of green and grayish ochre. The surface seemed softer now, smoother, with much less rugged relief. It

took a moment to realize why? The craters—so very like those on the moon both in shape and distribution—were gone, and so were all of the mountains, the scarps and hills, the giant volcanic constructs. In their place were dozens of low, perfectly straight blue lines. They were bordered by bands of green and extended across the entire planet in an elaborate oncrossing pattern, from polar icecap to polar icecap.

"I can't find anything," Woody was saying, exasperatedly. "What happened to everything? I can't even see Olympus Mons, for Christ's sake! The biggest fucking volcano in the solar system? Where is it? And what the fuck are those lines?"

Again Thomas felt an incredible burst of exaltation well up inside him. He gaped at the planet below, unable to speak, unable to answer, but Johnboy did it for him.

Johnboy had been leaning close to the window his jaw slack with amazement. But now an odd, dreamy look was stealing over his face, and when he spoke, it was in a matter-of-fact, almost languid voice. "They're canals," he said.

"Canals, my ass!" the commander barked, losing control of his temper for the first time on the mission. "There aren't any canals on Mars! That idea went out with Schiaparelli and Lowell!"

Johnboy shrugged. "Then what are those?" he asked mildly, jerking his thumb toward the planet, and Thomas felt a chill feather up along his spine.

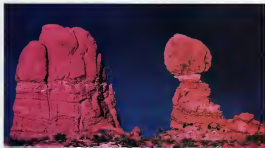
A quick visual search turned up no recognizable surface features: none of the landmarks familiar to them all from the Mariner 9 and Viking orbiter photomaps—although Johnboy annoyed the commander by pointing out that the major named canals that Percival Lowell had described and mapped in the nineteenth century—Strymon, Charicles, Eretbus, Oecus, Coe—were there, just as Lowell had said that they were.

"It's got to be the sandstorm that did it," Thomas said, grasping desperately for some kind of rational explanation. "The wind moving the sand around from one place to another, maybe covering up one set of surface features while at the same time exposing another set."

He referred to a stop, seeing the flicks in that argument even as Johnboy snorted and said, "Real good, sport, real good. But Olympus Mons just ain't there, a mountain three times higher than Mount Everest! Even if you could cover it up with sand, then what you'd have would be a fucking sand dune three times higher than Everest... but there don't seem to be any big mountains down there at all, anywhere."

"Know what happened?" Woody said before Thomas could reply.

His voice sounded so strange that they all turned to look at him. He had been scanning the surface with the small optical telescope for the Mars-Sat experiments, but now he was leaning on the telescope mounting and staring at them instead. His eyes were lecherous and unfocused and bright and



Early explorers believed this Utah skyline was the sculpted work of a lost civilization

SAND CITY

BY FRANK BUCK

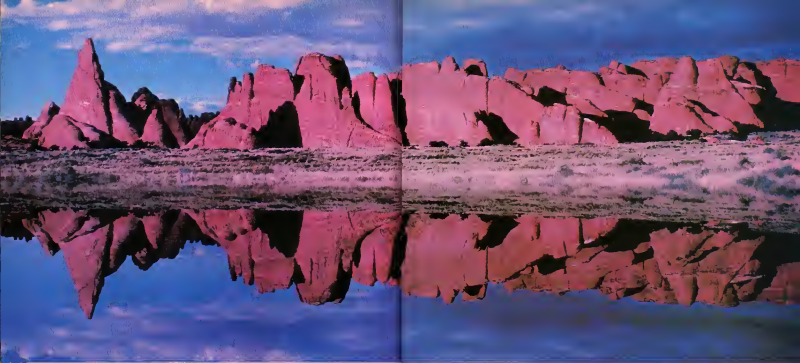
Rising from the desolate landscape like the fossilized fins of some long-dead giant fish, these sandstone monoliths in south-eastern Utah were once thought to be artifacts of a lost civilization akin to the Mayas or the ancient astronomers of Stonehenge. The early explorers of the region, now Arches National Park, found themselves in a sculpture

PHOTOGRAPHS BY ERIC MEOLA

garden of graceful arches, spires, and precariously balanced rocks in salmon and buff tones. It was easy to envisage this incredible terrain as the crumbling skyline of some ancient city or the abandoned playground of a race of giants. It seemed too intricately planned and styled to be natural.

Nowadays geologists credit the remarkable architecture of the rock region of Utah, home of the largest concentration of natural arches on the planet, to other forces: primarily the movement of a salt bed that lies beneath these stone structures. Thousands of feet thick, the salt bed is the floor of an inland





see that covered the area about 300 million years ago. After the sea evaporated, leaving the salt behind, floods and wind deposited sand over the dry seabed, which later compressed into sandstone. But as the sandstone layer grew—in some places a mile thick—the salt bed beneath it began to buckle and shift from the weight. It's this subsurface movement, sometimes turning enormous slabs of rock almost on ends that formed the gross features of the monoliths. The fine details, however, were fashioned by wind, rain, and extremes of temperature—the relentless sculpting of weather begun perhaps 100 million years before humans walked the earth. And weather, being a restless artist, will continue its work until the last delicate arches and spires have vanished. ☐

☛Fashioned by the violent forces of nature, this landscape is a sculpture garden of red stone.☚



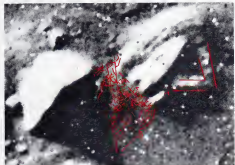
*First there was the
Face in Space. Now it appears that
the face has suburbs*

METROPOLIS ON MARS



Before the two Viking landers descended to the Martian surface in 1976, the mother craft of one of them photographed a seemingly unremarkable stretch of desert. Three years later two conquisador scientists, Vincent DiPietro and Gregory Molinari, then affiliated with NASA's Goddard Space Flight Center, in Greenbelt, Maryland, came

in the shadow of the largest pyramid (below) was the tracery of a honeycomblike structure.



across the image of a face on Mars and of a nearby structure resembling a pyramid. In their off hours they applied their considerable expertise to enhance the more subtle details of the images. Though the face was said to exist only in one Viking photo, the two discovered a second photo of the face, made 35 days later at what they said was a different sun angle and time of day. By applying sophisticated image processing techniques to the second image, DiPietro and his partner discovered that the face was truly symmetrical. It had two halves, each containing an "eye," a cheek, and an appropriate continuation of the "mouth." Most provocative, in the first photo they discovered what resembles an eyeball with a visible pupil in the eye socket. Their conclusion after studying all these data: was that this most symmetry (raised a doubt) that nature was totally responsible for the image. (See Face in Space, April 1982.)

Science writer Richard Hoagland had known of DiPietro and Molenaar's work, and after receiving a copy of original photos of the face, he discovered what might be the key to its origins and its reasons for existing—what he calls the city. In interpreting additional features in the original Viking photo (number 36A72), he claims to have found a clue to a lost civilization on Mars.

The focus of his attention is a collection of surface features located to the west of the

face. Among them is a gridlike pattern of rectilinear markings like the layout of a city. He also spotted a series of right angles contributing to an overall impression of a main avenue leading toward the face.

After a few minutes of work with a ruler and protractor, Hoagland discovered that this main "avenue" seems to be aligned in a special way with the face, which itself runs along a northeast-southwest axis. Using information supplied by Mars expert William Ward, of NASA's Jet Propulsion Laboratory in Pasadena, California, Hoagland calculated that about one half million years ago the face could have been aligned on a true north-south axis with the Martian poles. Back then, someone standing in the center of his hypothetical city, gazing east toward the face, would be sighting along a solstice alignment. In other words, that Martian creature would be seeing the sun rise directly over the face on the longest day of the Martian year. Therefore, according to the inexorable laws of celestial mechanics, Hoagland theorizes that for 50,000 years someone could have seen the first summer sun rise above the face each year. As the planet tilted, the alignment would disappear for one half million years or so then return.

Closer inspection convinced Hoagland that there were at least three additional surface features—which he calls structures—with what appear to be walls aligned on the old north-south axis. He also noted the so-called pyramid, originally spotted by DiPietro and Molenaar, and located on a hill southwest of the face. With a little more computation, Hoagland figured that his solstice

viewing line would have passed right through the top of the pyramid.

The most controversial of Hoagland's suggestions is that in the shadow of the pyramid exists honeycomblike tracery bearing an uncanny resemblance to the remains of a city. The region is a rough square measuring about one and one half miles on each side. With DiPietro and Molenaar's enhancement the "walls" were fairly visible.

Although he admits it is possible these lines could have been by-products or glitches of the photo-enhancing process, Hoagland remains convinced that what he saw is actually there. For one thing, objects in the city cast shadows. For another, DiPietro and Molenaar claim they did not get these kinds of glitches with enhancements of aerial photos taken here on Earth. Finally, Hoagland says that there is no ready geological explanation for rectilinear patterns of this scale on Mars.

The grid spacing suspiciously resembles that of real city streets, and the layout is aligned toward the winter solstice sun. An architect friend, Arthur Slopes, pointed out to Hoagland that the buildings would have been oriented in a manner that would best use the scant winter warmth of the shortest day of the Martian year.

Hoagland states that if someone were to stand in the center of this city and face east just before dawn, he would see Earth rising over the enigmatic face of Mars. The conclusion Hoagland has reached is simple and startling: that we are seeing the product of intelligence at work. Was it coincidence that one half million years ago (when a hominid known as *Homo erectus* was evolving here on Earth) celestial mechanics made the Martian summer sun rise over a remarkable likeness of man's image? he asks.

There are many who are tempted to say yes. Mars expert and NASA engineer James E. Oberg has challenged Hoagland's city-on-Mars thesis, on several points. First, he disputes the claim that two different photos of the face taken at different times of day and at different angles, prove the three-dimensionality of the structure.

This is not in accord with my own research nor with DiPietro and Molenaar's own book [*Unusual Martian Surface Features*]. Both photos were taken from nearly identical angles a little less than 36 Earth days apart. Converting the time to Martian days, Oberg computed that the photos were taken within two hours of the same part of the day, suggesting that the shadow would not have been different enough to confirm the three-dimensionality of the face. So Hoagland's assertions just don't match the facts, he says.

As for the coincidence of the summer solstice skyline from the city to the mouth

Obertal: Viking photos of a pyramid (at left in inset photo) and a structure known as the fortress (color enhanced) due west of the face. Were they built by an alien intelligence?



FICTION

C ombien d'années? Abe Rainer asked, knowing it pleased her when he could make a phrase of the nasal but melodious words she had been teaching him since he and Jacques had been assigned aboard her. Even this early into her third mission, he was beginning to feel mellowed by her young-old voice, her cograg, and the lounge's warmth. He intended to banter with her and make companionable small talk as usual when they were together. The two middle-aged pilots and the girl, but he was warned.

"A woman doesn't tell her years," Ron said. Fawn answered in the cozy tone that guarded him against too much thought about the emptiness outside. And your accent's intolerable. This trip we're really going to work on it. *Bleusoup*. She let a short laugh slip from her throat, as a woman lets a strap slide from a shoulder or a dress fall over an eye.

It's hard to imagine a language older than Global Fawnie.

There were more languages than you could believe, Ron said.

"How many of the dead languages do you know?" He took out a cigarette.

All languages are alive in me, Darling. I put the girl forever young, a survivor from the dawn of the modern world. I'm the very blood of Babel.

"How long, really, have you been in Exploration Command?" He raised the cig-

MINOR SURGERY AND A POKER GAME

BY M. G. JACOBS

What's a pilot to do when his spaceship falls in love with him?

PAINTING BY DI-MACCIO

arose and touched it to his lips, smiling shyly. "You think I'm going to say how old I am? Michener's garçon!" Sometimes when they talked in dim light, he thought he could see her as a bodily figure, at least a misty face. Its age was smiling now.

"Curiosity grows between the stars where nothing else will," he said. Each was the cat and each the mouse. How many crews have been with you?"

A chuckle from the depths of her electronic throat. One of her slender, many-jointed arms slid from the wall and advanced through the comfortable dusk, a silver fingertip glowing. Abe broke her cigarette tip off his cigarette so she could light it for him.

And a woman most certainly could talk about her former crews. She hesitated before crews, as if it might not have been the just, just, the word that would have occurred naturally.

"But my present crew, my darling boys," she let Abe inhale while her fingertip cooled "that of it seems to be missing."

Jacques aboard," he said, worrying but making himself sound as he would if he were home in Paris, in bed with Eloise, nudging her earlobe with his teeth.

Fawn started to say something, but it came to only a slight pip of static. He knew what it would have been. But he's always horny at the beginning of an expedition.

"You'll see, as soon as he has his duds stowed, Jacques will come bursting into your chambre d'amour as typed and horny as ever." Again he made his words bite his misgivings. But it was with a whole heart that he added, "I'll be over soon."

He would, and not merely to bend her attention away from Jacques' absence. Even though it had been less than a day since he kissed Eloise and climbed up into Fawn's towering body the knowledge that it was his job to explore as far from home as possible would grow relentlessly more intimidating. And even though the grimy angular mass of her fuel tanks made her as lumberous as a factory, she was still no more than a mole diving into the living apathy of space. Abe knew—no or any pilot, including Jacques—would need her bedchamber.

Although it was only a combination of hallucinatory drugs and sensual devices, it was as important as Fawn's conversation, her fond, irrelevant insults in the strange language of the poker, bridge, yatzee, and other games she knew for making a pilot's time pass safely.

"Do you want to watch?" she asked as she retracted her arm and her screen came to life. She knew he did. Flicking through a space contraction, being suddenly light-years away from the position of the previous nanosecond, was an inexpressible experience, even if it was well-known from the previous two voyages.

He knew that the reddish star in the upper-right corner was the one to watch to get the best effect. It disappeared faster than a human eye could blink and was replaced by a disc, around which he knew six planets

were scattered. It was the same star, but an instant ago its light had reached them around a hundred light-year curve of space. The second planet was Marfel, whose surface Jacques had verified as wholesome for men by spending five minutes on its surface. Colonists were there now, establishing a town and planting orchards.

"Pretty good for a so-distant gal, wasn't it?" she cooed.

"You're"—he searched for a word—"marvellous, Fawna."

Jacques came into the lounge as she was describing twilight into night; the fluorescent were just beginning to flicker.

Her tone was too full of joy and genuine surprise for Jacques to have used her bedchamber already.

Going to scrounge up a ten-thousand-light-year contraction for us this trip, sweet lady?" He blew a kiss in the direction of one of her eyes. "I'm vibrating right down into my bones. We're going to get rich, I know it."

•He was not
worried about mechanical
failure. It was
not that Fawn could not
talk or open her
bedchamber or prepare
their meals.
She was choosing not to •

"Wow," Fawn said. Then, tentatively, "It must have been a dull leave for you to come back with all this energy. But you know which door is first on the left."

"A beautiful leave," Jacques broke his palms together. "Makes me feel damn lucky this trip. Besides, I need the money."

Abe winced. "Because," he said, trying to keep his voice light but saying it now because it would have to be said, "Jacques is a married man."

Fawn was as silent as she had ever been. For a long, miserable moment there was not a hum or squeak anywhere in the lounge. Finally in a tone they had never heard, she asked, "And is she quite the belle?"

Abe forced a laugh and spoke before Jacques had a chance. "A busty pale with a high-to-low life walk, about half Jacques's age, Fawn. She hasn't got even a fraction of what you have."

"As if it were my business. I don't imagine a spacepilot would invite a human to its wedding, either."

The images of stars faded, and the screen went dark and stayed that way. When an hour Abe had learned that the chambre d'amour was locked.

"She loves you." Abe Flaxier was leaning against a railing in a part of the ship leading away from the living area, where they had never had a reason or the urge to explore. It was a dim, empty hall, painted a severe green, and there was no evidence of an eye or an arm socket. They could be fairly certain that she had no ears here. "She loves you, and the way she's acting is symptomatic of worn-out."

"That's bullshit, and you know it, Flaxier. There's a just blow or some wares crossed." Jacques's fingers warmed his ball. "I say let's turn this broken-down tub around and go home before it blows up."

"You turn her around, then." Abe had to laugh. Fawn had known nothing about ship operations for centuries.

"Well, maybe we could nip out some wares—disable her. Then send an SCG."

Abe shuddered. "You'd better figure out how to send it first. And even if we knew how to operate her radio, are you sure anybody would hear?"

He took a gulp of the beer he had brought with him from the lounge. As far as it was about doing her job—exploring. Just because she's stopped telling us where we are doesn't mean she hasn't discovered a new contraction. And until it's charted and message-relay defectors are stationed, any message we send toward Earth would have to go the long way. Are you willing to wait a thousand, maybe ten thousand years? She's a jilted woman. Putting. That's all."

"Be sentimental over a machine, then." Jacques spat on the polished floor.

"Her body may be plastic and steel and her mind expanded almost infinitely, but she was a healthy girl when she had her skiing accident," Abe said. "And that girl does still there, driving her desire to take care of us. Everything from the turn of our breakfast eggs to the illusions of her bedchamber grows out of that."

He had always suspected that for Exploration Command's idea of integrating a human's mind with a spaceship to work, there had to be a reciprocity of pressure. If Fawn's body no longer had blood flowing through it, her imagination—her ability to place herself into the illusions she created for them—had to be powerful beyond human belief.

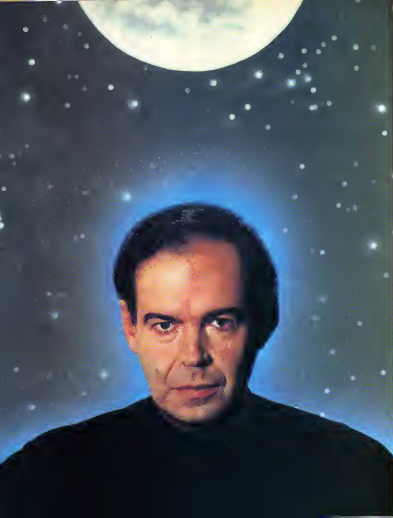
"That some of her ROM was in a girl who lived nine centuries ago doesn't alter the fact that the machine's malfunctioning," Jacques said, slapping the wall. "We don't know where we are, we have to punch in our own menus, and her bedchamber door is locked. We've got to do something."

"Win her—her heart," Abe suggested. "Again."

"My God, Abe, we're talking about a machine, a traveling machine, a food machine, a fucking machine," Jacques caught his breath. "Even so, I've always played the game. And since she froze up, I've knocked my knuckles raw at that bedchamber door. I've even said I'm sorry."

"Sorry is an easy word," Abe said quietly. "She knows you're acting. What would you say to your new wife if she found out you'd

CONTINUED ON PAGE 106



*Rejecting the mystique
of talent, this world-renowned
expert on thinking says
anyone can improve his creativity
by learning to take
unorthodox leaps of the imagination*

INTERVIEW

EDWARD DE BONO

The hot Mediterranean sun gilds the white statues and thick walls of the seventeenth-century Palazzo Marino nestled into a seaside hilltop in Malta. A scarlet dragonfly darts above rose goldfish in an ornamental pond, and at the bottom of the garden two young boys splash and sled in a blue pool. In a cool interior hall a padded black door opens, and Dr. Edward Francis Charles Publius de Bono emerges, beaming. Casual in navy shirt and khaki slacks, he is supposedly on vacation but has been up since 6 a.m. writing a new book. The theme is: a new approach to conflict resolution—a final solution to war and nuclear stalemate. In just eight days, working from a few pages of notes he will type, without revision, a final draft, clean except for a few typing flaws. De Bono's serenity is typical. Everything seems effortless and under control in his personal world, a relaxed order in which creativity flourishes. This book is the twenty-third from the

author, described in the handbook to last summer's Harvard Conference on Thinking as a "world authority on the teaching of thinking and the development of creative thinking skills."

The sold-out Harvard conference marked the coming of age of a new hand in global education: a growing interest in teaching thinking as a skill. De Bono's invitation to give a solo address on the conference's final evening was a tribute to his pioneering work in the field. He has been thinking about thinking—how it's done and how to do it better—for two decades. Though his methods are just now beginning to reshape on the U.S. educational system, they have been applied widely elsewhere. They are used by tens of thousands of executives in such multinational corporations as IBM and General Foods and by millions of schoolchildren in places as diverse as England, Bulgaria, and Japan.

