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SCIENTIFIC EXPERIMENTS IN THE FLIGHT OF THE 1977 BIOLOGICAL SATELLITE (DRAFT PLAN)

USSR Academy of Sciences - Interkosmos Council

Translation of "nauchnyye eksperimenty v polete biologicheskogo sputnika 1977 g (plan-prospekt)," USSR Academy of Sciences, Interkosmos Council and Ministry of Public Health of the USSR, Institute of Medical and Biological Problems, Moscow, 1977, pp 1-49
**Title and Subtitle**

**SCIENTIFIC EXPERIMENTS IN THE FLIGHT OF THE 1977 BIOLOGICAL SATELLITE (DRAFT PLAN)**

**Author(s)**

USSR Academy of Sciences, Interkosmos Council

**Performing Organization**

Leo Kanner Associates
Redwood City, California 94063

**Sponsoring Agency**

National Aeronautics and Space Administration, Washington, D.C. 20546

**Abstract**

The physiological, biological, radiobiological and radiophysical experiments planned for the 1977 biological satellite are described. The biological experiments will involve rats, higher and lower plants, insects and other biological specimens carried on the biosatellite. The responses of these organisms to weightlessness, artificial gravity, cosmic radiation particles and general flight factors will be studied. The radiophysical experiments will investigate certain properties of cosmic radiation as well as the possibility of creating electrostatic and dielectric radiation shields under actual space-flight conditions.

**Keywords**

Translation of "Nauchnyye eksperimenty v polete biologicheskogo sputnika 1977 g (plan-prospekt)," USSR Academy of Sciences, Interkosmos Council and Ministry of Public Health of the USSR, Institute of Medical and Biological Problems, Moscow, 1977, pp. 1-49.
Introduction

The purpose of biosatellite experiments is to study the principles governing the adaptation of physiological systems to the complex of factors involved in prolonged space flight, as well as to study numerous fundamental questions of general biology, particularly those dealing with the role of gravity in the growth, development and reproduction of organisms.

Soviet scientists were the first to conduct experiments with animals in space, and such experiments are continuing with much success. Experiments on three specialized biological satellites (the "Kosmos-605," "Kosmos-690" and "Kosmos-782") with various biological specimens have shown that prolonged weightlessness has no adverse effects on intracellular processes, including those associated with the transmission of genetic information and the accomplishment of cell division.

Investigations of the main physiological systems in animal organisms have revealed no pathological changes attributable to the action of weightlessness. At the same time, changes of both a specific and nonspecific nature have been discovered in a number of organs and tissues. The latter changes include signs of the activation of the hypothalamo-hypophyseal-adrenocortical system. Specific phenomena determined by the action of weightlessness include changes in the skeletomotor apparatus.

* Numbers in the margin indicate pagination in the foreign text.
For example, changes in the muscular system have been manifested in muscular atrophy, a decline in muscular strength and elasticity, the growth of connective tissue, and a number of changes in metabolic processes. The following changes were found in tubular bones: osteoporosis of cancellous areas, a moderate thinning and rarefaction of the cortical plate, a retardation of periosteal bone formation and mineralization, a retardation of longitudinal growth, and a decrease in mechanical strength.

Studies of the modifying effect of weightlessness on the radiosensitivity of organisms have shown that the development and course of radiation sickness in space are practically identical to its development and course under terrestrial conditions.

Centrifuge experiments were done for the first time in space aboard the "Kosmos-782" biosatellite. These experiments showed that the biological effects of artificial gravity under space-flight conditions are essentially the same as those of normal terrestrial gravity.

The experiments on the three biosatellites showed for the first time that high-intensity electric fields, which are of interest as cosmic-radiation shields, can be generated and maintained under the conditions of prolonged space flight.

Besides Soviet scientists, specialists from Czechoslovakia, Hungary, Poland, the United States and France participated in the experiments done on the "Kosmos-782" biosatellite.

Physiological, biological, radiobiological and radiophysical experiments will be conducted during the flight of the 1977 biological satellite. An overall list of these experiments is given in Tab. 1.
The physiological experiments planned for the 1977 biosatellite will attack a number of questions. First an attempt will be made to evaluate the functional reserves of one of the most important systems, and the one responsible for the nonspecific adaptive responses of the organism: the hypothalamo-hypophyseo-adrenocortical system. For this purpose a stress function test (fixation stress) will be employed during the readaptation period.

A major goal of the experiment with rats will be to broaden our understanding of the skeletomotor apparatus, particularly the bone system. For this purpose a study of ectopic osteogenesis will be done in addition to traditional bone tissue studies.

The presence of a centrifuge on the biosatellite will make it possible to conduct artificial gravity experiments with mammals.

The biological investigations will include a study of the growth dynamics of higher and lower plants under weightless conditions, as well as the physiology, anatomy and genetics of insects.

Studies on the possibility of utilizing electrostatic and dielectric radiation shields during space flights, as well as studies on the effects of heavy cosmic-ray nuclei on various biological specimens, will be continued in the radiobiological and radiophysical experiments.

The flight experiment will be accompanied by a synchronous ground experiment which will commence five days after the start of the flight. The synchronous experiment, to be conducted in a mock-up of the biosatellite, will repeat all the conditions of the flight experiment with the exception of weightlessness.
The first study of biomaterial will be performed immediately after recovery of the landing capsule. For this purpose a mobile laboratory complex with all the equipment needed to conduct a specialized examination of the biological specimens will be transported to the recovery site.

All further investigations will be carried out in scientific institutions in the Soviet Union and abroad. The biological specimens returned by the landing capsule will be examined by Soviet specialists as well as scientists from Czechoslovakia, Poland, Hungary, Rumania, Bulgaria, the United States and France.

K-1241: Experiment with Rats

Performing agency: Institute of Medical and Biological Problems of the USSR Ministry of Public Health

The following physiological experiments with rats will be done on the biosatellite:

-- experiment under conditions of weightlessness;
-- experiment under conditions of artificial gravity

The main purpose of the experiments with mammals is to study further the mechanisms governing the adaptation of functional systems to the effects of prolonged weightlessness.

The satellite will carry 30 Wister rats free of pathogenic microflora. A special feature of the 1977 biological satellite is its two on-board centrifuges containing a total of 10 rats (group I); the purpose here is to study further the biological effects of artificial gravity as well as provide a control for the weightlessness experiment.
Each centrifuge is equipped with five individual holding cells, similar in design to those used on the "Kosmos-782."

Each centrifuge is 760 mm in diameter and rotates at a rate of \(53.5 \pm 3\) rpm, creating 1 g at a radius of 320 mm (the provisional "longitudinal animal axis").

