Analysis of survival and DNA damage of space exposed *Deinococcus* spp.
宇宙曝露した*Deinococcus*属細菌の生存とDNA損傷の解明 (たんぽぽ計画)

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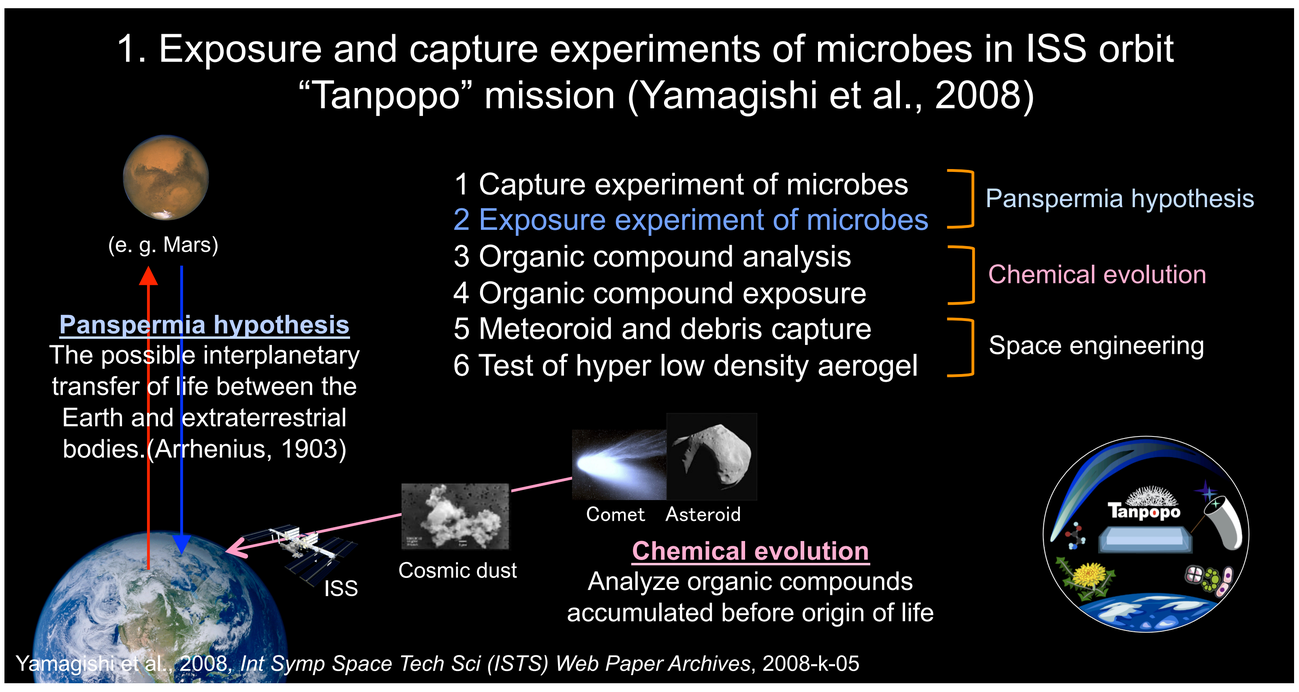
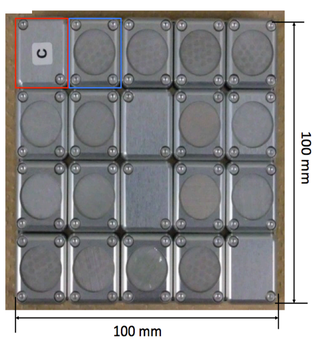
たんぽぽ計画ではISS日本実験棟曝露部を利用し、微生物の宇宙空間移動仮説(パンスペルミア説)を検証している。地上由来微粒子の捕集実験と地球微生物の宇宙曝露実験が1年間行われ、地上にサンプルが帰還し解析を進めている。その結果、十分な厚みを持つ微生物の凝集体は高い生存率を示した。また、宇宙で生じたDNA損傷、変異、他の微生物種についても報告する。

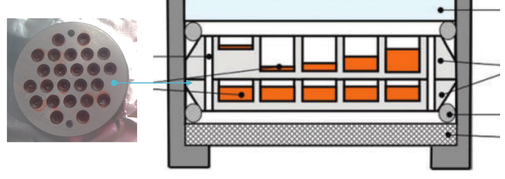




Exposure Panel (EPs). A passive dosimeter is placed in an exposure unit without a window shown in red rectangle.

