

# Atacama Desert as a Model for Hyper-arid Exoplanets

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# Introduction - Goals

**Question:** What might life be like on hyper-arid exoplanets and how might we find it?



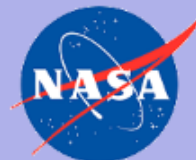
1.) Predict traits of extraterrestrial life



2.) Determine how life survives



3.) Develop working biosignatures



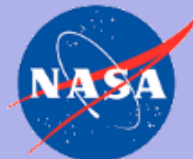


# Background – Why the Atacama?

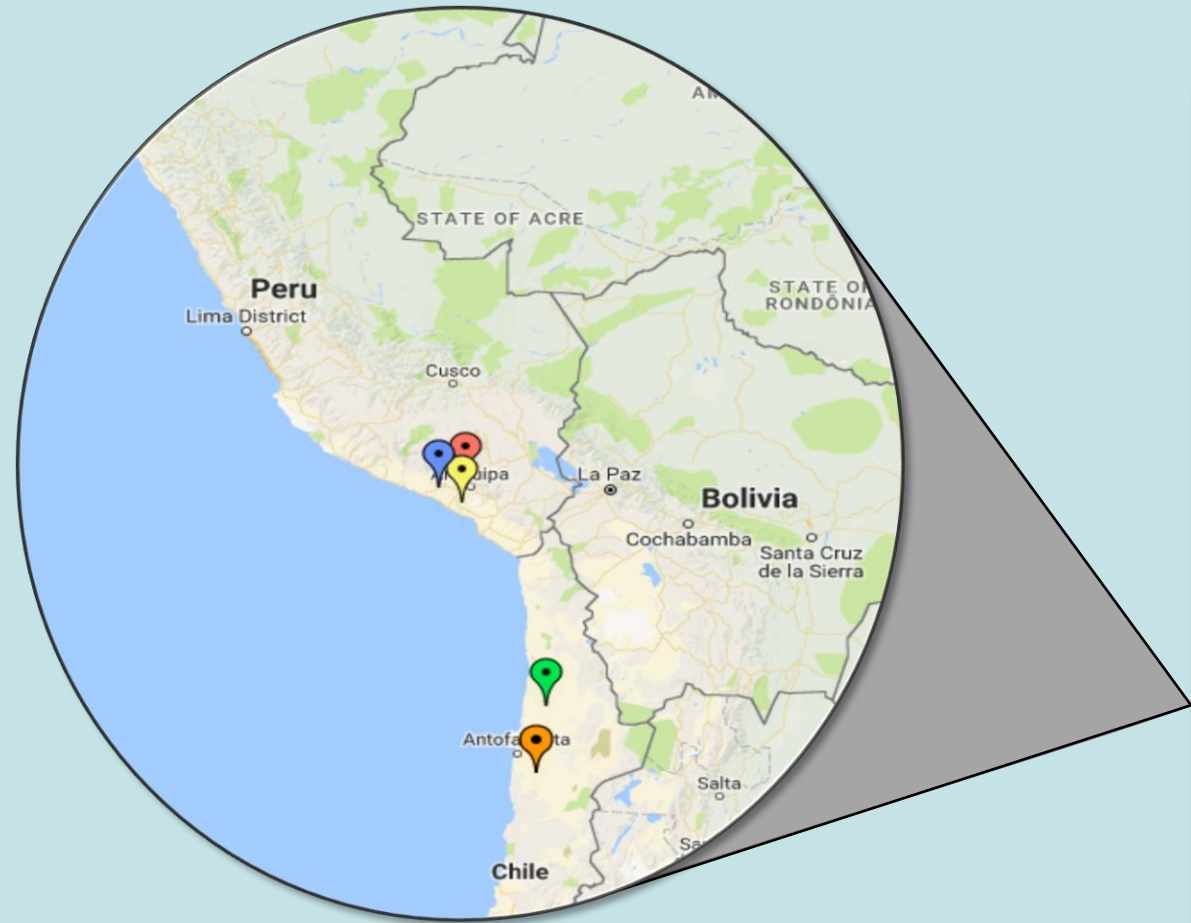


The Atacama is similar to the environments we are interested in

High UV Flux  
Minimal rainfall  
Cool temperatures  
Near absence of life  
Hostile soil conditions  
Oldest and driest desert on Earth