The remaining group of 20 rats, held in individual cells outside the centrifuges, is exposed to the effects of weightlessness in its "pure form."

Five animals from the centrifuge group and five from the main group will carry implanted biotelemetric sensors for measuring body temperature.

Another five animals from the main group will carry aponeurotic detector plates to enable the study of radiation damage to cephalic nerve tissue in the region of charged-particle tracks. These animals will also be delabynrhinated in order to study the role of the vestibular apparatus in adaptation to weightless conditions.

Each animal holding cell is equipped with a complex of life-support systems: a feeder, a water dispenser, ceiling illumination, a system of fresh-air vents, a special grilled opening for the removal of solid and liquid wastes, and compartments for storing the wastes from each two-day period of the experiment.

Each holding cell is also equipped with a special measuring device which counts and sums the number of movements made by the rat over a 24-hour period. The food paste, specially developed for zero-gravity conditions, will be dispensed through the feeder at six-hour intervals. Water during the flight is unlimited. A chemical air-regeneration system will provide for the supply of
oxygen and the removal of excess carbon dioxide and gaseous contaminants from the atmosphere of the biology capsule. The proper temperature and humidity will be maintained by a thermoregulatory system with a dehumidifier.

The experimental animals will be supplied by the Institute of Endocrinology of the Slovakian Academy of Sciences of the CSSR.

The final selection of animals and their training for the flight will be carried out at the Institute of Medical and Biological Problems of the USSR Ministry of Public Health in accordance with the pre-flight training program (Tab. 2).

After the flight some of the animals (five from group I and ten from the main group (excluding animals with temperature sensors or delabrinthation) will be killed immediately at the recovery site. They will be examined for functional and structural changes resulting from the action of weightlessness and compared with animals subjected to the artificial gravity created by the on-board centrifuges. The post-flight morphological and biochemical studies planned are listed in Tab. 3. The remaining animals will be killed on the 26th day of the readaptation period after a number of clinical and physiological studies have been performed (Tab. 4).

A list of the scientific institutions participating in the post-flight study of the rats is given in Tab. 5.

K-1242: Experiment with Higher Plants

Performing agency: Institute of Medical and Biological Problems of the USSR Ministry of Public Health, Moscow
The experiment with higher plants planned for the flight of the 1977 biosatellite will be done on corn sprouts (Zea mays) and crepis sprouts (Crepis capillaris). The purpose of the experiment is to:

1. study the role of gravity in the formation of cell structures responsible for cellular energetics (chloroplasts and mitochondria), particularly the effect of weightlessness on the development of the ultrastructure of these organelles as the seeds sprout during the space flight;

2. study the role of gravity in the formation of the genetic apparatus of the plant cell, including the effect of zero gravity on the duration of the mitotic cycle and the mutation rate.

The experiments will be conducted at a constant temperature (+25° C) in a device specially designed for nurturing sprouts under weightless conditions.

The device will be activated and water and fixing fluid supplied automatically on the 2nd, 4th, 6th, 8th, 10th, 13th, 16th and 19th days of the flight.

After recovery the device will be dismantled and the material photographed. Further analysis will be done under laboratory conditions using electron microscopy and cytological methods involving our own modification of the colchicine method. This will make it possible to trace the successive changes in the internal structure of cellular organelles, and to determine the duration of the mitotic cycle and the rate of spontaneous mutation in the meristematic cells of plants under weightless conditions.

These investigations will enable scientists first to learn
more about the genesis of cellular organelles and their ultra-fine structure under weightless conditions, and second to obtain data on the effect of weightlessness on the rate of mitosis and the formation of the nuclear apparatus in plant cells.

K-1243: Experiment with Lower Plants

Performing agency: Institute of Medical and Biological Problems of the USSR Ministry of Public Health, Moscow

A representative of the lower phycomycetous fungi (Phycomyces blakesleeanus) will be used to study the morphogenesis, and particularly the growth characteristics, of lower plants under weightless conditions. Phycomycetes is a convenient species for analyzing the morphological, physiological and biochemical characteristics of the lower plants.

The fungi experiment will be done in the same device used for the higher plants and according to the same program.

Immediately after lander recovery and the dismantling of the device, the substrate with the fungal culture must be photographed and transferred to glass containers. Further analysis will be done in the laboratory.

This experiment is designed to reveal the role of terrestrial gravitation in determining the morphological and cytological parameters of a fungal culture at various stages of its development and will make it possible to study the distribution of cellular organelles during fungal growth under weightless conditions.

K-1244: Experiment with Insects

Performing agencies: Institute of Medical and Biological
Problems of the USSR Ministry of Public Health, USSR
NASA Ames Research Center, U.S.

The pomace fly (Drosophila melanogaster) of the Oregon-R strain will be the object of experiments on the 1977 biosatellite.

Soviet scientists will conduct genetic studies in which the rate of deletions and visible mutations in the sex chromosome as well as regressive, sex-linked and lethal mutations will be recorded.

Deletions are structural changes characterized by the loss of a chromosomal segment. A number of special methods are known for detecting the loss of a certain segment. The most straightforward approach is to analyze the specific changes which have appeared under weightless conditions during the flight.

Recessive lethal mutations generally involve gene changes, specifically a change in the sequence of bases in the nucleotides. The most simple method of recording these mutations is the Meller 5 method: males and females of two distant strains are crossbred, and in the second generation the number of cultures which do not have the expected members are counted.

The experiments are designed to study the effect of weightlessness on the occurrence of structural and biochemical changes in the genetic apparatus of the pomace fly and to identify the causes and nature of these changes.

The American specialists will concentrate on physiological investigations of processes, especially those that can affect the life span. They will measure the life spans of flies of various ages and perform a series of biochemical and behavioral tests which characterize age-related changes.
The experiments planned will broaden our knowledge of the effects of weightlessness on the molecular mechanisms of processes occurring in chromosomes and will provide information on the danger posed to hereditary structures by prolonged space flight.

Data will also be obtained on the intensity of vital processes under weightless conditions, the rate of which is a factor in determining the life span.

K-1245: The "Bioblok" Experiment

Performing agency: Institute of Medical and Biological Problems of the USSR Ministry of Public Health Toulouse University, France

The purpose of the "Bioblok" [bioassembly] experiment on the 1977 biosatellite is to study the biological effects of heavy nuclei of galactic cosmic radiation (GCR) on the simplest animal organisms, cell colonies and plant seeds, as well as to study the effect of non-radiation flight factors. Another goal of the experiment is to investigate the properties of GCR heavy nuclei.