In the grandest public experiment in the field to date, Venezuela

PHOTOGRAPH BY DANIEL AUBRY

has set out to teach thinking skills to all its schoolchildren, from Caracas to remote mountain villages. Luis de Machado, an idealistic Venezuelan poet, writer, and civil servant, is one who has been inspired by De Bono's books. He persuaded the Venezuelan prime minister to appoint him the world's first minister of human intelligence. More than 100,000 teachers were trained to teach thinking skills. Nearly all of them followed De Bono's basic methods.

While the move elicited scorn and derision from the press, the results have been impressive. And popular enthusiasm for the project ensured that it would survive a change of government. Venezuelan law currently mandates that every school must spend two hours a week teaching thinking. One union wrote into its contract that training in thinking skills be provided to its members as a condition of employment.

Characteristically, there's nothing overly complicated about the training. De Bono has achieved wide influence partly through the clarity of his books and the utter simplicity of the methods that he suggests will boost effective thinking and creativity in the average person. A favorite technique, for example, is to "do a PMI," meaning that when faced with a suggestion, you first list all the "plus," "minus," and "interesting" aspects of the idea you can think of. Done by a group, this can result in a torrent of ideas that place the problem in a whole new perspective. Another is to open a dictionary, choose a word at random, then try to relate it to the issue at hand—an artificial but effective means of digging up fresh solutions.

If De Bono's hopes are realized—and his techniques adopted—average human thinking, he says, will improve dramatically over the next 20 years as more schools around the world take up these simple techniques. He doesn't confine his teaching to children, however. Based in London, he lives as much as nine months of the year in hotel rooms, flying some 200,000 miles annually to speak at seminars and conferences for businessmen, teachers, and civil servants. Last year the U.S. Defense Department invited him to open its first symposium on creativity. He had a prior commitment in Helsinki, but De Bono accommodated the Pentagon—by transatlantic telephone.

De Bono's mission to elevate human ingenuity began 20 years ago, when he was a medical graduate student at Harvard. Born in 1933 into an upper-class family in Malta, De Bono earned an M.D. from the University of Malta by the age of twenty-one, as a Rhodes scholar, he went to Oxford, where he gained an honors degree in psychology and physiology, and a D.Ph. in medicine. A Ph.D. from Cambridge University followed and then postgraduate work at Harvard.

A specialist in the behavior of human biological systems, the young De Bono demonstrated that a 25-cent whistle could test lung function, replacing a \$90 machine. He also devised a method that used a simple tube to test susceptibility to heart failure, thereby obviating an expensive photo-

graphic recorder. Disappointed by his Oxford cognitive-psychology courses ("all rats and mazes"), his interest in the impalpable and elusive territory of mental processes was reawakened by the computers used in medical research. Specifically, he says, he became interested in the thinking that computers cannot do.

But De Bono's real interest has been in analyzing winning thought processes, the lucid and accessible books he has written over the past 25 years explore this subject in many directions. The best known is *New Think: The Use of Lateral Thinking in the Generation of New Ideas*, which sold 400,000 copies in Japan, more per person than *Love Story* sold in the United States, he points out. In it he introduced his concept of lateral thinking, which the Oxford-English Dictionary defines as "a way of thinking which seeks the solution to intractable problems through unorthodox methods."

What De Bono specifically means by lateral thinking is a creative jump in the mind.

*“I pointed out
that God could not laugh
because He
has perfect knowledge. He
cannot be
surprised. It would be
an insult to
say that God could think.”*

a sideways leap away from the usual line of step-by-step, "vertical" logic used to solve a problem in a traditional manner. In thinking about a problem—designing a vehicle, for instance—the mind leads to a seemingly unrelated idea: an orange. Say then the mind builds a path back toward the original idea. Suppose the vehicle has orange-like globes for wheels, which would enable it to move sideways into a parking space. Unworkable idea? Possibly. But De Bono points out that lateral, or creative, thinking, unlike traditional vertical thinking, can include "wrong" steps on the way to a successful conclusion.

De Bono's message is that almost anyone can improve his own creativity by developing some skill in lateral thinking. He rejects the "mystique of talent and intangibles" that surrounds the topic of creativity. "This is only justified in the art world, where creativity involves aesthetic sensibility, emotional resonance, and a gift for expression." One thing that makes his views on creativity more scrupulous than rival gurus' is that De Bono's ideas are based on a theory of how the brain works. First advanced 15 years ago in his book *The Mechanism of Mind*, the theory now looks to

some as if it just might be the key to designing computers that think.

De Bono suggests that the brain is a self-organizing information system, not an information-handling machine, like a computer, but a special environment designed so that when information flows into it, the brain automatically forms patterns. Related units of information flow together—and in effect live in the same box—without any active processing at all on the part of the brain. Insight and humor occur when this unthinking, habitual process is actively interrupted and a conscious link between previously unrelated patterns is unexpectedly formed.

Tributes to De Bono's influence come from friends and disciples as diverse as Britain's Prince Philip, Paul McCartney, a designer of man-powered aircraft, the Eurythmics rock group, and Peter Ueberroth, commissioner of baseball and organizer of the 1984 Olympic games. Despite its broad public impact, De Bono's work is disparaged by some academics who are uncomfortable that this expert conducts no research. Few, however, attack his ideas directly, which is probably wise, as De Bono is fond of deceptive problems whose solutions look wrong at first sight.

Among his more unusual books is *The Dog Exercising Machine*, which reproduced the drawings of children asked to dream up the device suggested by the title. His latest work is *Tactics: The Art and Science of Success* in which he analyzes interviews with prominent people to determine the celebrated secrets of success.

When interviewed last August, De Bono was in the throes of working out his latest and possibly greatest idea, one that might conceivably save us all from nuclear holocaust. Under the scheme, SITD, his newly formed Supranational Independent Thinking Organisation, will serve as a conflict-resolution center or "Intellectual Red Cross," bringing governments fresh ideas from lateral thinking when diplomacy fails and war threatens. SITD's formation has been welcomed by international figures as well as by the U.S. State Department.

Visited by Anthony Liveridge at the Palazzo Marnes, his family's vacation villa and the planned site for SITD's meetings, De Bono proved a gracious host as did his blond, attractive wife, Josephine. Sitting by the pool, he amiably laid out themes refined by years of careful cogitation.

Ques: Why do you believe that most humans are ineffective thinkers?

De Bono: We don't treat thinking as a skill but tend to regard it as a matter of intelligence. Many highly intelligent people are rather poor thinkers, often arriving at a view of a subject and then using thinking only to support that view. The trouble is, the more you construct a nice, coherent, rational argument for one particular point of view, the less inclined you are to fully explore the whole subject. If you have a "right" answer, why look further? I call this pitfall the intelligence trap. Intelligence and thinking aren't the same. Very bright kids excel at reactive

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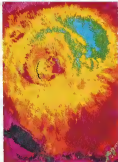
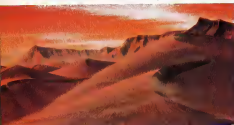
The planet Mars, a world of stark, red rock and shifting dunes, has always captured the imagination. Its mythic grandeur was first revealed in the late 1700s, when the English composer and astronomer William Herschel turned his telescope toward the rocky disc, identifying polar ice fields, moving clouds, and dark patches thought to be the Martian sea. By the 1800s, scientists said that life had evolved not only on Earth but on Mars as well. And in 1894, the flamboyant astronomer Percival Lowell claimed he'd detected precisely engineered canals—lines of individually uniform width, of exceeding tenacity, and of great length. Lowell's vision suggested to many a dying civilization and ancient cities crumbling in ruin.

If there were a doomed civilization on Mars, of course, its creatures would certainly dream of inhabiting Earth. And in 1897 the great science-fiction writer H. G. Wells spun a tale about just that. In his classic *War of the Worlds*, he wrote: "Across the gulf of space... intellects vast and cool and unsympathetic regarded this Earth with envious eyes, and slowly and surely drew their plans against us." Wells's fictional notion of the Martians attracted fervent believers well into this century, making it possible for a twenty-four-year-old named Orson Welles to orchestrate a modern-day radio play in 1938 based on H. G.'s gripping



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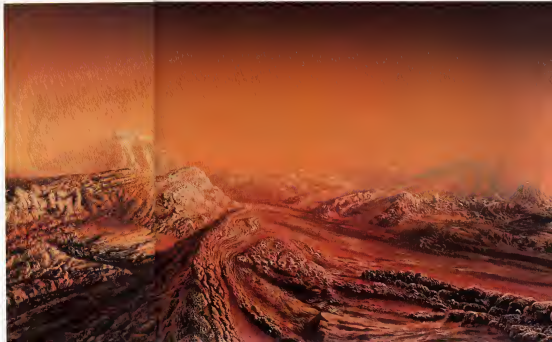
BY PAMELA WEINTRAUB



•The canals, Lowell said, were like a spider's web seen against the grass of a spring morning•

story: "Ladies and gentlemen," some 6 million listeners were told: "those strange beings who landed in the Jersey farmlands tonight are the vanguard of an invading army from the planet Mars. More than a million people were convinced that an invasion was under way. It seems unlikely that the listening audience could be similarly fooled today. Lowell's canals, it has been learned, are streaky, wind-blown dust deposits. Analysis of the Martian soil reveals no trace of organic material. But as the late Tim Mutch, leader of the Viking lander imaging team pointed out, our search for the true Mars has just begun. Someday man will roam the surface of Mars," he said. "Those Viking machines will be placed in a museum, and children will struggle to imagine the way it was." □

Myth and reality mix in these scenes. Previous pages: the Martian moon Deimos, by David Egge; color-enhanced photo of Mars from NASA. These pages clockwise from below: fictional Martian scape, by Don Dixon; Winter Mars, by Don Davis; Redshift, by Kim Peir; NASA photo of Olympus Mons volcano.



METROPOLIS

CONTRIBUTOR: FREDERICK W.

of the face. Oberg admits that there was a time in the Martian past when the planet's tilt was different. But he adds that tilts varies so much that practically any view to the north-east will coincide with some tilt at some time in the Martian past.

Another outspoken critic of the Hoagland thesis is Harold Masursky, senior scientist with the U.S. Geological Survey and one of the world's leading experts on Martian geology. He headed the NASA group in charge of selecting the sites where the Viking landers set down.

Concerning the face, Masursky says it is "interesting because it is a face, but it is in an area dissected by erosional agents—water and frost heavings. It's one of many thousands of little mesas on Mars, and many of them are shaped by inelegant faulting. Of these many mesas there are one or two that have lifelike features."

And as for the pyramid structure in the region of the dry, Masursky says: "It's a piss-poor pyramid. It looks like an accidental product. In central Nevada I have found a pyramid, formed partly by stream erosion and faulting, that's better than that. If you're going to say features like that are evidence for a past civilization, that's total nonsense."

Masursky told Omni: "I'm working on find-

ing landing sites for a possible Mars Rover. And the [the city on Mars] is not one of the areas where I would send what is probably a fifty-billion-dollar mission. In fact, if somebody brought us a free one, I'm not sure I'd send it there because there are too many other places that are more interesting."

Interestingly, however, neither Oberg nor Masursky dismisses the possibility of intelligent life or at least life on Mars. "I do think that the most likely evidence for extraterrestrial intelligence will be artifacts we will stumble across," Oberg says, "and I doubt if they will be small. So searching for artificial structures in space pictures is legitimate—as long as the facts and arguments are sound." For the time being, however, the most positive thing he is willing to say about the Martian-city theory is that "It is quite a piece of folklore."

Although he is doubtful any civilization thrived on Mars, Masursky remains an open-minded skeptic. Mars has had water as well as long periods of severe drought throughout its history, he explains. It is hotter from the sun than Earth is, and its water was tapped as ice for much longer spans of time. All of this means that there were fewer areas of favorable climate for intelligent life and civilizations to evolve. "But I cannot say there were no civilizations on Mars," he admits. "I just don't think it's very likely there were."

In the meantime, Hoagland continues working in spite of the criticism. He assembled a team of scientists under the title of

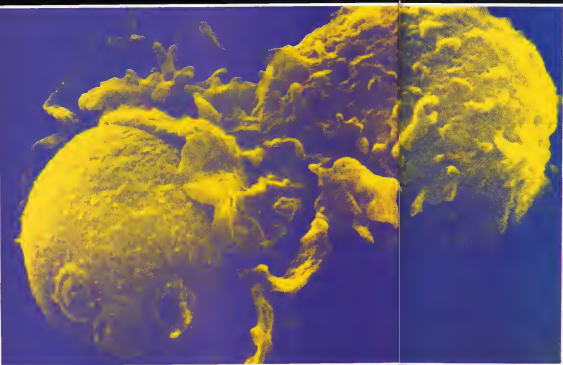
the Independent Mars Investigation Team to study his calculations and discoveries. After analyzing Viking orbiter photos they reported at the Mars II conference in Colorado last summer that there were enough anomalies to warrant further investigation.

To do this, a second effort, called the Mars Investigation Group, was begun. It is organized under the direction of C. West Churchman and Tom Rautenberg, of the International Program in Applied Systems Design at the University of California at Berkeley. The group has asked for and received image-data tapes from NASA and plans to assign 10 images for analysis to four teams of scientists working out of some of the country's top research centers. Experts at MIT's Artificial Intelligence Laboratory, Bell Labs, Lucent Ltd. and the Earth Satellite Corporation, which analyzes Landsat images, will independently enhance and study the Viking photos. Rautenberg and his associate director, former astronaut Brian O'Leary, say they are making an effort to answer "an open scientific question." By the fall of 1985, he and the team will publish a lengthy technical report on their findings.

"Now that we have glimpsed what may be waiting in our investigation of Mars," Hoagland says, "we face the question: What else lies undiscovered or ignored on the Viking project's remaining one hundred thousand magnetically recorded images?" In the months to come, he plans to find out. **DO**



'Fellow victims of Stone Age technology'



Fueled by modern diet and drugs, a "harmless" parasite may be wreaking havoc on both our minds and bodies

AN EPIDEMIC IN DISGUISE

BY SHERRY BAKER

I was in odd place to pitch a tent: behind the doctor's office in downtown Birmingham, Alabama. But at 2 a.m., with few cars humming past and the sky a star-strewn canopy, it wasn't so bad. Michael thought / *can make it one more night. I have to make it one more night.*

Taking another whiff of pure oxygen from the portable canister, he pulled the blanket—made from cotton grown without pesticides and never dyed—up around his neck. Staying in a hotel, with its synthetic carpet and chemically cleaned bathroom was out of the question. Any exposure to man-made chemicals left the young man in a weakened stupor.

For two years, since he was twenty-eight, Michael had waited low this, twirling on the edge of some contaminated new world where the things that had once been innocuous were now his enemies. Food. His home. The air he breathed.

He had been a marathon runner of national standing, training 60 miles a week, before this nameless horror sapped his strength. In just a days his pace dropped by three minutes a mile. Within a month he couldn't make it around the track even once. And then the humiliating impotence began.

Believing he was fighting for his life, Michael visited

dozens of doctors who told him his lab tests were normal. He felt tired, gassed, as they suggested that some psychological problem must be causing the increasing weakness, his racing pulse. Months passed, and he found that exposure to perfume, cigarette smoke, car fumes—any chemical—left him incapacitated. Finally, diagnosed as being totally allergic to foods and chemicals, Michael entered a sterile ecological unit. It helped but only for a while.

He came to Birmingham after hearing that an internist named Onas Truss had successfully treated people with similar problems. The doctor had an explanation that might make sense: "It's all—and might offer Michael a way out of this nightmare.

Reaching for the oxygen canister again, the first tent looked across the parking lot to a nearby apartment building. Shadows moved in front of a flickering light, and Michael heard muffled laughter and soft music. Perhaps some people were making love behind those windows. How many of them carry this thing inside, a time bomb ticking away? How wonderful. How many more will end up like me, crying alone, gasping for air like some alien clinging to life on a hostile planet?

Tall and trim, Onas Truss strides into a room with the gate

of a man younger than sixty-two. Wearing thick glasses and speaking in a deep Southern accent, he doesn't look or sound like a detective. But he thinks like one. "I've never been able to fool myself," he explains. "If I can't see all the way through something, it grows on me."

His talent for medical sleuthing has led him to track down a cause of ill health that may be baffling millions. The culprit is a parasite that's transmitted through ingestion and sexual contact and fueled by modern diet and certain drugs: the common yeast, *Candida albicans*.

Candida is one of the many different species of yeast. Each has distinct characteristics. *Candida* thrives in warm-blooded animals, for example, and brewer's yeast does not. *Candida* has a voracious appetite and multiplies rapidly.

Furthermore, recent electron micrographs taken of animal tissue reveal that *Candida* has the bizarre ability to change shape—to turn into a hard-edged arrow. Once transformed, it aggressively plunges far into the cells in mucous membranes, pushing the cell's own nuclei to one side as it enters.

Despite these traits, *Candida albicans* appears to live in most of us as part of the normal body flora. Billions of friendly bacteria help the immune system to keep the yeast under control. When the *Candida* balance is shifted slightly, the result can be a vaginal discharge or oral candidiasis (thrush), an aggravating but harmless white coating on the tongue. In the cruelest if, the yeast can run amok, entering the bloodstream and traveling to the heart, lungs, or brain, where it can cause deadly blood poisoning.

Within the past few decades, however, levels of yeast have increased dramatically in many people. Part of the reason may be that modern drugs and diets stimulate *Candida* growth. And after more than 20 years of clinical observations involving nearly 3,000 patients, Truss is convinced that this yeast is implicated in a wide variety of human ills: from depression and hormonal disturbances to allergic reactions and autoimmune diseases.

Truss is not alone in his conjecture. University of California at San Francisco immunologist Alan Levin estimates that the health of one third of the U.S. population may be adversely affected to some degree by *Candida albicans* allergies.

And while the medical community as a whole has remained noncommittal, several physicians other than Truss are questioning whether yeast may play a role in conditions ranging from autism to AIDS. How did Truss come to his conclusions about chronic *Candida albicans* infection? And how could a common yeast be tied to Michael's tragic inability to exist in the chemically laden twentieth century?

The trail of clues began one sticky August day in 1953. A physician went on a vacation to escape the Alabama heat, and Truss agreed to take over his hospital rounds. One patient was particularly troublesome. With

wasted muscles and a gaunt, hollow face, the man appeared to be elderly. But the chart showed he was only in his mid-forties. Hospitalized since April, the patient was running a spiking fever and suffering from a cough and diarrhea. Every prominent physician in the city had struggled to make a diagnosis. There was only one thing that everyone agreed on—the man was dying.

As baffled as the other doctors, Truss asked the patient a new question: "When were you last completely well?"

February, the man answered weakly. He had been a robust mens worker until then.

"I was working, and I put my finger. But I didn't have time to see to it, so I skipped a Band-Aid on it. It got red and sore. My doctor gave me some pills—antibiotics—for the infection. The man developed diarrhea shortly afterward, and his health began deteriorating."

Truss searched for any evidence in the man's lab workups that might have been overlooked. He found that two sputum cul-

● It seemed that
in some people, *Candida*
might be
interfering with the body's
suppressor
cells, which keep killer
cells from
attacking the organs ●

ture had reported the presence of yeast—*Candida albicans*. This hardly seemed noteworthy after all. *Candida* lives in everyone, and in severely debilitated people it often spreads to the mucous membranes.

Truss thought back to something that had happened a few years earlier, when he was chief resident at New York's Bellevue Hospital. Testing some of the newest, broad-spectrum antibiotics on infection-riddled indigents, he had seen these patients, just exuberant with diarrhea. The antibiotics, he noted, killed off the normal flora that usually kept the body's yeast under control. He began to wonder whether *Candida* could be responsible for his current patient's condition. Instead of the man's weakened state causing the yeast to flourish, could the opposite be true? Was *Candida* itself causing the man's ill health? Rushing to the medical library, Truss found two papers that reported using saturated potassium iodide solution to treat *Candida* blood poisoning.

"I thought we might as well give it a try. I put the man on six to eight drops of potassium iodide four times a day," Truss recalls. And you know, he went right on and got completely well.

It was only after observing hundreds of patients over the years and digging for explanations for symptoms that had been dubbed psychosomatic that Truss began putting the *Candida* puzzle together. In the Sixties, Truss's interest in allergies intensified. His son and several of his patients were suffering from asthma. He began traveling to Boston to study with allergy pioneer Elton Allen Brown. Soon, Truss was treating an increasing number of allergy patients. One day a woman with a stuffy nose and a throbbing headache came to see him. It was an incident that would change the doctor's career.

