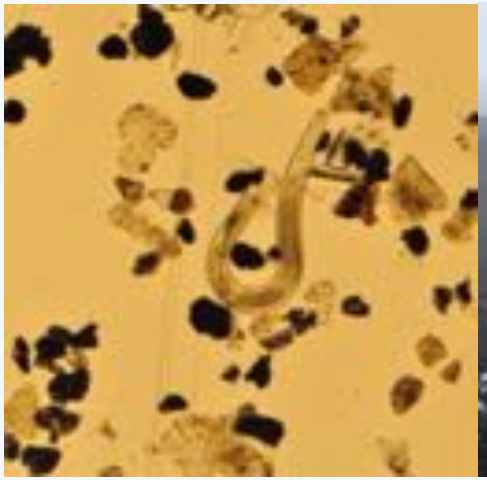
TEACHERS AND RESEARCHERS EXPLORING AND COLLABORATING

POLAR TREC

# Welcome to *PolarConnect*



## Tough Tardigrades

**With PolarTREC Teacher Josh Heward &**

**Antarctic Researcher Dr. Byron Adams**

**24 January 2017**

# Getting to Know Adobe Connect

Slides will be shown here

Exit presentation

Mute your speakers

Raise your hand

List of all participants

Follow the chat

Find out more about the presentation

Chat here

# Participant Introductions

**In the Chat box, please introduce yourself by typing in your:**

- ✓ Name
- ✓ School or Institution
- ✓ The number of students and adults participating with you in the same location

# What is PolarTREC?

- Since 2004, the Arctic Research Consortium of the United States (ARCUS), a non-profit organization, has been administrating the PolarTREC Program.

- PolarTREC is professional development for K-12 teachers. They are paired with researchers for 2-6 week research experiences in the polar regions.

- Over 150 teachers from around the United States have joined scientists in the Arctic and Antarctica to learn about science, the polar regions, and to share what they have learned with their students and communities.

ARCUS
ARCTIC RESEARCH CONSORTIUM OF THE UNITED STATES

*25 Years of Connecting Arctic Research*
*www.arcus.org*

# PolarConnect: Tough Tardigrades and Life in the Dry Valleys of Antarctica

with Josh Heward and Byron Adams

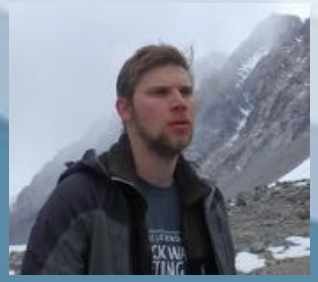
# Meet the MCM LTER Soil Team

Ross Virginia

Diana Wall

Byron Adams

Jeb Barrett



Andy Thompson

Ashley Shaw

Scott George

Walter Andriuzzi

Matt Hedin

Josh Heward

# Getting to McMurdo

# LC-130 and Ivan the Terra Bus

The flight from Christchurch, New Zealand to Williams "Willy" Field is 7-8 hours


Ivan the Terra Bus is our transport from Willy Field to town. The trip is only about 6 miles but lasts more than 30 minutes.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# McMurdo Station: Home to ~ 1000

# We Work in the McMurdo Dry Valleys

# Helicopter Ride to the Dry Valleys

- Two types of helicopters: Bell 212 and A-Star

- 40 minute flight to the Dry Valleys


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Taylor Valley

# Taylor Valley

# Field Camps

Camp at Lake Hoare in Taylor Valley

Camp at F6 near Lake Fryxell

# Collecting Soil Samples

Collecting soil in the Dry Valleys requires simple tools like scoops, spoons and plastic bags.

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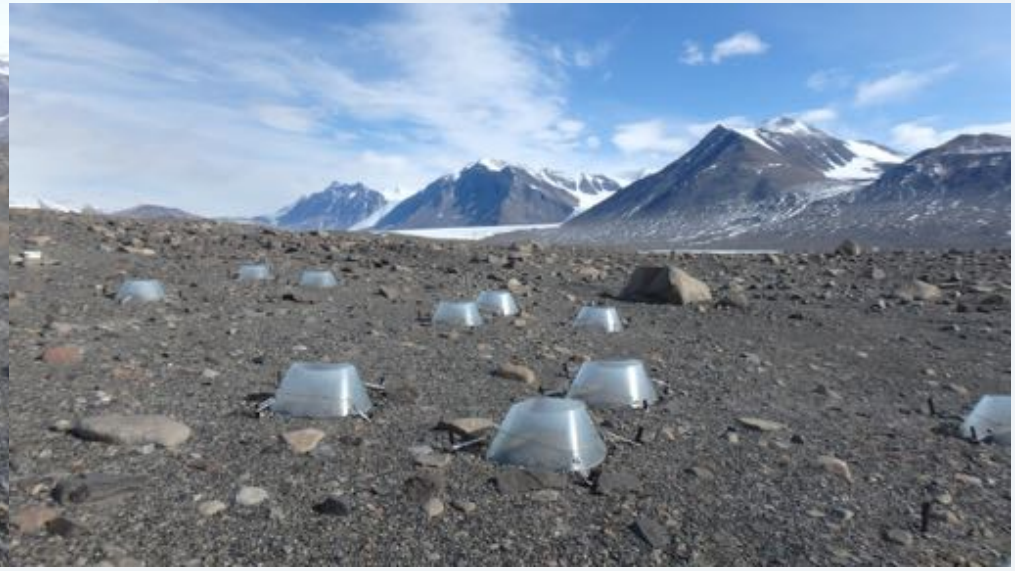
# Experimental Manipulation



Soil Plots are manipulated for some experiments. Here Nitrogen is being added to the soil.