The biological effects of GCR heavy nuclei will be studied based on an analysis of the genetic, cytogenetic and somatic injuries produced in biological specimens exposed to heavy-particle bombardment during the flight.

The experiment will involve the use of special assemblies comprised of alternating layers of dielectric track detectors and biological specimens contained in plate holders. As heavy nuclei traverse these detectors, they produce radiation damage
along their path of motion which can be developed by chemical treatment into hollow cylindrical or conical tracks. By tracing these tracks through the "Bioblok" assembly it is possible to identify specific biological specimens through which heavy nuclei have passed. By analyzing the tracks in the dielectric detectors, it is also possible to determine the charge composition and energy of the particles.

Intact biological specimens will serve as controls. By studying the changes in these specimens and in those exposed to analogous conditions on earth, it will be possible to determine the effects of non-radiation flight factors.

The following biological specimens will be used in the experiment: artemia salina and kolpoda eggs; colonies of yeast cells; tobacco, squash and lettuce seeds. To create conditions optimal for the growth and development of some of the specimens during the flight as well as proper radiation exposure conditions, the bioassembly will be thermostatically controlled (8° C).

In order to calibrate the radiation detectors, the flight experiments will be paralleled by ground-based experiments with a charged-particle accelerator.

Nitrocellulose, lavsan and polycarbonate films, as well as nuclear photoemulsions, will be used as the radiation detectors.

The following tests will be employed to study the reactions of individual biological specimens to the action of heavy nuclei and the effect of non-radiation flight factors: inactivation and anomalies of cell division, anomalies of egg development, and the occurrence of genetic and cytogenetic changes.

The "Bioblok" experiment is expected to provide:
-- information on the biological effects of GCR heavy nuclei and establish a correlation between the parameters of the incident radiation and the severity of the damage produced;

-- information on the effect of non-radiation flight factors on biological processes;

-- information on the charge composition and linear-energy-loss spectra of GCR particles within the biosatellite;

-- information on the calibration of radiation detectors by means of the charged-particle accelerators in Dubna (USSR);

-- experimental data on the biological effects of heavy ions.

K-1246: The "Heat Transfer I" Experiment

Performing agencies: Institute of Biophysics of the Czechoslovakian Academy of Sciences, Brno Institute of Medical and Biological Problems of the USSR Ministry of Public Health, Moscow

The experiment designated "Heat Transfer I" is designed to investigate the effect of weightlessness on the transfer of heat between a heated surface and the environment (air).

The equipment which will be used in the experiment was developed and built by Czechoslovakian specialists and includes:

-- an electrical dynamic katathermometer;
-- a tunnel with a ventilator for creating a calibrated air-stream velocity; and

-- an electronic control unit.

The device has a single-unit design and allows measurements both in the case of a stationary medium and at four different air-flow velocities.

The device is activated by connection to a 27-volt d.c. current source. At an ambient temperature of 20-25°C, a temperature of 37 ± 0.1°C is established on the surface of the sensor of the katathermometer within two minutes. This temperature is maintained with the aid of a built-in electric heater. Under the conditions established, the electric power required to maintain this temperature is a function of the air-flow speed and the ambient temperature. Four speeds of air flow past the sensor can be created by means of the tunnel-housed ventilator and the electronic control unit.

In accordance with the experimental program, the device is activated at two-hour intervals on odd-numbered days of the flight; each measurement cycle lasts a maximum of 15 minutes.

In each cycle a measurement is made of the electric power consumed in heating the sensor, as well as the ambient temperature. Information on the thermal conditions is fed into the onboard recorder in the form of voltage levels (from 10 to 6 V). The information will be interpreted and processed after the capsule is recovered.

By comparing the results of the flight experiment with the groundbased control, it will be possible to determine the difference in the cooling properties of the living environment in the satellite and on earth.
The results of the "Heat Transfer I" experiment may show ways to further develop the promising integral method of assessing the thermal properties of inhabited spaces, including the cabins of spacecraft.

K-1247: Electrostatic Shield Experiment

Performing agencies: Institute of Medical and Biological Problems of the USSR Ministry of Public Health, Moscow
All-Union Scientific Research Institute of Electronic Standards, Gatchina

The "autonomous" mode of electrostatic shield operation is the most advantageous in terms of energy consumption. In this mode a particle-deflecting electric field is generated when a high-voltage electrode is charged to the necessary potential by an external stream of electrons from the radiation belt; no high-voltage power source is required.

The purpose of the experiment is to investigate the principal features of autonomous electrostatic shield operation by using an electron gun to simulate a stream of electrons from the Van Allen belts, as well as to test the electronic hardware and materials used in the construction of electrostatic shields under actual space-flight conditions.

Investigations will center on:

-- the possibility of charging a high-voltage electrode by an electron beam;

-- the charge retention time of the high-voltage electrode;

-- the possibility of increasing the potential difference
between the electrodes by varying the interelectrode distance;

-- the magnitude of the interelectrode-space conduction current;

-- the "run-in" conditions for the working surfaces of the electrostatic shield model;

-- the size of the leakage current through structural materials;

-- the reliability of the products of electronic technology, including the satellite, under dynamic conditions;

-- the effect of space-flight conditions on materials used in the manufacture of electronic hardware;

-- measuring the pressure of the vacuum surrounding the spacecraft and within the electrostatic shield model.

A complex of scientific research equipment for simulating the operation of an electrostatic shield with a high-voltage electrode charged by an external electron stream (here, an electron gun) will be used in the experiment.

Test specimens of electronic hardware and materials will be attached to the outer surface of the landing capsule. The instrument compartment will contain a pre-programmed switching unit for controlling the electron gun and a low-voltage power supply.

The overall weight of this equipment is 90 kg.

The equipment will provide for the charging of the high-voltage electrode by an electron beam with an energy of 0-100 kV and current of 5-60 μA, measuring the characteristics of the
electrostatic shield over a range from $10^{-6}$ to $10^{-12}$ A, measuring the potential over the range 15-150 kV, measuring the pressure within the model and near the surface of the satellite over the range $10^{-4}$-$10^{-7}$ mm Hg, and testing the integral circuitry under dynamic conditions and without an electrical load.

