

LIFE IS ALL AROUND US

Length: 40 Minutes with possible extensions

Grades/Ages: Pre-K, grades 1-3

Setting/Preparation: School; homeschool; after-school program, library, youth club, museum or other informal education setting.

A deep knowledge of astrobiology is not a prerequisite for leading this activity. Presenters should familiarize themselves with the activity and the book. You will need to collect some props and prepare some activities ahead of time.

Lesson Overview:

This activity introduces students to a fundamental principle of astrobiology: in order to search for life forms throughout the Universe, we must first understand the characteristics of what makes something alive. Using interactive games and a children's storybook, students will:

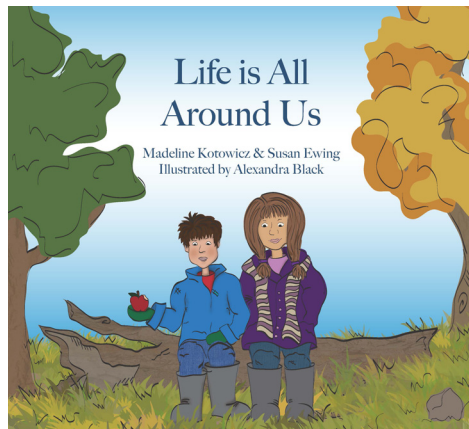
- explore what makes something alive,
- learn about some strange living creatures (extremophiles), and
- be able to define astrobiology.

SUPPLIES:

- Access to chalkboard /whiteboard plus chalk or marker
- Astrobiology sign (optional) (4 pages are included in this booklet to photocopy and tape together)
- Props for "Is it alive?" game (not included) Options include: rock, apple, plastic bottle (these three items are mentioned in the book), stuffed animal, small candle plus lighter/matches, wind-up toy, etc.
- Aliens card deck photos (optional; requires preparation ahead of time to make the cards)
- One photo of an extremophile (included here)
- "Life Is All Around Us" book. (Download at <http://abrc.montana.edu/outreach>)
- Evaluation (Please review prior to the activity as some questions ask about students' responses during the activity)

VOCABULARY:

The following words may be new to the students astrobiology, biology, universe, extremophile.



INTRODUCTION:

Introduce yourself and tell the students a little bit about you. Tell the students that you are excited to be with them and that you are going to share something very interesting with them. Encourage them to be good listeners and get their brains ready to think.

DEFINING ASTROBIOLOGY

Tell the students that we're going to begin with a big word — a REALLY big word. Tell them they might not be able to read this REALLY big word, but that's OK — we will work through it together.

- Pull out the long sign that says *Astrobiology* or
- Write *Astrobiology* on the chalkboard

The students may or may not be able to read the word.

Break the word down into parts. Fold the sign so they can only see "**astro.**" (or underline astro on the board). Read *astro* to them if they can't read it themselves.

Ask the class if they know of any words that begin with *astro*.

[They will likely say *astronaut*. Ask them to define what an astronaut is. They might come up with *astronomy* or maybe even *asteroid*. Each time, ask them to define what the word means. If they are not coming up with any, it's OK to share some words: e.g., Have you ever heard of Astronomy? That's when people study the stars]

Say, "So astro means out in space, or really in the whole Universe." [You might also prompt them with a few questions about the Universe: Is Mars part of the

Universe? Is the Sun part of the Universe? Is Earth part of the Universe? Are there planets we don't even know about yet that are part of the Universe? Everything is part of the Universe!]

Next, flip over the sign to show **biology** (or underline it on the chalkboard). Ask if they have ever heard of this word before or can define it. Tell them that biology is the study of living things.

Explain that people who study **astrobiology** study living things in the Universe.

TEN LIVING THINGS

Next, ask the students to think about things that are alive. Tell them you are going to quiz them and see if they can think of ten different things that are alive.

Write their answers on the board. [You will probably get lots of animals -- cat, dog, lion, cheetah, etc. You can either write the first 10 that come up, or prompt students for a variety of answers: Can you think of anything that is not an animal? What about us—are humans alive? Is there anything alive that is too small to see?]

OPTIONAL: ALIENS CARD DECK

If you choose to do this activity, you will display photos that you have printed out ahead of time. Choose a mix of odd organisms, such as a cuttlefish or a tardigrade (water bear) and the Sulfolobus photo that is included with this activity. Also print out photos of characters from science fiction movies, such as Yoda, E.T. or Transformers. Tell the students that this is a nonsense game and that they might see some photos of creatures that do not exist. They will have to tell you if the picture is REAL or NOT REAL. Then, they will have to tell you if the creature is from Earth or Space.

Show each photo in turn. First ask the students if the creature is real or not real. Then ask the students if the creature is from Earth or Space.

Make a big deal out of the creatures that are not real, such as E.T. and Yoda — make sure the students realize that these are only fictional characters from movies and TV.

Emphasize that some of the creatures that are found here on Earth are really strange!

Tell the students that astrobiologists study creatures on Earth that have unusual qualities or live in unusual places, because it's likely that if we find creatures on another planet or moon, they might be very different from us.