These ITEX chambers (plastic cones) are used to warm the soil. They are like tiny greenhouses.

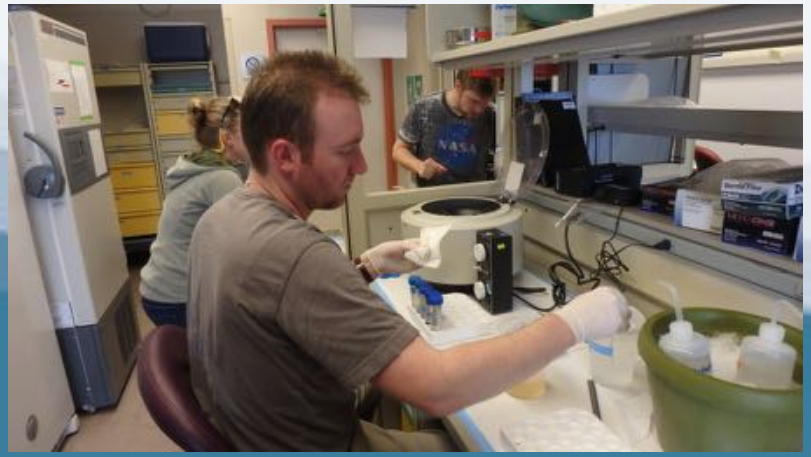
# Lab Work

Partitioning soil samples:

1. Soil moisture
2. Soil chemistry
3. Animal extraction
4. Archived sample

Sieves are used to separate animals from
soil particles that differ in size from the animals


A sugar solution and a centrifuge are used to separate the animals from the soil particles of similar size.

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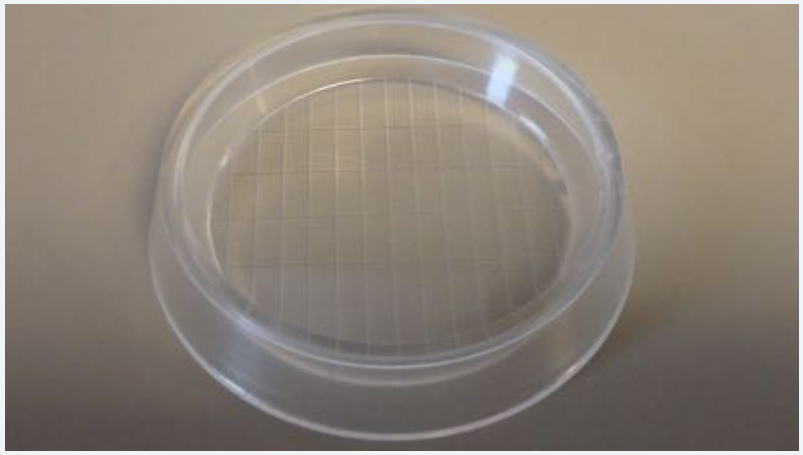
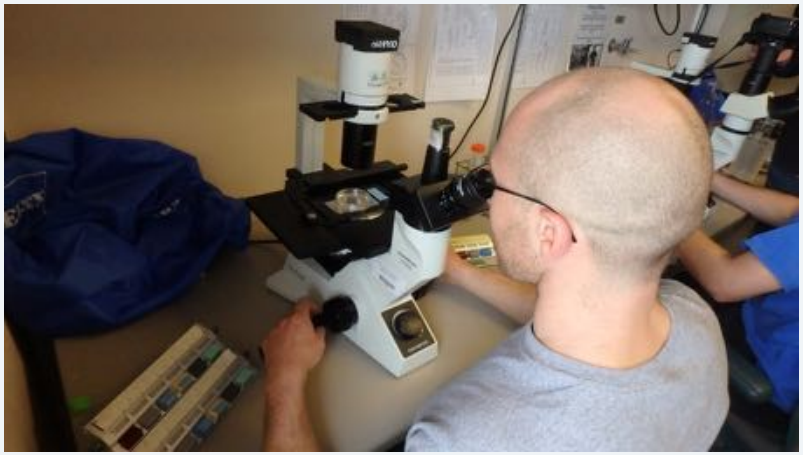
# Lab Work

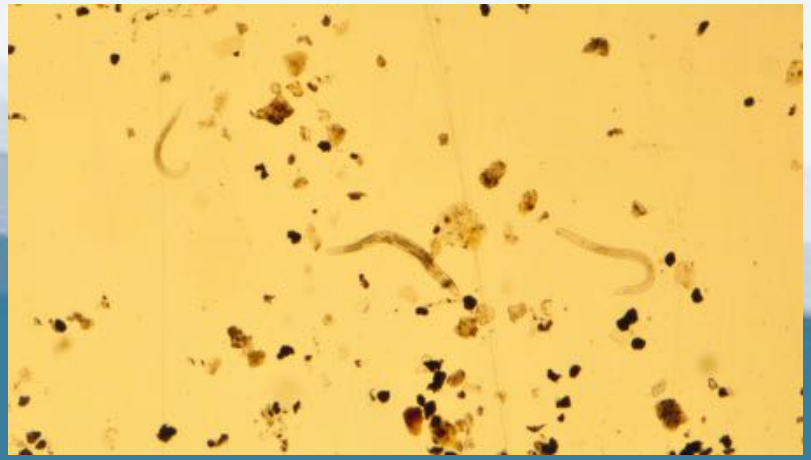
Extracted animals are poured into a counting dish like this one.



Using a microscope and a tally recorder each animal is counted.



