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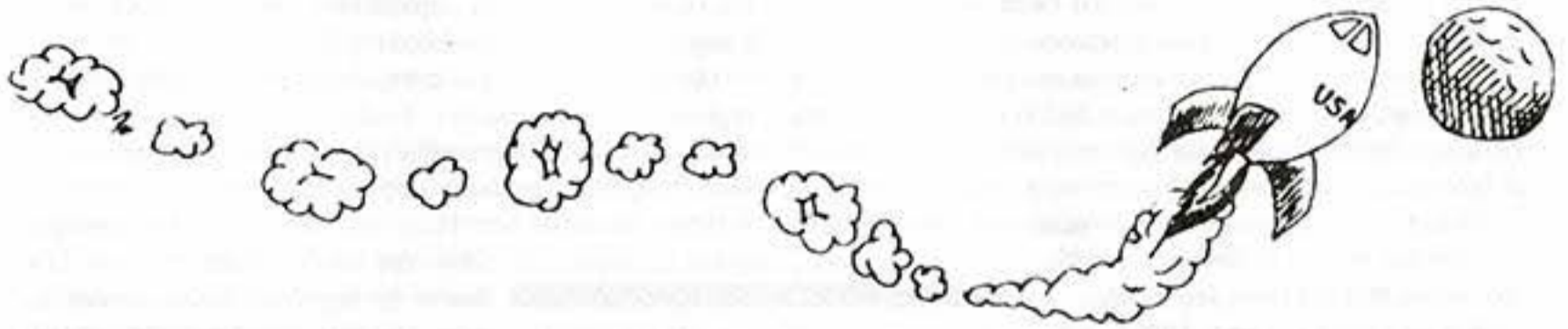
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WARP ten

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Out of the Rubble Comes the Hubble

By ROBBIE ROBB

Having suffered through launch delays, a jammed solar array, and a flawed primary mirror, the troubled Hubble Space Telescope (HST) is about to get emergency surgery on the fly.

The orbiting telescope, which in spite of its problems has sent back some remarkable images in its three years aloft, will be the object of a \$100 million repair mission this December. National Aeronautics and Space Administration officials hope that what its experts call "the mother of all repair missions" will bring the instrument to within 90 percent of its original potential.

The recently successful deployment and repair of the Gamma Ray observatory by the Space Shuttle Atlantis crew has heightened NASA's optimism about the upcoming mission, which will include an unprecedented number of space walks by the seven-astronaut crew. If the mission succeeds, it will all seem worth it. If it fails, NASA will have suffered yet another black eye.

The road to orbit was a rocky one for the Hubble. Soon after funding for the project began in 1977, the debut of the Space Shuttle, necessary to lift the telescope into space, was delayed. This forced the original 1983 launch date for the Hubble to be pushed back. Then, a series of technical and management problems plagued the telescope's progress in the early 1980s. And when finally it looked as if HST might be launched in late 1986, the Challenger disaster dashed all hopes of an orbital try that year.

By 1989, the project's original \$700 million price tag was escalating towards the billion dollar mark, propelled by huge storage and maintenance costs necessitated by endless delays.

Among the costs: an air-filtered and air-conditioned storage environment to prevent dust contamination of the mirror and the instrument's delicate parts.

At last Hubble was launched in April of 1990, to great fanfare in the media, which quickly labeled the device "The Eye in the Sky." But the project's troubles had just begun.

Hubble scientists soon discovered a devastating fact: the telescope's primary mirror had been made to the wrong specifications, causing serious visual distortion.

NASA, already suffering from low public esteem due to Shuttle failures, reeled from the new blow. Americans clearly felt that such a blunder, at a cost of \$1.5 billion of taxpayer's money, was all but unforgivable.

That was on the bad side. On the good side, despite the scandal and disheartenment at NASA, HST has still been

able to accomplish a great deal of the scientific work it was designed to perform.

HST uses a device much like a video camera to produce images that improve greatly on those of Voyager and other unmanned space exploration vehicles. The technology differs from photography in that the image consists of electrical signals that are fed into a computer on board HST. These



Tomatoes are just one food that may be a risk. See "A Taste of Three Mile Island" on page three.

signals are transmitted back to earth and reassembled by computers and the HST imaging team.

Hubble's first great deed was to focus on Pluto and its moon, Charon, the first time the pair have ever been imaged as two distinct bodies. Soon afterwards, in November of 1990, the Hubble zeroed in on the newly-discovered Great White Spot on Saturn. The beginning of a storm raging on the ringed planet's surface, the spot has been continuously recorded in all of its fury by the telescope.

Hubble's latest contribution was to spot one of fifteen protoplanetary disks in the Orion Nebula. These disks are thick masses of dust and gas that surround newborn stars. It is believed that the disks will eventually form solar systems much like our own. Astronomers have never before been able to study this type of stellar activity with the clarity that HST has provided.

Although when repaired, Hubble will provide images far superior to those produced by other instruments, perhaps its greatest advantage is its ability to swing into action virtually overnight. Unlike a space probe that takes years to reach its destination, HST can be swivelled towards an object or event on relatively short notice. Recording images of Saturn's storm would not have been possible without HST.

HST can also perform many experiments not possible for ground-based telescopes. "Seeing" wavelengths of the electromagnetic spectrum that cannot penetrate our atmosphere, HST can help identify objects previously undetectable by optical telescopes.

