

Space Research is Down to Earth

Can you remember the wink of the *Sputnik* satellite as it moved across the night skies? Perhaps you watched on a black and white television set as the first American in space, Alan Shepard, made a suborbital flight on May 5, 1961, lasting just over 15 minutes. If you were among 76 million Americans born during the baby boom, 1946 to 1964, you have watched the National Aeronautics and Space Administration (NASA) reach many milestones in spaceflight. Since its creation in 1958, NASA has sent several hundred astronauts into space. As missions to space become longer and more complex, data is being gathered and analyzed regarding the effects of spaceflight on the human body. This information is already being put to use in the field of medicine here on Earth.

Mary Anne Frey, Ph.D., physiologist and professor in the Aerospace Medicine Residency Program, Department of Community Health, has made a career of research in spaceflight physiology. She lists the symptoms that astronauts experience in space and on return to Earth: impairment of blood pressure control and a decrease of aerobic capacity; loss of muscle tissue and muscle strength, especially of the legs and back; loss of calcium from the bones; changes in the nervous system, including difficulty maintaining balance; mild anemia; depressed immune system function; and sleep disturbances.

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“Many of the effects of spaceflight are similar to changes with aging,” says Dr. Frey. “With spaceflight, these effects occur more rapidly and are—so far have been—reversible.” Although the mechanisms behind these changes may not be the same, performing research on the effects of spaceflight helps us understand the aging process.

One of the primary culprits behind the “aging” effects of spaceflight is the absence of gravity. Without

Astronaut Edward T. Lu, Expedition 7 NASA science officer and flight engineer, wearing squat harness pads, performs knee-bends using the Interim Resistive Exercise Device on the International Space Station.



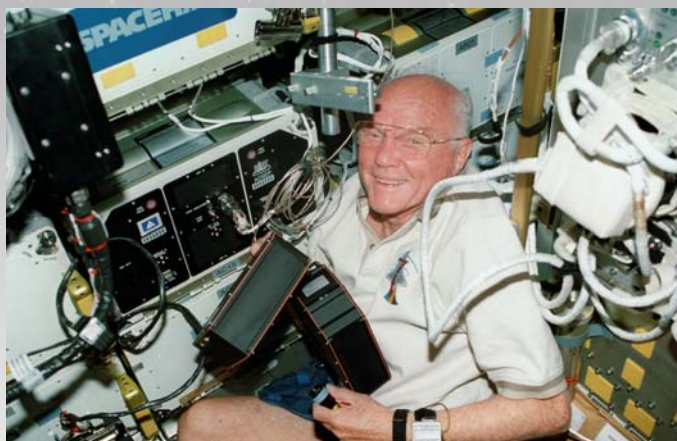
the accustomed load of gravity on muscle and bone, humans in space experience below normal levels of exertion as they stand, walk, run, jump, or lift objects. And, without the directional push of gravity on the body, humans in space can become disoriented: there is no sense of up or down, and even awareness of the location of one's own limbs is reduced in micro-gravity.

The longer a person remains in space, the more severe the effects of spaceflight become, and the longer it takes to recover. Dr. Frey cites the case of one U.S. astronaut who lost 12 percent of his bone mass after four and a half months in space, and who took a year to make a full recovery. Normal aging can cause 1 percent bone loss in one year; in space, the loss averages 10 percent per year. NASA flight surgeons prescribe programs with gradual resumption of rigorous exercise in order to safely rehabilitate astronauts upon their return to earth. A long-term program, the Longitudinal Study of Astronaut Health, has tracked astronaut health data since the 1950s to determine whether astronauts' unique occupational exposures are associated with special health risks.

As an integral part of its mission, NASA has continuously created new technologies, often with exciting new medical applications. NASA “spinoffs” have included imaging processes (MRI, CT, ultrasound, and

DEXA) made possible by digital processing developed for the Apollo program. Technology and software developed to analyze data from the Hubble Telescope have been put to use for digital guided biopsies and digital mammograms. Cardiac pacemakers, laser angioplasty, and virtual reality techniques for neurosurgery and other surgery are just a few medical innovations made possible by NASA technology.

If humans returning from space can reverse the “aging” process experienced during spaceflight, Dr. Frey suggests that aging people might take control of their own health in a similar manner. “As many people age,” she says, “they adopt a sedentary lifestyle, in which they are not working against gravity; their lifestyle, rather than the mere passing of days and years, may be the cause of their so-called ‘aging changes.’”



U.S. Sen. John H. Glenn Jr., payload specialist, works with the Advanced Organic Separation experiment inside the SPACEHAB facility onboard “Discovery.” Sen. Glenn joined five astronauts and a Japanese payload specialist for the nine-day STS-95 mission in Earth orbit.

Thirty-six years after making history as the first American to orbit the earth, Senator John Glenn returned to space on Shuttle mission STS-95, at the age of 77. On this spaceflight he made 134 orbits of the earth; spent a total of 8 days, 21 hours, and 44 minutes in space; and traveled 3.6 million miles. According to Dr. Frey, Senator Glenn made a rapid and full recovery from the effects of his second space mission. NASA has great news for the generation of the baby boom, and for all Americans. With a little help from space technology’s medical spinoffs and the will power to keep our bodies active, the “effects of aging” can be slowed or even reversed. 📧

—Sue Rytel



Faculty and staff of the Division of Aerospace Medicine gather before an autographed portrait of U.S. Senator John H. Glenn. (L–R) Stanley R. Mohler, M.D., M.S.; Farhad Sahiar, M.D.; Betty Somers; Mary Anne Frey, Ph.D.; and Robin E. Dodge, M.D., M.S.

Residency Program Celebrates Anniversary

The Wright State University Aerospace Medicine Residency program celebrates its silver anniversary this year. Aerospace medicine promotes the health and functional well-being of pilots, astronauts, flight crew members, and others traveling in air or space. Wright State’s program is the oldest civilian program in the country and claims more than 100 graduates, representing more than 20 countries around the world.

Stanley R. Mohler, M.D., the program’s director since its inception in 1978, notes that the program’s graduates play a major role at NASA, FAA, and developing space programs around the globe. They fill the roles of flight surgeons for space exploration, medical directors of airlines and the FAA, and aerospace medicine researchers and instructors. The highest ranking physicians at the Johnson Space Center and the Kennedy Space Center are both graduates of the program.

Medical residents study and perform research activities in the areas of epidemiology, biostatistics, health services administration, and environmental health. They also complete clinical rotations at such facilities as Kennedy Space Center, Wright-Patterson Air Force Base, the FAA, and commercial airlines.

Accredited by the American Board of Preventive Medicine, the Aerospace Medicine Residency Program emphasizes primary care in the work environment. The program includes a Master of Science in Aerospace Medicine.