

Is Astrobiology an Alien Concept?

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Department of Biology



What is Astrobiology?

- Astrobiology is the study of the origin, distribution, and future of life in the universe

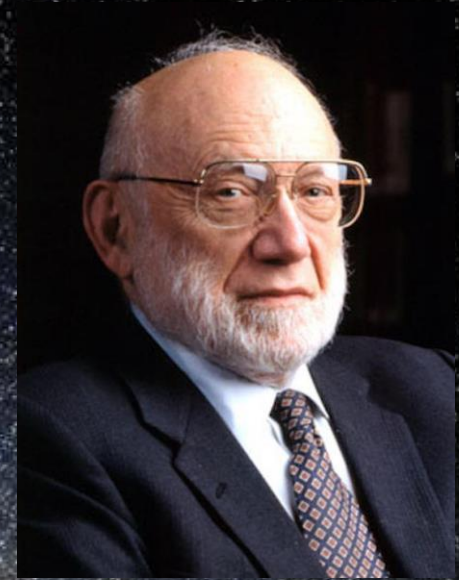
Three fundamental questions:

- How does life begin and evolve?
- Is there life beyond Earth and, if so, how can we detect it?
- What is the future of life on Earth and in the Universe?



History of Astrobiology

- Joshua Lederberg, microbiologist (1925-2008)
- Launch of Sputnik I from Soviet Union (1957)
- Lederberg foresaw dangers of space exploration
- Contamination of celestial bodies with microbes from Earth
- Alien microbes brought back to Earth by explorers



History of Astrobiology

- National Aeronautics and Space Act (1958)
- Signed by President Eisenhower
- NASA was born!
- Hugh Latimer Dryden, aeronautical scientist (1898-1965)
- NASA's first Deputy Administrator



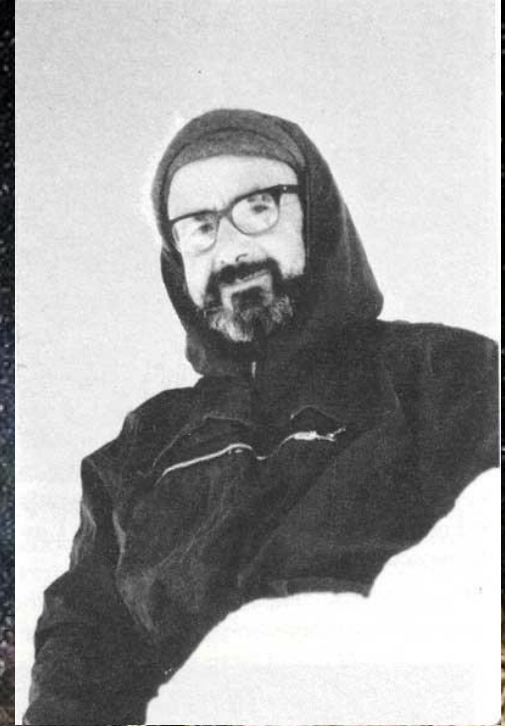
History of Astrobiology

- Lederberg spoke to Dryden about concerns of space exploration
- Dryden agreed and gave Lederberg a job at NASA
- Head of the Space Science Board's panel on extraterrestrial life
- Lederberg began recruiting scientists interested in life beyond Earth
- Carl Sagan, astronomer and much more (1934-1996)



History of Astrobiology

- Lederberg referred to the science of life beyond Earth as 'Exobiology'
- Two research teams dedicated to Exobiology formed on each coast of the U.S.
- First grant for Exobiology research was awarded by NASA in 1959
- Wolf Vishniac, microbiologist (1922-1973)
- The "Wolf Trap" – detected microorganisms in soil of other planets

