# EXOBIOLOGY

by Allen Yang

# Introduction

- Exobiology - the study of life beyond Earth
- Many planets and satellites have been found to contain elements capable of sustaining life

# Why?

- The thought of life outside of our planet intrigues us
  - Movies
  - Stories
- Scientist
  - NASA has beamed a song into space
    - *(Across the Universe)*

# How & Where To Look?

- Study of early life on Earth
  - "Where the sun don't shine"
- Meteorites
- Planets and Satellites in our solar system
- Atmosphere?

# Most recent Discoveries

- Most recent discovery of Tau Ceti
- 12 light years
    - Group of planets revolving around one star
        - Tau Ceti e
- Alpha Centauri (Binary Star System)
    - 4.22 light years
        - Alpha Centauri Bb

# Tau Ceti E

- Most recent confirmed planet
  - Orbits around its star
  - 4.3 times the size of the Earth
- Within Habitable Zone
  - Thermophiles

# Meteorites

- Crash landed in Antarctica
- Four billion years old
- The crust of Mars
  - Contained microfossils
  - Biologically produced methane

# Meteorites (Continued)

- Found in Morocco
  - 2.1 Billion years old
- Contain substantial amount of water content

# Satellite

- Titan
  - Saturn's satellite
  - Once supported life
  - Ocean below ice crust

# Atmosphere

- Recent discovery of microbes

# Civilizations

- (Kardashev Scale) Four categories
  - I - total control of planet energy
  - II - energy control of a star
  - III - control of multiple stars
  - IIII - Super clusters (?)

# Citations


http://jp.senescence.info/thoughts/exobiology.html

*Pedros De Magalhães, João. "Exobiology: Speculations on Alien Life and Extra Terrestrial Intelligence." : Speculations on Alien Life and Extraterrestrial Intelligence. João Pedros De Magalhães, n.d. Web. 31 Jan. 2013. <http://jp.senescence.info/thoughts/exobiology.html>.The chances of life out there, and the possibilities of civilizations far more sophisticated than us humans, far beyond our reach. There are four categories of civilizations they are classified by the ability to manipulate energy. Current human civilization on earth is placed at Class I, whereas there are Class IVs, which are sophisticated to a point where they're considered gods in comparison to humans. The existence of earth has only been 4 billion years, in comparison to the milky way that is predicted to be over 100 billion years old. This reasoning leads to believe that between the big time gap of our planet's very existence to the milky way, in just this galaxy Earth can not be the only one out there to be capable of sustaining life. However the conflict arises from the lack of evidence that either we or other civilizations haven't found each other, therefore being known as the Fermi Paradox.*

http://en.wikiversity.org/wiki/Topic:Exobiology

*"Topic:Exobiology." - Wikiversity. Wikipedia, 30 June 2012. Web. 31 Jan. 2013. <http://en.wikiversity.org/wiki/Topic:Exobiology>.Astrobiology is an idea that's currently in the process. Scientist around the world believe that life is or was present in millions of other planets, however through all of the extensive searching, there's only been few evidence of extraterrestrial life out there. It's more probable to find remnants of them here on earth still awaiting to be discovered.*

http://cmex.ihmc.us/sitecat/sitecat2/exobiolo.htm

*"Exobiology: The Search for Life on Mars." Exobiology: The Search of Life on Mars. N.p., n.d. Web. 31 Jan. 2013. <http://cmex.ihmc.us/sitecat/sitecat2/exobiolo.htm>.Exobiologist looking for answers on how life came to be on Earth. With the belief that it all started with chemical compound on our planet at its infancy that led to self replication. However that being 4.5 billion years in the making, most of the evidence has been wiped away by erosion, therefore looking into Mars for possible evidence, a planet with a thin atmosphere and has suffered less extreme deformation to its surface.*

# Continued


http://www.astrobiologia.pl/eana/esaexo.html
*"EANA: ESA Exobiology." EANA: ESA Exobiology. European Astrobiology Network Association, n.d. Web. 31 Jan. 2013. <http://www.astrobiologia.pl/eana/esaexo.html>.The ESA (Europe Space Agency) gives an introduction into what Exobiology does and what required knowledge there is to know about exobiology, beyond the word "biology". Utilizing many different ways to backtrack or unveil possible extinct life forms from other planets.*

http://www.reuters.com/article/2011/03/07/us-meteorites-life-idUSTRE7252KQ20110307
*Zabarenko, Deborah. "Strange Life Signs Found on Meteorites: NASA Scientist."Reuters. Thomson Reuters, 07 Mar. 2011. Web. 31 Jan. 2013. <http://www.reuters.com/article/2011/03/07/us-meteorites-life-idUSTRE7252KQ20110307>.Strange microscopic life forms found on meteorites that never originated from earth. Some scientists believe that not only does this prove that there are life outside of our solar system but a slight chance that life forms or us humans as well, might not have originated from Earth.*

http://www.nasa.gov/centers/johnson/home/mars_meteorite.html
*"NASA - National Aeronautics and Space Administration." NASA. NASA, n.d. Web. 01 Feb. 2013. <http://www.nasa.gov/centers/johnson/home/mars_meteorite.html>.A case that was re-opened in 1996 about an ancient meteorite from Mars that crash landed and found in Antarctica. Was re-examined and found microfossils, meaning evidence of life from ancient Mars.*

