



Evaluating Varying Bacterias' Capacity to desalinate water via Precipitating Calcium, Magnesium, Phosphate, and Sodium Chloride Ions

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Introduction

Freshwater Scarcity is a growing issue everywhere

Regionally:

- lake levels decreasing
- salinity is increasing
- changing natural ecology/habitats

Evaluating if bacteria is capable of precipitating Struvite

- a phosphate mineral
- has the potential to be an efficient means of desalination
- based on study conducted by Dayana Arias
 - shown that *Bacillus Subtilis* can partially desalinate Chilean seawater
 - utilizes biomineralization

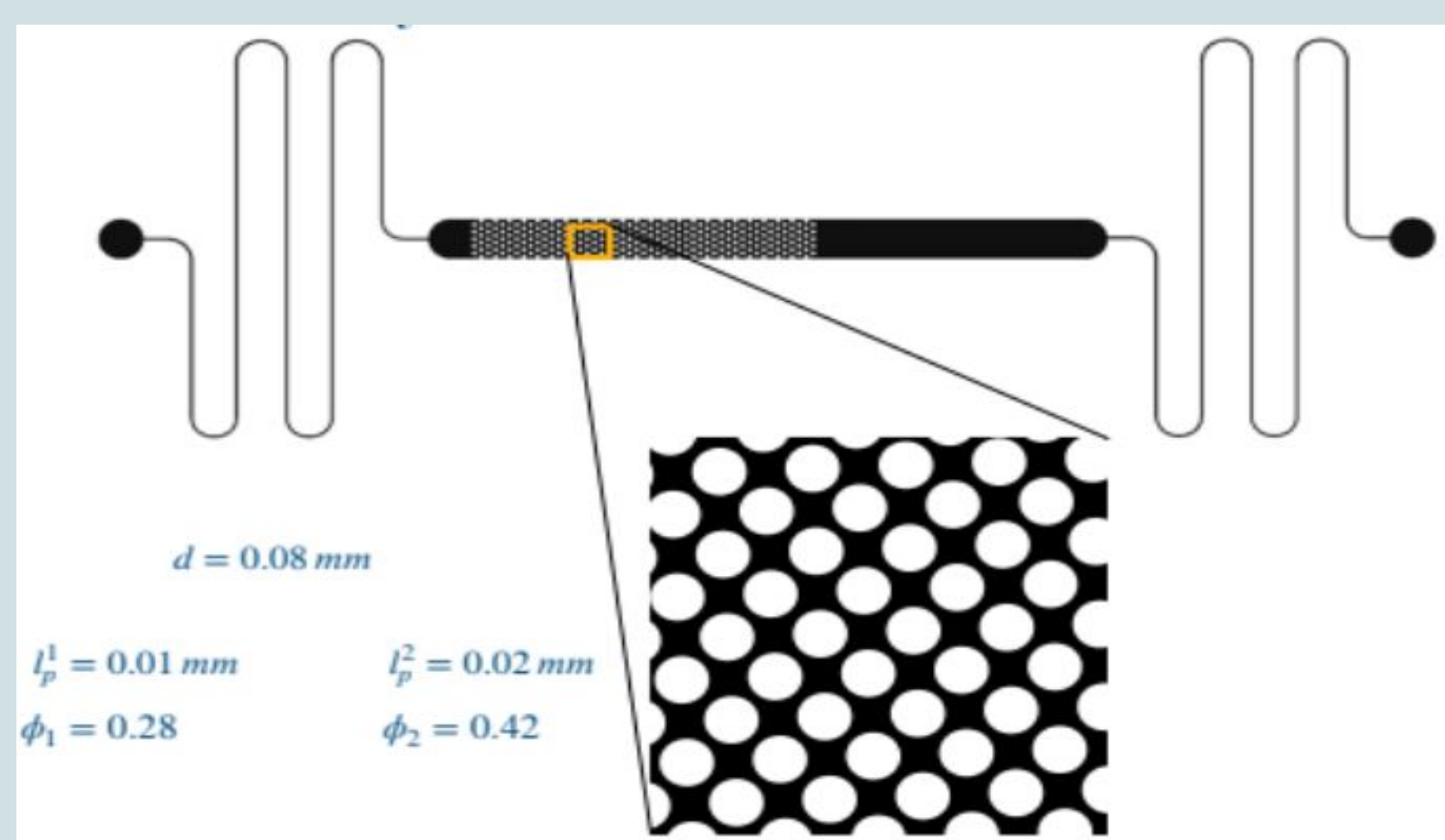


Figure 1, micromodel design

Methods

Bacteria solution created

- 1mL bacteria : 4mL deionized water
- 1mL solution : 4mL salt water
 - 4 different concentrations of salt, 0, 2.5, 5, 10gNaCl
 - Varied concentrations test halotolerance of bacteria
- Microfluidics
 - Salt solutions injected into micromodel
 - porosity mimicking sand

