Miracles of the next 50 years

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ABSTRACT

Wilson takes a look at what life might be like 50 years from now. Some of the predictions include pilotless airplanes, robot surgeons and virtual space travel.

FULL TEXT

Fifty years ago, POPULAR
MECHANICS attempted to predict what life would be like in the year 2000. We hit home runs with online shopping, microwave ovens and fax machines. We struck out in estimating the public's enthusiasm for food made from sawdust and electricity from nuclear fission (see "Miracles You'll See In The Next Fifty Years," Feb. 1950, page 112). Mindful of our batting average, we step up to the plate again. Some of our new prediCtions-pilotless aircraft, robot surgeons and virtual space travel-may seem more radical than anything we predicted in the past. But we've gone out of our way to err on the side of caution. Our caution arises because of our most dramatic prediction: An emerging class of pharmaceuticals and a new class of foods, called nutraceuticals,will significantly reduce the fatality rate from what are commonly known as the diseases of old age. This means most of PM's 10 million readers will be around in 2050 to judge our accuracy in predicting the miracles of the next 50 years.
Pilotless Planes
When you step aboard a jumbo jet and see the cockpit crew working through its preflight checklist, you are comforted by the thought of its years of training and thousands of hours of flight time. When the CEO of that airline steps aboard he sees six-- figure salaries gobbling up the bottom line. Since the first air passenger booked a reservation, airlines have been pleading, hounding and outright threatening aircraft manufacturers to build planes that could be flown by smaller crews. Growing up, you may have had friends whose fathers were airline flight engineers or navigators, jobs now done by sensors and silicon chips. The next empty seat on the flight deck will be the pilot's.
Today, every major defense contractor has at least one unmanned aircraft project in its research and development pipeline. By 2010 automated aircraft such as the Boeing-- Lockheed Martin DarkStar will take over reconnaissance work. On the ground, smart drones the size of lawn darts will provide squad leaders with a look over the next rise. Within another 10 years, by 2020, robot helicopters will routinely resupply troops in the field. Soon afterward, civilian versions will begin servicing deep-sea oil rigs.
How quickly pilotless planes switch from carrying wrenches to roustabouts will depend more on psychology than technology. We suspect it will take some high-visibility event to tip the balance of public confidence. Perhaps when a robot helicopter dropping off supplies at an oil rig evacuates a worker who is too seriously injured to wait for the arrival of a medevac team.
By then, the idea of planes that take off, fly and land by themselves will already be old news to the thousands of owners of Agates. The 21 st century's first original form of personal transportation, Agates will be the minivans of the sky, carrying a pilot and up to seven passengers at 220 mph to virtually any place on Earth. Truly the gems of private aviation, they will derive their nickname from the Advanced General Aviation Transports Experiment, which

was created in 1995 by NASA to revitalize private aviation in the 21st century. Its first dividend will be a "highway in the sky" cockpit display. Simply check off a city on a flat-panel display. Digital datalinks will keep the plane on course. Solid-state attitude controls will keep it flying straight and level. Future Agate projects will develop lighter, stronger airframes, more fuelefficient engines and training programs that turn drivers into pilots over a three-- day weekend.

With Agate and follow-on programs ensuring that the technological pieces will be in place, we predict you will roufinely fly in pilotless planes well before the year 2050.

Robot Surgeons

A new clice will be formed to encourage reluctant travelers to step aboard pilotless planes: "You let a robot take out your appendix, didn't you?" Much as airlines have pressured aircraft makers to design smaller-crew planes, insurance companies have put the screws to doctors and hospitals to cut healthcare costs. To protect their bottom lines, health-care providers have no choice but to become more productive. For surgeons that will mean increasing reliance on operating room automation. As early as 2010 this could include using robots for routine procedures, such as removing a problem appendix.

In the classic science fiction film "Silent Running," there is a scene in which a wastebasket-size robot stitches up the hero. The first generation of real surgical robots will be much smaller. By 2040 tiny "nanodocs" will be on call. As small as bacteria, they will be equipped with vision systems and memories that instantly recognize harmful microorganisms, malformed blood cells and cancer cells. With no connection to the outside world they will scavenge the blood for oxygen and fuel. When they recognize an errant germ, they'll rev up their nanoengines and ram into its protective membrane, spilling its contents for the blood's white cells to clean up. Machine vision systems capable of identifying different organisms have existed for years. Recently, T. Ross Kelly and his colleagues at Boston College built a nanoengine from only 78 atoms. It gets its power from the ATP molecule, the same "fuel" used by living cells.

You may be more willing to accept robot surgeons than you realize. In the late 1980s a group of Philadelphia hospitals analyzed why patients selected one hospital over the other. People, of course, preferred the hospital where their personal physician practiced. What mattered almost as much, though, was that their hospital offer the latest in high-tech equipment.