These electrostatic shield experiments are expected to provide:

-- first information on the possibility of storing a charge on a high-voltage electrode impinged upon by an electron beam;

-- first information on the time characteristics of the potential drop on an insulated electrode;

-- first information on the size of the leakage current through structural materials (insulators) in the presence of a vacuum surrounding the satellite;

-- data for studying the possibility of increasing potential differences by increasing the interelectrode distance;

-- data for studying the "conditioning" of insulated high-voltage electrodes charged by an external electron beam;

-- more accurate information on the conduction currents of a high-voltage vacuum gap;

-- data on the operational reliability of integral circuitry under space-flight conditions;

-- information on the effect of space-flight factors on materials used in the manufacture of electronic hardware;
-- information on the parameters of an actual electrostatic shield operating in the autonomous mode, i.e. with the high-voltage electrode charged by an external stream of electrons.

K-1248: Dielectric Shield Experiment

Performing Agency: Institute of Medical and Biological Problems of the USSR Ministry of Public Health, Moscow

The dielectric shield is based on the deflection and braking of charged particles by a powerful electric field (up to several MV/cm) created in a dielectric.

An optimal means of creating such fields is by the use of so-called radioelectrets, which are capable of storing a considerable electric charge under irradiation and retaining this charge for some time.

The purpose of the experiment is to study further the stability of stored electric charges under the influence of space-flight factors and the conditions of open space.

The dielectric specimens, charged in an accelerator, are carried into space in special containers mounted beneath the skin of the satellite. The containers are opened during the flight, thereby subjecting the dielectric to the conditions of open space. The containers are sealed before re-entry to prevent heating and possible damage to the dielectric specimens. During the flight a recording is made of the various factors acting on the dielectrics. Electric charge measurements are made in groundbased laboratories and are compared with control specimens.

It is expected that more information will be obtained on the effect of space factors on dielectrics charged to various
potentials. This will enable the next step to be made in the
development of dielectric shields.

K-1249/K-206: "Iondose" Experiment on Radiation Dosimetry

Performing agencies: Institute of Medical and Biological
Problems of the USSR Ministry of Public Health, Moscow
NASA Ames Research Center,
University of San Francisco, U.S.

This experiment is designed to study the dosimetric and
spectrometric properties of cosmic radiations in near-earth space
and to investigate the passage of charged particles of cosmic ra-
diation through shielding material and biological tissue. Mea-
surements will be made of linear-energy-loss spectra, charge com-
positions and the dose characteristics of cosmic radiations.
Measurements both inside and outside the satellite are planned.
Particular emphasis will be placed on investigating the charac-
teristics of heavy nuclei of galactic cosmic radiation to facili-
tate the planning of future radiobiological experiments in space
and in accelerators. One goal of the experiment is to standard-
ize the experimental techniques employed by Soviet and American
scientists. To this end, both American and Soviet detectors will
be used on the biosatellite, and a cycle of experiments will be
done on the concurrent calibration of the detectors in Soviet and
American accelerators.

Various types of detectors will be employed in the joint
Soviet-American experiment. Soviet specialists are installing
two C-1 analyzers on the 1977 biosatellite: one on the outer
surface of the satellite and one within the landing capsule. The
dosimetric unit, measuring 130 x 130 x 480 mm and weighing 6 kg,
will house the Soviet detectors (nuclear emulsions, dielectric
track detectors and thermoluminescent dosimeters [25% of total
volume of unit), the American detectors (nuclear emulsions, dielectric track detectors, thermoluminescent dosimeters, uranium and neptunium foils [25% of total volume of unit]), as well as a joint detector package (50% of total volume of unit). These detectors will be used to measure the linear-energy-loss spectra of cosmic-ray particles, the charge composition of the radiation and its dosimetric characteristics within the satellite. To determine the extent to which the unit is shielded by equipment, it has been suggested that gamma thickness measurements of the biosatellite be made. Ground-based calibration experiments will be done in accelerators using the same detectors.

It is hoped that in the "Iondose" joint Soviet-American experiment it will be possible to:

-- obtain information on the linear-energy-loss spectra of galactic cosmic radiation particles in the LEL range from 2 MeV/cm to $10^4$ MeV/cm in open space and within the spacecraft;

-- obtain information on the LEL spectra of radiation-belt protons in the region of the Brazilian anomaly;

-- measure the charge composition of cosmic radiations in near-earth orbits;

-- measure the streams of heavy galactic-radiation nuclei and their microdosimetric characteristics in order to assess the radiation hazard to astronauts and to plan future radiobiological experiments in space;

-- estimate the yield of secondary radiations from the inelastic interactions of heavy galactic-radiation nuclei with shielding material and biological tissue;

-- calibrate the detectors concurrently in heavy-ion
accelerators in the cities of Dubna (USSR) and Berkeley (U.S.) for the purpose of unifying experimental techniques;

-- test experimentally the technique of estimating the passage of cosmic radiations through shielding material and tissue based on data from measurements of particle streams and spectra outside and inside the satellite and data on the shielding of internal detectors by equipment and structural masses determined by gamma thickness measurements;

-- devise experimental techniques in heavy-ion accelerators which will aid in designing future radiophysical and radiobiological experiments in Soviet accelerators;

-- obtain experimental data on the biological effects of heavy ions in accelerators; such data are needed in order to perform the corresponding experiments in space.
Table 1. List of Scientific Experiments on the 1977 Biosatellite

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<tr>
<td>K-1246</td>
<td>t) Experiment with lower plants</td>
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</table>

Key: a - Experiment number; b - Name of experiment; c - Performing countries; d - Experiment with rats; e - Weightlessness; f - Artificial gravity (1 g); g - USSR; h - CSSR; i - Poland; j - Hungary; k - Rumania; l - Bulgaria; m - United States; n - France; o - Experiment with higher plants; p - Experiment with lower plants; q - Experiment with insects (Oregon-R-strain pomace fly); r - "Bioblok" experiment; s - "Heat Transfer I" experiment; t - Electrostatic shield experiment; u - Dielectric shield experiment; v - "Iondose" experiment on radiation dosimetry.
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</tr>
<tr>
<td></td>
<td>полетной, синхронной, варианто контурали</td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Вживление внутрибрюшинно передатчиков - температури тела.</td>
<td>22</td>
</tr>
<tr>
<td>17.</td>
<td>Физиоморфологическое обследование (выборочно 10 крыс).</td>
<td>25, 0</td>
</tr>
<tr>
<td>18.</td>
<td>Инъекция животным глюкозы 0.14.</td>
<td>20</td>
</tr>
<tr>
<td>19.</td>
<td>Инъекция животным доклюцина.</td>
<td>3</td>
</tr>
<tr>
<td>20.</td>
<td>Инъекция животным антитогена.</td>
<td>3</td>
</tr>
</tbody>
</table>
Key to Tab. 2: a - Sequence number; b - Steps in preflight procedure; c - Days before flight; 1 - Observation of animals' general condition, weight dynamics and behavior; 2 - Otoscopic examination; 3 - Microbiological examination (bactericidal activity of tail skin and microflora in throat); 4 - Hematological study (morphological picture of peripheral blood); 5 - Study of behavioral responses; 6 - Water and mineral metabolism studies, water and saline loading; 7 - Gas-exchange study; 8 - Determination of animals' working capacity based on static endurance; 9 - Study of equilibrium function; 10 - Electronystagmographic study of vestibular function; 11 - Study of inversion and landing reflex; 12 - Training for holding conditions; 13 - Transition to flight food (paste) and 12:12 light-dark cycle; 14 - Check of animals' body temperature and motor activity; 15 - Final division of animals into experimental groups: flight, synchronous, vivarium control; 16 - Implantation of intraperitoneal body-temperature sensors; 17 - Pathomorphological examination (10 rats selected at random); 18 - Injection of C14 glycine; 19 - Injection of declomycin; 20 - Injection of antigen; Note: 1. An analogous examination will be performed during preparation for the synchronous experiment; 2. The first declomycin injection (step 19) will be given to all animals three hours prior to the flight experiment.
Table 3. List of Post-Flight Morphological and Biochemical Studies (Experiment K-1241)