In addition to her allergy symptoms, the woman was severely depressed and suffering from vaginitis. Truss didn't think all her symptoms were related. But he recalled isolated reports in the medical literature that hay fever could be caused by an allergic response to *Candida*. Suspecting that her nasal congestion might be a reaction to a vaginal yeast infection, Truss gave the woman an allergy shot of *Candida* vaccine.

As he hoped it might, her headache and congestion cleared rapidly. But something else also happened: Her depression vanished. She smiled.

In subsequent months, Truss was successful in treating other allergy patients who were also suffering from depression. "I decided then that I would like to treat a schizophrenic patient who had a yeast infection, to see whether there would be any improvement in mental state. But I couldn't just go out looking for schizophrenics." Four years later, however, he had his chance.

A neighbor brought the middle-aged woman to Truss for treatment of anus allergies. Producing only an occasional yeast or no, the patient stared blankly ahead while her friend gave Truss a medical history. Except for a fungus infection on her fingers, occasional vaginitis, and gastrointestinal upsets aggravated whenever she was given antibiotics—all signs of *Candida* overgrowth—the woman had been well and relatively healthy until the age of twenty-six.

Her psychiatrist assured Truss that allergy treatment was not contraindicated. The woman had been treated for schizophrenia for six years, and she was about to be committed to the state mental hospital.

She had hundreds of electroshock treatments and massive dosages of thorazine and other drugs, the psychiatrist said. "Nothing helps. You certainly can't do any harm by treating her anus problem."

After one week on *Candida* vaccine, the woman seemed more alert. Two weeks later, she was able to hold a conversation. She made a full recovery and has remained well and productive. Her psychiatrist, amazed, called Truss.

"I told him all I tried to do was to clear up her allergies," Truss says. "I wasn't ready to reveal anything else about my thoughts in the years. It was beginning to look like this was going to be too important to be premature. I had to be extremely careful."

Indeed, over the years, many of Truss's

accomplishments began to sound like miracles. People who seemed to be "incurably ill" were restored to health. To substantiate his theory, Truss studied everything he could find on *Candida albicans*. And he realized if he were to falter how the yeast could be producing serious disease, he would have to learn all he could about the endocrine system, brain chemistry, metabolic pathways and more. "It was hard work," Truss says. "I had to teach myself." He began plowing through stacks of journals and attending informal meetings held by microbiologists from the University of Alabama Medical School.

There were all these academic scientists, discussing the latest findings in immunology, and here came this lonely clinician, Truss recalls. "They didn't know what to make of me at first. And I just listened."

Although he continued to keep his ideas to himself, Truss was becoming more convinced of *Candida's* connection to serious illnesses. Because the majority of the population has yeast present, lab tests aren't necessarily reliable indicators. So Truss made diagnoses of candidiasis based on patients' histories. With the diligence of a medical Sherlock Holmes, he sometimes spent two hours with a patient, tracing the onset of an unexplained illness.

And a pattern began to emerge. Many people reported they first became sick after taking certain drugs, including antibiotics, birth-control pills (which alter the body's hor-

monal balance and stimulate yeast growth) and cortisone (which suppresses the immune system's ability to fight the yeast). Data high in carbohydrates and sugars, foods that *Candida* thrives on, seemed to exacerbate physical and mental problems. A member of the mold family, *Candida* can produce a cross sensitivity to other molds and fungi. Truss found that moldy environments and foods containing yeast and molds (cheese, for instance) also irritated—or heightened—patients' symptoms.

Whenever he suspected that *Candida* might be playing a role in an ailment, Truss placed the patient on the nonmold, antifungal drug nystatin and a low carbohydrate, yeast-free diet. In severe cases, he added *Candida albicans* vaccine. His success was dramatic. Seventy-five percent of the patients reported some relief from symptoms within a few weeks. Others took two to three years to recover fully.

In all, the conditions that responded to the treatment composed a varied list—from gastrointestinal problems to allergic symptoms including asthma and skin rashes. And such signs of hormonal blockages as menstrual irregularities often cleared up. Children with learning disabilities and hyperactivity often showed improvement and sometimes returned to normal. One child, a normal one-and-one-half-year-old, had become autistic after taking heavy doses of antibiotics prescribed for ear infections. He began talking again after his doctor who had

heard of Truss's work, started treatment for *Candida*. His parents had spent \$50,000 in medical fees in their search for a cure.

In 1970 the mystery of yeast-produced illness grew more complicated. A young woman asked Truss whether her multiple sclerosis could in some way be related to her yeast allergy.

"She had been diagnosed as having MS by neurologists. Whether that diagnosis was right or wrong, there wasn't any doubt that she had neurological abnormalities, including a blind spot in one eye," Truss says.

Going over her medical history, Truss noticed that the woman had suffered from severe *Candida* vaginitis since her teens. She had chronic constipation and occasional cell thrush. Her MS symptoms always worsened before menstruation, a time when levels of the hormone progesterone appreciate yeast growth.

Truss told the woman that he had no reason to think that treating her for candidiasis would help her multiple sclerosis. On a therapeutic trial of nystatin, however, the woman's neurological symptoms began to disappear. She remained in complete remission until she went off the drug. Then her physical problems—including visual problems and numbness—returned. These cleared as soon as she was back on the antifungal medication, and she has remained well (and given birth to a healthy baby).

Truss was excited, but he knew that one isolated case—especially with a disease known for its remissions—didn't prove anything. In the ensuing years, however, he was to have dramatic successes with other patients whose autoimmune conditions—including lupus and Crohn's disease—also disappeared. Truss began to suspect that in some people, *Candida* might be interfering with the body's suppressor cells, the part of the immune system that keeps cytotoxic, or killer, cells from attacking the organs and tissues. It could be that certain individuals are genetically predisposed to this condition. Truss wondered whether many autoimmune diseases weren't different manifestations of the same problem. That two or more major autoimmune diseases can occur simultaneously in the same patient lends to support this concept, he points out.

Slowly word of Truss's work filtered into the psychiatric community. And in 1977 members of the Academy of Orthomolecular Psychiatry asked Truss to address their meeting in Toronto. He presented a paper discussing six cases in which patients had responded dramatically to *Candida* treatment. Shortly after the Toronto meeting, he spoke before the Husley Society—formerly the American Schizophrenia Association—in Florida.

The physicians who heard Truss at these gatherings were taken aback by his radical thoughts on *Candida*. "I began to think it was the most important paper I'd seen in the last ten years in terms of influencing the way we think about disease," says Sidney Baker, who is the clinical assistant professor of pediatrics at Yale and director of the Goodall Insti-





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FICTION

HONG'S BLUFF

BY WILLIAM F. WU

No one living had ever seen Hong without the big chain on his neck. No one had ever maneuvered him into the street when he didn't want to go or beaten him at a game of cards, either. Oh, he'd been known to lose a hand or two, and once even a foot, but never an eyeball or a rowl joint. He was laah, wry, and plainspoken. His arms were grousehack molybdenum steel, one of which he won—I hear—by bullying Sait Morasa into folding with three of a kind to Hong's nine-high. Grudge the Smith says he changed \$112,000 to make the left one, and Hong paid in cash. This was the day after Hong faced down Red-Eared Rick in the street and made him cough up the take from his last bank job—all over the ground. Hong had one silver eye and one gray eye, and they say he was harder to stare down than a one-eyed flounder. Since Hong was my cousin, I had been acquainted with him for many years, but he was less than friendly. He

PAINTING BY
IVAN KUSTURA



usually ignored me. The last time I saw him was one day at the Silver Transier Saloon. He stepped inside the swinging doors, and as he surveyed the crowd, I surveyed him.

Hong's eyes were a perpetual squint in a face the color of Kansas wheat. His reputation as a gambler and a never-miss gun was aided by the villain's mustache he twirled, though everyone swore he only sharked professional. A lumber stride carried him to one of the game tables, reminding me how he'd head two bull-pit knees put in after he and them clean out of Collegeville. Jed Foley's laws—according to rumor, anyway. Shooting a lawyer in Arizona was Hong an Avocado west with a one hundred-forty-degree turning and it was hot, green, and high in cholesterol. His pride and joy though, was a pair of black boots. They were clear and glossy like obsidian, according to Sally Flash the saloonie they were obsidian. And they weren't boots, either, they were his feet. No one knew for sure. Hackles my superior at the stable says Hong tucked a knp-high hand over none other than Sweetwater Curt in Dallas, winning the obsidian feet over queens and noses. Incredible.

Shoutwinkup from one of the games, and a shot was fired. When the excitement died, Hong sauntered over to take the place of the dead player.

I rolled over to Sally Flash at a nearby table and stood there awhile. She didn't like me, cause Hong ignored me, and she left in disgust. Her seat though was worth having because our local legend, Cicero Yang, used to watch fare players from that seat before he moved on to his parts.

I used to shine his boots and buckles for her while he played, and I could see from that angle that he'd arranged four mirrors and two pictures on the walls so that he could see every hand at the table. When Cicero he the trail, I inhaled his seat. The other fellows tolerated me, being Cicero's personal boot-and-buckle polisher. No one else ever sat there. They didn't want to risk being found in Cicero Yang's chair, just in case he came back. So when Hong sat at the table for poker, I had a ringside seat.

Hong sat down between Isotope John and Fred without a surname. Tommy Clanger was the only other player. I was allowed to observe. Isotope John was dealing. He couldn't use a boot polisher, he had caterpillar treads instead of feet. I hated him, never having forgotten the time he horsawoggled me out of a brand-new set of bellows at the stable. I'd be going to sell them to Grudge the Smith, but Isotope John talked me into wrapping them against his new four-gallon water pot. I was betting that he couldn't keep standing if I sat the spare arnel on top of his head. He'd cheated as usual—it turned out that he had a hydraulic diffuser under that big hat. When I sat the arnel on his head, little logs shot out from under the hat and landed themselves against the wall, holding up the arnel where he stood in the corner of the stable. He just grinned and said, "You're a sucker, Louie Hong. Not like the Hong." And he took my bellows.

Now Isotope John nodded at Hong and started tossing cards, saying, "I heard about your lucky charm, Mister Hong. They say you'll never miss with your gun nor bet a night of cards since the railroad slavers put that chain on your neck."

He dealt with a special wheel fingered hand, mail order from St. Louis.

They say—Hong agreed, looking at his cards. A pair of fours. He unlaced a gun from one holster.

"Ten dollars," said Fred without a surname. The glass over a painting behind him reflected a king high hand.

"Yin?" said Isotope John. Sally Flash was looking over his shoulder now and I couldn't see the mirror behind them. I figured she knew about the mirror system, too, having been light with Cicero Yang once.

Raise ten, said Hong. He yowled and looked with a bored expression at Sally Flash. Everyone stayed.

One card, said Fred.
Behind Isotope John, Sally Flash casually

*He knew
something was up, he
wasn't sure what.
I figured he was doing the
unexpected out
of sheer ornerness and
suspicion. He
wasn't scared of gunfights.*

begin to fiddle with the front of her dress. I turned away and just happened to catch Isotope John dealing from the bottom of the deck to Fred without a surname. Instantly Tommy Clanger leaped up and yelled, "I saw that!" He went for a gun, but Isotope John leaped to one side, flipped out his pistol, and blew Tommy Clanger away like a mosquito. Tommy's gun went off, though, and grazed Isotope John on the neck.

"Accused me of cheating," said Isotope John. A couple of bare wires stuck out of his neck. I recalled hearing Hackles say that a crowd in Wichita once tried toynch Isotope John, and that he had put in a slinky spring as a precaution against backlash.

John complained, "Fred. Two hands, and that's two players you've shot. Getting to be right now, playing with you."

Isotope John glared. "Dealer takes none." Fred shrugged and bet. "Ten."

Isotope John and Hong put in their money. Hong called and lost to a pair of eights.

"Well," Isotope John grinned and swept in his winnings. "Your chain's wearing out, Hong? Luck's weakening?"

"Luck never weakens," said Hong. "Deal!" Sally Flash wandered away and when I

saw the hand Isotope John dealt himself, I couldn't believe his audacity. One way or another, he'd given himself jacks and tens before the draw, most likely planning a full house. Fred held a nine-high hand and folded. But when I saw Hong's hand—four queens—I thought I would faint from glee. Of course he would have a hard time pulling off one of his patented bluffs when he had the best hand at the table. It had to be that fancy luck of his. I'd kept a close eye on him every moment, and he never once made a funny move. But then—I'd Isotope John was cheating and in control, he had dealt Hong his hand on purpose.

"Awful low for a lucky jerk like you," said Isotope John. "I hear you got that luck with guns, too."

Hong raised an eyebrow and his gray eyes glinted.

"So here's a real bet for you. If I win, you shoot it out with me."

Now I understood. Isotope John had a good hand and would make it better when Hong beat him with an "impossible" four queens. Isotope John could call him into the street anyway for cheating. He apparently really wanted to shoot it out with Hong.

Right, said Hong. Game two cards.

Isotope John and I both started as Hong tossed down a five and—a queen. Isotope John's astonishment was proof that he had dealt Hong four queens on purpose. His worry now, twice in two hands he'd cheated so clumsily as to be caught. What if he'd fouled up again and Hong hadn't received four queens? After all, Hong just discarded one, which would be unattractive if he was holding three more.

Hong twirled his villain's mustache and kept those squinty eyes on Isotope John. He knew something was up, most likely he wasn't sure what. I figured he was doing the unexpected out of sheer ornerness and suspicion. He wasn't scared of gunfights.

Two, squeaked Isotope John. The doubt in his voice told Hong all he had to know.

"I'm onto you now," said Hong with a grin. Isotope John went for his gun. Hong's snail-cold arms flew up with his pistol on the ends, and Isotope John checked himself with his gun still aimed downward. He managed a weak smile. Suddenly Hong spat and hit the wires protruding from that neck wound. Sparks flew, smoke faded, and Isotope John's gun went off, shattering an obelisk foot.

"Hey," said Hong, annoyed, looking at his stump.

At least you didn't bluff me with them cards, pointed Isotope John, swatting his neck. "That's your specialty, ain't it?" He holstered his gun. "Serves you right."

I'd bluff you, said Hong, flipping open the cylinders of his guns. "No bullets. I haven't loaded a gun for four and a half years now."

Isotope John leaped up, furious. "It's be outside! You can load them or not. I'll draw anyway!" He turned to go but stopped at Hong's voice.

No, you won't. You'll be scared to. I stare with my one gray eye and one silver. You'll

shake. I'll swivel my hips on the Avocado
seat, and you'll get dizzy. My springy arms
will wave every which way and you'll wonder
if you're about to shoot an unarmed
man—in which case I'd win. On the other
hand, if you don't shoot, I might. Hong
tugged at the villain's mustache and Isotope
John pushed through the crowd, muttering.

At that, I jumped up and ran like lightning
on wheels for the stable. Moments later, Isotope
John and Hong faced each other in the
dusty street outside. Isotope John swayed
impatiently from one catapillar toad to the
other, stroking the edge of his joans with the
wheel-fingers on his card hand. I wasn't
there, but of the saloon window Sally Flash
showed a three yuan piece into the slot-mo
camera and recorded the whole thing so we
could all see it later.

Hong's black hair fluttered in the slight
breeze, and the sunlight shone evenly off that
silver eye. His narrow mustache quivered
and the snake-like arms bounced in rest-
lessness over twin gun handles. Down the way
Isotope John's trigger finger scratched nerv-
ously at his thumb, and his cardplayer's
eyes searched Hong's tight smile and slightly
swiveling hips for an indication of whether or
not his guns were loaded.

In the meantime, I was like a greased pig
thundering up the stairs of the saloon and
lying to make the fourth-floor balcony. But
that thing I cawed was hairy.

The camera zoomed in on Isotope John's
face. His eyebrows were tense and un-
bored, his eyes went from eager to hesitant
to eager as he measured the glory of out-
shooting Hong against the ignominy of kill-
ing him unarmed. Suddenly he flashed his
teeth, and one hand dropped for his gun.

Hong's ball-joint knees spun in two direc-
tions; he sank and swayed, sending his arms
out and around like tentacles, his obedient
stump shivering in the dust. He leveled the two
gun barrels, and the gray eye logged sternly.
But Isotope John's gun was already level.
He squinted, and his elbows began to fill
with the impulse that would run down his arm
to the trigger. For another millisecond, he hesi-
tated. At that moment, I appeared on the balcony
looming over Isotope John. And as
Hong's trigger clicked on empty cham-
bers, I dropped my awl four lights down
on Isotope John's head. Some good that hy-
dra-like whammy did, now. I'm not sure ex-
actly what happened, but rivets and screws
splattered out all across the dirt of the street,
springy and bouncing.

Then the recording went blank.

As for me, well, I never wore a bag chain
on my neck. I never stood out in the street
or played cards, either. But that afternoon
my cousin lifted his gaze with one silver eye
and one gray one and looked at me, up on
the balcony. He leveled his villain's mustache
with his left hand, peering with that perpen-
dicular squint. For a long moment he studied me
sternly, and I let my stupid grin freeze and
die. Then, with a wink and a faint chuckle,
that old bluffer saluted me, pivoted and
sauntered back inside the saloon. ☐



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• I believed in
flying saucers before I took the
pictures, and
now I believe in them even more •

ANTI-MATTER

It was just before noon when Dave and Hannah McRoberts pulled into the Eve River Rest Area, on British Columbia's Vancouver Island. There was a mountain off in the distance, and Hannah wanted to get a picture of it.

Dave poked about Hannah's fuzzy photography, but she just focused on the mountain top and the pretty white clouds beyond. She took a single shot and then got back in the car to leave.

A few weeks later, toward the end of October 1981, the developed film came back in the mail. The mountain and clouds were in perfect focus, but there was something else in the picture as well: something that they hadn't seen before, a bright, silvery disc. It seemed to be a flying saucer.

The McRoberts reported the UFO to the Canadian national defense office, at Comox, but the army wasn't interested. Then they showed the photo to friends and neighbors and everybody wanted a copy. The McRoberts received so many requests, in fact, that they finally began to sell the photographs to their friends for \$5 for five-by-seven prints and \$10 for eight-by-ten.

One of these copies found its way to a meeting of UFO buffs in Pasadena, where Richard Haines spotted it. Haines, an experimental psychologist and president of the North American UFO Federation, thought the picture was so special that he visited the McRoberts at their Campbell River home. He examined and tested their camera. He went to the photo site and had the area surveyed. And approximately two years after the shot was taken, Haines took Hannah



McRoberts back to the site and had her redevelop the original photo-taking event.

In July 1984, Haines presented the results of his study to the Rocky Mountain UFO conference at the University of Wyoming. After conducting a computer analysis of the image and hiring an independent Frisbee consultant, he told his audience, "he had come to feel that the object was real."

It's definitely not a Frisbee, he said. But, although a blow-up of the image reveals a clear dome on top of the object, it can't be called an alien craft either. "It remains unidentified," he concluded. "And I don't know what it is."

UFO skeptic Robert Shaeffer, on the other hand, says he has an idea. "It's probably some type of hubcap," he says.

After inspecting McRoberts's photograph, Shaeffer, author of *The UFO Verdict* (Prometheus, 1981), said, "Haines may have established that the object is not a Frisbee, but this only leaves everything else. His next step should be to go through all the different models of automobiles and show that it's not a wheel cover from any of them. Then maybe I'd be convinced it's something different."

Hannah McRoberts, meanwhile, hasn't changed her mind. "I believed in flying saucers before I took the picture," she says, "and I still believe in them, even more so. We've put the picture under a microscope, and there's no way that the object can be anything else. The scary part is, once you've had a UFO experience, you're supposed to have another keep looking at the mountains and waiting for a UFO to come." — EDWARD REGIS JR.



SCIENCE MYSTICISM

Many people claim to remember their past lives with no prompting whatsoever. But a twenty-nine-year-old patient at the Dundee Royal Infirmary in Scotland discovered past-life memories only after a motorcycle accident in 1962. Upon regaining consciousness, the patient claimed he'd been a major in the Confederate Army during the Civil War.

