Space Age Medicine: New Technology That Could Save Your Life

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You're confined in a tiny room for six months. The only contact with the world is a radio signal. Suddenly your chest seems two sizes too small. You can barely catch your breath. You crawl to the medical computer. The machine peers into your eyes, scans your blood and evaluates your condition. Soon, it spits out a cure.

Meet Robo Doc, NASA's vision for astronaut health care, an automated high-tech physician that could one day save your life, too.

Robo Doc would be an onboard, integrated set of devices that would allow astronauts to easily monitor and maintain their own health on the International Space Station, as well as on years-long missions to Mars. Back home, health care by computer could be especially useful for people in remote regions or after accidents, such as when a victim is trapped in a car.

This so-called "smart medical system" is just one of many new Space Age technologies -- from bionic eyes to petri dish hearts and an in-home device that monitors unborn babies -- that promise better health and longer life in space and on Earth.

Head rush

The hazardous environment of space steers much of the research effort into Robo Doc, its various components, and several other technologies making their way into terrestrial health care systems.

In one example of the perils faced by astronauts, microgravity causes blood to flow irregularly and weakens muscles, including the heart.

Researcher Babs Soller at the University of Massachusetts is working on a way to monitor and counteract these ill effects by perfecting an infrared scanner that measures blood content, metabolism and circulation -- all without taking blood or tissue samples.

The device would be about the size of a quarter. Placed on the body it could determine the amount of oxygen-carrying red blood cells a person has, if blood is getting to a particular region in the body, and whether muscles are using the blood efficiently.

The scanner would be attached to the onboard medical computer or a Palm-Pilot-sized monitor, where individualized treatment would be calculated. An astronaut might be prescribed certain exercises to combat circulation problems or muscle weakness.

The scanner would also determine the right course of treatment for an unconscious patient or someone bleeding internally -- perhaps after taking a tumble down a Martian ravine or after being run off a terrestrial highway by an erratic driver.

Trauma victims need to be resuscitated carefully, Soller explains. Without knowing a patient's blood metabolism or blood quantity, the wrong combination of fluids, transfusions and medications can be lethal for a person in shock.

"This device will provide equipment and knowledge that will enable people who've not had four to five years medical school to help evaluate and resuscitate," Soller said.

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Soller's research is one of several of the devices being developed by the NASA-sponsored National Space Biomedical Research Institute, a cooperative research endeavor of 11 universities and the Brookhaven National Laboratory, begun in 1997.

Through NBRI, University of Washington scientists developed a non-invasive portable ultrasound device that stops internal bleeding.

And a miniature MRI (multipurpose magnetic resonance imager) is in development at both Harvard and the Massachusetts Institute of Technology. It would assess physical traumas to the brain and could also monitor for psychosocial disorders that can develop in the confining environment of a spacecraft.

Eagle eyes

In space, eyesight must be superb.

"Vision is the primary sense for performance," says NASA flight surgeon Jonathan Clark.

Many astronaut applicants get turned away because of imperfect vision. Ironically, the space environment can jeopardize eyesight. High-energy cosmic particles penetrate spacecraft and zip through the human body. Astronauts have actually reported seeing this radiation with closed eyes, and a soon-to-be-published study claims the radiation can put astronauts at risk for cataracts, Clark said.

The cramped quarters of a spacecraft can make eyes lose their focus. Sailors in submarines, who stay underwater for months at a time, lose the muscular ability to focus their vision further than ten feet away. The same might happen to a Mars adventurer, who will likely travel six months or more one way.

Microgravity can also damage eyes. Blood travels too easily to the head and the extra pressure can lead to stroke-like conditions and temporary vision loss, says Wolfgang Fink, a physicist and ophthalmologist at Caltech.

Increased pressure in the inner eye can also cause glaucoma, a disease that destroys the optic nerve. It can cause blindness if it's not detected early and treated with eye drops. Millions of Americans are diagnosed with glaucoma every year.

Fink has devised a space-friendly way to ferret-out such changes in vision. It's a computerized version of what's called an Amsler Grid. The original grid involved white lines printed on a black background. With defective vision, the grid appears to have blank or wavy areas in it.

To make the test more accurate, Fink devised a computerized grid that works with a touch screen. A patient outlines the blank or wavy areas they see. The contrast and size of the grid varies so that different degrees of glaucoma can be detected. Tests show that Fink's computer detects glaucoma more accurately and earlier than any other test.

Astronauts could easily monitor their vision with the new device and might solve a problem with a solution as simple as eye drops.

On Earth, Fink's grid will soon be in mobile testing units and perhaps even on the Internet, to aid people in remote locations who might otherwise go untreated.

To save money, components of Robo Doc are being designed to integrate with existing computer systems on space shuttles and the Space Station.

In space, the future of medicine will be dictated by cost efficiency, ease of use, and the desire to serve people in hopelessly remote locations. The same may hold true back here on Earth. People of poverty-entrenched countries, elderly patients at home or in nursing facilities, or anyone caught in an emergency with no time to spare could benefit from commercial spin-offs of the Robo Doc.

After all, as Fink puts it, "you can't always have a physician on board with you."

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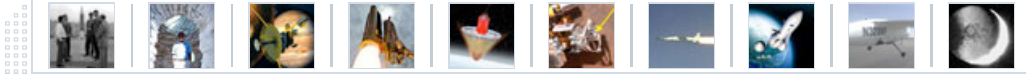

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