Nevertheless, the flaws in the mirror have impeded some of the serious work that HST was designed to perform. During the grinding and polishing the mirror underwent while under construction, it was frequently tested with a so-called "null correction" unit — a series of lenses through which a laser is projected to test the curvature of the primary mirror. In HST's case, the null correction unit was made to the wrong specifications, resulting in a mirror that was too flat.

The flaws make it impossible for the mirror to focus the light it gathers into one sharp point. Instead, light is scattered, creating a halo image of the object it is viewing.

Four of the five key instruments are still able to produce images better than any ground-based telescope, but fulfillment of the original expectations for the Hubble will have to wait until new instruments are installed in late December of this year.

Still, much of the credit for work that HST has been able to do while handicapped belongs to the HST imaging team, which processes all of Hubble's images. The technicians have been inventive in correcting for the mirror aberrations

on the ground as the images are reconstructed by computers from radio signals sent back to earth.

The instrument most adversely affected by the mirror flaws is the Faint Object Camera. This instrument is designed to take pictures of deep sky objects, located in the farthest reaches of the universe. Unfortunately, the light at the edge of the cosmos is so dim it requires far more focusing power than the mirror is presently capable of. Thus, full faint-object imaging awaits the scheduled repairs.

The Hubble's mirror is not the only instrument that will be replaced come December. Faulty gyroscopes will also be chucked, as will some wobbly solar panels. The panels are there to power the telescope's computers and electrical systems. But it has been found that, as the telescope emerges

from the earth's shadow every few hours, the heat from the sun causes the panels to expand and contract, creating a vibration of up to three meters in either direction. This shaking causes problems when the telescope is imaging one object for long periods of time. The result is a blurred image. Worse, if one of the panels were to break loose, it could damage the Hubble beyond repair.

There are a total of five instruments aboard HST. These instruments are able to measure and image objects in both visible and invisible wavelengths.

The wide-field and planetary camera, for example, can "see" a much wider range of wavelengths than the other four instruments. It is this device that treated us to the stunning images of Saturn and Pluto. The camera is also capable of spectroscopy, measuring the spectral lines of celestial objects to determine their chemical makeup.

The Goddard high-resolution spectrograph, meanwhile, also collects spectrographic information in the ultraviolet range, a part of the spectrum inaccessible to ground-based telescopes. The instrument is so sensitive that it is able to count individual photons — units of light.

The Faint-object spectrograph is designed to gather information at a much broader range than the high-resolution spectrograph. The two instruments combined produce a range of spectroscopy not previously available to astronomers.

But the main player is the Faint-object camera, which, once corrected, will be able to magnify light from distant stars by more than 100,000 times. This means that stars of almost any distance from Earth could be imaged.

There will be one net loss when the repairs are made. The final imaging device, the high-speed photometer, designed to measure a star's brightness, will be removed to make room for the corrective optics to be installed.

Despite the scandal and disheartenment at NASA, HST has still been able to accomplish a great deal of the scientific work it was designed to perform.

A Taste of Three Mile Island

By JOANNE ESTERS-BROWN

Bombarding food with gamma rays may sound like something from a science fiction movie, but the fact is "food irradiation" is moving closer to becoming a commercial reality, despite intense controversy.

A Florida company has already opened a food irradiating plant and begun shipping irradiated fruit and produce to a number of states, including Illinois.

Proponents of the process say food irradiation kills disease-causing organisms and retards spoilage without significantly impairing taste.

But opponents passionately disagree, noting that while irradiation does not make food products radioactive, it can rob foods of some nutritional value and may also increase the risk of cancer and birth defects.

As the debate gains momentum, attention is focusing on the biological changes that gamma rays can and cannot produce in the foods we eat. The chemical changes that occur during irradiation are difficult to identify, but the fact is, food is exposed to gamma rays strong enough to knock electrons out of the atoms.

Such a sizable jolt creates particles called ions, which are electrically-charged atoms resulting from the loss or gain of one or more electrons. These particles can recombine with other ions to form new, and perhaps harmful, chemicals.

Irradiation is not a new technology. For many years, medical supplies such as syringes and bandages, and some consumer products such as condoms and tampons, have been sterilized in the nation's 38 commercial irradiation facilities. On a much smaller scale, spices and herbs that go into hot dogs and other processed meats have undergone irradiation.

But until recently, no zapped foods other than condiments were commercially available. That all changed in 1992, when Vindicator, Inc. of Florida

opened the nation's first facility built explicitly to irradiate a wide variety of foods. Fresh strawberries were the first to be irradiated and shipped from the facility. Since then, irradiated tomatoes have joined the list. The products have been sent to a number of states, among them Illinois, Ohio, Virginia, and Washington.

You may or may not know it if you bought any irradiated items. Federal law requires that such foods be labeled as such, but sources say that some supermarkets ignore the order.

Although Vindicator received Food and Drug Administration (FDA) approval in May of 1990 to also irradiate poultry, technical difficulties have held up implementation of the plan. Says Harley Everett, vice president of Vindicator, "We are waiting for the FDA to approve a suitable packaging material before we can start irradiating poultry."

