

Discussion Scenarios

Thinking About Values in Astrobiology?

These scenarios are fictional. They are designed to help you practice the kind of ethical reasoning that real scientists, philosophers, and policymakers grapple with when thinking about life beyond Earth. There are no correct answers — only better and worse arguments.

Scenario 1: The Microbe on Enceladus

A NASA probe orbiting Enceladus, a moon of Saturn, has collected water samples from a geyser erupting through the moon's icy crust. Lab analysis back on Earth confirms what scientists have long suspected: the water contains microbial life. Simple, single-celled organisms.

A powerful coalition of tech companies has already proposed a mining operation on Enceladus. The moon's ocean contains rare minerals valuable for next-generation batteries. The mining process would almost certainly destroy the microbial ecosystem. The companies argue that a few microbes shouldn't stand in the way of technologies that could help solve climate change on Earth. Some scientists agree. Others are horrified.

You are on the international advisory council, asked to make a recommendation.

Discussion Questions

1. Does microbial life on another world have the same value as microbial life on Earth? Does it have more value, less, or the same? What reasoning leads you to your answer?
2. The companies argue that saving Earth outweighs protecting alien microbes. Is that a compelling argument? What assumptions about value and priority does it rest on?
3. How much certainty do we need before we act to protect something? The scientists are not 100% sure the organisms can feel anything or are harmed by disruption. Does uncertainty change your answer?
4. Who should have a voice in this decision? Scientists? Governments? Indigenous communities with traditions about stewardship of the natural world? The general public? How would you design the decision-making process?
5. Does it matter that these microbes have never interacted with humans, and never will? Does a relationship between beings affect our moral responsibility toward them?

Scenario 2: The Signal

Astronomers using the James Webb Space Telescope have detected a repeating radio signal from a planet orbiting a star 40 light-years away. The signal is mathematical in structure, prime numbers, repeated in sequence. It almost certainly did not occur naturally. Someone, or something, sent it.

There is intense global debate about whether humanity should respond. Responding would mean broadcasting a signal that would take 40 years to arrive and another 40 years for any reply to return. Whatever is out there would know exactly where we are. Some scientists argue that responding is an act of cosmic neighborliness. Others warn it could be the most dangerous thing humanity has ever done. Many point out that this decision affects every person on Earth, but only a small group of scientists and governments are currently making it.

Discussion Questions

1. Should humanity respond to the signal? What values are driving your opinion, curiosity, caution, humility, something else?
2. The article talks about non-anthropocentrism — not assuming human experience is the measure of everything. How might that value apply here? Could the beings who sent the signal have values or intentions that are genuinely impossible for us to predict?
3. Who has the right to speak for humanity? If a response is sent, it will be sent on behalf of every person on Earth, without their consent. Is that a problem? How would you solve it?
4. Some argue that staying silent is also a choice with consequences. Do you agree? Is there a meaningful difference between choosing to act and choosing not to act?
5. Several Indigenous traditions hold that the cosmos is not empty or indifferent, that it is inhabited by presences deserving of respect. How might those perspectives enrich or complicate the scientific conversation about whether and how to respond?

Scenario 3: The Algorithm That Found Life

A new AI system called FINDER has been trained on all known data about Earth life, every genome, every ecosystem, every biochemical process ever recorded. FINDER has been deployed on a Mars rover and is now analyzing soil samples autonomously, flagging potential biosignatures in real time.

FINDER has flagged something. Its confidence level is 87%. It has identified a pattern in the soil chemistry that does not match any known geological process and closely

resembles the metabolic byproduct of anaerobic microbes on Earth. Mission control must decide: does an 87% confidence from an AI system constitute enough evidence to halt further drilling, which could destroy the sample, and trigger the full planetary protection protocol? Halting the mission would cost hundreds of millions of dollars and set back the broader Mars program by years.

Meanwhile, a journalist has leaked the story. The public is demanding answers. Social media is erupting with both excitement and skepticism. FINDER's lead engineer has admitted publicly that the AI was only trained on Earth-based life and may be pattern-matching to something it simply doesn't have a category for.

Discussion Questions

1. How much should we trust an AI system to identify something it was never trained to recognize? What are the limits of pattern recognition when the pattern may be genuinely alien?
2. The precautionary principle suggests we should act cautiously when the stakes are high, even without full certainty. At what confidence level would you halt the mission — 87%? 95%? 99%? Is there a number that feels right, and why?
3. The engineer admitted FINDER may be pattern-matching to something unfamiliar rather than detecting life. Does that change your answer? How do we tell the difference between discovery and error?
4. The story has already gone public. How should scientists communicate uncertainty to a public that wants clear answers? What are the risks of saying “we don't know yet”?
5. This scenario puts economic costs in direct tension with ethical caution. How do you weigh financial and scientific setbacks against the possibility of destroying evidence of life, or life itself? Is there a way to assign value to both sides of that scale?

Closing Question for the Whole Group: *Across all three scenarios, what single value or concern kept coming up as most important to your group? And where did your group most disagree?*