Results visualized by recording utilizing a Leica microscope

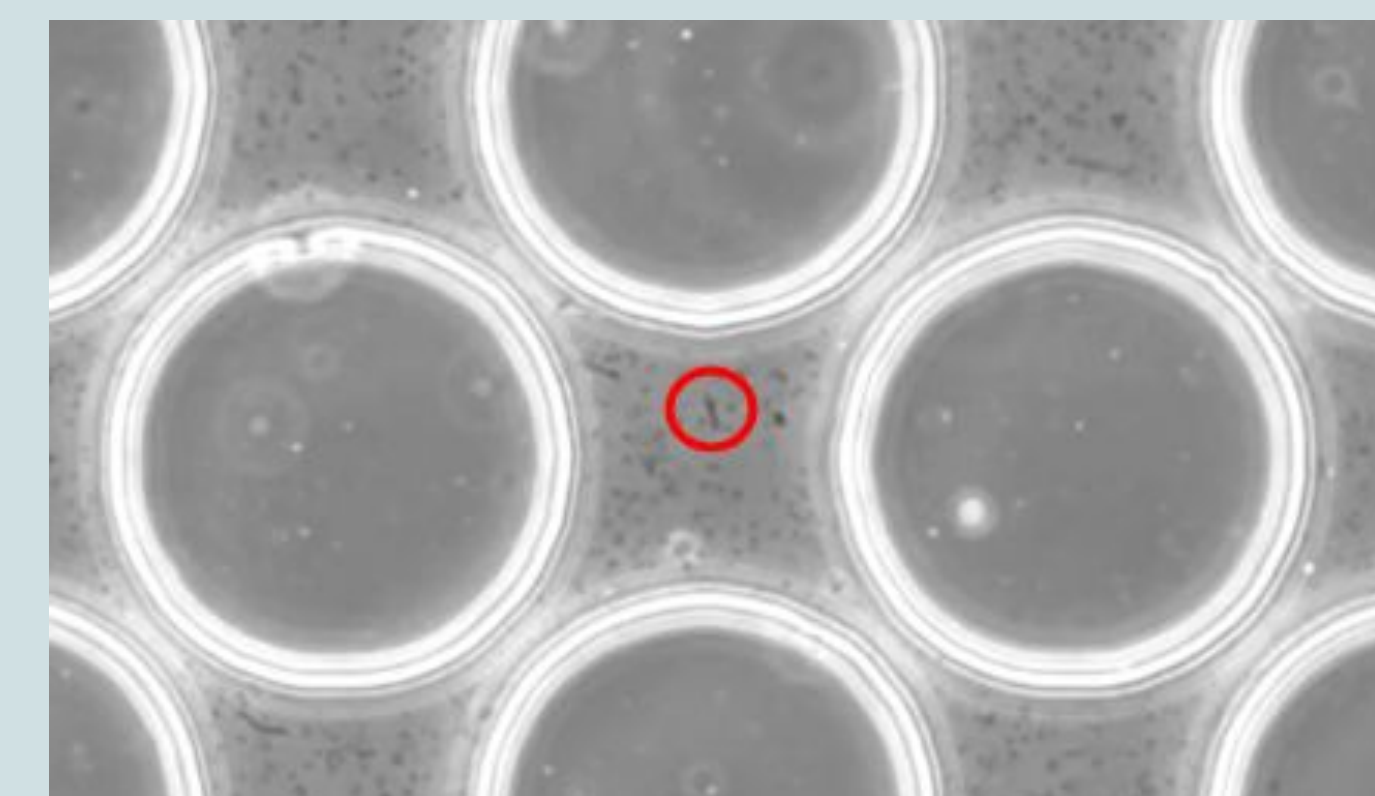


Figure 2, 45:00 minutes elapsed 10g/L NaCl

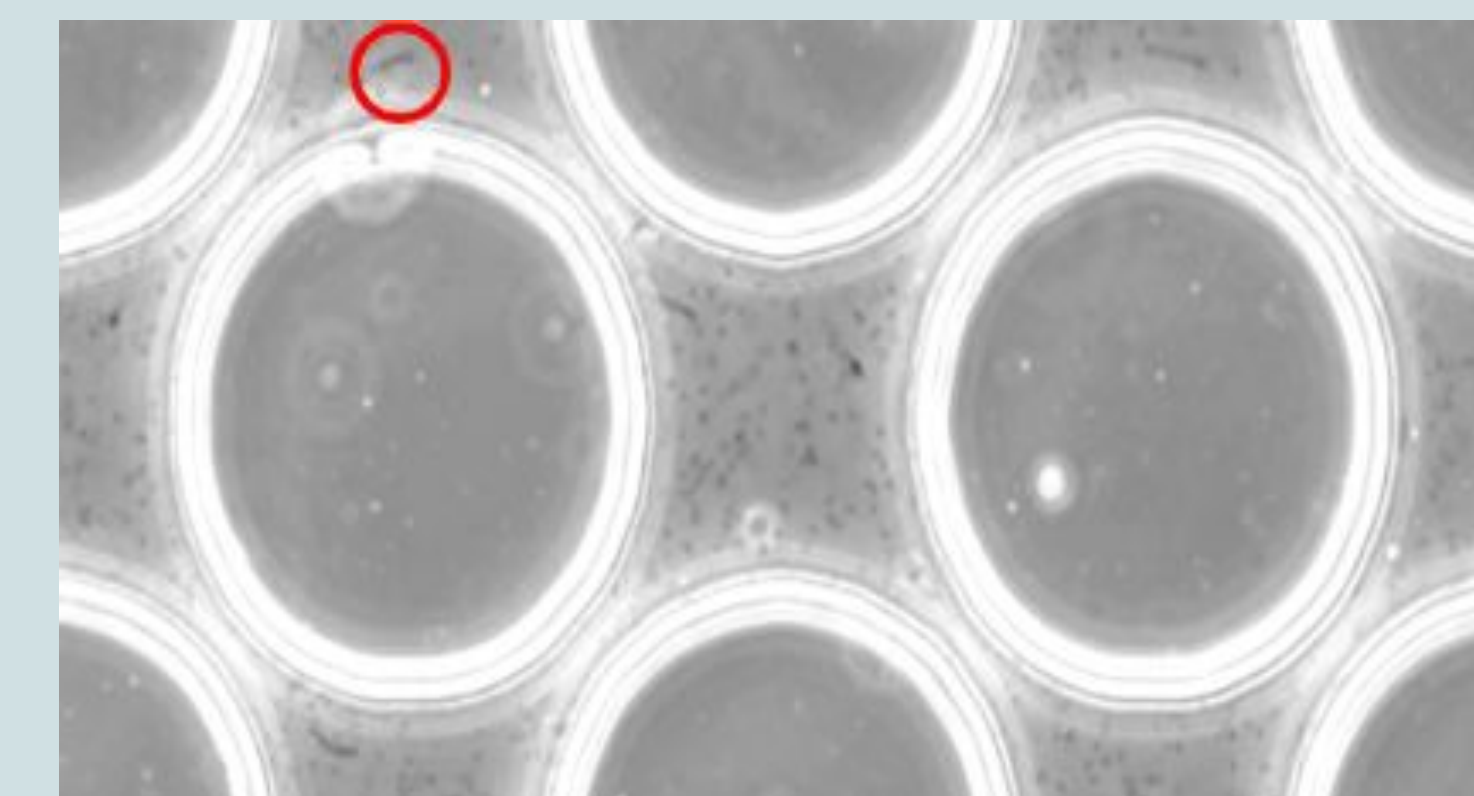


Figure 3, 60:00 minutes elapsed 10g/L NaCl

Overview

In this study, various species of bacteria are being tested to see if they can precipitate Struvite in saline water.

- to evaluate if bacteria are a viable solution to increase efficiency of desalination processes
- findings of study will potentially influence
 - solution to the issue of freshwater scarcity
 - Globally and regionally