It is not a trivial matter, the FDA says. "Sometimes the polymers used in the packaging can combine with other molecules to form new compounds," notes Pat Hansen, consumer safety officer for the FDA, "or they may produce bacteria

which may be absorbed into the food. We need to be confident that the packaging materials that are going to be used are suitable for enclosing poultry which has been processed with radiation."

Irradiation takes place in a heavily-secured environment. Products to be treated are placed on a conveyor belt, which travels into a chamber with thick concrete walls. The food is then exposed to gamma rays from a radioactive source of cobalt 60. The normal dosage for most foods is 100,000 rads, a powerful amount equivalent to about 10 million chest x-rays. The process takes about 15 to 45 minutes, depending on the shape and density of the food product. When the cobalt is not in use, it is lowered into a water-filled storage pool, which acts as a barrier to radiation.

Unlike microwaves, which excite atoms but do not disturb their basic structure, gamma rays can break chemical bonds in the food's proteins, fats, and carbohydrates — causing the molecules to form new chemicals known as radiolytic products (RPs), compounds which may be injurious.

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There's a Fruit Fly in my Soup

By GLEN D. KATO

Biotechnology is coming to dinner.

Since it first burst onto the scene 20 years ago, biotech—the union of biology and industry—has given us test tube babies, new ways to make pharmaceuticals such as insulin, and bacteria that can dissolve oil spills. But now it is in the process of changing the way we eat.

Sometime this summer, a California-based biotechnology firm will introduce a product that at first glance will look pretty familiar, but which will have momentous implications.

The product is a tomato. But not just any tomato. A tomato that has been genetically-engineered to be round, red, and juicy throughout the year — not just in late summer, when tomatoes traditionally ripen.

The tomato, dubbed the "Flavor Savor" by its creators, Calgene, represents the first time genetically-altered produce is to be put on supermarket shelves. As such, it is the vanguard of a host of genetically-engineered foods that will soon be stocking our refrigerators, and perhaps one day feeding hungry Third Worlders.

The event will be the culmination of a trend that began more than a decade ago when scientists started seriously to examine ways to add new genes to certain foods and thereby improve them.

By 1990, Monsanto, the St. Louis-based biotechnology giant, had synthesized bovine growth hormone, the naturally-occurring substance that governs growth in cows, and used it to augment milk production.

With approval by the Food and Drug Administration, it appeared that

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This has bothered many critics. Says Richard Piccioni, of Accord Research and Educational Associates: "Treatment of food with ionizing radiation presents issues of food safety qualitatively unlike those posed by any other food-processing method or food additive. The large amount of energy contained in ionizing radiation provides the potential for exceedingly complex chemical transformation of food components, including the production of mutagenic or carcinogenic substances which were not present, or were present in far smaller amounts, before irradiation."

But advocates argue that after almost 40 years of research, scientists have found no evidence that these fears make biological sense. To some degree, they argue, all commercial methods of food preservation destroy some of a food's nutrients. On the average, irradiation reduces nutrients by about 10-15 percent, which compares favorably with other processing methods.

The key question is whether irradiation results in the formation of radiolytic products, which may be carcinogenic. Available evidence appears to be inconclusive.

Bio-engineered food continued from page three

genetically-modified milk was about to enter our lives. But a series of research snags, and the banning of the hormone by Wisconsin, the nation's largest dairy state, caused the genetic engineering of food to grind to a halt.

The situation is about to change this year, however.

What will the introduction of the Flavor Savor, and other products sure to follow, mean to us? Healthier and cheaper, the experts predict. Says Karen Marshall of Monsanto, "The consumer will ultimately get better, more nutritious food. The early advantages will be that the cost of food to the consumer will go down."

The Flavor Savor will offer "extended shelf life and improved taste," says Carolyn Hayworth, spokesperson for Calgene. "It will offer premium quality all year round."

But bioengineered foods should bring other advantages as well. For one thing, in spite of fears that they may themselves be unsafe, such foods may actually lessen exposure to toxicity. Says Allen Goldhamer, a spokesperson for the Industrial Biotechnology Association, "One of the benefits of genetically-

ally-altered produce will be the reduced reliance on pesticides.

N o t e s
Goldhamer, "Viruses that attack plants are transmitted by insects. By making plants resistant to these viruses, we should be able to cut down on the amount of insecticides necessary to control insect infestation."

Scientists genetically alter plants by taking genes for certain desirable traits from other plants or animals and intro-

ducing those genes directly into the plant's genetic structure.

In humans, certain genes give us blue or brown eyes and various other qualities. In plants, newly-introduced genes will impart a host of characteristics of other species. For example, they may confer a certain taste or make a plant more resistant to rot.

Immunizing a plant to viruses uses a different strategy. Here, the agent introduced to the plant is not a gene, but a protein, the product of a gene, in hopes it will trigger antibodies. Says Goldhamer, "They take a specific protein from a virus and give it to the plant. It is like vaccinating someone, but instead of giving a person immunity, you're giving a plant immunity to a virus."

The critics of genetically-altered produce are many. The Foundation On Economic Trends, a biotechnology watchdog group, warns: "The use of certain agricultural biotechnology products could result in increased soil loss, biological pollution, loss of genetic diversity, monoculturing, and elimination of family farms and their communities."

Most opponents to genetically altered foods are concerned about the safety of the new products. There is a fear that shortcutting evolution to create novel genetic species could create a nightmare "Andromeda Strain" — a species that could pollute the environment and have few, if any, natural enemies. There is also worry that tampering with the genetic structure of a plant might trigger certain undesirable genes — those that cause cancer, for example.

