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Longitudinal Study of Astronaut Health

# Candidates invited to participate in study

## *Qualified JSC civil servants are being mailed study information*

The Longitudinal Study of Astronaut Health (LSAH) currently is working with an astronaut population of 195. For the study to proceed, a group of comparison subjects—Johnson Space Center (JSC) civil servants—is being assembled with a 4:1 ratio, comparison subjects to astronauts. That means 780 comparison subjects are needed for the study now. In the future, as new astronauts are selected, more comparison subjects will be needed.

Candidates selected as potential comparison subjects had to meet specific criteria. To establish a ground-based group, each selection class of astronauts was matched against JSC civil servants by body mass index, age, and sex. 1,668 civil servant employees met this criteria. 80 female comparisons were needed; 166 met the criteria. 700 male comparisons were needed; 1,502 met the requirements. The 780 participants needed were randomly selected and are being invited to participate in the study.

The selection classes start with the year 1959 and run through the present year, 1992. For each new astronaut that is selected, new comparisons will also be selected using the 4:1 ratio.

Invitations to participate in the study, and a Study Participation Packet, are being mailed with this newsletter to the selected candidates .

# Treadmill tests offered to LSAH participants

One of the first-line, non-invasive methods of testing for progressive atherosclerotic heart disease is the graded exercise test, sometimes called a "stress test." The test is often performed using a treadmill or stationary bike.

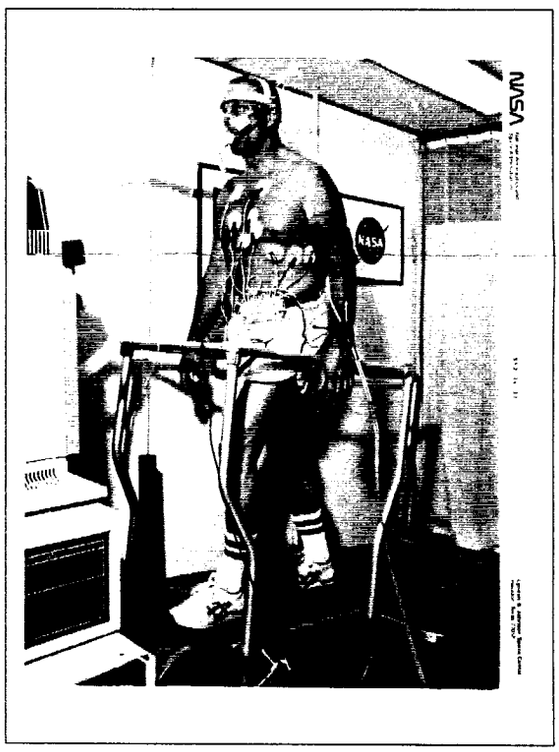
The workload gets progressively harder with each stage of the test. Electrocardiographic (ECG) changes during the exercise test, specifically ST depressions, are cues to the attending physician to do further testing for heart disease.

Pulmonary function tests done during the exercise test provide data which is used in diagnosing lung and respiratory disorders.

Blood pressure changes with exercise. Typically, systolic blood pressure rises and diastolic blood pressure remains the same or decreases sightly.

In healthy individuals, these tests are good measures of fitness and capacity to handle physical work. Routine physical examinations which include exercise testing are a basic component of preventative health care.

Those individuals, such as former astronaut Jack Lousma (in photo), who make the effort to fully participate in the examinations provided to the participants of the LSAH are thereby also taking an active role in their own health maintenance.




*NASA photo, above: Former astronaut, Jack Lousma, performs the treadmill stress test.*

*The LSAH Newsletter is published semi-annually, more often if significant study news arises. Until study results can be reported, we intend to supplement the newsletter with timely and informative health-related information. If you have any questions about the study, please write or phone:*

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# U.S./Russian space agreement may benefit LSAH

The Russian Federation and the United States reached a historic agreement recently on the cooperative use of space. The agreement was signed June 17 by Russian President Boris Yeltsin and President Bush at a Washington summit meeting.

NASA Administrator Daniel S. Goldin's plan for implementing the agreement includes an expansion of cooperation in life sciences research.

What does NASA's new relationship with the Russian Space Agency mean to the Longitudinal Study of Astronaut Health?

It could enhance the study through sharing of cosmonaut medical files, which would provide the LSAH database with more data. The extra data is important to the LSAH because it increases the size of the data pool and provides the LSAH with a different kind of data. Much of the Russian data is from space flights of six months to more than a year — a significantly longer duration than U.S. space flights.

Such medical data is essential in studying the effects of long-duration space flight on humans.