The patient, called Robert G. (his identity remains confidential), was soon referred to psychiatrist James McHenry of the University of Dundee. And though McHenry offered a diagnosis of cryptnesia, a condition typified by severe memory disruption, Robert's elaborate Civil War tales continued to baffle him.

McHenry solved part of the mystery a year and a half later, when he learned that just a week before his accident, his patient had read an article about a Irish group dedicated to the mem-

ory of the American Confederacy. But Robert had access to information in no way related to the article and the group, and McHenry remained confused. "How can we be sure that a paranormal element is not allied with the cryptnesia element," he asked his colleagues at a meeting of parapsychologists at Cambridge University not long after.

These doubts were recently resolved, however, when McHenry traced the remaining details to a 1951 BBC TV rendition of the Civil War story *The Red Badge of Courage*.

"The cryptnesia seems to have had a basis in elements drawn from both 1961 and 1962," says McHenry, adding that this is the first time he'd heard of a past-life fantasy drawn from two sources. —D. Scott Rogo

"From my earliest childhood I accustomed myself to the role of considering myself contrary to the way of ordinary mortals."

—Salvador Dalí

MYSTIC & MULE

Last summer, Bill and Oneta Swearer of Champion, Nebraska, noticed that their mule, Krause, was gaining weight. Her mother was a Welsh pony and they have big stomachs. So we just thought she was getting fat, Oneta recalls. "We don't realize she was pregnant until she gave birth."

What makes Krause's motherhood so startling is that mules, crosses between female horses and male donkeys, are supposed to be incapable of reproduction. "Horses have sixty-four chromosomes and donkeys have sixty-two," says geneticist Oliver Ryder, of the Zoological Society of San Diego's Center for the Reproduction of Endangered Species. "Mules inherit only three chromosomes that 'get along' with each other quite well as far as forming a mule. It is only when the mule tries to produce reproductive cells that the incompatibilities are manifest."

Ryder points out that several other mules have supposedly given birth. But in recent years, whenever researchers, armed with chromosome tests, were able

to investigate, such claims always turned out to be erroneous. The supposedly fertile mule would sometimes prove to be a mulish-looking horse. Or she was indeed a mule, but the foal wasn't her own; she had adopted the foal of another horse or donkey, Ryder explains.

Based on the available evidence, he adds, "It was safe to conclude that mules of both sexes were completely sterile. But the situation has changed because of Krause. To my knowledge that is the first case of alleged mule fertility that has stood up to complete genetic analysis." His chromosomes indicate that the foal is indeed the offspring of Krause, Ryder says. And those determinations were complemented by blood analysis performed by the University of California at Davis.

While scientists pore over the significance of an animal long believed to be genetically infertile, the Swearsers report that Krause and her foal, Blue Moon (first shown below), are doing fine.

—Sherry Baker

"We do not really understand nature at all."

—Lewis Thomas



HELL'S HANDWRITERS

The visions described by patients brought back from clinical death have become almost standard: a tunnel of light leading to lush green pastures, rows of smiling relatives long since gone, and an awesome feeling of peace. Many recalling the near-death experience in fact claim they've tasted "if only for an instant, the heavenly reward to come."

But there's just one thing wrong with this rosy picture. According to a Tennessee cardiologist, about half of all near-death patients may actually be grasping the ravages of hell. Nearly 50 percent of a group of 300 patients claiming to have returned from the afterlife, says Dr. Maurice Rawlings, reported tales of fire and brimstone, devil-like figures, and other symbols hewing from the darkness of hell.

Clinical professor of medicine at the University of Tennessee College of Medicine in Chattanooga, and

author of *Hell Experiences: Death's Dark Rawlings*, studied near-death patients he and his emergency room colleagues had treated. The new risk—alston Rawlings says—was obtained by interviewing patients immediately after resuscitation, while they're still too shaken to deny where they've been. After all, he notes, most people are simply ashamed to admit they've been to hell. "It's like getting an F on a report card, and they won't even admit it to their families."

Just listening to these patients has changed my whole life," Rawlings adds. "There's a life after death, and if I don't know where I'm going, I'm not sure to die."

—Eric Mathers

All who leave the earth go to the moon, which is swollen by their breath during the first half of the month.

—The *Lippenheide*

"And time had they for water." —*Genesis*



PERMANENTLY HANDWRITING

Are you nervous, insecure and plagued by childhood anxieties? Don't blame your parents. Blame your third-grade penmanship teacher. Many of the traits you have as an adult, says one-time school principal Richard Stoller, were subliminally induced into your personality when you first learned cursive writing.

A Milwaukee graphologist, Stoller believes penmanship not only reflects personality but makes it as well. "To tell his story," he first gave 96 elementary school students personality tests and found many insecure. He then taught his pupils to write in a cursive style for 30 days. The students again took personality tests. According to Stoller, seventy-nine percent of the individuals had improved self-esteem.

Not all penmanship lessons are beneficial. "Kids are taught to write I's and J's with effort," notes Stoller. "They develop terrible temperaments." Children who learn to make capital L's with fat

strokes, he adds, tend to grow up with jocular streaks.

Fortunately, Stoller says, you can change your personality by changing your handwriting.

Say you are tense—a "personality" flaw that may manifest itself in hard, angular handwriting. Simply practice writing soft, rounded letters for a half hour each day. Around the twenty-seventh day, says Stoller, "you will begin to round your letters automatically. At that point your personality will become less tense, too."

New York psychoanalyst Harry Perowitz disagrees. Handwriting may sometimes be a clue to personality, he says. But the feel of curing a patient by changing his handwriting is something the psychiatric profession has yet to stir.

Stoller nonetheless stands firm. "If I had not statistically proved this," he adds, "would be the last person to believe it was true."

—Carol Fletcher

"One of the deepest and most widespread of human prejudices was laid in the uneducated, unmodulated human senses."

—Daniel Boorstin





MURDERING HOUDINI

Harry Houdini (above) spent his life escaping locks, boxes, and water torture cells. But his death was allegedly more mundane. He is said to have succumbed to strangulation pneumonia caused by a ruptured appendix.

This long-accepted explanation, however, has recently been disputed by fellow magician Norman Bigelow. Bigelow leads an entourage of escape artists and magicians determined to prove that Houdini was the victim of foul play. Bigelow's overriding hypothesis: Houdini's murder was planned by the many-angled spirit mediums he exposed as frauds.

Houdini's appendix, Bigelow points out, ruptured after he was attacked by a medical student at McGill University. And it's entirely possible, adds Bigelow, that the student acted at the request of psychics who

may have been his friends.

Once Houdini arrived at Grace Hospital, in Detroit, Bigelow adds, doctors tried to ease his discomfort with an experimental serum. But they refused to divulge the nature of the serum, he says, speculating that poison may have been involved as a little helping hand from spiritland. Finally, Bigelow contends, the appendix may have been ruptured not by the blows of the medical student but by the surgeons, posing Houdini in Detroit.

There is no doubt in my mind that there was a cover-up, says Bigelow, and that somehow, Houdini was murdered upon the command of fraudulent mediums. When the truth comes out, it will prove Houdini's claim that mediums will even commit murder to stay in business. —Steven Castle

Everything unknown is magnified.

—Cornelius Tacitus

SIMULATING MARS

A group of scientists has recently urged the European Space Agency to colonize Mars, making the red planet man's next great mission in space. Toward that end, an English lord and an organization called Argo Ventures will simulate a Martian colony right here on Earth. About 30 colonists from Europe and North America will reside in huts off the coast of England, explains Lord Michael Young of Dartington, and when they step outside, they will perform the same sort of tasks they'd be expected to perform on Mars.

Young, an ecologist, hopes that the simulated colony will help determine the social and political conditions best suited to Mars. We want to find the proper balance of sexes, whether there should be children, the right mix of personalities, what authority should be invested in whom and by what right, and what steps should be taken in the beginning to reduce the risk of wars on the new planet, he says.

Along with the social experiment, Young adds, will

be a biological experiment to find out whether bubble chambers simulating the Martian atmosphere can be modified by the introduction of oxygen-producing algae from Antarctica.

If vegetation grows in the chambers, he says, it may mean we'll be able to create a new Martian ecosystem in which the proportion of oxygen on the planet could be raised to sustain human life.

Young's project is endorsed by former astronaut Russell Schweickart, now energy commissioner of California and a member of Argo Ventures. Although the Martian habitat is just one of the organization's concerns, he notes, "it is certainly not trivial."

Argo Ventures hopes to establish a colony on Mars during the early part of the twenty-first century.

—Rob MacGregor and Tish Janeshutts

There is considerable evidence that great empires and civilizations have been undone not by barbarian invaders but by climatic change.

—1977 CIA report



IF THEY LIVED AND WROTE TODAY, WOULD YOU RECOGNIZE THEIR GENIUS?

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THE GODS

CONTINUED FROM PAGE 34

seemed to have surked into his head. He was trembling slightly, and his face had become waxen and pale.

His scared Thomas realized he's just plain scared right out of his skull.

"This has all happened before," Woody said hoarsely.

"What in the world are you talking about?" Thomas asked.

"Haven't you read your history?" Woody asked. He was a reticent man: slow voiced and deliberate, like most computer hackers, but now the words rushed from his mouth in a steadily accelerating stream, almost tumbling over one another in their anxiety to get out. His voice was higher than usual, and it held the ragged overtones of hysteria in it. "The *Manner 2* mission, the probe probe. Back in 1971. Remember? As as the probe reached Mars orbit, before it could start sending back any photos, a great big custom storm came up, just like this one. Great big bastards. Covered everything. Baked the whole planet in for weeks. No surface visibility at all. Had the scientists back home pulling their hair out. But when the storm finally did lift, and the photos did start coming in, everybody was just about amazed. None of the Lowellian features, no canals, nothing—just craters and rifts and volcanoes. All the stuff we expected to see this time around. He gave a shaky laugh.

So everybody got shrugged and said Lowell had been wrong—poor visibility, no selector bias, he just thought he'd seen canals. Connected up existing surface features with imaginary lines, maybe. Had seen what he wanted to see." Woody paused, looking at his lips, and then began talking faster and shriller than ever. "But that wasn't true, was it? We know better, don't we boys? We can see the proof right out that window! My crazy old uncle Barry, he had the right of it from the start, and everybody else was wrong. He told me what happened, but I was just too dumb to believe him! It was the space people, the UFO people! The Martians! They saw the probe coming, and they whopped that storm up, to keep us from seeing the surface, and then they changed everything. Under the cover of the sandstorm, they changed the whole damn planet to fool us to keep us from finding out they were there! The proof is! They changed it back! They're out there right now, the flying saucer people! They're out there—"

Bulberr! The commander said. His voice was harsh and loud and cracked like a whip, but it was the unprecedented use of obscenity that startled them more than anything else. They turned to look at him, where he loomed near the command console. Even Woody, who had just seemed on the verge of a breakdown, gasped and fell silent.

When he was sure he had everyone's attention, the commander smiled coldly and said, "While you were all going through your little psychodrama, I've been doing a little

elementary checking. Here's the telemetry data, and you know what? Everything shows up the same as it did before the sandstorm. Exactly the same. Deep radar, infrared, everything. We tapped the command console. It's just the same as it ever was, no breathable air, low atmospheric pressure, subzero temperatures, nothing but sand and a bunch of goddamn rusty-red rocks. No vegetation, no surface water, no canals. He switched the view from the ship's exterior cameras onto the cabin monitor and there for everyone to see was the familiar Mars of the *Manner* and Viking probes, rocky rugged, craters, lifeless. No green oases. No canals.

Everyone was silent, mesmerized by the two contradictory images.

I don't know what's causing this strange visual hallucination we're all seeing," the commander said, gesturing at the window and speaking slowly and deliberately. "But I do know that it is a hallucination. It doesn't show up on the cameras; it doesn't show up

◀ All four men
were silent, feeling a sudden
isolation. For
months, their only contact
with Earth had
been a faint voice on the
radio, and now
even that link was severed. ▶

in the telemetry. It's just not real.

They adopted the argument to the bar Docuss the Moose—an orange inflatable toy out of Johnboy's personal kit—smiled benignly down on them as they sipped from bags of reconstituted citrus juice (NASA did not believe that they could be trusted with a ration of alcohol), and the hip task Woody had smuggled aboard had been polished off long before) and went around and around the issue without reaching any kind of consensus. The "explanations" became more and more far-fetched: until at last the commander uttered the classic phrase *mars hypnosis*, causing Johnboy to start whooping in derision.

There was a long humming silence. Then Johnboy, his mood altering, said very quietly, "It doesn't matter anyway. We're never going to find out anything more about what's happening from up here." He looked soberly around at the others. There's really only one decision we've got to make: Do we go on down, or not? Do we land?

Even the commander was startled. After all this—you still want to land?

Johnboy shrugged. "Why not? It's what we came all the way out here for, isn't it?"

It's too dangerous. We don't even know what's happening here."

"I thought it was only mass hypnosis," Johnboy said stily.

"Think it is," the commander said stoutly, unperturbed by Johnboy's sarcasm. "But even if it is, we still don't know why we're having these hallucinations, do we? It could be a sign of organic deterioration or dysfunction of some sort, caused by who knows what. Maybe there's some kind of intense electromagnetic field out there that we haven't detected that's disrupting the electrical pathways of our nervous systems, maybe there's an unforeseen flaw in the recycling system that's causing some kind of toxic buildup that affects brain chemistry. The point is, we're not functioning right, we're seeing things that aren't there."

None of that stuff matters," Johnboy said. He leaned forward, speaking now with great urgency and passion. No one had ever seen him so zealous or so ferociously intent. "We have to land. Whatever the risk, it was hard enough funding this mission. If we fuck up out here, there may never be another one. NASA, that might not survive." He stared around at his crewmates. "How do you think it's going to look, Woody? We run into the greatest mystery the human race has ever encountered, and we immediately go scurrying home with our tails tucked between our legs without even investigating it? That sound good to you?"

Woody grunted and shook his head. "Sure doesn't of buddy," he said, he glanced around the table and then cooily said, "Let's get on down there." Now that he was apparently no longer enveloping the imminent arrival of UFO riding astronaut mutilators, Woody seemed determined to be as cool and unflappable and ultracalm as possible, as if to prove that he hadn't really been frightened after all.

There was another silence, and slowly Thomas became aware that everyone else was staring at him.

It all came down to him now. The deciding vote would be his. Thomas locked eyes with Johnboy, and Johnboy stared back at him with unwavering intensity. The question didn't even need to be voiced, it hung in the air between them and charged the lingering silence with tension. Thomas moved uneasily under the weight of all those watching eyes. How did he feel? He didn't really know—strange, that was about the closest he could come to it—hung up between fear and some other slowly stirring emotion he couldn't identify and didn't really want to think about. But there was one thing he suddenly was certain about: They weren't going to abandon his part of the mission, not after he'd come this far! Certainly he was never going to get another chance to get into the history books. Probably that was Johnboy's real motive, too, above and beyond the jazz about the survival of NASA. Johnboy was a cool enough head to realize that if they came home without landing, they'd be laughingstocks, wimps instead of heroes, and somebody else on some future mission would get

all the glory. Johnboy's ego was much too big to allow him to take a chance on that. And he was right! Thomas had even more reason to be afraid of being passed over: passed by. When you were black, opportunities like this certainly don't knock more than once.

"We've still got almost three days until the launch window opens," Thomas said, speaking slowly and deliberately. "I think we should make maximum use of that time by going down there and finding out as much as we can." He raised his eyes and stared directly at the commander. "I say we land."

Commander Redenbaugh insisted on referring the issue to Houston for a final decision, but after several hours of trying, it became clear that he was not going to be able to get through to Earth. For once, the buck was refusing to be passed.

The commander sighed and ran his fingers wearily through his hair. He felt old and tired and ineffectual. He knew what Houston would probably have said: "Anyway, With the exception of the commander himself [who had been too well-known not to be chosen], de facto policy for this mission had been to select unmanned man with no close personal or family ties back home. That alone spoke volumes. They were supposed to be taking risks out here. That was what they were here for. It was part of their job."

At dawn over Chryse, they went down.

As commander of the landing party, Thomas was first out of the lander. Awkward in his suit, he climbed backward out of the hatch and down the exterior ladder. He caught reeling flashes of the Martian sky, and it was orange, as it should be. His first instinctive reaction was relief, followed by an intense stab of perverse disappointment, which surprised him. As he hung from the ladder, one foot almost touching the ground, he paused to reel off the words that some PR man at NASA had composed for the occasion: "In the name of all humanity, we dedicate the planet of war to peace. May God grant us this." He put his foot down, then looked down from the ladder, twisting around to get a look at the spot he was standing on.

"Jesus Christ," he muttered severely. Orange sky or not, there were plants of some kind growing here. He was standing almost knee-deep in them, a close-knit, springy mat of grayish-other vegetation. He knelt down and gingerly touched it.

"It looks like some kind of moss," he reported. "It's plant and giving to the touch, springs slowly back up again. I can break it off in my hand."

The transmission from the Flowshare cracked and buzzed with static. "Thomas," said the commander's voice in his ear, "what are you talking about? Are you okay?"

Thomas straightened up and took his first long, slow look around. The other-colored moss stretched out to the orange horizon in all directions, covering both the flat plains immediately around them and a range of

gently rolling hills in the middle distance to the north. Here and there the moss was punctuated by light clusters of spiny, misshapen shrubs, usually brown or glossy black or muddy purple, and even occasionally by a lone tree. The trees were common about ten feet high, the trunks glistened with the color of fresh, wet blood, and their flat, glossy leaves glistened like sheets of amethyst. Thomas dubbed them lamellae.

The lander was resting only several hundred yards away from a canal.

It was wide, the canal, and its still, perfectly clear waters reflected the sky as dark as wine, as red as blood. Small yellow flowers trailed delicate tentacles into the water from the edging walls, which were old and crumbling and carved with strange, geometrical patterns of swirls and outcures that might, just possibly, be runes.

It *can't* possibly be real, Thomas thought directly.

Johnboy and Woody were clambering down the ladder clumsy and troll-like in their

●His eyes were
fervent and unfocused and
bright and seemed
to have sunk into his
head. He was
trembling slightly, and
his face had
become waxen and pale●

hulking suits, and Thomas moved over to make room for them.

"Mother dog!" Woody breathed, looking around him, the wonder clear in his voice. "This is really something, isn't it?" He laid a gloved hand on Thomas's shoulder. "This is what we saw from up there."

But it's impossible! Thomas said. Woody shrugged. "If it's a hallucination, then it's sure as hell a beautiful one."

Johnboy had walked on ahead without a word, until he was several yards away from the ship; now he came to a stop and stood staring out across the moss-covered plain to the distant hills. "It's like being born again," he whispered.

The commander cut in again, his voice popping and crackling with static. "Report in! What's going on down there?"

Thomas shook his head. "Commander, I wish I knew."

He unslashed the exterior camera from the lander set it up on its tripod, removed the lens cover. "Tell me what you see."

"I see sand, dust, rocks... what else do you expect me to see?"

"No canals? Thomas asked sadly. "No trees? No moss?"

"Christ, you're hallucinating again, aren't you?" the commander said. "This is what I was afraid of. All of you listen to me! Listen, godd! There aren't any goddamn canals down there. Maybe there's water down a few dozen meters as permafrost. But the sun's out as dry as the moon!"

But there's some sort of moss growing all over the place, Thomas said. Kind of grayish-other color, about a foot and a half high. There's clumps of bushes. There's even moss of some kind. Can't you see any of that?"

"You're hallucinating," the commander said. "Believe me, the camera shows nothing but sand and rock down there. You're standing in a goddamn lunar desert and babbling to me about trees for Christ's sake! That's enough for me. I want everybody back up here, right now. I shouldn't have let you talk me into this in the first place. We'll let Houston unravel all this. It's no longer our problem. Woody, come back here! Stick together, dammit!"

Johnboy was still standing where he had stopped as if entranced, but Woody was wandering toward the canal, poking around, exploring.

"Listen up!" the commander said. "I want everybody back in the lander, right now. I'm going to get you out of there before somebody gets hurt. Everybody back now. That's an order! That's a direct order!"

Woody turned reluctantly and began bouncing slowly toward the lander, pausing every few yards to look back over his shoulder at the canal.

Thomas sighed, not sure whether he was relieved to be getting out of here or heartbroken to be going to sleep.