<table>
<thead>
<tr>
<th>No.</th>
<th>Step in post-flight procedure, organs and systems studied, indices</th>
<th>Material studied</th>
<th>Number of animals</th>
<th>Country</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Histological study of bones.</td>
<td>Tibia</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>USSR</td>
<td>One tibia from each rat.</td>
</tr>
<tr>
<td>2.</td>
<td>Biochemical study of bone mineral composition.</td>
<td>Femur and humerus, mandible</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>USSR</td>
<td>One femur, humerus and mandible from each rat.</td>
</tr>
<tr>
<td>3.</td>
<td>Study of mineral composition.</td>
<td>Femur and tibia</td>
<td>5 rats from weightless group</td>
<td>USSR</td>
<td>One femur, tibia and humerus from each rat.</td>
</tr>
<tr>
<td>4.</td>
<td>Determination of new bone growth and resorption. Determination of bone strength and mineralization. Morphological bone studies.</td>
<td>Femur and tibia</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>U.S.</td>
<td>Performing agency will receive one femur and one tibia from each rat.</td>
</tr>
<tr>
<td>5.</td>
<td>Study of mineral composition, histological structure and growth of bone.</td>
<td>Femur, tibia, scapula and cranial crest</td>
<td>5 rats from weightless group</td>
<td>Poland</td>
<td>One femur, tibia and scapula from each rat.</td>
</tr>
<tr>
<td>6.</td>
<td>Biochemical study of bone marrow.</td>
<td>Humerus</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>CSSR</td>
<td>One humerus from each rat.</td>
</tr>
<tr>
<td>7.</td>
<td>Biochemical study of hydrolytic enzymes in bones.</td>
<td>Radius and ulna</td>
<td>25 rats (10 centrifuge + 15 weightless)</td>
<td>USSR</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
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</tr>
<tr>
<td>8</td>
<td>Study of chromosomal damage in bone marrow cells.</td>
<td>Humerus bone marrow</td>
<td>5 rats from weightless group</td>
<td>Bulgaria</td>
<td>One humerus from each rat.</td>
</tr>
<tr>
<td>9</td>
<td>Histological study of bone marrow.</td>
<td>Ilium</td>
<td>25 rats (10 centrifuge + 15 weightless)</td>
<td>USSR</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Cytological study of bone marrow.</td>
<td>Sternum</td>
<td></td>
<td></td>
<td>USSR</td>
</tr>
<tr>
<td>11</td>
<td>Study of proliferative capacity of bone marrow stem cells.</td>
<td>Humerus</td>
<td>5 rats from weightless group</td>
<td>CSSR</td>
<td>One humerus from each rat.</td>
</tr>
<tr>
<td>12</td>
<td>Study of ectopic osteogenesis.</td>
<td></td>
<td>5 rats from weightless group</td>
<td>USSR</td>
<td>U.S.</td>
</tr>
<tr>
<td>13</td>
<td>Histological, histochemical and electron-microscopic muscle study.</td>
<td>Soleus, gastrocnemius, quadriceps femoris, extensor digitorum longus, diaphragm, forelimb muscles</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>USSR</td>
<td>Muscles taken from one hind limb and one forelimb.</td>
</tr>
<tr>
<td>14</td>
<td>Biochemical investigation of fractional composition of proteins, ATP-ase activity and lipids.</td>
<td>Soleus, gastrocnemius, quadriceps</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>USSR</td>
<td>Muscles taken from one limb.</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
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</tr>
<tr>
<td>15.</td>
<td>Biochemical study of carbohydrate metabolism and ionic composition of muscles.</td>
<td>Sol, Gast, EDL, plantaris, diaphragm and tibialis</td>
<td>5 rats from weightless group (Sol, Gast, Quad); other muscles from 20 rats (10 centrifuge and 10 weightless)</td>
<td>USSR</td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Study of amino acid composition of muscles, nucleotide content, glycolysis rate, acetylcholine and cholinesterase activity.</td>
<td>Quadriceps, forelimb muscles</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>USSR</td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>Electron-microscopic and histochemical study of muscles.</td>
<td>Soleus, gastrocnenius</td>
<td>5 rats from weightless group</td>
<td>Poland</td>
<td>One muscle from each rat.</td>
</tr>
<tr>
<td>18.</td>
<td>Study of the mechanical properties of glycerinated muscle fibers.</td>
<td>Soleus, extensor digitorum longus</td>
<td>5 rats from weightless group</td>
<td>USSR</td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>Assay of blood-plasma lipids.</td>
<td>Blood plasma</td>
<td>from 20 rats (10 centrifuge and 10 weightless)</td>
<td>CSSR</td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>Biochemical study of nucleotides.</td>
<td>Formed blood elements</td>
<td>25 rats</td>
<td>CSSR</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
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</tr>
<tr>
<td>23. Study of glycolysis and ATP in erythrocytes.</td>
<td>Formed blood elements</td>
<td>25 rats</td>
<td>USSR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. Determination of hemoglobin structure.</td>
<td></td>
<td>10 rats (5 centrifuge + 5 weightless)</td>
<td>USSR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25. Histological study of lymphoid organs.</td>
<td>Spleen, thymus, inguinal lymph nodes</td>
<td>20 rats</td>
<td>USSR</td>
<td>1/2 spleen and 1/2 thymus from each rat.</td>
<td></td>
</tr>
<tr>
<td>26. Biochemical study of lipids and DNA in lymphoid organs.</td>
<td>Spleen, thymus</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>CSSR</td>
<td>1/2 spleen and 1/2 thymus from each rat.</td>
<td></td>
</tr>
<tr>
<td>27. Biological study of nucleic acids and enzymes controlling their metabolism in the spleen and thymus.</td>
<td>Spleen, thymus</td>
<td>5 rats from weightless group</td>
<td>USSR</td>
<td>1/2 spleen and 1/2 thymus from each rat.</td>
<td></td>
</tr>
<tr>
<td>28. Immunological studies.</td>
<td>Spleen, plasma</td>
<td>5 rats from weightless group</td>
<td>France</td>
<td>1/2 spleen and 0.1 ml plasma from each rat.</td>
<td></td>
</tr>
<tr>
<td>29. Cytochemical study of RNA and protein in spinal cord, brain and intraventricular ganglia.</td>
<td>Lumbar region of spinal cord, cortex of dermo-motor analyzer, intraventricular ganglia</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>USSR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30. Biochemical study of the cholinergic structures of the brain and spinal cord.</td>
<td>Cervical and lumbar enlargement of spinal cord, frontal, occipital and temporal cortex of brain, cerebellum</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>USSR</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>31.</td>
<td>Biochemical study of cholinesterase.</td>
<td>Thoracic cord</td>
<td>5 rats from weightless group</td>
<td>USSR</td>
<td></td>
</tr>
<tr>
<td>32.</td>
<td>Biochemical study of catecholamines and the enzymes involved in their metabolism in the hypothalamus.</td>
<td>Hypothalamus</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>CSSR</td>
<td></td>
</tr>
<tr>
<td>33.</td>
<td>Biochemical study of serotonin, histamine, catecholamines and their precursors in the spleen, hypothalamus and cortex of the brain.</td>
<td>Brain cortex</td>
<td>5 rats from weightless group</td>
<td>USSR</td>
