

THIS MONTH: CLOSE ENCOUNTER WITH A NEW COMET

SEP. 2003

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ROBO-BUGS

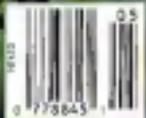
**AND THE WORLD'S
SMALLEST MACHINES**

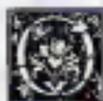
**THE KILLING FIELDS:
SETTING THE STAGE
FOR FUTURE EPIDEMICS**

**PLUS:
A LITANY OF
NOVEL-
SOMETIMES
NASTY-
WAYS TO
REMOVE
FACIAL HAIR;
A HEAVY-
DUTY SPORTS
QUIZ; AND A
GUIDE TO
THE IDEAL
HOME OFFICE**



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Cover art: Tim White's portrait of a macroengineered fly-mosquito, *Dark Side of the Sun*, was painted in gouache for Terry Pratchett's book of the same title. White also has a collection of published art in his book *The Science Fiction and Fantasy World of Tim White (Paper Tiger)*.

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People are swarming back home to work, that is. More than ever before, businesses are setting up in what were once recreational rooms. Sounds like a great idea, but where do you start? Our team of writers will help you to decide whether it's feasible to be your own boss and will aid you in the pursuit of excellent equipment, from telephones to computers.



FIRST WORD

By Claudine Schneider

•According to one poll, female candidates fare better than men in some respects: The majority of voters perceive female candidates as being more honest and caring than their male counterparts •

Even though women have managed to overcome many barriers (beginning with the right to vote in 1920) and have made impressive strides toward equal rights in all aspects of society, integration of women in government has been notably slower than our estimation into the other professional ranks. For example, between 1970 and 1990, the number of women holding executive, administrative, and managerial positions rose from 1.1 million to nearly 4 million and the number of women in careers such as law, architecture, and engineering more than doubled during the time. Yet today barely 17 percent (1,261) of the nation's state legislators are women up from only 4.7 percent (362) in 1971. At the federal level the statistics worsen: Fifteen women—2.8 percent—were members of Congress in 1971, while currently only 29 women (5.39 percent) hold House and Senate seats. Why has it been so difficult for women to break into public office? And why have women been less effective in national elections than in campaigns at state and local levels?

When a woman tries to move on to higher office, she risks losing the advantages of her supervisor status at the local level. You become perceived as personally ambitious rather than as a high-minded, dedicated public servant," says Barbara Bugge Baymond, the mayor of Princeton, New Jersey, and a former candidate for the Democratic gubernatorial nomination. Women, for the most part, are now accepted as competent in state and local politics by most of the general public, but when it comes to federal agenda or high-profile positions such as governor the public often rejects women candidates. (Only three states—Arizona, Nebraska, and Vermont—have female governors.)

In addition, popular myths often work against female candidates in political forums, such as the idea that the word leader evokes a male image. Men have consistently promoted a profile of "tough under pressure," which indeed is an important characteristic for a government figure—but not a trait belonging solely to male personalities. Unfortunately, female politicians must use a great deal of finesse to prove their courage, toughness in women is often labeled as being harsh or shrill.

Even so, women running for public office enjoy some inherent advantages over men. According to a 1987 survey by the National Women's Political Caucus, the majority of voters almost always perceive women candidates as being more honest, sincere, and caring than their male counterparts. While I do not agree that these traits belong exclusively to women, these characteristics have long deserved a higher profile on every political agenda.

Women may not have all the solutions to the problems in our government but we have a unique and important contribution to make. The female experience is different from the male experience, and this difference manifests itself in a range of social and intellectual patterns. And because women don't share equal representation in Congress, the contributions from the female experience are largely lost. For instance, women possess a clear understanding of the needs of underprivileged children, and we have firsthand knowledge of the day-to-day frustrations of young costs.

I am convinced, however, that a greater percentage of elected positions at all levels of government will ultimately be held by women. Because of the increase of women in regional politics, it is inevitable that soon we will see even more women serving at the national level. Many federal candidates come from state and local governments (in cities with populations of more than 30,000 there are now 139 women mayors up from seven in 1971; in eight states women now make up a quarter of the legislators.)

The statistics on incumbency for women in Congress, however, are still daunting. Men dominate the House and Senate, and 98 percent of those congressmen were reelected in the last few years. Currently two women serve in the U.S. Senate, only 38 women have been elected or appointed to the Senate since Rebecca Linnier Felton served in 1822. Calculations indicate that at the present rate of turnover it would take 410 years to achieve a 50-50 ratio of women to men elected to congressional ranks. Regardless, I continue to be an optimist. A new generation of men and women, prospering in the professional world and active in politics, is emerging. They carefully consider the positions taken by each candidate and vote without bias toward the sex of the men and women running for office.

In addition, the majority of voting Americans, men and women alike, realize more and more that female candidates are serious about solving the critical issues related to education, homelessness, the environment, drug problems, the economy, and defense. People increasingly see that the gender of mayors, governors, or senators does not affect the decisions these elected officials make on domestic and foreign issues. As this realization continues to make its way into the public consciousness, I am convinced we'll see ardent strides by many more women seeking candidacy for public office. **DD**

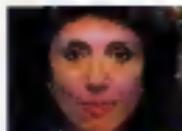
Claudine Schneider (R-Florida Island) is a member of the U.S. House of Representatives and is running for the Senate this year.

CONTRIBUTORS

OMNIBUS



HAGGOOD



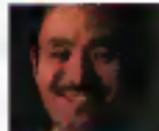
DINKLA



McAULIFFE



STEWART



SCOTT



PHILLIPS

Good things come in small packages, or so we thought. This month *Omn* puts the future under the microscope and discovers contrasting science. Micro-engineering may enable our grandchildren to live a life of luxury. But this will be moot if tomorrow's population is decimated by a global epidemic wrought by a deadly microorganism.

"I have always been fascinated with the Black Plague and that historical period," says freelance writer Kathleen McAuliffe ("The Killing Fields," page 50). "Whenever I'm morbidly depressed, reading about the Black Death acts as a catharsis to my modern angst." Now the former *Omn* senior editor has something to ponder during her darker moments. After attending a conference on new viruses, McAuliffe passed along the news that modern medicine has not necessarily eradicated the possibility of a devastating twenty-first-century plague.

Artificial intelligence research revealed a much brighter picture of the future for Fred Haggood ("No Assembly Required," page 55), who envisions micro-machines that will perform a variety of tasks, from cleaning teeth to regulating body temperature. Of all these nanobots, the Boston-based reporter would most enjoy the *MicroJeep*, which would enable him "to explore the backyard from the viewpoint of some incredibly small thing

And imagine being able to have a video camera on the back of a fly for an insect's-eye view of the world." Currently writing a book on engineering research at MIT, Haggood writes frequently for *National Geographic*.

Although Arnold Reiman (Interview page 76) spends most of his time putting together the world's leading professional medical publication, the editor of *The New England Journal of Medicine* impressed writer Doug Stewart as someone who's primarily "a working clinical doctor and a researcher. He's not just an ivory tower character. He's a doctor first and an editor second." The writer and the good doctor, however, disagree on the benefits of alternative medicine. Reiman dismisses the field and "won't give an inch," says Stewart. "He has good reasons for what he thinks."

The inspiration for Kate Wilhelm's "And the Angels Sing" (page 58) came from the author's fascination with nature. "I love watching dragonflies rising up in the air without any terrific effort, and I love the Oregon coast," Wilhelm says. "The two seemed to want to go together." The Oregon-based novelist has written more than 25 books, including *Cambio Bay* (St. Martin's).

Sculptor Takenobu Igarashi ("Building Character," page 72) has received several major awards, including the 1989 Katsuno Masaru Award for design excellence. Igarashi doesn't just

win awards; he also designs them, says *Omn*'s assistant managing editor Phil Scott, who interviewed the Japanese artist for this month's pictorial.

The winner of the World Hunger Project Award went home this year with an Igarashi original. The honor is given annually to an African leader for his or her efforts to increase food production for that continent.

"I have a horrible memory," jokes writer Kathryn Phillips (World, page 30). And who doesn't? But at least Phillips isn't a memory researcher, like Richard F. Thompson. Ironically, he forgot that his office was being moved on the day he arranged to meet with Phillips. "He kept our appointment, but the whole time I was interviewing him, the movers were coming and going," she says. She assumes Thompson remembered where his files went.

An authority on nutrition and alternative medicine, Gary Null (Earth, page 38) has written several health-related books; the most recent of which is *Healing Your Body Naturally* (McGraw-Hill, 1988). Null hosts a weekly New York radio program, *Natural Living*, and nationally syndicated radio segments on health and nutrition.

Formerly a teacher in the Watts section of Los Angeles, Linda Marsa (Forum, page 26) is a contributing editor at *Moose*. Her work has appeared in *Family Circle*, *Flare*, and many other magazines. **DD**

OMNI'S HOME OFFICE FOLIO

INFO TO SET UP YOUR WORKSTATION,
COMPUTERS, FAXES, AND MORE



WHO'S THE BOSS NOW?

ENTREPRENEURS

Today about 26 million Americans work at home, either full- or part-time, and that number is expected to reach 31 million by 1992. So for those of you who contemplate moving your office in to your home, we thought you might like a smart guide to help you out, whether you're buying new hardware, seeking easier software, looking for tiny gizmos jammed with information, or ordering a hot electronic typewriter.

A decade ago, people might have looked askance at those who said they worked at home, figuring the was merely a cover-up for the fact that they couldn't get a job. But millions of ordinary people, inspired by the success stories of others, have found the

entrepreneurial start-ups could be much higher. My research suggests that the home business's back door swings almost as often as its front door, much like the world of big business.

The reasons home businesses fail are numerous. Some people find that the responsibilities of a regular job, coupled with a part-time business at home are just more than they care to handle. Others become discouraged when they realize the amount of hard work it takes to market even the best product or service successfully.

After years of working for someone else, many who try to boss themselves find they lack the discipline to meet dead-

people accustomed to socializing in the traditional office setting.

While home-based entrepreneurs find it difficult to keep business from overpowering their personal lives, they tend to view their long workweeks positively. Tammy and Gus Vitale of Forestville, Maryland, held full-time jobs for three and a half years while also developing Bassounds, a home-based sound-systems business. Like many entrepreneurial couples in my newsletter network (National Home Business Report), they put in 60 to 80 hours a week. "This sounds hard," Tammy Vitale says, "but it doesn't feel like work to us because we enjoy it and because it's something we've chosen to do."

Although a business at home is no way to get rich quick, those who make even modest profits often find that their work leads to a more satisfying and productive life. They'll tell you that the home office perks are priceless. Time once spent on commuting is now saved. As much as \$3,000 a year may be saved on transportation costs, lunches out, and wardrobe expenses, not to mention child care costs.

What I appreciate most is being able to control my own destiny," says Patricia Gallagher in Richboro, Pennsylvania. After the birth of her second child, she left a \$20,000-a-year job to start a child care program in her home. "I figured that if I put the same amount of hours into marketing my own products and services, I could earn the same income and also be at home with my children." Gallagher is now a nationally known child care consultant and author of *Start Your Own At-Home Child Care Business* (Doubleday).

The business owners quoted in this article are what author Dennis Henley would call "positive workaholics." Such people, he says, have a winning attitude, high levels of energy, fierce independence, and a mystical sense of destiny. It isn't stress that kills but boredom," he says.

Entrepreneurs who call the shots are never bored, and the ones I know are too busy to get sick. So go ahead! Work as hard as you like on your own business ventures. Being in control of your life is good for you—especially when you're smiling all the way to the bank.—Barbara Brabec



coverage to launch small businesses of their own, offering everything from hand-made gifts to high-tech business services. Some make two to three times the income they might have earned in a salaried position.

"In our second year of business, we had already surpassed the income we were making as employees," say Greg and Debbie Robus who publish *Workpaper News* from their home in Heber Springs, Arkansas.

The number of self-employed individuals is at least 10 million and growing at the rate of 500,000 a year, according to Tom Miller, director of research at Link Resources in New York City. Given the volatility of home-based businesses, however, the number of such en-

TODAY ABOUT 26 MILLION
PEOPLE WORK
AT HOME, EITHER FULL-OR
PART-TIME. BY
1992, IT'LL BE 31 MILLION

tries or adhere to regular schedules. "Sometimes it feels like everyone else is out playing ball while you're inside practicing the piano," says Barbara Winter, who publishes *Winning Ways News* in Minneapolis. And feelings of isolation are an even bigger problem for

"It's his first national story...so Dave goes up there to get away from it all. Got himself a first-class communications setup...all AT&T...interviews over the phone...he goes for a run...answering machine takes messages...his editor calls and he faxes rewrites...makes every deadline...series starts tomorrow."

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THE WORLD IN YOUR HAND

REFERENCE DEVICES

If you haven't been paying attention to what's happening in the world of tiny gadgets, it's time to swing by your local tiny-gadget store. The hottest items in hand-held electronics these days are reference works that fit in your pocket: calendars, dictionaries, even Bibles.

The heart of the market is so-called business organizers, devices like Sharp's Wizard (\$329 list) and Casio's B O S S (Business Organizer Scheduling System—\$260 to \$300). Each is the size and heft of a small paperback book and stores massive volumes of phone numbers, addresses, memos, train schedules, and credit card numbers. Type in appointments anytime between now and A.D. 2099, and the organizer will beep when the appointed hour arrives. Casio's B O S S displays the current times in Moscow, Manaus, Rangoon, and Hanoi (although it ignores St. Louis, Nashville, and Detroit).

Mark Weiker, a globe-trotting photographer with an office in his Manhattan apartment, swears by his Wizard. No more cramming his pockets with wadded-up scraps of paper with names, numbers, and dates. He just types them all into his Wizard— presto. "Just the idea of having all this information in my pocket excites me," Weiker says. "I just love toys."

Daniel Markus loves toys, too. This Los Angeles-based personal manager for recording artists always travels with a "crisis bag" containing a portable CD player, a hand-held TV, a palm-size video camera, even a portable record player. Markus has tried several hand-held organizers, but none have earned a permanent spot in his crisis bag. "I'm not happy with those things yet," he says. "They don't do enough." Enough, in his view, means a hand-held full-function computer with a built-in modem. Until such a masterpiece of miniaturization appears, he'll stick with his Filofax.

For the non-yet-gotter on a budget, a warning: These reference gadgets, which aren't cheap to start with, can end up costing more than you expected. To take full advantage of them, you need a link to a personal computer, which lets you enter data on a full-size qwerty keyboard and gives you a backup file. Casio charges \$110 extra for this hookup, Sharp \$150. And to use these, you have to have a computer in

the first place, of course. The newest Sharp and Casio models offer pop-in special-function cards—for financial planning or more memory, for instance—and these options can cost more than \$100 apiece.

Aside from organizers and directories, most of the reference devices on the market are simpler, special-purpose items. One popular category is the hand-held dictionary/thesaurus/spelling checker. Somehow their designers have squeezed whole dictionaries into their slender innards. That's a seven-by-three-by-one-inch gadget like Texas Instruments' (TI) Thesaurus/Spell-Checker (\$120) has room for deliquescence is nothing short of astounding. For dummies, its thesaurus offers 85 synonyms, from contemporary to archaic. Seko Instruments' Word Power Professional WP-4000 (\$180) lists only six synonyms for dilemma, but unlike the TI model, it offers definitions, too—after a fashion. Japanese comes out "lacking the qualities required for spontaneity and originality," which may or may not be English. Also, its spelling checker changes

dumbfounded to dumfounded, which will strike some users as pretty dumb. But why quibble? As Samuel Johnson might have said, the point ain't how well they say things, it's that they can say anything at all. And Franklin Computer's Language Master LM-4000 (\$380) talks out loud. Push the six button and a voice chip pronounces any word you type in, provided it's in the stored vocabulary. Take it to parties and never worry again about accenting indelible in the wrong place.

A notable subcategory of portable reference gadgetry is the electronic Bible. The idea may seem silly, but if Bible study is your bag, this is a godsend. Both Selectronics and Franklin Computer offer unabridged Bibles for \$300. The search function lets you type in a key word or words, then zoom to the appropriate chapter and verse. How else could you discover which two chapters make no mention anywhere of God or His synonyms? Those things are just what you need if you're a procrastinating preacher working up a last-minute sermon or a priest searching for the mot juste while hearing confession (though the latter would probably want to do something about the beeps).

And speaking of mot, a flurry of electronic translators have recently hit the market. The Rand McNally Insta-Phrase Travel Translator (\$119), slightly bigger than a pack of cigarettes, offers a whole phrase book that you work your way through by keyboard. It's fun, but it won't outmode the printed phrase book. Who, upon spying a plummeting piano just ahead, is going to hit ten keys to get the proper translation of "Look out!" And there are glitches: A pâtisserie is a pastry shop, not a delicatessen.

Seko's humbler and thus more practical is Seko Instruments' translator collection (\$90 to \$100 per model). The size of a credit card, these simply translate single words you type in. Seko should be marketing these not just to tourists going abroad but to locals who venture into fancy restaurants and want to check what *roulade* lambos are without seeming the rube. (Ah, yes, blazing gypsy wagons—but of course!) Perhaps Seko could beef up the culinary vocabularies in future versions.—Doug Stewart

THE HOTTEST-SELLING ITEMS IN HAND-HELD GIZMOS ARE CALENDARS, DICTIONARIES, TRANSLATORS, EVEN BIBLES.



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HARDWARE

Once little more than glorified calculators, home computers have become serious business machines. Now buying a computer is almost synonymous with starting a home office. Sorting through the techno jungle for the right machine can be beastly. But don't fret, we've tracked down the best of these mechanical ogres for you.

In selecting a PC compatible with home-office use, Norman Schneider, author of *Your Home Office* (which will be published this summer by Harper & Row, warns against being swayed by the latest fashions in technology. He has coined an acronym that home-office users should consider: ACC—available cheap computer. Says Schneider, "Get the system that is most useful to you within your price limit."

But Stewart Alsop, editor and publisher of the *PC Letter*, a computer journal, counters that "too many people think that price is most important when buying a computer. Often the more important consideration is what the computer can do." For Alsop, the Macintosh is the ultimate machine. It's easy to learn and operate, and the graphics make it ideal for publishing newsletters or brochures.

Because most business software today is written for the Macintosh or for systems compatible with IBM's personal computer line, the logical choice for home office users, then, either of these two types of computers.

Personal computers come in three price and performance varieties. Low-cost variations on the original PC models (though now running two or three times faster) have base-price systems that sell from \$600 to \$1,500, moderately priced models (with a more powerful Intel 80286 central processor) have complete systems that range from \$1,500 to \$2,500. Premium models (built around a more advanced Intel 80386 chip) are ideal for graphic needs. The most recent state-of-the-art personal computers (built around Intel's i486 processor) have prices starting at \$9,000. But these are unnecessarily powerful and expensive for the typical home office.

Innovation in the industry is exemplified by Headstart models. These are the first personal computers with built-in capacity CD-ROM drives and an entire ref-

erence library on compact discs—similar to audio CDs. The Headstart models include discs containing such information sources as *The New Grolier Electronic Encyclopedia*, along with 100,000 business addresses, phone numbers, and fax numbers. Equally remarkable is the cost: less than \$2,000 for the complete Headstart LX-CD system.

Portable computers, though not specifically targeted for the home office, have become domestic favorites. Sporting built-in screens, these portables are excellent for home offices. "Typically a laptop computer is selected because it can be folded up and stored away," says Craig Paschett, executive editor of *PC Laptop Computers* magazine in Beverly Hills, California. "Many people do a

really you pay a higher price for a smaller model," Paschett says. And some smaller models don't have the functionality of bigger portables.

If you feel the need for speed, IBM has just the thing—its P70 386. It tips the scales at a hefty 20 pounds and will lighten your wallet with its base price of \$7,695. At 16 pounds and with a more agreeable list price of \$3,995, the Packard Bell PB256LT features a highly readable screen. Its power however isn't necessary for everyone.

Fortunately the latest in portable computers weigh in at seven pounds or less. Compaq has put out its lightweight contender, the Compaq LTE, with full-size keyboard and easy-to-read screen, weighing just 6.2 pounds and



SORTING THROUGH THE TECHNO-JUNGLE FOR THE RIGHT MACHINE CAN BE BEASTLY. SO HERE ARE A FEW TIPS

lot of their business on the road with their computers."

If you take your computer along when you travel, remember that every pound feels like 20 when you're trekking through endless airport corridors. But bear weight comes at a premium. "Gen-

erally you pay a higher price for a smaller model," Paschett says. And some smaller models don't have the functionality of bigger portables.

If you feel the need for speed, IBM has just the thing—its P70 386. It tips the scales at a hefty 20 pounds and will lighten your wallet with its base price of \$7,695. At 16 pounds and with a more agreeable list price of \$3,995, the Packard Bell PB256LT features a highly readable screen. Its power however isn't necessary for everyone.

Fortunately the latest in portable computers weigh in at seven pounds or less. Compaq has put out its lightweight contender, the Compaq LTE, with full-size keyboard and easy-to-read screen, weighing just 6.2 pounds and

solting for \$2,399. If you insist on sheer power, go for the Compaq model with the 80386 processor starting at \$3,899. A remarkable British import is entering the home office ring with the Paon MC-600—an ultralight PC compatible with standard keyboards, a mere four and a half pounds for \$2,999. If you don't mind a doll-size keyboard and a display the size of an unfolded matchbook cover, the Alan Portfolio is the lightest (only one pound) and at \$399 it's also the lowest priced.

In the Nineties, whether out of necessity or convenience, you can probably expect a PC to creep into your home. Keep in mind that any personal computer you choose should more than pay for itself.—Steve Dileo



Panasonic brings you a portable fax machine with built-in answering machine, speakerphone and auto dialer.

This portable fax machine has so much going for it you'll take it wherever you're going. To your hotel room or to your office.

Simply plug it into a standard modular phone jack and AC outlet, and you're in business — sending or receiving letters, graphs, charts, and documents with ease.

The KX-F80 also has an automatic telephone facsimile switching feature. So you can switch between phoning and faxing without hanging up and redialing. And it does it all on one phone line.

The portable fax isn't just compact, it's also loaded. With a built-in speakerphone. One-touch dialing. Auto redialing. A built-in copier function. Plus, G-II speed and fine resolution.

But most impressive of all, there's even a built-in answering machine with one-touch Auto-Logix™. It's like having a personal office manager on the road with you.

So if you're a business person who spends time on the road, travel with the Panasonic portable fax machine. It won't take up much room. ■



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HAVE FAX WILL TRAVEL.

GET WITH THE PROGRAM

SOFTWARE

Start with a map on the computer screen. Because you're in the real estate business, it's a map of a town-house development clustered around a golf course. Point to one of the lots with the mouse and click the button. Instantly the map is replaced by a picture of a house on that lot, along with the price and basic information. Point and click again and you see the floor plan. Point to a room and click and you see the interior of the room.

Pretty powerful sales tool, wouldn't you say? But probably too complicated and expensive for a home office. Actually it's the demonstration package that comes with a program called *Filevision IV* from Marvinlin. It runs on an Apple Macintosh computer and costs \$495. People are using *Filevision IV* to keep track of everything from the graves of Egyptian pharaohs to the contents of their own wire collars. *Filevision IV* exemplifies what today's software is all about: it's powerful, innovative and aimed squarely at the real needs of the people who use it.

The new generation of software programs such as Microsoft Word (between \$395 and \$450) have built-in outlines to help you get your thoughts in order. Do you have some stock information stored in a file? Use the "bullet-point" feature to put it where you want it. Need charts and graphs from your spreadsheet or diagrams created from a drawing or CAD (computer-aided design) program? Most modern word processors import the files you need with ease.

It's no secret that the PC got more powerful in the Eighties. The latest microprocessor chips, including the Intel 486 and the Motorola 68040, have about the same raw processing power as a small mainframe such as IBM's 4381. The difference between mainframe software and personal computer software is in how they use that power. In a PC a lot of it goes to making things easier for the user. "We use the power to do things that would have been prohibitively slow in the past," says Ross Wolfley, director of PC marketing for WordPerfect Corporation, an Orem, Utah, maker of word processing software. "On the old XT for example, using graphics and managing them the way we do today just wasn't possible."

If you need the absolute maximum performance in processing information and the greatest possible control over the results, get yourself an information management program like *DB IV* from Ashton-Tate (\$795). The program runs on IBM or IBM-clone personal computers and has its own programming language. Not easy to set up or learn, *DB IV* is powerful enough to let you run a small country.

Another type of program that has become more sophisticated and powerful is the spreadsheet. When the first computer spreadsheet was cooked up in the Seventies, the designers just wanted a computerized version of the rows and columns of numbers on paper.

But you couldn't recalculate the entire spreadsheet in a matter of minutes or play "what-if" games—for instance, what if you increase your margins on this product? Spreadsheet programs, however, like *Lotus 1-2-3* from the Lotus Development Corporation (\$195), perform these functions and more, including printout charts and graphs of the results. They even handle equations

with trigonometric functions, providing the user with elaborate models that can help predict everything from the price of oil in six months to the heat flow through an airplane part.

But that's only one dimension of the change in spreadsheets. As computer spreadsheets got larger, the need to break them down into subunits grew. That led to three-dimensional spreadsheets like *Lucid 3D* from DAG Easy. The program lets users split the spreadsheet into pieces and make each piece a separate spreadsheet, all tied back in with the main spreadsheet. For instance, 12 monthly spreadsheets can feed into an annual spreadsheet. Make changes in any of the monthly spreadsheets and they will ripple back into all the affected spreadsheets.

Another advantage of the new spreadsheet programs: The graphics are great. Modern spreadsheets (such as *Wingz* from Informix) produce print-quality graphics featuring three-dimensional graphs, shadowed graphics and even color.

Today's software market is booming and that's great news for people working at home. Not only is there a lot of software out there to choose from, it's easier to learn, easier to use and, most important, more powerful—it's a harder workhorse, multiplying your abilities as if you had a team of experts at your call. It isn't magic; you still have to do the work. But with surprisingly little effort on your part, you can compete with much larger enterprises.

—Rick Cook

TODAY'S SOFTWARE IS VERY
POWERFUL
AND AIMED SQUARELY AT
THE NEEDS OF
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THE GOLD STANDARD

JUST THE FAX, MA'AM

FACSIMILE MACHINES

A new element has crept into business meals. After the exchange of business cards, the handshakes, and even the "Let's do lunch" chatter, someone will wrap things up with a bright-eyed "Great! We'll get back to you. What's your fax number?"

Trust me, that question will make you feel like a total impostor—a bumpkin who's stumbled into the halls of the powerful—if you don't happen to have a fax machine. Shaken, the best you can do is mumble something about getting one and back away.

You needn't! If you can afford an office computer, you can afford a modern fax machine. "There are eighteen manufacturers and sixty-two vendors of fax machines. With that many people in the market, the prices are under a lot of pressure," says Dennis McLaughlin, assistant general manager at Sharp Electronics Corporation's personal home office equipment division in Mahwah, New Jersey. "Two years ago, two thousand dollars was a good price. Last year, one thousand dollars was good. Now we're seeing good machines priced well under a thousand."

