Muscle Physiology

NASA supported life sciences research has advanced our understanding of many body systems. This knowledge benefits the health of humans both in space and on Earth. NASA funded research on muscle physiology goes beyond simply solving space flight problems, for example:

- The muscle weakness, fatigue, faulty coordination and delayed-onset muscle soreness that astronauts experience after spaceflight mimics the changes seen in bed-ridden patients and the elderly.
- Space flight results in increased susceptibility of skeletal muscle to contraction damage, which also occurs in muscular dystrophies.
- Reduced muscle use, such as during spaceflight, decreases its size and strength, and contractile proteins adjust to maintain power output. The understanding of the basics of these processes can help patients who have lost muscle mass and strength.
- Exercise alone has not prevented muscle wasting during space flight. Different types of exercise are required to build strength and resistance to fatigue and injury. These programs may be applicable to people on Earth as well.
- All human muscles contain fast and slow contracting muscle fibers, and the fast fibers are more vulnerable to injury during contraction. Space flight and bed rest unloading cause slow muscle fibers to acquire fast fiber properties. Studies examining regulation of these muscle genes may lead to methods for blocking this conversion.
- Muscle development was disrupted when gravity-loading exercise was removed from immature rats flown on Neurolab. Human infants born prematurely and placed in incubators, where they no longer exercise their leg muscles against the uterine wall, may suffer retarded maturation. These infants may benefit from resistance exercise therapy to stimulate muscle development.
- Reductions in growth hormone and testosterone during space flight worsen muscle health. Aging down regulates growth hormone secretion. Augmenting selected hormones may maintain muscle mass in space and on Earth. Also, genetically engineered muscles of mice can produce human growth hormone, demonstrating the potential feasibility of gene therapy countermeasures for space and Earth.
- Muscle fiber regeneration is less successful in space. In cases of Duchenne muscular dystrophy, muscle regeneration ultimately fails, leading to respiratory muscle failure. Studies to improve muscle regeneration may help with this condition and with sport exercise-related injury and healing.

The American Society for Gravitational and Space Biology asks for your support for the Life and Microgravity Sciences research programs of NASA, as we strive to keep America leading the world in utilizing space for improving life.

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