<td></td>
</tr>
<tr>
<td>34.</td>
<td>Histological study of hypothalamus.</td>
<td>Hypothalamus</td>
<td>5 rats from weightless group</td>
<td>USSR</td>
<td></td>
</tr>
<tr>
<td>35.</td>
<td>Cytochemical study of enzymes of energy metabolism in the brain.</td>
<td>Medulla oblongata</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>USSR</td>
<td></td>
</tr>
<tr>
<td>36.</td>
<td>Histological study of hypophysis.</td>
<td>Hypophysis</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>USSR</td>
<td></td>
</tr>
<tr>
<td>37.</td>
<td>Biochemical determination of ademilate cyclosis.</td>
<td>Hypophysis</td>
<td>5 rats from weightless group</td>
<td>USSR</td>
<td></td>
</tr>
<tr>
<td>38.</td>
<td>Histological study of epiphysis.</td>
<td>Epiphysis</td>
<td>25 rats (15 weightless + 10 centrifuge)</td>
<td>Rumania</td>
<td></td>
</tr>
<tr>
<td>39.</td>
<td>Histological and histochemical study of adrenal glands.</td>
<td>Adrenal glands</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>USSR</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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</tr>
<tr>
<td>40</td>
<td>Assay of catecholamines and the enzymes of their metabolism in the adrenal glands.</td>
<td>Adrenal glands</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>CSSR</td>
<td>One adrenal gland from each rat.</td>
</tr>
<tr>
<td>41</td>
<td>Assay of corticosterone in the adrenal glands.</td>
<td>&quot;</td>
<td>5 rats from weightless group</td>
<td>USSR</td>
<td>One adrenal gland from each rat.</td>
</tr>
<tr>
<td>42</td>
<td>Determination of corticosterone production and the response to corticotropicin.</td>
<td>&quot;</td>
<td>5 rats from weightless group</td>
<td>CSSR</td>
<td>One adrenal gland from each rat.</td>
</tr>
<tr>
<td>43</td>
<td>Histological study of the thyroid gland.</td>
<td>Thyroid gland</td>
<td>25 rats (10 centrifuge + 15 weightless)</td>
<td>USSR</td>
<td>1/2 gland from each rat.</td>
</tr>
<tr>
<td>44</td>
<td>Biochemical study of thyroid gland hormones.</td>
<td>Thyroid gland</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>USSR</td>
<td>1/2 gland from each rat.</td>
</tr>
<tr>
<td>45</td>
<td>Histological study of testes.</td>
<td>Testes</td>
<td>25 rats (10 centrifuge + 15 weightless)</td>
<td>USSR</td>
<td>One testis from each rat.</td>
</tr>
<tr>
<td>46</td>
<td>Morphological and cytogenetic analysis of the testes.</td>
<td>Testes</td>
<td>25 rats (10 centrifuge + 15 weightless)</td>
<td>Bulgaria</td>
<td>&quot;</td>
</tr>
<tr>
<td>47</td>
<td>Histological study of the kidneys and bladder.</td>
<td>Kidneys, bladder</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>USSR</td>
<td>One kidney from each rat.</td>
</tr>
<tr>
<td>48</td>
<td>Biochemical study of the kidneys.</td>
<td>Kidneys</td>
<td>&quot;</td>
<td>USSR</td>
<td>&quot;</td>
</tr>
<tr>
<td>49</td>
<td>Determination of osmotic gradient and sodium-potassium activity of ATP-ase.</td>
<td>&quot;</td>
<td>5 rats from weightless group</td>
<td>USSR</td>
<td>Two kidneys from each rat.</td>
</tr>
<tr>
<td></td>
<td>1</td>
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</tr>
<tr>
<td>50.</td>
<td>Electron-microscopic study of the inner ear.</td>
<td>Inner ear</td>
<td>25 rats (10 centrifuge + 15 weightless)</td>
<td>USSR</td>
<td></td>
</tr>
<tr>
<td>51.</td>
<td>Histological study of the lungs.</td>
<td>Lungs</td>
<td>&quot;</td>
<td>USSR</td>
<td></td>
</tr>
<tr>
<td>52.</td>
<td>Biochemical study of catecholamines and the enzymes of their metabolism in the myocardium.</td>
<td>Myocardium</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>CSSR</td>
<td>1/2 myocardium</td>
</tr>
<tr>
<td>53.</td>
<td>Biochemical study of contractile proteins, their enzymatic activity and lipids in the myocardium.</td>
<td>Myocardium</td>
<td>&quot;</td>
<td>USSR</td>
<td>1/2 myocardium</td>
</tr>
<tr>
<td>54.</td>
<td>Biochemical determination of the catecholamine content of the myocardium.</td>
<td>Myocardium</td>
<td>5 rats from weightless group</td>
<td>USSR</td>
<td></td>
</tr>
<tr>
<td>55.</td>
<td>Electron-microscopic study of myocardium.</td>
<td>Myocardium</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>Poland</td>
<td>One 2x2 section from each heart</td>
</tr>
<tr>
<td>56.</td>
<td>Electron-microscopic study of retina.</td>
<td>Eyes</td>
<td>10 rats (5 weightless + 5 centrifuge)</td>
<td>U.S.</td>
<td>Two eyes from each rat.</td>
</tr>
<tr>
<td></td>
<td>Study of the enzymes which transform carbohydrates to lipids.</td>
<td>Liver</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>U.S.</td>
<td>1/2 liver from each rat.</td>
</tr>
<tr>
<td>57.</td>
<td>Biochemical study of lipid content of hepatic nucleic acids.</td>
<td>Liver</td>
<td>&quot;</td>
<td>CSSR</td>
<td>600 mg from each liver.</td>
</tr>
<tr>
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</tr>
<tr>
<td>59.</td>
<td>Biochemical study of the enzymes of catecholamine metabolism and other enzymes in the liver.</td>
<td>Liver</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>CSSR</td>
<td>2.5 g from each liver.</td>
</tr>
<tr>
<td>60.</td>
<td>Biochemical study of protein synthesis in the liver.</td>
<td>Liver</td>
<td>5 rats from weightless group</td>
<td>Hungary</td>
<td>2/3 liver.</td>
</tr>
<tr>
<td>61.</td>
<td>Biochemical study of oxidative-metabolism enzymes in the liver.</td>
<td>Liver</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>USSR</td>
<td>500 mg from each liver.</td>
</tr>
<tr>
<td>62.</td>
<td>Biochemical study of the glycolysis rate and amino acid metabolism in the liver.</td>
<td>&quot;</td>
<td>5 rats from weightless group</td>
<td>USSR</td>
<td>200 mg from each liver.</td>
</tr>
<tr>
<td>63.</td>
<td>Biochemical investigation of the nucleic acid content and the activity of the enzymes involved in controlling their synthesis.</td>
<td>&quot;</td>
<td>&quot;</td>
<td>USSR</td>
<td>1.2 g from each liver.</td>
</tr>
<tr>
<td>64.</td>
<td>Histological study of the liver.</td>
<td>&quot;</td>
<td>20 rats (10 centrifuge + 10 weightless)</td>
<td>USSR</td>
<td></td>
</tr>
<tr>
<td>65.</td>
<td>Biochemical study of white and brown adipose tissue.</td>
<td>White and brown adipose tissue</td>
<td>25 rats (10 centrifuge + 15 weightless)</td>
<td>CSSR</td>
<td></td>
</tr>
<tr>
<td>66.</td>
<td>Biochemical, histological, histochemical and electron-microscopic study of submaxillary glands.</td>
<td>Submaxillary glands</td>
<td>&quot;</td>
<td>USSR</td>
<td>One gland from each rat.</td>
</tr>
<tr>
<td>No.</td>
<td>Operation</td>
<td>Number of animals</td>
<td>Readaptation days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>---------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>1</td>
<td>Observation of animals' general condition, behavior and body-weight dynamics.</td>
<td>15</td>
<td>0 - 25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Injection of declomycin.</td>
<td>15</td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: 1. Analogous studies will be done on the animals from the synchronous experiment and the vivarium control group.
2. For study No. 4, the left and right tibias and left femur will be taken from six animals of the vivarium control group.