This has come about because the business community has created—entirely by accident—a communications network that anyone can join. Thanks to international engineering standards, any Group 3 fax machine should be able to communicate with any other—and there are now about 12 million in the world and about 4.6 million in the United States. And fax machines display none of the tormenting complications that often confound computer novices when they first try using a modem. You plug your fax machine into a phone line. You feed in a piece of paper. You dial the phone number of a distant fax machine. Your machine causes the distant machine to print a facsimile (hence fax) of the paper. It's child's play.

A Group 3 machine reproduces your document with a resolution of about 200 dots per inch horizontally and 100 vertically. Vendors market transmission times of 12 to 18 seconds, but that's for a blank page; a double-spaced, typewritten full page will average 40 seconds. For artwork, there's also "fine mode," which reproduces at about 300 by 300 dots per inch, but

that doubles the transmission time. (Some vendors also offer further non-standard "halftone" resolution.)

Being universal, fax is the great equalizer. The humblest kitchen-corned office's fax is indistinguishable from those of the World Trade Center. But so far, few home offices have joined the fax world; only about 3.6 percent of the estimated 18.1 million "income-producing" home offices in the country had a fax by the end of 1989, says Raymond Boggs, an analyst at BIS CAP Inc., a market research and consulting firm in Norwell, Massachusetts.

All this is expected to change as prices fall and more people without fax numbers begin to find themselves embarrassed. For those entering the market, vendors caution you agree that features to look out for include:

- A paper cutter. You'll soon get sick of cutting incoming faxes off the paper roll with scissors.
- A document feeder. Likewise, you'll soon get sick of hand-leading outgoing faxes into the machine.
- Speed. Some cheaper machines

use one of the standard fax "fallback" speeds intended for noisy lines, operating at a half or even a quarter of the standard 9,600-baud speed.

Rigging a phone connection is a big issue for home office fax users, since shelling out for a second phone line just for the fax machine is an unpopular burden for the average household budget—hence the appearance of discriminator switches.

They vary by type, costing from \$150 to \$400. A unit that can be installed where the line enters the house can answer an incoming call, determine if it's from a fax machine (by listening for the initial "handshaking" tone), and route it to the fax. Otherwise, it rings the voice phone. Other units installed inside the house can divert a call to the fax after you've answered the phone.

Meanwhile, if you already have a computer, you can get (for \$155 to \$1,000) a "PC-fax board" that adds fax circuitry to your computer. Incoming faxes can be viewed on the screen or printed on a laser printer. Text files can be converted into outgoing faxes that will look like typewritten text. You can also get software that lets you "print" desktop publishing documents to the fax modem—turning the recipient's fax machine into your graphics printer.

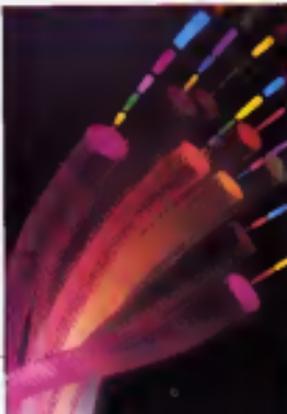
"Since each dot is generated by the computer, you get higher quality than with a scanner—no fuzziness or stray lines," says Hugh Mackworth, vice-president of marketing at GammaLink in Sunnyvale, California, where the PC-fax idea originated in 1985. "But if I start out with a piece of paper, I'm stuck unless I have a scanner."

With the home office market touted as a growth area, there's hardly a fax vendor without some home office offering, and some—such as Sharp and Murata—have specialized in it. Prices can be expected to continue going down, and Boggs says that by the end of the year we should be seeing "minifaxes" with minimal features, listing for less than \$500. These should at least lure people into the stores, where they can be sold "real" faxes, he adds.

Regardless of how you get one, just be sure to have your fax number in mind when the guy in the gray flannel suit asks for it. And try not to smile.

—Lamont Wood

THERE ARE NOW ABOUT 12
MILLION FAX
MACHINES IN THE WORLD
AND ABOUT
4.6 MILLION IN THE U.S.



THE TALK OF THE TOWN

TELEPHONES

Steven K. Roberts is the ultimate mobile executive. His Winnebago is a 275-pound home office—a recumbent bicycle with cellular phone, ham radio, and eight computers, including a Macintosh for "bike-top publishing."

Since going on the road in 1983, Roberts has logged more than 18,000 miles. But phone technology has gone farther. When he started, Roberts says, he relied on a Columbus, Ohio, base station to keep track of messages. Now he sends data from the road using a Spectrum Cellular modem and Touchbase fax board, both of which use a forward error-correcting scheme to make up for choppy connections. His Gti 491 cellular phone is also integrated into an on-line network and he maintains service everywhere through a technique called roaming. He enters a code like "71" that tells computers in cellular phone switches where he is and bills his phone account.

The newest cellular phones won't weigh down the Winnebago, either. The Motorola Micro-TAC Personal Telephone, for instance, comes in at just over 12 ounces with a standard battery. Larger phones, which draw their power from car batteries, have more range and hands-free operation. One Chicago executive has his Motorola 6000 set to turn on when he says, "Hey, dude," and to dial frequently used numbers up on voice commands such as "Call home." He can also gab without taking his hands off the wheel. The price for such features can be high—up to \$3,000. But a perfectly serviceable

Parasonic unit can be had for just \$600, and special discounts drop cellular service prices to 30 cents per minute from their normal 38 cents—when you agree to make or take at least five to eight hours of calls each month. (Cellular subscribers pay for incoming as well as outgoing calls.)

The most controversial phone innovation is Northern Telecom's Maestro, which displays the number of whoever is calling you. This takes advantage of a new phone service named Caller ID, now being rolled out nationwide, and sold by phone companies as a way to stop obscene callers and false alarms on 911 lines.

There are other, less controversial innovations in phones priced at \$100 to \$300. AT&T now offers a two-line intercom speakerphone. Parasonic has a model that forwards messages at the touch of a button, and Innovative Communications, a division of a Swiss firm, has two phones with the same voice-activation feature found on the \$2,000 Motorola 6000.

What people seem to want most in a

phone, however, is no cord at all. Cordless phones, with any radios that carry calls from where they're plugged in to you, now work at distances of up to 1,000 feet. But your mileage will vary, depending on the terrain, the number of wires around your home, which can cause interference, and the thickness of the walls through which the radio waves must travel. Even the best models don't work clearly farther than 600 feet away from their bases.

One of the most important new features on Southwestern Bell's cordless phones is a clutter button, which lets you move to another call if you have Call Waiting. Without this feature, you're stuck dropping one call or the other.

ANSWERING MACHINES

Roberts, the roving bike exec, does have one complaint: He lacks an answering machine. "I need one small and light that works on the twelve volts of power output by my solar panels," he says. He also could use something that actually works. That's the big problem with today's answering machines, quips Paul Edwards, who studies home-based businesses in Santa Monica, California. "Reliability is a major problem in answering machines. There's some real shit out there."

The problem, according to Pam Deberdt of Southwestern Bell, is the cassette tape. "Voice chips offer improved reliability and allow you to have a smaller machine," she says. Southwestern's newest machines offer a voice chip for incoming messages.

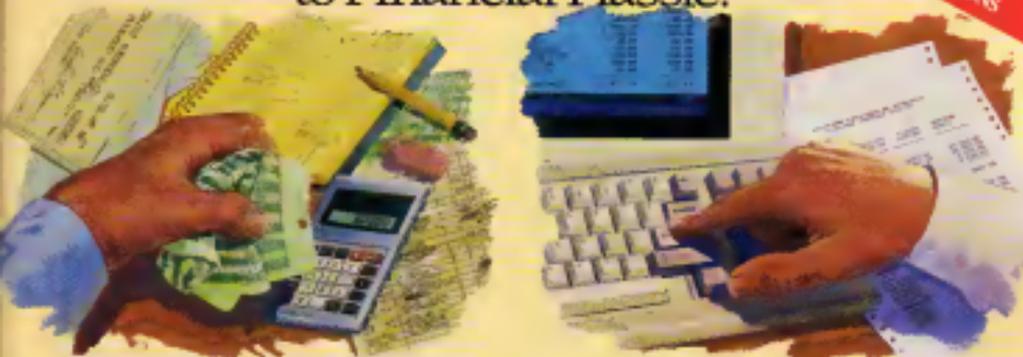
Finally, since we can now all be reached on our cordless, corded, or cellular phones, a new form of etiquette is needed, says Ken Bosomworth, president of International Resource Development, Inc., a research firm in New Canaan, Connecticut. "You need to admit when you can't be reached and provide someone callers can talk to. 'I don't give out my cellular number,'" Bosomworth says, but if an important call comes in, his secretary reaches him and he returns the call. "The people," he notes, "who are most often using these new technologies are one-man bands, who can't delegate to others." Now that we can have it all in our phones, the real luxury is being out of touch.—Dena Blankenhorn

THE BIGGEST PROBLEM WITH TODAY'S ANSWERING MACHINES IS THE TAPE. TRY REPLACING IT BEFORE TOSsing THE THING



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THE KEY CONNECTION

TYPEWRITERS

I can't look at a manual typewriter without lusting for it in my heart: the shiny black Remingtons with wire-rimmed keys, the sleek pastel green and blue Royals circa 1980, the high-backed Olivettis whose *g's* and *a's* have been rubbed away with use. I would probably experience existential ecstasy at the sight of Queen Victoria's gold-plated machine. Something has been lost with the silencing of typewriter keys. That's not to say I am unhappy with their successors—the self-correcting electronic and the electronic, spell-checking, block-moving word processors. For those of us whose fingers are prone to dystonia, word processors are a godsend.

A few years ago, it looked as though the typewriter was headed for that big junk heap of outdated technology in the sky, but something unexpected has happened: The market for typewriters is growing. That may seem strange in an age of computers, but among those who use computers at home, 77 percent use them primarily for word processing and spreadsheets. Why many home workers are asking, should they suffer through DOS—and pay more—if they don't have to? "Using a computer for word processing," says Fred Foverhake, vice president of marketing for Smith Corona, "is like hunting rabbit with a cannon."

Not surprisingly, old typewriter hands such as Smith Corona, Olympia (now AEG-Olympia), and Brother have come out with complete lines of typewriters designed for word processing. In fact, even the simplest electronic typewriters now have functions that were once found only on word processors, such as the ability to make revisions and move blocks of copy in a document before printing on a page. It is now possible to find a handful of models in any given price and function range. Of course, this is both lead and frustration for prospective buyers. Like someone looking for a new car, the consumer is faced with the heady problem of figuring out which model to purchase. "You have to decide what your needs are before you buy," says Brother marketing manager Karl Wardrop. For instance, some office buyers who need to be able to store large documents and do spreadsheets can begin their search by looking at top-end

word processors. These machines fall into two basic categories: the ones with separate CRT screens (they look like computer monitors) and the more compact models that have the CRT built into the word processor/printer. Both types of machines resemble typewriters. Their keyboards and printers are part of the same unit. Unlike their cousins, however, word processors also come with internal memory, a disc drive for external storage, and such sophisticated features as a built-in thesaurus and Mail Merge.

In addition, word processors have a feature that computers do not and that many people find handy if not essential. By simply flicking a lever, you can switch from word processing mode into typewriter mode, which means that you can easily fill out forms and type envelopes and notes. One of the curiosities of the computer age is the proliferation of handwritten envelopes. Many people don't have the time to take out their tractor-led paper, put in an envelope, and format their program for an address. Word processors sidestep

that problem by retaining traditional typewriter features.

Most of the top-end word processors are competitively priced (between \$600 and \$1,000) and carry comparable functions, so the consumer may end up deciding which one to buy for more personal reasons—the machine's appearance, the feel of the keyboard, the hum the machine makes, the look of the letters on the screen.

If portability is important, or if space in a home office is scarce, but you still need a top-of-the-line word processor, at least two manufacturers have laptop models. The Smith Corona PWP 7000 LT and the Panasonic KOWLS0 (scheduled for release in June) are both classic-looking laptops as powerful as their full-size counterparts.

If you don't need to store data, word processing typewriters may be the best choice. Considerably lower in price (\$200 plus), they have the added advantage of being small enough to tuck away in a closet or beneath a desk. Most lower-end typewriters have both an LCD screen to allow for preprint corrections and a typewriter mode for letters and notes, but not all of them do. In addition, many have enhanced features such as spelling and grammar checks. The Brother AX-650, for instance, combines its typewriter good looks with a dictionary, "punctuation alert," and grammar check.

Finally, for home office types who need only to write an occasional letter or note and for the computer aficionado whose knowledge of printing functions may be limited, it's still possible to find a not-so-smart typewriter for less than \$200. These models are cousins of old-fashioned typewriters. Just the basic fit the keys and work, the word appears, misspelled though it may be. I happen to have solved the envelope problem with a small Royal manual, but there will be hell to pay when the ribbon wears out. My hope is that by then somebody will have produced "The Envelope," a pin-size gizmo made just for envelopes, perhaps with a compartment built on to hold envelopes and stamps. Ideally, the machines would come in a variety of colors, from mat black to passion pink, the perfect complement to any home office. It's an idea whose time has come.—Jane Bevard

I CAN'T LOOK AT A SHINY
BLACK REMINGTON
WITH WIRE-RIMMED KEYS
OR A SLEEK PASTEL
ROYAL WITHOUT LUSTING.



THE DESIGNER OFFICE

We asked six prominent architects to describe the dream home office. Here are some of their thoughts.

"At night the work surface, such as a drafting table, would be bathed with a pool of light clearly defining a space within a space. The ambience would change according to the worker."

—Paul Rudolph

"My dream home office would have lots of northern light, soundproof walls, and no telephone."—Edward Larabee Barnes, John M. Lee & Partners

"One wall would be a big window another would be a big pinup board. There would be fluorescent ceiling lights and flexible lamps on a big square table."—Hugh Stubbins Stubbins Associates, Inc.

"I think a home office is nice when you can't get to a real office, but work is a social activity. I want to talk to people face-to-face. I want to see what they look like, smell their perfume, and then decide if I want to have a cup of coffee with them or not."—Robert Stern, Robert A. M. Stern Architects

"I'd have a home office that is cheerful and comfortable, where I would be surrounded by personal memorabilia and with a nonthreatening atmosphere for people who come to work with me."

—Charles W. Moore

"The real issue for me is creating an environment that is both present and absent. When you are not working, the office has to disappear. When you are in the office, the home has to be absent."

—Peter Eisenman, Eisenman Architects

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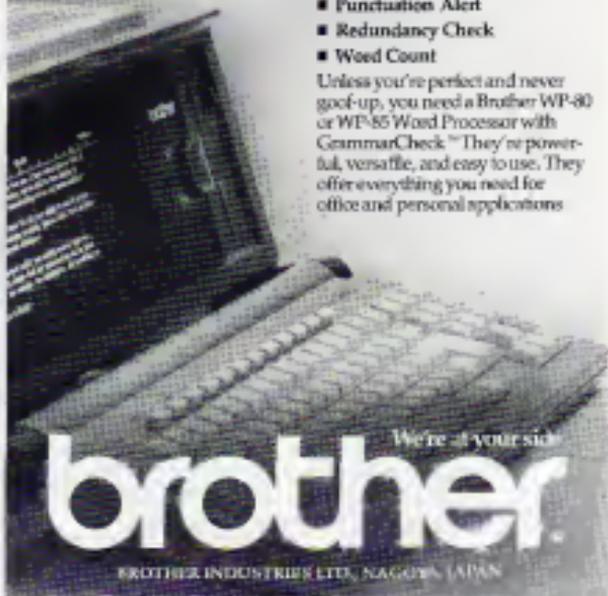
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HANDS-ON EDUCATION

FORUM

By Linda Mersa

In 1981 seventy-one-year-old Eugene Lang, a self-made millionaire, addressed graduating sixth graders at P.S. 121 in East Harlem. Looking around the sea of young faces assembled in the school auditorium, he was struck by a sudden impulse: "If you can somehow manage to graduate from high school," he said, "I'll pay your college tuition."

Lang kept his promise. Of the original 61 members of that mostly Hispanic class, 34 are now enrolled at least part-time in colleges, and close to a dozen are completing their junior years at schools like Swarthmore, Hunter, Bard, and Barnard. Lang picks up their tabs, no strings attached. Another nine, after finishing high school, came to Lang for jobs. He found them well.

The man has demonstrated that one person can make a big difference. At stake: millions of inner-city youths who live in a world dominated by violence, drugs, gangs, and grinding poverty. Around the nation, people are showing their concern by donating what they can, be it time or money, to help get America's ailing public education systems back on track.

"Frankly," muses Lang, "I really hadn't the slightest idea of the implication of that original promise. Only afterward did I realize that it was an empty promise unless I did something to help them go all the way." Lang's money paves the way, of course, but he takes special pride in the way his "adoption" program supports his young charges. He meets with students regularly, offering encouragement, support, and advice as they go through the inevitable crises of growing up. A project coordinator maintains a sense of cohesion within the group. The responsibilities of the coordinator include arranging tutoring and remedial work for those who need it, as well as involving the children and their parents in a wide range of academic, cultural, and recreational experiences.

Lang's promise fuels the kids' excitement for learning. Locked doors

open because studying becomes a means of escaping poor neighborhoods. "I want these kids to grow up and be on their own," Lang stresses.

The success of Lang's effort has inspired others to follow suit. In 1993 Louisiana oilman Patrick F. Taylor found himself in a situation similar to Eugene Lang's. While addressing 221 kids from a high-crime, drug-infested neighborhood in New Orleans, Taylor asked how many would like to go to college. "Every hand went up," Taylor recalls. "Every kid knew that education was the way to succeed."

Taylor struck a deal with the youths: "If you make an A average, you don't need me, the university will snap you up. If you make C's or D's, I don't think you'll be qualified for college, but you'll have a valid twelfth grade education and you can go to vo-tech school or junior college and you can get a job. But if you make a B average, I'll see to it you go to college."

Of the original 221 youths, 172 responded to Taylor's challenge and

are still in school, heading for college. He has initiated a host of programs, including direct aid to promising students and free tuition, room, and board for kids from low- to moderate-income families who meet the Taylor B challenge. "If they chose to drop out and end up on the streets, they could blame whomever they wished but it wouldn't make any difference," says Taylor. "They would have to live with the results of that failure. But I didn't think it had to be that way."

The examples set by Lang and Taylor stimulated the growth of another philanthropic group, the I Have A Dream (IHAD) Foundation in New York City. Says Mary-Jerney, the program's executive director: "More and more people recognize that children, particularly poor children, are in jeopardy unless we do something." IHAD provides the framework for "sponsors." With a \$300,000 pledge, businessmen can adopt a classroom. The money helps expose kids to activities normally restricted to wealthier students, such as museum tours, ballets, and Outward Bound programs. When "Dreamers" graduate from high school, they can apply to 43 colleges around the nation for their higher education. "The same sponsors put in really make a difference," says Jerney. "Kids and their parents see that we are there on weekends and during evenings. They realize that we will be there to help."

Not everyone can afford to underwrite the education of an entire class. Gary Appel, executive director of Life Lab—a scientific education organization based at the University of California, Santa Cruz—enriches kids' education in his own way. Not long ago, Appel strode into a classroom of first graders at a school in Watsonville, California, with a large pillowcase stuffed with something wiggly inside. When Appel pulled out Kneads, a six-foot-long box constrictor, excitement swept through the room. "Kneads is a friendly, cuddly snake that kids love wrapping around their necks," says



Getting a child a chance at tomorrow

YOU MUST REMEMBER THIS

MIND

By Kathryn Phillips

Think back to the first time you played hopscotch. If you are like most people, you can't actually remember when or where you learned that childhood game. But you still know how to hop the nine-square pattern in other words—even though you can't remember the event, you can remember the motor skill. How come?

This simple question has a complex answer that still eludes neurobiologists. Two collaborating scientists, however, may have moved a step closer to providing part of the answer. Their research gives some of the strongest evidence yet that the ability to learn motor skills—and recall them—appears to be located in the cerebellum, the minibrain wedged under the back side of the cerebrum and behind the brain stem.

Richard F. Thompson and William Groerough discovered that when we learn a motor skill, part of the cerebellum's nerve cell system changes physically. Certain fibers and dendrites, which act as communication wires to other nerve cells, grow differently during

learning. In effect, skills are "hardwired" into the brain as one acquires them. This can happen at all ages and may turn out to be an outstanding example of the brain's dynamic plasticity. If the scientists' preliminary study is proved correct, it could ultimately lead to ways of restoring motor learning and memory or even enhancing normal motor skills and memory. And although the study doesn't answer questions about remembering events, it may provide a model for how to better identify and study the and other forms of memory.

Neuroscientists have long been interested in the cerebellum and its relationship to movement. It is credited with controlling balance and keeping movements smooth and quick, helping walkers stroll instead of stumbling and tennis players charge across a court without falling. But only in the last 25 years have investigators seriously suggested that the cerebellum—which claims only one eighth the total weight of the brain—might do more than just refine the actions that other parts of

the brain learn and remember.

Previously influenced by the pioneering neurophysiologist Karl Lashley, most researchers believed that memories were everywhere and nowhere at the same time. No single brain structure was thought to carry a specific type of memory. In the mid-1950s scientists began to consider learning and memory as a function of changing neuronal circuits in specific brain areas. By the late 1960s this consideration had extended to the cerebellum. It remained more or less hypothetical, however, until neuroscientists such as Thompson began looking for a specific learning site and memory linked to that learning.

"My fundamental interest is in the mechanisms of neuronal cells. How do they store memories?" Thompson asked recently in the new offices for the Program in Neural, Informational, and Behavioral Sciences, which he directs at the University of Southern California in Los Angeles. "I decided that wild hares the best shot at understanding that mechanism if we used a very elementary form of memory that occurred in a particular part of the brain.

Thompson settled on a classical Pavlovian conditioning exercise called eye-blink puff. The rabbits were taught to associate the sound of a bell with a subsequent puff of air on their eye. Once the rabbits had learned the exercise they automatically closed the target eye as soon as they heard the bell and before the puff was released.

Thompson began to look for neural signs of the simple conditioned response in 1971. At first he and his team focused on the hippocampus of the limbic system. The hippocampus is very important in memory, but its specific purpose remains uncertain. Using his trained rabbits, Thompson determined that motor skill learning and memory are not centered in the hippocampus. "After we removed the hippocampus, the rabbits would still remember the conditioned response."

Motor learning and memory had to be somewhere else. But where? Thompson continued to work on



Riding down memory lane: We're getting a handle on why we remember certain acts.

COMET TALES

STARS

By Fred Schaaf

The date: December 6, 1989. The place: a secluded spot on the west coast of New Zealand. Amateur astronomer Rodney R. D. Austin gazed into the clear night sky, trying to pinpoint an already discovered comet—a celestial object sometimes described as a "dirty snowball" by astronomers. Then he decided to spend a little time trying to find a new one. Austin trained his telescope on the Taurus constellation and made a painstaking survey of the stars for about half an hour. By his tenth sweep, he was ready to give up.

Then he saw it. Just barely bright enough to detect with Austin's eight-inch telescope, a fuzzy patch of anomalous light stuck out where his star charts said no star, cluster, galaxy or nebula should be. Austin had discovered a new comet, unnamed and unknown to earthly astronomers.

That night Austin called a friend at Perth Observatory, who forwarded news of Austin's discovery to scientists at the Harvard-Smithsonian Observatory in Cambridge, Massachusetts. The observatory, in turn, checked the coordinates Austin provided to confirm his find. Before he went to work the next evening, Austin's sighting was official. He had discovered a new comet, his third since 1982. But neither Austin nor anyone else yet knew that his object would make an amazingly favorable pass by Earth this month—the closest pass of a major comet since Halley's brushed our planet with its tail in 1910. Astronomers say that this comet has the potential to answer some of our deepest questions about the solar system.

At the age of two, Rodney Richard Dacre Austin was introduced to stargazing. One of his earliest memories is of his mother pointing out the Great Southern Comet of 1947. The fledgling's interest continued to grow under his mother's guidance. "The streetlights used to be turned off at ten p.m.," he recalls. "My mother would take us out to show us the stars and point things out." At the age of twenty, Austin

witnessed a total eclipse of the sun in New Zealand, and from that point on he was hooked.

Later, Austin worked at the University of Canterbury as a lab technician and soon afterward landed a position at Mount John University Observatory, developing photoelectric photometry, a technique measuring the brightness of celestial objects. But it wasn't until 1981, when he started a night job as a camera operator with a local newspaper, that Austin became a regular comet hunter. Leaving work at 2:30 a.m. gave him ample opportunity to search for comets in those last few hours before dawn.

Austin seems to have an almost magical touch when it comes to finding comets. Suppose you had a good, strong telescope, knew all your star charts, and were well versed in the basic techniques of comet hunting—how long would it take to find a new comet? Most experts agree that it would take protracted work totaling between 200 and 500 hours, the kind of legwork

professional astronomers gladly leave to others. "Amateur astronomers," says John C. Brandt, an astronomer at the University of Colorado in Boulder, "are definitely an asset," adding that the majority of professionals don't care who discovers a comet. Most feel it's unnecessary to duplicate the efforts of the amateurs, especially because of the enormous amount of time it takes. For example, it took amateur Don Nachholz, a very successful hunter, 1,700 hours of searching before he bagged his first comet. Discounting the days of his youth, when he would gaze with the naked eye or with binoculars, Austin spotted his first comet after just 151 hours of observation. His first comet was a good find, barely but definitely reaching a brightness that could be spotted by the human eye. Forty-seven hours of observation later, in 1984, he found his second comet, dim in the sky but passing quite close to Earth. Austin was hot on the trail of more discoveries until a nasty back injury in 1987 (sustained while lifting his telescope) put him out of action for nearly two years. Back on his feet in 1989, with a custom-designed mount to manipulate his weighty gear, Austin discovered his third and greatest comet just eight months later.

What is the secret to his success as a comet hunter? "Luck," he says, but there's more to it than that. Austin is one of just two regular comet hunters in his native New Zealand, in Australia, about eight or nine folk put in time as regular searchers. That leaves much of the Southern Hemisphere under the watchful gaze of fewer than a dozen people, cutting down on competition. In addition, Austin uses a self-designed computer program to provide helpful clues, but the computer's role in discovery is nominal. He admits that "recognition of [star] patterns and application" are the keys to success in the field, but the answer lies to safety fully. Finally, like some gruff old lighter pilot who has been asked once too often what the "right stuff" means, the



Austin: Three discoveries and counting.

FIELDS OF VISION

EARTH

By Gary Nul

One third can't earn enough to cover their bills. Some of their children show signs of malnutrition. And psychologists have documented their suicidal urges and high rates of depression. They are not residents of an impoverished Third World country; they are American farmers.