Animals are counted by species, life stage and sex. Here you can see three *Scottnema* nematods: a juvenile, an adult female and an adult male



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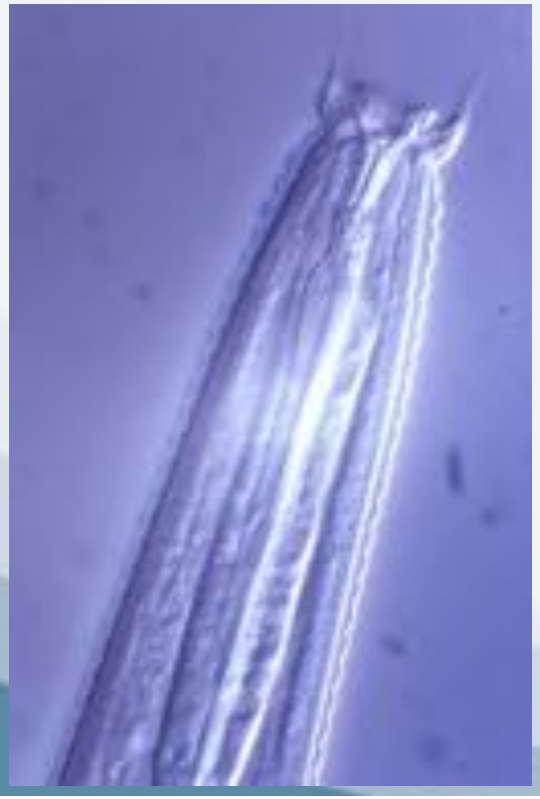
# Dry Valley Animals



*Scottnema lindsayae*
Microbial feeder

*Eudorylaimus antarcticus*
Predator

*Plectus antarcticus*
Bacterial feeder

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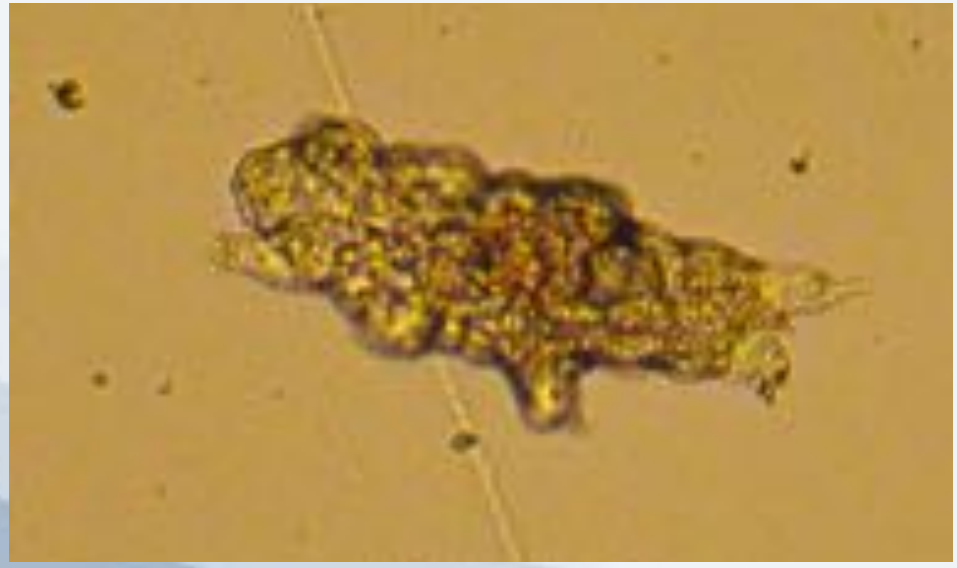
# Dry Valley Animals

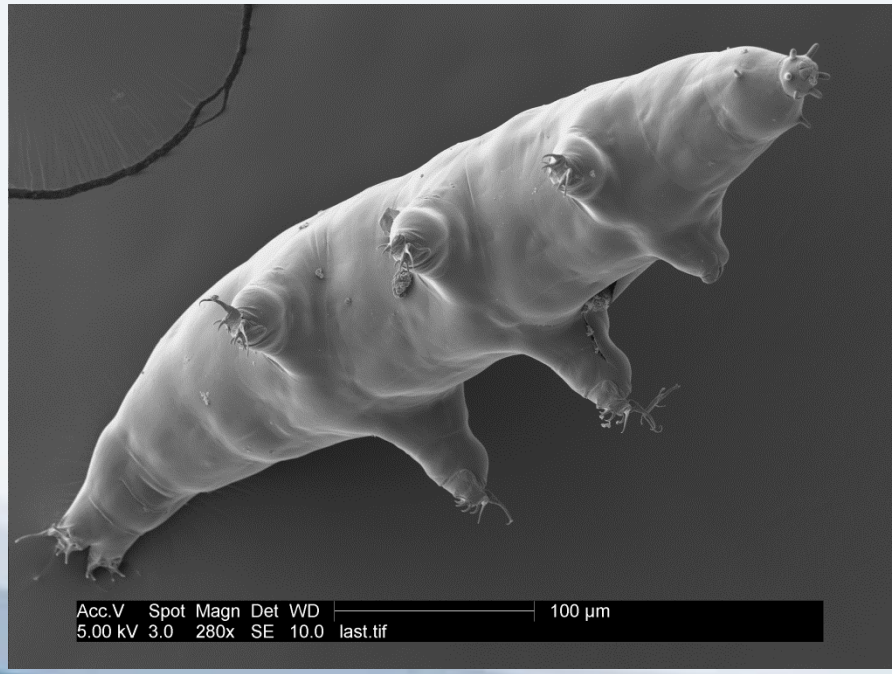


*Acutuncus antarcticus*
microbe, algal feeder

*Philodina sp.*
microbe, algal feeder

# Life is Tough in the Dry Valleys

- The Biggest Challenges
  - Freeze-Thaw Cycling
  - Desiccation
  - Salt Accumulation
  - Nutrient Availability

