

# Phys 122: Life in the Universe

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“The discovery of life of any kind beyond Earth would forever change our perspective of how we fit into the universe as a whole, and would undoubtedly teach us much more about life here on Earth as well.”

From *Life in the Universe*, Bennett & Shostak

- We live in a unique time when we have the ability to discuss this topic in a scientific context for the first time.
- In the next 50-100 years, we may very well know **The Answer**. (What was the question?)

# Objectives of this course

- Review relevant aspects of astronomy, geology, biology and chemistry to develop a **sound investigation** of life here and elsewhere in the universe.
- **Apply principles** of the scientific method, the nature of evidence and critical thinking to evaluate the possibility for, and current searches of, life on other worlds.
- Everything is easily available on Syllabus link.

SIT IN THE FIRST 8 ROWS of the CLASSROOM ONLY

I registered my PRS transmitter on blackboard, brought it to class, turned it on, and set it to channel 80 (Go, 80, Go)

1. Yes, I'm certain of it
2. Not sure, but we'll soon find out
3. What's a PRS?

# Your First Task

- Form student groups with your choice of composition and size (I suggest 3-4 members)

Discuss and answer the following questions on paper:

1. What is the purpose of having a professor in the classroom?
2. What are the advantages and disadvantages of lectures, powerpoint, and large classes?
3. How can the disadvantages be overcome to increase student learning?
4. What are the most effective things students can do to learn the overwhelming number of facts and concepts in a typical science course?

# Class Format

- Centered on **active learning** not passive
- What are passive activities? :
  - Listening to lectures, esp. powerpoint slides filled with words
  - Taking notes
  - Reading the textbook and notes
- Research has shown these activities to be ineffective and inefficient for student learning

# Employer, Graduate School, and Professional School Assessment of Recent College Graduates

- Most have good content knowledge, but
- Are deficient in professionalism and work ethic
- Lack written and oral communication skills
- Have a poor ability to work effectively in collaborative settings, i.e. groups or teams
- Have difficulty with critical thinking, i.e. can solve problems but can't problem solve

# Class Format

- Students will first review the material, reading before class and guided by study questions
- Students will have the opportunity in class to fully master material, using other students and professor as resources
- Students will have their mastery tested at the end of class
- **The key is making connections between old and new material**



# What do you believe about life beyond Earth (ET)?

Everyone with a registered clicker, raise their hand.

Those with clickers spread out just a bit.

Everyone else: join a group where one person has a clicker with them today (keep groups even sized).

Discuss then answer the following four questions as a group



Some form of life, perhaps single cell, has  
(or does) exists elsewhere in our Galaxy.

1. Strongly Agree
2. Agree
3. Neutral
4. Disagree
5. Strongly Disagree

# Intelligent life (like a dog or dolphin) exists elsewhere in our Galaxy

1. Strongly Agree
2. Agree
3. Neutral
4. Disagree
5. Strongly Disagree

Extraterrestrial (ET), intelligent life knows  
about us on Earth.

1. Strongly Agree
2. Agree
3. Neutral
4. Disagree
5. Strongly Disagree

ET has visited us, interacts with us and has directly affected humans.

1. Strongly Agree
2. Agree
3. Neutral
4. Disagree
5. Strongly Disagree

# We will learn about life on Earth

In your group, discuss and answer these questions:

1. Do we expect ET to be like life on Earth?
2. Would we know ET if we found it?
3. What *is* life? What are its characteristics?
4. How does understanding life on Earth help us in a search for life elsewhere?

# What does astronomy tell us regarding searches for ET?

1. We need to travel in space to search
2. The physical laws are the same everywhere
3. The universe is geocentric
4. Life exists elsewhere
5. 1 & 4 are correct

# What has geo-planetary science told us with regards to ET life?

1. Life requires plate tectonics
2. We live in a Geocentric universe
3. Exoplanets exist
4. How planets form and evolve
5. 3 & 4 are correct

# What tells us that biology might be universal (exist elsewhere)?

1. Photosynthesis is abundant
2. Building blocks of life are naturally found universally
3. Life is seen to emerge everywhere
4. Life is seen to re-emerge on Earth.



# Where might life exist in our Solar System?

- Mercury?

Seems unlikely

# Where might life exist in our Solar System?

- Venus?

Seems unlikely

# Where might life exist in our Solar System?

- Mars?

3.5 Billion years ago, the Earth and Mars were nearly identical in properties and this is when life formed on Earth.

# Where might life exist in our Solar System?

- Jupiter?

Probably not on Jupiter, but the moon, Europa, looks to be very promising to host life presently.

# Where might life exist in our Solar System?

- Saturn?

The moon, Titan, is often studied as a prototypical 'Early Earth'. But its really, really, really cold (not likely to host life).

# Astrobiology

Astrobiology is a newly recognized science which merges other traditional fields of astronomy, chemistry and biology.

Its efforts concentrate on:

1. Study the conditions supporting the origin and existence of life.
2. Searching for these conditions beyond Earth.
3. Searching for evidence of life elsewhere

# The Search for ExtraTerrestrial Intelligence (SETI)

SETI is a collective name for activities to identify signals from intelligent life. This requires ET to create detectable, artificial signals.

Its efforts concentrate on:

1. Selecting frequency and direction of electromagnetic radiation to do a search.
2. Building telescopes and powerful algorithms to sort out an ETI signal from cosmic noise.

# To do list for Thursday's class

- Read and understand how to use syllabus
- Read assigned pages in textbook and review study questions on objectives list
- Register and bring PRS transmitter to class