Monsanto's Marshall said, "we test our products in a variety of ways, through a variety of field trials supervised by regulatory agencies. We use sensory testing and analytical testing to make sure the product is safe."

Calgene's Hayworth added, "We test our genetically altered plants for safety by sending them to labs that use rats and we test for nutrition by sending them to labs that specifically deal with nutrition.

"Under current FDA regulations, we could market our tomato now. The tomato (Flavor Savor) was approved by the FDA in 1991, but we have chosen to wait for an extra advisory opinion from the FDA before we sent it to market."

Hayworth said the firm's biggest obstacle will be consumer acceptance. "We will try to get around this through education."



Could bio-engineered pineapples be on the fruit horizon?

Health Update: The Common Cold

By DEREK CUMMINGS

Last winter's ravages probably had you either fighting a cold or trying to prevent one from interrupting your life. An object of well-placed dread, the common cold accounts for more missed work and school days than all other diseases combined.

Colds are caused by a variety of virus strains which are spread directly from person to person. By the time symptoms are apparent, the cold virus has probably already been transmitted to others.

People of all ages are subject to colds. However, the younger you are, the more susceptible you are, it seems, probably because you have not built up immunity to the different strains over the years. Children from one to five years are the most vulnerable, of course. Adults in their 20s and 30s average about six colds per year while older adults average half that number.

The numbers change if you have a tendency toward aller-

Major breakthroughs in treating the common cold will be on the horizon. A far cry from chicken soup and two aspirin.

gies. Being allergic heightens susceptibility to a cold.

Viral invasion of the lining of the respiratory passageways prompts the uncomfortable symptoms of a cold. The nose, throat and bronchial tissues all may become infected. Inflammation of the invaded tissues is the direct cause of the familiar symptoms of a stuffy or runny nose, chest congestion, and sore throat. A cough may also be present due to the congestion spawned by post-nasal drip.

Unfortunately, treatment of a cold is directed towards symptoms rather than the virus responsible for the condition. There are only a few, very expensive anti-viral remedies, but there are more than 800 nonprescription cold, cough, and sinus preparations available, well within everyone's budget. To choose the product which will be of maximum benefit to you, you should consult your pharmacist. Since some of these products may cause drowsiness as a side effect, the pharmacist will need to know whether you plan to drive or what kind of work you do. Other products may contain ingredients which raise or lower blood pressure, so it is important to consider your medical history before deciding on a product.

The newest over-the-counter medication is a preparation known as Tavist. Once available only by prescription, Tavist

has recently been added to the ever-growing list of antihistamines now stocked on drug store shelves. It is a potent drying agent used for runny nose or sneezing.

A number of other prescription drugs are being considered for over-the-counter status. The two most well-known are Seldane and Hismanal, currently being reviewed by the U. S. Food and Drug Administration. Both are strong antihistamines which cause less sedation than their predecessors. Yet Seldane in particular carries some risk. Under certain circumstances it can cause heart rhythm disturbances and should thus be taken with caution by people with heart problems.

At the moment, there is a good deal of research involving anti-viral agents being carried on by drug companies. Of particular interest are experiments with interferon nasal sprays. Interferon is a human protein which has anti-viral properties and is often used to treat cancer. Though present in the body in only minute amounts, it can be produced in larger quantities by bacteria thanks to genetic engineering. Other antiviral nasal sprays are also being tried. If successful, major breakthroughs in treating the common cold will be on the horizon. A far cry from chicken soup and two aspirin.

A cold can trigger serious complications in people with asthma, chronic bronchitis, or emphysema. Bacterial sinus infections, middle ear infections, and pneumonia can also follow a cold. Should such complications occur, you should seek further evaluation of treatment.

Is Gayness Inborn?

By TOM MARKAKIS

For years, members of the gay community have argued that a person does not choose to be homosexual the way someone chooses a career, hobby, or lifestyle. Rather, they say, sexuality is inborn, like skin tone or the color of one's hair or eyes.

Recent studies published by a Northwestern University researcher suggest that their contention may be true.

The researcher, Michael Bailey, assistant professor of psychiatry, studied female identical twins in his efforts to discern a biological basis of sexual orientation.

Since identical twins come from a single fertilized egg, both individuals share the same genes — which sets up an ideal means to test whether or not a given trait is genetic. As the twins grow up, each will be exposed to different life experiences, but if they still exhibit matching characteristics, then the scientist can conclude that their similarities are biological.

Bailey found that roughly half the time, if one twin was lesbian, then her sister was, too. These results mirror similar findings in an earlier study by Bailey of male identical twins.

"Evidence of this kind strongly implies a hereditary component to someone's sexuality," said Bailey, whose research appeared in the *Archives of General Psychiatry*.

The twin studies dovetail with research announced in August, 1991, by Simon LeVay, of the Salk Institute in La

Jolla, California.

LeVay reported finding that a cluster of brain cells, which are thought to trigger male sex drive, are smaller in homosexual men than in heterosexuals. The controversial finding became front page news and opened the door to further investigation of sexuality's origins.

LeVay said he was surprised by Bailey's work. "It's the best proof I've seen so far for a genetic explanation of sexual orientation."