"Okay, Commander," Thomas said. "We need you. We're coming up. Right away." He took a few light, buoyant steps forward—fighting a tendency to bounce kangaroo-like off the ground—and tapped Johnboy gently on the arm. "Come on. We've got to go back up."

Johnboy turned slowly around. "Do we?" he said. "Do we really?"

"Orders," Thomas said, uneasily, feeling something begin to stir and turn over ponderously in the deep backwaters of his own soul. "I don't want to go yet, either, but the commander's right. It *is* weird hallucinating."

"Don't give me that shit! 'Hallucinating,' my ass! You touched the moss, didn't you? You felt it. This isn't a hallucination, or mass hypnosis, or any of that other crap. This is a world, a new world, and it's ours!"

Johnboy got in the lander right now! the commander broke in. "That's an order!"

"Fuck you, Assh! Johnboy said. And fuck your orders, too!"

Thomas was shocked—and at the same time felt a stab of glee at the insubordination, an emotion that surprised him and that he hurried uneasily to deny, saying, "Route out of line, Johnboy. I want you to listen to me, now."

"No, you listen to me," Johnboy said fiercely. "Look around you! I know you've read Burroughs. You know where you are! A

dead sea bottom, covered with ocher-colored moss. Rolling hills. A canal!

"Those are the very reasons why I can't be real," Thomas said uneasily.

"It's real if we want it to be real," Johnboy said. "It's here because of us. It's made for us. It's made out of us."

"Stop gabbing and get in the lander!" the commander shouted. "Move! Get your asses in gear!"

Woody had come up to join them. "Maybe we'd better—" he started to say, but Johnboy cut in with:

"Listen to me! I know what was happening the moment I looked out and saw the Mats of Schaparelli and Lowell, the old Mars Woody, you said that Lowell saw what he wanted to see. That's right, but in a different way than you meant it. You know, other contemporary astronauts looked at Mars at the same time as Lowell, with the same kind of instruments, and saw no canals at all. You ever hear of consensual reality? Because Lowell wanted to see it, it existed for him! Just as it exists for us—because we want it to exist! We don't have to accept the gray reality of Ahab here and all the other gray lifeless back at NASA. They want it to be rocks and dust and dead, drab desert, they like it that way—"

"For God's sake!" the commander said. "Somebody get that nut in the lander!"

"—but we don't like it! Deep down inside of us—Thomas, Woody—we don't believe in that Mars. We believe in this one—the real one. That's why it's here for us! That's why it's the way it is—it's made of our dreams. Who knows what's over those hills, bone white faerie cities? four-armed green men? beautiful princesses? the Twin Cities of Hellum? There could be anything out there!"

"Thomas!" the commander snapped. "Get Johnboy in the lander now. Use force if necessary, but get him in there, Johnboy! You're emotionally unstable. I want you to consider yourself under house arrest!"

"I've been under house arrest all my life," Johnboy said. "Now I'm free."

Moving deliberately, he reached up and unsnapped his helmet.

Thomas started forward with an inarticulate cry of horror, trying to stop him, but it was too late. Johnboy had his helmet completely off now and was shaking his head to free his shaggy, blond hair, which rippled slightly in the breeze. He took a deep breath, and then grinned at Thomas. "The air smells great," he said. "And my God, it is clean!"

"Johnboy?" Thomas said hesitantly. "Are you okay?"

"Christ!" the commander was muttering. "Christ! Oh my God! Oh my sweet God!"

"I'm fine," Johnboy said. "In fact, I'm terrific." He smiled brilliantly at them, then sniffed at the inside of his helmet and made a face. "Pshaw! Smells like an airport in there! He started to strip off his suit.

"Thomas! Woody!" the commander gasped loudly. "Put Johnboy's body into the lander and then get in there yourselves fast, before we lose somebody else!"



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But Thomas said, "there's nothing wrong with Johnboy. We're talking to him." "God damn it, look at your med-readouts!" Thomas glanced at the chestnut readout board, which was reflected into a tiny square on the right side of his faceplate. There was a tiny red light flashing on Johnboy's readout. "Chris!" Thomas whispered.

"He's dead! Thomas, he's dead! I can see his body. He fell over like he'd been poleaxed right after he opened his helmet and hemorrhaged his lungs out into the sand. Listen to me! Johnboy's dead—anything else is a hallucination!"

"Johnboy grinned at them, kicking free of his suit. 'I may be dead, kids,' he told them quizzically, 'but let me tell you: dead or not, I feel one-hundred percent better now that I'm out of that crummy suit. Believe it. The air is a little bit cool, but it feels wonderful. He raised his arms and stretched lazily, like a cat."

"Johnboy—?" Woody said tentatively. "Listen, the commander raged, 'You're hallucinating! You're talking to yourselves! Get in the lander! That's an order!'"

"Yes, sir, sir," Johnboy said mockingly, sketching a salute at the sky. "Are you actually going to listen to that asshole?" He stepped forward and took each of them by the arm and shook them angrily. "Do I feel dead to you, schmuck?"

Thomas felt the fingers close over his arm, and an odd, deep thrill shot through him—part incredulity, part supernatural dead, part a sudden, strange exhilaration. I can feel him, Woody was saying wonderingly, patting Johnboy with his gloved hands. "He's solid! He's there! I'll be a son of a bitch—"

"Be one?" Johnboy said, grinning. "Oh, buddy, you already are one."

Woody laughed. "No hallucinations that carry, Woody said. Thomas: 'He's real all right!'"

"But the readout— Thomas began. Obviously wrong. There's got to be some kind of mistake—"

Woody started to unbuckle his helmet.

"No!" the commander screamed, and at the same time Thomas darted forward shouting, "Woody! Stop!" and tried to grab him, but Woody twisted aside and bounded limberly away out of reach.

Cautiously Woody took his helmet off. He sniffed suspiciously his lean, leathery face still with tension, then he relaxed and then he began to smile. "Hoove," he said in awe.

"Get his helmet back on, quick!" the commander was shouting. But Woody's medical readout was already flashing orange, and even as the commander spoke, it turned red.

"Too late!" the commander moaned. "Oh, God, too late!"

Woody looked into his helmet at his own flashing readout. His face registered surprise for an instant, and then he began to laugh. "Wh-why? Woody drawled, now that I'm officially a corpse, I guess I don't need this anymore!" He threw his helmet aside, it bounced and rolled over the spongy moss. "Thomas," Woody said, "you do what you want, but I've been locked up in a smelly ol'

tin can for months, and what I'm going to do is wash my face in some honest-to-God, un-recycled water!" He grinned at Thomas and began walking away toward the canal. "I might even take me a swim!"

Thomas, the commander said brokenly. "Don't worry about the bodies. Don't worry about anything else. Just get in the lander. As soon as you're inside I'm going to trigger the launch sequence."

Johnboy was staring at him quizzically, compassionately—waiting.

Johnboy: Thomas said. Johnboy: how can I tell which is real?

You choose what's real," Johnboy said quietly. "We all do."

Listen to me, Thomas, the commander pleaded, there was an edge of panic in his voice. "You're talking to yourself again! Whatever you think you're seeing, or hearing, or even touching, it just isn't real! There can be tactile hallucinations, too, you know it's not real!"

Old Ahib up there has made his choice.

●The lander was
several hundred yards away
from a canal.
The canal was wide, and
its still, perfectly
clear waters reflected
the sky as dark
as wine, as red as blood.●

too. Johnboy said. "For him in his own conceptual universe, Woody and I are dead. And that's real, too—for him. But you don't have to choose that reality. You can choose this one."

I don't know, Thomas mumbled. I just don't know.

Woody hit the water in an explosion of foam. He swam a few strokes, whooping, then turned to float on his back. "C'mon in, you guys!" he shouted.

Johnboy smiled, then turned to bring his face close to Thomas's helmet, peering in through the faceplate. Johnboy was still wearing that strange, dreamy look, so unlike his usual animated expression, and his eyes were clear and compassionate and calm. It calls for an act of faith, Thomas. Maybe that's how every world begins. He grinned at Thomas. "Meanwhile, I think I'm going to take a swim, too. He strolled off toward the canal, bouncing a little at each step.

Thomas stood unmoving, the two red lights flashing on his chestnut readout.

They're both going swimming now," Thomas said dully.

Thomas? Can you hear me, Thomas?
I hear you, Thomas mumbled.

They were having fun in their new world—he could see that. The kind of fun that kids had, that every child took for granted. The joy of discovery of everything being new, the joy that seemed to get lost in the gray shuffle to adulthood, given up bit by incremental bit.

You're just going to have to trust me, Thomas. Trust me. Take my word for it that I know what I'm talking about. You're going to have to take that on faith. Now listen to me. No matter what you think is going on down there, don't take your helmet off!

His father used to lecture him in that same tone of voice, demanding, domineering, and at the same time condescending. Scornful. Daddy knows best. Listen to me, boy. I know what I'm talking about! Do what I tell you to do!

Do you hear me? Do not take your helmet off! Under any circumstances at all. That's an order!"

Thomas nodded, before he could stop himself. Here he was, good boy little Tommy, standing on the hinges again, taking orders, doing what he was told. Getting pressed over again. And for what?

Something flew by in the distance, headed toward the hills.

It looked to be about the size of a large bird, but like a dragonfly it had six long, limy, gossamer wings, which it swirled around in a completely unswerving pattern, as if it were towing itself through the air.

Get to the lander, Thomas, and close the hatch!

Never did have any fun. Have to be twice as good as any of them, have to bust your goddamn ass—

That's a direct order, Thomas!

You've got to make the bastards respect you, you've got to earn their respect. His father had said that a million times. And how little time it had taken him to waste away and die, once he'd stopped trying, once he realized that you can't earn what people aren't willing to sell!

A red and yellow lander sat over his boat, as quick and silent as a tickle. It had six legs.

One by one, he began to undig the latches of his helmet!

No! Listen to me! If you take off your helmet, you'll die. Don't do it! For God's sake, don't do it!

The last latch. It was sticky, but he tugged at it purposefully.

You're killing yourself! Stop it! Please Stop! You goddamn stupid nigger! Stop—

Thomas smiled, oddly enough feeling closer to the commander in that moment than he ever had before. "Too late," he said cheerfully.

Thomas twisted his helmet a quarter turn and killed it off his head.

When the third red light winked on, Commander Redenbaugh slumped against the board and started to cry. He wept openly and loudly for they had been good friends, and he had failed all of them, even Thomas, the best and dearest of the lot. He hadn't been able to save a goddamned one of them!

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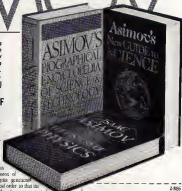
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groaned, rubbing his eyes. "A big one, but I can remember exactly." He reached for his box of hangover pills, but one of her arms held him out of the wall for the first time since she learned of Jacques' marriage. Above his lips two of her fingers suspended one of the tablets.

"That's two hundred ninety-six light years Jacques' voice was apprehensive.

"Hang on!" she said, pausing dramatically. Her breath came in short gasps. "We're in normal space again, over twenty-two thousand light years from home."

There was no sound, not even the static that usually underlay her voice.

"We must be in another galaxy," Jacques finally choked.

Abe realized what must be going through his copilot's mind: the stunned awareness that a small hole in the treading fabric of space had separated her from home, from his new bride, by humanly impossible gulfs of time and distance. And that he was imprisoned in a defective vehicle.

But Fawn laughed a free, glad-to-be-alive laugh. "No, same old galaxy. Oh, dear, you boys do need your cosmography lessons, don't you? But for now, we'll celebrate. She dropped the pill into Abe's tongue.

"My boys are going to be rich, really rich," Fawn giggled as if she herself were drunk.

"Hail, we are rich," Jacques shouted back as he danced Abe around the lounge, an open champagne bottle sipped above their heads. "It's in the bank. All you have to do is get us home to pick it up, Fawn."

"Tell us, Fawnie. Tell us about our bonus," Abe said, wiping his cheeks with his hands and licking his fingers.

"I can't," she said. "I've already run a file search, and there isn't a fixed amount for a discovery of more than a live thousand-light-year distance. But I can sure extrapolate. That is, if you two can stand it. She did not wait for a reply. Her voice, rising in delight almost glee, exploded around them. "You will be among the wealthiest men on Earth."

Who's going to spend five minutes out-comes? she asked. Both of them looked to ward her lounge speaker. "Why don't you out for it before we play poker?" She dropped the deck in front of Jacques.

"If you find us a planet, we'll out," Jacques said. He began to shuffle the cards. "What does it matter who goes out, anyhow?"

"Twenty-two thousand light years from home?" Abe held the cognac up to the light. "It matters."

"The distance matters, all right," Jacques began to flip out the cards. "Those are like the little dollar signs dancing in my head."

"I still can't believe it," Abe said, gathering his live cards and fanning them out.

"I hope you remembered to record its exact position," Jacques looked sideways at her speaker. "I won't do Earth any good if we can't find our way back."

Fawn laughed. "Navigation with me is like digestion with you, chen."

"How many?"

"Cards?" she said abstractly. "Excuse me, I'm busy just now."

They waited, exchanging looks.

"None. I'm good," she said finally. "By the way, were you bring an Earth-likely type? You can out alter his hand."

It came on the screen as a crescent. Neither of them gave it more than a glance, but the prospect of more bonus money for having found yet another world for humanity to colonize made the feeling in the room that much more expansive.

"Three," Abe said. "I think Fawnie's built-in. Animated dollar signs may have been dancing more frenetically in Jacques' head, and Abe himself would later begin to imagine what the new fortune would mean to him and Elsie and Georgia. But for now, this early in the voyage, it was enough that Fawn was well again and the old good feeling among the three of them was back.

Jacques took two cards from the deck, added them to his remaining three, and regarded his hand a moment. Then he said a

*•If he let the
thought have its way, it
would turn into
a gut-squeezing fear. What
about the feelings
of a teenage girl in love with
a creature
no longer of her own kind?•*

pile of chips forward over the green felt.

Five thousand.

Talk about bluffing! Fawn chuckled. Her slender fingers, metal clicking on plastic, gathered chips into a neat stack, which she deposited next to Jacques's in the center of the table. "I wish ships could get bonuses."

"What would you do with it, love?" As he threw his cards face down among the chips, Abe smiled into the eye just above her table radii-arm sockets.

"Get a face lift," Jacques said.

"Mr. Morley," she said laughily.

Jacques shrunk behind his cards.

Fawn began to laugh, and so did Abe. Jacques had made a joke, and Fawn had accepted it. It was good. It was like the last voyage and the one before that.

Between fits of laughter, her hand went back to her chips. She gathered a number of them into another pile, a large one, and pushed it forward.

"Since Abe's told me, here's a ten thousand more to make it interesting between us."

Ouch. Jacques hunched over his hand.

"Keep a poker face, Jacques," Abe said, grinning.

"That's a lot, win or lose." He drummed his

fingers on the table. "And she can't even spend it if she wins."

A vibration passed through the ship, almost imperceptibly like a gooseflesh-raising whiff of breeze on a hot evening.

"Was that something?" Abe said.

"I don't know," Jacques murmured, fawn lay down her cards, and the sparking arm slithered into the wall. When she spoke again, her voice was shaky.

"I'm paralyzed, I think. I can't make myself move. I mean through space. A meter, maybe," she added miserably.

Jacques closed his throat, frowning in Abe's direction.

"How long?" he said.

"Long?"

"To make repairs."

"Don't be pitiful!" she snapped. Then, her voice quavering near the edge of tears.

"I can't do it. I don't have any hands—not even sensors—in there. When I was b-born, they thought there'd never need to be b-repairs, way down in my nervous system. I guess, it's so well protected, and—for me to make repairs would be like a person cutting into his own spinal column." She ended in what sounded like a sob.

Well, it is a matter of putting in spare parts, Jacques said, his eyes still steady on Abe. "Just tell us where they are."

"Oh, I have spare parts galore, and I'll lead you to my warehouse if you want me to. But you couldn't begin to sort out those cross-crossed filaments of wire down there. She sighed. "There'd be every likelihood of killing me."

"Well, we can't just sit here and—"

"Shut up, Jacques," Abe barked. Then mildly but firmly to Fawn: "But we're going to have to do something."

My reading shows that's a ninety-nine percent Earth-probable down there, her voice rose hopefully.

If you could get us down there," Jacques said darkly. "And even if, so what?"

What had sounded like an incipient sob became Fawn's equivalent of unmistakable and uncontrolled tears.

"You could become our coffin, Fawnie," Abe said, talking almost as he would to a child. "or your orbit will decay, and we'll all lose there something we can do the three of us together?"

"Oh, Abe, it would take a hand like this. The first few parts of an arm came lazily from its socket. The hand opened, and the fingers traced a complicated figure in the air. "Or the hands of a computer specialist. Or," she added as an afterthought, "the knowledge of an old-fashioned pick. To one of them it would be relatively minor surgery."

There was a deep silence. Finally she said apologetically. "Don't panic, mes gergons. I'm stoked for more years than any human. We can last."

Abe and Jacques went to the location of the trouble. The door had opened easily. Just inside there was a rack of delicately configured tools hanging above a squat bench. On the opposite wall, at the other side of the

door was a bank of meters. The readouts on most of them flashed red zeros.

They shone their cigarette tips beyond the cramped work area. It was a huge, curving vault. It looked like spiders had been spinning webs there since the beginning of the world. There were dark tunnels in the shimmering mesh of filaments, and they were just large enough that a repairman could crawl through them to find a break or a place where a melt and fusion had happened—it he knew exactly where he was going.

"Is there a way, Fawn?" Abe said.

"Yes," she said flatly, "and no. I've considered everything, and there are two ways. One is an operation that I couldn't help you with much—"

"I wouldn't take that kind of chance with you, Fawn," Abe said, squaring bewilderedly into the cacophony of wires.

"I know, Abe, and Jacques would either. But the other ways—"

"Tell us, Fawn!" Abe said soothingly. "Can we do it?"

"It's been done before. I've been soaked many times."

The two pilots stared dumbly at each other for a moment.

"Before ships became people, humans always soaked them. And I was even pickled once, not long after I became myself."

"As if we've ever been able to pilot you—to make you do anything," Jacques said, on the edge of sarcasm.

"Hold on, Jacques," Abe said. "Can it still be done? Tell us how, Fawn."

Using the controls? What? She was silent for a moment. Yes. They're still there.

"A special sequence of words? What are they, Fawn?" Abe encouraged her.

"Not words," she said. "Not as if you'd tell me to play you Chopin's nocturnes while you're falling asleep. Buttons. Switches."

"Like the old keyboard," Abe flicked it up. Exactly," she said. "Manual controls."

Her eyes wandered over the console of keys labeled with pictures of every combination that could be made from her ladder.

No," she said, laughing. "Controls like these but much older. The ones I mean were here before I was installed. You'll have to go to the bridge."

"Bridge," they echoed together.

"It's real. I'll show you how to get there."

It was a cramped compartment—even their bathtubs were larger. The stale dryness of long cruises seared their nostrils. Across from the room's entrance was a view screen. Below it, in front of two plumply padded swivel chairs, was a keyboard, above which was a battery of switches and blinking lights.

Suddenly the right side of the view screen was illuminated by a blue-green crescent.

"My God," Abe crossed the compartment at a stride, leaned over the back of one of the chairs, and put his hand, then his nose

against the transparent substance. "It's a window. That's the real thing down there."

"Beautiful," Jacques said. "It does look a lot like Earth, all right. And we still can't get down there or... he raised a thumb over his shoulder, "up there."

"I know home seems far," Fawn said, trying to be soothing, using the speaker now to them and long unfamiliar to her. "But all we have to do is retrace our way to the contraction. We could be back home in less time than it took to get here, since I was sniffing for contractions on the way."

"Okay," Jacques said, dropping heavily into one of the seats, scowling at the array of controls and lights before him. "Move it, Jacques," Abe said.

It's all right, Abe. Fawn said. We can't blame him. But I have been soaked. It was back when space contractions were still a theory and I was one of those sent out to learn the truth. My boys were Jerzy Sutulsky and Henn Legasid. We had lovely times. Lee knew my grandfather, you know, but that was a long time after my tumble down the cliff and E.C. had saved my mind. Grampa was mostly positive by the time Lee knew him. I'm glad I didn't have to see him the way Lee knew him. Lee said Grampa could remember back when E.C. was mostly a dream in the depths of the big computers on Earth. That wasn't long before I was born, though I guess. When our first cruise started—

Those sound like times that deserve nice



telgia. "Abe interrupted. "But you say they had to sail you?"

