Abstract:

Opportunities are available for projects in Fundamental Space Biology of microbial communities. An emphasis of our research group at KSC has been the development of microbial communities in closed systems of manned space platforms such as the International Space Station. Unlike the Earth's surface, which has a nearly infinite pool of microbial species that can move from place to place to fill unrealized niches, spacecraft, once launched, have no opportunity to recruit organisms from other habitats. The only mechanism for change in community composition is mutation driven evolution.

In reactors on the ground, we study the effects of low microbial diversity such as expected in a cleaned, but inhabited vehicle or platform, or the ability of the community to withstand physical disturbance through changes in temperature, O$_2$ concentration etc., and to withstand invasion, especially by microbes that might be introduced upon a crew change or upon a re-supply mission. Because the Earth’s microbial communities are hyperdiverse, it is difficult to study diversity effects in natural systems. Additionally, it may be that harsh environments such as Mars have developed communities of a few, highly specialized organisms specifically capable of coping with their native habitat. Contamination of such communities with terrestrial organisms could mean a complete change in the (hypothesized) Martian microbial community that might render native organisms extinct.

Questions to be addressed by a postdoctoral fellow might include, but are not limited to:

- Is there a minimum size (i.e., richness) of a microbial community in which all critical ecosystem functions are present?
- Are there critical physiological functions that must be present for a microbial community to persist in a moderately fluctuating environment?
- Do periodic fluctuations in physical-chemical conditions select communities that are more or less diverse and that are more or less stable than communities that develop under constant conditions?
- Does prolonged exposure of a microbial community to space conditions (specifically to the radiation flux experienced in low Earth orbit) cause a decrease in diversity due to selection by nearly constant conditions or an increase in diversity due to speciation induced by the radiation?