PREBIOTIC SYNTHESIS IN OPEN SPACE AND EXOBIOLOGY («Biolaboratory» Project)

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Introduction. It is known that proteins, which were formed from amino acid remnants, are the chemical basis of all the known life forms. The origin of amino acid on Earth is elucidated by model experiments and analysis of natural objects of terrestrial (volcanic samples) and cosmic origin (meteorites, Lunar and Martian rocks). However, the issue of the mechanisms of abiogenic origin of peptide and protein molecules is still debatable and cannot be solved without performing preliminary model experiments and analysis of organic compounds by special oversensitive methods.

Experiments proposed on board the ISS contemplate:

— establishment of cardinal paths of abiotic transformations of proteinogenic amino acids adsorbed on the surface of highly-dispersed silicon as a model of cosmic dust;

— study of possible modes of peptide bond formation under the influence of outer space factors and further verification of the established regularities.

It is a known fact that organisms being in active physiological state do not survive in outer space. Proposed experiments will allow studying the protective capabilities of organisms against solar radiation outside the ozone layer. Utilization of lichens in experiments in outer space will be a new approach to this problem.

«Biomolecules» Experiment

STUDY OF PREBIOTIC SYNTHESIS IN OUTER SPACE CONDITIONS

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It is known that cosmic dust microparticles could have an important role in the origin of life on Earth. As one of the models of organic substances origin in outer space, we propose studying the intermolecular mechanism of proteinogenic amino acids interaction in the surface layer of superfine silica, resulting in peptide bond formation.

The intent is to establish the cardinal pathways of abiotic transformations of proteinogenic amino acids on an inorganic surface and possible ways of peptide bond formation under the effect of specific factors of outer space.

We will apply the methods of mass spectrometry, IR-spectroscopy and liquid chromatography to identify the products obtained. Sample analysis will be carried out by mass spectrometric recording of volatile products during temperature-programmed desorption. Non-isothermal methods will be also applied for evaluation of the energy of activation and pre-exponential factor for heterogeneous surface reactions, causing peptide bond formation.