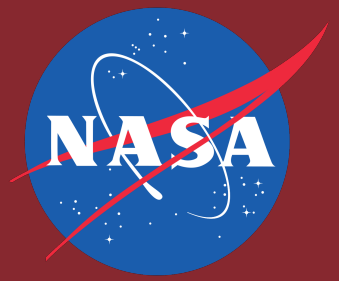
Growth of Arctic Sea Ice Algae in an Analogue of Icy Worlds

Student: Jonathan Durkin

Mentor: Susanne Neuer



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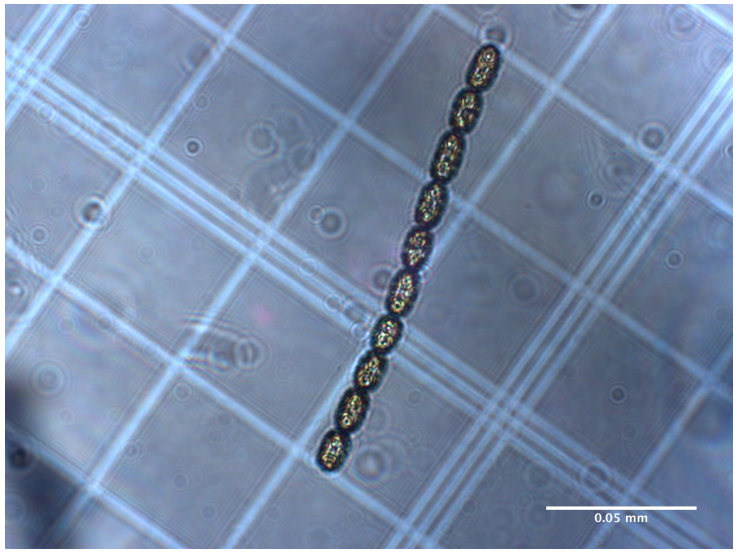
Introduction

Samples retrieved from ice near Barrow, Alaska.



- Arctic Sea Ice Algae: *Melosira arctica*
- Centric Diatom, creates energy via photosynthesis and is cornerstone of Arctic Food Web.
- By adjusting light, salinity and temperature, I am testing the limits of growth for *Melosira arctica.*

- *Gives insight into adaptability of life on Earth and credence of possibility of life on other icy worlds in solar system.*

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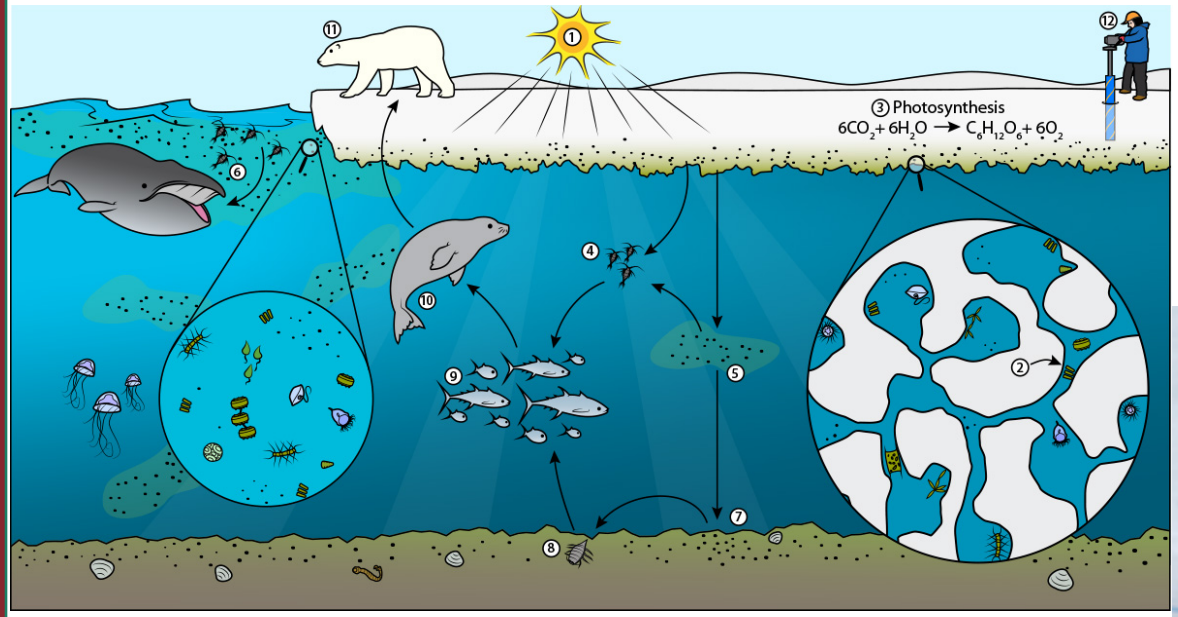
Land Fast Sea Ice Environment



