LIFE DETECTION IN BASAL ICE FROM THE GREENLAND ICE SHEET: CHALLENGES AND OPPORTUNITES. W. Li[1], M. L. Skidmore[1*], J. E. Dore[2], M. R. Lindsay[3], A. J. Steigmeyer[1], P. G. Tunby[1], and E. S. Boyd[3]. [1]Department of Earth Sciences, Montana State University, Bozeman, MT, USA. [2]Department of Land Resources and Environmental Sciences, Montana State University, Bozeman, MT, USA. [3]Department of Microbiology and Immunology, Montana State University, Bozeman, MT, USA. (*skidmore@montana.edu)

Debris-rich basal ices outcrop at glacier termini and ice sheet margins, have been shown to harbor microbes [1, 2]. The entrained debris provide energy sources and nutrients to support microbial metabolism [1, 2], which is localized to unfrozen water films on particle surfaces that persist at sub-zero temperatures [2, 3]. Debris containing ices also exist elsewhere in the solar system, for example in the polar regions on Mars, though these ices are likely formed via different processes to terrestrial basal ice [4].

Terrestrial basal ices contain metabolically diverse microbes that can be cultured oligotrophically at low temperatures (0 - 4°C), including aerobic chemoheterotrophs, anaerobic nitrate reducers, sulfate reducers, and methanogens [1]. Microorganisms that survive in the basal ice layers in terrestrial polar ice masses need to be adapted to surviving subzero temperatures on extended timescales, as would microbes in ices elsewhere in the solar system. Isolates from terrestrial basal ice have been shown to be well adapted to sub-zero temperatures in laboratory studies, demonstrating respiration in ice [5, 6], alteration of ice structure via ice-binding proteins [7, 8] and respiration in sub-zero brines [9].

The presentation will describe the physical, chemical and biological properties of debris-rich ice sampled from the margin of the Greenland Ice Sheet and from deep ice cores (~ 2500m ice depth) from the continental interior, contrasting the habitat potential of these different environments. It will also focus on i) the specific challenges that arise when analyzing low volume samples for life detection as would likely be the case for future missions to icy environments elsewhere in the solar system and ii) discuss the opportunity that basal ice sequences provide as possible test sites for life detection tools that might form part of future planetary missions.

References: [1] Skidmore, M.L. et al. (2000) *Applied and Environmental Microbiology,* 66(8), 3214-3220. [2] Montross, S., et al. (2014) *Geomicrobiology Journal*, 31(1), 76-81. [3] Price B P. (2007) *FEMS Microbiology Ecology*, 59, 217–231. [4] Davila A. F. et al., (2010) *Astrobiology,* 10(7), 705-710. [5] Bakermans C. and Skidmore M. (2011b). *Environmental Microbiology Reports,* 3(6), 774-78. [6] Doyle S. M. et al. (2013) *Biology,* 2(3), 1034-1053. [7] Brown J. R. et al. (2014) *Biotechnology Reports*, 3, 60-6. [8] Brox T. I. et al. (2015) *Journal of Glaciology,* 61, 225, 55-64. [9] Bakermans C. and Skidmore M. (2011a) *Environmental Microbiology,* 13(8), 2269–2278.