To find volunteers for their study, Bailey and co-author Richard Pillard, of Boston University, ran ads in gay oriented publications seeking lesbians who had an identical twin.

A total of 108 sets of twins participated, 71 identical and 37 fraternal. Fraternal twins serve as controls in the study,

**It's the best proof I've
seen so far for a genetic
explanation of sexual orientation.
—Simon LeVay**

because even though they develop side by side in the uterus, they come from separate egg cells and do not possess matching genes.

It turned out that in 34 of the 71 identical pairs (48%), both sisters were lesbians. By contrast, only six of the 34 fraternal sets of twins (18%) were gay.

"The results are true to logic," said Bailey. "The sisters with identical genes had the greatest ratio of homosexuals among all the siblings."

In December of 1991, the researchers published a study of male identical twins in the Archives of General Psychiatry. The results showed 29 of 56 identical twin brothers were gay, while only 12 of the 54 fraternal twins were gay.

According to Bailey, the twin studies show that genetics plays a key role in determining someone's sexuality, but inheritance doesn't tell the entire story.

"Half of the twins don't share their sibling's orientation," he noted. "This proves that the environment also plays a critical role."

To explore this notion, Bailey asked all the twins if they behaved atypically as a child. For example: Did a girl play sports? Did she not like dresses? Was she considered a tomboy? Did the boy like dolls? Was he thought to be effeminate? Did he want to be a girl?

This step of the investigation remains in the early stages, though Bailey has some clues. He suspects that physical trauma in the womb or dissimilar treatment of the children by their parents could bring about differences in identical twins.

"Ultimately, the goal has to be to tell a convincing story as to why someone is gay," said Bailey.

Lemony Fresh

BY LAURA CALLO

We have all seen the commercial. A woman walks into the shower, eyes barely open, and finds a bar of soap. As soon as she smells the soap, she becomes invigorated and awake.

Does the nose know? Is there a connection between the sense of smell and behavior? Most researchers say that when it comes to influencing moods or the state of alertness, the answer appears to be yes.

"Maybe what fragrance does in raise the level of physiological arousal," says aroma researcher William Dember, of the University of Cincinnati.

In a study Dember recently presented at the annual meeting of the American Association for the Advancement of Science, he tested the relationship between odors and performance. Subjects were required to watch a video screen and whenever a line pattern appeared, they pressed a button. Those subjects who were given a whiff of peppermint or lily of the valley performed 25 percent better than those smelling pure air.

"Possibly there's some sort of pharmacologic effect on the centers of the brain that affect alertness, something chemically special," said Dember.

The human nose can distinguish and identify 10,000 odors. What holds the key to these smells are the receptor cells located in the olfactory epithelium, or lining. Two investigators at Columbia University isolated the genes for these receptors and identified a number of them. But there appear to be a large diversity. "Possibly there may be as many as a thousand," said molecular researcher Richard Axel.

When odor molecules enter the nasal cavity, they pass through these receptors. The receptors then carry messages to the olfactory bulbs located deep inside the nose at the base of the brain. From there, the results are sent to the brain's limbic system, which is the focal point of memory and emotion.

According to Susan Knasco, of the Monell Chemical Senses Center in Philadelphia, what is often responsible for a certain mood is the association of smell and the memory of an incident that goes with that smell.

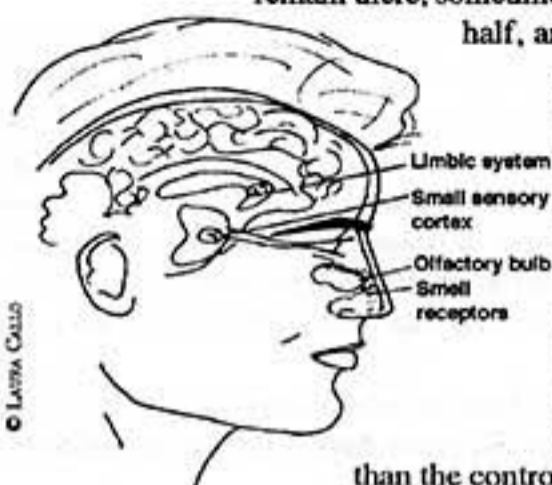
"It's half direct association and half cognitive (learned) association," said Knasco. "For example, the smell of pine trees reminds people of Christmas time, so it gives them a festive feeling."

Knasco is currently doing studies on the association. "One of our findings is that the scent of lemon decreases the number of health complaints. The association, we've found, is that lemon reminds people of cleanliness," said Knasco.

One practical application of the influence of smell on mood has come in the field of magnetic resonance imaging. William H. Redd, of Memorial Sloan-Kettering Cancer Center in New York City, has found that the smell of heliotropine relaxes patients undergoing the stressful test.

"In MRI," said Redd, "you're put into a small cylinder inside a big machine that's a 12-by-12 cube. You have to

© LAURA CALLO



remain there, sometimes for an hour and a half, and you're not supposed to move. People have claustrophobic reactions, anxiety, and panic attacks." Those 85 patients who smelled the heliotropine experienced 63 percent less anxiety than the control group.

So promising are the research findings linking smell and behavior that they have given rise to a new type of treatment for the body and mind called aromatherapy.

