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# Microbe space exposure experiments at International Space Station (ISS) in the mission ”Tanpopo”

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Origin of life on the Earth is one of most important issues for the biological studies. 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]. We have also collected microorganisms at high altitude by using airplanes and balloons. Spore forming fungi and Bacilli, and Deinococci have been isolated in these experiments. Our two high-altitude isolates of Deinococci were then suggested to be novel species by molecular phylogenetic analyses and other microbiological characterizations (*D. aerius* from top of troposphere and *D. aetherius* from bottom of stratosphere) [4-6]. Spores and Deinococci are known by their extremely high resistance against UV, gamma ray, and other radiations [4]. *D. aerius* and *D. aetherius* showed high resistance comparable with *D. radiodurans* R1 to the UV and ionizing radiation such as gamma rays. If microbes could be found present even at the higher altitude of low earth orbit (400 km), 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 microbes - capture experiment of microbes at the ISS orbit and space exposure experiment of microbes. In this paper, we focus on the space exposure experiment of microbes.

Microbes in space are assumed be exposed to the space environment with different depth of layered cells. This simulates different sizes of cell aggregates. Surface cells may protect inner cells against UV, although the former might die. Dried vegetative cells of *D. radiodurans* and our novel deinococcal species isolated from high altitude are candidates for the exposure experiment. We are now testing survivals of deinococcal species and strains under the harsh environmental conditions simulating ISS environmental conditions (UV, radiation, temperature, etc). The species we testing are *D. radiodurans* (R1, and some mutant strains for DNA repair systems which might affect survivability of cells under these conditions), *D. geothermalis*, *D. aerius*, and *D. aetherius*. In this paper, we discuss current status of exposure experiment of microorganisms defined for the Tanpopo mission and others.

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