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TELEMEDICINE

If media scare stories are anything to go by, we are all obsessed with our health. Despite this obsession, many people are afraid of going to see the doctor for fear of what they might discover. Soon we will worry no more: our vital signs will be monitored remotely and, if anything abnormal happens, your friendly, holographic computer-generated doctor will pop up to alleviate your concerns, or even start surgery right there in your home.

SCIENTIFIC HISTORY

Telemedicine, the real-time transmission of medical data, started with the invention of the telephone in 1865 and developed with the invention of radio later that century. In 1903, Dutch physiologist Willem Einthoven created a highly sensitive galvanometer, which he used to record the electrical activity of the heart. In 1905, Einthoven began transmitting signals from this apparatus across telephone lines from the hospital to his laboratory a mile away, allowing him to monitor patients remotely.

NASA began work on telemedicine in the 1960s with the *Mercury* Earth-orbit program. Satellite links allowed ground crews to monitor the medical status of astronauts in orbit. The big boost for telemedicine came in the 1970s and 1980s with the development of videoconferencing, allowing high-quality video to be beamed across great distances. In September 2001, the first major telesurgery—the removal of a gall bladder—took place, with a surgeon in New York controlling a robot arm in Strasbourg, France.

Holography was conceived by Hungarian physicist Dennis Gabor in 1947. However, early holograms were distorted and contained an extra twin image because of the limitations of the light source used. The invention of the laser in 1958 at Bell Labs changed all that, but science has not yet been able to create a three-dimensional image that you can look at from any angle.

REALITY

Telemedicine and telehealth are now big business—some estimate that the industry is worth $30 billion a year. A major factor has been the recent explosion in the number of home computers and the emergence of broadband connections, which have allowed sophisticated telemedicine applications to flourish.

Although the computer power and telecommunications links are in place to enable many aspects of telemedicine, access to a three-dimensional holographic doctor is still some way off. Hologram technology can currently only produce images from one angle, and the artificial intelligence necessary to diagnose any disease—let alone perform surgery—has yet to be developed.

1905_
Willem Einthoven transmits medical data over telephone cables

1947_
Dennis Gabor conceives holography

1958_
Laser is invented

1960s_
NASA uses satellite links to monitor astronauts in orbit.

2001_
First telesurgery takes place

SIGHTINGS IN SCI-FI

- In the original *Star Trek*, Dr. "Bones" McCoy was provided with both hospital beds that monitored key body functions without messy wires or tubes, and the "tricorder," a machine that could instantly diagnose, treat, and heal damaged tissues using energy instead of surgery.
- Larry Niven's *Ringworld* (1970) included the "autodoc," an automated physician
- In *Star Trek: Voyager* (1995), Robert Picardo played an emergency medical hologram (EMH), programmed with the sum of human medical knowledge as well as futuristic physician's techniques.

TECH SPEC: 3D HOLOGRAMS

Three-dimensional visualization systems do exist, although they typically use bulky equipment—spinning screens, light sources, or hidden mirrors—to achieve the effect. One of the more promising technologies is the cathode ray sphere, developed by Barry Blundell and a team at the University of Canterbury in New Zealand in the 1990s:

- The cathode ray sphere is a sphere from which all the air has been evacuated.
- A phosphor-coated screen rotates within the sphere.
- Voxels—the three-dimensional equivalent of pixels—are drawn on the screen using two electron beams.
- The phosphor screen spins fast enough to give the illusion of a 3D image.
- The view seen from outside changes as the eye position moves, giving important clues about visual depth and making the image appear solid.