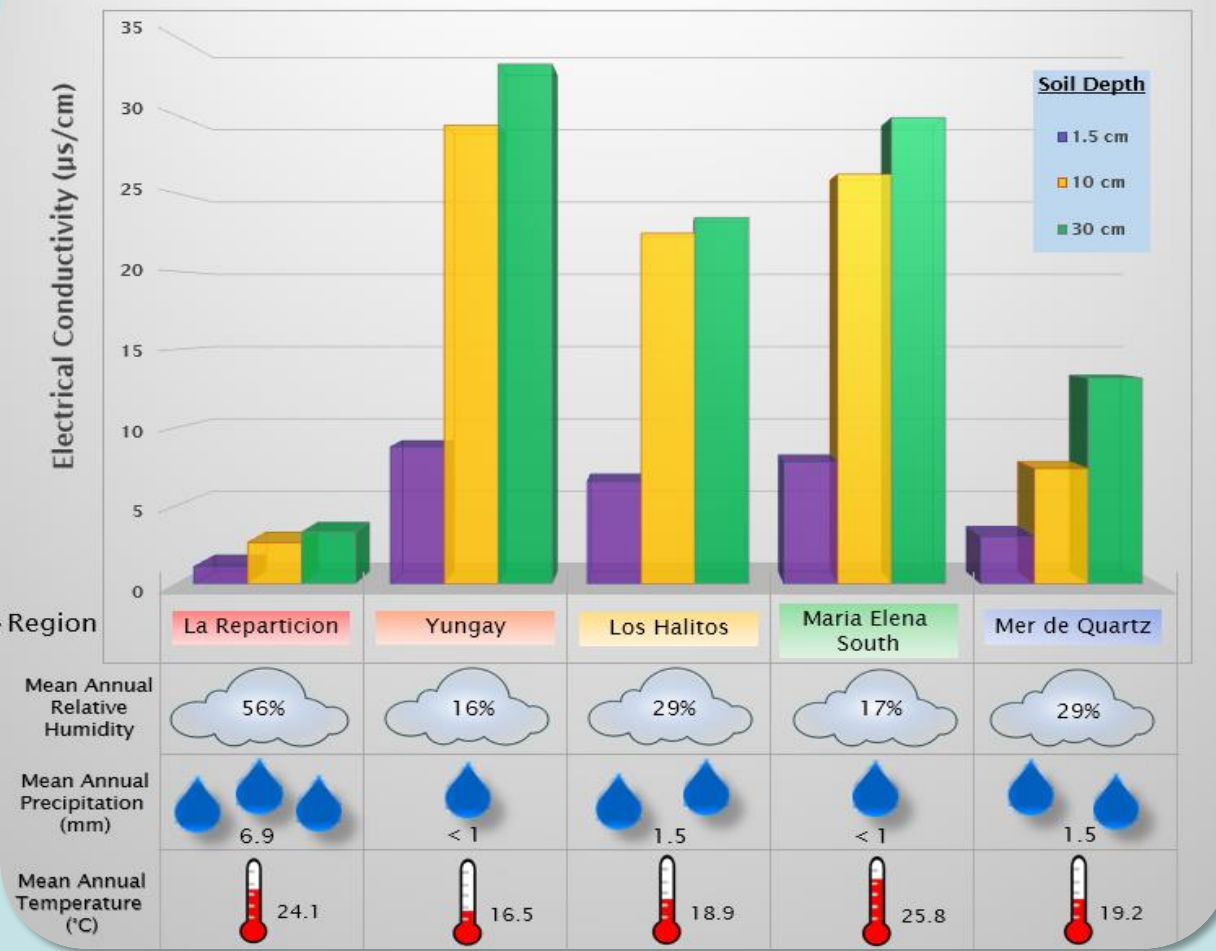


# Methods – Soil Collection & Analysis



Location of soil sites; color matches name in table to the right

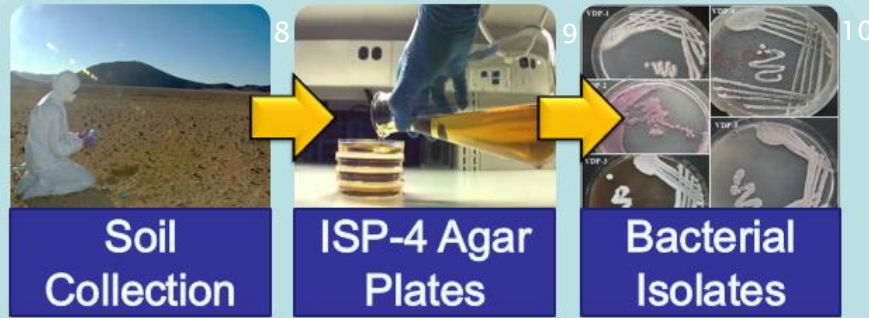
### Atacama Soil Characteristics by