Unicellular Eukaryotes at the Extreme: Terrestrial Protozoa of the McMurdo Dry Valleys of Antarctica. A. R. Thompson[1] and B. J. Adams[2], [1] Department of Biology, Brigham Young University, andy_thompson@byu.edu, [2]Department of Biology, Brigham Young University, byron_adams@byu.edu.

Introduction: Delineating the limits of habitability for microorganisms is an important first step in finding life outside of Earth, however relatively little is known about the physiological limits of Earth's diverse eukaryotic lineages. Although extremophiles from most of these lineages are known, a deeper understanding of their limits is required if we are to better understand their potential distribution across novel planetary bodies. The soil habitat in the McMurdo Dry Valleys (MDV) of Antarctica is one of the harshest natural environments on Earth – oligotrophy, high solar radiation, basic soils (pH 8-10), high salinity, extreme cold, low humidity, numerous and rapid freeze-thaw cycles and short growing seasons limit diversity to a handful of hardy microorganisms. These factors render these valleys excellent natural analogs for extraterrestrial cold terrestrial deserts, like those found on Mars. Among others, MDV soils are home to protozoa - motile unicellular heterotrophic eukaryotes – which can serve as excellent models for studying the habitability limits of eukaryotes due to their key functional roles and position in the tree of life. A more complete understanding of what delimits the habitability of more complex life, both unicellular and multicellular, can render our search for extraterrestrial life more productive by providing additional criteria as to where and how to look. Functionally, protozoa likely played an important role in the early evolution of the planet's ecosystem by providing selective pressures on early bacteria, while phylogenetically they are sister to multicellular life. As the most biologically diverse biospheres will have potentially passed through either or both of these phases, the study of protozoa under an astrobiological context is of critical importance. The MDV is home to a variety of protozoan lineages, including members of phylum Ciliophora, Amoebozoa, and Cercozoa. As virtually nothing is known about the physiologies of these extremophiles, here we present preliminary research on their growth rates and limits of some of these organisms. Soil samples were collected over the 2016-17 field season, physical soil parameters were measured (moisture, pH, conductivity), and samples were returned to Brigham Young University and stored at 4C. Culturing progressed using a modified extraction method used originally for metazoan meiofauna (e.g. nematodes) and the Non-flooded Petri dish method. Cultures were established using either live bacterial prey or a nutrient medium made from the soil matrix. Physiological tolerance of salinity, pH and temperature was determined by subjecting replicate cultures to a range of each parameter and measuring the changes in maximum optical density as a proxy for population health.