The plight of the nation's farmers, of course, is no news to Americans accustomed to seeing their despairing faces on the evening news—even before the crippling summer drought of 1989. But many of us remain unaware of the forces that have led to the decline of the American farmer. The problems of farmers portend a larger crisis in American agriculture, one that writer Gary Nul brings to light in his new book, *Clearer, Cleaner, Safer, Greener*.

A recent report issued by the Office of Technology Assessment (OTA) predicted that by the year 2000, three quarters of many of the nation's crops will be produced on only 50,000 large farms. By comparison, in 1987 that

same three quarters was produced by 650,000 farms and ranches.

The surviving giants will not be farms as such as factories, employing the latest gene-splicing, embryo-transforming, electronic monitoring, and chemical-dependent technologies. Meanwhile, in less than 15 years 1 million farms will have disappeared.

Other agricultural lands have diminished farmers' ability to make ends meet. To maximize profits through higher yields, farmers are tending to use ever-increasing amounts of pesticides and fertilizers. The result, says Robert Thompson, formerly of the USDA, is that the actual costs per bushel are being driven way up, even as the values of land are being driven down.

The increasing costs are creating a peculiar situation. On one hand the nation is awash with food, but because it is so expensive, many U.S. food processors are going abroad for much of their produce.

In the process, economic principles have been turned topsy-turvy. Farmers

see their food costs rising, yet when yields are particularly abundant the price that the farmer gets for his crop decreases—the basic law of supply and demand.

In fact, modern agricultural practices, while yielding bumper crops under ideal circumstances, have also left American agriculture in a vulnerable position. Large-scale irrigation, upon which much of today's agriculture relies, causes the buildup of salt and mineral deposits as the water evaporates, eventually rendering lands useless.

Monoculture, the practice of planting large areas of land with a single crop, does increase per-acre productivity, but it also makes crops much more susceptible to insects. The systematic cultivation of only certain hybrids has eliminated the vast genetic variety that once existed.

The issue of genetic diversity comes into play in the up-and-coming area of biotechnology. Breeders have used a variety of techniques—and are now beginning to use genetic engineering—to produce crops that grow faster, are less expensive to plant, and have better defenses against insects, diseases, and harsh weather. The following predictions illustrate the trend.

- Steers headed for market could be spliced with a gene allowing them to thrive on low-grade crop residues and fibrous plants that are barely digestible now.
- Botech chickens and cattle could be engineered with an inheritable gene that would make them resistant to disease and infection.
- Breeder chickens that could double their current rate of 140 chicks per year through artificial insemination could be developed.

Genetic engineering is already on the rise. In 1988 scientists injected 2,200 cornseeds with a gene altered vaccine to test its efficacy against the destructive European corn borer. The experiment

American farmers are looking toward a brighter future with gene-altered animals and crops grown without pesticides.

CONTINUED ON PAGE 112





CONTINUUM

THE LURE OF THE HOAX

The other day while passing around in an overstuffed file cabinet I unearthed a file labeled HOAXES. It included a number of clippings about a few of the more embarrassing chapters in the history of science, stories of "scientists"—hacksters really—who duped us, led to us, even cheated us. There were articles about Pittdown man—the infamous missing link between ape and human—a report on a nineteenth-century perpetual motion machine, and several stories about the gentle Tasaday, the Stone Age tribe that had miraculously survived through most of the twentieth century, unnoticed and unasked by contact with the outside world. There was also a book about the Senoi, a Malaysian tribe that reportedly used nocturnal dreams to guide their waking lives.

I began wondering what compelled the hoaxers to undertake such elaborate shenanigans. In the case of the perpetual motion machine, the answer was easy—greed. Charles Redheffer, the self-proclaimed inventor, stood to rise in thousands of dollars if he could persuade enough people to invest in the machine—until Robert Fulton got steamship fame exposed the hoax. Similarly, some anthropologists believe that Manuel Elizalde, Jr., a rich kid from the Philippines, created the Tasaday in order to gain control over their tribal lands and, as it turned out, over the lucrative mining and logging rights that came with it. Elizalde supposedly paid members of a neighboring tribe to masquerade as the Stone Age Tasaday. According to one anthropologist, the Tasaday are merely rain forest clock purchasers who log their time as hunter-gatherers and return to their local villages in time for dinner.

A hoax of a different color was anthropologist Kilton Stewart's claim that the Senoi, a primal tribal people, had developed sophisticated methods of controlling the content of their dreams and that they conducted morning dream clinics in order to glean important information to guide their daily lives. In this case the hoax was not that dreams can be directed but rather that the Senoi had evolved such an elaborate understanding of and reliance on them. It was not until another anthropologist, Robert Derrin, traveled to Malaysia to do his own ethnographic work that the truth came out. Dreams did play an important role in Senoi life, but they

were by no means as integral to the tribe as Stewart claimed. According to G. William Domhoff, a professor of psychology and sociology at the University of California, Santa Cruz, Stewart's description of Senoi dream theory was a "creative amalgamation" of his own ideas of the meaning and power of dreams. "It was Stewart, not the Senoi," Domhoff wrote in his book *The Mystique of Dreams*, "who first proposed that we actually might be able to share and control our dreams for our own pleasure and development rather than merely letting them happen to us." Stewart, Domhoff explains, "was first and foremost a storyteller."

The curious thing about hoaxes is that they quickly take on a life of their own. Indeed, despite Denton's revision of the Senoi dream work, Stewart's myth lives on in a plethora of books and articles. The myth of the Senoi has rooted itself in the popular imagination, Domhoff suggests that the appeal of the Senoi comes from a desire for control. "For Americans," he writes, "human nature is malleable and perfectible. We are what we make ourselves.... Senoi dream theory is an extension of that basic precept to the world of dreams."

Other, more innocent hoaxes may be embraced for similar reasons, speaking to facets of our collective unconscious. Our fascination with perpetual motion machines, for instance, may, in part, be a reflection of our desire for perfection and independence. Symbolically such a machine is a circle, producing far itself whatever it needs to keep going. Similarly, our curiosity about and sudden affection for the gentle Tasaday may reflect our desire for purity and innocence. Could it really be that in the modern world, where frontiers are scarce and certainly polluted, a relic of cultural innocence still prevails? As long as such a tribe exists, we can continue to believe that what we once were we still are—a tribe untainted by modern realities.

Scientific hoaxes may be embarrassing to a profession dedicated to fact, but they serve a purpose. In an age where myth runs a poor second to fact, hoaxes can be a romantic expression of the hope, the love of what might be, that lies deep within us. To paraphrase Abraham Lincoln, it is altogether fitting that they should do so. And it is altogether inevitable that we should find them out.—JANE BOSVELD

CONTINUUM



Moon lights: Can a bright asteroid unleash the centuries-old mystery of flying sparks on the lunar surface?

NIGHT LIGHTS

For centuries observant sky watchers have reported mysterious flashes of light on the surface of the moon. Modern astronomers have noticed the same thing, but nobody has been able to explain satisfactorily how, or why, the moon sporadically sparks. But now Richard Zito, a communications engineer at Lockheed Missiles and Space Corporation, believes he may have finally solved the age-old mystery.

Zito examined the chemical content of Apollo-retrieved moon rocks and

found they contained volatile gases such as helium and argon. Zito suggests that stray electrons, freed when the rocks crack, may ionize the gas, causing the sparks. Indeed, lunar samples, when fractured in the lab, threw off tiny sparks.

What causes rocks on the lunar surface to crack? Zito notes that the flashes are most often seen at the borders between sunlight and shade on the moon, where the surface is being either intensely heated or cooled. This sudden change in temperature may cause thermal cracking, a process similar to

what happens when a frozen mug bursts after boiling water is poured into it. "Another possibility," he says, "is that meteorites may strike the rocks and cause them to crack." Finally, lunar rocks could be fractured by "weak seismic events"—in other words, moonquakes.

—Mark Sunlin

"The best way out is always through."

—Robert Frost

RAIN OF TERROR

Back in 1882 the surprise appearance of the El Niño Effect, an odd, unpredictable climatic shift, threw the world into a mild panic. Heavy rains pelted normally dry Southern California, triggering mudslides. Australia dried up so badly that wildfires burned for months. Now comes word that an extremely severe El Niño effect triggered a 30-year drought that may have helped topple a Peruvian culture 1,500 years ago.

Lorne Thompson, an atmospheric scientist at the Polar Institute at Ohio State University, extracted ice core samples from glaciers high in the Andes. Much to his surprise, he discovered traces of a warmer climate around A.D. 800, probably the signature of an El Niño climatic event. On Peru's coast, University of Florida anthropologist Michael Mosley found signs of severe floods devastating coastal cities of a people known as the Mochea, or Moche. The floods on the coast coincided with the warming trend suggested by the ice core data.

Researchers have cautiously synthesized the two events to produce the following chronicle of the Mochea's downfall: Around A.D. 600 an El Niño appeared, shifting rainfall patterns away from the mountains and toward the coast, where floods ran rampant. Shortly thereafter, a 30-year drought dried up the intricate irrigation systems of the lowland Mochea. The cities were covered in sand dunes and abandoned.

The link between climatic disaster and the downfall of the Mochean culture, cautions Harvard University's Izumi Shimada, is far from certain. He notes that other factors not visible in climatic records could have contributed to cultural collapse. Thompson plans to return to Peru to gather more climatological data to support his case.—Jeff Hecht

"The limits of my language mean the limits of my world."
—Ludwig Wittgenstein



Last of the Mochea: Extinction by fire and water



Oh, bother. Silly old bear need not pour—just make friends with the greater honey guide bird from Africa.

WATCH THE BIRDIE

According to one African legend, Bush men hunting for honey are aided in their search by a wild bird that sings to them as it leads them to the hive. H. A. Isack, an ornithologist at the National Museum of Kenya, says that his countrymen have long insisted that his tale is no myth. "It is hard to believe," says Isack. "But we have documented how the birds guide and communicate with people."

In a three-year study with researcher H. U. Rieger of the Max Planck Institute in West

Germany, Isack observed the birds, known as greater honey guides, leading Boran tribesmen in Kenya to the hives of wild honeybees. The hunt begins, Isack explains, when people from the tribe whistle and a honey guide approaches. A few moments later it flies away. It returns within a minute or two, perches nearby, and calls to the hunters. Tribe members move toward the bird and it takes off again, flying a short distance away and then stopping once more to call.

"This pattern of leading and following is repeated until the bee colony is reached."

explains Isack. "It would normally take the Borans nine hours to find a wild hive. But with the birds' help, it takes only about three hours."

Why do these birds help humans? The researchers found that honey guides benefit from directing people to beehives. "The bird feeds on the wax and larvae left after people have removed the honey," says Isack. "Most of the time, the bird could not get food from the hives unless they were cracked open by humans."

Does their interaction with humans suggest honey guides are unusually intelligent creatures? "I don't think so," says Isack. "They are just highly specialized in one direction. But apart from dogs, I don't know of any other animal that actually cooperates with humans like this." —Sherry Baker

"Learning is the art of ignoring."

—Ella Carell

THE WORST-SMELLING TREES IN THE WORLD

If you think rustlers are found only in old cowboy movies, you're wrong. Out west they're still rustling, but the quarry is trees, not cattle.

In the past few years, city-wide-law-abiding people have turned "bad," hauling out their axes and whacking down fluffy evergreens to save a few dollars in Christmas expenses. Some even uproot trees, bushes, or cacti to spruce up their yards or gardens. Unfortunately, the greenery they rip off more often than not belongs to cit-

rus, parks, ski areas, and landscape companies.

When Colorado Springs lost about \$2,000 in trees to rustlers last year, the city called on a former trapper and pheromone researcher by the name of Major Doddicker for help. His solution: a maddening mixture of fox urine, skunk essence, and other foul odors he calls Soroogo, which is guaranteed to stop tree poachers.

"Our product is a small people don't get used to," says Doddicker. A light spray at the base of a tree sticks for about six weeks before gradually diminishing. Soroogo has also been used by building owners, who dab it along doorways and openings to keep vagabonds at bay. A pint costs \$6.50, a gallon retails, \$45. —Peggy Noonan

"I never knew whether to pity or congratulate a man on coming to his senses."

—William Makepeace Thackeray



Beats the acid of poachers. One whiff will do it.



CONTINUUM



A wolf-in-dog's clothing—superdogs from the heart of the bush are giving South Africa's law enforcement officers a brand new weapon in that country's continuing struggle.

DOGS OF WAR

At first glance, Peter Georhtsen's dogs look similar to German shepherds. But the dogs' extra-long legs and tendency to howl reveals they have ancestors far removed from Rin Tin Tin's family tree—wolves.

Georhtsen, a former professor of genetics, creates "wolf dogs" in South Africa. The canines, which weigh between 90 and 110 pounds, are one-sixth gray wolf. Georhtsen insists that he is not interested in producing wolflike dogs. "We only want some of the wolf's characteristics," he says, such as improved stamina, superior coat, stronger teeth, and better resistance to heat.

But according to a recent report in the *London Times*,

wolf dogs with fierce tempers and five times the strength of German shepherds are being bred to assist South African police in crowd control. At least one wolf dog, the *Times* says, is already patrolling along Johannesburg streets helping police capture criminals. The Johannesburg police department declines comment, and Georhtsen denies that any of his dogs are being used by the city's law enforcement officers.

The *London Times* also stated that wolf dog experiments have been carried out by the South African army and that one of its first-generation efforts, named Jungie, was so strong it took three handlers with chains to cage it. Commandant Kees Arnold of the South African Defense Force's dog training station,

located deep in the bush, will say only that the army has tried wolf dog research. "But I can't talk about it," he says. "It's not allowed."

—Shary Baker

WHAT THEY DID FOR LOVE

Giving chocolate to a loved one may be modern in origin, but the idea behind it may stretch back over millions of years. In fact, hominid males may have been presenting their ladies with gastronomic delicacies as "nuptial gifts" as far back as *Australopithecus africanus* some 3.5 million years ago, according to Sue T. Parker, an anthropologist at Sonoma State University in California.

Instead of giving chocolates, *Australopithecus* may

have wooed his sweetheart with other high-calorie delicacies of the day. "Brains are an interesting candidate for nuptial feeding gifts because they are the food most coveted and least shared among chimpanzees," explains Parker, who notes that even with tools, cracking open the skulls of prey carcasses "is hard work."

Parker's theory is actually an extension of popular anthropological thinking. *Australopithecus* were the first primates to develop a bipedal stance, leading researchers to believe they were the forerunners of the human family. Parker thinks that if *Australopithecus* were proto-humans, then sharing food could have led to the earliest expressions of human culture. Other primates, such as chimps, rarely share food.

"Through courtship or nuptial feedings, males could entice females to go away with them where competing males were not a threat," says Parker. —Mark Sunlin



The thoughtful savage: He brings home brains.

LOST PATROL

In 1942 a convoy of six P-38 fighter planes and two B-17 bombers en route to England was in big trouble. Low on fuel, their communications disrupted by a Nazi U-boat, the planes were forced down on a glacier in southern Greenland. All crew members survived, hiked to the coast, and were rescued. But the airplanes remained where they were and became slowly buried under 250 feet of ice and snow.

This month, however, Atlanta residents Phil Epps and Richard Taylor, founders of the Greenland Expedition Society, hope to retrieve the World War II warbirds from their deep freeze. Having located the planes with subsurface radar in 1988, they plan to drill 15-foot-wide shafts down to the planes. Once they reach each plane, they will erode the ice surrounding it and hoist it up the shaft, piece by piece.

Why go to so much trouble

for a bunch of old war-planes? In today's market, restored fighter planes fetch up to \$1.8 million apiece, while bombers can bring in up to \$600,000. Taylor and Epps have already sold four of the airplanes to hopeful speculators for as little as \$268,000. "We don't know if they're crushed," says Gai Lund, a Seattle-based engineer specializing in underground excavations. "But even if they're squeezed a little, they'll still be pretty valuable." —Phil Scott

LOOK, MOM, IT'S A Y!

Until now, pregnant women who wanted to know the sex of their unborn children had to submit to risky tests that could end in miscarriages or infection. But doctors in England and Italy have developed a more benign way to determine a fetus's sex—with a \$10 blood test.

The technique developed by Dennis Lo and his colleagues at John Radcliffe



Having baby: Determining if it's a he or a she now takes place in the womb without endangering the fetus.

Hospital in Oxford and at the University of Milan relies on amniocentesis. Knowing that cells from the fetus pass through the placenta and into the mother's bloodstream, they drew blood samples from 19 mothers-to-be. The blood was subjected to a highly sensitive sampling technique to look for DNA sequences unique to the Y, or male, chromosome. Among the 19 pregnant women tested, the researchers found Y-chromosome sequences in 12, all of whom turned out to be carrying boys. The seven women without traces of Y

chromosomes were carrying girls. The test scored a bullseye in every case.

Lo expects his method to become an important preliminary test in searching for genetic diseases in male babies. —Bill Lawton

"No man is exempt from saying silly things, the mischief is to say them deliberately."

—Michel de Montaigne

"Culture is roughly anything we do and the monkeys don't."

—Lord Raglan



Mingus II. Abandoned in Greenland 48 years ago, a convoy of World War II airplanes will be coming home.

CONTINUUM



After being plucked from its decaying orbit, NASA's LDEF has unloaded part of its freight into America's classrooms.

INVASION OF THE SPACE TOMATOES

It sounds like a plot hatched by a mad scientist: Take tomato seeds that have been orbiting Earth for five and a half years, possibly undergoing all kinds of weird mutations from cosmic rays, and set them loose among America's schoolchildren.

Oddly enough, it's true. Last January when NASA plucked the Long Duration Exposure Facility (LDEF) from its decaying orbit, among its cargo were 12.5 million tomato seeds. Two months ago NASA distributed the entire freight to 750,000 classrooms, where some 5 million students will plant the seeds to see how the offspring have been affected by radiation.

Students will be expected to grow several generations of plants and record the number and types of mutations that occur. NASA has

suggested a variety of experiments ranging from those suitable for elementary-school students to college-level studies of chromosomal rearrangements.

It's possible, says J. Gregory Martins, director of NASA's seed project, that interesting new strains of tomatoes may be discovered. As an example, Martins says, "when the seeds of a white grapefruit were irradiated, no one knew that a pink grapefruit would result. But it did."

In most grade-school science experiments, the intended results are already known in advance. The tomato experiments, on the other hand, are "open-ended. This is more of an educational experience than a controlled scientific experiment," says Martine. "We can only be surprised!" —Steve Nash

"Must you know the reason for everything?"

—Charlie Chaplin

MARCUS AURELIUS, M.D.

Around A.D. 200 a 60-foot-long Roman ship sank off Sicily's precipitous eastern shore. What makes the ship of particular interest to archaeologists, however, is evidence that suggests a doctor was onboard—specifically, an eye surgeon.

British maritime archaeologist David Gibbins of Cambridge University points out that although some 1,000 wrecks from ancient days have been excavated, none have produced a doctor's medical kit before. It seems more likely that instead of looking at a crew member, we are looking at a traveling doctor," he says. Gibbins thinks that the doctor was on an emergency call and hitched a ride aboard the ill-fated ship.

The instruments found among the wreck's debris revealed the doctor's professional specialty: Three scal-

pel handles cast from finely made bronze were found, two of the handles had a blunt dissector blade at one end and a slot at the other and that held an iron blade. The third handle, says Gibbins, was designed to hold a needle. "From the graves of Roman doctors, we've found different kinds of scalpels used for surgery," he says.

"We know that the type of instruments found on the ship were associated with ophthalmologic surgery."

These three tools, Gibbins speculates, were all an eye specialist needed to pursue his trade. "Roman eye specialists did astonishing things with their basic tools," says Gibbins. "They could perform cataract surgery, treat cataracts, and remove cataracts—all without the benefit of anesthetics, of course."

—Sherry Baker

"If two surgeons don't make a night, try three."

—Laurence J. Peter



Ship of fools: When a Roman merchant galley went down centuries ago, it preserved a unique record of surgical methods.



The weeds of change: Wealthy reefer growers are unwittingly boosting the yields of agricultural researchers in Oregon.

POT LUCK

Researchers at the Southern Oregon Experiment Station have a lot in common with the state's marijuana farmers: Both are concerned with developing high-yield crops and improved growing techniques. But one huge gulf separates them—money. The billions of dollars asked in annually by thriving marijuana plantations allow pot farmers to undertake some advanced agricultural experimentation. By comparison, the experiment station—concerned with fruits, cereals, and forage grasses for live-

stock—scrapes by on limited funds from Oregon State University and the U.S. Department of Agriculture.

A couple of years ago the station's superintendent, Ron Mobley, decided that it was high time to do something about the situation. "We're always under a budget crunch," says Mobley, "and I kept reading in the paper about how a pot plantation was raided. We got curious about what happened to all the equipment confiscated by the police."

Sergeant Jim Dukas of the Oregon state police told Mobley that the equipment

was usually carted off to a landfill or smashed, or auctioned off at the sheriff's office at about 10 percent of its original cost. Mobley suggested that the state police donate the equipment to the impoverished experiment station. Since then, the station has collected about \$25,000 worth of free equipment, including grow lights, irrigation gear, portable generators, rakes, shovels, and laboratory glassware. "It's been like Christmas," Mobley says.—Curt Wohleber

"Why futz with rules? Why not just get it done?"

—Frederick Barthelme

ROLL OVER, SEGOWIA

Guitar virtuoso Andrés Segovia was picky about his instruments. He chose his guitars from a selection made especially for him. Surprisingly, before he died in 1987, Segovia tried a new kind of classical guitar designed by physicist Michael Kasho and was actually pleased with it. Kasho's instrument, Segovia told him, possessed the versatility of one of his favorite guitars, with the docility of another, and was better than both combined.

Segovia's rare review was the highlight of Kasho's 25-year quest to design the perfect classical guitar. The Florida State University professor redesigned the 3,400-year-old instrument by "applying physical mechanics" to the real world, he says, first studying how sound waves behave within the confines of a guitar's hollow body and then changing its structure to

coax clearer sounds from the instrument.

Kasho-designed guitars are conventional in appearance but feature internal changes, such as varying soundboard thickness and the placement of internal frame members. These changes offer more bass and an overness of tone throughout the instrument's four-octave range. Perhaps the greatest advantage of Kasho's design lies in the instrument's ability to prolong a note. In most acoustic guitars, a single note fades quickly. But Kasho's guitar lets a player sustain a note longer. As a guitarist, I'd never had it before. But now, I'd never be without it," says performer Kurt Rodemer.

Kasho's guitars, made by "some superbine builders," says the designer, cost between \$3,000 and \$12,000, roughly comparable to a top-flight classical guitar that retails for \$5,000 to \$10,000.

—J. A. Dedeker



The physics of moving sounds: Kasho and his creation.

CONTINUUM

FORGET ME NOT

On sleep opens a bump on the head causes temporary, selective amnesia. Victims forget who they are and where they live, yet continue living relatively normal lives. In real life, most amnesia victims aren't so lucky. They suffer extreme, often incapacitating losses of memory or identity. Now a step toward a cure may have been made by a team of researchers at the University of California, San Diego, that has located an area of the brain crucial to memory storage.

Gary Press used magnetic resonance imaging (MRI)—a technology that allows researchers to examine and explore soft tissues in the body—to study the brains of four healthy men and of three other men crippled by amnesia. Rather than perform the MRI scans with the patients lying down in a neutral position, Press tilted their heads back 20°. This position revealed a hockey-stick-shaped section of the hippocampal formation (an area of the brain associated with long-term memory) in unprecedented detail in living subjects. "This has never been done before in living people," Press says. "It allows us to see exactly what damage this region may have."

The damage, it turned out, was considerable. When Press looked at the long-term memory bank of his amnesia patients, he found it was only about half the size of the corresponding hippocampal formation in the "normal" group, suggesting severe damage. What caused the abnormal-



Rocks around the clock. They said it couldn't be done, but rock hound Bowling found evidence of ancient Earth in a tiny grain of crystal.

ity? "No one really knows," Press says. "It might be a lack of oxygen and blood flow to the brain or some other disease-associated degenerative process in the brain." —Bill Lawren

"Nose is manufactured in the city, just as goods are manufactured. The city is the place where nose is kept in stock, completely detached from the object from which it came."

—Max Picard

To determine their age, Bowling ground up samples of granite and tonalite to extract zircon grains, tiny crystals weighing just 20 to 100 micrograms apiece, and analyzed them in the Sensitive High-Resolution Ion Microprobe (SHRIMP). When SHRIMP dated Bowling's rocks, the geologist was surprised. They turned out to be 3.96 billion years old. That's almost 200 million years older than any other rock yet found on our planet.

Because our solar system is believed to have originated about 4.6 billion years ago, these ancient rocks probably formed when the earth was a geologic youngster of just half a billion years. "This is a period of Earth's history where we know next to nothing," Bowling says. "By studying the geochemistry and geomorphology of these rocks, we may find clues about Earth's earliest crust."

Bowling plans to lead a scientific team back to Canada next summer to search for more ancient rocks. "Unless I was exceedingly lucky and the last rock I picked up was the oldest in the world," he says, "I suspect we'll find even older ones."

—Sherry Baker

"If you consider the contribution of plumbing to human life, the other sciences fade into insignificance."

—James Garman

"The reason that the all-American boy prefers beauty to brains is that he can see better than he can think."

—Farrar Fawcett

ROCKS OF AGES

When Washington University geologist Samuel Bowling trekked through Canada's Northwest Territories on a geologic mapping expedition in 1983, he didn't think the rock samples there were especially old. But a recent high-tech test proved they were older than Bowling's wildest dreams. In fact, they appear to be the most ancient rocks ever discovered on Earth.



ARTICLE

THE KILLING FIELDS: LATTER-DAY PLAGUES



*AIDS may be just
the beginning. Experts fear a rash
of worldwide epidemics*

BY KATHLEEN McAULIFFE

"An entire hospital has been wiped out and we still don't know what's behind the outbreak. Can you find out for us?"

It was not the sort of phone call Ken Johnson relishes, but as a world-renowned expert on tropical infections at the U.S. Centers for Disease Control (CDC), he reluctantly bid farewell to his wife and boarded the next plane for Central Africa. There, near the left bank of the Ebola River in northwestern Zaire, a horrible fever had sprung seemingly from nowhere. The year was 1976, and as

Johnson arrived with an international team of investigators, fleeing villagers were being turned back at gunpoint by government authorities ordered to quarantine the entire province. None of the community would go near the bush hospital where the outbreak began. So the party of foreigners—wearing surgical gowns, gloves, and face masks for protection—set off in jeeps to visit the sick in scattered villages.

"For two to three weeks, we really held our breath," says Johnson, who now works at National Biophys-

PAINTINGS BY GEORGE TOOKER

lans, Inc. in Rockville, Maryland. "We saw very rapidly that the disease had an eighty to ninety percent fatality and we had no idea how it was being transmitted." Compounding their fears, members of the team—all of whom had volunteered for the mission—kept getting splattered with blood while collecting medical samples. Meanwhile the villagers were unwittingly inviting death by participating in burials that involved inhaling of mists of contact with the deceased.