Region





# Methods – Isolates

## Phase 1



Isolate Growth

## Phase 2

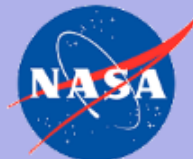


DNA Extraction

## Phase 3

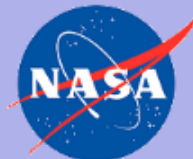
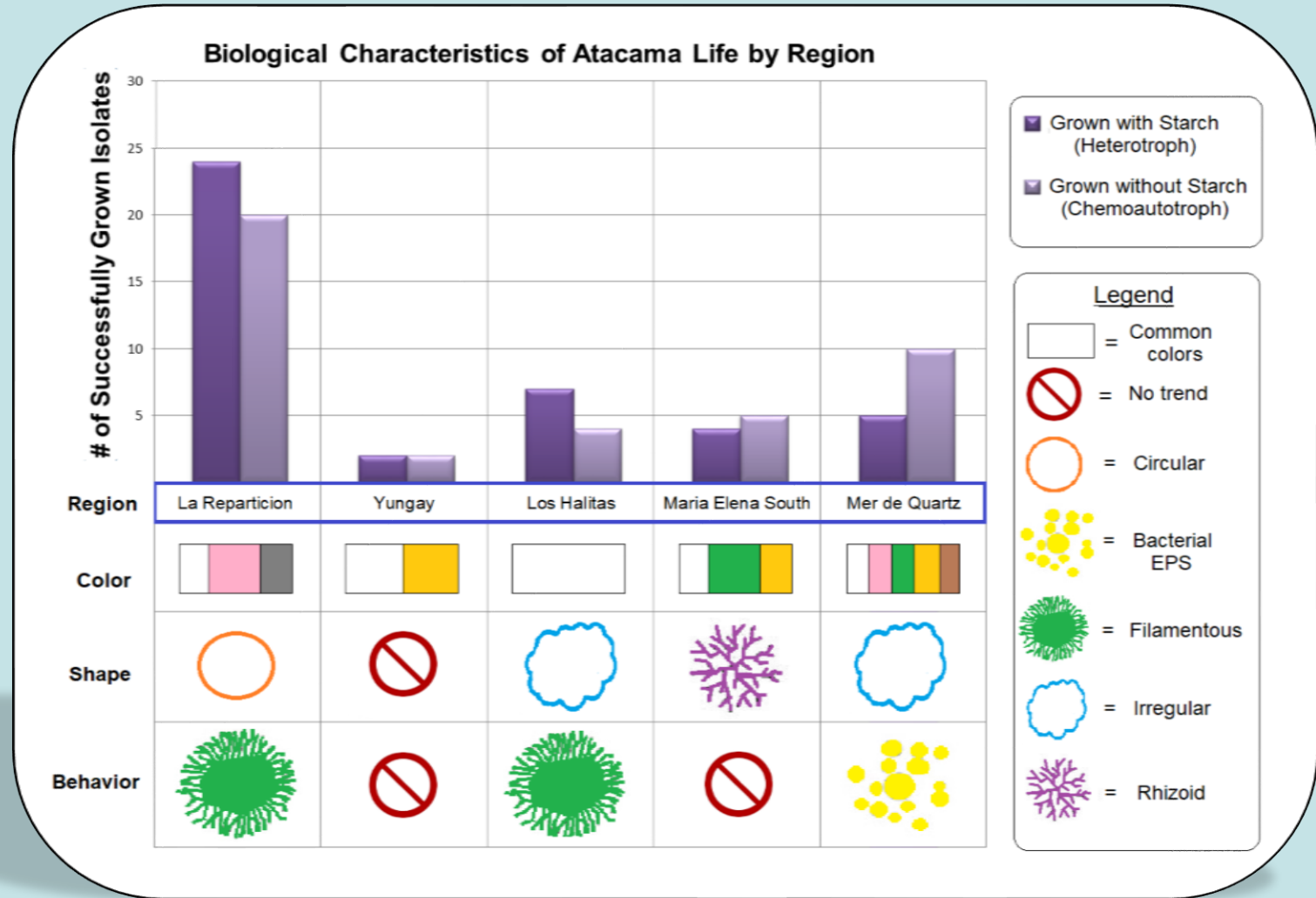


