

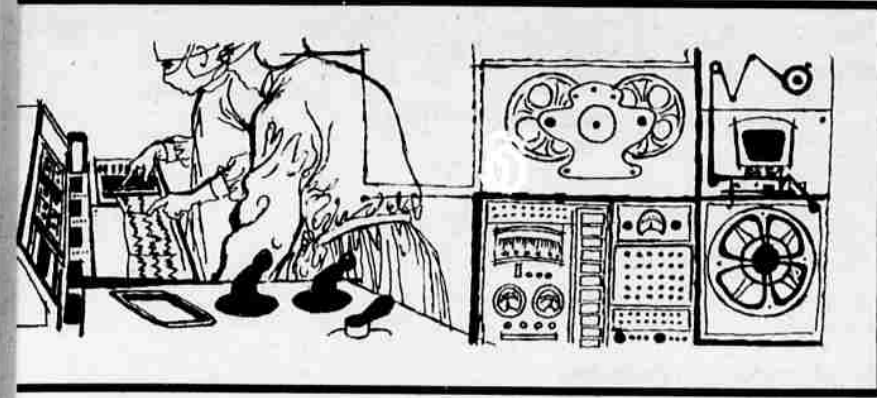
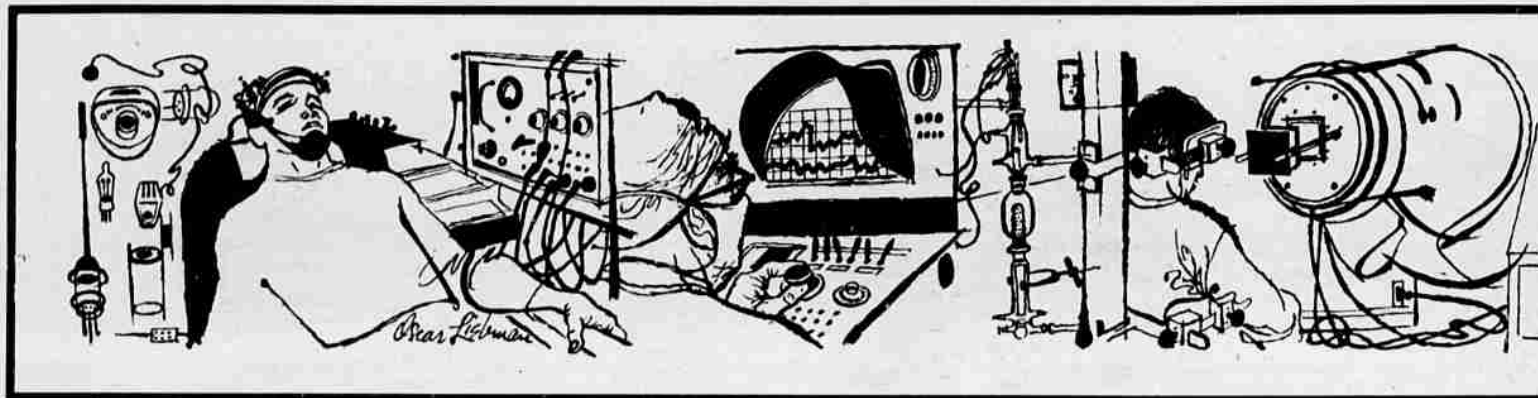


ILLUSTRATION BY OSCAR LIEBMAN

**T**WO YEARS AGO, a New York boy fell from a sixth-story window. The result: a severely damaged spinal cord which, at the time, meant permanent paralysis.

Recently, however, a medical pioneer, Dr. Adrian Kantrowitz of Brooklyn, conducted a radical experiment involving the boy. He taped electrodes over four of the lad's key leg muscles. Then an attending engineer twisted a computer dial; electrical impulses were fed into the long-unused muscles—and the boy rose gingerly to his feet! In that simple act, he became the first paraplegic in history to stand up by the strength of his own muscles.

But the wizardry of medical electronics reaches beyond the problem of paralysis. In modern hospitals, age-old diagnostic instruments are rapidly being replaced by new electronic ones. Instantaneous electronic thermometers and stethoscopes have taken over the time-consuming jobs of their predecessors.

Tiny radio pills, dubbed "gutniks" by doctors, are used to pinpoint intestinal troubles. Swallowed by the patient, they act as miniature radio transmitters, broadcasting temperatures and pressures from the gastrointestinal tract. One radio pill even measures acidity in a newborn baby's stomach and thereby tells the physician what formula to prescribe.

Hemorrhages in the stomach can be pinpointed exactly by having the patient swallow a string of tiny Geiger counters. A radioactive substance injected into the blood stream will turn up at the bleeding site and register on a counter.

The electrogastragraph, invented in Russia and now undergoing tests in the U.S., detects stomach ulcers—and cancers. An electrode is placed on the surface of the abdomen to pick up the minute electrical waves which the stomach sends out when it contracts. Cancerous tissue generates electricity of a different frequency from that of normal tissue, and analysis of these waves indicates the presence and location

of tumors before they are visible by X ray.