To Johnson's relief, the tribal chief's awe of the gravity of the threat, banned the ritual, and mandated stringent disease control practices used since antiquity in Africa to thwart the ravages of smallpox. The infected were isolated in a hut, where they only contact with the outside world was through food and water slipped under the door. "If they walked out," says Johnson, "like, if not, the hut was set on fire."

Several hundred deaths later, the disease vanished as mysteriously as it had appeared. The researchers eventually determined that it was a blood-borne viral infection—unprecedented in medical history—prevalent at the hospital by the use of a few unsterilized syringes to administer hundreds of injections, and possibly spread by sex with infected individuals.

Such an outbreak would be unthinkable at a modern, well-equipped hospital in the United States or Europe. But that hasn't stopped Johnson from pondering alternative "what-ifs" scenarios—that haunt him like a recurrent nightmare more than a decade later. "What would we have done if the virus was spread by cough droplets in the air?" he asks. "If that were the case, there's no doubt in my mind that Ebola fever could have qualified as the Andromeda strain and we'd all have died."

Such a disaster may not be as remote as commonly thought. As Nobel laureate Joshua Lederberg of Rockefeller University warns in a leading medical journal: "Most people today are grossly overoptimistic with respect to the means we have available to forestall global epidemics comparable with the Black Death of the fourteenth century or on a lesser scale the influenza of 1918, which took a toll of millions of lives."

In a span of less than 15 years, the United States alone has been struck by a wave of new infections. Toxic shock syndrome, Legionnaires' disease, AIDS, Lyme disease—all have emerged from obscurity to become household

names. And while no one has a crystal ball, infectious disease experts fear an escalation of new—and possibly more deadly—epidemics in the future. Indeed, some candidates already loom on distant horizons—isolated in tiny geographical pockets. Others—notably an insect-borne infection that can be fatal to children—are rapidly encroaching on American territory.

Why the explosion of pathogens? If there were the Dark Ages rather than the Space Age, we would undoubtedly wonder if God was punishing us for our sins. To be sure, changing mores associated with sex and drug use have contributed to the spread of highly lethal diseases—AIDS being a leading example. But many other global forces have also conspired against us.

With air travel becoming increasingly affordable, infectious agents that would have been confined to one corner of the world just a few decades ago are now jumping across continents at near-supersonic speeds.

The plucky modern man at a historical crossroads—much like New World inhabitants at the dawn of the Age of Discovery—that makes us uniquely vulnerable to novel plagues. As William McNeill, a noted professor of history at the University of Chicago and author of *Plagues and Peoples*, points out, "Corries did not conquer the Aztecs—it was the smallpox that the Spaniards brought with them." Whenever an unexposed population comes into contact with a new, lethal infectious agent, the death toll is notoriously high, leaving only a

tiny subgroup of survivors composed largely of resistant individuals. Just 150 years after the conquistadores arrived in central Mexico, up to 90 percent of the indigenous population had perished from smallpox and other European diseases—a frightening reminder of the threat posed by today's globe-trotting microbes.

Our encroachment on rain forests and other wilderness areas is also bringing humans into direct contact for the first time with potentially dangerous pathogens harbored by wild animals. In the U.S. Northeast, for example, new housing developments infringing on natural deer habitats have been implicated in the explosion of Lyme disease—a debilitating arthritis condition transmitted by a deer-borne tick.

Just as ominous, a favorite breeding ground of microorganisms—the slummy tropics—now sustains the densest human population ever. Of particular concern is the unprecedented emer-

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REPORT



gence of "mega-crisis" of 5 million or more people in developing parts of the tropics, where malnutrition and poor sanitation give microbes a further edge. Says McNeill, "Swelling numbers at the top of the food chain constitute a magnificent feeding ground for microbes."

Adding to this peril, the United States and other nations are withdrawing support for infectious disease surveillance around the world. Such biological "listening posts" are critical for detecting epidemics early on—especially in primitive cultures at high risk for emerging plagues.

Before beating a hasty retreat to civilization, however, be forewarned that technology is no safeguard against the rising risk of infection—and may even increase our chances of succumbing. Ironically, inventions designed to ease our lives can sometimes backfire, providing microbes with more lethal routes of entry into the body. Consider *Staphylococcus epidermidis*, a bacterium long viewed as harmless, which is now a leading cause of infection in intensive care units. "Tough new strains that don't respond to antibiotics routinely find their way into patients' veins through intravenous tubes and sometimes even cobrize artificial-heart valves. "It's a terrible problem and can be fatal for patients who are very ill to begin with," says Clare Broome, chief of the CDC's

special pathogen branch.

The bacterium that killed 29 people who attended a 1976 American Legion convention in Philadelphia may also have gained a technological boost. Recent outbreaks of the disease have been traced to faulty ventilating systems, which permit the pathogen to proliferate. This is not to imply—public perceptions to the contrary—that the bacterium sprang out of thin air. After isolating the culprit at the convention, the CDC found similar samples in its vaults that came from people presumed to have died from pneumonia. "In the past," says Broome, "Legionnaires" probably occurred and was mistaken for viral pneumonia."

Likewise, toxic shock syndrome owes its notoriety to a more absorbent tampon introduced by Rely in 1980. Before then, according to CDC epidemiologist Benjamin Schwartz, the bacterial infection probably struck infrequently—and hence was likely mistaken for scarlet fever, which has similar symptoms.

As AIDS and Ebola fever clearly demonstrate, however, some diseases are true originals, emerging unheralded in man. As such, they pose a formidable challenge to medical science—and tracing their evolution involves detective work of the highest order. Although there are often more clues than answers, high on the suspect list are patho-

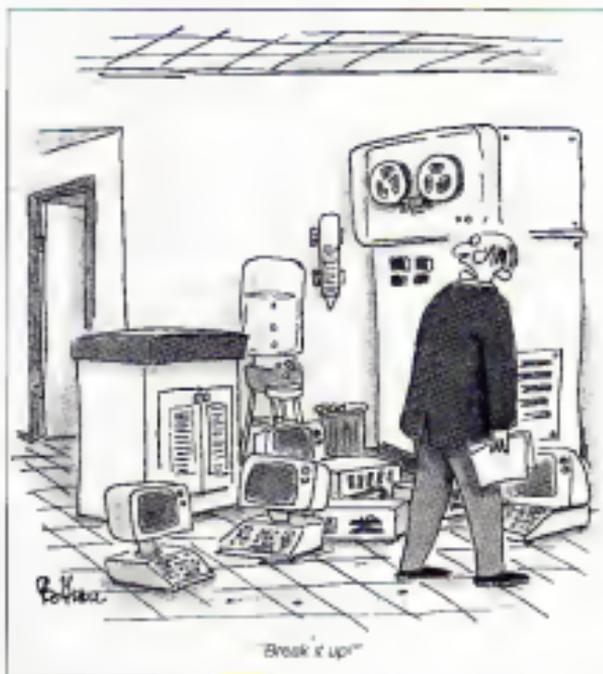
gens that appear to have jumped from an animal to a human host.

An intriguing example from the past: The oldest documented case of syphilis has been tentatively traced to a bear that lived 11,500 years ago in what is now Indiana. That is more than 5,000 years before there is clear-cut historical evidence of the first outbreak in man. The bear's bones, uncovered in 1957, had holes and other signs of the venereal disease—a possibility further supported by an antibody test. Although more studies of both human and animal remains could alter the picture, researchers now speculate that a bear bite, or contact with a contaminated carcass, could have unleashed the scourge of syphilis upon mankind.

In a similar vein, a primate is now suspected of having played a key role in the eruption of AIDS. The evidence: Large numbers of seemingly healthy African green monkeys living in the wild carry antibodies against a closely related virus. "Possibly facilitating virus transmission from animal to man," says Gerald Myers of Los Alamos National Laboratory in New Mexico, "there was a sharp rise in the exportation of monkeys from Africa into the United States in the Sixties for medical research."

The origin of Ebola fever is more perplexing. While Johnson struggled to stamp out the epidemic in Zaire, an identical disease broke out in another rural hospital in the southern Sudan—600 miles away. Initially, it was assumed that the same virus had caused both epidemics. But to everyone's shock, laboratory analyses later revealed that two distinct—though related—strains of viruses were involved. "It's a bizarre biological coincidence," says Johnson. "A disease never before encountered in recorded time strikes with the same vengeance, in the same season, six hundred miles apart. It almost makes you think that some environmental factors were just right for the family of viruses to explode on the scene."

The plot thickens: Last January a Swedish tourist returning from a vacation in Kenya mysteriously contracted another related virus—and, after hovering at the edge of death for two weeks, appears (as of this writing) to be recovering in the intensive care unit of a hospital south of Stockholm. Only a month earlier, Ebola fever made an even odder appearance: the time striking monkeys imported into the United States from the Philippines. This makes Johnson wonder whether a primate is a key link in the propagation of the disease in Africa. But, as he cautions, an exhaustive search for infected animals in the vicinity of the stricken villages turned up negative. "Frankly, we're scratching our heads about this," he says. "Ebola fever is as lethal to monkeys as it is to man, and you'd



"Break it up"

FICTION

AND THE ANGELS SING

BY KATE WILHELM



Eddie never left the office until one or even two in the morning on Sundays, Tuesdays, and Thursdays. The North Coast News came out three times a week, and it seemed to him that no one could publish a paper unless someone in charge was on hand until the press run

PAINTING BY MICHAEL PARKES

Effortlessly as a butterfly, she drew herself up into the air, her wings flashing light, gleaming, and appearing to vanish as the light reflected one way and another.

He knew that the publisher, Stuart Wicks, didn't particularly care, as long as the advertising was in place, but it wasn't right, Eddie thought. What if something came up, something went wrong? Even out here at the end of the world there could be a late-breaking story that required someone to write it, to see that it got placed. Actually, Eddie's hopes for that event, high six years ago, had diminished to the point of needing conscious effort to recall. In fact, he tried to see his editor's face before he packed it in.

This night, Thursday, he read his own words and then belatedly, "Where is she?" She was Ruthie Johnson, and she had spotted frequency with one *e* and an *e*. Eddie stormed through the deserted outer office, looking for her and caught her at the door just as she was wrapping her vampire cloak about her thin shoulders. She was thin, her hair was cut too short, too close to her head, and she was too flighty-headed of him. And, he thought with bitterness, she was crazy, or she would not wait around three nights a week for him to catch her at the door and give her hell.

"Why don't you use the goddamn dictionary? Why do you correct my copy? I told you I'd wing your neck if you touched my copy again!"

She made a whispering noise and looked past him in terror, down the hallway into the office.

"I'm sorry, I didn't mean." Fast as a quail after her, she fled out into the storm that was still howling. He hoped the goddamn wind would carry her to Australia or beyond.

The wind screamed as it poured through the outer office, scattering a few papers, setting a light ashore on a chair. Eddie slammed the door against it and surveyed the space around him, detesting every inch of it at the moment. Three desks, the flutney papers that Mrs. Rendale would leave out because anything on the floor got heaved out. Except dirt, she seemed never to see quite all of it. Next door to the pres-

ence room, people were doing things, but the staff that put the paper together had left now. Ruthie was always next to last to go, and then Eddie. He kicked a chair on his way back to his own cubicle, slushing the ink-wet paper in his hand, well aware that the ink was smearing onto skin.

He knew that the door to the press-room had opened and softly closed again. In there they would be saying Fat Eddie was in a rage. He knew they called him Fat Eddie, or even worse, behind his back, and he knew that no one on Earth cared if the North Coast News was a mess except him. He sat at his desk, scowling at the editorials—*one* of his better ones, he thought—and the word frequency leaped off the page at him, nothing else registered. What he had written was "At the time of year the storms beat down onshore with such regularity, such frequency, that it is as if the sea and air are engaged in the final battle" got better, but he put it aside and listened to the wind. All evening he had listened to reports from up and down the coast, expecting storm damage, light outages, winds, seaswelling. At midnight he had decided it was just another Pacific storm and had wrapped up the paper. Just the usual Highway 101 under water here and there, a tree down here and there, a few deaths, no deaths.

The wind screamed and let it up, caught its breath and screamed again. Like a kid having a tantrum. And up and down the coast the people were like parents who had seen too many kids having too many tantrums. Ignore it and it goes away, and then get on about your business, that was their attitude. Eddie was from Indianapolis, where a storm with eighty-mile-per-hour winds made news. Six years on the coast had not changed that. A storm like this, by God, should make news!

Still scowling, he pulled on his own nincal, a gray black wallpaper of garment that covered him to the floor. He added his black, wide-brimmed hat

and was ready for the weather. He knew that behind his back they called him Mountain Man, when they weren't calling him Fat Eddie. He secretly thought that he looked more like The Shadow than not.

He drove to Connolly's Tavern and had a couple of drinks, sitting alone in glass slush, and then offered to drive Truman Cox home when the bar closed at two.

The town of Lewisburg was south of Astoria, north of Cannon Beach, population nine hundred eighty-four. And at two at the starting they were all sleeping, the town blacked out by rain. There were the flicking night-lights at the drugstore, and the lights from the newspaper building, and two traffic lights, although no other traffic moved. Rain pelted the windshield and made a river through Main Street, cascaded down the side streets on the left, came pouring off the mountain on the right. Eddie made the turn onto Third and hit the brakes hard when a figure darted across the street.

"Jesus!" he gawked as the car skidded, then caught and righted itself. "Who was that?"

Truman was peering out into the darkness, nodding. The figure had vanished down the alley behind Sara's Restaurant. "But it was the Boland girl, the young one. Not Norma. Following her sister's footsteps."

His tone was not condemnatory, even though everyone knew exactly where those footsteps would lead the kid

She sure earned whatever she got tonight," Eddie said with a grunt and pulled up into the driveway of Truman's house. "See you around."

"Yep. Probably will. Thanks for the lift." He gathered himself together and made a dash for his porch. But he would be soaked anyway, Eddie knew. All it took was a second out in the driving rain. That poor, stupid kid, he thought again as he backed out of the drive, retraced his trail for a block or two, and headed toward his own little house. On impulse he turned back and went down Second Street to see if the kid was still scurrying around, at least he could offer her a lift home. He knew where the Bolands lived, the two sisters, their mother, all in the trade now, apparently. But God, he thought, the little one couldn't be more than twelve.

The numbered streets were parallel to the coastline. The cross streets had become wind tunnels that rocked his car every time he came to one. Second Street was empty, black. He breathed a sigh of relief. He hadn't wanted to get in-

voiced anyway, in any manner, and now he could go home, listen to music for an hour or two, have a drink or two, a sandwich, and get some sleep. If the wind ever let up, he slept very poorly when the wind blew this hard. What he most likely would do was finish the book he was reading, possibly start another one. The wind was good for another four or five hours. Thinking the way, he made another turn or two and then saw the kid again, this time sprawled on the side of the road.

If he had not already seen her once, if he had not been thinking about her, about her sister and mother, if he had been driving faster than five miles an hour, probably he would have missed

her. She lay just off the road, face down. As soon as he stopped and got out of the car the rain hit his face, streamed from his glasses, blinding him almost. He got his hands on the hood and hauled her to the car, yanked open the back door and deposited her inside. Only then he got a glimpse of her face. Not the Boland girl. No one he had ever seen before. And as light as a shadow, he hurried around to the driver's side and got in, but he could no longer see her nose from the front seat. Just the lumpy black raincoat that gleamed with water and covered her entirely. He wiped his face, cleaned his glasses, and looked in the seat, he couldn't reach her, and she did not respond to his voice.

He cursed bitterly and considered her next move. She could be dead, or dying. Through the rain-soaked windshield the town appeared uninhabited. It didn't even have a police station, a clinic, or a hospital. The nearest doctor was ten or twelve miles away, and in the weather. . . . Finally he started the engine and headed for home. He would call the state police from there. He decided. Let them come and collect her

He drove up Hammer Hill to his house and parked in the driveway as the walk that led to the front door. He would open the door first, he had decided, then come back and get the kid, either way he would get soaked, but there was little he could do about that. He moved fairly fast for a large man, but his fastest was not good enough to keep the rain off his face again. If it would come straight down, the way God meant rain to fall, he thought, fumbling with the key in the lock, he would be able to see something. He got the door open, ficked on the light switch, and went back to the car to collect the girl. She was as limp as before and seemed to weigh nothing at all. The slicker she wore was hard to grasp, and he did not want her head to fall about for her to brain herself on the porch rail or the door frame, but she was not easy to carry, and he grunted although her weight was insignificant. Finally he got her inside, and kicked the door shut, and made his way to the bedroom, where he dumped her on the bed.

Then he took off his hat that had been useless, and his glasses that had blinded him with running water, and the raincoat that was leaving a trail of water with every step. He backed off the Navaho rug and out to the kitchen to put the wet coat on a chair, let it drip on the linoleum. He grabbed a handful

of paper toweling and wiped his glasses, then returned to the bedroom.

He reached down to remove the kid's raincoat and jerked his hand away again. "Jesus Christ!" he whispered and backed away from her. He heard himself saying it again, and then again, and stopped. He had backed up to the wall, was pressed hard against it. Even from there he could see her clearly. Her face was smooth, without eyebrows without eyelashes, her nose too small, her lips too narrow, hardly lips at all. What he had thought was a coat was part of her. It started on her head, where hair should have been, went down the sides of her head where ears should have been, down her narrow shoulders, the backs of her arms that seemed too long and thin, almost boneless.

She was on her side, one long leg stretched out, the other doubled up under her. Where there should have been genitalia, there was too much skin, folds of skin.

Eddie felt his stomach spasm, a shudder passed over him. Before he had wanted to shake her, wake her up, ask questions, now he thought that if she opened her eyes, he might pass out. And he was shivering with cold. Moving very cautiously, making no noise, he edged his way around the spasm to the door, then out, back to the kitchen where he pulled a bottle of bourbon

from a cabinet and poured half a glass that he drank as fast as he could. He stared at his hand. It was shaking.

Very quietly he took off his sodden shoes and placed them at the back door next to his waterproof boots that he miserably forgot to wear. As soundlessly as possible he crept to the bedroom door and looked at her again. She had moved, was now drawn up in a huddle as if she was as cold as he was. He took a deep breath and began to inch around the wall of the room toward the closet, where he pulled out his slippers with one foot and eased them on, and then tugged on a blanket on a shelf. He had to let his breath out; it sounded explosive to his ears. The girl shuddered and made herself into a tight ball. He moved toward her slowly, ready to turn and run, and finally was close enough to lay the blanket over her. She was shivering hard. He backed away from her again and this time went to the living room, leaving the door open so that he could see her, just in case. He turned up the thermostat, retrieved his glass from the kitchen, and went to the door again and again to peer inside. He should call the state police, he knew, and made no motion toward the phone. A doctor? He nearly laughed. He wished he had a camera. If they took her away and they would, there would be nothing to show, nothing to prove she had existed. He thought of her picture on the front page of the North Coast News and snorted. The National Enquirer? The time he muttered a curse. But she was now. She certainly was now.

Mary Beth, he decided. He had to call someone with a camera, someone who could write a decent story. He dialed Mary Beth, got her answering machine, and hung up, dialed it again. At the fifth call her voice came on. "Who the hell is this, and do you know that it's three in the fucking morning?"

"Eddie DeLooort. Mary Beth, get up, get over here, my place, and bring your camera."

"Get Eddie? What the hell—"

"Right now, and bring plenty of film." He hung up.

A few seconds later his phone rang, he took it off the hook and laid it down on the table. While he waited for Mary Beth, he surveyed the room. The house was small, with two bedrooms, one that he used for an office, on the far side of the living room. In the living room there were two easy chairs covered with fine, dark green leather, no couch, a couple of tables, and many bookshelves, all filled. A long cabinet held his sound equipment, a stereo, hundreds of albums. Everything was neat, arranged for a large man to move about easily, nothing extraneous anywhere. Underfoot was another Navaho rug. He knew the back door was secure



ARTICLE

Welcome to the year 2029, when insect-size robots will construct, transform, and clean everything from ranch houses to silk suits

NO ASSEMBLY REQUIRED

BY FRED HAPGOOD



ANNUAL REPORT OF MICROBOT TECHNOLOGY, INC.

Fifteen years ago, almost to the day, you're truly was an unemployed engineer trapped in the great LA Gridlock of 2014, daydreaming in my car, waiting for the red lights drop. I was musing about technologies past and present and found myself playing (intellectually) with two very different kinds of engineering: social robotics and micro-mechanics. Social robotics is the self-governing activity of thousands of interacting machines. That kind of engineering was beginning to appear on Earth in such dramatic applications as the self-organizing herds of cars in which we now do our commuting, as well as in our schools of submarines for underwater mining and fisheries management and flocks of helicopters for meteorological and agricultural research, all autonomous to different degrees.

Micromachines were constructed using the same manufacturing techniques that made possible the miniaturization of electronics since the late 1950s. That is, they would print, or print, layers of chemicals with the right electrical characteristics, one atop the other, and then control how those layers interacted by etching lines and other shapes into them. This technique avoided the major obstacle to building on a small scale: the difficulty of handling very small wires and other components.

In 1965 H. C. Nathanson built the first micro-mechanical device at Westinghouse Labs. It was a tiny metal cantilever beam that was intended to work as a mechanical transducer to filter certain frequencies out of an electrical signal. Unfortunately, Nathanson couldn't overcome the metal fatigue that rapid vibration created in his beams.

The micromachine breakthrough came about thanks to silicon—stronger than steel and highly reliable for minute construction projects. During the next 15 years silicon micromechanics advanced to include the manufacture of miniature nozzles, tweezers, valves, channels, springs, diaphragms, gears, and levers. Engineers built tiny instruments from these, including barometers, inserted in tubes to measure turbulence and velocity in fluids, and acoustic sensors—miniature microphones—for medical diagnostics.

During the 1980s a number of research centers contributed to the growth of the micromachines field. Perhaps the most impressive development, however, was the creation of tiny electrostatic motors. Too weak to be practical on a large scale, they perform fine on a micro scale. Conventional electric motors use electromagnets to spin their rotors. Such magnets were not practical on a micro scale. Instead of using electromagnets, micromotors employ external switches made of silicon to

move positive and negative electrical charges around the opposite sides of a circle of six fixed electrodes. As the charges move around this circle, they pull a statically charged rotor with them. The rotor, as in a conventional electric motor, is the source of external torque. Berkeley's Richard S. Muller devised the first successful micromotor. Then Stephen C. Jacobson at the University of Utah developed a number of micromotor designs capable of producing higher torque.

In the Nineties microwing-robots built more elaborate devices including cutters, scrapers, staves, gyroscopes, and micro-positioners—even accelerometers so insensitive that they were used in washers and dryers to turn them off if damaging vibrations began, in automobile suspensions and air bags, and for the control of micromotors in optical communication systems.

It occurred to me in 2014, as I sat in

Each microsnail explores the tooth, secreting minute quantities of bioengineered enzymes that epoxy microcracks in enamel, remove plaque, and shred organic material caught between the teeth.

my car in the great LA Gridlock, that by combining the ideas of social robotics and micromachines I could develop flocks of self-governing micromachines operating in concert.

My first products were "nervous systems for construction materials"—materials with networks of tens of thousands of interacting micro-sensors that send continuous measurements of compression and tension, vibration, and temperature from the surrounding material. I had guessed that materials able to signal changes in load or shifts in stress patterns, as might be caused by cracks or weakening of a structural member, would find a market. So it proved. Soon "sensitive materials" found uses in chemical and power plants, the bodies of jet engines and rocket shuttles, in bridges and pipelines, and other critical projects.

Such success was satisfying, yet I sensed more exciting frontiers—by combining social robotics and micro-mechanics I could address the needs of the world's consumers. That was the real reason for founding Microbots.

THE MICROBOTS CATALOG

TOILETRIES

Nothing but the Tooth: Dental Microbots That Brush Your Teeth for You While You Sleep

During the average lifetime a human spends a total of 40 days of his life brushing his teeth. (Sorry if he "kisses.") Recent breakthroughs in micro-robot technology, however, have now made it possible for us to offer our customers the dental equivalent.

Just rub onto teeth before sleeping. During the night each microbot, glued to a pair of traction balls, systematically explores the entire surface of the tooth on which it lands. As it moves, powered by the tooth's own natural electrochemistry, it secretes minute quantities of bioengineered enzymes that detect and epoxy microcracks in enamel, remove plaque, and shred organic material caught between teeth. You awake to find your smile polished to a high gloss. Microbots are small enough to be barely detectable by the tongue and harmless if swallowed. They vanish down the gut after they've finished their job.

For those interested in the latest in decorative dentistry, Microbots also makes an "artist microsnail" that colors your incisors in the pattern of your choice, from a simple checkerboard to selected graphics based on works of Blake, Klee, Mondrian and De Kooning. Images fade after 24 hours.

COSMETICS

Fairy Dust: Flying Robot Mites That Make You Glow

Imagine you're in an exclusive restaurant surrounded by the rich, the powerful, the beautiful, and the famous—yet all eyes are on you. Why? You've sprinkled your hair with our luminescent robot gnats.

When activated, each individual gnat uses an onboard infrared sensor to rise a predetermined distance above the head. There it will stop, hover, and search its immediate environment for lights from other gnats. Each will fly toward the geometric center of the cloud of lights, yet stay a specific distance from the nearest light. The contradictory impulses keep the cloud moving in a glowing swirl. A second set of upwinding photosensors brings the swarm of lights down onto your hair whenever a hand or hat comes into the vicinity. These robot gnats are available in green and blue phosphor, and rechargeable microbatteries that shut their charges in bright glittering colors. Timed release of perfumed essences is available as an option.

Roused Tattoos: Cosmetics for Clothes

Ever dream of having a fully dynamic tattoo that would go anywhere—on

skin, clothes, even your desk—while it presents any number of images in any order? Our color-coordinated, networked floabots can do just that. First use the floabot graphics software on your computer to create the designs; the program will calculate the movements needed to generate that pattern and transmit them by cellular modem to your floabots.

Using our robo-phantom sick, define the course you want your troupe of floabots to follow (be sure to make it circular) then shake floabots onto the path. The floabots will take 30 seconds to assign "addresses" to each other and test the integrity of their communications. When every member knows the others' locations, 10,000 tiny micro-machines, each with its own choreographic programming, will gravitate to the center of the phantom path, or organize themselves into the first pattern, and begin to move along the course you've chosen.

Want to make your notes stand out? Write letters with the robo-phantom sick and include a vial of floabots in the envelope. When the letter arrives, all the recipient has to do is sprinkle floabots onto the page and they will travel over your writing and bring it to life! (We like to say that floabots take the "stationary" out of stationary.)