They came right in here and sat in those very seats, and they took me home, by the seat of their pants, they said. I remember a lot of pain, or what-you-call pain, but I think I was unconscious most of the time.

"I guess if white-then-names did it, we can, too," Abe said.

"Sit, when did we ever get training in all this?" Jacques's hand swept and dismissed the console.

"Don't do yet. Fawne can show us. 'H can't.' Her voice was small and curled in on itself. This room's as much of a mystery to me as it is to you, and I've never had any use for it. I decide on a vector and I move, just as you take steps. The times that I was asked from the room, I had no control over my body.

Abe and Jacques stared at her speaker. There seemed nothing to say.

"But," Fawn went on, "it has to do with those controls. There's a combination of log-gles that will override my will. You'll have to throw those first."

"Damn it, were plots," Jacques said. "We go outdoors and breathe the air of new worlds. That's what we're trained for."

"Lee and Jerry were plots, too," Fawn said in a whisper.

"Well, figure it out," Abe said. His eyes, ranging over the console, did not seem so sure.

"When we begin to lose confidence, we'll guess," Fawn echoed. Abe's reassurance. "But our guesses will be educated."

"But that could take—" Jacques's shoulders sank inward. "I just want to get home."

"We all do, darling," Fawn said. "We'll do it together. Je vous aime."

Jacques turned suddenly and Abe ran up against him. They were in the green passageway. "It's obvious now, isn't it, Abe? She planned it all."

"I can't believe she's lying."

"What are the chances of getting hit by a meteor bad enough to really do damage?"

Abe shrugged. "A subconscious desire to burn out some wiring? I don't know. But I do know that she's a sick."

"She's sick all right," Jacques muttered. And whatever the cause, we're not going to do it here." He put a steady hand on Jacques's shoulder.

"Men—men Jacques—have sailed her before us. We'll learn."

Jacques laughed. "I'd make just as much sense to sit around speculating about what we would have done with our bonuses or what our wives will do with our disaster insurance."

"We'll work on the problem," Abe said, squeezing. "Inseme, wounded, or both, she is disabled and depends on us just as much as we depended on her."

"Of course," Jacques agreed finally, beyond despair. "I suppose our choices are limited. He betted his mouth into a strange smile. "Where do we start?"

"I'll start with those characters on the key-board. I think."

"What do they say?" Jacques wondered, sarcastically.

"I haven't got the faintest idea. But I'd bet they're in the same classical language that Fawn has tried to teach me now and then."

"Oh, sure. Then why doesn't she just tell us? I'll tell you why," he hurried on. "Because she doesn't want to."

Maybe, Abe said. "But maybe her human consciousness has forgotten what the written tongue of her girlfriend looks like. In any case, it's all in that memory banks."

"Well, let's tell her so—"

Abe put out a restraining hand. "Wait. A machine wouldn't intrude us in orbit around a planet several lifetimes from home. A machine would never feel a need for us. But Fawn—"

Abe: that's goddamn morbid. We aren't machines, and she—

"Let's not go into that again. You resent the idea that she may feel anything womanly through her metal 'organs' and the devices behind her bedchamber walls. And you can—"

●There were dark tunnels in the glimmering mesh of filaments, and they were just large enough that a repairman could crawl through—if he knew where he was going.●

think what you like about her soul, but we are where we are, and our only hope is that writing on those bridge controls and

And?

"Her needs," Abe left a cress of guilt.

"Me? amours." Her voice was husky and low. "You boys must do what you can about sailing. I have only one specialty left."

"I understand," Abe said, slumping into one of the lounge chairs. The table had been cleared of the chips, cards, and glasses from the interrupted poker game. One of her hands held a poured glass of wine beside his chair. He took it and raised it toward her nearest eye. "Je t'aime, Fawn."

Should have known—Jacques growled, refusing to sit down.

"Jacques needs cheering up, Fawn."

"I'm untucked," she murmured.

"Remember what we were talking about," Abe said before Jacques's angry glance could translate itself into words. "You go on. I'll relax and try to figure out how to sail."

Jacques went out, sailing suspiciously almost lescroquely at Abe.

"Oh, Abe, I'm so sorry," she said. Her long fingers slid around the neck of a decanter.

"I can't be helped, dearest," he said, watching the amber liquid trickle into the glasses. "Forget the stars."

He remembered that she had withdrawn from the game while she established orbit. He stepped once, then put the glass down.

A few minutes passed. Then several more.

"Fawn," he said gently. "How do you say tomorrow in what do you call it?"

"Demain," she said after a moment of static like fingertips passing over skin. "French."

Fawne, can French be winter?"

A silence was followed by a weak breathless. "Yes, once."

"Do you remember how?"

No.

I have to find a hobby while we're stuck here, and you've always liked teaching me to say the words. Can you tap your banks?"

"Yes," she answered, her voice coming at a high, strained pitch.

"Will you teach me?"

No, reply.

He smiled grimly. "How would you write say, Je t'aime, Fawn?"

After a winning moment, the words flickered on green letters on the screen.

"I showed you some written French, could you tell me what it meant in Global?"

"Yes. But must you have a less-than now?" she was distracted, sounding like a person breathing quickly.

"No, Fawne. Not now," he said sadly. "There will be other times. They will be fine lessons."

He drained his glass of wine and got out a yachzee score pad. "Goodnight, Fawne," he said as he left the room. He waited briefly at the door, but he hardly expected a reply.

To help him study a classical language, he thought as his footfalls echoed in the green corridor to the bridge, she would have to make her electronic storage vaults for information that predated her bath as a machine. When she was making love—at least with Jacques—he supposed that in her mind's eye she moved backward in time and saw herself as a young girl of the Alps, rather than as a fabric of inorganic matter and electric impulses—a girl who could read and write French. He let himself down into one of the plush seats. It fit his back and shoulders. It was comfortable. He crossed his legs and propped the score pad against his knee. Most of the Earth-probably was in sunlight. It surely hot spots such as those in which Fawn's limitless imagination would place her and Jacques over the next... how long would it take?

Abe could almost see the two of them—Fawn, a body, but shimmering—walking hand in hand into a crisp, flowering meadow high in the mountains during its brief, fragrant summer. And while the two of them lay on a cushion of broad-bladed grass, he would have his language lessons. He sighed and began to copy the keyboard's characters. It would take a long time, but he was confident that he would see Eloise again and Georges perpetual summer would wear away the memory of betrayal. **DD**

RACING

CONTINUED FROM PAGE 33

humans to collect samples from the surface of Mars as soon as possible.

The mechanics of a Mars flight are straightforward enough. For reasonable rocket designs, launch windows open up only when Earth is properly aligned with Mars—about every two years. Flight times can last ten months or more, plus a long lay-over while waiting for the most fuel-efficient return route to open. Astronauts flying to Mars would be gone two or three years.

This time lag would allow for detailed investigations. "We concluded that the Apollo up-and-back mode is not really the most productive way to explore the planet," noted Jim French, space expert with the Jet Propulsion Laboratory (JPL) in Pasadena, California. "To explore Mars, one must have a permanent base. The first visitors to Mars will spend most of their time preparing a base for future travelers, those who follow will use their time probing Mars's surface."

The long travel times involved require a manned spacecraft many times heavier than the small Apollo command module that carried men on brief dashes to the moon. A permanent base calls for even more equipment. Whereas Apollo could start out with little more than 100 tons in parking orbit, manned Mars spacecraft could weigh up ward of 1,000 tons in the same orbit—and

most of that would be fuel. Because that weight is more than NASA is prepared to launch even in the next century, participants in the Colorado conference sought—and found—several ways to cut the weight substantially. Their plans optimize conditions unique to Mars. Mars compared with the moon is like the Garden of Eden compared with the Sahara Desert: when it comes to material resources," says Barton Clark, an engineer who worked on the Viking project.

For one thing, the atmosphere of Mars—carbon dioxide, nitrogen, argon, and water vapor—offers a ready source of oxygen and water. In addition, the polar caps are made up in part of water ice, perhaps several cubic miles of it, and some scientists suspect that more water may be hidden as permafrost. Growing plants would have an abundant supply of carbon dioxide.

Another Martian resource of immense value would be rocket fuel. Given enough power, water can be hydrolyzed into hydrogen and oxygen—ideal fuels for a return flight. "For a round trip, the spacecrafts launching mass dominates design, especially the weight of the propellant needed to get back," says JPL's French. "If you can get rid of the need to carry this load, you have a major advantage."

Nothing is free, the engineers realize. The equipment to process the fuel, and the power sources to run the hydrolyzers, will be useful only if they weigh far less than the fuel they are supposed to save. But French and other

members of the Mars Underground have shown that the scheme is feasible, especially if a fuel refinery were part of a permanent installation. The result: major weight and cost savings in the construction and launch of the manned expedition.

There are other methods for reducing the starting weight. Science Applications, Inc., a spaceflight-consulting firm in Ithaca, has proposed a 500-ton spacecraft that would leave Earth with a crew of four. The Martian lander and return vehicle would be launched separately. The return craft, slated to arrive unmaned a month after the astronauts, would never land. Instead, after several weeks on the Martian surface, the crew would climb into its ship, blast off, and rendezvous with the empty return craft as it orbited Mars.

It's a viable concept," says space engineer Rob Staehle, who is president of the World Space Foundation. "We haven't asked anything of the tooth fairy—except the money." Science Applications estimates that the operation would cost only about half what the Apollo program did—about \$40 million in 1984 currency.

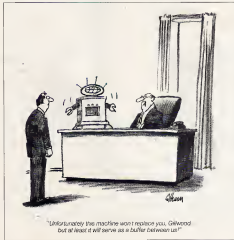
Some analysts recommend that the first manned expeditions, not land on the red planet, but rather orbit it and visit Mars two small moons, Phobos (1 ton) and Deimos (1 ton). The key advantage is that the black moonlets are carbonaceous, believed to be as much as 20 percent water by weight, and could be tapped as a refueling station. No chemical data exist to support this, but spectrographic measurements indicate the presence of water, and there is one major topographic hint: the mysterious grooves and crater chains that cover the potato-shaped Phobos.

Boam vents are the only plausible explanation for them," says former astronaut Brian O'Leary. The tremendous impact that formed Phobos's crater Stickney might have also provided the heat that boiled the water. The moonlet's surface dimples could be above tunnels that are still blocked with ice.

If water is still bound chemically to the soil, "salt" solar furnaces could easily bake it out. And electrical power could hydrolyze the water into the hydrogen and oxygen needed to fuel a homeward-bound rocket. This would save on shipping water and oxygen from Earth. At an approximate cost of \$10,000 to ship a pound of water from Earth to Mars, the total value of water on the 204-square-mile moonlet could be estimated at \$10¹⁰.

If all that water were recoverable, its worth would be 10 million times as valuable as this country's gross national product. More realistically, using Phobos's water as fuel would cut the costs of a mission by \$3 billion to \$5 billion. Hydrocarbons recovered from Mars moonlets could be put to many other uses—from plastics to soil for farming.

The rocket fuel from Phobos could support vents to and from the Martian surface. Space vehicles could leave Earth with just enough fuel to reach Mars, perform a banking maneuver through the planet's thin at-



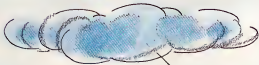
"Unfortunately this machine won't replace you, Gilwood, but at least it will serve as a buffer between us!"

The Artist

© ART CUMINGS

If your so great

How come you can never
strike the same place twice?



I hate repeating myself



mosphere, and then tap off their tanks with fuel from Phobos. Instead of heading for home, spacecraft might venture farther out to the asteroid belt and its wealth of minerals or to the Jovian system.

Water from Phobos could even be shipped at considerable savings in rocket power to areas of space where water is rare and terribly expensive—such as the moon. For the fuel needed to send one pound of water to the moon from Earth, a Phobos expedition could send four pounds of water back to the moon—a bargain, if the three years it takes to make the trip isn't a problem.

A key step in confirming Phobos' potential as a source of fuel would be to send an unmanned prospector there. The lander

would fire parabolic probes 100 meters or so into the moonlet to analyze subsurface material. Such an expedition would cost less than the bargain basement MGCO to be launched in 1990.

"This would be the mission paving the way for going to Mars with men," stresses Douglas Jones, a graduate student at the University of Colorado. A manned mission could follow within ten years after the robot prospector arrived, Jones says.

The Soviets are equally interested in Mars satellites. They will resume their Mars-exploration program with a launch or two in June 1988. Their purpose: to support a Phobos rendezvous and assay.

Paine says that a Soviet manned Phobos mission in the Nineties is a distinct possibility. "I believe there will be a galvanizing effort," he adds.

Here in the United States, things are not advancing quite as rapidly. Although the MGCO will spend one to two years mapping Martian mineral and water deposits and analyzing the planet's atmosphere, what's really needed is a sample return mission.

More than just scientific curiosity is at stake. "I don't think there is any life on Mars," says Chris McKay of NASA's Ames Research Center in Mountain View, California. But Viking did not actually rule this out. And no one wants to run the risk of contaminating an alien ecosystem.

According to NASA's Douglas Blanchard, the agency believes that a sample-return mission—separate from the MGCO program—could be carried out from 1996 to

1998. There are many areas on Mars where distinctly different geological formations are quite close to one another, which would allow a half-ton robot jeep with a range of less than 100 miles to sample different terrains and then load the cargo aboard a small rocket for the trip back to Earth.

Before a manned mission can get under way, engineers must perfect a deep-space life-support system. When members of the Mars Underground sketched their mission plan, they assumed that closed-loop life-support systems—in which air and water are recycled—would be developed for the space station of the Nineties. Such a system is not absolutely necessary, however. Close to the earth, a space station can simply dump

ion "waste" NASA's Dr. Joe Sharp, of the Ames Research Center. Experts acknowledge that the closed-loop system must be applicable to other projects as well. "The trouble is that we can't really show what it would do for the space station itself," comments Johnson Space Center's Michael Duke. "NASA always seems to get into a position where we can't work on a technology until we have a clear use for it. Work on solar-electric propulsion died for that reason. It's also preventing us from developing the technology needed to support a lunar base."

In the end, the public will help decide how much support any given program receives. There is only one way to get to Mars, quips one member of the Underground. "With

government money. You don't need the public with you, but God help you if they're against you."

The Underground's arguments center on traditional American themes. "This is the frontier that will motivate great things, not only by nations but by individuals," says former astronaut Harrison H. (Jack) Schmitt, who is also a former senator from New Mexico. "We must give freedom the opportunity to grow on the shores of the new ocean of space. Our ancestors did it for us. It is in the blood of Americans and in the blood of adventurous people worldwide."

The choice is no longer whether people will ever go to Mars. Schmitt stresses, the Soviet Union has already made that decision. "The principal historical question is what part will be played by free men."

Says NASA's Jescro

von Puttkamer, "Exhibiting that there are no limits to humanity's future in the universe could revive faith in the idea of progress."

If the American public realizes the need for a Mars mission, it will be because the space professionals have already recognized the merits of such an effort. And for that, the Mars Underground can take credit.

One of the speakers at Case for Mars II quoted a Buddhist riddle that sums up the Mars movement: "How does a tree climb a hill?" he asked. "It drops its seeds uphill. The process must go through several cycles to complete the movement, and the first has already begun. The seeds that the Mars Underground planted on this fertile new hill are already flowering." □

Wine of The Fine Grapes Co., Louisville, Ky. © 1981



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used water and air overhead, relying on shuttled-up supplies to keep going. But in the long run a closed-loop system like the one the Soviets are planning is far cheaper. For a flight to deep space, it is mandatory.

Initial budget restraints may prevent the closed-loop system's development. NASA will build the space station under the \$8 billion ceiling promised to the White House. All operating and launch expenses, however, will come out of another part of the budget. The goal is to minimize the net cost, even at the expense of operational costs. And though a closed-loop life-support system would save money in the long run, it would require far more in developmental funds. We haven't won this battle yet, even for the sta-

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INTERVIEW

CONTINUED FROM PAGE 76

thinking when you give them the pieces of a problem to analyze, but they're less effective at working out an overall design for something or figuring out how to achieve a general goal.

We haven't done much about thinking since the Greeks. We still use that kind of dialogue and dialectical forms. As tools these are very limited. They are absolutely useless for resolving conflict, which is why we are still fighting so many wars. Dialectical math, logic and data processing are all second-stage thinking. Perception comes first, and we have yet to improve perception. Ours, why haven't we?

De Bono: Because we have never understood that perception takes place in an 'active' information universe. Our usual information universes are all 'passive.' In an active information universe, information has a vitality of its own; it moves around according to gradients. As I wrote in 1969 in *The Mechanism of Mind*, the brain acts as a self-organizing, active information system that enables incoming information to organize—to form—into patterns.

Just as Darwin provided a plausible explanation for the origins of different animals, the book explains insight and humor in purely mathematical terms—it provides a plausible explanation for the mysteries of the mind. AI projects are moving in this direction—toward self-organizing information systems. And if they don't, they'll continue to waste time as they have been doing for a long while. The AI work should focus not on computers but on perceptual languages.

Qweil: All is fifteen years behind your book?

De Bono: It's catching up but still limited. Its architects still think that pattern recognition is the important side, but it's pattern formation that enables information to organize itself, which is the key. There is no automatic pattern-recognition system in the brain, but in it there is the ability to allow patterns to be built up through perceptual learning. That is not the same thing.

Qweil: What is an example of a self-organizing system?

De Bono: It is difficult to see in terms of computer designs, but a real and natural example is the way rain falling on a landscape is channeled into streams, rivers and lakes. *The Mechanism of Mind* suggests that the mind functions similarly. But to create the same thing with a computer is not easy—you'd have to construct a rather more like the nerve networks of the mind.

Qweil: *The Mechanism of Mind* is widely recognized as your most significant work.

De Bono: It's my favorite. And I would say that not in itself, but in what it's talking about, it will probably be one of the most important books of this century. Its implications are enormous. But I should update it, as my ideas have evolved considerably since then. The role of brain chemicals, for example, is critical. Humor may help generate creativity

by releasing endorphins.

Qweil: Why is humor so important?

De Bono: Humor is by far the most significant phenomenon in the human brain because it demonstrates lateral thinking—the escape from the mundane perceptual path to another path. For example, an airline pilot goes for a medical checkup and he learns he is in fact almost blind. Still, he wants to fly for another year to gain his pension. When the doctor asks him how he is able to land the plane, the pilot explains that he uses the Jesus Christ method: "I point the nose down and when the copilot screams Jesus Christ, I level off."

The fact that philosophers have paid no little attention to humor shows how little they understood brain-information processing. In information terms, reason is a very cheap commodity. Humor illustrates the asymmetry of patterns and pattern switching, which is what one does in lateral thinking. Once you understand the logic of the active information pattern-forming universe, you can devise thinking tools as I have done for lateral thinking.

Qweil: Why did you say that God cannot laugh?

De Bono: That might sound sacrilegious, but I was recently talking to a group of Irish educators to whom I pointed out that God—as generally conceived—couldn't enjoy humor because He has perfect information. I said that God can neither think nor have a sense of humor. The theological definition of God as perfect knowledge means He cannot proceed from one arrangement of information to a better one (that is thinking)—nor can He be surprised (that is humor). I would be an idiot to say that God could think. So however far the jump from the usual perceptual path He might make, He would experience no surprise since He would know that it would eventually make sense.

Qweil: Will a computer ever laugh, and what will it mean if it does?

De Bono: Should a computer laugh it would be capable of insight and change and thus of some independence from its programmer. We will need to build emulators into thinking computers because the chemical changes of neurons are crucial to the behavior of self-organizing systems. We may have to develop richer, different languages for both encoding information and for describing the world. Suppose, for example, whenever we thought of a certain noun, we attached it most likely use. Instead of the word egg we would have egg-wal, as one concept, so that the eggs major use was implicit in the concept egg. Any noun might have such an antenna, a kind of line, radical or connector attached. This antenna would connect to other concepts.

Qweil: Why don't people naturally and automatically think well?