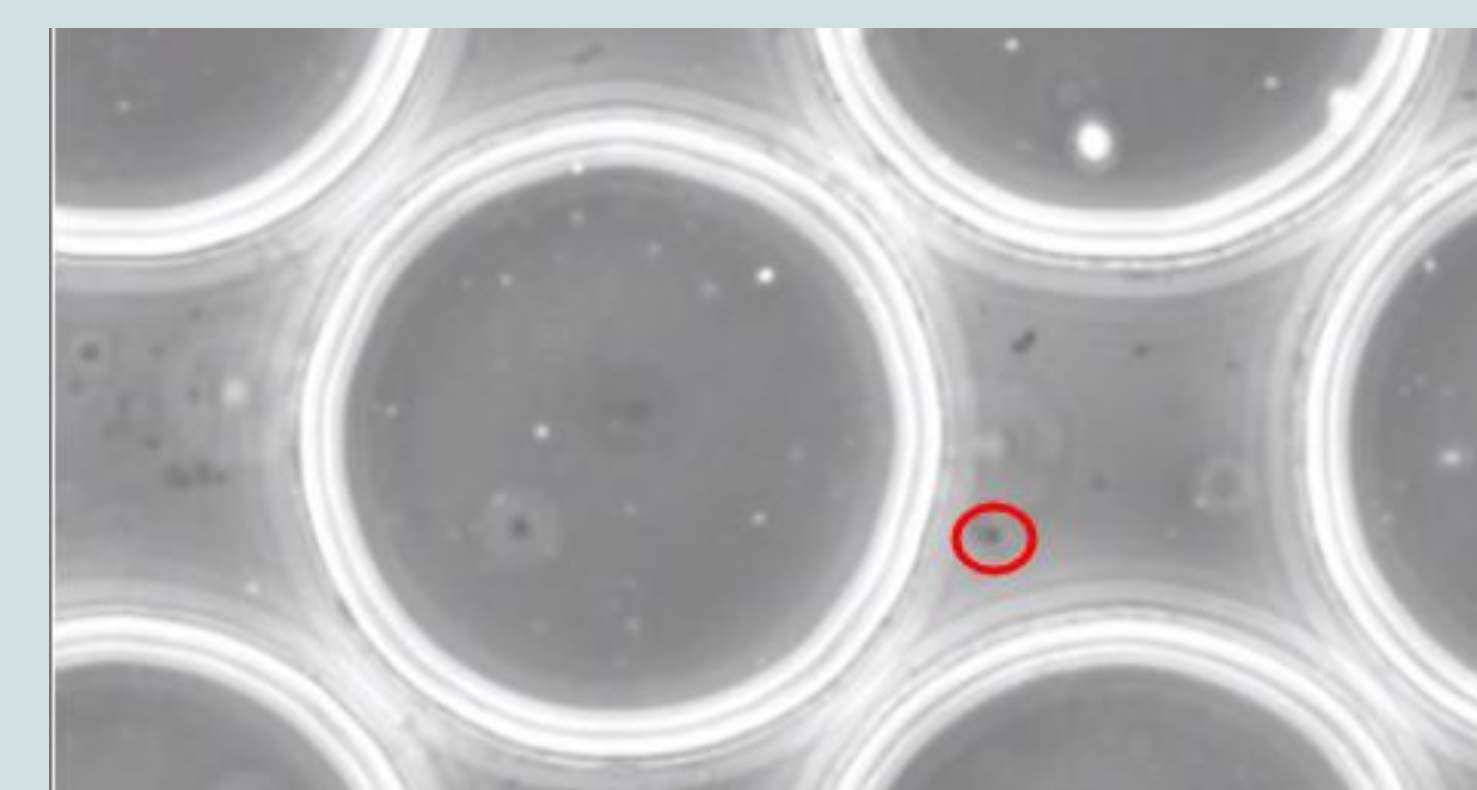


Figure 4, 45:23 minutes elapsed, 5g/L NaCl

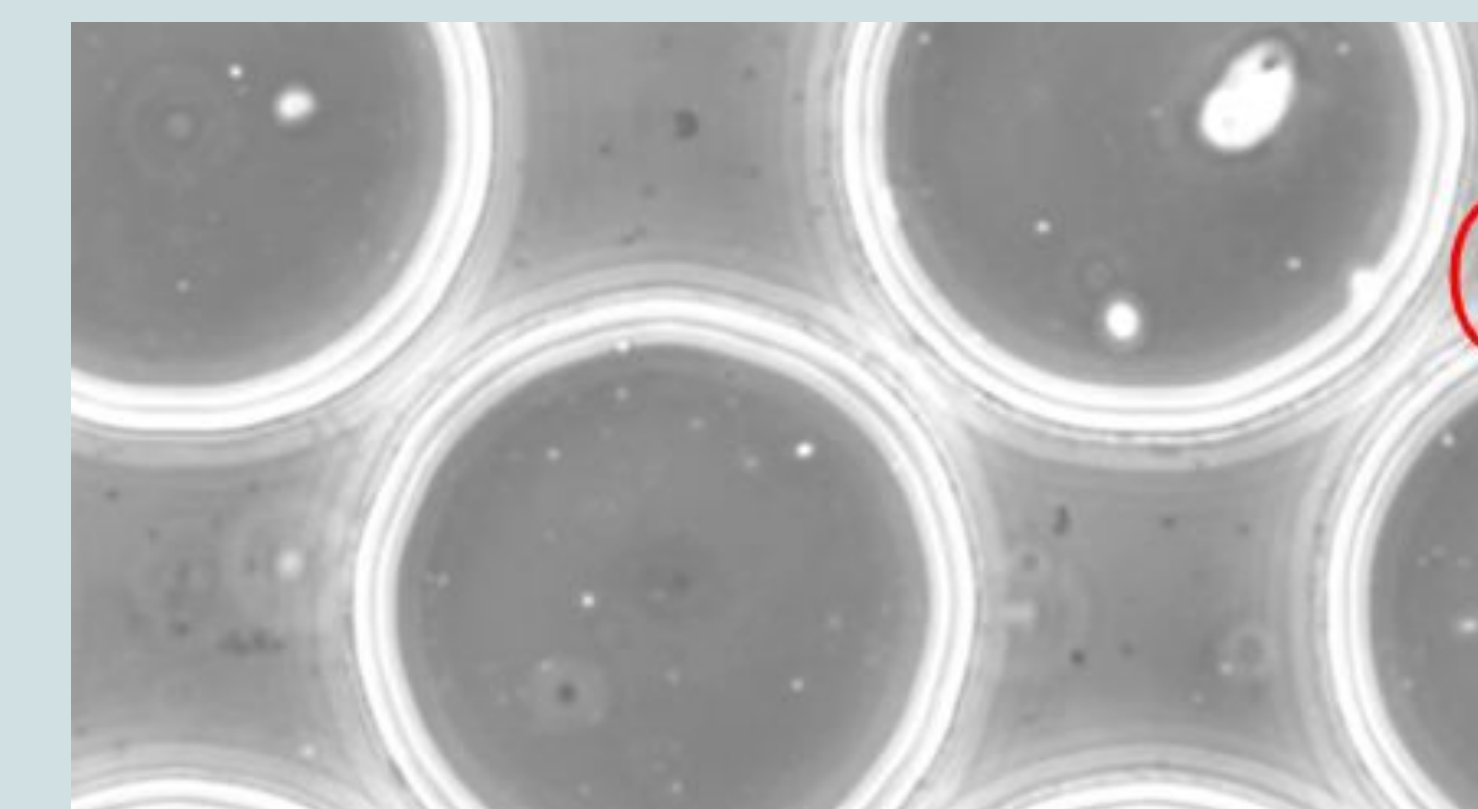


Figure 5, 60:00 minutes elapsed 5g/L NaCl

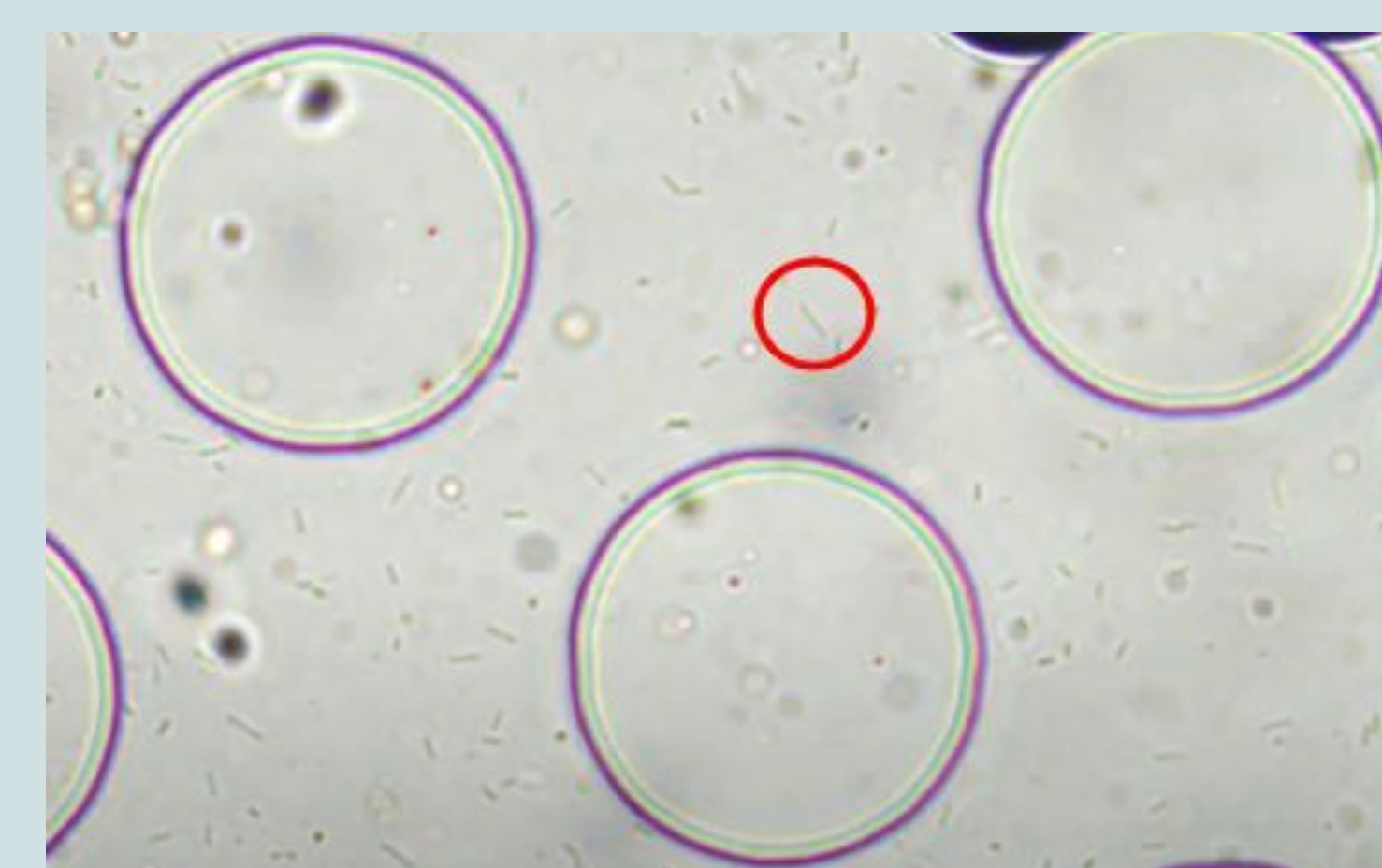


Figure 6, 45:00 minutes elapsed, 2.5g/L NaCl



Figure 7, 60:00 minutes elapsed, 2.5g/L NaCl

Preliminary Results

Visualized results for

- halotolerance of E. Coli
- all four concentrations of NaCl
- Figures 2 and 3 show the movement of a single bacteria through micromodel in final 15 minutes of the experiment
 - shows E.Coli is capable of surviving 10g NaCl/L

Findings

- bacteria survived for full hour in each concentration
- E.Coli is likely to survive in conditions replicating seawater
- has the potential to desalinate it by precipitating Struvite