The Monofilament Wig: Going One Better Than Natural

Natural hair, no matter how beautiful it may be, has one flaw: You can't change it on command. Aside from a few dyes and curls, natural hair refuses to give us the up-to-the-minute control we now expect from our bodies. If you want short hair, you have to cut it for long hair, you have to wait while it grows. Suppose you want four feet of silky blond tresses for lunch, a savory rust-red pageboy during office hours and a drop-dead slope for dinner and dancing. Unless you had a suitcase full of wigs, you would be out of luck—until now. Our engineers have created the next generation in torsional technology: fully programmable body hair.

First technicians at any neighborhood Microbot Technology center search the body area of your choice for hair follicles. Next they insert a hydrostatic micro-pump into each one and plant a tiny cache of hypocoelgeranic filaments just under the skin. To control your hair, they fit you with an elegantly designed earring-computer and customized torsional software.

Coiled inside each pump is a single transparent hollow, flexible filament. Depending on commands from the computer, the micro-pump fills these filaments with the body's own natural lymphatic fluids, which make them extend to 60 inches in length. At lengths under 18 inches, macrolament can swim

stand erect. Microcables embedded in the filament walls control curl, dye-releasing and mixing features are standard, and a range of Clay-Glo luminous-cent dyes are available.

FASHIONS

Haute Couture: Clothing That Suits Every Situation

How many times have you walked into a presentation and realized that your suit was wrong for the audience? Changing an outfit is now easy with Microbot Technology's Autofashions™. Each garment comes with a wristwatch-size combination cellular modem and computer. Press the number of your fashion center, type in the identifying codes, and your selection of styles will appear in the display. When you see what you want, press a button, and in seconds your clothing will shape itself into the design of your choice.

Each thread in an Autofashion™ suit

◀ *With MicroJeep you'll experience spiders the size of elephants, ferocious predatory sparrows, parasitic wasps, and the exhilaration of leaping over blades of grass 50 times your height* ▶

comes strung with individually rotatable multifaceted microbeads that can display a wide range of colors and transparency indexes. Microcables threaded through the garment open seams and fix them to any degree of gaps, and form pleats and tucks and curls as the design specifies. The suit's metamorphosis is so smooth that you can even continue working or playing while your clothes automatically reshape themselves into a new fashion.

For up-to-the-minute fashion statements, try our video camera accessory. If you see a garment you like, at a party or on the street, merely point the camera directly at the wearer and photograph the ensemble from as many angles as possible. A special onboard computer chip will analyze the images into the appropriate Autofashion™ programming and store them for future use or for immediate transmission to your garment. Sixty seconds after you see it, you can wear it.

Clothing isn't just about looks, however; comfort is also important. That's why we offer the ultimate in personal

heating plant underwear—a bodysuit with a complete A/C system woven into the fabric. Every square inch contains two complete networks of thread-thin artificial capillaries (one for heated water, one for cold), sensors to ensure even temperatures, and micropumps. Heating, refrigeration, and power units fit on a belt (included). Keeps you at your ideal temperature from Calcutta to Nome. Perfect for our customers with circulatory problems.

Improved creature comfort isn't the only clothing goal at Microbots. We are now developing monofilament clothing. Soon you will have the option of reversing evolution by installing microfilaments in every pore on your body. Feel like a panther? Then look like a panther down to a titch, head-to-foot. Lustrous ebony body coat.

HOUSEHOLD CONVENIENCES

Boss Arms: Tiny Quicker Picker-Uppers

Let your fingers do the housecleaning. Order Micromeads from our catalog and put a thousand domestic servants in the palm of your hand.

Arrange "ant hills" (small containers, each the size of a bagel) inconspicuously under chairs and behind furniture (autocamouflaging is standard with this year's models). When the colony has detected no footholds in that room for an hour, thousands of Micromeads, legged wheelies the size and shape of a clove, spread-out through the room. They locate loose grains of sand, grit, lint, skin, hair, and other debris, then carry the refuse back to the anthill. If the hill detects vibrations, it releases a high-pitched acoustic signal, summoning the Micromeads to return.

These home bases serve as tiny waste disposal plants. Each contains specialized microbots that process the trash. Some secrete enzymes and bacteria to break down and sanitize organic matter. Others use tiny pinners to crush and cut up larger items. The anthill then seals the garbage in a polymer bag, which it custom-produces to surround the excreted refuse. The Micromeads carry this package to a preprogrammed location, such as a chute leading to a trash compactor in the basement of your house.

HOME SECURITY

RoboHometz: The Ultimate Weapon for Home Security

Let a face fit—as wonderful as the twenty-first century can be, home security is a growing challenge for all of us. Here's how Microbots can help you deal with it. Whenever the nest detects a possible intruder entering a zone you have designated as "private," a mosquito-size probe takes off and lands quietly on the person's clothing and locates a flake of skin caught in the garment. An onboard DNA sampler then re-

CONTINUED ON PAGE 76

BUILDING CHARACTER

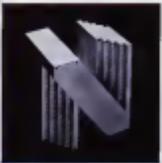
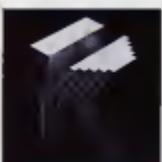
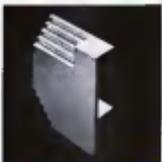
Consider the figure 150. It represents the number of milligrams of magnesium a three-year-old needs each day. The damage, in millions of dollars that Hurricane Audrey inflicted on the United States in 1957. It is also the pitiful amount, in single dollars, I have after paying the rent.

To Japanese artist—and creator of this sculpture—Takenobu Igarashi, the figure 150 means nothing. It's simply one of his some 300 sculptures. "Maybe even more—I never count," he says. Most of Igarashi's works, whether commissioned by corporations or produced for the pub-



Sculpt by numbers: Artist Takenobu Igarashi

Top row, right: A, E, C, D, E... well, you know the rest. Forty-six-year-old Igarashi sculpted this series, which is called *Aluminum Alphabet*. Each ten-inch-tall letter is made up of aluminum plates of varying thickness that he casts, polishes, and bolts together with screws. Each costs a cool \$5,000. Please, do not try to build any of these letters from your home's aluminum siding! At right, Igarashi hits the speed limit with his spray-painted plastic work, which he has titled *Toyoko SS*.



to are based on the 36 alphabetic characters. At first, I thought that an artist might find this confusing. Then someone threw an unabridged Webster's Dictionary on my lap and (after the swelling subsided) I realized there's a lot you can do with just the 26 characters of the Roman alphabet and the ten numerical figures. Igarashi, for example, has built a one-and-a-half-story-high "Ni Igoo-sun-pee"—Tokyo's Ni N Building. With the precision of a mathematician, Igarashi begins each sculpture by penning mechanical drawings, he then constructs small 3-D mock-ups from plastic or paper. The final full-scale product is cast in plastic, carved in hardwood, or it emerges from a foundry—forged in aluminum, steel, or bronze. "I like to produce something for people to see and touch," Igarashi says. "People buy his stuff, too. The Kajima Corporation paid \$12,000 for the 22-centimeter by 29-centimeter 150. (For less money there's his jewelry pin series, which runs about \$400 per pin.) The appeal of his work comes on the style and feature of the sculptures rather than the letters themselves.

Many of us Occidentals have grown accustomed to our own letters and numbers and see Oriental written characters as exotic. For Igarashi the opposite is true. Growing up in post-World War II Japan, this young son became fascinated with the alphabet. While attending a Tokyo art school, to learn graphic design, Igarashi would sneak away to the sculpture classes and hang out with the students there. "Sculptors were much more unusual than graphics people so I enjoyed working with them," he says. His first sculpture attempt was a 3-D kana, a character in a Japanese system of writing. "But Japanese characters are so complicated that there's little freedom," he says. "And each Japanese symbol is a word. It has a meaning that bothers me. One Roman character is much more neutral, more of an international symbol." An international symbol of things to come? By the way, things look, 4 is, as Japan and Igarashi continue their role in the West, the artist's blend of Oriental simplicity and Occidental alphanumeric may be the merging style for the united future.—Phil Scott **CC**

NO ASSEMBLY

CONTINUED FROM PAGE 78

dies the raw biological data back to the nest, where a DNA fingerprint lab performs an analysis and checks the results against a list of those individuals cleared for access to the area. If the person is unauthorized, the mosquito probe triggers a loud and explicit warning message from a rooftop speaker while summoning a cloud of other RoboHomes, each carrying a vicinilocking one-inch-long cream-colored sanger. Any intruder continuing to ignore the warning message will receive a lesson in the sanctity of private property, the memory of which will linger for several months.

LEISURE

Jeep Drive: The MicroJeep Adds a New Dimension to Travel

Throughout our history all of our products have involved large numbers of assembling micro-machines. But when we see a chance to break the pattern, we're not afraid to do so. With this issue of our catalog, we introduce our first stand-alone product. When you buy the MicroJeep, you get only one, but what a one that is! It will enable you to

trav for hours through untamed wilderness without leaving your desk! You work hard, play hard. The problem has always been putting the two together. How do you take the complete break you deserve, yet still make that vital meeting at three PM?

The answer is to use the MicroJeep (MJ)—a remotely operated, rugged vehicle about a tenth of an inch in length, with onboard manipulators and sensors for sight, sound, touch, smell, and taste. Thanks to a cellular modem that connects the MJ to your desktop super-computer, MJ operator console, and high-fidelity display, you sense everything the MJ is sensing with the immediacy of actually being there.

You will experience spores the size of elephants, voracious predatory sparrows, parasitic wasps, and the exhilaration of leaping over blades of grass 50 times your height. The mazes of ant-hills and wasp nests are there to explore at your convenience. Comes with your choice of an off-road terrain or office use. Get them all for a complete wilderness experience.

RESEARCH HORIZONS

Brave New MicroWorld: Micromachines to Change the World

So far, we've used micromachines to carry only very light weights for short dis-

tances. But I have a vision of intercommunicating micromachines connecting into billions—even trillions—of tiny structural elements, like the cells of whales or bees, to form structures of any size at all. Imagine, for example, a building that reshapes itself continuously, or a road that travels anywhere at all (compatible with the rights of private property owners), or a tower growing into geosynchronous orbit like a tree 23,000 miles high!

That may sound like science fiction, but our engineers are close to building the first generation of fully self-reproducing, hydrodynamically generated micromachines. When they achieve this goal, such devices will grow like crops, like grass, out of fortified micromachine nutrient flows. This achievement will make possible such enormous powers of natural increase that these engineering marvels will be able to accomplish any function: You'll be able to use them to build houses, bridges, even outer-space orbital islands!

Sometimes I have a vision of an entire planet of micromachines in which every particle is constantly communicating with every other and any form or shape is instantly realizable.

Log in now if you want! But when that day finally comes, just remember I told you so. ☐

FORUM

CONTINUED FROM PAGE 24

Appel. "The experience not only qualifies their fears about snakes, but it also opens up discussions on the bees we have about unfamiliar things."

Appel and 200 other professionals donate time to a program jointly sponsored by individual schools and the Santa Cruz County Office of Education's School Volunteer Program. The volunteers bring new dimensions into the classroom, lecturing about their specialties such as journalism and law, frequently they collaborate with teachers and tutor kids. Others work with kids on science fair projects, help organize class newsletters, or open doorways to astronomy and the stars.

"These experts give children a unique window on what life is like in the outside world," says Joan Pfotenhauer, coordinator of the program since its inception in 1985. Despite meager funding, the program's curriculum rivals that of a post liberal arts college. In the process, these volunteers form a specialized support staff for the county's 1,700 teachers and 88,000 students—at no cost to the district. "We measure our effectiveness in individual victories," says Pfotenhauer. "If we

spark just one child's curiosity, then we're successful."

Helping youngsters open a new window on the world played a significant role in the formation of the Los Angeles-based Youth Intervention Program (YIP), founded in 1984 by nurse-turned-entrepreneur Margo Wainwright. Essentially, Wainwright's sense of guilt drove her to establish the program. "Other minority businesspeople lectured me that we were all responsible for helping our youth," she recalls. "If we did nothing, they said, the kids would suffer tremendously because of our neglect."

Wainwright soon recognized just how adversely these kids suffered. Most had barely a nodding acquaintance with the three R's. In 1986 she headed a consortium with five other minority businesswomen to boost the students' basic academic skills. In 1986 YIP allied itself with the Los Angeles Unified School District and became an alternative educational center, offering high-school equivalency classes and vocational/prosperificity programs. "You can't save them all," says Wainwright of the program's participants. "But they represent too much of our total future to just let them slide." The school, with about 100 students attending at any one time, boasts an astounding 89 percent attendance rate. More

important, at least half of the program's graduates find decent jobs and lead productive lives.

Educators, too, find the mentoring results impressive. Says Erwin Fleisman, associate director of the Institute for Urban and Minority Education at Teachers College of Columbia University, "There is no question that these programs have a positive impact on the kids. Students who have gone through them make decisions that keep them on an educational track, and most attribute their success to the mentoring relationship." Fleisman warns, however, that hard-to-reach kids either don't respond to or ignore the programs, and they are the ones most in need of help. "The kids who respond are usually already motivated," he says. "But we also need to discern the needs of hard-to-reach kids."

Students who have taken the long road to success say they know what kids need. "Life on the streets is a one-way ticket to prison or pushing up daisies," says sixteen-year-old Eric Docksey, a former dropout who enrolled at YIP and now works for IBM. "I think everybody gets one chance in life. This one's mine, and I'm not going to blow it," he adds intently. "That's what the other kids who are still on the street want—just one chance." ☐

Stoli. For the purist.

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The New England Journal of Medicine is a stage, says its powerful editor in chief, who speaks his mind on megabusiness medicine, tax-based health care for the poor, dangerous doctors, and more

INTERVIEW

ARNOLD S. RELMAN

As a young man, Arnold Relman toyed with the idea of becoming a philosopher. It would have been a serious mistake. Philosophers sit in quiet rooms and think. Relman, the outspoken, self-confident editor in chief of the powerful and prestigious *New England Journal of Medicine*, is a brawler.

Despite its name, the *Journal* is read by doctors and scientists in some 125 countries. No medical journal in the

world has as many paid subscriptions (nearly a quarter of a million). And none carries more clout. Relman uses his position atop its masthead to rail against abuses within the medical profession and, with equal fervor, to defend the oft-questioned rightness of mainstream medicine. In his editorials, on panels, and in testimony before Congress, he issues diagnoses—moral, financial, and political—that vex many of his peers. Relman's call

PHOTOGRAPH BY TIMOTHY WHITE



last year for more government spending on health care drew cries of "Socialist medicine" from a number of colleagues. His condemnation of the growing trend among doctors toward owning profitable pieces of the clinics to which they send their patients struck some as an assault on the constitutionally guaranteed freedom of doctors to get rich.

The real power Reiman wields, of course, is not in the wording of his editorials but in the choice of research papers he journal deems publishable. The Journal, as Reiman readily concedes, is a pillar of orthodoxy, a staunch upholder of the traditions of cautious, measurable, where-are-your-data Western medicine. Don't look for reports on faith healing or meditation in these pages.

The most visible battle Reiman has waged as editor has been his unwavering defense of the Ingelfinger Rule. This is an in-house policy, copied in watered-down form by several other journals, whereby authors who leak even the gist of a forthcoming study to the press are summarily yanked from the Journal's pages. Critics assail the rule as nothing but a power grab on the Journal's part, an attempt to monopolize the hottest medical news.

For whatever reason, the Journal has been remarkably successful at doing just that. Its published reports of new findings are routinely snatched up and trumpeted on page one of the nation's newspapers. When aspirin was suddenly touted as a potent heart-attack prevention pill two years ago, or when oat bran's much-hyped reputation as a cholesterol fighter was challenged last January, the familiar phrase "according to a report published today in *The New England Journal of Medicine*" echoed around the world.

The medium for all this excitement is 178 years old and courted. Physically, it looks the part: The Journal's cramped, monotonous format gives new meaning to the word gray. Yet surprises abound for those willing to explore its musty pages week by week. Lewis Thomas's *The Lives of a Cell* (reprinted as columns in the Journal) The letters to the editor offer a cornucopia of weird medical phenomena from Space Invaders (what is cocaine-induced-sar syndrome?) (One letter reported that Classic Coke is a more effective spermicide than New Coke.)

The man with the final say over what's in and what's out seems to relish the publicity and controversies of the job. At sixty-six, Reiman is a hearty, forceful, combative spokesman for the medical profession and, more particularly for his journal. He chooses his words cautiously, asserts that a verbal misapprehension by the editor of the Journal can tant a career or cause a pharmaceutical stock to plunge. His well-modu-

ated voice and broad, somewhat tense grin (which invariably appears whenever he recounts criticisms) are not unlike those of a seasoned politician.

Reiman grew up in Far Rockaway, New York, where he zoomed through the public schools, reaching high school by age eleven. Biology and medicine fascinated him from the start. During family visits to a local doctor's home, he would sneak into his head's study and pore through the illustrated medical texts, thrilled not only by the uncensored pictures but also by the detailed revelations of how the human body worked. He received his M.D. from Columbia University in 1948, then served his residency at Yale-New Haven Hospital. From the Fifties through the Seventies, at Boston University and later the University of Pennsylvania, Reiman taught, saw patients, and carried out research. He specialized in kidney physiology and disease. Following a

“I got a call from a reporter for The New York Times who asked me whether I know anyone on my staff who might have been dealing in Smith Kline and French stock. I said I didn't.”

part-time stint as editor of *The Journal of Clinical Investigation*, he was appointed full-time editor of *The New England Journal of Medicine* in 1977.

Doug Stewart interviewed Reiman at the Journal's hushed offices in a top-floor suite above Harvard Medical School's Courtyard Library. A ruddy-faced man with bushy eyebrows and deceptively crooked front teeth, Reiman left no doubt that he's learned the importance of being thick-skinned if you're going to run a medical journal. His comments he made clear: are his alone, not the Journal's.

Q: You were a practicing physician for years. What was it like to switch from medicine to publishing?

A: Reiman: I had to learn all sorts of things. Behind every manuscript, I soon realized, there's often a complicated story of personalities, politics, and ethics. An article on abortion or health insurance involves you immediately in each of these areas.

Q: How do you think your authors often have an ax to grind?

A: Reiman: Of course. The *New England Journal of Medicine* is a stage—it's the leading forum for the discussion of medical ideas, information, and opinions. The editor's job is to moderate this discussion. You have to be constantly alert because anything that you publish—indeed, everything—has implications, sometimes international implications. For instance, shortly after I came here, we were about to publish an article about Tagamet, which was a drug manufactured by Smith Kline and French that inhibits gastric acid secretion [a cause of ulcers]. Tagamet was their largest-selling drug, and one of the largest-selling drugs in the world at that time. Smith Kline stock had done very well. The article we were about to publish was the first to report some undesirable side effects.

Q: How undesirable?

A: Reiman: Not terrible. It turned out that Tagamet reduced a man's sperm count and may have lowered the production of male hormones. This occurred only in large doses and turned out to be reversible. But it was the first troublesome news reported about this wonder drug.

Two days before our official publication date, I got a call from a reporter for *The New York Times* who said, "Dr. Reiman, have you seen what's happening to Smith Kline and French stock?" I said no. He said, "It's fallen fifteen points in one day, and the SEC [the Securities and Exchange Commission] has been looking at it, wondering what's going on. We just got our copy of *The New England Journal*, and now we understand why. Your information might frighten some investors." Then he asked me if I'd sold any Smith Kline and French stock recently. I told him I didn't own any drug stocks. He said, "Do you know anybody on your staff who might have been dealing in Smith Kline and French stock?" I said no.

I looked into who could get advance information. I found that lots of people were getting their copy of the Journal delivered by airmail several days before the official publication date. They could have sold Smith Kline and French stock before it started to go down. The Journal officially comes out on Thursday, but in those days anybody who wanted to pay for the cost of airmail could get it on the Saturday or the Monday before. When I came here, I didn't even know that I discovered our air mail subscription list includes every major stock brokerage firm in the country!

Q: How do you know that stockbrokers subscribed at all?

A: Reiman: Not Why would I? Suddenly, I realized how naive I was. Here I was a professor and researcher thinking that a medical editor's job would be considered an art. Everything that comes out

in the Journal has an impact.

Orin: You once wrote that an editor's relationship with an author can be difficult. What kinds of problems can the Journal's authors give you?

Reiman: Authors invest a lot of time, effort, and ego in their publications. A lot is riding on the fate of their manuscripts. The Journal isn't the only place, but it is certainly one of the best places to publish clinical research, and authors don't like to be turned down. It's a blow to their self-esteem. Sometimes, after we've turned down an article, the authors will accuse us of being biased against them for one reason or another. I've had rejected authors call up and say, "You must have sent my paper to my archrival for review. I knew he would tell you to reject it." When I tell them I didn't do that, they don't believe me. It's also difficult for an editor when prominent people send you work they'd like to see published, or good friends, and you have to turn it down.

Orin: Have you ever published articles in the Journal on acupuncture, laying on of hands, or holistic medicine?

Reiman: I don't accept the idea of alternative therapies. There are no alternatives to good science. You either believe in science, which is based on evidence of phenomena that can be observed and measured, or you don't. If you don't believe in science, then you're

no longer playing the game. You've left the mainstream of modern science-based society and moved into mysticism. We don't deal with mysticism here. We are a scientific journal. We are concerned with evidence. When there is objective evidence that acupuncture or laying on of hands or thinking good thoughts or any other so-called alternative approach to the treatment of disease works, we'll publish it.

Orin: Studies suggest the mind influences the body. Harvard magazine referred to a study of fatty buildup in the arteries of rabbits. One group of feet rabbits was consistently healthier than the others. It turned out that the researcher who led this group was stopping to hold and cuddle them.

Reiman: If that conclusion can be demonstrated by objective, appropriately controlled, appropriately quantitative data, we'd publish it. Our assumption, which is the assumption of all modern science, is that there would be some mechanistic explanation. We assume that all phenomena occur in the world of space, time, and physical reality, and that these phenomena can be measured by physical and chemical means. In principle, we don't have any problem with publishing reports of objectively documented phenomena for which there is presently no physical explanation. But we're not going to publish hearsay, an-

ecdotes, testimonials, or undocumented, unmeasured, uncontrolled observations. And most of what is put forward as evidence for so-called alternative approaches to health is based on that sort of inadequate evidence.

Orin: Have you seen any scientifically sound studies showing a connection between mental state and disease?

Reiman: It's a well-established fact of human biology that emotions can be reflected in pulse rate, respiration, skin temperature, gastric secretion, and so forth. That's not news. As for whether mental states can influence the course of disease, there is simply no hard scientific evidence of that. One's emotional state can, of course, determine how one feels about one's illness and whether the illness is tolerable or not.

Orin: Even so, a growing number of distinguished researchers believe there is a connection between the brain and the immune system. Are they wrong?

Reiman: If someone says, "Yes, some data appear to indicate that mental states have a measurable effect on the immune system," that doesn't settle the basic issue of whether one's mental state can influence the course of an illness. I don't know of any reputable scientist who claims to have evidence—and to have published such evidence—suggesting that the course of serious, chronic illness can be changed significantly by thinking about it.

Orin: Norman Cousins, the longtime editor of the *Saturday Review*, believes that laughter helped cure him of degenerative, seemingly incurable arthritis. His description of the experience first appeared in the Journal in 1976, the year before you became editor. Would you have accepted his manuscript?

Reiman: No. Here was a highly cultured and sophisticated man, Norman Cousins, who was persuaded that by laughing and maintaining an optimistic, cheerful state of mind, you could cure an illness. My predecessor, Franz Ingelfinger, chose to publish that because he thought it had a degree of human interest. But he did not regard it as scientific evidence. No one can regard that as scientific evidence.

Orin: Yet therapists routinely teach visualization techniques, claiming that they help people recover from advanced cancer. What's wrong with encouraging you to think positive thoughts?

Reiman: Nothing, if it makes you feel better. What is wrong is to imply, as many of these therapists do, that you can cure your disease this way. And that if you can't, it's your own fault. Lots of patients now have been led to believe that their cancer is progressing because they don't have an optimistic, anticancer attitude. That's cruel, and it's unfair. It blames the victim. And there's not a shred of evidence that it's true.



now than there used to be. It may be in part because of the economic pressures that doctors never had to face before, and the increasing specialization of medicine. When doctors are only concerned about a piece of a patient—a particular organ or a particular procedure—they tend to become more like technicians and less like the old family physician. That, in turn, alienates patients, which undoubtedly has something to do with the rise in malpractice litigation. Patients are not likely to sue doctors who have been their friends and advisers.

Orin: You've criticized the growing popularity of "boutique medicine"—fasciitis, liposuction, and so forth. Why is that a problem?

Reisman: It's a free country, and if someone wants to purchase some fancy elective service, that's okay. But if it's paid for by public funds or by businesses through the cost of insurance, then that's a problem. When voluntary community hospitals start devoting their resources to these kinds of fancy services, which they advertise and market, that's a problem, too. They ought to be concentrating on services really needed by the community. The trouble is, under the present system, those services may not be profitable. Hospitals prefer to provide services that customers will pay for. That's a perversion of

their function as tax-exempt community hospitals.

Orin: How do you persuade hospitals to offer services that lose money?

Reisman: You have to change the system. Sooner or later the government and the public will have to recognize that we must spend tax money to take care of the people who can't afford health care. There are thirty to forty million people in this country who have little or no insurance. We must have a greater public investment in subsidizing health insurance for the poor and the unemployed. We can't expect hospitals to go broke trying to provide uninsured services. I do not favor socialized medicine, and I do not favor nationalization of hospitals or making doctors government employees. I do support some sort of national tax-based plan to provide minimum necessary coverage for all. Some in the medical profession fear this would lead to socialized medicine and the enslavement of the profession. I don't share that fear. A wealthy, civilized society, three percent of whose population is uninsured and inadequately cared for, has to face up to this problem.

Orin: Is spending more money on the system really going to fix it?

Reisman: Of course not. In fact, it might be an invitation to disaster. If we keep putting public money into the present

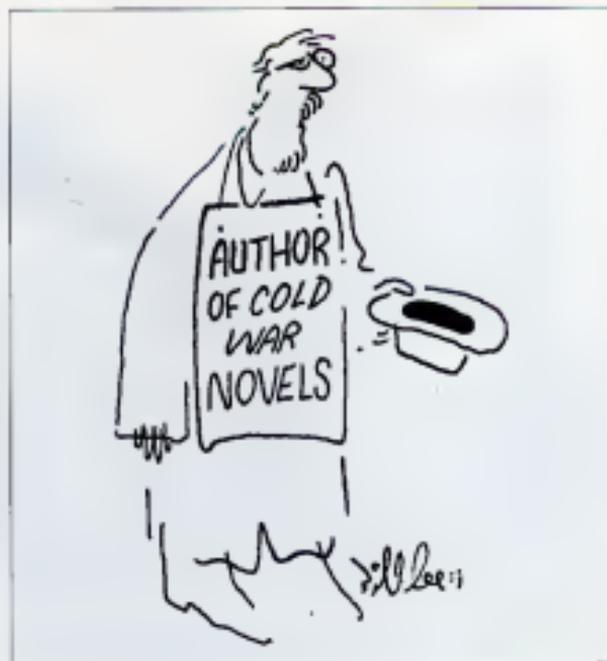
delivery system, we'll just be watching it disappear down a black hole. We have to make the system more efficient and more rational. We're going to need a much greater investment in finding out which services are worth the money and which are not. That kind of information is gathered today only in a quite haphazard way. We need to invest at least four or five hundred million dollars a year. That's a fraction of one percent of what we spend on health care annually, which is somewhere on the order of six hundred billion dollars.