Aromatherapists believe that if one smells certain herbs or foods, a certain mood will be produced. Lavender and chamomile are said to have a calming effect. Rose and bergamot are supposed to be spirit lifting. Sage and spearmint will stimulate alertness. Tangerines are even said to combat insomnia.

The United States Food and Drug Administration does not acknowledge aromatherapy as a legitimate treatment for illnesses. But the field is gaining ground in other countries, particularly New Zealand, Britain, France, and Germany.

Air New Zealand uses herbal blends to help passengers fight jet lag by pumping the scent throughout the cabin. In France and Germany, aromatherapy treatments have become so accepted that they are covered by health insurance.

As time passes, more and more stores in the U. S. are stocking the natural soaps and fragrances that are based on the principles of aromatherapy.

So does the nose know? You'll have to see (or smell) for yourself. Maybe the old "apple a day" adage should be changed to "a whiff of lemon a day keeps the doctor away."

Cellular Madness

BY ALEX TOMA

Anyone who has enjoyed the convenience of cellular telephones insists on good reception, clarity, and privacy while using the phone.

But with one in five cars in the Chicago area now equipped with a mobile phone, and the numbers continuing to grow, the cell towers which relay signals from all those phones are becoming jammed with conversations, jeopardizing not only the quality of a call but its immunity from snooping.

Fortunately, the companies which oversee cellular technology have come up with an answer, which should expand the capacity of those clogged cell towers by up to three times.

It is already making a significant difference in sound quality.

The takeoff of cellular phones has surprised even those in the industry. People are not just buying the phones for business reasons anymore. They are using them for personal

safety, convenience, increased accessibility, and the sense of status and power they convey.

"Every time a crime happens to a woman on the street or in a car, the sale of cellular phones increases," notes Daniel Cain, a sales assistant at Tri-Electronics in Hammond, Indiana, which is an outlet for mobile phones.

Housewives, retired people, even college students are buying the devices. Says George Palatine, 23, a full time student at Columbia College, "I can always do without it [a cellular phone], but the ability to just conveniently call and receive calls wherever I'm at is very important. People can always get a hold of me wherever I am. It makes the world seem a little smaller."

Reductions in the price of cellular phones have also lured more consumers into buying the units. As a result, the phones seem to be almost everywhere. "At the present time, around 20 percent of the vehicles in the Chicago area have cellular phones installed," says Bob Florin, cellular service manager at Tri-Electronics. "That percentage is growing every year." This does not include the number of people owning handheld and other transportable cellular phones.

"Cellular phone use was never expected to be so big," says Florin.

But the mainstreaming of cellular phones has raised serious problems. With cell towers becoming overcrowded with users, cellular phone customers are experiencing more technological breakdowns such as cross talk, dropped calls, and eavesdroppers.

Cross talk occurs when voice frequencies randomly change over to other frequencies. This results in a cellular caller inadvertently hearing other people's conversations.

Dropped calls result when radio links between a cellular phone and the cellular tower are broken. Although this can happen for a variety of reasons — traveling outside the prescribed twelve mile radius, proximity to a steel mill, interference from trees, equipment breakdown, or atmospheric problems — it is more common now that the cells are overcrowded.

Eavesdropping has also become more frequent. High tech equipment used by police and the FBI are no longer necessary to listen in to a cellular phone call. Anyone can buy a two-way radio and a transmitter to eavesdrop, says Mike Thinger, of Cellular One Customer Service.

The most infamous example of such eavesdropping was the highly-personal call placed by England's Prince Charles to his mistress, which was recorded and circulated in the press late last year.

Fortunately, the introduction of a new technology promises to overcome most mobile phone congestion. Called code division multiple access (CDMA) digital technology, the new process replaces the older analog technology that has been the way information is transmitted to and from cellular phones since the birth of cellular networks in 1983.

CDMA digital technology allows more users to place calls at the same time and gives them clearer, more concise cellular calls. It does this by boosting the capacity of the 832 existing cellular channels so that they will accommodate three times

as many customers.

Besides easing overcrowding of the airwaves, CDMA digital technology is expected to greatly reduce eavesdropping and other problems associated with analog transmission. CDMA can scramble signals from cellular phones to cellular towers three times faster than analog transmission, making it harder to catch a signal with unsophisticated equipment.

The target date for the switchover from analog to digital was supposed to be late 1993 or early 1994, but industry giant Cellular One has already begun modifying its cellular towers to accept CDMA digital. Customers with older equipment should not panic, however, because the towers will be able to translate both analog and CDMA digital signals.

The price of a cellular phone may rise slightly due to the advent of the new digital system as manufacturers try to recoup the costs of retrofitting their equipment. But the price increase is expected to be temporary.

Some cellular customers might already be enjoying the benefits of CDMA digital technology without knowing it. Manufacturers such as Motorola and Erikson have quietly equipped their new phones with both analog and digital transmission technology.

How long digital technology will continue to compensate for the surge in cellular phone use is anybody's guess. It seems likely, though, that sometime in the future the cells will become overcrowded once again. Then it will be back to the drawing board for the manufacturers and engineers.

“Hey, 98.2”

BY TOM MARKAKIS

Imagine taking someone's temperature using a ten-inch long thermometer and having to hold it in the patient's armpit for at least five minutes.

Now imagine repeating that task over a million times.

Sounds impossible, but Austrian physician Carl Wunderlich did just that in the 1860s.