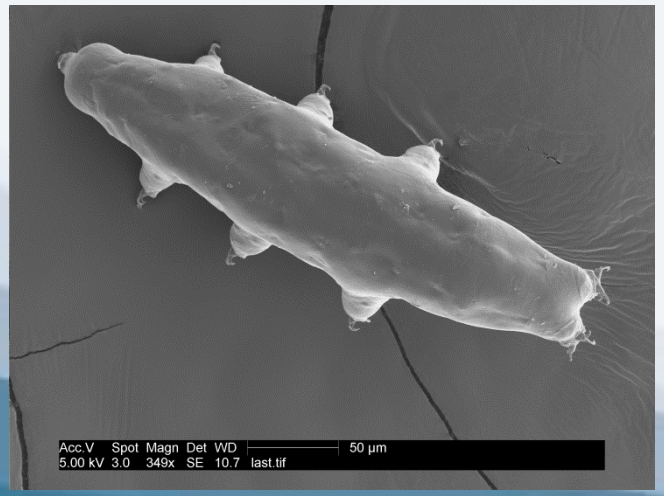



*Milnesium* sp.

# Cryptobiosis

- Cryptobiosis - a state where metabolism is suspended in order to preserve life until favorable conditions return

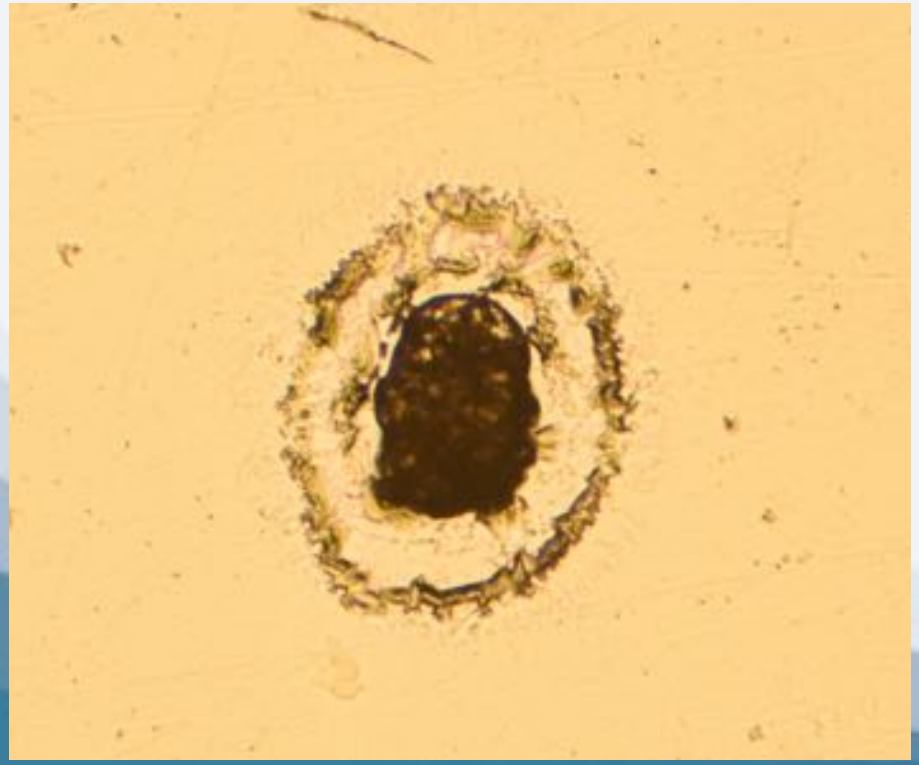
- Tun - the cryptobiotic state of a tardigrade where the animal withdraws into its protective cuticle.



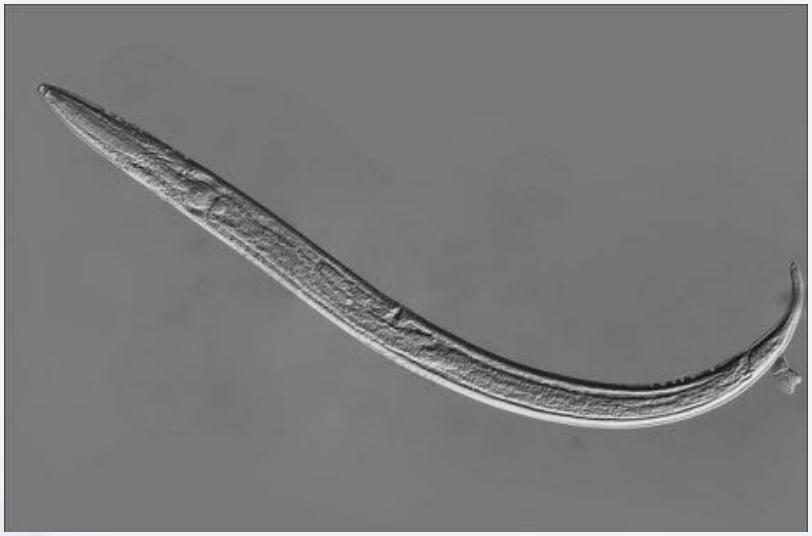

*Macrobiotus* sp.