Figure 8, e.Coli body

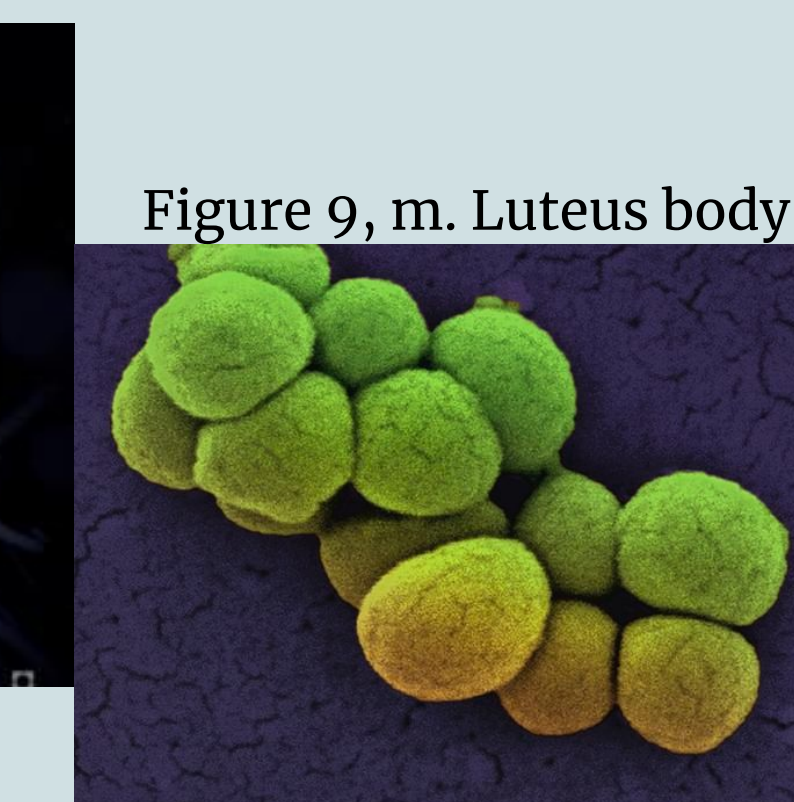


Figure 9, m. Luteus body

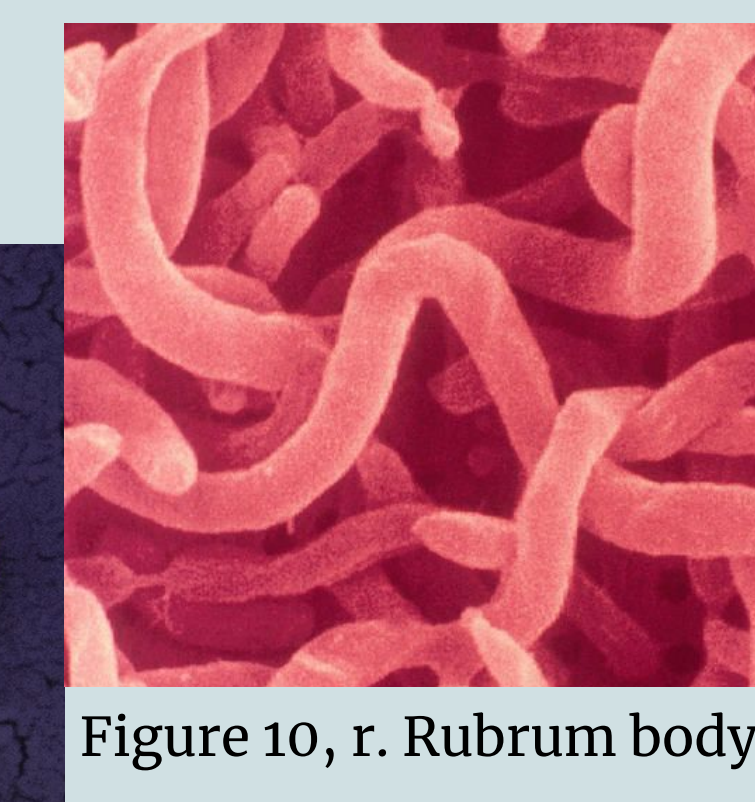


Figure 10, r. Rubrum body

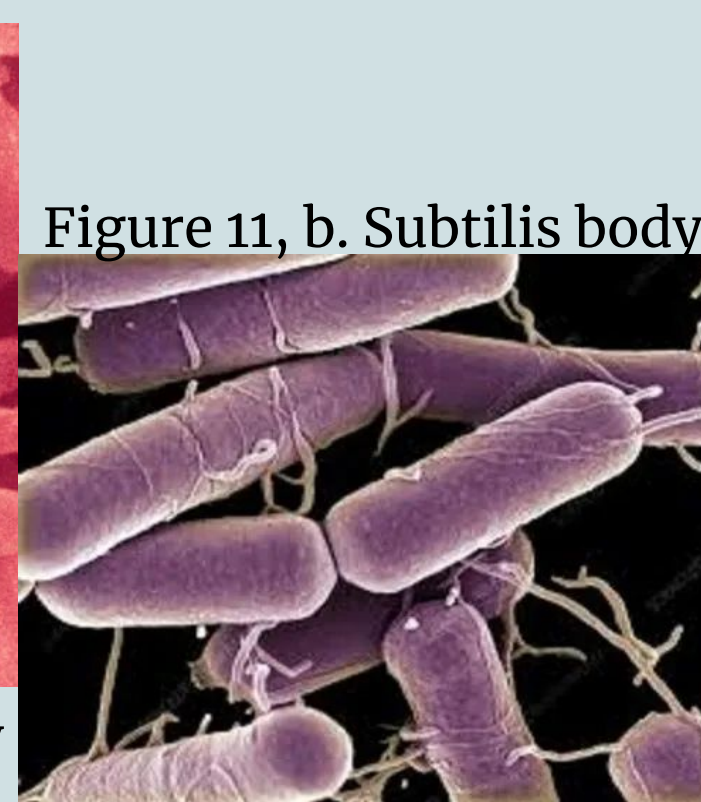


Figure 11, b. Subtilis body

Discussion

Significance of results

- E.coli is halotolerant
- moves freely throughout the micromodel
- supports objective
 - if bacteria survives these conditions, it can precipitate minerals in this environment

Next Steps

- other components can be added to the water
 - magnesium and phosphates
- steps will be replicated utilizing 3 other bacteria
 - each with a different body shape
 - difference of body shapes is to see if there will be change in movement and/or precipitation rates of minerals.