In dentistry there also is a startling new electronic development. Dentists now can implant miniature radio monitors in tooth cavities—batteries and all—to chart faulty chewing patterns that may be the cause of gum disease.

Another electronic diagnostic device is the portable electrocardiograph. Until now, doctors had no means of detecting the kind of heart trouble that shows up only during exercise or in the midst of an emotional crisis. "Patients may show no sign of trouble when they're in your office," says one heart specialist. "It's when they're running for the bus or watching the stock ticker that attacks occur."

Today, a patient can wear a portable electrocardiograph, which pipes a continuous record of his heartbeat into a pocket recorder. If a radio broadcasting attachment is included, the device can even transmit heartbeat directly into the doctor's office. Via radio and telephone, a doctor in New York recently listened to his itinerant patient's heartbeat from California!

**B**UT THE MOST startling example of electronic control applies to heart block, which fells 40,000 people a year. In heart block, communication between the nervous system and heart muscle is blocked. Two years ago, the only remedy was use of a gigantic electrical stimulator. Two electrodes, fastened to the chest wall or to the heart muscle itself, sent painful wallops of electrical current through the chest to make the heart contract.

Surgeons today can actually implant an artificial "pacemaker" in a heart-block patient. The automatic ticker is painless and restores him to normal activity. The pacemaker, a signal generator the size of a cigarette pack, is buried in the abdomen just under the skin. Two wires run beneath the skin to the heart where they are sewed directly into the tough muscular part of its wall. When the batteries wear down, the patient undergoes a simple operation to replace them.

Another version of the cardiac pace-

maker allows the patient to step his pulse up or down, depending on whether he wants to walk, run, or sleep. A radio transmitter is taped to the patient's chest over the spot where the pacemaker is installed. It is connected to a simple battery unit in his pocket, which has dials to increase or decrease the heartbeat.

Russian scientists are using electrical stimulus to solve the problem of insomnia. They report that more than 100,000 patients have been successfully treated by passing low-current electricity from electrodes on the eyes to one at the nape of the neck, thus temporarily blocking sleep-killing brain activity.

These are only a few of the strides medical electronics has made to date. If they seem considerable, the future promise is even greater.

When the New York paraplegic stood for the first time, he pointed the way toward new hope for 250,000 of his co-sufferers. Dr. Kantrowitz believes that it is just a matter of time before more complex motion can be electronically induced. He says it is quite possible that paraplegics may one day carry miniature computers, linked to muscles, that will let them walk, run, and even dance!

Muscle stimulation might also free polio victims from imprisonment in iron lungs. Here, nerves leading to chest-throat muscles are impaired, and the patient is unable to breathe. Rhythmic electrical stimulation promises to reactivate dead breathing muscles as well.

**R**ESearchers have also discovered appetite-control areas of the brain that might be regulated electrically to prevent obesity. Others have located centers of aggressiveness and extreme pleasure in the brain that might be stimulated to prod recalcitrant soldiers at the battlefield or provide instant bliss for the discontented. While it is doubtful this knowledge will ever be put to this kind of use, one Swedish doctor has found evocation of the pleasure sensation extremely effective in easing pain for terminal-cancer patients.

Glands, too, might be prodded electrically. Stimulation of the adrenal cortex, for example, might be used to produce extra hormone for the control of arthritis or low blood pressure.

But more practical work is getting the lion's share of attention. High priority is going to the development of electronic aids for the deaf, mute, and blind. Plans have already been drawn for a compact instrument that will allow the speechless to talk. The "vocal typewriter" will have a keyboard of commonly used words. When the mute punches a key, the device will emit the desired word in vocal form. The mute might have both a 500-word speaker for his living room and a small, 100-word pocket version.

**F**OR THE BLIND, medical engineers are exploring the possibilities of a similar device that would translate printed words into audible sounds, enabling the blind to "read." An electronic "seeing-eye dog" also is a near reality. The device emits a beam of light that precedes the blind person. When it hits an obstacle or a step, the reflection triggers a warning system.

Doctors also believe that someday the heart will be reproduced mechanically and powered either by an outside battery or by a spring mechanism wound like a clock by the breathing muscles. Scientists at Bell Laboratories have already built a duplicate of the brain cell with transistor components. They know that an electronic copy of the brain is no longer a question of size: "molecular electronics" today offers computer parts the size of molecules, compactness comparable to that of the brain itself.

Clearly, scientists have a long way to go before they can duplicate the exquisite human brain—or build a portable heart. Yet their achievements to date suggest a wide horizon of possibilities ahead.

More than 3,000 doctors and engineers in the U.S. alone are combining their talents to bring these miracles into being. Their efforts point to the dawn of a new era when "inner space" will be as fully explored as outer space.

# Coming: The Era of Electronic Medicine

Techniques which have  
revolutionized U.S. industry  
now offer new hope  
for solving the most  
vexing health problems

By LYDIA RATCLIFF

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## No Nagging Backache Means a Good Night's Sleep

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