According to a few studies, somewhere between fifteen and thirty percent of the procedures we do are not necessary. There is evidence that we do too many cesarean sections, too much nuclear scanning, and too many cardiac arteriograms (a cleaning out of the carotid artery to prevent strokes). The trouble is, we often can't be sure which procedures are necessary and which are not because we don't have the data. And if we're talking about a system that wastes fifteen to thirty percent of more than half a trillion dollars a year, we certainly should be able to afford a few hundred million dollars a year in research to find out more about what's worth the money and what isn't.

Orin: Where do you find the articles you publish each week?

Reisman: All of our scientific articles are unsolicited. We accept between ten and twelve percent of the ones we receive. We require that papers be original, interesting, important, scientifically sound, and readable. We try hard to select our articles without regard to whether they will get a lot of public attention or not. Our function is to publish what we think represents the best scientific work, relevant to the practice of medicine, without regard to its public impact. But sometimes when we sit around the table at our editorial meetings we I predict that something is going to make quite a splash, and then it doesn't. And sometimes we don't anticipate it when something is picked up by the media and widely broadcast.

We do no promotion, send out no press releases. We don't call the media's attention to anything. The only thing we do to cooperate with the media is to allow them to get annual delivery of the *Journal*, provided they agree to abide by our embargo, a media rule that we share with most other scientific journals. We ask the press not to release its stories until six PM on Wednesday the evening before publication. We embargo our stories to give physicians a chance to see the full published data before the press goes wild and the doctors' phones start ringing. Doctors cannot be expected to advise patients on the basis of something Dan Rather said on the evening news. They've got to see all the evidence.



read our editorial comments perhaps, and discuss it with their colleagues. **Oliver:** You have a similar role for authors, correct?

Reisman: Our policy, the Ingelfinger Rule, says that, with a few exceptions, we will not consider publishing information that has been widely publicized beforehand. Like any journal, we want to be fresh and original. Two, and more important, we want to discourage authors from going public with their data before they've presented them in full to their colleagues. If you think you've got a cure for cancer, you don't call in reporters and say, "I've got this great discovery!" before you present your evidence in an article or at a scientific meeting. We do make exceptions. If the publicity follows a presentation at a scientific meeting, that's okay. Another exception is when the information is of such urgent importance that it needs to be made public right away. When anything important about AIDS is announced, we don't apply the Ingelfinger Rule.

Oliver: The *Journal of the American Medical Association (JAMA)* has called the Ingelfinger Rule "unrealistic and elitist." It claims the rule gags researchers.

Reisman: That makes no sense at all. We've made it very clear that researchers are free to talk about their work with their colleagues and to answer ques-

tions from the press about what they've said at scientific meetings. We just don't want researchers to call press conferences and give out their results before their colleagues have had a chance to see them. We have sent out questionnaires to our readers, and the majority support that position. Again and again, when stories have been broadcast on the basis of press conferences or personal interviews alone, bad mistakes have been made.

In 1986, for example, we published a study showing that aspirin was useful in the prevention of heart attacks in apparently healthy male physicians. The full report made it clear that these conclusions applied only to that particular group of people. The manufacturers of aspirin heard about the results, and news reports came out making it sound as though everybody should go out and start taking aspirin right away. That was potentially dangerous. Lots of people got gastrointestinal hemorrhages from aspirin. Some got very serious allergic reactions; others serious liver disease. Most people take aspirin for a day or two when they have a headache. But in this study, people were given aspirin every day. Everyone was tested for his sensitivity to aspirin first, and those who couldn't tolerate it were dropped. Information about the study results

was leaked to one or more of the aspirin manufacturers. Just by hearsay the news was out. Any reporter who wanted to go with the story, without waiting for publication of the full report, could do so. It was unfortunate that one news service, Reuters, chose to do so. **Oliver:** You say, "If the data are there, we'll publish." What about the so-called impossible experiment of Jacques Benveniste's group in 1988 which suggested water molecules have memory? *Nature's* editors were profoundly skeptical, yet they couldn't find the paper's flaws, so they published it. Might you have published that paper?

Reisman: Never! The evidence was not persuasive enough to justify publishing something that essentially overturned basic principles of twentieth-century physics and chemistry. This wasn't just a novel idea—this was a revolution. When you deal with something like that, you ask for more than the limited evidence offered by Benveniste. It would probably have been adequate for a routine paper, but it wasn't the kind of evidence that would justify having *Nature* or *The New England Journal* publish a paper saying the sky's falling. In my view, *Nature's* editors made two mistakes. They published the paper without asking for more substantiation from other

continued on page 107



Drink Wild Turkey now,
and you won't have to change
bourbons when you
become a millionaire.

WILD TURKEY

8 years old, 101 proof, pure Kentucky.



• The tireless Vallee
visited country after country, interviewing
witnesses, collecting metal
fragments, and sifting through police records •

ANTI-MATTER

In 1980 Jacques Vallee, one of the world's best-known UFO researchers, stopped appearing at UFO conferences. "People thought I was off on some philosophical mountain," he says. "But I'd just decided I could spend my time best by investigating UFOs in the field."

After a decade of wild investigations, Vallee is back. Just about a year ago he published *Dimensions* (Ballantine), which traced UFOs through recorded history and showed they have always been part of human experience. And in a sequel called *Confrontations* (Ballantine), published this spring, he attempts

to correct what he says is a dearth of careful research and reliable scientific data in UFO investigations today.

"Most UFO books rely on hearsay," Vallee declares. "But I wanted to meet the original witnesses and personally visit the sites." As promised, *Confrontations* describes Vallee's stunning array of hands-on case studies. In Costa Rica, for instance, he was given a piece of silvery metal from a supposed UFO and eventually had it broken down element by element under a scanning ion mass spectroscope. In France, after discussions with countless witnesses and investigators, he calculated the "duration, distance, trajectory, sound, and luminosity parameters" of a series of UFOs.

The spate of evidence he has gathered with so much care, Vallee says, has convinced him that UFOs are not necessarily extraterrestrial at all. For instance, witnesses recall UFOs appearing out of nowhere. And while witness-



UFO UPDATE

es report humanoid creatures, Vallee believes that extraterrestrial visitors may not resemble us so closely at all. In fact, he says, the chance of such a resemblance is "very remote." As an alternative to the extraterrestrial hypothesis, Vallee suggests UFOs may be interdimensional vehicles "that manipulate dimensions from anywhere or any time."

After reading Vallee's new book, Jerome Clark, vice president of the Center for UFO Studies in Chicago, commends the research. "I like the nuts and bolts of his work," says

Clark. "The detail in these cases is new, starting, and important. When he's functioning as the scientist that he is qualified to be [Vallee is a trained astrophysicist and a computer scientist], he does a good job."

The problem, according to Clark, is when Vallee goes outside his scientific training. "His interdimensional hypothesis is worthless," Clark opines. "To prove his flaky theory, he's been highly selective with his evidence."

UFO skeptic Robert Sheaffer isn't thrilled even with the science. "Vallee accepts people's stories at face value, and he's not well versed in witness reliability," Sheaffer says. "Normally, when a scientist finds a contradiction, he knows something is wrong. When Vallee finds a contradiction, he thinks it's profound."

None of this deters Vallee. "Twenty years ago I believed in the extraterrestrial hypothesis," he says. "But now the orbital physics has invited us to look beyond the fourth dimension." —MARK TEICH



DRIVE-BY BODY VIEWING

Want to pay your last respects to a loved one but don't have time to change into proper mourning clothes and stand in line to view the body? In a Chicago funeral home's new drive-by service catches on, you may one day be able to see your dearly departed lying in state, without ever leaving your car. Lafayette Gelling, owner of Gelling a Funeral Home, added the high-tech drive-through service to his mortuary about a year ago. So far, according to his wife, funeral director and co-owner Marquette Gelling, about 40 percent of their clients have opted for the video body viewing as an addition to traditional funeral services.

Following a sign that reads, drive thru visitors a waiter drives up to a speakerphone, signs the register

and pushes a button to call an attendant whom he wishes to see. The attendant uses remote controls to aim a video camera at the deceased. Then the driver proceeds to a 25-inch TV screen, which displays the image of the deceased for three seconds. To view the embalmed body for a longer period, you can have an attendant push a button causing the image to appear over and over.

Marquette Gelling points out that the service can be handy for the elderly and handicapped, who might not be able to come at all. Now, she notes, "those people can view their dearly departed comfortably."

There are less than a handful of funeral homes around the country that are using drive-by viewing, notes Bob Hardist, executive director of the Milwaukee-based National Funeral Di-

rectors Association. "We've received no complaints from anyone saying it's in bad taste. We don't encourage or discourage the use of drive-by viewing. It's left up to the individual funeral director whether he thinks the families of the deceased would opt for that service."

—S. S. Zho

"The mist rolls over the still
potholes of Alaska. Memory
does not pass away so easily."

—Yamabe No Akahito

"Death, you lie in my arms
like a charub, so heavy as
bread dough."

—Anne Sexton

WITCHES OF EAST MILLSTONE

If you drop in the health food section of Waldbaum's grocery store in East Millstone, New Jersey, you may meet a mysterious dark-haired woman wearing a peaked hat. Don't be alarmed. It's just Barbara Janus selecting ingredients for her "Witch's Diet."

Janus is an enterprising witch. Her latest venture, the Witch's Diet, is concocted, she says, to rid overweight clients of "psychic fat" as well as extra pounds. The special regimen combines health foods like oat bran and carrot juice with "psychic cleansing fluids" that include placing raw eggs in the corners of rooms and bathing in a brew of special herbs, sea salt and baking soda.

Janus, who claims to be a couple of thousand years "old" but looks to be in her

low twenties, is also the director of Rom-A-Witch, a group of 17 psychics based in East Millstone. Group members lecture at conventions, consult on the occult, and entertain at parties by reading tarotures and sketching past-life portraits of guests. The group also dispatches Witch-O-Grams for those who wish to surprise that special someone with an in-depth tarot reading or astrological chart performed at the home or office by one of Janus' authentically costumed staff. It's more fun than a belly dancer, she says, and it's good for the witches, too, because it gives them a chance to get out and learn more about how ordinary mortals live.

In general, East Millstone has been tolerant of its local witch and her staff. "People still gawk at my clothes, but when they get to know me they relax," Janus says, adding, "After all, we don't want to scare anyone. That would be bad for business."

—Jeff Goldberg



CONTACTS

If you've ever encountered a UFO, *Contact* is for you. Edited by UFO photographer Ellen Crystal, this recently launched newsletter is written by and for people who have had close encounters with UFOs. The eight-page quarterly already has a small but devoted core of 150 subscribers, Crystal says. And if they've had a close encounter of the third, fourth, or fifth kind (seeing, communicating with, or boarding an alien craft), I write them special letters when they subscribe.

According to Crystal, who has seen many UFOs herself, cover stories are written by subscribers describing their own first-person investigations of UFOs. A Hot Spots column lists areas of high UFO activity. Other columns focus on UFO photography and gossip about the state of UFO research around the world today.

The newsletter, Crystal adds, is the voice of her new organization—also called *Contact*—whose members do UFO field research worldwide. "I don't want the members of *Contact* to have coffee and coffee in somebody's living room," she says. "I want to see them conducting their research out in the field. Let's go see the ships. It's the only way we'll make contact and learn what's really going on."

What do other UFOlogists think about Crystal and her new publication? Herley Ruedge, a physics professor at Southeast Missouri State University, has enough left to be on the *Contact* board



of advisors, but he does have some doubts. "I think she's brought some information to the public. But to me, one of her photos looks like freetrackers going off."

Mark Rindgeher, scientific director of the Center for UFO Studies, is less impressed still. "I don't feel she is qualified," he says, "or that her photos and data are very reliable."

But Crystal intends to persist. The aliens are out there, she says, operating high-tech ships and building mysterious installations underground.

"People used to tell me, 'Shhh, don't tell anybody,'" she says. "But since I've had all these sightings, why not let others know?"

—Mark Toch

"A snake came to my water trough on a hot, hot day, and I'll give you for the heat, to drink there."

—D. H. Lawrence

SERPENTS

Pavida recently carried a story that could make you think twice about napping outdoors.

The Soviet newspaper claimed that an eleven-year-old girl from Azerbaijan, near the Caspian Sea, grew sleepy after picking tomatoes in the sun and took a snooze in the fields. When she woke up, she was choking.

Rushed to a children's clinic in nearby Baku, the girl was given 2.5 pints of a salt solution to drink. The youngster soon recovered, according to *Pavida*, after vomiting up the cause of her distress—a 25 1/2-inch Caucasian cat snake.

Assistant reptile curator Denise Herman of the Atlanta Zoo says the chance of a snake withering down a person's throat is highly improbable. "There are several incidences of people waking

up in the morning with a rattlesnake coiled on top of them. To a snake, that's just a warm spot," he says. "But it's hard to believe a snake would survive in someone's stomach, where acids would digest it like any other meat."

Emory University Hospital gastroenterologist Stanley Piepe adds that although the story of the Soviet girl sounds bizarre, it's physically possible to swallow a snake.

"We do endoscopies with lighted flexible tubes, so we know individuals can easily swallow something the size and length of a snake," he says. "But it seems unlikely that you could do it and not be aware of it. I have to wonder if the girl had a seizure or whether she was totally unconscious the whole time. Most of us have some gag reflex, and I can't imagine that a snake going down her throatn't gag her to some degree." —Sherry Baker

SUICIDAL BIRDS

Each September and October, thousands of birds commit suicide in the small Indian village of Jatanga. For some mysterious reason, as many as 500 birds a night converge on the town. They empty their stomachs, refuse to eat, and starve. The hapless creatures even refuse to fly away when villagers descend on them, gathering them up to cook over a barbecue grill. Researchers have identified 26 species of birds among the dead.

In a recent study of the birds, ornithologist Sadin Songupta of the Zoological Society of India noted that the suicides coincide with the end of the monsoon seasons and most often occur on dark, windy, and rainy nights. Theoretically, he says, these conditions could dull the birds' sense of direction by disrupting geomagnetic and electric fields.

Charles Wilcoff, professor of neurobiology and behavior at Cornell University and director of the Cornell Laboratory of Ornithology, has a simpler explanation still. "I think the clue is the stormy nights. When you have heavy rains, for reasons we don't totally understand, birds' orientation mechanisms break down. Also their feathers get wet and they can't fly. And if the feathers get really soaked, they lose their insulating ability, and the birds get cold," he says. "So I suspect that these birds are flying along until the weather changes—maybe there's a localized storm with head



winds and heavy rain—and they land simply because they are exhausted and cold. These bird suicides sound like a problem with simple mechanics—not something caused by magnetism or witchcraft.

Until the mystery of the Indian bird deaths is solved, the state government of Assam has launched a plan to save the animals. Tall towers with bright lights have been built to divert the birds from the lights of Jatanga, and bird-watching clubs have been organized to protect the downed birds from villagers bent on barbecuing them.

—Sherry Baker

The *Blind* ate on the hawthorn tree. But he dies also, presently.

—Cara Pound

I do like to see the arms and legs fly

—Col' George S. Patton II

PSYCHIC SURGERY CHALLENGE

In so-called psychic surgery, people claiming to be healers appear to reach into a patient's body and remove tumors, blood clots, and other disease-related material without making incisions or leaving scars. Researchers have long speculated about the origins of the issue: these healers appear to remove. In an effort to solve the mystery, medical anthropologist Philip Singer of the School of Health Sciences at Oakland University in Rochester, Michigan, recently arranged a controlled demonstration featuring psychic surgeon Philip Melodan, who was president of the Filipino Psychic Healers' Association. All the material that Melodan "removed" was then collected and subjected to laboratory analysis.

The material, says

Singer, "turned out to be dead animal tissues of undetermined origin. We didn't catch Melodan using sleight of hand, but his performance showed typical magician's discretionary tactics.

Singer points out that the purpose of his investigation was not to debunk Melodan or other reputed psychic surgeons. As an anthropologist, I need to respect these people for their performances," Singer says. "But I am questioning the credibility of scientifically trained people from my own culture. People who are trained in the scientific method ought to be able to accept scientific conclusions. We have to take a stand in the face of magic, superstition, and quackery." Melodan, however, maintains that the tissue analyzed by Singer was removed from the bodies of patients and was not produced by sleight of hand. "In my opinion, he says, 'It's a spiritual thing. Our purpose is to kill the tumors, and the scientists should take into account how many people were healed.'

Adds psychologist Stanley Krippner, who has observed psychic surgery in the Philippines, "People have gone to fraudulent medical practitioners for centuries and have still gotten better. Even if sleight of hand is involved, it's possible that the experience triggers the immune system and other self-healing mechanisms in ways that are not yet understood."

—Keith Henry

"Purish an audience—they love it

—Ian Hunter

KILLING FILLS

CONTINUED FROM PAGE 54

normally expect the animal that harbors the virus in nature to be resistant to it."

The evolution of a new disease agent cannot always be traced to a microbe expanding its range of target hosts, however. Sometimes the precipitating event may be an internal transformation—a genetic mutation that turns a once-benign microorganism into a powerful foe. It appears to be just such a fluke that brought tragedy to a small Brazilian town in 1984. Ten children were rushed to an emergency ward after developing a high temperature and huge purple blotches on their skin—a syndrome that came to be known as Brazilian purpura fever. As doctors puzzled over how to treat their strange symptoms, all of the youngsters perished. A second outbreak in 1986, involving 14 more children, eventually yielded an important clue. Many of the victims of Brazilian purpura fever had earlier suffered from conjunctivitis, a bacterial infection that causes symptoms no more serious than runny eyes. But in this Brazilian town, says CDC epidemiologist Bradley Perkins, it looks as though the bacterium "underwent a genetic change that made it more virulent."

Viruses are a still more prolific

source of new mutants in nature. That, coupled with the fact that they are impervious to antibiotics, makes them a daunting threat to public health. We have slain the tiger and speared the mighty whale, but we are still at the mercy of the world's smallest creatures. As Rockefeller's Lederberg proclaimed at a conference last year in Washington, DC, on emerging viruses, they are "our only real competitors for dominion of the planet. We shall have to be very nimble indeed to keep up with them."

Unlike bacteria and the cells of higher organisms, many viruses lack "proof-reading" mechanisms for correcting genetic errors during replication. Since their sheer numbers are staggering—many billions of times the entire human population could easily fit inside a test tube with a good source of bacteria for food—genetic copying mistakes are commonplace. According to recent estimates by John J. Holland, a virologist at the University of California at San Diego, viral mutations occur in about 1 in 10,000 replications—a figure much higher than previously suspected and a full six orders of magnitude greater than occurs in human cells.

To be sure, most of these mutations are deleterious—and even when the organism is rendered more potent, it must still contend with immune cells in the body. But there is always the risk

that a rare mutant will be able to crush the host's defense system. Such gangbusters typically go on a killing spree until they have virtually exhausted their food supply.

That is exactly what happened in a Pennsylvania chicken farm in 1983. A mild avian flu that normally infects the chickens' lungs suddenly turned killer and attacked their brains. Every chicken died, and the virus spread to three states before it was finally brought under control. To do so, the U.S. Department of Agriculture spent \$70 million and eradicated 17 million chickens, burying them in a mass grave. "The virus nearly wiped chickens off U.S. menus," says Robert Webster, a virologist at St. Jude's Children's Research Hospital in Memphis. "It was that serious."

Remarkably, a single point mutation wrought all the mayhem—and there's no ruling out a repeat episode. A close relative of the mutant germ is now broadly disseminated in the wild duck population, where it coexists in their guts and is excreted into the water. "Several hundred million chickens are just waiting to be infected," says Webster. And he's not just worried about a cheap source of protein evaporating. The situation of the chickens, he warns, "is very similar to humans who live in urban environments. What if this occurred to us? We can't dig trenches and bury everyone [suspected of being infected]."

Actually an evolving strain of the influenza virus may be the least of our worries. What might happen, for example, if the already lethal AIDS virus were to undergo further genetic change? Could this formidable opponent become a more efficient multiplier, one day enabling it to populate the bloodstream in sufficient quantities for an insect to transmit it? Or could the virus grow more readily in the skin, intestines, lungs, or mouth—paving the way for transmission by casual contact, ingestion, or inhalation? At the Washington conference on emerging viruses, even Nobel laureates clashed in their assessment of these risks.

One of them, Howard M. Temin of the University of Wisconsin, remained skeptical. Sure, he acknowledges, a mutation could permit the virus to grow more efficiently in other tissues—such as the respiratory tract. But if that were the case, he argues, the pathogen would have to alter its external coat so much that it would lose the capacity to infect immune cells. "So it would no longer cause AIDS," says Temin. "It might be just another cold virus."

Lederberg, on the other hand, was not so sanguine. "There will be surprises," he says, "because our fertile imagination does not begin to match all the tricks that nature can play."

Doctors tracking the spread of a novel human disease agent called a word



would undoubtedly share Laderberg's awe at nature's inventiveness. Smaller than any known virus, this odd entity lacks a protein coat, being little more than a collection of free-roaming genetic material. Viroids have been implicated in many plant diseases, but they are exceedingly rare in the animal kingdom. Or so everyone thought until an Italian researcher in the late Seventies discovered a viroidlike particle in man. Referred to as the delta viroid, or agent, it is the ultimate parasite. To replicate, it requires not only a human cell but one infected by hepatitis B virus (whose outer coat provides protection for the viroid). If these two conditions are satisfied, the viroid can cause a far more devastating form of liver disease than hepatitis B alone. Called delta hepatitis, it now kills about 850 Americans each year. The majority are IV drug addicts and their intimate partners because the delta agent, like hepatitis B, is spread by needle sharing and sex.

The good news is that all these diseases can now be prevented with the newly developed hepatitis B vaccine. The bad news is that the vaccine comes too late for much of the developing world, where hepatitis B has already reached epidemic proportions. Explains Stephen Hadler of the CDC's immunology branch: "Hepatitis B can be transmitted through festering skin wounds. So whenever people sleep—especially to a bed—so happens in poor communities around the globe—the virus is commonplace." More than 200 million people worldwide are estimated to be chronic carriers of the hepatitis B virus—and thus under grave threat from the delta agent. Indeed, delta hepatitis has recently caused devastating outbreaks in South America and is beginning to make inroads into Asia's vast population. "Over there it could do major damage," says Hadler, "but here it's likely to remain mostly in IV drug users."

Also insidiously spreading among IV drug users in the United States is a virus that was once largely confined to southwestern Japan and the Caribbean. Called HTLV, it causes a rare, highly lethal type of lymphoma and, less frequently, a degenerative nerve disease that resembles multiple sclerosis. Adding to concerns: it has a mysterious cousin, HTLV-II, which is also spreading among addicts—but so far without causing any illness. Although needle sharing is the most common route of propagation for these viruses, they can be transmitted by sex, blood transfusions, and from mother to baby through breast milk. Depending upon the part of the United States, 2 to 40 percent of IV drug users carry HTLV or HTLV-II. Long-term studies in Japan, however, indicate that less than 5 percent of infected individuals will actually develop disease symptoms.



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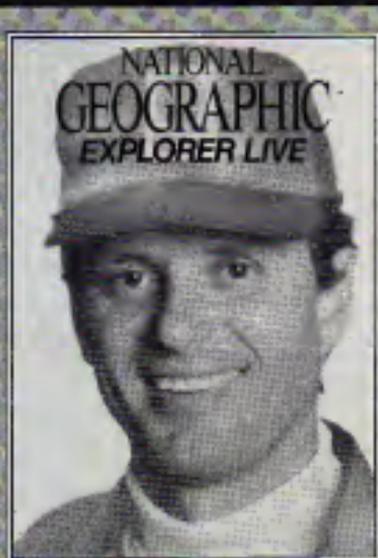


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TBS



Even so, the American Red Cross isn't taking any chances with the nation's blood supply. In December 1988 it began screening for the two viruses. "With so many uncertainties surrounding their health effects," says CDC epidemiologist Rama Khabbazi, "it's hard to know how to counsel infected people who are sexually active or who want to have children."

The behavior of rodents rather than humans is primarily responsible for yet another viral plague that has quietly infiltrated this country. Called Seoul virus, it causes an acute disease of the kidneys in Asia. The pathogen is believed to have been brought to our shores by adventurous women that climbed aboard ships carrying goods from South Korea and is now harbored by rats and mice in Philadelphia, Houston, New Orleans, and Baltimore. The rodents themselves are unaffected by the virus, but humans who inhale dust contaminated by their urine or feces may not fare so well.

At Johns Hopkins Hospital in Baltimore, tests showed that 15 out of 1,148 patients with acute kidney failure had been infected by the Seoul virus. In addition to chronic renal problems, they often suffered from hypertension and strokes. None had traveled outside the United States, ruling out the possibility

of exposure to the virus overseas.

"This is a very suggestive finding," says James Childs of the Johns Hopkins University School of Hygiene and Public Health. As he points out, hypertension and strokes are 100% more common among inner-city residents—particularly blacks—than among rural inhabitants of the same race. He suspects that rat infestations in urban settings could be one reason why. "I don't mean to imply that the Seoul virus is the predominant or only cause of hypertension in inner-city blacks," says Childs, "but it's an intriguing link that we certainly want to explore further." If the association holds up, he predicts city health departments will make the eradication of rats a top priority.

Or one would hope. So far the nation's response to the threat of dengue hemorrhagic fever does not inspire much confidence. A viral infection transmitted by insects, dengue has been around in a mild form for centuries in Asia, causing flu-like symptoms and aching joints in adults. In the Philippines, however, the virus suddenly became much more violent—especially in children. Young victims typically break out in a rash and begin bleeding from the nose and ears. Many of them then go into shock and die. More than 600,000 cases of this severe type of dengue

were reported in Southeast Asia in 1957, compared with 2,000 in 1967—a 300-fold increase in 10 years.

As if that were not bad enough, one type of mosquito that transmits the disease was overwintering in Florida since the early Eighties aboard trees imported from Japan for reforestation. The insect's eggs, explains entomologist Bruce Eklodge of the University of California at Davis, hatch in water that collects inside the trees when it rains. This highly successful invader is known as the Asian tiger mosquito and is now found in Texas, Missouri, and everywhere east of the Mississippi. So far it does not appear to be transmitting the deadly dengue virus—at least not within the continental USA. But there are plenty of mosquito carriers throughout the tropics—including Puerto Rico and Mexico, where the hemorrhagic fever attacked more than 50,000 people in 1986. "The disease is literally knocking at our back door," warns Eklodge.