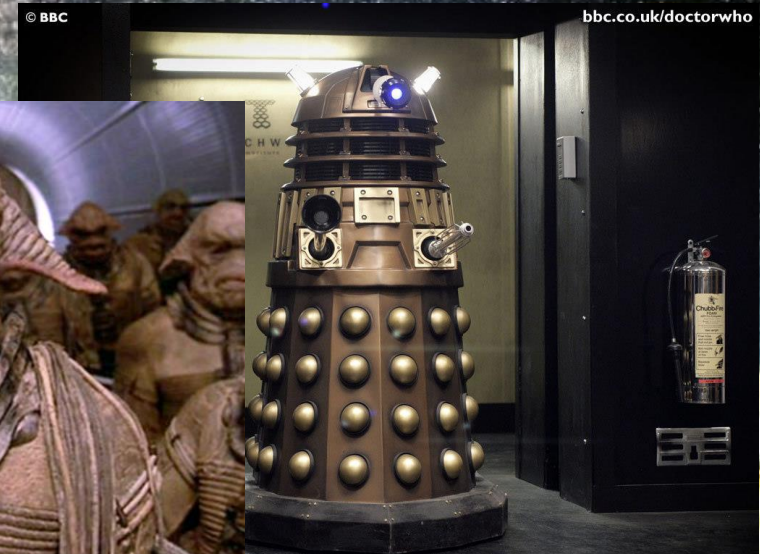


History of Astrobiology

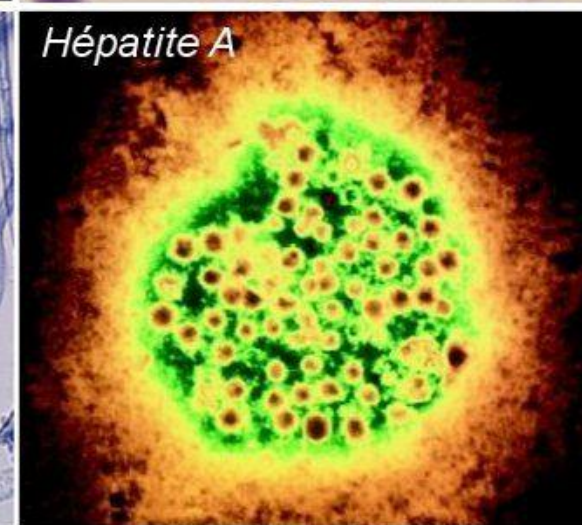
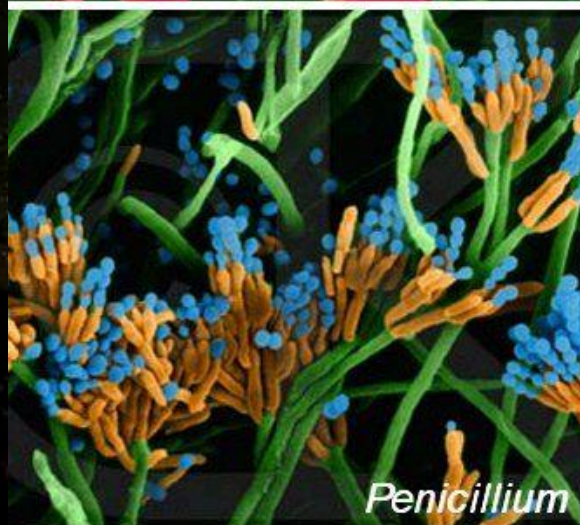
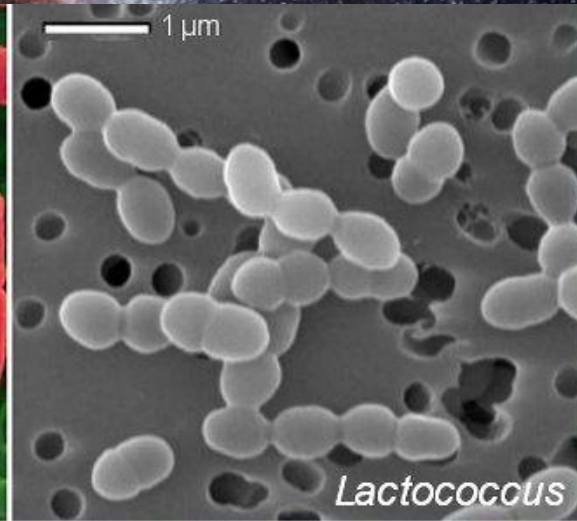
- In 1960, Life Sciences office created at NASA
- Exobiology program was established
- Exobiology research groups created at NASA JPL and Ames
- NASA Ames started to recruit postdocs for Exobiology
- First mission dedicated to searching for evidence of life beyond Earth launched in 1976



What does life look like beyond Earth?



What does life look like beyond Earth?



Has life beyond Earth been found?

