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「たんぽぽ」計画で提案している国際宇宙ステーション上での微生物曝露実験について

Microbe space exposure experiment at International Space Station (ISS) proposed in "Tanpopo" mission

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To explain how organisms on the Earth were originated at the quite early stage of the history of Earth, Panspermia hypothesis was proposed [1, 2]. Recent findings of the Martian meteorite suggested possible existence of extraterrestrial life, and interplanetary migration of life as well. On the other hand, microbes have been collected from high altitude using balloons, aircraft and meteorological rockets since 1936, though it is not clear how could those microbes be ejected up to such high altitude [3]. Spore forming fungi and Bacilli, and Micrococci (probably Deinococci) have been isolated in these experiments. These spores and Deinococci are known by their extremely high resistance against UV, gamma ray, and other radiation. Indeed, we have also collected microorganisms at high altitude by using airplanes and balloons. We collected two novel species of the genus Deinococcus, one from top of troposphere (D. aerius) and the other from bottom of stratosphere (D. aetherius) [4-6]. These two species showed high resistance comparable with D. radiodurans R1 to the UV and radiation such as gamma ray. If microbes could be found present even at the higher altitude of low earth orbit (400km), the fact would endorse the possible interplanetary migration of terrestrial life.

We proposed the "Tanpopo" mission to examine possible interplanetary migration of microbes, and organic compounds on Japan Experimental Module (JEM) of the International Space Station (ISS) [7]. Tanpopo consists of six subthemes. Two of them are on the possible interplanetary migration of microorganisms. One is capture experiment of microorganisms at the ISS orbit and the other is space exposure experiment of microorganisms. In this paper, we focus on the space exposure experiment of microorganisms.

In our proposal, microorganisms will be exposed to the space environment with/without model-clay materials that might protect microorganisms from vacuum UV and cosmic rays. Spore of

Bacillus sp., and vegetative cells of Deinococcus radiodurans and our novel deionococcal species isolated from high altitude are candidates for the exposure experiment. In preliminary experiments, clay-materials tend to increase survivability of microorganisms under irradiation of heavy ion beam and other radiation. In this paper, we discuss current status of exposure experiment of microorganisms defined for the Tanpopo mission.

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