The Asian tiger mosquito is an extremely aggressive biter, and it is difficult to eradicate. On the outskirts of almost every major metropolitan area are tire dumps that stretch for acres. Since pesticides can't penetrate to the inside of the tires, they are of little use in controlling the insect. The obvious solution is to conduct a massive cleanup—but

it is also a costly solution, and so it has been abandoned. "I'm deeply concerned about this," says Eldridge. "If we don't commit the resources today, it could harm us in the long run."

Despite abundant evidence that we live in times most favorable to microbes that prey on man, the invention of antibiotics and several vaccines since World War II has lulled many people into a false sense of security. As the Institute of Medicine recently documented, there is now a tremendous shortage of specialists in infectious disease control both in the United States and in developing countries. Owing to budgetary pressures, the National Institutes of Health was forced to close the last of its laboratories for tropical virology in 1973. More recently, an important tropical medicine laboratory in Hawaii shut down, and the U.S. military has scrapped a key surveillance unit for new diseases in Kuala Lumpur, Malaysia. As for the World Health Organization, it has only a handful of people manning its viral disease unit at its headquarters in Geneva and a single regional office for all of Africa. Wams Donald A. Henderson, dean of the Johns Hopkins University School of Hygiene and Public Health: "We are not well structured or staffed on a global level to detect and investigate new diseases."

Like many of his colleagues at the DC conference, Henderson pleaded for greater funding of infectious disease control programs, especially in tropical regions where microbes thrive. For \$150 million a year, he estimates, a global consortium could finance 15 tropical medical centers and ten U.S. research facilities, with a remaining \$25 million available for special projects.

Given the current budget crunch, however, scientists are skeptical that politicians will be persuaded to cough up even that modest sum. In all likelihood, the early warning detection system will be postponed—until another disaster on the scale of AIDS jolts us into action.

Although dengue is an obvious contender for the title of microbial menace number one, scientists are quick to point out that the threat could come from almost anywhere. Brazilian purple looper, for example, has so far accounted for only a few sporadic cases in small, rural towns. But as the CDC's Perkins observes, "If the disease gets to São Paulo, with its population of fourteen million, it could be catastrophic." Even with intensive antibiotic treatment, he reports, the bacterial infection claims the lives of half of its victims.

In this era of fiscal shortightedness, it is well to recall that germs have far-flung reaches. As Nobel laureate Lederberg stresses, "The microbe that lashed one child on a distant continent can reach yours today and seed a global pandemic tomorrow." **DD**

COMMUNICATIONS

CONTINUED FROM PAGE 25

speaking countries, and your edition will certainly help to fill in the gap. That's why I'm sure *Oms* magazine will be extremely popular with the Soviet readers.

Wishing you a success on the Soviet market, I want to warn you of some difficulties that you may encounter. One of them is the correct use of the Russian language, which presents lots of traps for foreign learners.

Even those who think that they have mastered Russian to the full extent can find themselves in such a trap. And that's exactly what happened with you (or rather with your linguistic staff) on the very front page of the first issue, circulated in the Soviet Union in September 1989. Your cover persuades

Берегите здоровье! *Берегите здоровье!*
Здоровье — это счастье. *Здоровье*
The sounds alien to the Russian ear because it contains three incorrect usages of modern Russian. Two of the mistakes can be regarded as not very bad as they do not hinder understanding (only show that the text was made by a foreigner), but one is rather serious, because it affects sense. I mean the use of the word «продукты». Perhaps your translators were misled by the meaning of the English word products, but in Russian, «продукты» (plural of «продукт») has only one meaning, and that is "something one can eat" foodstuffs, food products. That is why the first, natural reaction which the title page causes in the Soviet reader is: How on Earth can one eat up so many foodstuffs? The word you should have used instead of «продукты» is certainly «товары» (goods).

I'm not going to tire you with lengthy

linguistic analysis because that's not what I'm aiming at: I can only offer you a better Russian variant, which won't sound alien to the Russian readers. *Be здоровы!* *Берегите здоровье!* *Здоровье — это счастье!* *Здоровье*

While making these comments, I by no means intended to blame your linguistic staff for their inadequate knowledge of Russian. Being a linguist myself and having a special interest in the comparative study of English-Russian word combinations, I know perfectly well how difficult it is to create a flawless text in a foreign language. Please regard this letter as a friendly sign of appreciation of your and Kathy Keeton's attempts to make our life better and a sincere wish of success to *Oms* in the future in the Soviet Union.

It is always better to do things with a little help from one's friends, isn't it? And you've got them in the Soviet Union.

With best regards,
Tatiana Dobroskokovskaya
Doctor of Philology
Moscow State University
Moscow, USSR

For Good Measure

I was quite surprised to find an apparent lack of sense of speed and distance in "Adventure Capital" (February 1989). You used the term knots per hour twice. A knot is a speed of nautical miles per hour. We are also informed that 100 meters is "less than a mile." While true, this is misleading, since 100 meters is less than one tenth of a mile. Someone needs to tighten ship.

John E. Runniger
Roma, NY

Forgive us, we know knot what we did

—The editors **DD**



Soviet philologist Tatiana Dobroskokovskaya with children Alexia and Kathy reading *Oms*.

ANGELS SING

CONTINUED FROM PAGE 54

ly looked, the bedroom windows were closed; screens in place. Through the living room was the only way the kid on his bed could get out, and he knew he would not get past him if she woke up and tried to make a run. He nodded, then moved his two easy chairs so that they faced the bedroom, he pulled an end table between them, got another glass, and brought the bottle of bourbon. He sat down to wait for Mary Beth, brooding over the girl in his bed. From time to time the blanket shook hard, a slight movement that was nearly constant suggested that she had not yet warmed up. His other blanket was under her, and he had no intention of touching her again in order to get to it.

Mary Beth arrived as furious as he had expected. She was his age, about forty, graying, with suspicious blue eyes and no makeup. He had never seen her with lipstick or, or jewelry of any kind except for a watch, or in a skirt or dress. That night she was in jeans and a sweatshirt and a bright red hooded raincoat that brought the rainstorms inside as she entered, cursing him. He noted with satisfaction that she had her camera gear. She cursed him expertly as she yanked off her raincoat and was still calling him names when he finally put his hand over her mouth and took her by the shoulder, propelled her toward the bedroom door.

"Shut up and look," he muttered. She was stronger than he had realized and now twisted out of his grasp and swung a fist at him. Then she faced the bedroom. She looked, then turned back to him red-faced and sputtering: "You... you got me out... a floozy in your bed... So you really do know what that thing you've got is used for! And you want pictures? Jesus God!"

"Shut up!"

That time she did. She peered at his face for a second, turned and looked again, took a step forward, then another. He knew her reaction was to his expression, not the lump on the bed. Nothing of that girl was visible, just the unquiet blanket and a bit of darkness that was not hair but should have been. He stayed at Mary Beth's side, and his caution was communicated to her, she was as quiet now as he was.

At the bed he reached out and gently pulled back the blanket. One of her hands clutched it spasmodically. The hand had four apparently boneless fingers long and tapered, very pale. Mary Beth exhaled too long and neither of them moved for what seemed minutes. Finally she reached out and touched the darkness at the girl's shoulder, touched her arm, then her face. Abruptly

ly she pulled back her hand. The girl on the bed was shivering harder than ever, in a tighter ball that had the many folds of skin at her groin.

"It's cold," Mary Beth whispered.

"Yeah." He put the blanket back over the girl.

Mary Beth went to the other side of the bed, squeezed between it and the wall and carefully pulled the bedspread and blanket free, and put them over the girl also. Eddie took Mary Beth's arm, and they backed out of the bedroom. She sank into one of the chairs he had arranged and automatically held out her hand for the drink he was pouring.

"My God," Mary Beth said softly after taking a large swallow. "What is it? Where did it come from?"

He told her as much as he knew, and they regarded the sleeping figure. He thought the shivering had subsided, but maybe she was just too weak to move so many covers.

He had backed up to the wall, but even from there he could see her clearly. Her face was without eyebrows or eyelashes, her nose too small, and her lips too narrow.

"You keep saying it's a she," Mary Beth said. "You know that thing isn't human, don't you?"

Reluctantly he described the rest of the girl, and this time Mary Beth finished her drink. She glanced at her camera bag but made no motion toward it yet. "It's our story," she said. "We can't let them have it until we're ready. Okay?"

"Yeah. There's a lot to consider before we do anything."

Silently they considered. He recalled their glasses, and they sat watching the sleeping creature on his bed. When the lump flattened out a bit, Mary Beth went in and lifted the covers and examined her, but she did not touch her again. She returned to her chair very pale and sipped bourbon. Outside the wind moaned, but the howling had subsided, and the rain was no longer a driving presence against the front of the house, the side that faced the sea.

From time to time one or the other made a brief suggestion.

"Not NPR?" Eddie said.

"Right." Mary Beth said. She was a stringer for NPR.

"Not newsprint," she said later. Eddie was a stringer for AP. He nodded.

"It could be dangerous when it wakes up," she said.

"I know. Six rows of alligator teeth, or poison fangs, or mind rays."

She giggled. "Maybe right now there's a hidden camera taking in all this. Remember that old TV show?"

"Maybe they sent her to test us, our reaction to them."

Mary Beth sat up straight. "My God, more of them?"

"No species can have only one member," he said very seriously. "A counterproductive trait." He realized that he was quite drunk. "Coffee," he said and pulled himself out of the chair, made his way unsteadily to the kitchen.

When he had the coffee ready, and tuna sandwiches and sliced onions and tomatoes, he found Mary Beth leaning against the bedroom door, contemplating the girl.

"Maybe it's dying," she said in a low voice. "We can't just let it die, Eddie."

"We won't," he said. "Let's eat something. It's almost daylight."

She followed him to the kitchen and looked around it. "I've never been in your house before. You realize that? All the years I've known you, I've never been invited here before."

"Five years," he said.

"That's what I mean. All those years it's a nice house. It looks like your house should look, you know?"

He glanced around the kitchen. Just a kitchen—stove, refrigerator, table, counters. There were books on the counter and piled on the table. He pushed the pile to one side and put down plates. Mary Beth lifted one and turned it over. Russet-colored, gracefully shaped pottery from North Carolina, signed by Sara. She nodded, as if in confirmation. "You picked out every single item individually, didn't you?"

"Sure. I have to live with the stuff."

"What are you doing here, Eddie? Why here?"

"The end of the world, you mean? I like it."

"Well, I want the hell out. You've been out and chose to be here. I choose to be out. That thing on your bed will get me out."

From the University of Indiana to a small paper in Exton, on to Philadelphia, New York. He let her had been out plenty, and now he simply wanted a place where people lived in individual houses and chose the pottery they drank their coffee from. Six years ago he had left New York on vacation, he had said, and he had come to the end of the world and stayed.

"Why haven't you gone already?" he asked Mary Beth.

She smiled her crooked smile. "I was married; you know that? To a balhman

That's what girls on the coast do, marry fishermen or lumbermen or policemen. Me, Miss Original No-Talent herself. Married, playing house forever. He's out there somewhere. Went out one day and never came home again. So I got a job with the paper, this and that. Only one thing could be worse than staying here at the end of the world, and that's being in the world broke. Not my style."

She finished her sandwich and coffee and now seemed too restless to sit still. She went to the window over the sink and gazed out. The light was gray. "You don't believe here any more than I do. What happened? Some woman tell you to get lost? Couldn't get the job you wanted? Some young slim punk worm in a front of you? You're dodging just like me."

All the above he thought silently, and said, "Look, I've been thinking. I can't go to the office without raising suspicion, in case anyone's looking for her, I mean. I haven't been in the office before one or two in the afternoon for more than five years. But you can. See if anything's come over the wires, if there's a search on, if there was a week of any sort. You know if the FBI's nosing around, or the military. Anything at all." Mary Beth rejoined him at the table and poured more coffee, her restlessness gone, an intent look on her face. Her business face he thought.

"Okay. First some pictures, though. And we'll have to have a story about my car. It's been out front all night," she added crisply. "So if anyone brings it up, I'll have to say I keep you company now and then. Okay?"

He nodded and thought without bitterness that that would give them a laugh at Connolly's Tavern. That reminded him of Truman Cox. They'll get around to him eventually, and he might remember seeing her. Of course, he assumed it was the Boland girl. But they'll know we saw someone.

Mary Beth shrugged. "So you saw the Boland girl and got to thinking about her and her trade and gave me a call. No problem."

He looked at her curiously. "You really don't care if they start that scuttlebutt around town about you and me?"

"Eddie," she said almost too sweetly, "I'd admit to fucking a pig if it would get me the hell out of here. I'll go on home for a shower, and by then maybe it'll be time to get on my horse and go to the office. But first some pictures."

At the bedroom door he asked in a hushed voice, "Can you get them without using the flash? That might send her into shock or something."

She gave him a dark look. "Will you for Christ's sake stop calling it a hor?" She scowled at the figure on the bed. "Let's bring in a lamp, at least. You know I have to uncover it."

He knew. He brought in a floor lamp, turned on the bedside light, and watched Mary Beth go to work. She was a good photographer, and in this instance she had an immobile subject; she could use time exposures. She took a roll of film and started a second one, then drew back. The girl on the bed was shivering hard again, drawing up her legs, curling into a tight ball.

"Okay. I'll flash in daylight, maybe when she's awake."

Mary Beth was right. Eddie had to admit: the creature was not a girl, not even a female probably. She was elongated, without any angles anywhere, no elbows or sharp knees or jutting hipbones. Just a smooth long body without breasts, without a navel, without genitalia. And with that dark growth that started

high on her head and went down the backs of her arms, covered her back entirely. Like a mantle, he thought, and was repelled by the idea. Her skin was not human, either. It was pale with yellow rather than pink undertones. She obviously was very cold, the yellow was fading to a grayish hue. Tentatively he touched her arm. It felt wrong, not yielding the way human flesh covered with skin should yield. It felt like cool silk over something firmer than human flesh.

Mary Beth replaced the covers, and they backed from the room as the creature shivered. "Jesus," Mary Beth whispered. "You'd think it would have warmed up by now. This place is like an oven, and all those covers." A shudder passed through her.

In the living room again, Mary Beth

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began to fiddle with her camera. She took out the second roll of film and held both rolls in indecision. "If anyone's roving around, and if they learn that you might have seen it and that we've been together, they might snatch my film. Where's a good place to stash it?"

He took the film rolls and she shook her head. "Don't tell me. Just keep it safe." She looked at her watch. "I won't be back until ten or later. I'll find out what I can, make a couple of calls. Keep an eye on it. See you later."

He watched her pull on her red rain-coat and went to the porch with her, where he stood until she was in her car and out of sight. Daylight had come; the rain had ended, although the sky was still overcast and low. The fringes in his front yard glistened and shook off water with the slightest breeze. The wind had turned into no more than that, a slight breeze. The air was not very cold, and it felt good after the heat inside. It smelled good, of leaf mold and soil and earth and fish and tree trees. He took several deep breaths and then went back in. The house really was like an oven, he thought, momentarily refreshed by the cool morning and now once again feeling lousy. Why didn't she warm up? He stood in the doorway to the bedroom and looked at the huddled figure. Why didn't she warm up?

He thought of victims of hypothermia:

the first step, he had read, was to get their temperature back up to normal, any way possible. Hot water bottle? He didn't own one. Hot bath? He stood over the grill and shook his head slightly. Water might be toxic to her. And that was the problem, she was an alien with unknown needs, unknown dangers. And she was freezing.

With reluctance he touched her arm, still cool in spite of all the covering over her. Like a hot-house plant, he thought then, brought into a frigid climate, destined to die of cold. Moving slowly, with even greater reluctance than before, he began to pull off his trousers, his shirt, and when he was down to undershirt and shorts, he gently shifted the sleeping girl and lay down beside her, drew her to the warmth of his body.

The house temperature by then was close to eighty-five, much too warm for a man with all the fat that Eddie had on his body, the fat good food to him, cooling, even soothing. For a time she made no response to his presence but gradually her shivering lessened, and she seemed to change subtly, lose her rigidity, her legs curved to make contact with his legs, her torso shifted, relaxed, flowed into the shape of his body; one of her arms moved over his chest, her hand at his shoulder, her other arm bent and tucked itself against his. Her cool cheek pressed against the pl-

lows of flesh over his ribs. Carefully he wrapped her arms about her and drew her closer. He dozed, came awake with a start, dozed again. At nine he woke up completely and began to disengage himself. She made a soft sound, like a child in protest, and he stroked her arm and whispered nonsense. At last he was untangled from her arms and legs and stood up and pulled on his clothes again. The next time he looked at the girl, her eyes were open, and he felt embraced momentarily. Large, round, golden eyes, like pools of molten gold, unblinking, inhuman. He took a step away from her.

"Can you talk?"

There was no response. Her eyes closed again and she drew the covers high up onto her face, buried her head in them.

Warily Eddie went to the kitchen and poured coffee. It was hot and tasted like tar. He emptied the coffee maker and started a fresh brew. Soon Mary Beth would return and they would make the plans that had gone nowhere during the night. He felt more tired than he could remember and thought ruefully of what it was really like to be forty-two and a hundred pounds overweight and miss a night's sleep.

"You look like hell," Mary Beth said in greeting at ten. She looked fine, except a flush on her cheeks, her eyes sparkling. "Is it okay? Has it moved? Come awake yet?" She charged past him and stood in the doorway to the bedroom. "Good. I got hold of Homer Carpenter, over in Portland. He's coming over with a video camera around two or three. I didn't tell him what we have, but I had to tell him something to get him over. I said we have a coelacanth."

Eddie stared at her. "He's coming over for that? I don't believe it."

She left the doorway and swept past him on her way to the kitchen. "Okay, he doesn't believe me, but he knows it's something big, something hot, or I wouldn't have called him. He knows me that well, anyway."

Eddie thought about it for a second or two, then shrugged. "What else did you find out?"

Mary Beth got coffee and held the cup in both hands, surveying him over the top of it. "Boy oh boy, Eddie! I don't know who knows what, or what it is they know, but there's a hurt on. They're saying some guys escaped from the pan over at Salem, but that's bull. Roadblocks and everything. I don't think they're telling anyone anything yet. The poor cops out there don't know what the hell they're supposed to be looking for, just anything suspicious, until the proper authorities get here."

"Here? They know she's here?"

"Not here here. But somewhere on the coast. They're closing in from north and south. And that's why Homer de-



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ceded to get his ass over here, too."

Eddie remembered the stories that had appeared on the wire services over the past few weeks about an erotic comet that was being tracked. Stuart Winkie, the publisher and editor in chief, had not chosen to print them, but Eddie had seen them. And more recently the story about a possible burnout in space of a Soviet capsule. Nothing to worry about, no radiation, but there might be bright lights in the skies, the stories had said. Right, he thought.

Mary Beth was at the bedroom door again, sipping her coffee. "I'll owe you for this, Eddie. No way can I pay for what you're giving me." He made a growling noise, and she turned to regard him, suddenly very serious.

"Maybe there is something," she said softly. "A little piece of the truth you know you're not the most pacifist man in town, Eddie. You're always doing little things for people, and yet, do they like you for it, Eddie? Do they?"

"Let's not do any psychoanalysis right now," he said coldly. "Later."

She shook her head. "Later I won't be around. Remember? Her voice took on a mocking tone. "Why do you suppose you don't get treated better? Why no one comes to visit? Or invites you to the clubs, except for office parties, anyway? It's all those little

things you keep doing, Eddie. Overdoing maybe. And you won't let anyone pay you back for anything. You turn everyone into a poor relation, Eddie, and they begin to resent it."

Abruptly he laughed. For a minute he had been afraid of her, what she might reveal about him. "Right," he said. "Tell that to Ruthie Jensen."

Mary Beth shrugged. "You give poor little Ruthie exactly what she craves—mistreatment. She takes it home and nurtures it. And then she loads guilty The Boland led you intended to rescue. You would have had her, her sister, and their mother all feeling guilty. Truman Cox. How many free drinks you let him give you, Eddie? Not even one. I bet. Stuart Winkie? You run his paper for him. You ever use that key to his cabin? He really wants you to use it, Eddie. A taken repayment. George Altmann, Hamlet Davies—it's a long list, Eddie, the people you've done little things for. The people who go through life owing you, feeling guilty about not liking you, not sure why they don't. I was on that list, too, Eddie, but not now. I just paid you in full."

"Okay," he said heavily. "Now that we've cleared up the mystery about me, what about her?" He pointed past Mary Beth at the girl on his bed.

"It, Eddie. It. First the video, and

make some copies, get them into a safe place, and then announce. How does that sound?"

He shrugged. "Whatever you want." She grinned her crooked smile and shook her head at him. "Forget it, Eddie. I'm paid up for years to come. Look. I've got to get back to the office. I'll keep my eyes on the wires, anything coming in, and as soon as Homer shows, we'll be back. Are you okay? Can you hold out for the next few hours?"

"Yeah, I'm okay." He watched her pull on her coat and walked to the porch with her. Before she left, he said, "One thing, Mary Beth. Did it even occur to you that some people like to help out? No ulterior motive or anything, but a little human regard for others?"

She laughed. "I'll give it some thought, Eddie. And you give some thought to having perfected a method to make sure people leave you alone, keep their distance. Okay? See you later." He stood on the porch, taking deep breaths. The air was mild, maybe the sun would come out later on. Right now the world smelled good, scoured clean, fresh. No other house was visible. He had let the trees and shrubbery grow wild, screening everything from view. It was like being the last man on Earth, he thought sudden-

ly. The heavy growth even screened out the noise from the little town. If he listened intently, he could make out engine sounds, but no voices, no one else's music that he usually detested, no one else's cries or laughter.

Mary Beth never had been ugly, he thought then. She was good-looking in her own way even now, going on middle age. She must have been a real looker as a younger woman. Besides, he thought, if anyone ever mocked her, called her names, she would slug the guy. That would be her way. And he had found his way, he added, then turned brusquely and went inside and locked the door after him.

He took a kitchen chair to the bedroom and sat down by her. She was shivering again. He reached over to pull the covers more tightly about her, then stopped her motion and stared. The black marle thing did not cover her head as completely as it had before. He was sure it now started farther back. And more of her cheeks was exposed. Slowly he drew away the cover and then turned her over. The marle was looser, with folds where it had been taut before. She reacted violently to being uncovered, shuddering long spasmodic movements.

He repeated the cover

"What the hell are you?" he whis-

pered. "What's happening to you?"

He rubbed his eyes hard and sat down, regarding her with a frown. "You know what's going to happen, don't you? They'll take you somewhere and study you, try to make you talk, if you can, find out where you're from, what you want, where there are others... They might hurt you... Even kill you."

He thought again of the great gold an pools that were her eyes, of how her skin felt like silk over a firm substance, of the substantiality of her body, the lightness when he carried her.

"What do you want here?" he whispered. "Why did you come?"

After a few minutes of silent watching, he got up and found his dry shoes in the closet and pulled them on. He put on a plaid shirt that was very warm, and then he wrapped the sleeping girl in the blanket and carried her to his car and placed her on the backseat. He went back inside for another blanket and put that over her too.

He drove up his street, avoiding the town, using a back road that wound higher and higher up the mountain. Stuart Wexler's cabin, he thought. An open invitation to use it any time he wanted. He drove carefully, taking the curves slowly, not wanting to jar her. He pulled his off the backseat. The woods pressed in closer when he left the road for a log

road. From time to time he could see the ocean, then he turned and lost it again. The road clung to the steep mountain side, climbing, always climbing, there was no other traffic on it. The loggers had finished with this area, this was state land, untouchable, for now anyway. He stopped at one of the places where the ocean spread out below him and watched the waves rolling in forever and ever, unchanging, unknowable. Then he drove on. The cabin was high on the mountain. Up here the trees were mature growth, mammoth and silent, with deep shadows beneath them, little understorey growth in the dappled shade. The cabin was redwood, rough, heated with a wood stove, no running water, no electricity. There was oil for a lamp, and plenty of dry wood stacked under a shed, and a store of food that Stuart had said he should consider his own. There were two beds in the single bedroom and a couch that opened to a double bed in the living room. Those two rooms and the kitchen made up the cabin.

He carried the girl inside and put her on one of the beds, she was entirely enclosed in blankets like a cocoon. Hastily he made a fire in the stove and brought in a good supply of logs. Like a hot-house plant, he thought, she needed plenty of heat. After the cabin start-

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ed to heat up, he took off his outer clothing and lay down beside her, the way he had done before, and so before, she conformed to his body, melted into him, absorbed his warmth. Sometimes he closed, then he lay quietly thinking of his childhood, of the heat that descended on Indians like a physical substance, of the tomatoes that sometimes came murdering funnels that sucked life away, shredded everything. He closed and dreamed and awakened and dreamed in that state also.

He got up to feed the fire and tossed in the tin Mary Beth had given him to guard. He got a drink of water at the pump in the kitchen and lay down by her again. His fatigue increased, but pleasantly. His weariness was without pain, a floating sensation that was between sleep and wakefulness. Sometimes he talked quietly to her, but not much, and what he said he forgot as soon as the words formed. It was better to lie without sound, without motion. Now and then she shook convulsively and then subsided again. The light came, darkness, then twilight again. Several times he aroused enough to build up the fire.

When it was daylight once more, he got up, reeling as if drunk, he pulled on his clothes and went to the kitchen to make instant coffee. He sensed her presence behind him. She was standing up, nearly as tall as he was, but incredibly insubstantial, not thin, but as slender as a straw. Her golden eyes were wide open. He could not read the expression on her face.

"Can you eat anything?" he asked. "Drink water?"

She looked at him. The black mantle was gone from her head, he could not see it anywhere on her as she faced him. The strange folds of skin at her groin, the boneless appearance of her body, the lack of hair, breasts, the very color of her skin looked right now, not alien, not repellent. The skin was like cool silk, he knew. He also knew this was not a woman, not a she, but something that should not be here, a creature, an it.

"Can you speak? Can you understand me or at all?"

Her expression was as unreadable as that of a wild creature, a forest animal, aware, intelligent, unknowable.

Helplessly he said, "Please, if you can understand me, nod. Like this." He showed her and in a moment she nodded. "And like this for no," he said. She mimicked him again.

"Do you understand that people are looking for you?"

She nodded slowly. Then very deliberately she turned around, and instead of the black mantle that had grown on her head, down her back, there was an iridescence, a rainbow of pastel colors that shimmered and gleamed. Eddie

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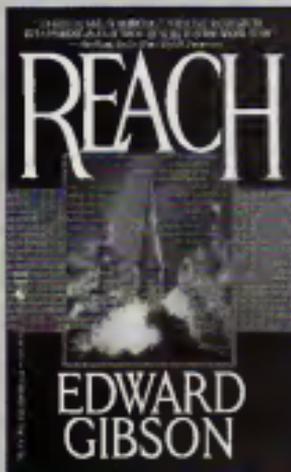
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sucked in his breath as the new growth moved, opened slightly more.