Replication & Analysis



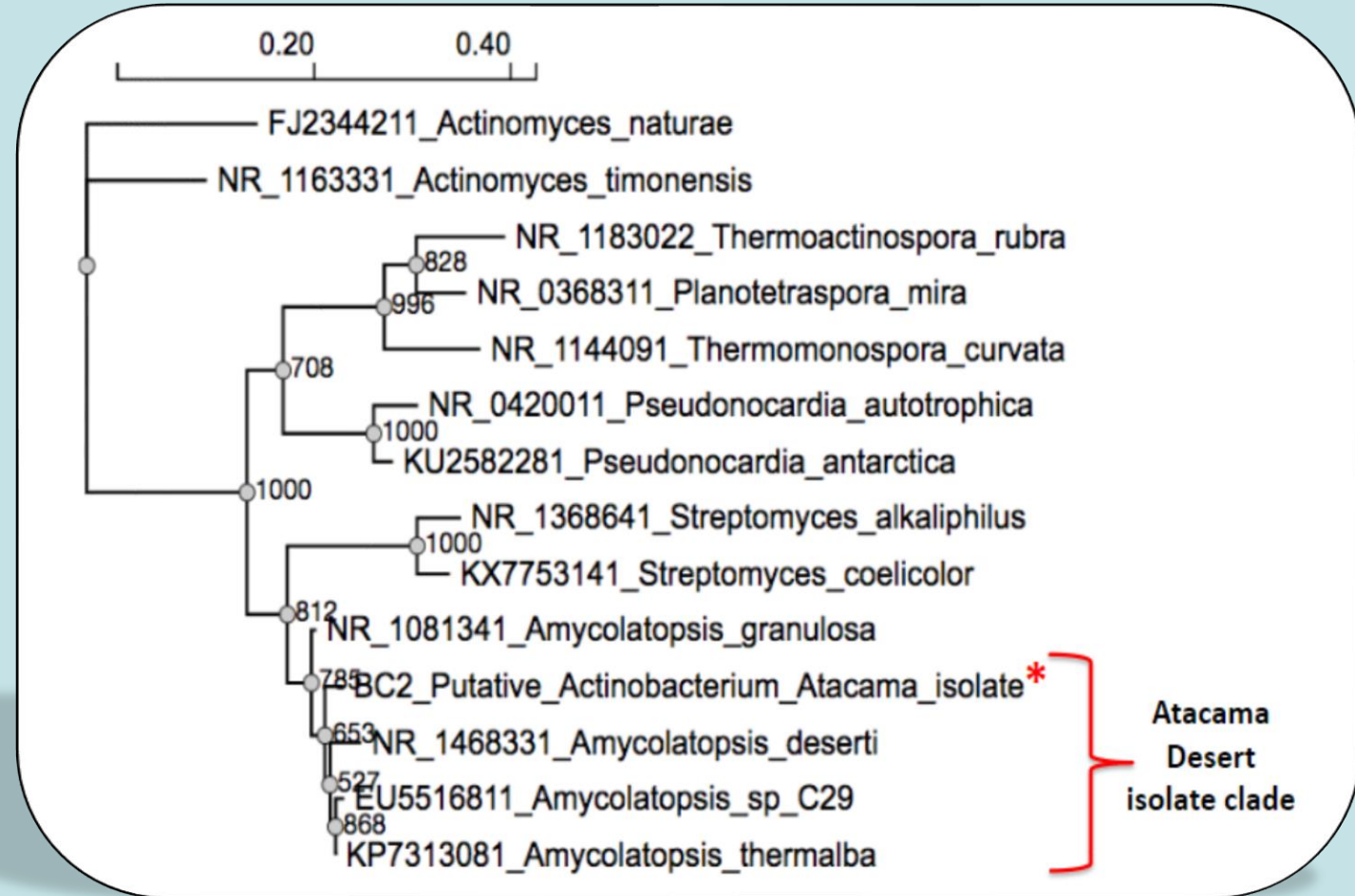
# Results & Discussion – Isolate Traits

- Higher annual precipitation results in more life
- More Chemoautotrophs than Heterotrophs
- Most isolates grew from surface soil



# Results – Biological Identity

- Similar to life found in other hyper-arid areas
- Part of Actinobacteria phyla
- Actinobacteria survive via atmospheric H<sub>2</sub>
- Potential C sources:
  - Carbon Dioxide
  - Carbon Monoxide



Phylogenetic tree of a single isolate compared to phyla with similar evolutionary relationships





# Conclusion – Next Steps

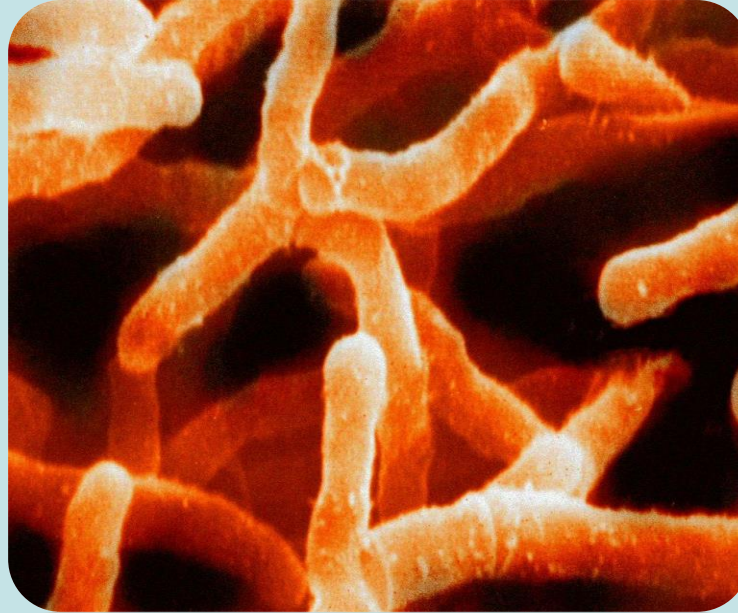
Data shows us what life might look like



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Need more of the DNA sequenced

How do these life forms survive?



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Analyze metabolic pathways

How can we find these life forms?



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Biosignatures produce false positives





# Acknowledgements

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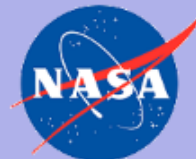
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A photograph of Earth from space, showing the blue oceans, white clouds, and dark landmasses. The Earth's horizon is visible in the upper right. The text 'THANK YOU' is overlaid in a large, bold, white, sans-serif font across the center of the image. A bright light source, likely the sun, is visible in the upper left corner, creating a lens flare effect.

**THANK YOU**



# Image Sources

- 1 - <https://www.newscientist.com/article/2139771-the-exoplanet-zoo-a-whistle-stop-tour/>
- 2 - <http://insanvekainat.net/2017/10/16/life-the-grand-mystery/>
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