Franklin, R.B., J.L. Garland, and A.L. Mills 2005. The influence of ecological isolation on the structural and functional stability of complex microbial communities. 3rd International Workshop on Space Microbiology, European Space Agency, Mol, Belgium.

To help understand how the behavior of microorganisms and microbial communities in insular space habitats may differ from the behavior of these groups on Earth, long-term incubations (100+ days) were conducting using wastewater bioreactors (batch fed) designed to mimic "closed" and "open" ecological systems. The issue of immigration was considered, and the goal of the research was to determine whether the stability of microbial communities in space is reduced due to their prolonged isolation. Bioreactors were established by inoculating flasks of sterile synthetic wastewater with the microbial community obtained from a local treatment facility; each day, one-third of the medium in the flask was replaced with an equal volume of sterile artificial wastewater. Flasks were divided into two treatments: "closed" and "open" to recruitment of additional microorganisms. "Closed" flasks were maintained as described above, while the medium used to feed the "open" flasks was supplemented daily with a small amount of raw sewage (which provided a continuous source of new potential community members). Significant differences in microbial community structure and function developed in the two sets of communities, and the results suggest that the open community was more stable and better able to adjust to changing environmental conditions. Each community's resistance to environmental (temperature fluctuations) and biological stresses (starvation and invasion by an opportunistic pathogen *Pseudomonas aeruginosa*) was monitored. Experiments were also conducted to determine whether the effect of isolation changes depending on the microbial communities' initial diversity or composition; communities with a low(er) initial diversity were less stable. Overall, the results indicate that isolation will be an important factor influencing the activity of microbial communities on board spacecraft. A possible way of mitigating these effects would be to include communities with high initial diversity or to periodically re-inoculate the systems using diverse inocula transported from Earth.