each point of the membrane. The rearrangements in the physical-chemical properties of the cytoplasmic membrane underlie the changes in its permeability, receptors' functioning, membrane-bound enzyme activity. This, in its turn, leads to the subsequent metabolism changes, eventually resulting in physiological responses of cells and organisms to the influence of microgravity. New approaches concerning the ion and water transport examination under microgravity are revealed, due to the currently available data on the presence of mechanically-sensitive calcium channels and highly selective water channels (proteins-aquaporins) in the cytoplasmic membrane. Investigations of the topography of cytoskeleton elements as a supportively motive apparatus are directed to clarifying the role of cytoskeleton (tubulin microtubules and actin microfilament complexes) in cell responses to the influence of microgravity.

Comprehension of mechanisms of pathological changes in excitable cells (nervous and endocrinal) at the subcellular and molecular levels in a space flight, will contribute to a more profound understanding of rearrangements of the physiological processes, which arise in mammals under these conditions. It will also facilitate working out prophylactic recommendations and pharmacological preparations for prevention of pathological changes in human health.

A decrease in bone minerals content in astronauts during the space flight has been established, as well as a tendency to redistribution of mineral substances in the skeleton. The experiments with mammals and birds gave evidence of a reduction in the intensity of growth and osteoplastic processes in skeleton bones, as well as of a loss of bone mass and osteoporosis. So, study of structural and metabolic rearrangements in bone tissue cells, will require further examination of cytological mechanisms of gravi-dependent changes in developing and mature bone skeleton under microgravity.

Study of the influence of microgravity on the immune system of the astronauts and test animals has shown a depletion of immune cells and lowering of the general competence of the immune system. At the same time, it remains unknown, what stages of an immune response that is a complex process, are the most sensitive to microgravity. Revealing the stages of an immune response is planned to be carried out on test animals in vivo and with utilization of cell cultures in vitro.

Diverse model systems were chosen for study of the influence of microgravity at the cellular and molecular levels. Among them are the artificial phospholipid (liposomes) and biological membranes; tip-growing plant cells; photosynthetic cells and photosynthesis process; endocrine cells of different types; neurites and their growth; isolated central and peripheral neurons and their maturing; unicellular and coenobial algae; moss protonema; annual higher plants and small animals; tumor cells of plant and animal origin; proliferation and differentiation processes of transformed nervous cells induced by the nervous growth factor, as well as crown galls induced by Agrobacterium tumefaciens, processes of their induction and efficiency of anti-tumor preparations.

«Calcium-cytoskeleton» Experiment

IMPACT OF ALTERED GRAVITY ON THE CYTOSKELETON DYNAMICS AND CALCIUM HOMEOSTASIS DURING DEVELOPMENT OF GRAVIPERCEIVING AND GRAVIRESPONDING ROOT CELLS

Kordyum E. L.

M. G. Kholodny Institute of Botany, NAS of Ukraine
2 Tereschenkivska St., Kyiv 01601Ukraine
tel. /fax: (380) +44 +2123236, e-mail: ekord@botan.kiev.ua

Research on development and functioning of plant cells in altered gravity is proposed. The following objectives are to be achieved:

— to locate the cytoskeleton arrangement during development of graviperceiving (root cap) and graviresponding (epidermis and cortex) cells under altered gravity (actin, tubulin and myosin components of cytoskeleton);

— to study the calcium homeostasis in graviperceiving and graviresponding cells during their development and to define the role of calcium ions in specification of these cells;

— to establish the impact of altered gravity on the cytoskeletal protein genes expression during development of graviperceiving and graviresponding root cells;

To met these objectives, the following methods will be applied: electron, light and fluorescent microscopy, dot and in situ hybridization techniques, immunohistochemistry and fluorescent dyes staining.

This research will be carried out for the first time. The intent is to obtain comparative characteristics of cytoskeleton arrangements in two cell lines originating from two different types of root meristem (root cap meristem and apical root meristem, accordingly). It will be important for establishment of the role of cytoskeleton in histogenesis of graviperceiving and graviresponding root sites and, consequently, in the process of gravisensing. Study of calcium homeostasis during the specification of graviperceiving and graviresponding plant cells, as well as study of expression of cytoskeleton genes will promote the definition of the signal-transducing pathway for gravity in plant roots.

«Membranes» Experiment

PHYSICAL-CHEMICAL PROPERTIES OF BIOLOGICAL MEMBRANES UNDER MICROGRAVITY

Polulyakh Yu. A.

M. G. Kholodny Institute of Botany, NAS of Ukraine
2 Tereschenkivska St., Kyiv 01601Ukraine
tel/fax: (380) + 44 +2123236, e-mail: ekord@botan.kiev.ua

Przhonska O. V.

Institute of Physics, NAS of Ukraine
46 Nauky Ave., Kyiv 03039 Ukraine
tel: (380) +44 +2656713, fax: (380) +44 +2651589, e-mail: olga@iop.kiev.ua

The experiment is aimed at performance of complex investigations of physical and chemical properties of the cytoplasmic membrane of plant cells at the molecular level under altered gravity and understanding the mechanisms supporting its microviscosity within certain limits under altered gravity, i. e., homeoviscous adaptation of plant cells to altered gravity.

The main objectives are the following:

— to develop a new method of fluorescence probes, which will allow measurement of the dynamic changes in microviscosity of the model and native biomembranes;

— to develop new highly sensitive and specific fluorescence probe-molecules for their incorporation into biomembranes;

— to develop a special and original mini-device for measuring microviscosity on board the space station;

— to work out procedures of recurrent measurement of biomembrane's microviscosity during a space flight according to a special program;

The methods of ultracentrifugation, extraction, fractionating, thin-layer chromatography, gas-liquid chromatography, and modified fluorescence probes will be used. The results obtained will promote an understanding of the physical-chemical properties of biomembranes under altered gravity, and the mechanisms of homeoviscous adaptation of plant cells to microgravity.