Table 4. List of Clinical and Physiological Studies during the Readaptation Period (Experiment K-1241)
<table>
<thead>
<tr>
<th>No.</th>
<th>Operation</th>
<th>Number of animals</th>
<th>Readaptation days</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>Determination of body temperature and motor activity.</td>
<td>15</td>
<td>7, 9, 15</td>
</tr>
<tr>
<td>4.</td>
<td>Otoscopic examination.</td>
<td>15</td>
<td>0, 10, 25</td>
</tr>
<tr>
<td>5.</td>
<td>Hematological study (morphological picture of peripheral blood).</td>
<td>15</td>
<td>0, 3, 6, 11, 16, 25</td>
</tr>
<tr>
<td>6.</td>
<td>Microbiological study (assessment of bactericidal activity of tail skin and microflora in throat).</td>
<td>15</td>
<td>0, 3, 6, 11, 16, 25</td>
</tr>
<tr>
<td>7.</td>
<td>Gaseous-exchange study.</td>
<td>15</td>
<td>3, 6, 11, 16, 25</td>
</tr>
<tr>
<td>8.</td>
<td>Assessment of animals' behavioral responses.</td>
<td>15</td>
<td>3, 6, 8, 10, 11, 14 - 21, 25</td>
</tr>
<tr>
<td>9.</td>
<td>Balance studies based on indices of water and mineral metabolism. Assimilability study of proteins, fats and carbohydrates. Determination of the ion-regulatory function of the kidneys (water and saline loading test).</td>
<td>15</td>
<td>0, 1, 2, 4, 5, 12 - 13</td>
</tr>
<tr>
<td>10.</td>
<td>Study of the degree of spontaneous hemolysis during the erythrocyte lifetime.</td>
<td>15</td>
<td>3, 6, 8, 10, 11, 16 - 25</td>
</tr>
<tr>
<td>11.</td>
<td>Functional stress test (immobilization stress)</td>
<td>15</td>
<td>0, 16</td>
</tr>
<tr>
<td>12.</td>
<td>Determination of animals' working capacity based on static endurance.</td>
<td>15</td>
<td>0, 3, 6, 11, 16, 25</td>
</tr>
<tr>
<td>13.</td>
<td>Study of equilibrium function.</td>
<td>15</td>
<td>0, 3, 6, 11, 16, 25</td>
</tr>
<tr>
<td>14.</td>
<td>Electronystagmographic study of vestibular function</td>
<td>15</td>
<td>0, 3, 6, 11, 16, 25</td>
</tr>
<tr>
<td>15.</td>
<td>Study of the inversion and landing reflex.</td>
<td>15</td>
<td>0, 3, 6, 11, 16, 25</td>
</tr>
</tbody>
</table>

