Nutritional Biochemistry of Space Flight

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Adequate nutrition is critical for maintenance of crew health during and after extended-duration space flight. The impact of weightlessness on human physiology is profound, with effects on many systems related to nutrition, including bone, muscle, hematology, fluid and electrolyte regulation. Additionally, we have much to learn regarding the impact of weightlessness on absorption, metabolism, and excretion of nutrients, and this will ultimately determine the nutrient requirements for extended-duration space flight.

Existing nutritional requirements for extended-duration space flight have been formulated based on limited flight research, and extrapolation from ground-based research. NASA's Nutritional Biochemistry Laboratory is charged with defining the nutritional requirements for space flight. This is accomplished through both operational and research projects.

A nutritional status assessment program is included operationally for all International Space Station astronauts. This medical requirement includes biochemical and dietary assessments, and is completed before, during, and after the missions. This program will provide information about crew health and nutritional status, and will also provide assessments of countermeasure efficacy.

Ongoing research projects include studies of calcium and bone metabolism, and iron absorption and metabolism. The calcium studies include measurements of endocrine regulation of calcium homeostasis, biochemical markers of bone metabolism, and tracer kinetic studies of calcium movement in the body. These calcium kinetic studies allow for estimation of intestinal absorption, urinary excretion, and perhaps most importantly - deposition and resorption of calcium from bone. The *Calcium Kinetics* experiment is currently being prepared for flight on the Space Shuttle in 2001, and potentially for subsequent Shuttle and International Space Station missions. The iron study is intended to assess whether iron absorption is down-regulated during space flight. This is critical due to the red blood cell changes which occur, and the increase in iron storage that has been observed after space flight. The *Iron Absorption and Metabolism* experiment is currently planned for long-term flights on the International Space Station.

As we embark on missions to the International Space Station the importance of nutrition is evident. We have only begun to scratch the surface of understanding the impact of weightlessness on the human body. A more complete understanding will not only enable the exploration of our universe, but will provide information we need for maintenance of human health and treatment of diseases here on Earth.