

Stellar Training Science by Joan Vernikos first appeared in Muscle and Fitness, February 2000 p.115-116

[In: "Future Shock," Jeff O Connell (editor). "Science, yes. Fiction, no. Buckle up as some of the world's strongest minds envision the body of the 21st century."]

Understanding the genetic basis of disease and extending the human lifespan are arguably the two biggest medical achievements of the 20th century; and the notion of healthy aging for the longest possible life will gain momentum in the 21st century. Remaining active and independent until death now seem more achievable than ever, in part because of our having ventured into space and the new insights NASA's research is providing.

We evolved on Earth to live in gravity but aren't conscious of its influence. Only by going into space can we begin to appreciate ways in which gravity "tunes" our bodies from the day we're born. Astronauts are in excellent physical condition, but after only a few hours or days in space, they show dramatic symptoms that become more accentuated and diverse with longer flights. During space flight, blood volume and red cell mass decrease; aerobic capacity decreases by 20-25%; and endurance, strength and muscle mass, especially in the postural muscles, decrease by 1% a week. The growth factors (such as growth hormone, insulin-like growth factor-1) needed for healthy muscle and bone are reduced, and visual-spatial orientation is altered, affecting awareness of the position of the limbs and hand-eye coordination.

On return to Earth's gravity, a sudden drop in blood pressure can result in fainting because deconditioned heart and blood vessels are less responsive. Balance, gait and motor coordination are severely affected.

Fortunately, these symptoms are all reversible. Using bed rest on Earth to minimize the influence of gravity-loading results in similar, but less-intense symptoms, allowing us to explore the underlying mechanisms and develop preventive measures. We've learned that standing provides loading and that exercise without loading, as in space flight, is of minimal value. Loading and activity combined are the key to maintaining muscle mass and tone as well as bone density and strength. Directional and acceleration input is essential to spatial and motor coordination, and frequent change in posture (8-16 times a day) is critical to tuning blood pressure-controlling sensors in the neck and heart.

The similarity of these symptoms to those associated with aging is striking. This process has been assumed to be irreversible in the elderly, but space-related research increasingly suggests that weight training can delay or even reverse muscle and bone atrophy.