- No ☹️

If life has not been found beyond Earth, then what do astrobiologists study?

Six major research areas:

- Identifying abiotic sources of organic compounds
- Synthesis and function of macromolecules in the origin of life
- Early life and increasing complexity
- Co-evolution of life and the physical environment
- Identifying, exploring, and characterizing environments for habitability and biosignatures
- Constructing habitable worlds



Where has life been found on Earth?

Cold



McMurdo Dry
Valleys in Antarctica

Hot



Grand Prismatic Spring in
Yellowstone NP

Deep



Floor borehole, Lupin gold
mine, Nunavut Territories,
Canada

Acid



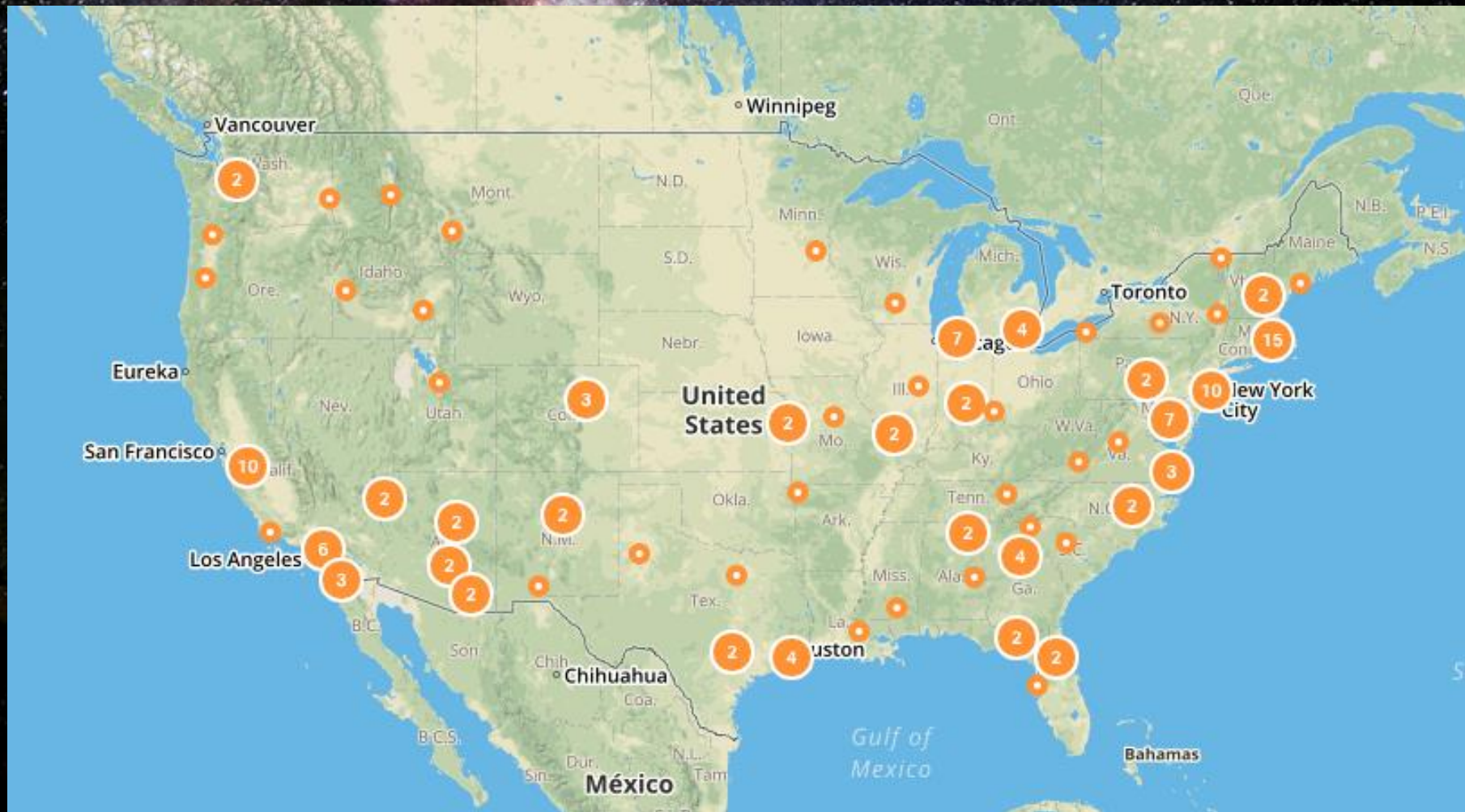
Rio Tinto in Spain

Ocean
Depths

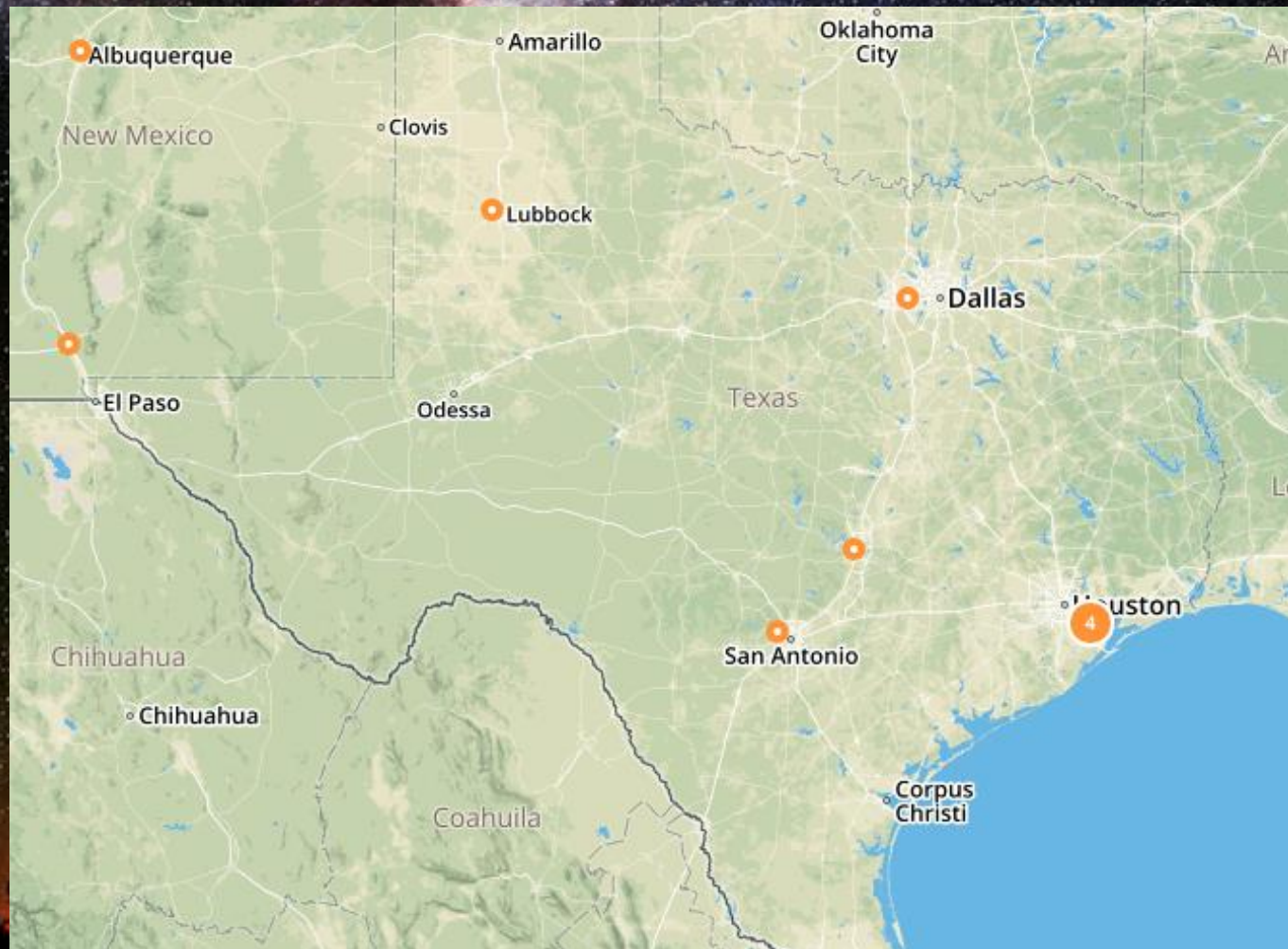


Hydrotherm
al Vent
"Black
Smoker"