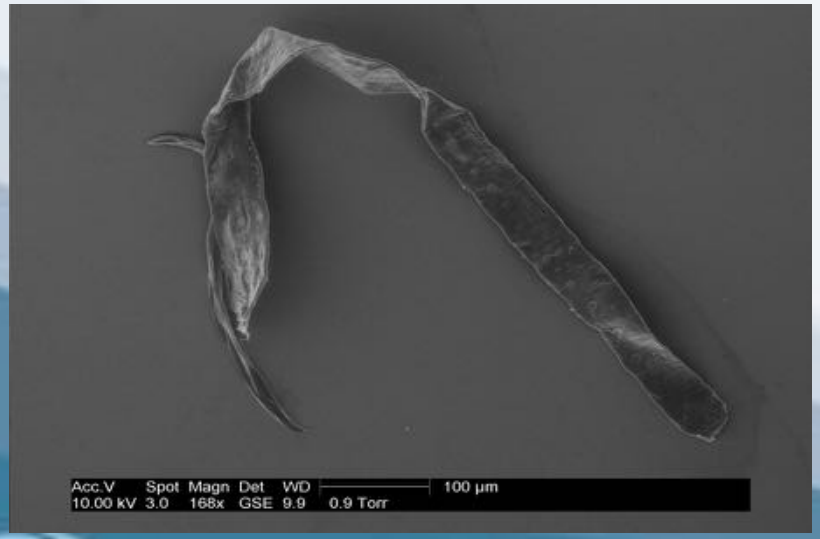
# Tun Formation

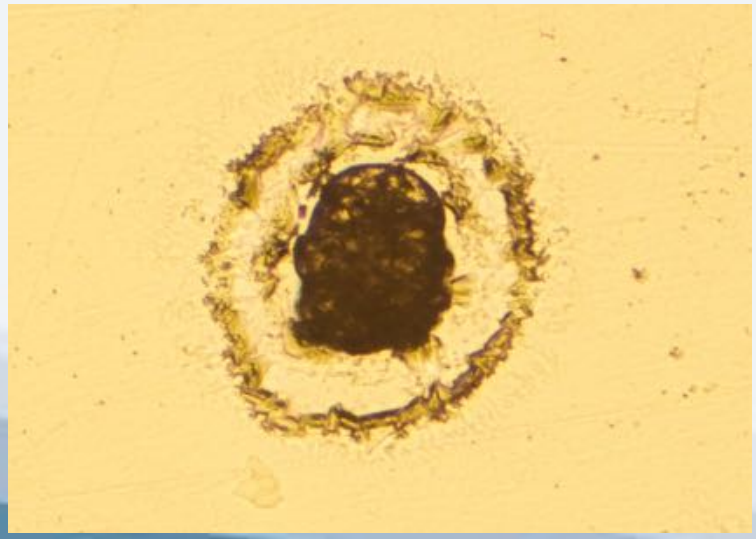
- Too Dry
- Too Cold
- Too Salty



# Living on Easy Street





# There Goes the Neighborhood

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# Cryptobiosis (Anhydrobiosis)

- Freezedrying = Lots of Cellular Changes
  - Antifreeze Proteins
  - Cryoprotectants
  - Aquaporins