Future Drugs

We expect the first part of the 21 st century to usher in a new golden age of pharmaceuticals. It will begin with the introduction of a powerful arsenal of weapons against the 200 or so diseases we collectively call cancer. We don't predict that cancer will be conquered. However, we do believe that between new treatments and drugs that modify the eating, drinking and smoking behaviors that lead to cancer, rates of the most common forms of this disease will plummet.

The 21 st century will also see the emergence of the first drugs developed as the result of the Human Genome Project, a now 25 percent-- completed effort to identify all 3 billion of the base pairs in human DNA. Using this information it will be possible to tailor drugs to treat not only specific diseases, but the biochemistry of individual patients.

Paralleling the new age of drug discovery will be a major change in drug delivery. Injections will be rare. Most drugs will be administered with inhalers like those now used for asthma relief, in foods or through ingested time-release capsules. The coatings on pills may seem a trivial concern, but they go to the very heart of keeping the pharmaceutical industry thriving. Patients, even those suffering from serious medical problems, want their medications to be convenient. One of the principal criticisms of some TB and HIV medications is that patients must follow strict dosage regimens. The brass ring is one pill a day for each disease.

We also expect drugs to do more than treat diseases. One emerging category will be personal enhancement pharmaceuticals. Drugs that jumpstart balky hair follicles are already on the market as a treatment for male pattern baldness. Elaine Fuchs of the University of Chicago has found a way to fool nature into growing new follicles, potentially making full heads of hair available to all. At the University of Pennsylvania, H. Lee Sweeny has

isolated a compound that could lead to the ultimate cosmetic drug. Called an "insulinlike growth factor," it causes muscles to respond as if they had spent serious time in the gym. There is also very preliminary evidence it may be possible to produce drugs that improve our memory and enhance our intelligence.

Perhaps the most important of the new classes of personal improvement drugs will be those that deal with behavior disorders. Within the last several years, researchers in the now-infant field of molecular psychiatry have identified genes that influence depression and aggression, traits exaggerated among those convicted of committing violent crimes. More recently, evidence has emerged that genes also determine our propensity to become drug addicts. Just as this article was going to press, scientists at the National Institute on Drug Abuse had identified brain chemicals involved in "switching on" cocaine addiction. If the genetic key to addiction can be found it may break the stalemate in the war on drugs as dramatically as tanks ended trench warfare in World War I. We believe that by 2020 there will not only be pills for what ails you personally, but for societal ills as well.

The Ultimate Body Shop

Diseases, of course, are not the only things that kill people. Traumatic injuries from accidents claim most young lives. The early part of the 21 st century will see the blossoming of four technologies that will dramatically reduce the death rate among young adults.

The first will come from the application of Agate-inspired technology to cars and highways. By 2030 we expect computer overrides on manual controls to reduce traffic fatalities to only a few hundred per year.

The second is tissue engineering. Pioneered at the Massachusetts Institute of Technology and Harvard Medical School, this technology has already led to the creation of replacement skin for burn victims, cartilage for damaged knees and, most encouraging of all, a matrix along which nerves can regrow.

The third technology, xenotransplantation, or the use of animals as a source of human replacement organs, has improved prospects. Recent scientific studies suggest that, contrary to previous fears, there is little risk of these organs creating

a public health problem by allowing diseases from animal populations to jump to humans. By 2010 we expect transplantation of genetically modified pig hearts to all but replace human heart transplants.

By 2030, however, we expect xenotransplantation to have been made obsolete by the fourth technology, the cloning of body parts from our own DNA. A small amount of blood from the umbilical cord will be frozen at birth. Later, if the patient has a serious accident, or suffers from an- organ-crippling disease, a few drops will be shipped to the local body shop where the resident genetic engineer will selectively "turn on" those parts of the DNA needed to grow a new eyeball, gall bladder or index finger.

Going under the knife for transplant surgery will be less worrisome since the risk of blood-borne infections will drop to zero. This will come about as the use of human blood for transfusions is phased out in favor of vegetable--based blood replacements. One promising process that derives blood from turnips has been developed at the Pacific Northwest National Laboratory in Richland, Wash.

Future Foods

It might seem that with all the advances in medical science, the only way you could die would be to eat yourself to death. Quite the opposite will be true. A new class of medicinal foods, nutraceuticals, will make you healthier with each bite you take. Two pivotal factors in determining whether a person will die of heart disease or stroke, the chief killers

of older adults, are their blood pressure and their level of low-density lipoproteins (LDL), so-called "bad" cholesterol. Today, we lower both by limiting what we eat. Recently, a study conducted at Wake Forest University Baptist Medical Center in Winston-Salem, N.C., suggested it might be possible instead to eat more food with a particular class of chemicals, known as isoflavones.