Note: Animals will be given another dechlormoxin injection on the last day of the synchronous experiment.
Table 5. List of Scientific Institutions Participating in the Experiments on the 1977 Biological Satellite

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of Institution</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Institute of Medical and Biological Problems of the Ministry of Public Health of the USSR</td>
<td>USSR</td>
</tr>
<tr>
<td>2.</td>
<td>Central Scientific Research Institute of Traumatology and Orthopedics imeni Piorov of the USSR Ministry of Public Health</td>
<td>USSR</td>
</tr>
<tr>
<td>3.</td>
<td>Central Scientific Research Institute of Stomatology of the USSR Ministry of Public Health</td>
<td>USSR</td>
</tr>
<tr>
<td>4.</td>
<td>Institute of Evolutionary Physiology and Biochemistry of the USSR Academy of Sciences</td>
<td>USSR</td>
</tr>
<tr>
<td>5.</td>
<td>Institute of Biochemistry imeni Bakh of the USSR Academy of Sciences</td>
<td>USSR</td>
</tr>
<tr>
<td>6.</td>
<td>Institute of Physiology imeni Pavlov of the USSR Academy of Sciences</td>
<td>USSR</td>
</tr>
<tr>
<td>7.</td>
<td>Central Scientific Research Institute of Gastroenterology of the Moscow Municipal Executive Committee</td>
<td>USSR</td>
</tr>
<tr>
<td>8.</td>
<td>Institute of Medical Radiology of the USSR Academy of Medical Sciences</td>
<td>USSR</td>
</tr>
<tr>
<td>9.</td>
<td>Institute of Nutrition of the USSR Academy of Medical Sciences</td>
<td>USSR</td>
</tr>
<tr>
<td>10.</td>
<td>Central Scientific Research Institute of First Aid imeni Sklifasov of the RSFSR Ministry of Public Health</td>
<td>USSR</td>
</tr>
<tr>
<td>11.</td>
<td>Institute of Aviation Medicine, Warsaw</td>
<td>Poland</td>
</tr>
<tr>
<td>No.</td>
<td>Name of Institution</td>
<td>Country</td>
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<tr>
<td>-----</td>
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</tr>
<tr>
<td>12.</td>
<td>Institute of Experimental Endocrinology of the Slovakian Academy of Sciences, Bratislava</td>
<td>CSSR</td>
</tr>
<tr>
<td>13.</td>
<td>State University imeni P. Shafarik, Koshitse</td>
<td>CSSR</td>
</tr>
<tr>
<td>14.</td>
<td>Institute of Physiology, Bucharest</td>
<td>Rumania</td>
</tr>
<tr>
<td>15.</td>
<td>Curie National Scientific Research Institute of Radiobiology and Radiohygiene, Budapest</td>
<td>Hungary</td>
</tr>
<tr>
<td>16.</td>
<td>Institute of X-Ray Technology and Radiobiology of the Medical Academy, Sofia</td>
<td>Bulgaria</td>
</tr>
<tr>
<td>17.</td>
<td>L. Pasteur Institute</td>
<td>France</td>
</tr>
<tr>
<td>18.</td>
<td>University of Paris</td>
<td>France</td>
</tr>
<tr>
<td>19.</td>
<td>Dosimetry Laboratory of the Fontenay-aux-Roses Center</td>
<td>France</td>
</tr>
<tr>
<td>20.</td>
<td>NASA Ames Research Center</td>
<td>U.S.</td>
</tr>
</tbody>
</table>

**K-1242: Experiment with Higher Plants**

1. Institute of Medical and Biological Problems of the USSR Ministry of Public Health

**K-1242: Experiment with Lower Plants**

1. Institute of Medical and Biological Problems of the USSR Ministry of Public Health

**K-1244: Experiment with Insects**

(Oregon-R-strain pomace flies)

1. Institute of Medical and Biological Problems of the USSR Ministry of Public Health
<table>
<thead>
<tr>
<th>No.</th>
<th>Name of Institution</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Institute of Medical and Biological Problems of the USSR Ministry of Public Health</td>
<td>USSR</td>
</tr>
<tr>
<td>2.</td>
<td>Institute of Nuclear Physics of the Atomic Energy Commission</td>
<td>Rumania</td>
</tr>
<tr>
<td>3.</td>
<td>Laboratory of Medical Biology of the Department of Medicine of Toulouse University</td>
<td>France</td>
</tr>
<tr>
<td>4.</td>
<td>Laboratory of Corpuscular Radiation of the Strasbourg Nuclear Research Center</td>
<td>France</td>
</tr>
</tbody>
</table>

**K-1245: "Bioblok" Experiment**

<table>
<thead>
<tr>
<th>No.</th>
<th>Institute of Medical and Biological Problems of the USSR Ministry of Public Health</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Institute of Medical and Biological Problems of the USSR Ministry of Public Health</td>
<td>USSR</td>
</tr>
<tr>
<td>2.</td>
<td>Institute of Biophysics of the Czechoslovakian Academy of Science</td>
<td>CSSR</td>
</tr>
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</table>

**K-1246: "Heat Transfer I" Experiment**

<table>
<thead>
<tr>
<th>No.</th>
<th>Institute of Medical and Biological Problems of the USSR Ministry of Public Health</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Institute of Medical and Biological Problems of the USSR Ministry of Public Health</td>
<td>USSR</td>
</tr>
<tr>
<td>2.</td>
<td>All-Union Scientific Research Institute of Electronic Standards</td>
<td>USSR</td>
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</table>

**K-1247: Electrostatic Shield Experiment**

<table>
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<th>Institute of Medical and Biological Problems of the USSR Ministry of Public Health</th>
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<td>2.</td>
<td>All-Union Scientific Research Institute of Electronic Standards</td>
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</tbody>
</table>

**K-1248: Dielectric Shield Experiment**

<table>
<thead>
<tr>
<th>No.</th>
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</thead>
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<td>-----</td>
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<td>-------------</td>
</tr>
<tr>
<td>1.</td>
<td>Institute of Medical and Biological Problems of Public Health</td>
<td>USSR</td>
</tr>
<tr>
<td>2.</td>
<td>NASA Ames Research Center</td>
<td>U.S.</td>
</tr>
<tr>
<td>3.</td>
<td>University of San Francisco</td>
<td>U.S.</td>
</tr>
</tbody>
</table>
Unit for biological investigations, including a thermostat for the Soviet-French "Bioblok" experiment, "biofixators" (4) and the instrumentation for the Soviet-Czech "Heat Transfer I" experiment.
Centrifuge for creating artificial gravity in rat experiment.
Automatic "biofixator" for conducting experiments with plants during space flight.
A single rat holding cell from the onboard centrifuge.
On-board equipment for performing biophysical investigations (Czech design).