JpGU-AGU Joint Meeting 2017

500 μm cell-aggregation of *Deinococcus* spp. was enough thickness to survive after 384 days exposure at ISS orbit in Tanpopo mission

*Yuko Kawaguchi[1], Iori Kinoshita[1], Jun Yatabe[1], Yuka Murano[1], Daisuke Fujiwara[1], Miyu Harada[1], Kazumichi Nakagawa[2], Issay Narumi[3], Satoshi Kodaira[4], Yukio Uchihori[4], Hirofumi Hashimoto[5], Shin-ichi Yokobori[1], Akihiko Yamagishi[1]

1. Tokyo University of Pharmacy and Life Sciences, 2. Kobe University, 3. Toyo University, 4. National Institutes for Quantum and Radiological Science and Technology (QST), 5. ISAS/JAXA

The concept of panspermia hypnosis is interplanetary transfer of life prospered by solar radio-pressure (Arrhenius, 1903). Previous exposure experiment of microbes in space reveals microbes inside of shielding (*e.g.* small fragments of rock, mixture of sugar or clay) with efficient thickness to protect from UV irradiation survive in space for a long period (*e.g.* Onofuri et al., 2012). On the other hand, we proposed interplanetary transfer of cell-aggregation in sub-millimeter to survive at hash space environment (Kawaguchi et al., 2013). The hypothesis is named massapanspermia. For the investigation of microbial survival and their DNA damage induced in space, dried cells of the radioresistant bacteria *Deinococcus* spp. put in wells of aluminum plates in Exposure Panels (EPs) were exposed in space at the outside of International Space Station (ISS) in Tanpopo mission since May 2015 (Yamagishi et al., 2007; Kawaguchi et al., 2016). EPs are going to be exposed for one, two and three years. The first year’s EPs were retrieved into the ISS pressurized room in June 2016 and returned to the ground laboratory in September 2016. Dried-deinococcal cell-aggregations with various thickness from single layer to about 1500 μm were used to expose in space. Dried-deinococcal cells with 100 μm-thickness were dead. However, cell-aggregations with 500 μm-thickness were alive. Intact DNA (%) with 100 μm-thickness was less 1% according to an analysis by quantitative-PCR. The results indicated that a lethal dose of UV reached inside of cell-aggregation in the case of the 100 μm-thickness samples. For 500 μm-thickness samples, UV reached only the surface of cell-aggregation, and the surface of dead cells protected inside of living dried-cells. No remarkable difference was observed in surviving fractions between space exposed samples and laboratory controls in the case of cell-aggregation over 1000 μm-thickness. These results highlight the importance of microbial cell-aggregates as an ark for interplanetary transfer of microbes as we hypothesized in our previous study (Kawaguchi et al., 2013). Global-shaped cell-aggregation of *Deinococcus* spp. with 1 mm-thickness is possible to survive during the interplanetary journey and propagate if water exists in landing planets.

Keywords: panspermia, cell-aggregation, Tanpopo mission