De Bono: Because the brain is designed to function not as a thinking machine but as a recognition machine. The only reason we can cross the street is because the brain is designed to be brilliantly uncreative. As a recognition machine the brain still needs some

sort of thinking because if you meet something you don't recognize, then you need to analyze it to find something you do recognize about it. A sorting, if you like, is necessary even in a recognition machine. But we must avoid point-to-point thinking—the coming to instant conclusions within a narrow framework of perceptions that are possibly faulty. The purpose of thinking is to scan to get a broader perceptual map and then to apply your emotions to it. Beyond that you have what I call lateral thinking—invention, creation, this ability to change perceptions and concepts by cutting across patterns.

Oron: Why are we so mired in the dialectical mode of thought?

De Bono: It's the Greek idiom redesigned by the Church in the Middle Ages. The dialectic adversarial system is an extremely inefficient mode for change because its original purpose was to repress change. It was designed by medieval scholastic philosophers to destroy heretics. Saint Augustine, for example, got forced into all sorts of extremisms on predestination and other points because the Donatists [a fourth century Christian sect] of North Africa were more skilled at dialectic arguments than he was. In the Church view it was a perfectly correct idiom because if you accepted the same basic premises, then the dialectic wordplay could "prove" something wrong or right, inconsistent or consistent. For that purpose it was perfectly valid, but in many other areas where perceptions differ and people change it is very detrimental.

Oron: Which groups do you find least hindered in their way of thinking?

De Bono: Businessmen: the world over are more interested in thinking than anyone else because theirs is the one area where defense is not a sufficient strategy for survival. In politics the academic world, or anywhere else, if you can defend your point of view that's enough. In business, you can defend your idea until you're blue in the face, but if no one buys your product you're out of business—unless you're so big like Chrysler that the government bails you out.

Oron: Do children, by nature, think laterally?

De Bono: Funny enough, it's a mixture. Because children don't know the accepted approach to a problem, they can come up with a highly fresh, original, creative solution. But if you then say to them, "That's very interesting, what about another, they can be very rigid and conservative. Many apparently creative scientists, artists, and advertising people, somewhat like children, are actually very rigid.

Many artists really may be productive stylers. They are just producing different objects within the same style. Chagall, Braque, and some others are more stylists than they are creators. We need to contrast the creativity of innocence (children) with the creativity of "escape" (adults).

Oron: What about drugs and other chemical influences on creativity?

De Bono: Certain brain chemicals make creativity easier or more difficult. In a sense there may be a number of different brains

depending on the chemical background. For instance, in a panic people tend to act in a rather stereotypical fashion. With that stress chemical background there may be only one pattern available and thus a limited range of responses. Similarly, confidence acts positively and frustration on the whole acts negatively. Amphetamines may possibly make people seem more creative, but in fact they probably lessen imaginative thinking because they reduce the activity of certain neurotransmitters. Other drugs, such as LSD, probably reduce creativity too, and there is a certain stereotyping of painting done under the influence of LSD.

Oron: As a person who had devoted his career to thinking about how to think, are you one of the best thinkers around?

De Bono: It doesn't necessarily follow. You may be a brilliant designer of a motorcar, but not the best Grand Prix driver. After attending a seminar on forming SETO, the Swedish diplomat, Göran Backstrand, said this was his first encounter with a group focused purely

● *The brain is not designed to function as a thinking machine. The only reason we can cross the street is because the brain is designed to be brilliantly uncreative.* ●

on thinking. In his vast experience of peace foundations, ecological scenarios, and many other bodies, he'd encountered people who always pushed a point of view. I am setting up an organization that will suggest alternative designs, but will not choose one over another. I design the bicycle, but you decide where to ride it. My task isn't to tell people what to do.

Oron: So you don't push any ideas?

De Bono: Yes, I do very much so. I push thinking as a skill as an area for attention as hard as I can. And I am succeeding. Largely due to my pioneering work, thinking is now taught as a school subject in many countries around the world.

Oron: Which of your own suggestions outside your specialty do you like best?

De Bono: On an industrial level I think that workers and unions, instead of retreating before robots, should take the initiative and get to own the robots, then lease them to the factory. I suggest a trinity concept of industry: a three-way contract between business, companies, management, and suppliers of labor or robots. I also recommend the simultaneous use of different currencies in the same country. You might employ a time cur-

rency for buying people's time when there's no input of raw materials, and a tax currency with which you pay taxes. Each would have its own circulation system, with the cross-exchange rate varying as it now does between countries. Currency will have a higher value in one area than in another, as has already happened in a small extent in food stamps. With multiple currencies you could increase the money supply without inflation.

Oron: What horizon do you see for human thinking?

De Bono: There are many quite ordinary concepts that humankind has yet to invent that will greatly simplify our thinking. A new word, for instance, can have a powerful information value. The word *bikini* in Pidgin English in Upper New Guinea, for instance, means in the association frame of *being* allows you to hold something in a frame of reference without defining its relationship very precisely. "You being this restaurant" means that you are in the restaurant at the moment, or that you should be here, or a whole lot of other things. Lamp being being table means the lamp is part of what we would normally regard as the table scene.

I am working on a new higher-order language for everyday use. It would allow us to say things precisely and also to talk in paragraphs instead of single words.

Oron: Is your self-coined word *po* an example?

De Bono: *Po* allows you to say things you cannot otherwise say in English. *Po* signals that you have to suspend judgment; that you have to provide a new angle of vision in contemplating a problem. I drew it from words like *hypothesis*, *poetry*, *suspect*, and *possible*—situations in which ideas are used for forward effect. In German, *po* means "bedsheet" and in Thai it means "naked." I found out later, *Po* is not maybe or perhaps. It allows the setting up of patterns never to be found in experience in order to reset the mind so that it can snap into new patterns. You can say, "*Po*, a factory should be downstream of itself" and that leads to the notion of legislating that a factory's input pipe should be downstream of its own output pipe to ensure that it doesn't pollute the river. You can say, "*Po*, cars should have square wheels" and that provokes some very interesting ideas, including the reason why North American cultures never developed that wheel. They had something better in the axles they bound together and towed behind their horses. These axles could bounce up and down and so be effectively friction-free in the up phase. *Po* is an extremely powerful word because it takes us instantly from the judgment idiom in the end of course the idea has to be judged before it is put to use, but only then. The notion that an idea must be right at each stage is an information absurdity. We so much of our traditional logic.

For example, the invention of radio began on a completely misguided suggestion put before [British physicist] Robert Watson-Watt. Some crank wrote in and proposed that radio waves might be used as a death ray

to shoot down enemy aircraft. Watt thought that was a dull idea, since the amount of energy you get in a radio transmission is tiny. But his assistant, Wilkins, speculated that if we can't shoot down an airplane, maybe we can detect where it is. The original notion wasn't at all feasible, but it provided the successful idea that radio might be used to track hostile aircraft at night or beyond the line of sight.

The whole of the electronics industry is based upon a mistake. [American physicist] Lee De Forest was playing around in his lab with two copper spheres, and when he put a high static electric charge on them, he noticed that at the moment the spark jumped the gap between the spheres, the gas flame in the corner of the room flickered. He thought this phenomenon showed the ionization of air, and based on that idea he invented the triode tube, the first real means of electronic amplification. The only problem was that it was a total load of nonsense. Sound, not electricity, had been the cause clapping his hands would have produced the same effect.

Orin: You have said you intend to be involved with an AI project sometime. What will be your approach?

De Bono: If I was designing a computer to think, I would make sure that it could not do arithmetic. Similarly, I would design a computer capable of making mistakes, which is how the human brain operates. Imagine a hawk with very acute eyesight that accurately spies mice from a long distance. If the mice die out, that hawk is doomed. But a short-sighted hawk, not very good at discriminating and prone to pounce on anything above a certain size, will survive because it will go for lizards and other things after the mice die out.

So mistakes can be valid, and errors can be twisting. What I call the blurry brain has an ability to form rather vague general concepts as a base for narrowing down at toward. If you narrow down in the beginning, you don't get any cross-links.

Orin: You rarely quote scholars and researchers in your field. How much do you read of the literature?

De Bono: I am involved in so many practical operations, such as teaching or SITO, it's difficult for me to find the time. In my idiom I'm a modern equivalent of Aristotle in this day—a conceptualizer, a designer. I regard myself as a sort of mathematician—designer who puts things into practice, not an academic scholar.

The idea that you should read as much as you can in a research field—what I call the scholarship or library function—is a great misconception. I have suggested paired research teams where two guys both start out reading the literature, but then one guy stops and gets on with the innovating. The other continues reading, and if he sees the first going in a well-known direction, he tells him. If the innovator needs a certain piece of information, the researcher provides it. But if the reader sees the other going in an innovative direction, he keeps quiet. That way

you combine full information in one head with innocence in the other head.

Orin: Some critics call your thinking tools simplistic. Do they misunderstand you, or am I?

De Bono: I'm interested in very simple practical thinking tools that can be learned early in school or by people in business, and then applied throughout life. I'm delighted to end up with something simple. If you cannot make something simple in the end, you don't know what you are about. If you want to be taken seriously, however, you have to write impenetrable rubbish, because no writer can rely on the reader to see the full implications of what is simply written. The value of obscure writing is that it gives employment to a whole brood whose business it is to interpret you to the world—interpreting Marcuse, interpreting Wittgenstein, and so on. Since there are many more of those than there are of you, they act as amplifiers.

Orin: Can you teach anyone to be creative?

De Bono: Without any doubt at all! Creativity is a function of motivation—curiosity, wanting to do things differently—and talent. In artistic creativity a great deal of the talent is judgment—will it do, won't it do, shall I change it? Creativity is largely a method of thinking, style, pattern, habits, and techniques that can become internalized. There is a very serious creativity dilemma. Every valuable creative idea will be logical in hindsight, so we then say what is needed is not creativity but better logic. That is why we have been unable culturally to pay serious

attention to creativity. We can recognize a creative idea as valuable only when it is logical in hindsight. So we have to understand the asymmetric nature of patterning systems in order to see that an idea, logical in hindsight, may be invisible in foresight. We have to go beyond ordinary thinking.

Orin: Can an untalented person think as effectively as a Harvard graduate can?

De Bono: Oh, sometimes better. I find university thinking is good of its type, but that type is very limited. Much academic thinking could be carried out by a computer programmed to do library searches.

Orin: Do politicians like new ideas?

De Bono: I should say any group I've experienced, including fiercely religious sects, politicians are the least interested in ideas. One reason is that a politician cannot test an idea. He can't say, "We're going to try this tax system in this little town here. It's risky for him to take an initiative. His best policy is to wait for a crisis, when any action is seen as an amelioration, and then act."

Orin: Critics assert President Reagan is ill-informed, makes gaffes in press conferences, and otherwise shows limited intellectual grasp. Does an effective president have to be a good thinker?

De Bono: Reagan is a good president, whether or not he is a good thinker. America should really be a monarchy in order to separate the magic reassurance or leadership role of the president from the thinking and executive roles. It's an impossible job to have



them all played by one person. As a symbolic leader with certain reassuring qualities, Reagan does very well. The amount of change that can be made by any president in practical policy is minute. The United States should acknowledge this reality by moving to a kind of monarchy with a figurehead who provides emotional satisfaction and absorbs the image needs of the people and lets the thinking be done by others.

Omni: Your proposed agency SITO will provide new thinking to political leaders on an international level?

De Bono: SITO will endeavor to focus the best thinking in the world on such areas as economics and war. In a truly well-thinking world, we won't have wars. The dialectic mode is an extremely inefficient mode of change because in order to change something, you have to attack what is, so its supporters defend it. They get more rigid, you get more divided. Until one party or the other prevails. Very little of the thinking that is done during this process is ever related to devising a better alternative. A changeover to perceptual thinking is the key. The logic of the nuclear standoff will not be dissolved without a change in concepts and ways of looking at the issue.

Omni: What else do you feel strongly about?

De Bono: Waste inefficiency, the inability to use available resources to solve existing problems, and bullying—I don't see a justification for bullying. Arrogance, too, is inexcusable because it says, "I know I don't want to listen, and stop all communication."

Omni: Suppose politicians ignore SITO and continue to endanger the world with old thinking patterns. Will you then speak out?

De Bono: No. As my work in teaching shows, great change comes more by concept design than by passion. The days of scoring points with passion in most areas is over. Gandhi, for instance, was extremely persuasive in his dispassionate way. I can push a ball across a foam rubber surface or, if I depress the foam, the ball will roll of its own accord. Similarly, I don't push but lead by making available a concept in an area into which it moves.

Omni: You've written a book, *The Happiness Purpose*, about the problem of achieving happiness. Is there a solution?

De Bono: [Laughing] I'd say that happiness isn't achieved so much by the removal of all cares, worries, and suffering but rather through an active design process. Just as you construct a stage setting for a play to bring out the best in a group of actors, you need to design a life stage setting. Some of the traditional styles make one seem more unhappy.

Omni: Are you a happy man?

De Bono: Not all the time, perhaps about sixty percent. Of the remaining forty about half is dealing with maintenance problems that have arisen out of success. Some parts have gone up and some down.

Omni: Do you think that's a good score?

De Bono: Yes, it's a pretty good score. But there are probably some very placed personalities who achieve a seventy-thirty **BO**

EPIDEMIC

Concussion: Here's what it is

bute of Human Development" in New Haven, Connecticut.

Like Baker and many other doctors at the meetings, New York psychiatrist Allan Cott began to search for a pattern of yeast-related problems in his own patients.

Asking detailed questions about his patients' medical histories, Cott found that many had taken antibiotics, birth control pills, and other immunosuppressors. "I tried treating them for yeast and I saw a remarkable clearing of their neurotic—as well as their physical—symptoms," he says.

Autism pioneer Bernard Rimland, director of the San Diego-based Institute for Child Behavior Research, was also fascinated by Truss' observations. While the number of cases in which autism is caused by Candida may be quite small, I think it clearly plays a role in some cases. We are presently looking for kids with particular characteristics—for example, a history of ear infections and repeated rounds of antibiotic therapy—that lead us to suspect that Candida infections is related to their autism. Rimland says.

Despite the growing interest of other doctors—many of whom were traveling to Birmingham to ask Truss questions about candidosis and to share their own observations of yeast patients—Candida was not going up its secrets easily. And it seemed to be implicated in more and more illnesses. By the late Seventies, Truss was seeing an increasing number of people who were hypersensitive to chemicals and many foods. As he studied their case histories, Truss became convinced that severe environmental illness, sometimes called twentieth-century syndrome, was somehow yeast induced.

One of these people was Michael, the former runner. For nearly three years, the young man had lived an isolated existence, spending most of his hours in a room made as sterile as possible and taking allergy shots that doctors hoped would boost his immune system. Nothing worked. One day another hypersensitive patient told Michael about Truss. So armed with his oxygen tank, face masks, organic food, and a tent, Michael forced his body to make the trip to travel hundreds of miles from home for one last shot at finding an answer.

Truss asked the pale, drawn man the same question he had asked the dying mine worker nearly 30 years earlier: It is, he believes, the most important question a doctor can ask. When did you last feel well?

"Until the summer of 1976, I was in the top twenty of the U.S. road-race rankings," Michael said. But in late August, after jogging one morning, I noticed that my penis was swollen. Within thirty days, I was too weak to run at all.

A rash had developed on his scrotum, and his pulse raced every time he ate. Exposure to cigarette smoke made him ill. Then, any chemical smell began to leave him dazed.

He also became impotent.

As Truss asked question after question, delving for details that might have been overlooked, Michael remembered that his wife had a severe case of yeast vaginitis at the same time his penis first became itched.

Truss placed him on diet and drug therapy. Michael began to improve immediately. Within months, he gained 30 pounds and a chronic fungus infection on his toes disappeared. By late summer of 1980 he was running competitively again. Perhaps most dramatically, he was no longer impotent.

Although yeast vaginitis and menstrual irregularities had made candidosis more obvious in women, Michael's case brought Truss dramatic evidence of the yeast's role in men's health problems. "Here was a man in his late twenties, a vigorous athlete who was impotent for two years, until his yeast problem was treated," Truss explains. It reinforced my suspicion that it was possible for the yeast to have a profound interference in hormone function in men.

Truss heard from other doctors that they too had dramatic results when they treated chemically sensitive patients for candidosis. Other serious health problems sometimes cleared up when doctors treated Candida albicans infections. By 1981 Truss had word that cases diagnosed as seven different serious autoimmune diseases had responded to yeast treatment. But this was all clinical observation. It didn't explain how Candida was wreaking its havoc on the human body.

"If Candida is making people this sick, it has to be leaving all sorts of tracks behind," Truss told his friend, Alabama businessman Emil Hess. "We need to look at metabolic pathways. We need to find statistically significant abnormalities—things that you don't ordinarily see on a chemistry profile."

"Well, what's next?" asked Hess, a former candidosis patient himself.

Truss sighed. The bitter truth was that he had no resources to pursue technical research. And he had gone as far as he could working with patients and reporting what he saw. "Guess all I can do is hope somebody with a laboratory will get interested in doing research on this problem."

To Truss's complete amazement, Hess said, "I'll build you a lab."

Hess, his wife Jimmie, and two other prominent Birmingham families (the Holmans and the Palmers) whose own lives had been touched by Truss formed the nonprofit Critical Illness Research Foundation to fund candidosis research. The laboratory, built onto the back of Truss' office in downtown Birmingham, opened in 1983.

Truss knew it could take years before he had measurable evidence that the yeast was disrupting multiple body systems. I said at the time I began working in the lab that I would be delighted to find just one thing that was consistently out of kilter in candidosis patients, he remembers. Instead, every test we ran was abnormal.

He ran samples of Candida patients' blood and urine through a series of tests. He looked

at amino acids—by products of protein metabolism that show up in the urine—and found marked elevations from normal levels, including extremely low levels of GABA, one of the most important neurotransmitters in the central nervous system. To assess red blood cells' ability to elongate and compress as they have to do in the body's small capillaries, he filtered the cells through a sieve-like screen with openings about one third their size. The test showed that the oxygen-carrying red blood cells from Candida patients were rigid and stiff when compared with those of patients without Candida. Furthermore, Candida patients' cells returned to normal after the patients took nystatin for several months.

These and other preliminary findings gave Truss new confidence that the Candida nodule would one day be solved. There was more reason than ever to be optimistic: He was no longer a lone clinician pursuing an out-of-the-mainstream theory. There were calls from scientists and doctors around the world—from France, India, Bulgaria—"to help answer questions and, he hoped, to enlist other physicians in treating patients for candidiasis," Truss wrote and published a book *The Missing Diagnosis* in 1983.

In December of that year, it became obvious that his Candida theory had generated much curiosity. Hundreds of mycologists, immunologists, and doctors packed a hotel ballroom in downtown Birmingham for a yeast/human interaction symposium, co-

sponsored by the Critical Illness Research Foundation and the Gezell Institute.

"Anyone who takes an open-minded look at the always says it's very important," Baker says. "We need an environmental understanding of illness. We have to learn that we exist in an environment—as external as well as an internal one. *Candida albicans* may teach us that."

Many in the medical community have never heard of Truss's views on Candida. Before publishing his work in a major medical journal, he needed the results from lab tests—results he has only recently obtained. But the observations of other researchers are bearing out many of his ideas. It is as though a mosaic were being laboriously pieced together. Doctors throughout the country are demonstrating a link between Candida and several other more serious illnesses.

For example, allergist and immunologist Alan Levin suggests there may be a connection between AIDS and Candida.

"Candida is an opportunistic organism, and AIDS patients develop candidiasis because their immune systems are so bad. I treated several patients at high risk for AIDS whose T cell helper/suppressor ratios looked as though the patients would develop the disease," he says. After Candida treatment, and life-style changes, the ratio normalized. So although a virus causes AIDS, I think there's a chance you might be able to reverse the onset of the disease by getting rid

of the Candida early on," he adds.

There have been other hints of a fungus/AIDS link. National Institutes of Health scientists reported in *The New England Journal of Medicine* that they've found molecules from fungus infections in the blood of AIDS victims. And in an article published in *The Journal of the American Medical Association*, doctors at Montefiore Medical Center in New York, stated that thrush was a clear and early AIDS warning sign in high-risk individuals.