Thickness of microbial cells

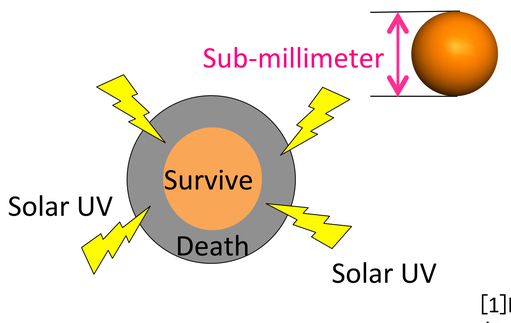
- Front plate
  1 μm、100 μm、500 μm
  1000 μm、1500 μm
- Bottom plate
  1000 μm



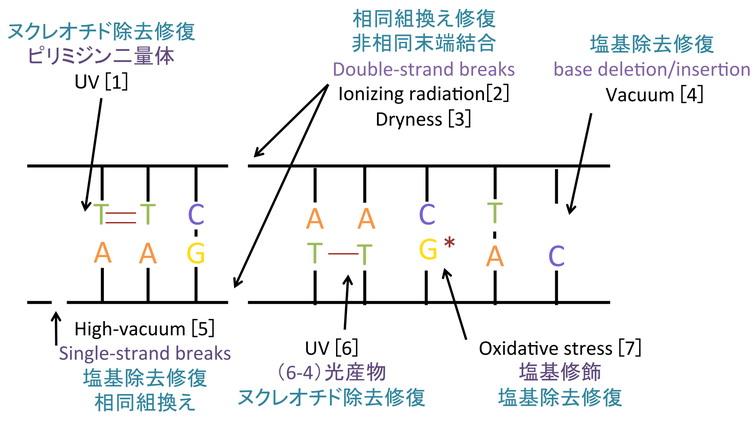
Sample plates with microbial cells are placed in the exposure unit shown in the blue rectangle (Kawaguchi et al, 2016, Astrobiology).

3. Purpose of the exposure experiment of microbes

1. Survivability of microbes depending on the thickness
   (Kawacuchi et al., 2013, *Ori. of Life and Evol. of Biosp,* 43, 411-428.)

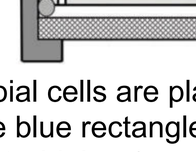


2. DNA damage arisen in space



[1]Hornrck et al., 1984 [2]Moeloer et al., 2010 [3]Yang et al., 2009 [4]藤原 2016 年度卒論 [5]Dose et al., 1992 [6] Moeloer et al.,2007 [7]Slade et al., 2011

4. Materials and Methods

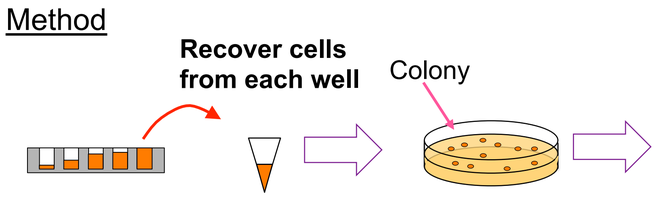


D. radiodurans
(Nicholson. 2009)
Bar= 1 μm

Model organism: The radiation resistance of *Deinococcus* spp.

D. radiodurans	Isolated from a canned meat after gamma ray irradiation. Extreme resistance to the UV, gamma ray and desiccation.	
Mutants		DNA repair pathway
D. radiodurans UVS78	*ΔmtcA , ΔuvsE*	Nucleotide excision
rec30	*recA*	Homologous recombination
KH311	*pprA*	The non-homologous end joining

Method



Calculate the survival fraction

Survival fraction=

$$\frac{\text{the number of colon (UV-Irradiated Sample)}}{\text{the number of colony (non UV-irradiated sample)}}$$

Colony formation assay
(Living cells make colony)

<References>
[1] Hotchin et al., 1967, *Life Sci. Space Res*. 5,1–6. [2] Horneck et al., 1993, *Adv. Space Res*. 14, 41–45 [3] HorneckStoodley et al., 2001, *Ori. of Life and Evol. of Biosp*. 31, 527–547 [4] Onofri et al., 2012, *Astrobiology*, 1, 3-13 [5] Nicholson, 2009, *Trends Microbiol*. 17, 243–250 [6] Toole et al., 2000, *Annu. Rev. Microbiol*., 54, 49–79 [7] Stoodley et al., 2002, *Annu. Rev. Microbiol*. 56, 187–209 [8] Lighthart, 1997, FEMS Microbiol. Ecology, 23, 263-274 [9] Wanunwrught et al., 2003, *FEMS Microbiol. Letters,* 218, 161-165 [10] Yang et al., 2008, *Biol Sci Space,* 22, 18–25 [11] Smith et al., 2011, *Aerobiologia*, 27, 319-332 [12] Yamagishi et al., 2008, *Int Symp Space Tech Sci (ISTS) Web Paper Archives*, 2008-k-05 [13] Anderson et al., 1956, *Food Technol* 10, 575–578 [14] Cox and Battista, 2005, *Orig Life Evol Biosph*, 23, 29–36 [15] Yang et al., 2009, *Int J Syst Evol Microbiol*, 59:1862–1866 [16] Yang et al., 2010, *Int J Syst Evol Microbiol*, 60, 776–779 [17] Kawacuchi et al., 2013, *Ori. of Life and Evol. of Biosp,* 43, 411-428.