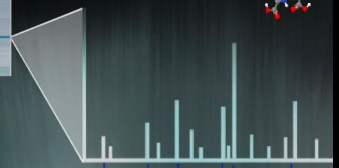

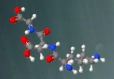

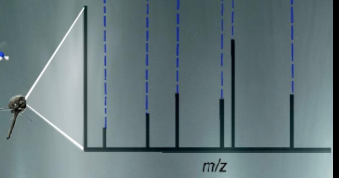

Polar Microbes Give Peptide Clues For Detecting Life on Icy Worlds

Introduction: Some of the moons around the giant gas planets (notably Jupiter and Saturn) likely have subsurface liquid oceans deep beneath their icy crusts. Living organisms (known as psychrophiles) are found in similar environments on Earth. If life exists in these extraterrestrial subsurface oceans, they would likely share similar adaptations and biochemistry to Earth-based psychrophiles. This new study, from a cross-departmental group at the University of Washington, explored conditions affecting the growth and long-term viability of psychrophiles, characterizing proteins that could be used to identify life in extraterrestrial oceans.

If life is present in subsurface oceans on icy worlds, can we use these cold adapted organisms on Earth to understand what to look for in our search for life in such places?

Experiments & Results: A marine psychrophile, *Colwellia psychrerythraea*, was grown for 4 months in 8 different sets of salinity and nutrient conditions and in two sub-zero environments. Analysis of the proteins suggested that the organisms use unique ways to process energy from the environment in order to survive under these harsh conditions. About 20 short protein fragments were identified as being useful for identifying organisms in similar environments.

Significance: This study shows how organisms develop unique proteins and biochemistry in sub-zero and extreme salt environments. Organisms that can live in these environments are extremely rare on Earth, but these conditions are remarkably similar to what we would see on other planets and moons within our Solar System. Instruments on current and future life-detection mission could be designed to detect these proteins, possibly allowing us to find signs of life as we continue to explore these planets and moons.

← Deciphering the limits of life on Earth also provides us with a list of biomolecules that are enriched and detectable using mass spectrometers. Knowledge of what molecules can be found in these unique environments allows us to target them on off-planet explorations using similar instrumentation.- Brook L. Nunn

Mudge, Miranda C., Brook L. Nunn, Erin Firth, Marcela Ewert, Kianna Hales, William E. Fondrie, William S. Noble, Jonathan Toner, Bonnie Light, and Karen A. Junge. "Subzero, saline incubations of Colwellia psychrerythraea reveal strategies and biomarkers for sustained life in extreme icy environments." *Environmental Microbiology* (2021).

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