# How is percentage body fat measured?

Percentage body fat is a more accurate measure of obesity than weight in pounds.

Measuring body composition is based on the assumption that body weight can be divided into two parts: lean body weight and fat weight.

Lean body weight refers to that part of the total body weight which remains after all of the body fat is removed. It is composed of muscle, skin, bone, organs, and all other non-fat tissue.

Body fat can be measured in several different ways, including hydrostatic (under water) weighing, skinfold thickness, and bioelectric impedance.

*Hydrostatic weighing*

In hydrostatic weighing, the individual is weighed while totally submerged in water after exhaling all the air out of the lungs. This weight is then corrected for the buoyancy effect of additional air trapped in the lungs, and pockets of gas in the stomach and intestines. This technique is based on the principle that a body immersed in water will be buoyed by a counterforce equal to the weight of the water displaced. Although this technique provides an accurate assessment of body composition, it requires special equipment, is expensive, and is time consuming.

*Skinfold thickness*

Skinfold thickness is measured by using a special caliper to assess the fat that lies directly beneath the skin. This technique is based on the principle that approximately one-half of stored body fat is located as subcutaneous fat. Equations are then used to convert skinfold measurements into percent body fat. The most common places of the body these measurements are taken include the upper arm, shoulder blade, chest, stomach, and thigh. This technique is fairly easy to perform and inexpensive; however, accuracy is dependent on the skill of the technician taking the measurements.

*Bioelectric impedance*

Bioelectric impedance is a relatively new technique for measuring body composition. It is based on the premise that water conducts electricity, but fat does not; therefore, total body water can be detected as a current is passed through the body. This technique is performed by placing several electrodes on various parts of the body. The equipment is relatively expensive and requires periodic maintenance.

The average American female, younger than 30, has 25 percent body fat; older than 30 — 31 percent. The average American male, younger than 30, has 20 percent body fat; older than 30 — 25 percent. These averages are above the recommended percentages of body fat (see table below).

***Total body weight = lean body weight + fat weight***
***Relative body fat = (fat weight/total body weight) x 100***

**PERCENT BODY FAT**

| | LEAN | INTERMEDIATE | OVERWEIGHT | OBESE |
|---|---|---|---|---|
| MALE | 14% or less | 15-17% | 18-19% | 20% or more |
| FEMALE | 19% or less | 20-24% | 25-29% | 30% or more |

# Dietary antioxidants and heart disease

Antioxidants, such as vitamin C, vitamin E, and beta-carotene, appear to protect against heart disease, cataracts, and certain cancers by "mopping up" toxic particles in the body.

These toxic particles are called free radicals. Free radicals are thought to contribute to the extent of lesions, which are a factor in these chronic diseases. Antioxidants are thought to reduce the zones of lesions.

By being readily oxidized itself, the antioxidant reduces the amount of oxygen available to other substances that may otherwise be destroyed or changed undesirably by the uptake of oxygen.

These vitamins have been shown to have an antinecrotic action, i.e., a decrease in the destruction of tissue in heart muscle with occluded coronary arteries.

These antioxidants are found in a variety of the foods consumed every day. The best way to get more beta-carotene is to eat more yellow-orange fruits and vegetables and certain green vegetables. The yellow/orange foods which are rich in beta-carotene include carrots, sweet potatoes, winter squash, cantaloupe and apricots. The green vegetables rich in beta-carotene are the dark green ones such as spinach, kale, broccoli and Brussels sprouts.

Vitamin C is found in citrus fruits such as oranges, grapefruit, and tangerines, and in melons, strawberries, tomatoes, broccoli, and raw cabbage. Vitamin E occurs in greatest concentration in vegetable oils. Those foods which contain large proportions of oil are, consequently, good sources of vitamin E. Mayonnaise, salad dressings, and margarine are examples of such foods.

Although marginal vitamin status may be induced by inadequate vitamin intake, there is little evidence to support the argument for vitamin supplementation to the diets of healthy adults. Nutrition experts recommend that vitamins be obtained from food sources. Approximately four servings of fruits and vegetables per day, with at least two of these being from the groups that are high in vitamin C and beta-carotene, will supply the needs of most adults. An additional one or two servings of these foods each day should provide sufficient vitamins for those individuals who are in high stress situations, who smoke, or who have increased needs for other reasons.

Diets that contain generous amounts of vitamin C and beta-carotene are likely to be high in fiber and low in fat. The use of vegetable oils instead of animal fats will increase the intake of vitamin E and polyunsaturated fats and decrease the intake of saturated fats and cholesterol. These are all "heart-healthy" dietary habits.