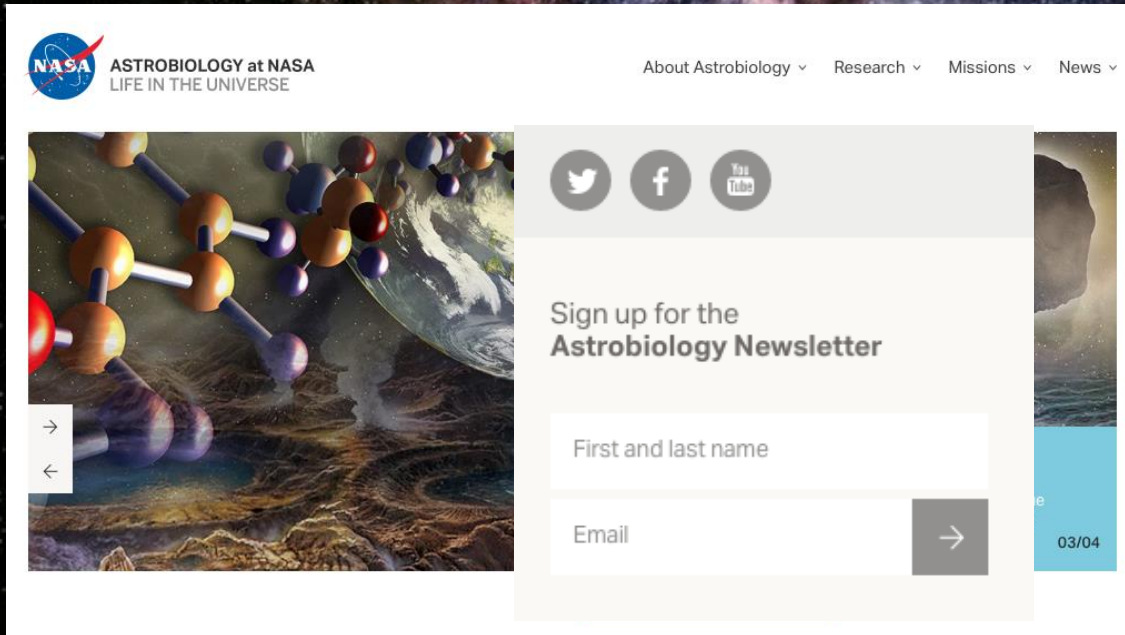
Where is Astrobiology research being done?



Where is Astrobiology research being done?



Astrobiology Resources



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4


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The building blocks and formation of life

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Early Career Spotlight Series



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Eric Smith
The many faces of the nature of life

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5th ELSI Symposium



Ask An Astrobiologist
Episode 1: November 6th, 2016
DR. CHARLES COCKELL
NASA ASTROBIOLOGY PROGRAM

12

Ask An Astrobiologist

For Students Interested in Astrobiology

Courses & Programs


Undergraduate Program Resources

- Florida Institute of Technology – [Space Sciences Astrobiology](#)
- Pennsylvania State University – [Astrobiology Minor Program](#)
- Princeton University – [Certificate Program in Planets and Life](#)
- Rensselaer Polytechnic Institute – [Astrobiology Minor](#)
- University of Arizona – [Undergraduate Minor in Astrobiology](#)

Graduate Program Resources

- Arizona State University – [Astrobiology Focus](#)
- Pennsylvania State University – [Graduate Studies in Astrobiology](#)
- University of Arizona – [Graduate Minor in Astrobiology](#)
- University of Colorado – [Graduate Certificate in Astrobiology](#)
- University of Washington – [Astrobiology Dual-Title PhD and Graduate Certificate](#)



The background of the image is a deep night sky filled with stars. A prominent view of the Milky Way galaxy is visible, stretching diagonally from the upper left towards the lower right. The galaxy's core is a bright, dense cluster of stars. In the lower right corner, a large, golden-colored radio telescope dish is visible, illuminated from below. The dish is a complex structure of many smaller elements. The foreground at the bottom is dark, with silhouettes of trees and some faint, warm-toned light suggesting a landscape or city lights. A semi-transparent dark grey rounded rectangle is centered in the upper half of the image, containing white text.

Somewhere, something incredible
is waiting to be known.

- Carl Sagan