After taking more than one million temperatures from thousands of patients, which at five minutes per reading adds up to about ten years of studying thermometers, Wunderlich made a fateful pronouncement which has been taken as the medical gospel ever since: The average body temperature for a healthy adult is 98.6 degrees Fahrenheit.

For this finding, Wunderlich and his research have been enshrined in the pantheon of medical practice and teaching for better than a hundred years.

Would anyone dare to question such a time-honored standard?

Indeed they would. Just last winter, a team of doctors from Maryland challenged this sacred cow with data of their own. Their finding: the normal temperature of the human body is 98.2.

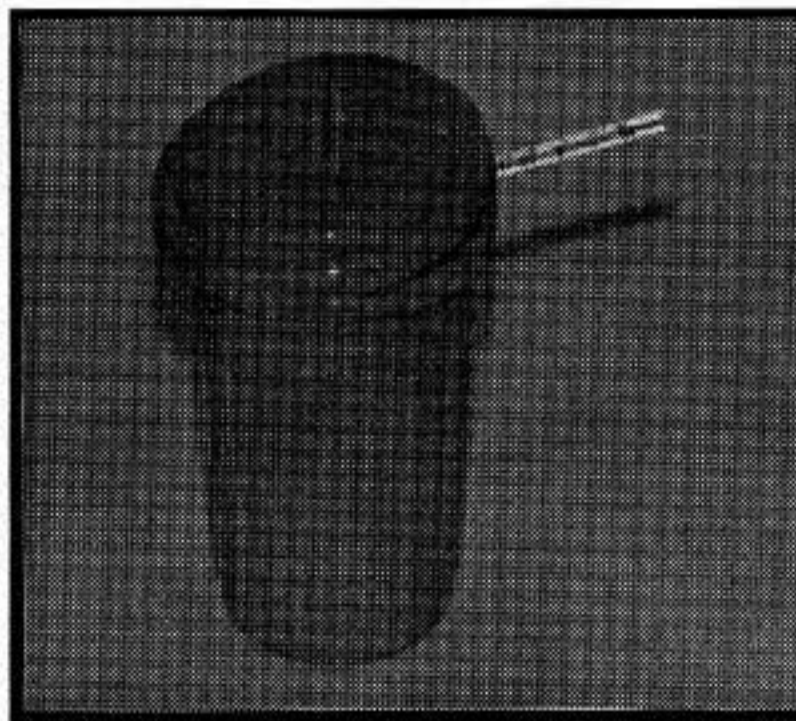
Imagine it. After five generations of acceptance, and the huge amount of research Wunderlich undertook, the standard

could be wrong.

“I was amazed that 98.6 has been an unchallenged standard for over a hundred years,” said Philip Macowiak, one of five researchers from the Veterans' Affairs Center in Baltimore.

Macowiak and his colleagues questioned Wunderlich's work because they believe he may not have used a truly representative sample of people. Applying some retrospective logic, they claim he could only have been able to examine a portion of his collected data, which could have yielded an inaccurate result.

“We don't know how he selected his data for analysis,” Macowiak said, “but we know there is no way he could have analyzed it all by hand.”



In his classic work, “The Temperature in Diseases,” Wunderlich identified 98.6 as the average reading, and went on to explain that body temperature varies throughout the day — being lowest in early morning and highest in late afternoon.

He noted, too, that women generally have higher body temperatures than men and that there may be racial differences as well.

Wunderlich was instrumental in also dispelling some myths of the day. For example, at the time only a trained physician was believed capable of taking someone's temperature. Wunderlich exploded this idea, noting that nurses, technicians, even a patient's relatives, could take the reading if necessary.

Moreover, physicians of that era felt that the initial temperature reading, taken upon the appearance of the illness, was the most valuable. Any further readings would be too late and thus useless. Wunderlich disagreed, arguing that since temperature fluctuates, several readings would be more helpful.

In the Baltimore study, Macowiak and his colleagues took a total of 700 readings from 148 men and women. They measured temperature orally, four times a day, using elec-

tronic thermometers. Oral temperature readings have been proven to be more accurate than axillary (armpit) readings, the kind used by Wunderlich, and are the current medical standard.

The results, analyzed by computer, revealed 98.2 to be the normal reading. But the researchers emphasize that this figure represents an average of all the collected data and thus is no more "normal" than 98.6.

Normal body temperature manifests itself as a range which varies within a degree Fahrenheit, not as a specific number, they said.

The Maryland team's goal, Macowiak says, "is to dispel the concept that 98.6 has any particular significance to body temperature."

The team has found Wunderlich to be correct in several areas. For example, it appears women do have slightly higher temperatures than men. Readings from black people were

The Maryland team's goal is to dispel the concept that 98.6 has any particular significance to body temperature. —Philip Macowiak

also higher than those of whites.

No clear reason exists to explain why the new data differs from the old, but Macowiak proposed two possibilities.

The thermometers Wunderlich used may have been calibrated differently. To test this hypothesis, the researchers borrowed a 19th Century thermometer from a museum. A comparison of the two devices found the old thermometer yielded readings that were a full 1.8 degrees higher than the modern one.

The research team expressed the belief that the gap was due to design flaws rather than the age of the antique thermometer.

Also, since they are unsure how many temperatures Wunderlich used to compute his average, and how these were selected, the Maryland researchers feel his sample of people could have been atypical.

