



NIH MedlinePlus

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Easing Chronic Pain

Better treatments
and medications

Medicine in Outer Space

Space-based medical
research is bringing benefits
to all Americans

Understanding Alzheimer's Disease

The risk factors and the
ongoing efforts to treat
and cure AD

Controlling Asthma

Wynonna Judd
never lets
her asthma
hold her back

New guidelines, meds, and action plans

By Keith Ferrell

SPACE

The New Medical Frontier

Even as you read these words, there's a world of research going on high over our heads—approximately 200–215 miles up. The International Space Station (ISS), which has been taking shape for much of the past decade, is an orbiting laboratory for many kinds of research.

This past September, the National Institutes of Health (NIH) and the National Aeronautics and Space Administration (NASA) established a formal understanding that will make medical and health research an important ongoing part of ISS research activities. This new relationship between the nation's premier medical laboratories and the national space effort is a first, and already there is much excitement about the various

advances to come from space-based research.

There are many new frontiers and considerable new knowledge that medical researchers can gain from using the space station, says Stephen I. Katz, M.D., Ph.D., director of the National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS) and NIH's liaison with NASA.

A Unique Laboratory

Continuously inhabited by astronauts and scientists since 2000, the ISS is a perfect place to research all manner of scientific, technical, and medical questions. In fact, some medical research can only be performed in orbit. That means aboard the space station, where there is no gravity. The same weightlessness that lets space-suited astronauts move massive



American scientists now have an out-of-this-world platform from which to conduct groundbreaking health and medical research. A recent agreement between NIH and NASA provides the basis for a U.S. national laboratory on the International Space Station.



Photo: NASA

objects easily also offers a unique learning opportunity.

Zero-gravity's effects on astronauts' skeletal systems and loss of bone and muscle mass have long attracted scientific interest, Dr. Katz says. "Research on the space station will help generate better understanding of how weightlessness affects the bone, muscle, and inner ear systems."

The more we know about how the various systems of the human body react to weightlessness and the other conditions found only in space, the better able we will be to ensure the health of ISS crew members, as well as those future astronauts and researchers who will journey to the moon (again), Mars, and beyond.

The benefits also will pay off back on earth:

- Increased understanding of bone-strength and loss of bone-mass may help patients suffering from delicate bones or muscle-wasting diseases.
- Without gravity to help orient them, astronauts experience changes in their sense of balance. Studying this phenomenon may yield insights into dizziness, vertigo, and balance problems and disorders related to the inner ear.
- Observing the behavior of microbes and other organisms in space can generate insights into the behavior of organisms on earth, and perhaps lead to better understanding of infectious diseases and the immune system's response to them.

Our health and medical knowledge and capabilities have grown greatly because of space exploration and the equipment and techniques developed for it. Remote health-monitoring sensors and temperature-lowering "cool suits" are just two examples derived from the lessons learned from orbital space suits. And medical imaging technologies and ultrasound procedures are based, in part, on NASA innovations.

Long-Term Space Research

Until the advent of the ISS, research missions in space were necessarily brief—usually only a few days or weeks, at best. With long-term human residence in space now made possible by the ISS, it is important that a certain percentage of each ISS crew be dedicated to vital medical research. As with everything connected with space travel, results will take time because of the planning, preparation, and training involved.

"An enormous amount of time will be required to develop the questions and experimental models for use on the

space station," says Dr. Katz. "First, you have to make sure you're asking important questions. Also, the scientists' time is valuable, and it's very expensive to put the experiments together and transport them to the space station." Added to this is additional training the astronauts—many of whom are scientists—must complete to be able to perform the



NIH Director **Dr. Elias A. Zerhouni** and NASA Administrator **Dr. Michael D. Griffin** sign an agreement making U.S. resources on the International Space Station available for NIH-funded research. **Senator Kay Bailey Hutchison** (left), **Senator Barbara Mikulski** and **NIAMS Director Dr. Stephen I. Katz** witness the occasion.

experiments correctly. Thanks to the formal agreement between NIH and NASA, the research will be carefully coordinated into high-priority areas, with promise of practical results.

"Both NIH and NASA are committed to real cooperation," Dr. Katz says.

This cooperation may serve as the foundation for a potential flowering of both space medicine and earth-based health care.

"We are extremely pleased that this collaborative effort is moving forward," adds NIH Director Dr. Elias Zerhouni. "The International Space Station provides a unique environment where researchers can explore fundamental questions about human health issues, including how the body heals itself, fights infection, or develops diseases such as cancer or osteoporosis."

Research projects on the ISS funded by the NIH will be conducted on the U.S. segment of the space station and be consistent with existing NIH priorities and relevant to improving human health on earth.

Dr. Michael Griffin, NASA administrator, adds enthusiastically, "Not only will the station help to explore the moon, Mars, and beyond, its resources also will be applied to the much broader purpose of improving human health."

NASA Spinoffs

Milestones in Space Research

DIGITAL IMAGING BREAST BIOPSY SYSTEM—A non-surgical system developed with Space Telescope Technology that greatly reduces the time, cost, pain, and other effects associated with traditional surgical biopsies.

BREAST CANCER DETECTION—A solar cell sensor that determines exactly when x-ray film has been exposed to optimum density; it reduces exposure radiation and doubles the number of patient exams per machine.

LASER ANGIOPLASTY—A “cool” type of laser, called an excimer laser, which offers precise non-surgical cleanings of clogged arteries and fewer complications than in balloon angioplasty.

ULTRASOUND SKIN DAMAGE ASSESSMENT—An advanced ultrasound instrument to immediately assess depth of damage, improving patient treatment and saving lives in serious burn cases.

HUMAN TISSUE STIMULATOR—A device employing NASA satellite technology that is implanted in the body to help control chronic pain and involuntary motion disorders through electrical stimulation of targeted nerve centers or particular areas of the brain.

COOL SUIT—Custom-made suit that circulates coolant to lower body temperature; it dramatically improves symptoms of multiple sclerosis, cerebral palsy, spina bifida, and other conditions.

PROGRAMMABLE PACEMAKER—An implant connected to a physician’s computer and used to regulate heart rate, incorporating multiple NASA technologies.

OCULAR SCREENING—An image-processing technique developed by NASA and now used to detect eye problems in very young children.

VOICE-CONTROLLED WHEELCHAIR—Robotic wheelchair manipulator that responds to 35 one-word voice commands, helping patients to perform daily tasks like picking up packages, opening doors, and turning on appliances.

WATER PURIFICATION SYSTEM—A municipal water treatment system for developing nations that uses iodine instead of chlorine to kill harmful bacteria.



Photo: NASA

Inspired by the space suits Apollo astronauts wore to survive the moon’s harsh climate, the Recharge™ Active Cooling System by Cool Systems Inc. helps patients with multiple sclerosis and heat-related neurological disorders manage their symptoms by lowering their core body temperature.

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