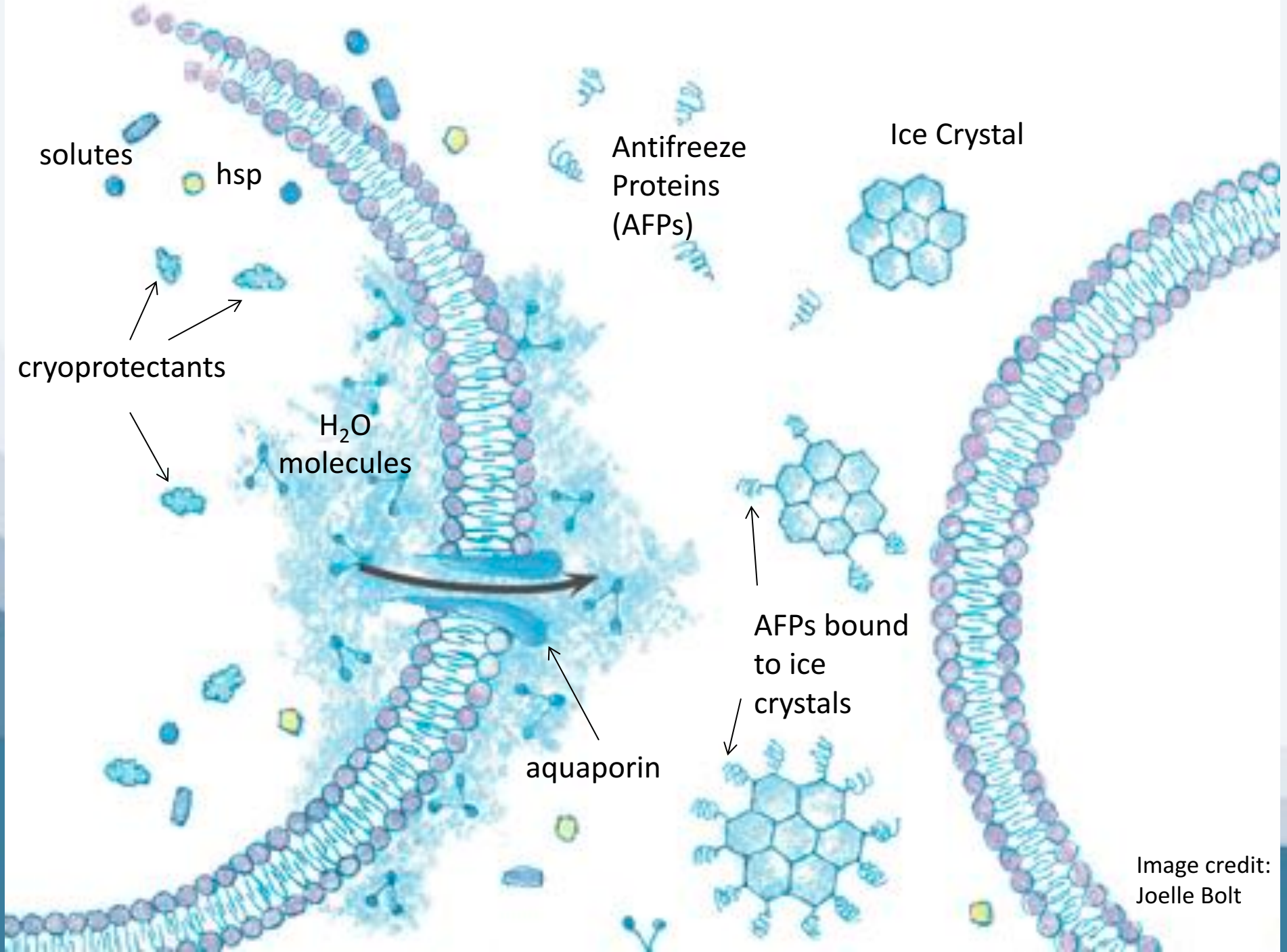


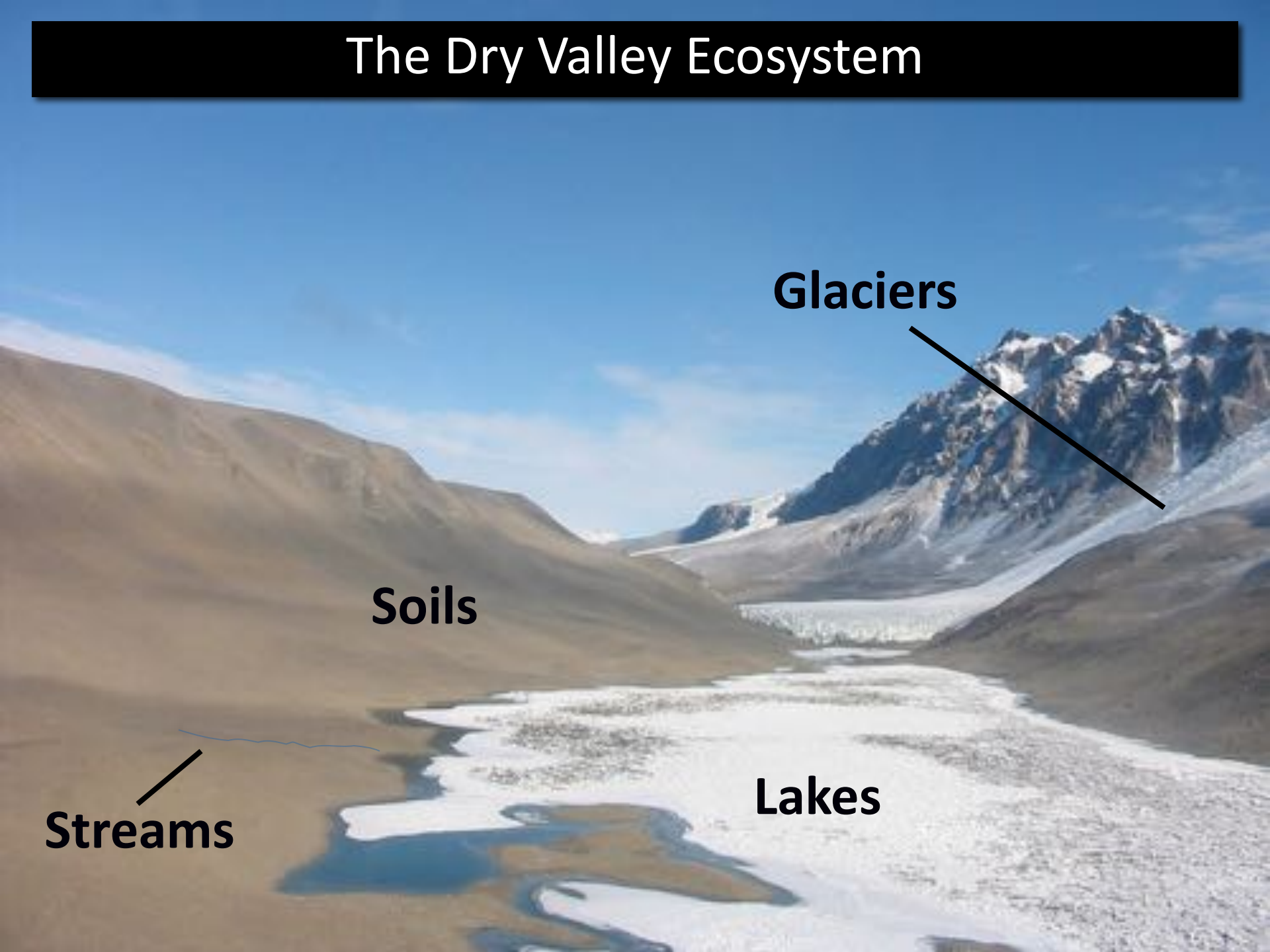

Image credit: Joelle Bolt

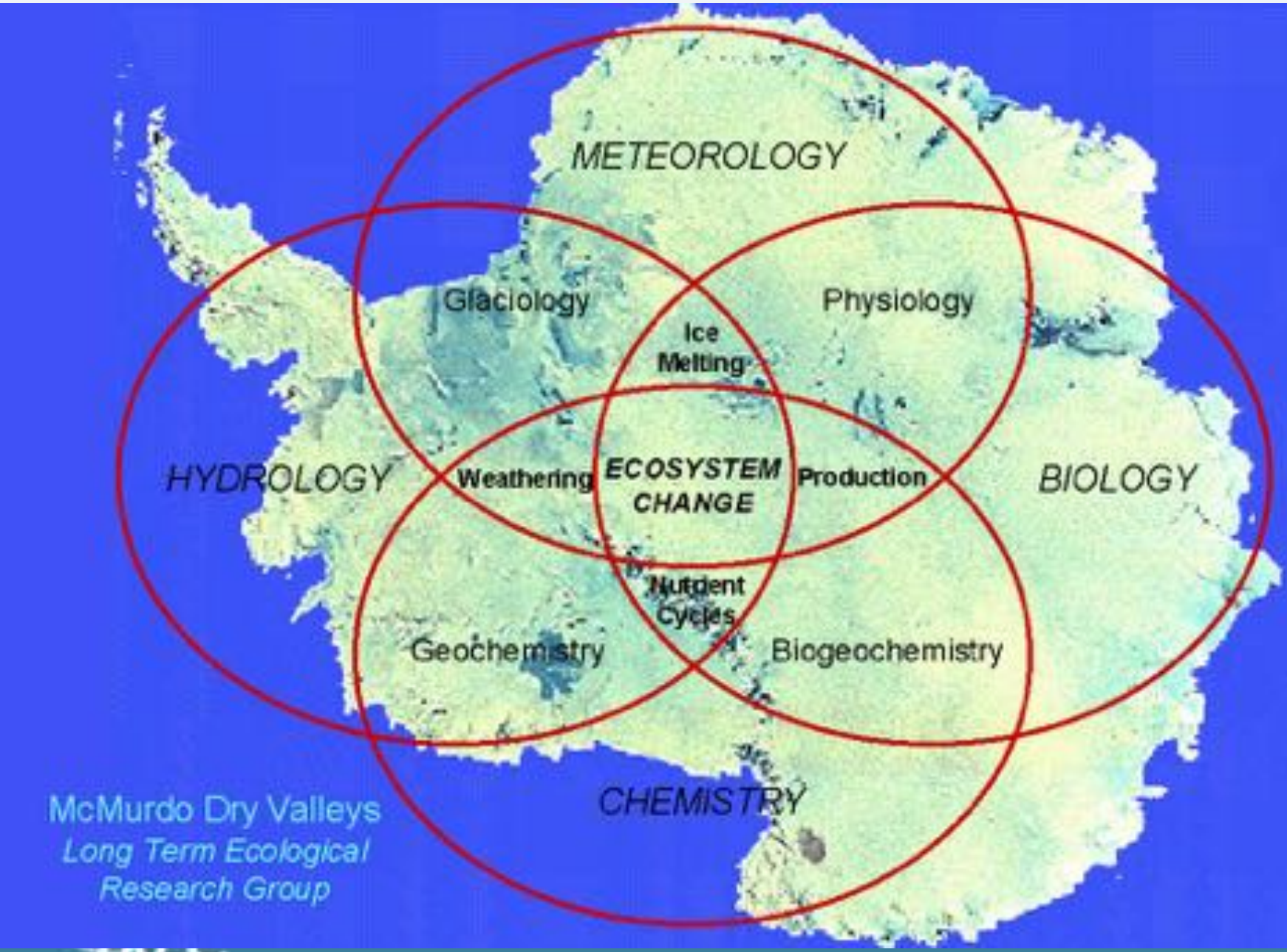
# Extreme Survivors

- Pressure
  - 600 MPa (87,000 psi)
  - Pure Vacuum
- Radiation
  - 5,700 grays of X-ray radiation
  - 7,000 grays of UV-A and UV-B
- Temperature
  - -200°C for 20 Months (-272°C for 8 hours)
  - 151°C
- Dessication
  - 10 years or more

http://visibleearth.nasa.gov/

# The Dry Valley Ecosystem




METEOROLOGY
Glaciology
Physiology
Ice Melting
HYDROLOGY
Weathering
ECOSYSTEM CHANGE
Production
BIOLOGY
Nutrient Cycles
Geochemistry
Biogeochemistry
CHEMISTRY
McMurdo Dry Valleys
Long Term Ecological Research Group

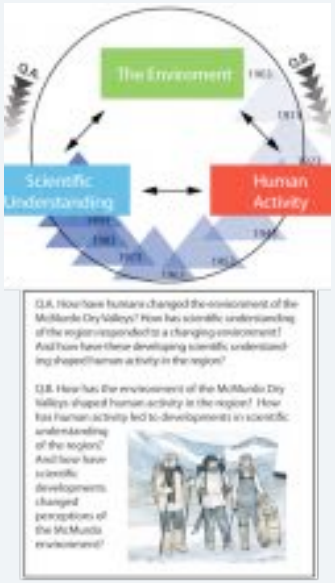
# McMurdo Long-Term Ecological Research (MCM LTER)

