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ISLET IN WEIGHTLESSNESS: BIOLOGICAL
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Yu. Zhuk

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16. Abstract A series of biological experiments are planned as an international venture for "COSMOS-1129" satellite. These include tests of: a) adaptation of rats to conditions of weightlessness, and readaption to earth's gravity; b) possibility of fertilization and embryonic development in weightlessness; c) heat exchange processes; d) amount of gravity force preferred by fruit flies for laying eggs (given a choice of three centrifugal zones); e) growth of higher plants from seeds; f) effects of weightlessness on cells in culture and g) radiation danger from heavy nuclei, and electrostatic protection from charged particles.					
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ISLET IN WEIGHTLESSNESS: BIOLOGICAL EXPERIMENTS
ON BOARD "COSMOS-1129" SATELLITE

Yu. Zhuk*

The biological satellites occupy a prominent place among the Soviet artificial earth satellites. The results of studies conducted with their help make it possible to systematically perfect methods and means of medical and biological support for long space flights of man, and to enrich science with new and unique data. /3**

In the period from 1973 to 1977 there were four Soviet biosatellites in space, "Cosmoses" with numbers 605, 690, 782 and 936. Experiments on the new biosatellite, "Cosmos-1129" are the development of a previously planned program that stipulates an investigation of the processes of vital activity under space flight conditions, study of the effect of space flight factors on different systems of the organism, creation of effective measures for prevention and protection of it from the adverse effect of these factors.

The main task of today's experiments is further study of the mechanisms for adaptation of the organism to weightlessness, and readaptation to the earth's gravity force after the flight. Albino rats are used as the experimental animals. They are grown under "especially clean" conditions by specialists of the Institute of Endocrinology of the Slovakian Academy of Sciences (CSSR). The final selection and preparation of the animals for the flight are

* Colleague of the Administration of Space Biology and Medicine of the USSR Ministry of Public Health.

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conducted in the Institute of Medical and Biological Problems of the USSR Ministry of Public Health. The systems of organisms, organs, tissues and cells will be exposed to comprehensive analysis. Modern methods of study will be widely used; in the majority they are inaccessible for medical studies on people.

There are 38 rats on board the satellite. Thirty of them are placed in individual "rooms" of scientific apparatus analogous to that previously employed. They are automatically provided with food four times a day, water supply, ventilation with regenerated air, waste removal, illumination, etc. Rapid assessment of the condition of the animals and obtaining of scientific information are implemented with the help of an electronic control system of motor activity, as well as from signals of miniature devices implanted in some animals that measure body temperature.

Further increase in flight duration and complication of the program of human work in space are linked to an increase in the loads on the central nervous system. For an objective assessment of its reserves and performance capacity it is important to study under analogous conditions the dynamics of the nerve processes in the brain of the animals whose behavior is not complicated by social factors, such as feeling of responsibility, duty, that to a considerable measure stimulates high performance capacity of the cosmonauts. A study of the condition of the higher regions of the brain of animals in a long flight (experiment "Behavior") is being made for the first time.

A study will also be made on the nature of reconstruction of the daily periodicity of certain physiological processes in the animals, which will supplement with new data the results of studies conducted in long human flights.

There are grounds to believe that the organism is the most sensitive to unusual environmental factors in the early, embryonal period of development. In the experiment "Ontogenesis"

for the first time an attempt is being made to determine the possibility of fertilization and development of an embryo in mammals under conditions of weightlessness. For this purpose, a vivarium unit was installed on the satellite. It consists of two sections that are separated by a transparent partition. It contains six females and two males. On the third day of the flight, by opening the "trap doors" on command from earth, communication of the animals of different sex will be permitted. After completion of the flight it is planned to obtain progeny of rats who have passed the main stages of embryonal development in weightlessness. The task is set of studying the condition of the neonatal organism, revealing possible developmental anomalies, and evaluating the rates of growth and viability. It is also planned to obtain and study the next generation by crossing these animals.

The experiment conducted jointly by the scientists of the USSR and CSSR with the participation of the U. S. specialists covers a study of the course of embryonal development in weightlessness. During the flight it is planned to incubate 60 eggs of the Japanese quail. The necessary conditions for this will be automatically guaranteed within the on-board incubator made in the CSSR.

A further investigation of the heat exchange processes in weightlessness that are very important in formulating life support systems will be made with the help of another Czechoslovakian instrument.

The task of the experiment "Gravity Preference" is to determine what amount of gravity force that is created by a rotating centrifuge is preferred by the animals for life and development of their progeny. The fruit fly, *Drosophila*, will answer this question. During the flight it will be given the opportunity to select at its discretion a place for laying eggs in any of three zones with different amounts of artificial gravity force.

A study will be made on an automatic unit for growing higher plants from seeds with the help of photography. It will investigate the effect of space flight factors on the formation and dynamics of growth of corn, flax, khibinskiy cabbage and other plants.

It is not clear as yet whether weightlessness affects the rate of cellular duplication. An experiment on living cells grown outside the organism covers this problem.

The experiments prepared by the U. S. specialists and conducted jointly with the Soviet scientists with cultures of plant cells have the goal of confirming the capacity of isolated somatic cells of plants to develop normally in weightlessness from the embryo to the adult organism, as well as to study the intensity of metabolism in the tumor plant cells.

The Soviet-French radiobiological experiment "Bioblock" will continue the work started in the previous biosatellite flights to evaluate the radiation danger of heavy nuclei of galactic space radiation. Determination of the characteristics in the streams of this type of radiation within the biosatellite with the help of Soviet and American dosimeters is the task of another experiment that is to be conducted jointly by the specialists of the USSR and United States.

The main part of the radiation-physical studies on the biosatellite is further investigation of the electrostatic protection from the effect of charged particles of outer space. During the new experiment it remains to evaluate for the first time the performance capacity of a unified module of electrostatic protection with working voltage on the electrode of 300 kilovolts that has been installed in the instrument compartment of the satellite. With the help of such modules one will further be able to screen the most vulnerable sections of space apparatus of any shape in a radiation sense.

The experiments on the next Soviet biosatellite "Cosmos" have continued the cooperation among the scientists of the USSR and a number of socialist countries, as well as the United States and France within the "Intercosmos" program. This is a new contribution to the strengthening of friendship among countries, and deepening of the process of detente among states.