In one study, John R. Crouse III fed soy protein containing varying amounts of isoflavones to humans. In just nine weeks, LDL levels in those patients whose levels were previously greater than 164 mg/ dl, or moderately high, dropped by 10 percent. "The dose-response relationship raises the possibility that soy protein with higher amounts of isoflavones might have even greater cholesterol-lowering effects," Crouse says. What's more, as isoflavone

content increased, blood pressure decreased among the female participants.
In the past the packaged food industry has been fast to incorporate medical research into improving the nutritional characteristics of food. We expect the discovery of the protective effects of isoflavones in soy to be exploited rapidly, with the substance being used as an additive in everything from ersatz hamburger patties to potato chips. It will still be easy to find bad cooking in the year 2050, but we predict that you will have to go out of your way to find food that is bad for you.
Future Housing
Computers will be so much a part of everyday life, they will fade into the background, much as electric power does today. And, like the ubiquitous power outlet, they will change everything they touch. Your refrigerator will keep track of the food you store. Your microwave will watch what you cook. Both of these appliances will hear your washing machine's call for more detergent and fabric softener, and see that it is included in the grocery delivery that appears outside your door. And computers will even change that door, by replacing the key with an irisor face-recognition lock.
The big change at home will be in windows. Socalled "smart glass" will turn windows into active elements. During the day windows will automatically adjust the degree of tint to keep out the sun. At night they will opaque for privacy. Or that's how it will appear from outside the house. From inside, windows will double as giant flat-screen televisions. Forget about cable TV or a hardwired Internet connection for delivering entertainment. Your personal satellite link that routes all your communications will make today's fiberoptic lines seem as primitive as two cans and a string.
By 2020, however, television entertainment could be on the wane, replaced by virtual reality seen through inexpensive glasses. Soon after, we expect to see 3D holograms that put the stars of your favorite shows on your sofa. Let's hope kids tire of that purple dinosaur before then.
Virtual Everywhere
Virtual reality (VR) will make scientific research a lot like playing a video game. In drug discovery, where it will find its first application, it will work something like this: A computer will create a 3D representation of the active region of a disease-causing molecule. The scientist seeking a molecule that can deactivate the site will slip on a pair of virtual reality goggles and enter cyberspace. Here, the active region will be enlarged to the size of an elephant. Examining its shape more closely, the scientist will draw upon
a pharmaceutical house's "library" of potential drugs until one is found that fits over the active region, thereby preventing it from taking part in chemical reactions.
VR systems represent more than a tool for scientific research. They will permeate almost every aspect of our lives, from video games to creating the traffic scenarios our grandchildren will have to navigate to pass their driver's license tests. They will also be the basis of the training programs for teaching would-be pilots how to operate Agate aircraft.
The road to making VR systems as common as VCRs is being paved by the makers of video games. The next giant step will come around 2010. By then the major movie studios will have all abandoned film in favor of digital storage. With VR equipment already in most homes, it will be economically attractive to turn digitized films into interactive entertainment. You won't just watch spacemen battle aliens on the screen, you will jump into the fray and blast away to your heart's content.
When you've tired of playing cyber shoot'em-ups, there will be plenty of virtual adventure on public broadcasting. By 20 10 a digital map of the moon will let you race your lunar buggy around Tranquillity base, without leaving your living room, which most people will call the media room. The only people who won't be turning to VR for entertainment will be the NASA scienfists who use it on the job. Donning powerful virtual reality goggles, they will explore Mars by "walking" alongside actual rover robots. When they find something of interest, they will be able to examine it as though they were there. If they deem it worthy of further study, they will simply direct their mechanical on-planet assistant to pick it up and load it into the next Earth-bound rocket.
Live To Be 150

Our final and most dramatic prediction has to do with you, our readers. The medical advances and safety improvements you will see in the next 10 to 20 years will expand your life span beyond what life insurance tables now predict. In theory, the human body has a design life of 120 years, some say as long as 150 years. What limits our actual life span is the cumulative effect of living. And much of this is limited to a few bad habits, chiefly overeating, smoking and drug use. Within the last several years, researchers at several leading medical schools and universities have collected solid evidence that the likelihood of our acquiring these bad habits is grounded in our genes. This opens up the possibility that harmful habits could before long be corrected by the same gene therapy techniques now used to treat some hereditary diseases.
Our confidence that by 2050 science will be able to dramatically lower the incidence of heart attack, stroke, diabetes and cancer, and the "bad habits" that cause these diseases, leads us to our most dramatic prediction: We believe that many of our younger readers will be alive and enjoying PM at the start of the 22nd century.

DETAILS

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