Glacier Hydrology and Mass Balance Research

Climate / Meteorological Research

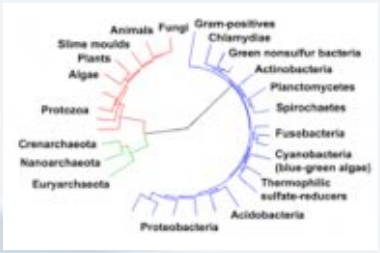
Stream Hydrology and Ecology

Limnology

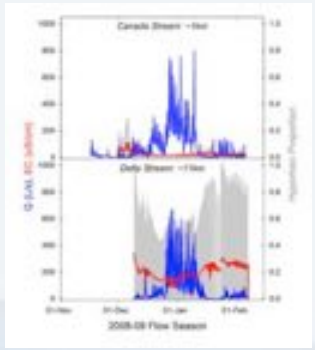



Environmental History

Soil Ecosystems




Molecular Biodiversity



Ecosystem Modeling

Photos Courtesy:
McMurdo Dry Valleys
*Long Term Ecological Research Group*

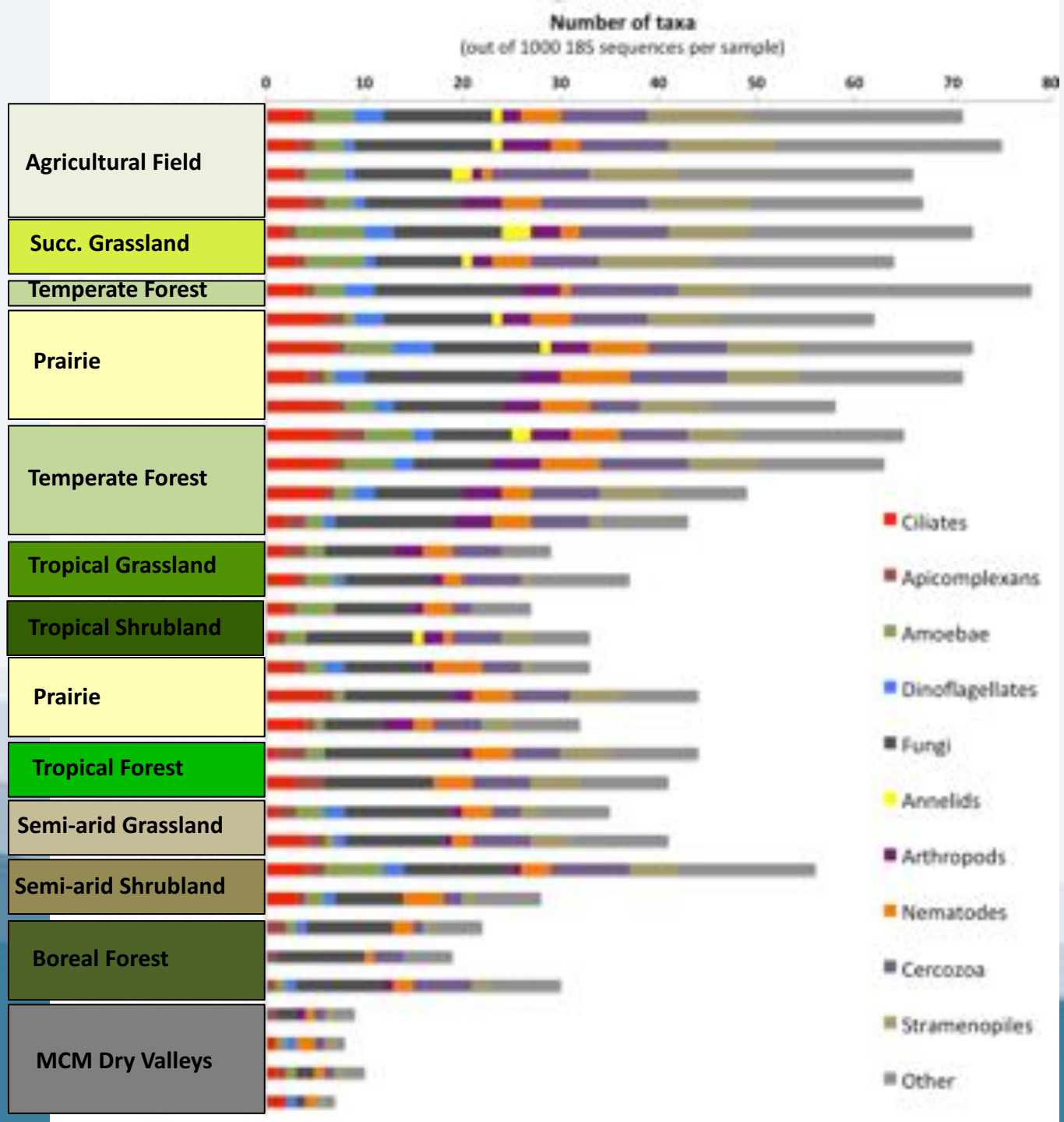
# Why do this research in Antarctica?

Comparison of Eukaryotic soil diversity

Number of taxa per sample based on taxonomic level (NCBI level 5)

Taxonomic units based on 97% sequence similarity

Noah Fierer
Unpublished Data



# Why Antarctica?

- Low biodiversity
- Human disturbance is minimal
- Environment can be manipulated
- Simple systems can be used to model and predict changes that might occur in more complex systems

# Thank You

- McMurdo Dry Valleys LTER
- National Science Foundation
- PolarTREC
- ARCUS

# Questions

## During the Presentation:

- Type your question in the text chat box

## At the End of the Presentation:

- Raise your hand with the "hand button".
- PolarTREC staff will call on you and activate your microphone.
- Speak loud and clear, directly into the computer microphone or the phone to ask your question.

# Join PolarTREC!

www.polartrec.com/about/join

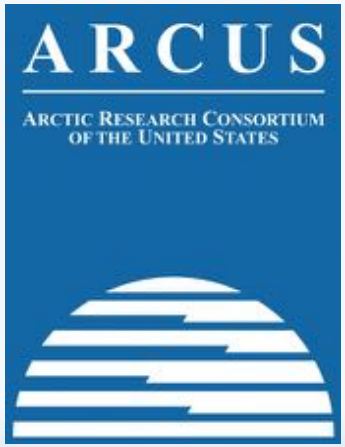
Everyone can participate in different ways:

- **Follow Expeditions**
- **Participate in PolarConnect Events**
- **Join the Polar Education Email List**
- **Check out the great resources**
- **Become a PolarTREC Teacher or Researcher**
- **Become a member of ARCUS**

# Thank You!

*An archive of the event will be available shortly.*

***http://www.polartrec.com/polar-connect/archive***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***www.arcus.org***