Brine Melt Channels:
Melt in Spring -> More Fresh Water -> Less Salty Waters

Freeze over in Fall -> Brine Exclusion -> Saltier Waters

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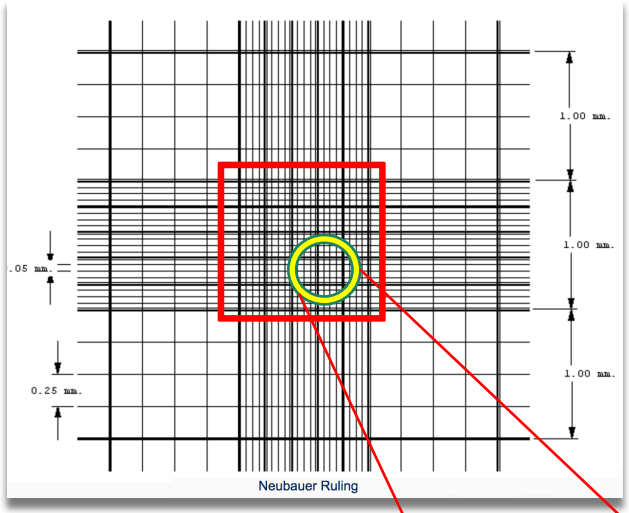
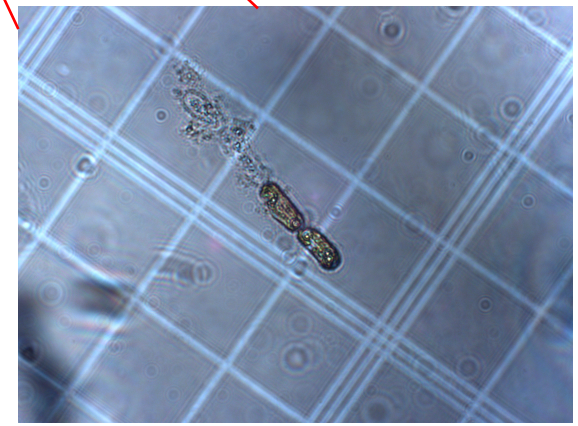
Experimental Setup and Methods





- Media made in sterile conditions using artificial seawater of varying salinities.
- Flasks placed in incubators of varying temperatures.
- Cells Counted under Zeiss microscope using Hemocytometer.
- Cell counts used to generate growth rates in Excel by using exponential growth rate formula.

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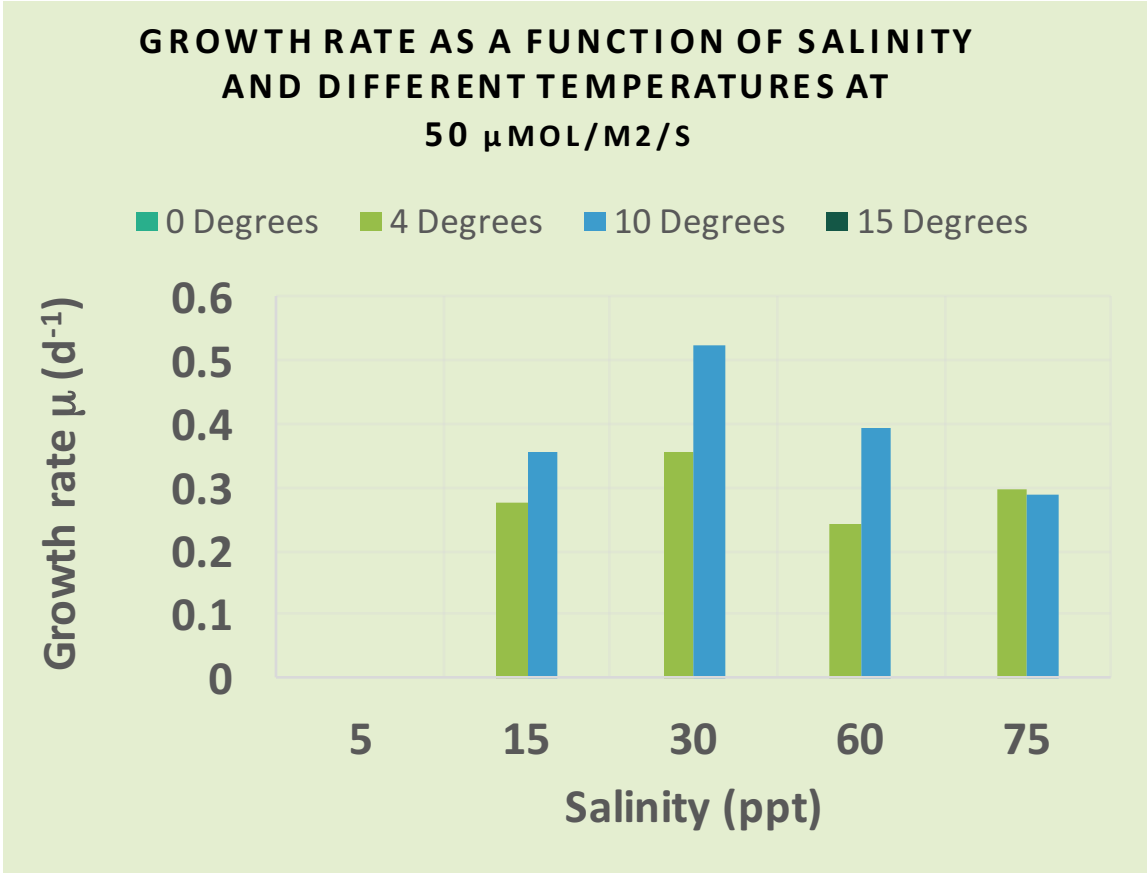
Results