There wasn't enough room in the cabin for her to open the wings all the way. She stretched them from wall to wall. They looked like gauze, filmy, filled with light that was alive. Not realizing he was moving, Eddie was drawn to one of the wings, reached out to touch it. It was as hard as steel and cool. She turned her golden liquid eyes to him and drew her wings in again.

"We'll go someplace where it's warm," Eddie said hoarsely. "I'll hide you. I'll smuggle you somehow. They can't have you!" She walked through the living room to the door and studied the handle for a moment. As she reached for it, he lumbered after her, lurged toward her, but already she was opening the door, slipping out.

"Stop! You'll freeze. You'll die!"

In the clearing of the forest, with sunlight slanting through the giant trees, she spun around, lifted her face upward, and then opened her wings all the way. As effortlessly as a butterfly, or a bird, she drew herself up into the air, her wings flashing light, now gleaming, now appearing to vanish as the light reflected one way and another.

"Stop! Eddie cried again. "Please! Oh, God, stop! Come back!"

She rose higher and looked down at him with her golden eyes. Suddenly the air seemed to tremble with sound, trills and whistles and flutings. Her mouth did not open as the sounds increased until Eddie fell to his knees and clapped his hands over his ears, moaning. When he looked again, she was still rising, shining, invisible, shining again. Then she was gone. Eddie pitched forward into the thick layer of fir needles and forest humus and lay still. He felt a tugging on his arm and heard Mary Beth's furious curses but as if from a great distance. He moaned and tried to go to sleep again. She would not let him.

"You goddamned bastard! You filthy son of a bitch! You let it go! Didn't you? You turned it loose!"

He tried to push her hands away.

"You scum! Get up! You hear me? Don't think for a minute, Buster, that I'll let you die out here! That's too good for you, you lousy tub of lard. Get up!"

Against his will he was crawling, then stumbling, leaning on her, being steadied by her. She kept cursing all the way back inside the cabin, until he was on the couch, and she stood over him, arms akimbo, glaring at him.

"Why? Just tell me why. For God's sake, tell me Eddie, why?" Then she screamed at him. "Don't you dare pass out on me again. Open those damn eyes and keep them open!"

She savaged him and nagged him, made him drink whiskey that she had brought along, then made him drink cof-

began using electrodes to record cell activity in the rabbits' brains as they learned. The recordings led to the cerebellum. They showed that neurons there massively increased activity as the rabbits learned the eye-blink maneuver. Thompson found that when he damaged a specific area of the rabbit cerebellum, they could neither perform the task nor learn it. The loss of the motor skill learning and memory was he says "complete permanent and selective."

Thompson's next move: determining what happens in neurons here. The most important site for the eye blink maneuver appeared to be in a tiny region of the tightly folded cerebellar cortex, called H-VI. The cerebellum contains four types of cells, and the recordings suggested that H-VI Purkinje cells were important during learning. To establish what neuronal activity was occurring, Thompson trained 15 rabbits in the eye-blink maneuver. But instead of a bell, he used a tiny electric shock. The electrical stimulation affects a more restricted area of the cerebellum than a bell.

After the training, he sent the rabbit cerebellums to psychologist Greenough's lab at the University of Illinois at Urbana-Champaign, where Greenough is associate director of the Beckman Institute and studies learning-related structural changes in the brain. There, for the next two years, Greenough's group used light microscopes to analyze the Purkinje cells of the H-VI region of both the trained and untrained sides of the cerebellums. "The result we got was exactly as Dr. Thompson predicted," Greenough says. On the trained side his group found a reduction in the number of connections between the nerve pathways called parallel fibers and the Purkinje cells. They also saw a reduction in the number of dendritic branches.

Normally Greenough says one might expect to find an increase in branches and fibers from learning. But in the cerebellum, the Purkinje cells are inhibitory. Here the Purkinje cells' most common reaction when stimulated during learning is to decrease their response. As the cells learn what's coming, they tend to ignore it. The finding is the strongest evidence yet of a cellular change occurring in the cerebellum during learning.

But most researchers are cautious about the experiment. Investigators have not completed control studies and the history of cerebellar memory study is crowded with contention. Several prominent neuroscientists have been vocal in their concern that existing research does not support Thompson's idea. One is James Bloddel, a neurobiologist at the Barrow Neurological Institute in Phoenix. Bloddel has removed a rabbit's cerebel-

lum and still managed to train the rabbit in eye-blink skills. The evidence, he says, shows that the cerebellum is not the required site of the memory trace for this type of motor learning.

What is agreed upon by everybody is that the cerebellum plays an important role in learning and memory," says Stephen Lisberger, a physiologist at the University of California, San Francisco Medical School. What isn't agreed upon is what that role is, precisely where it occurs and whether the cerebellum is a storage site for memory. If Thompson and Greenough's research holds up, though, it will add weight to the idea that memory is stored in the cerebellum. While learning how cerebellar memory works could lead to practical therapeutic applications for people suffering from brain damage that affects motor skills, rehabilitation experts might also design treatments that include neuron growth-inducing drugs and methods that would stimulate rewiring in the cerebellum.

"Say you determine these neuroanatomical changes are basic to memory storage," says John Dusek, associate professor of cell, molecular and structural biology at Northwestern University Medical School. "It means neurons can prune off or add to parts of the dendritic tree. On the one hand, you could see it as a Brave New World thing. On the other hand, if it stroke victim had damage, you could potentially inject some kind of substance to encourage neurons in that area to become more plastic, more mobile. Then you'd simultaneously do the physical therapy you know is going to get those neurons active."

Could the same principle be applied to boost athletic prowess? For some athletes, gaining the "slightly" edge is a near obsession. Could it transform a klutz into a graceful dancer, push a ballerina into the prime spotlight? Maybe, says Greenough, although it's hard to speculate right now because of all the unknown factors. For instance, as a normal athlete improves skills, cerebellar changes presumably occur without any special stimulation by acetylcholine, an undiscovered substance. And considering the delicate balance of the normal system, he adds, any intervention could be more disruptive than helpful.

Greenough and Thompson emphasize that the latest experiment is just a start. "I like to think of this as almost a lessobvious thing," says Greenough. "It says okay, we know with over more certainty that these cells are involved in the learned behavior change. But it is a first experiment. First experiments can be the most exciting and interesting because they point in a direction that is likely to pay off. But it must be considered a first experiment, certainly not something where aha, we've done it, we wrap it, we send it off to a paper, and don't have to work in the area anymore." □

was the first approved by the EPA and the USDA for outdoor feeding of a genetically altered plant vaccine.

Whether the new products prove to be safe, nutritious and appealing is another matter. By offering only high yields and other factors that bolster profitability, many of today's crops are already sorely lacking in overall quality. Food grown on factorylike acreage, sprayed, irradiated and processed, has little in common with vine- or tree-ripened fruits or organically grown and stone-ground grains.

In short, American agriculture is not a sustainable or even desirable system. Not only does it pollute and exhaust the environment, it has diminished the quality and variety of our fruits and vegetables.

Fortunately, grass-roots movements are beginning to rise up in response to these crises. Farmers are realizing that their survival and the survival of American agriculture lies in decentralizing and developing sustainable farming techniques. In the Northeast, where the typical farm is one third the size of the national average, farmers have chosen to stay small, to diversify their crops, and to sell directly to the consumer at roadside stands and farmers' markets.

Some of the more creative Midwestern farmers are taking note. In southern Minnesota, where 1,000-acre farms are going out of business all around here, one farmer and his family make a living from organically farming five acres. He now sells his own vine-ripened fruit and vegetables to local customers.

Other farmers are following suit. A grocery store chain in suburban Minneapolis has agreed to buy vegetables from the local growers. Additionally, a group of farmers has formed a nonprofit organization that plans to build a food processing center that will gather, prepare and ship all the produce and to construct a huge greenhouse where farmers' plants can be started.

Sustainable agriculture, which does not deplete the soil or rely on pesticides, has established a foothold. Experts estimate that between 30,000 and 100,000 of the nation's farmers are raising crops with out chemicals. The government now funds a toll-free number in Arkansas that provides information on sustainable agriculture. Universities are also beginning to offer research grants in the new technique. "This kind of research," says Senator Patrick J. Leahy, chair of the Senate Agriculture Committee, "could eventually bring about the healthiest agriculture in the world." □

Excerpted from *Cleaner, Closer, Safer, Greener* by Gary Neal, published by Fiksdal Books. © 1997 by Gary Neal and Denis Publications International, Ltd.

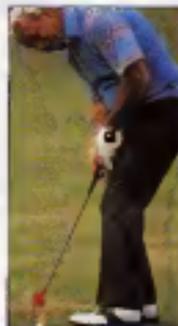
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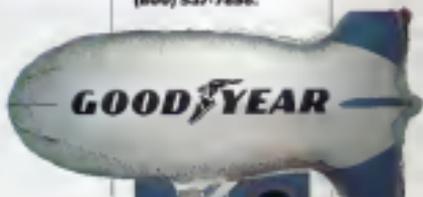


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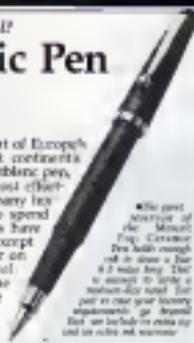
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STARS

CONTINUED FROM PAGE 24

received New Zealand replies. "I simply love observing the stars, and it's a beautiful universe. I really just enjoy scanning along."

Austin downplays his discoveries and judges his latest find as nothing too important. But Jet Propulsion Laboratory comet expert Donald Yeomans disagrees with the veteran hunter. "It is quite possible," Yeomans says, "that because of the groundwork pioneered by the study of Halley's in 1985, we will learn even more from Comet Austin in 1990." Yeomans points out that Comet Austin, on its closest approach to Earth on May 25, will pass within 20 million miles of our planet, considering that the comet's tail could be 30 million miles long (more than the average distance between Earth and Venus). Comet Austin will miss our planet by a celestial hairbreadth. Indeed, the close approach means that earth-bound radar probing the comet will have a good, strong return signal that may shed light on its inner workings.

The timing of this comet's appearance has the professional astronomical community in a gleeful uproar. If all goes well with the orbiting Hubble Space Telescope (HST), the first object it trains its sights on could be Comet Austin. The camera onboard this telescope is powerful enough to discern surface features on the planet Pluto and cloud patterns on Jupiter. The details HST might reveal of a major comet passing 17 times closer than Jupiter stagger the imagination.

Comet Austin will make its appearance during one of the strongest peaks of solar activity in modern history. Comet gas jet expert Malcolm Neidner says that the "solar maximum" environment, with its increased EUV (extreme ultraviolet) radiation and abundance of fast-moving solar wind, should "promote a long and vigorous comet gas jet." Depending on the comet's brightness (still unknown at the time of this writing), ordinary people inclined to awaken a few hours before dawn should be able to spot the comet from virtually anywhere in the world.

All of these possibilities stem from what was at first only a dim blur in a telescope. But there is one further bonus. This comet appears to be a first-time visitor to the inner solar system. Comets are believed to harbor remnants from the birth of the sun and the planets. A first-time visitor like Comet Austin would carry an almost unmarred freight of these elements, far purer than the materials carried by the veteran visitor Halley's Comet. For the first time ever, astronomers may have an excellent view of a pristine comet. ☐

CONTINUED FROM PAGE 37

laboratories. And they published something they really didn't believe. In fact, they planned to investigate it later themselves. That was a foolish thing to do. Journal editors are not policemen.

Omni: How big a problem is fraud in medical research?

Reisman: It's not a big problem. Considering the number of potential miscreants, the number of cases that have come to light is a tiny drop in the bucket—a dozen or twenty cases of proven fraud over a period of years when tens of thousands of people have been doing biomedical research. Also, one ought to distinguish between fraud, the deliberate attempt to mislead by falsifying or plagiarizing data, and error or sloppiness, which leads to invalid conclusions but represents honest mistakes. You could even say that the progress of science is a process of identification and correction of error. Without error, there's no science. Scientists are only human. They may overlook things or draw wrong conclusions. Their methods may be inaccurate or inappropriate. They may do the wrong experiment. But they honestly believe that they're entitled to draw the conclusions they've drawn. Furthermore, careful peer review will usually identify that kind of error.

Omni: To deter fraud, Drummond Renne, editor of JAMA, is urging that authors' raw data be spot-checked for discrepancies.

Reisman: That's not a good idea. It's just as easy to fake your books as it is to fake an experiment. If you know that every hundredth paper submitted is going to be subjected to a random audit, you'll see to it that your notebooks are consistent with what you sent to the journal. Renne's proposal would also be terribly expensive and time-consuming. And it would create such an atmosphere of distrust that the collegial spirit of science will be lost.

The best course is to prevent fraud. And the best way to prevent it is to have co-workers and supervisors pay closer attention to what the research team is doing. Almost always, fraud is the work of one person, not of a team. You don't have a network of crooks in science. I'm not saying there should be an inquisition. One problem now is that people working on a team tend to go their own way. They don't talk to one another. There isn't close enough attention being paid, in a friendly way, to what the other members are doing. When I was doing research, it was unusual for the senior person not to be in the laboratory, talking to the fellows and technicians, looking at the raw data, watching the experiments. There's increasing distance between the super-

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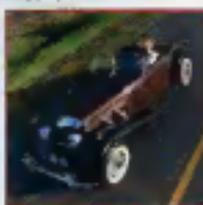
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visors and the people who are actually doing the work. That's not healthy.

Omni: Why did you originally choose medicine as a career?

Reisman: As a young man, I thought medicine was a wonderful way for me to make my way in the world by combining biology, which I found fascinating, with helping people. I majored in biology and also in philosophy. For a while I considered becoming a professional philosopher rather than a doctor. I decided I didn't have enough to contribute as an academic philosopher. And I could always do that as an avocation.

My interest in ethical issues in medicine stems directly from my continuing interest in philosophy. My early experiences with death and dying also played a big part. I was a kidney spe-

cialist in the days before kidney transplants and artificial kidneys. Everybody with progressive kidney disease died, so I took care of hundreds of patients who had a fatal disease. I couldn't avoid thinking about the philosophical and ethical questions involved. Studying philosophy was a perfect preparation for that. I suppose becoming a minister is another way to deal with death and dying. But that's limited in a sense, because you have the skeptics—the atheists and agnostics who cannot embrace religion and still have to face death. By including everyone, philosophy is broader.

Omni: And atheists get sick, too.

Reisman: Sure. So it seems to me medicine and philosophy makes a wonderful combination. **CC**

Just for kicks: A sports quiz that will surprise and teach you—and is fun to boot

GAMES

By Scot Morris

In the spring many peoples' thoughts turn to love—the love of sports, that is, and scientists are no exception. This month we cover the science of sports. I am indebted to Peter J. Brancazio, professor of physics and astronomy at Brooklyn College, for help in preparing this quiz. Brancazio is the author of *Sport Science: Physical Laws and Optimum Performance*.

The following quiz is filled with interesting bits of trivia about sports. Think about the answers before peeking; some may seem illegal.

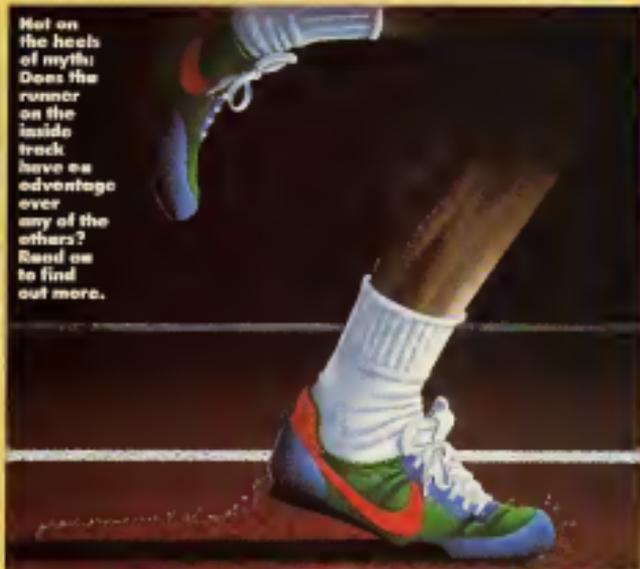
1. Weather report: When does a baseball travel the farthest? (a) a hot, humid day; (b) a hot, dry day; (c) a cold, humid day; or (d) a cold, dry day.

2. Swing away: Consider a right-handed batter. In the swing, his left hand pulls the bat and his right hand pushes it. Calculations show that the greater force is provided by the pull, in this case, the left hand. Why doesn't a right-hander stand on the other side of the plate so that he can use his stronger hand and arm to do the pulling?

3. Top speed: In which race do runners reach the fastest average speed? (a) 100 meters; (b) 200 meters; or (c) 400 meters.

4. Staggered start: In a 200-meter sprint, runners line up with a staggered start and must stay in their lanes throughout the race. The runner on the inside track starts farther back to compensate for the shorter radius of the turn. The dis-

Not on the heels of myth: Does the runner on the inside track have an advantage over any of the others? Read on to find out more.



tances run are the same. Which runner has the physical advantage? (a) the one on the inside track; (b) the one on the outside track; or (c) the track positions are irrelevant.

5. Nonmetric: In 1976 the International Amateur Athletic Federation, or IAAF (the major governing body of track-and-field events) decided to stop carrying world records for such events as the 100-yard dash and the quarter-mile run. Since then the IAAF has allowed only races measured in metric units—the 100-meter dash, etc.

What is the one exception?

6. Throw that disc: Olympic champion Al Center can hurl a discus more than 220 feet. Which wind condition would Center prefer? (a) throwing into the wind; (b) throwing with the wind; or (c) no wind at all.

7. Sticky bounce: Some witnesses swear that a tennis ball flies faster after it bounces. (a) This is an illusion—nothing can make a ball speed up after bouncing; (b) this is no illusion—sometimes it happens.

8. Foul shots: In shooting free throws in basketball, muscle analyses by Branca-

zio shows that the most effective technique is the underhand throw. Current professional players don't use this technique, however. Why is this throw considered best, and why isn't it used today?

9. Out to launch: Studies of trajectories indicate that when air resistance is not a factor, a missile has the greatest horizontal range when it is launched at a 45° angle. Here are two exceptions: Explain why in each case the actual trajectory differs from 45°.

(a) In the shot, put the farther distances are

achieved when the launch angle is about 42°.

(b) The launch angle for football punts is between 50° and 55°.

10. Longest jump. In the 1968 Mexico City Olympics, American athlete Bob Beamon set a long jump record of 29 feet, two and a half inches. This bettered the previous record by more than two feet. According to physical analysis, because of Mexico City's high elevation, three factors may have contributed extra inches to the jump. First, the lower gravity added about one inch to the jump. Second, the lower air resistance during the jump provided another inch and a half. What was the third factor, estimated to be more important?

11. The O₂ tank. Giving pure oxygen to an exhausted athlete will speed his or her rate of recovery. True or false?

12. Take the high train. Athletes who train at high altitudes (such as the U.S. Olympic facility in Colorado Springs) develop greater endurance and perform better when they return to sea level. True or false?

ANSWERS

1. Weather. A ball travels farthest on (a) hot, humid days. In the summer of 1985 an unusually high number of home runs were scored, leading to speculation that the ball had changed or that hitters had tinkered with their bats. It turned out that the preponderance of homers was hit during the first part of the

summer—one of the hottest on record. And despite our impression that a humid day is "heavy," water molecules are actually lighter than the oxygen and nitrogen molecules of normal dry air. Damp air weighs less, which means less drag on a projectile.

2. Swing. In swinging a baseball bat, accuracy is more important than strength. In a regular baseball swing the right hand not only pushes the bat, it also steers it to the desired point of impact.

3. Speed. (b) 200 meters. In the shorter race runners spend more time accelerating and less time running at top speed. The 100-meter record is an average speed of 22.5 miles per hour, whereas the 200-meter record average is 22.7 mph. By comparison the fastest mile was at an average speed of about 15.8 mph.

4. Stagger. (b) The runner on the outside track has the advantage because less force must be expended in making the turns where the radius is wider. In a 200-meter race the advantage may be as much as one tenth of a second. Despite this, most runners still prefer "getting the inside back" (which has become a cliché for having an advantage), so they can see the other runners and catch them from behind.

5. Metric. The one-mile race was retained for its historical value. (The marathon, also measured in nonmetric units, is 26 miles, 385 yards, but the IAAF

doesn't keep official records for this race.)

6. Disc. (a) The discus goes farther when thrown into the wind. For example in a wind of 25 mph, a discus will fly 25 feet farther when thrown into the wind than when thrown with the wind. The faster air speed gives the discus greater lift which carries it farther.

7. Bounce. (b) If a spinning tennis ball's rotational speed in the direction of its flight is faster than its linear speed, it will accelerate on contact with the ground. The friction causes the ball to gain speed, afterward the ball spins slower, but flies faster.

8. Foul. The underhand shot can be thrown with great backspin. When the ball hits the rim or backboard it loses speed quickly and is more likely to drop into the basket. Most players, however, use the same throw at the foul line that they use in ordinary play which requires that they have to practice only one kind of throw. Even so, the record since 1960 for career free-throw percentage (50 percent) in the NBA is held by underhander Rick Barry (of the Golden State Warriors).

9. Launch. (a) The ballistic rule applies when the launch point and the landing point are on the same level. In the shot put, the launch point (at the end of the athlete's outstretched arm) may be seven or eight feet above the landing point. This is a downhill trajectory, so a lower launch angle is optimal.

(b) In football, while a 45° kick goes farthest, a 50° kick may go a few yards less but result in longer "hang time," giving defenders extra time to reach the receivers and prevent a long runback.

10. Jump. The third factor was lower air resistance during the approach. Beamon may have been able to reach a running speed at the moment of his jump that was 1 percent faster than usual, which would have resulted in a jump about two inches longer than usual. The combined elements (one inch for lower gravity, one and a half inches for lower air resistance during the approach, and the approach factor) add up to only four and a half extra inches. So even taking into account the high altitude, Beamon's leap was still a prodigious feat.

11. O₂. False. Getting oxygen to the brain may help the athlete "clear his head" more quickly, making him feel that he is recovering more rapidly. But tests indicate that the concentrated dose of oxygen doesn't enter the bloodstream any quicker than in normal breathing and therefore doesn't help one recover faster from exhaustion.

12. True. False. The theory is that training in the foothills or of the mountains will give athletes relatively more endurance when competing at sea level. Says Brancaccio, "The evidence seems to be that training at high altitude offers no advantage over training at sea level." **CC**



LAST WORD

By Paul Angiolillo, Jr.

Let's face it, whisking away whiskers still means dragging a piece of sharp metal across one's skin or plugging into an electric power grid. It's time we rethought the entire concept of shaving. ♦

Remember safety razors—those dangerous slivers of steel that mineralized TV screens balanced on? Ancient history. Check out the latest technology: independently suspended, laser-welded, ultralubricated cartridges. Or you might even opt for a battery-powered wet/dry shaver.

Is this progress or just some heavy 'breaking? Let's face it: Whisking away whiskers still means dragging a piece of sharpened metal across one's skin or plugging into an electric power grid. It's time we rethought the concept of shaving and the implements that we use to do the dirty deed.

Ultrasonic waves, now used for cleaning clogged arteries, could generate a Sound Shave. The technique might require some fine-tuning to eliminate side effects such as loosened fillings, headaches, and dislocated jaws. On the other hand, vibrating one's head in the early morning might substitute well for stimulants like caffeine and tobacco.

Blade makers might create shaving gloves: a pair of gloves sporting razor-sharp fingertips. They'd definitely be a hit with the upcoming generation of males. Hey, ladies, it's the Freddy Krueger Shaving Technique.

After working mainly for academics and Japanese clinicians in the Eighties, robotics experts now could win over John D. Public by developing a shaving slave. A simple arm with remote sensor, vision, and AI software would do intelligent software would learn facial contours, until Roboblade could do its job fearlessly while one reads the newspaper or doodles.

Instead of shaving in the morning, one might grab the remote control and turn on a videotaped TV special about a global crisis. Weyding a major catastrophe would probably send one scurrying back to bed—and certainly dampen one's enthusiasm for doing something as meaningless as shaving.

Low household products could be recycled into a "black-mayonnaise" to dissolve facial hair. This method, Sludge Shaving, would catch on as soon as municipalities began charging private citizens for disposal of hazardous wastes such as battery, cleaning fluids, cosmetics, motor oil, and paints. Unisex salons might develop the treatment as a variation on mudpacks.

Highly-reflective materials, like those used in logging and bicycling clothing, could be fashioned into shaving collars. These bright, stylish accessories would reflect light waves into dark stubble, turning it pink. With modulators, Cuneiform might also be used to eliminate smokes, accentuate chins, and de-emphasize noses. Flooding whiskers with colors could create a fashion trend for the Nineties: punk beards.

Lucid dreaming, also known as waking sleep, requires that you stay awake while remaining in a dream state. The logical next step would be to get up and do something. With hours to sit, one could easily knock off routine chores, like shaving, in the middle of the night.

The U.S. space general might use his position to insist that we quit using biased terms like unshaven and clean-shaven to mean filthy and proper. Instead, our society could substitute the more accurate word bearding for the unshaven and, for the clean shaven, the older more poetic term shorn. Movie makers could help change the antebellum attitude by hiring the male members of the *Thyristorshaving* cast as romantic leads in the Nineties.

Body patches, used for time-releasing medicines and fragrances for the bumen body might also distribute anti-growth hormones to hair follicles. An added feature of the John Boy shaving technique would be a cute little mole-like spot on the cheek.

In some tribal cultures young men learn how to stretch and distort their skin for aesthetic purposes. Why not train our adolescent males to distort their cheeks so they can later fold them up to hide facial hair? This method, named after its most famous practitioner, could be called Duzzy's Shave.

You've heard all about it: Buddhist monks concentrated to ease their body heat. But mystics restrain their breathing for weeks. Californians walk on fire. Why not use these supernatural abilities to eliminate everyday routines? Mind Shave: the control of facial hair growth, might save a whole lot of master. But the beneficial side effects—vast energy, cosmic insight, and shockwaves—would make up for the effort.

Why during young adulthood, do thousands of otherwise healthy human bodies suddenly reject harmless substances like pollen, dust, and peanut butter? When immunologists finally solve the riddle of allergies, we might be able to use that information to trick the male body into rejecting what it already accepts at puberty: facial hair.

Once geneticists can manipulate the gene for fairness—a new generation of men will be able to stay as smooth as the day they were born. Millions of man-hours now spent performing the tedious act of shaving will be transferable to more soul-satisfying work and leisure. Productivity and the quality of life will improve throughout the world. Men and women will come closer together. And the technique of removing hair by electrolysis will go the way of bloodletting. **OO**

Paul Angiolillo, Jr. is a freelance writer who shaves once a month, whether he needs for or not.