

## **STRATEGIES FOR DETERMINING SAFETY OF FERMENTED FOODS PRODUCED IN SPACE**

Natalie Ball<sup>1</sup>, Sadie Downing<sup>1</sup>, Ami Hannon<sup>1</sup>, Hiromi Kagawa<sup>2</sup>, Jing Li<sup>3</sup>, Hami E. Ray<sup>4</sup>, Oscar Roque<sup>1</sup>, A. Mark Settles<sup>5</sup>, Kevin Sims<sup>1</sup>, Sandra Vu<sup>1</sup>, and Frances M. Donovan<sup>5</sup>

<sup>1</sup>KBR, NASA Ames Research Center, Moffett Field, CA 94035, <sup>2</sup>SETI Institute, Mountain View, CA 94043, <sup>3</sup>Entry Systems and Vehicle Development Branch, NASA Ames Research Center, Moffett Field, CA 94035, <sup>4</sup>Flight Systems Implementation Branch, NASA Ames Research Center, Moffett Field, CA 94035, <sup>5</sup>Bioengineering Branch, NASA Ames Research Center, Moffett Field, CA 94035

The BioNutrients experiments examine the feasibility of using microbially produced foods – yogurt, kefir, fermented food products– to supplement the current prepackaged food system to provide freshly synthesized nutrients and genetically engineered protein therapeutics to support crew health for sustainable and long duration crewed exploration. Safety of the products must be established as direct consumption of such products is a risk due to potential contamination with pathogenic organisms. Identifying pathogen contamination is particularly challenging as the fermenting cultures can mask the presence of contaminating organisms. Here we consider current methods of detecting coliforms, aerobic colonies, non-lactic acid bacteria, molds (yeasts), and specific pathogens including *Staphylococcus aureus* and salmonella. We also consider alternate and additional testing including sequencing and quantitative PCR. We investigate the use of the E-Nose developed by NASA Ames Research Center. This portable device senses volatile organic compounds in real time and can be trained to recognize “good” uncontaminated products from contaminated ones as a means of predicting food safety. Finally, we consider methods of in-flight pasteurization to increase safety and decrease overall microbial load of these products. This presentation will summarize testing status and outline the strategy that will be employed in the BioNutrients-3 ISS fermented foods experiment.