Growth Rate (d^{-1}), By Temperature and Salinity

Salinity	0 Degrees	4 Degrees	10 Degrees	15 Degrees
S5	N/A	0	0	N/A
S15	X	0.28	0.36	X
S30	X	0.36	0.53	X
S60	To Do	0.24	0.39	X
S75	To Do	0.30	0.29	X

X – Survives but does not grow.

For Comparison

- Average Arctic Sea Water Temp: -1.8 ℃
- Average Sea Water Salinity: 35 ppt
- Cloudy Winter Day in Flagstaff:
  ~ 50 µmol/m2/s
- Bright Sunny Day in Tempe:
  ~ 2000 µmol/m2/s

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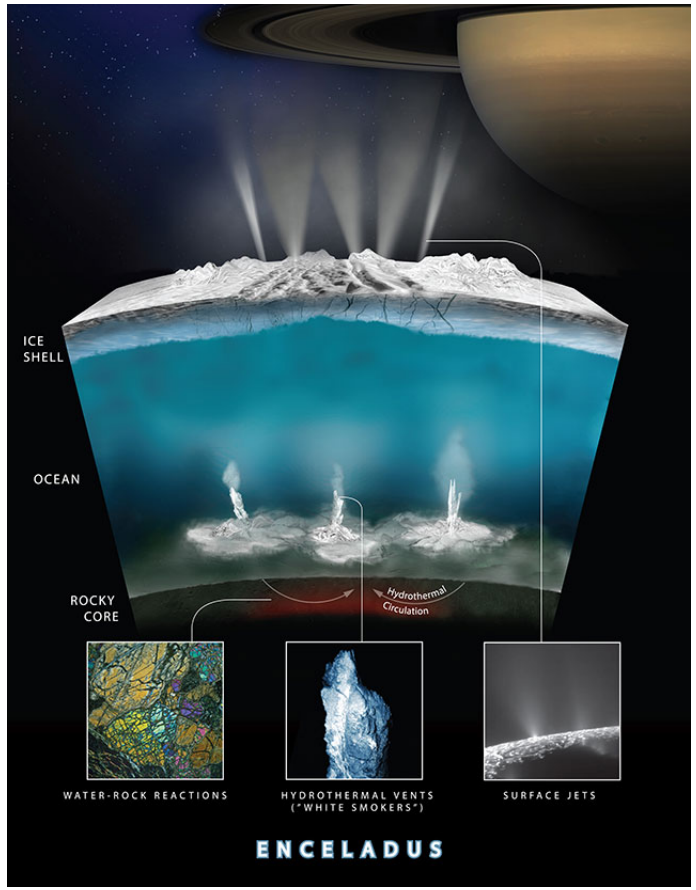
Icy World Analogue



- October 28, 2015: Cassini Fly-By mission revealed potential hydrothermal activity and ingredients for life on Encaledus.

- Ingredients for Life: Liquid Water + CHNOPS there

Encaledus vs. Arctic:

- Less Light, higher reliance on hydrothermal energy
- Methanogenesis vs Photosynthesis
- Encaledus 73.75 times dimmer than Earth
- 27 µmol/m2/s In Growth Range of Melosira arctica

Question Remains Open: *Given the adaptability of life on Earth to similar conditions, could there be life on an icy world such as Enceladus or Europa?*

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Potential Future Research

- Morphological Study

- Nutrient Limitation Study

- Europa Clipper

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Acknowledgements

ARIZONA SPACE GRANT

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Special Thanks to Dr. Neuer, Bianca Cruz, Jasmine Smalls and the rest of the Neuer Lab, Desiree Crawl, Dr. Sharp, Mom and Grandpa
and all the great teachers I've had along the way!

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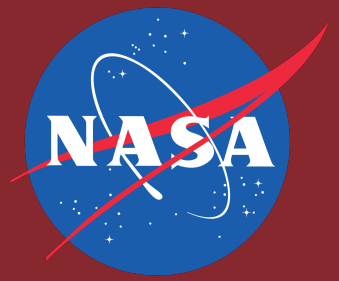
Questions?



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