http://www.dailygalaxy.com/my_weblog/2010/08/nasa-4billionyearold-antarctica-meteorite-previews-biology-and-life-on-mars.html
*"The Daily Galaxy --Great Discoveries Channel: Sci, Space, Tech." 'The Daily Galaxy --Great Discoveries Channel: Sci, Space, Tech' The Daily Galaxy, n.d. Web. 01 Feb. 2013. <http://www.dailygalaxy.com/my_weblog/2010/08/nasa-4billionyearold-antarctica-meteorite-previews-biology-and-life-on-mars.html>.The discovery of a 4 billion year old meteorite that landed in Antarctica was re-examined and found substantial amount of biologically produced methane that came from Mars' atmosphere. Leading scientists to believe that life was once present on the red planet.*

# Continued..

https://astrobiology.nasa.gov/articles/2013/01/29/searching-for-life-where-the-sun-dont-shine-part-1/

*Fitzpatrick, Garrett. "NASA Astrobiology: Searching For Life, Where The Sun Don't Shine Part 1." NASA Astrobiology: Life In The Universe. NASA Astrobiology, 8 Nov. 2012. Web. 1 Feb. 2013. <https://astrobiology.nasa.gov/articles/2013/01/29/searching-for-life-where-the-sun-dont-shine-part-1/>.Learning and understanding how the existence of life is possible without the reliance of energy and sunlight is actually a way for scientist to better understand how life on earth existed in its early days.*

https://astrobiology.nasa.gov/articles/2013/01/09/first-meteorite-linked-to-martian-crust/

*Gronstal, Aaron. "First Meteorite Linked to Martian Crust." Astrobiology: Life in the Universe. NASA Astrobiology, 9 Jan. 2013. Web. 1 Feb. 2013. <https://astrobiology.nasa.gov/articles/2013/01/09/first-meteorite-linked-to-martian-crust/>.A meteorite recently discovered in Morocco, Africa by scientists is actually a 2.1 billion year old martian rock that is believed to have originated from the crust of Mars. An analysis shows that there was high water content once present on the surface of Mars. Which in turn means that it's probable that life existed on the red planet before Earth did.*

https://astrobiology.nasa.gov/articles/2012/11/15/life-on-earths-ceiling/

*Schirber, Michael. "Life on Earth's Ceiling." Astrobiology: Life in the Universe. NASA Astrobiology, 15 Nov. 2012. Web. 1 Feb. 2013. <https://astrobiology.nasa.gov/articles/2012/11/15/life-on-earths-ceiling/>.The stratosphere, a layer of the Earth's atmosphere is thought to be uninhabitable, where life can not exist due to the extreme condition. But it turns out scientist predictions were wrong, life does exist at that level of the atmosphere, tiny microbes live in this zone. So if looking for proof of life on the surface of other planet is difficult, reassuring by checking the atmosphere doesn't hurt.*

http://www.theatlantic.com/technology/archive/2012/10/atlast-the-gargantuan-telescope-designed-to-find-life-on-other-planets/263409/

*Andersen, Ross. "ATLAST: The Gargantuan Telescope Designed to Find Life on Other Planets." The Atlantic. The Atlantic, 11 Oct. 2012. Web. 01 Feb. 2013. <http://www.theatlantic.com/technology/archive/2012/10/atlast-the-gargantuan-telescope-designed-to-find-life-on-other-planets/263409/>.NASA's finished product of a massive telescope soon to launch and replace it's current predecessor, the Hubble Space Telescope. The telescope's designed to look into the far outreaches of the universe, in search for a planet like ours. One that sustains life, and with the technology that it's equipped with, it's a step forward to reaching that possibility.*

# More citations!


http://www.dvice.com/2012-12-20/astronomers-discover-another-planet-just-might-support-life

Trei, Michael. "DVICE." DVICE. DVICE, 20 Dec. 2012. Web. 01 Feb. 2013. <http://www.dvice.com/2012-12-20/astronomers-discover-another-planet-just-might-support-life>.Astronomers at University of Hertfordshire discovered a group of planets with interesting similarities to our solar system, meaning that it's possible that life is possible in at least one of the planets involved. That one is named Tau Ceti e, the only disclaimer is that the planet is literally four times the size of our planet. This shows that even now there's already a slim chance of finding life out there.

http://www.theatlantic.com/technology/archive/2012/12/are-there-planets-better-at-supporting-life-than-earth/265970/

Garber, Megan. "Are There Planets Better at Supporting Life Than Earth?" The Atlantic. The Atlantic, 6 Dec. 2012. Web. 01 Feb. 2013. <http://www.theatlantic.com/technology/archive/2012/12/are-there-planets-better-at-supporting-life-than-earth/265970/>.We are the only planet that we know of, having proof of existing life. But scientists wonder if there are planets that create and sustain life better than we do. If so, where are they? This seems a bit of a step forward from finding life, it's when they're even more advanced than we are.