Abstract: Red Rocks Community College students collected cryptobiotic crust samples from Death Valley, California in March of 2015. These samples were stored in amber vials in a cool dry location mimicking the long transport time samples would endure between Mars and Earth. In February 2018, I re-animically took a portion of this cryptobiotic crust and placed it on Nutrient Agar plates. The plates were either exposed to sunlight or placed in the dark to determine if different species of bacteria would grow. Surprisingly, several different bacterial and at least one fungal strain immediately began forming colonies. Some of the strains I hope to identify are cyanobacteria, spore formers, actinomycins, and other various bacteria and fungi. I will gram stain and use biochemical tests in attempts to identify the microbes growing from the samples. In the future, I would like to identify additional bacterial species using 16S genetic sequencing techniques. As the samples were successfully re-animated I think it is realistic to conclude that if life exists on Mars, samples may be transported to Earth for further biochemical and genetic testing.

Hypothesis

Hypothesis: Bacteria and fungal cells from Death Valley cryptobiotic crust samples will be viable after storage in a cool dry location for 3 years. If growth occurs, sunlight will influence the growth of photosynthetic cyanobacteria from this sample.

Introduction

Introduction: Early Mars is thought to have had liquid water and an atmosphere similar to Earth, and if this is the case, then early Mars may well have harbored microbial life. Currently robots have been sent to the surface of Mars to evaluate if life has or currently exists on that planet. If evidence of life on Mars becomes apparent it could be beneficial to execute a sample-return mission from Mars. As the travel time from Earth to Mars is on the order of months to years it is necessary to ensure the samples will reach Earth with viable microbes. This study was designed using Death Valley samples often used as Mars-analogues. This project involves samples collected, dried and stored 3 years ago that were successfully re-animated. The Nutrient Agar plates were placed in different conditions to see if different bacterial or fungal cells would re-animate and form different colonies. Samples were re-animated under conditions varying moisture, temperature, and availability of sunlight to allow the cyanobacteria, bacteria or fungi to grow.

Methods

Methods: Soil from the cryptobiotic crust was placed aseptically onto Nutrient Agar plates, 1 plate was placed in each of the following conditions

- Sunlight
- No sunlight, wrapped in foil
- Incubator, 37 Degrees Celsius
- Sunlight, with a mist of distilled water
- No sunlight, with a mist of distilled water

Results and Conclusions

Results and Conclusions: The results so far are immediate growth of different kinds of bacteria and fungi. The white, cobweb-like filamentous growth, that I labeled as Sample 1, grew in all conditions, except when there was no sunlight, and without further testing I cannot explain why this occurred. The shamrock shaped bacteria, named Sample 2, that grew best without sunlight was shiny and soft in texture. The gram stain showed both purple and pink rods, either indicating a mixed species or a gram-variable strain. The bacteria labeled Sample 3 was similar in texture and color to Sample 2, but it looked different on the Nutrient Agar plate as it lacked the ridges and the distinctive shamrock shape. When I gram stained it, it had the same purple and pink rods, and I think it possible that it is an earlier formation of the same bacteria as Sample 2. The bacteria labeled Sample 4 is rhizoidal in shape and all of the colonies are similar in size, with ridges that start from the center (where the piece of soil is) and continue to the edges. This microbe appears to be a gram negative rod. I would like to use further testing to identify these samples.

Future Testing

Future Testing: In order to identify these bacteria, I will use genetic sequencing techniques to determine the species. Additionally, I will study the physiology of these microbes to determine their potential as life forms on Mars.