Oninus reports from Michigan Technological University microbiologist Eunice Carlson state that there's a deadly, synergistic relationship between *Candida albicans* and certain strains of staphylococcus. Carlson infected mice with staph strains associated with toxic shock syndrome (TSS). Usually these strains are relatively nonfatal in mice. Only massive doses could possibly cause death. But when she added *Candida*, the amount of staph needed to kill the animals dropped 100,000 times.

According to Carlson, the two infectious agents seem to aid each other. Staph grows inside colonies of *Candida*, and the yeast, somehow, protects the bacteria and encourages its growth. This synergism, she postulates, could play a role in TSS. "It is important to note that TSS is associated with the menstrual period, and *Candida* infections flare up right before menstruation. And TSS primarily affects the upper and middle classes—people who are more likely to go to doctors frequently and take more yeast-stimulating antibiotics," she explains.

Other scientists are producing laboratory data that suggest *Candida* is waging a sophisticated war against the immune system.

Japanese microbiologist Kazuo Iwata has identified the molecular structure of potent toxins found in some strains of *Candida* that severely depress B cells and T cells in the immune systems of animals.

And at Cornell Medical College, immunologist Steven Wilson is recording changes in the lymphocytes (white blood cells that are an important part of the immune system) of women who suffer from chronic yeast vaginitis. His findings? In a group of sixty-five such women, approximately three fourths had lymphocytes that became paralyzed when confronted with *Candida*. Even when we just took a patient's serum—the part of the blood with no cells—and mixed that with normal lymphocytes, there was some factor capable of blocking the response of normal lymphocytes.

Drawing on his own laboratory research, Truss proposes the following: In addition to antigenic products and immunosuppressive spore, *Candida albicans* may be producing the chemical acetaldehyde. Alcoholism researchers have already documented the devastating effects this chemical has on the body.

Acetaldehyde is the precursor of ethyl alcohol and the first by-product of alcohol's oxidation. Normally when we drink alcohol or when intestinal flora produce tiny amounts of alcohol, our bodies immediately oxidize it



"Ernest, let's talk about your carbohydrates."



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into acetaldehyde and then into safe compounds. But Truss proposes that people with yeast-related health problems are being overloaded with the toxin.

In the mid-Seventies, Japanese scientists found a strain of *Candida albicans* with the ability to make testators measurably drunk. The yeast changes carbohydrates in the body into alcohol. Thirty Japanese victims, ranging in age from three to seventy-four and one American, had been stricken with this peculiar health problem, dubbed *meiker shō*, or drunkenness disease.

The *meiker shō* *Candida* strain demonstrated that fermentation can take place within the body. Test-tube research shows that regular strains of *Candida albicans* can ferment carbohydrates into acetaldehyde, if oxygen is restricted. So Truss postulates that while some strains of the yeast, like those discovered in Japan, have the necessary enzymes to ferment all the way to alcohol, other strains may get only as far as the production of acetaldehyde.

If you want to screw up every system in the body I can think of a better way to do it than with acetaldehyde. Truss says bluntly.

The toxin depresses the citric acid cycle (by which the body produces energy from food) and disrupts collagen production and fatty-acid oxidation. Acetaldehyde is a potent blocker of synapses, the junctions between neurons or between a neuron and an organ, where electrical or chemical impulses are transmitted.

That blockage, Truss says, could account for certain symptoms in candidiasis patients. Doctors often report that such patients don't perspire normally and frequently suffer from low blood pressure, night blindness, and chronic constipation.

All these associations are interesting. There's a lot of circumstantial evidence to point to acetaldehyde, but that doesn't prove a thing, Truss admits.

The next step was obvious—test *Candida* patients for abnormal levels of the toxin. But how? Acetaldehyde binds quickly with protein and is rapidly excreted in the liver, making it difficult to trace in the body.

Truss walked into the Alabama Medical School Gas Chromatography/Mass Spectrometry Center one gray February day in 1984, looking for ideas. As had happened so many times before in his research, fate was waiting to lend a hand.

Springing down with the center's director of research, biochemist Steve Barker, Truss explained some of his ideas. I think there's a chance that acetaldehyde is being generated by the yeast, and it may be binding to neurotransmitters and causing brain symptoms, he explained.

Wart, Barker said, I'll be right back.

He returned with a paper he had published in the *Journal of Medical Hypotheses* four years earlier. In this paper, Barker suggested that formaldehyde might be implicated in schizophrenic brain dysfunction. Formaldehyde is a close molecular cousin of acetaldehyde, and the two toxic substances are metabolized similarly by the

body. Truss had observed that exposure to formaldehyde—in carpeting, furniture, pesticides—often caused candidiasis symptoms to worsen.

It was enough to make me think about divine providence. Truss acknowledges, laughing. Not only had I run into probably the only man in the South with the know-how and the technology to run the tests I needed, but he had a personal interest in what I was looking for.

In the spring of 1984 the search began for acetaldehyde in the plasma, red blood cells, and breath of untreated candidiasis patients. Barker used two complicated machines: the gas chromatograph and the mass spectrometer, which separate substances into a pattern that is digitized and read by a computer.

What have they found? Neither Truss nor Barker will reveal all the details of their research until it is published in the medical literature. Measuring his words carefully, Barker says, "Preliminary studies in certain untreated *Candida* patients have demonstrated high levels of this very toxic compound, acetaldehyde. And in several instances, those high levels returned to normal soon after treatment."

Some members of the medical and scientific community have begun to cast doubts on Truss's theory. Says Stephen Reingold, assistant vice president of research for the National Multiple Sclerosis Society, "The only people I know pursuing the acetaldehyde theory are Truss and his colleagues. Most of the mainstream researchers think multiple sclerosis involves a genetic predisposition that probably has some early life trigger—most likely a virus."

If people with MS do well on Truss's therapy, this reflects another susceptibility—they may also be susceptible to allergies. By countering the allergies, they will feel better. But "heads" to my knowledge, Truss has not demonstrated a relationship between his allergen of choice and MS.

The Medical Advisory Board does not recommend this treatment. It costs money and raises false hope. And people with MS, especially the relapsing and remitting kind, are notoriously susceptible to the placebo effect.

Furthermore, Reingold points out that Truss has never tested his theory in a double-blind study using MS patients.

Truss has never claimed that chronic candidiasis is the cause of depression, lupus, menstrual disorders, and the host of other ills that have reportedly cleared up in yeast patients after treatment.

What we are trying to do is to see the relationship between *Candida* and these conditions that go under different names. At no time have I said it is possible to treat MS or lupus by treating *Candida*. My approach has always been to look for the yeast problem and to treat it where it exists. Then I observe to see if that seems to help any other problems, he says.

I don't believe that it is ethical for me as a private practitioner to conduct double-



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PHENOMENA

"Two always been fascinated with certain forms in nature," says Henry Gerth, a marine biologist and underwater photographer who lives in Santa Barbara, California. While working with the Cousteau family on a project off the coast of New Guinea, Gerth witnessed a disturbing example of his favorite configuration, the spiral. "Part of the project included a medical clinic. One of the doctors was treating a young native boy for a severe case of ringworm. The fungus covered the child's entire stomach and chest," Gerth explains. "I had just observed the same shape underwater, while swimming by some brain coral. Looking at the boy, I was struck by the connectedness of nature, the universality of the spiral." Below the physician began applying a fungicide to the child's body. Gerth photographed the pattern carved by the parasite. He used a Canon F-1 with a 50mm lens and Kodachrome 64 film. **DO**

Microworlds, jogging records,
dominoes, and doves!

GAMES

By Scot Morris

This month we catch up on new developments related to some of the subjects treated in past columns.

SMALL WORLDS

Great Competition #10 asked readers to suggest prize-worthy human achievements—missions that might be reached sooner if prizes were offered as an incentive. This would be in the spirit of Charles Lindbergh's first solo flight across the Atlantic, which won him a \$25,000 prize and the human-powered Gossamer Albatross flight across the English Channel which netted a prize of \$180,000.

A runner-up in Competition #10 (reported in June 1985) was a challenge by Glenn Jenkins of Kent, Washington, for the first self-contained and self-sustaining environment of living things—air and waterlight—and including at least one kind of plant and one kind of animal (nonmicroscopic).

A significant advance toward that goal has recently come to our attention, and the nice thing about it is that you can buy one for yourself and put it on your desk. It is a sealed glass ball about five inches in diameter, containing several tiny red shrimp, some green algae, a soup of bacteria in seawater, and air. Set the sphere where it will get plenty of indirect sunlight, and the life cycle will take care of itself for who knows how long.

The truth is, no one does know because the oldest prototype, which will be five years old this July, started with three shrimp and still has two healthy ones going strong. The algae and bacteria reproduce continuously in this environment. The female shrimp have gotten pregnant and released eggs, but unfortunately the eggs didn't survive. So the sphere is not perpetually self-sustaining for the nonmicroscopic creatures, but five years is still a pretty good record.

The makers of the EcoSphere say that the technology for making these tiny environments comes out of NASA research at the Jet Propulsion Laboratory, in Pasadena, California, on bioregenerative human life support systems for long-range space travel.

They say that in the wild these Pacific

shrimp live more than five years. The plant-animal life cycle works like this. Algae bask in light and produce oxygen as they grow. Shrimp breathe the oxygen and eat the algae and bacteria. The shrimp and bacteria give off carbon dioxide needed by the algae for photosynthesis and growth. The bacteria decompose any waste material from the shrimp, breaking it down into basic chemical nutrients used by the algae. The only energy source that's necessary for the sphere is sunlight—the same energy source that drives life systems on Earth.

Each EcoSphere is assembled by hand. They cost \$250 apiece, postpaid, and can be ordered from Engineering and Research Associates, 500 North Tucson Boulevard, Tucson, AZ 85710. Shipments usually go out the same day an order is received, so time your order so that it will reach you on a day you are home. This way you can promptly open the package and give the critters some needed sunlight. A lighted base is supplied in case your office has no windows. Each sphere comes with a warranty for replacement if fewer than three shrimp are still alive after one year. The warranty doesn't apply if you accidentally drop and break the sphere.



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Muxse and Einstein in domino portraits.

OH, OH, DOMINO

In May 1981, we described computer-graphic artist Ken Knowlton's technique for producing pictures out of dominoes. Knowlton has patented his process and now markets plans for making several famous portraits (Einstein, Groucho Marx, Lincoln, Washington, Charles Chaplin, Marilyn Monroe, the Statue of Liberty, a panda, and a cheetah), each out of four complete sets of double-nine dominoes. Knowlton sets himself the restriction of using only complete sets of dominoes—otherwise it would be too easy to use just double-blank dominoes when black areas are needed, double-sixes for white areas, and double-fives for intermediate grays. By requiring that every domino in the set be used, he sets himself the task of finding the optimal place for such "difficult" dominoes as the nine-blank, the eight one, and so on.

He finds that the minimum number of complete sets of double-nine dominoes necessary for a recognizable picture of someone famous is four (with 95 in each set, the total 220 dominoes), which produces a 20 inch by 22 inch rectangle when standard dominoes (each about 1 inch by 2 inches) are used. Now you can order several famous-portrait plans (\$10 each, plus \$1.60 for shipping). The plans come in two parts. First, for masochists, there's a puzzle version, in which each square of the design is identified, but the orientation of the dominoes is left for the puzzler to work out. And for those of us with a low tolerance for frustration there's a complete "correct" plan for making the portrait. One nice thing about all this is that once you have your dominoes (four sets

for \$16, plus \$2.50 for shipping) you can assemble them one way to make your Marilyn, then take them apart and start over to make your Groucho, your Einstein, your Chaplin, and so on.

Order Domino-Pix from Metron Studios, Box 27103, Oakland, CA 94602.

THAT IMPOSSIBLE DOWTAIL

Last May, in the Museum of the Impossible, Part II, we showed a classic puzzle, the impossible dovetail, a joint of two blocks of wood on which there are identical dovetails projecting the same way (upward in the example shown) on all four sides. We then posed a challenge suggested by Nob Yoshigahara, games editor of the Japanese science magazine *Quark*, to construct a similar joint in which the dovetails alternate—up, down, up, down. We asked readers to send in their solutions. Yoshigahara received four replies after he posed this puzzle to Japanese puzzle solvers. We guessed that Omni readers would come up with even more. We were right. We received more than 60 proposed solutions from 35 different readers. We reviewed the entries and sent copies to Yoshigahara and to Bill Cutler, a Watous, Wisconsin expert on wood-puzzle design.

Omni readers came up with far more variations on the theme than we ever imagined. Unfortunately our open-ended wording of the problem left the door open for some diagonal but less-than elegant solutions. Since we didn't specify "two pieces of wood," some proposals were made from three or four pieces, and one reader in a stroke of clever lateral thinking, did it with two pieces of foam rubber! Others capitalized on the flexible nature of wood and got very thin dovetails that could bend out of the way as a block is pushed past, then snap back into position.

Another less-than-elegant solution involves hollowing out the pieces of wood so that when they are assembled, empty spaces remain inside. These cavities ranged from mere slots to huge hollows so that the remaining pieces looked more like shells of wood than blocks. Since the puzzle can be solved with two solid pieces of wood, we should have disallowed this approach.



From left: Impossible dovetail, its secret, and a reader's solution to the dovetail challenge.

But since we didn't, a large number of our correspondents probably stopped working on the problem once they had come up with one of these solutions.

When the solid solutions there were two basic approaches. In a "slide" the two pieces fit together by sliding one onto the other at a 45° angle. We judged the best solution on the line to be from Raymond Stanton, of Alameda, California (shown above), and Gary Winn, of St. Charles, Illinois. In a "twist" solution, one piece fits into the other by twisting or rotating. Three readers sent "twist" solutions, and the best of them was judged to be by Kent Graybeal, of Wausau, Wisconsin. The problem with "twist" solutions is that they leave any dovetails that aren't centered on their sides, or they present sketches that our judges felt wouldn't work in practice.

LOOK MA, I'M JUGGLING!

Since our look at the physics and mathematics of juggling, in August 1981, this combination of sport and art form has taken off. Membership in the International Juggler's Association (IJA) has doubled (from about 1,500 to 3,000) in the years since, and several world records then are former world records now.

Juggling is the inspired term to describe juggling while juggling. It is usually done with three bean bags because they don't bounce if dropped. Once you know how to juggle three objects, juggling is not as hard as it sounds. Until a few months ago the one mile record was 5 minutes, 44.7

seconds. Then last summer, at the IJA convention in Las Vegas, the 5-minute mark was broken with a time of 4:56.01. Kirk Swenson, who set the record, says that his best time for an ordinary mile run is 4:40, so the act of juggling slowed him down by only 16 seconds.

The 100 meter dash juggling record is now 12.6 seconds, set last summer by Albert Lucas, the Ice Capades juggler now with the Hacienda Hotel in Las Vegas. In the week prior to the same meet, performing for judges from the Guinness Book of World Records, Lucas kept five clubs going for over 37 minutes, shattering the previous IJA record of 6 minutes, and he juggled seven balls for 2 minutes, 3 seconds, six times longer than the IJA record of 20.63 seconds, set in 1983.

The all-time record for juggling objects of any kind is still 11 rings, it was set by Sergei Ignatov of the Moscow Circus. The IJA and Guinness consider that two throws and catches are necessary for a demonstration of juggling (as opposed to "flipping" which involves throwing and catching all objects just once). Lucas, who likes to juggle even numbers of items, thinks that he is now able to do six rings in each hand, twice around (24 throws and 24 catches) and intends to demonstrate it next month to bring the official Guinness record back to the United States.

Next month we'll present an I.O. test so difficult that only one in a million can pass. Watch for it here. **OO**



LAST WORD

By Clyde James Aragon

Who could have done it? Who could have been devious enough and had the technological ability to carry out this dinosaur rustling? People from other planets. Aliens.

There are so many mysteries in this world that we have ample room for speculation. The Shroud of Turin, the creation of the universe, the purpose of that little hole at the end of toothbrushes. But the most puzzling of all is the mystery of why the dinosaurs disappeared some 65 million years ago. Where did they all go?

To answer the question, scientists have offered all kinds of theories, from death virus to killer comets. Because of these headline-grabbing conjectures, the more plausible but mundane answers have been shunted aside. In recognition of those who worked long and hard at their beleaguered theories, I present to the world these other ideas no one dares speak of.

• The theft theory. A person or persons (weirded) stole the dinosaurs. Perhaps the most controversial of the new theories, this is, I believe, the most plausible explanation. It's based on the premise that if something is missing, chances are that it was stolen.

Take my friend's car. Tuesday night it was parked in his driveway. Wednesday morning it was gone. Now do you think the police tried to tell him that a comet carried it off? No. They wrestled with him and told him the truth. Somebody ripped it off.

Another story. This same friend is at the bus station. He puts his suitcase down to buy a pack of cigarettes at a vending machine. He turns around to pick up his suitcase, and it's gone. What's his first thought? A killer star swooped through the bus terminal and grabbed his bag? Not at all. To him, it was evidence of a great truth in life: if you leave something lying around long enough, chances are it's going to get ripped.

The same thing could have happened to the dinosaurs. These dinosaurs are a lot more mobile than suitcases, and they didn't just disappear off the face of the planet, who could have done it? Who could have been devious enough and had the technological capability to carry out the dinosaur rustling? People from other planets. Aliens. They probably came down in their UFOs and spirited away all the brontosaurus and stegosaurus and so on.

Why? For one thing, a dinosaur is a walking mountain of protein. The aliens probably used them as the main course at some intergalactic cafe or as the prime ingredient in some weird kind of meat loaf. For another thing, dinosaurs could have been valued as pets. What better way to ward off pesky salesmen than with a 50-ton animal sitting in the back yard? If a tyrannosaurus ate doesn't want you in, it's not going to let you in.

A skeptical reader might point out a telling fact. Not all the dinosaurs are gone. True, the aliens didn't take every one of them; they did leave a few dinosaurs behind in the frozen Siberian tundra, but only to throw us off their trail. A trained archaeological sleuth like myself can easily see through such a ploy. To catch a thief, you have to think like one.

• The not-tonght syndrome. Mass headbanging in tribal dances could have ended the mating ritual for most species. There is a precedent for this among Homo sapiens. During the last century, mass toothaches disrupted the mating habits of a tribe of pygmies in Africa. Medicines were tried to reverse this trend by introducing proper dental hygiene. In their zeal to comply and reestablish mating, the surviving tribal members forced themselves to death. Today all that remains of this unfortunate group are a few shrunken heads with root canals.

• The Rumpelstiltskin effect. Another by-product of the dinosaur-growing longer is that they became heavier. No longer could a brontosaurus flex like a butterfly or fit into a saw-tooth hole. And what was a fat lizard to do? Sink. And sink they did—into swamps, into rivers, into tar pits. Luring hunter traps into tar pits was great fun for saber-toothed tigers, who, with their sense of humor peculiar to those who grew up during the Mesozoic, would chuckle at the sight of the sinking behemoths.

• The three-minute-egg theory. Even during the days when giant dinosaurs roamed the earth, there were many smaller animals underfoot. And many of these liked to steal and eat dinosaur eggs. Then, as now, eggs tasted terrible, raw, so in a creative feat of animal intelligence, many of these creatures would drag the massive eggs to nearby hot springs. There they would roll the eggs into the boiling waters and eat the parboiled results. Paleontologists refer to these now extinct animals as poachers.

• The Copernican theory. To support the vegetation necessary for the dinosaurs, dirt must have rained a great deal. It also follows that a sudden spell of dry, sunny weather could have caused the clouds to part, the land to dry, and food supplies to disappear. During these hot spells, the earth could have become an arid place, not unlike a beach on a hot summer day. Ultraviolet rays would beat unmercifully down on the earth, leaving those who were unprotected. Is it possible the dinosaurs could have tanned to death?

• The Franklin like effect. The opposite of the Copernican theory, this hypothesis suggests that with all that rain, the skies must have been alive with thunder and lightning. And because the dinosaurs were so tall, they must have been the constant target of all these electrical discharges. One too many strikes by lightning bolts could well have led to the not-tonght syndrome.

Of all these ideas, I espouse the theft theory. It makes the most sense to me. It could also explain other mysteries of our solar system. Our wasn't the only planet subjected to intergalactic looting, just look at Mars. Not a tree left standing. And who dug all those holes on the moon? Come to think of it, who stole my friend's car? **CO**

Clyde James Aragon is a freelance writer living in Albuquerque, New Mexico. His most last his pocket picked by some one from Venus.