The only thing certain is that with more than one million readings to consider, and no computer available to help him, Wunderlich could only have analyzed a tiny fraction of readings.

Currently the Maryland team is gathering more temperatures in the belief that 700 may be too few on which to base a new standard. In other words, 98.2 may be wrong as well.

How many readings would they need? No one is quite sure. But the medium is the message to Macowiak.

"At this point," he says, "we want to get people thinking about the dogma, and to give it a new and critical look."

Getting Real (Well, Almost)

By MARCOS SVEIRO

You are at the realtor's office leafing through photographs of new houses when one residence in particular catches your eye. It looks very attractive from the outside, but naturally, you want to know what the inside is like. You could ask the broker to take you over, but that's time-consuming and anyway the place is not available for showing until tomorrow.

Instead, you choose another option. You put on a pair of 3-D glasses, step on a treadmill, and presto, you're walking around the house in question. Pity. Its main hallway feels oppressively narrow. On to the next house.

If this scenario seems like fantasy, it's not. The technology already exists that allows such "walk-throughs" and a great many other applications as well. It is called Virtual Reality, and it may be coming soon to a telephone line near you.

What most people know about Virtual Reality they learned from the Steven King movie, "Lawnmower Man," in which a highly-futuristic version of the technology is misused for frightening ends.

But the fact is Virtual Reality is already being used and its potential for bettering our lives seems to outweigh any darker side that it may have.

Among the first to employ Virtual Reality have been architects. At the University of North Carolina, a design flaw in an academic building called Sitterson Hall was discovered and corrected by two architects who were miles away from the Chapel Hill campus at the time. The two designers had been taking a "tour" of the new building via Virtual Reality when they noticed that two walls were uncomfortably close together.

Fittingly enough, Sitterson Hall is to house a center for research on Virtual Reality technologies.

Viewing building interiors may seem like something that could be just as easily done with videotape. But Virtual Reality offers a crucial difference. It is interactive. In other words, the world you see changes, just like the real world, according to your actions and your vantage point. If you turn your head to the right, you see something different than if you turn to the left. If you reach out for an object in front of your eyes, you can modify the scene before you — something entirely impossible in a movie.

Moreover, you can change the virtual world in ways undreamed of in real life. One might, with the wave of a virtual magic wand, turn everything the wand touches pink. Or play a musical instrument whose pitch depends on your heart rate at the moment. The possibilities are innumerable.

How does it all work? The essence is simple. First, one enters into a computer the parameters of any environment one wishes: size, color, shape, texture, and so on. This can be done

on a 3-D modeler program such as MacDraw, which allows one to design three-dimensional models. (Preset "worlds" are also available for those who don't want to program their own.) These parameters are then transferred to a mainframe computer, which of necessity must be very powerful to support virtual software.

Next, one dons some sort of sensor, be it glove, helmet, or bodysuit, which will record the position and movement of one's hands, eyes, head, or feet. Information from the sensor is continuously relayed to the mainframe in real time, altering accordingly the scene before the participant's eyes.

How is the scene presented? Things get really fancy here. The medium of choice for most systems are polarized 3-D glasses, which house a pair of tiny screens to depict a complete, three-dimensional, wraparound world. A pair of headphones with surround sound usually complete the picture.

The heart of any Virtual Reality system are the sensing devices, and these utilize highly-sophisticated technology. Gloves, for example, use fiber optics to sense position and movement of the fingers.

A representation of one's own hand then appears in the virtual world. The helmet, meanwhile, senses movement of the head, causing the perspective shown on the 3-D glasses to shift dynamically.

Other devices often used are treadmills, which pick up foot movement, and handlebars, which allow objects in the virtual world to be manipulated. The handlebars supply so-called "force feedback," which offers resistance if, say, the virtual object should feel heavy. Research is currently being carried out on a glove which will have tiny force-feedback elements on its fingertips, allowing one to feel "virtual textures."

Virtual Reality offers a huge array of applications. For engineers, it provides a way to deal with complex problems in an intuitive way. Chemical bonding of molecules, for example, is possible using a representation of the atoms involved and force-feedback to simulate electrical charges. In such a way novel molecules may be created and tested by industry. Medicine can also use the technology in a number of ways. Surgeons-in-training, for example, can perform "operations" on virtual "patients."

And, of course, the entertainment industry is closely watching these developments. The idea of having a "holodeck" in

one's living room seems more plausible every day. The chief obstacle is the fact that personal computers still lack the memory and speed necessary to manage even simple Virtual Reality models. But it seems likely that communications companies will soon offer virtual worlds through phone lines linked to a large mainframe computer. All you would have to do then is buy the interface devices, such as a glove and a helmet. Then you could simply choose a virtual world from a menu — taking a "trip," say, to Venus with your friend, who lives in Seattle.

This inevitable terminology — taking "trips" — makes some proponents of the the new technology uneasy. They fear Virtual Reality may be banned as some sort of cybernetic



"drug." Indeed, there is the real possibility for misapplication by escapists. Why deal with real problems when one can orbit around Alpha Centauri? For this reason, it is likely that, when the technology becomes more available for consumer use, it will be tightly regulated. One can imagine the warning signs aboard the CTA: "No smoking, littering, or Virtual Reality playing while riding."

Warp ten

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