CHARACTERISTICS OF LIFE

Tell the students that in order to study living things, astrobiologists have to think about what makes something alive.

Ask: Can you tell me what makes something alive? Tell the students you will write down all their ideas and that every idea is OK. You will probably get some answers that are not necessarily correct, such as “it moves.”

Write all the answers on the board (even if incorrect) and tell the students you will revisit the list later.

GAME: IS IT ALIVE?

Tell the students that they have made a great list and that you are going to play a game. Tell the students that you are going to show them some objects and that they have to say whether the object is alive or not alive.

[It is ideal to hide the items in a bag for suspense.]

Start with something easy, such as a **rock**. They will probably know right away that the rock is not alive. Ask them why they think the rock is not alive.

Pull out other items such as a **plastic bottle, the wind-up toy, and the stuffed animal**. Light the candle and ask about **fire**. Show the students the **apple**. Ask them each time to explain their answer. You might pose some other ideas or concepts, such as **water, sunlight or clouds**. If students give a wrong answer, this is a good time to help direct them toward the right answer. *The item that might be trickiest is the apple. The characters in the storybook theorize that the apple IS alive, because apple trees are born from the seeds inside the fruit.*

LIFE IS ALL AROUND US STORY

Now tell the students that you are going to share a very special story with them. *[If you have copies to distribute, tell them that if they are good listeners, they can have a copy of the book to take home with them.]*

Read the story aloud. There are a few places in the book where students can say the words along with you.

At the end of the story, ask the students if they have any questions about the story. Ask the students what they learned from the book.

REVIEW THE CHARACTERISTICS OF LIFE

Tell the students that now you are going to look back at their list of what makes something alive. Reinforce that they have created an interesting list and that sometimes scientists are not even sure how to describe when something is alive!

Go back through the list and ask the students if they still think each characteristic they described should be listed.

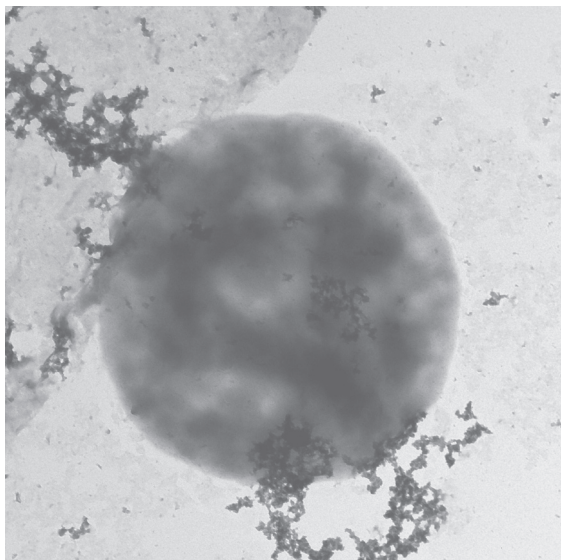
Cross off the characteristics that are not accurate. If they are missing any, you can add them now. Living things:

- Grow
- Reproduce
- “Eat” things for energy
- Make waste products
- Respond to the environment (e.g., sweat, shiver, turn away from sunlight)
- Die and evolve in successive generations

Emphasize that in order to be considered alive, an organism has to exhibit several of these qualities. For example, students observed that the fire could grow and reproduce (make more fire) but is not alive. Tell the students that this idea is complicated, and sometimes even scientists argue about what it means to be alive!

Ask the students if they think there is anything alive in the Universe beyond Earth. Ask students to explain their answers.

Tell them that there is no right or wrong answer, because we don't know yet! Scientists have not yet found anything alive on any other planet or moon, but they are looking.



WEIRD LIFE! *SULFOLOBUS ACIDOCALDARIUS*

This organism is alive! *Sulfolobus* are microscopic organisms (organisms that are so small you can't see them without a microscope). They live in water that is very acidic and so hot it would burn a huma. (65-87°C (149-188°F)). *Sulfolobus* are found in acidic streams and pools around Yellowstone National Park such as White Creek, Rabbit Creek, Mud Volcano, and Norris Geyser Basin. Species of the genus *Sulfolobus* have also been found in sulfurous volcanic areas or hot springs on Mount St. Helens and in Italy, Russia, Chile, Japan and Papua New Guinea.

SUMMARY

Introduction

Definition of astrobiology

Name 10 living things

Characteristics of life

Game: Is this alive?

Read the story

Review characteristics of life

Alien card game (optional)

Strange creatures live in strange places

Conclusion and distribution of items

Ask the students how they think scientists might try to find out if there is life on other planets. (Answers may include rockets, rovers, spacecraft that photograph planets, meteorites that fall to Earth, etc.)

STRANGE CREATURES IN STRANGE PLACES

Tell the students that living creatures can be found in some really strange places on Earth, such as deep beneath frozen ice or in a pool of water that is so hot it would burn a human.

Ask the students if anyone has ever heard of or visited Yellowstone National Park. Ask the students what you might see in Yellowstone. Ask if they have seen (or seen pictures of) some of the very hot places, where steam comes off the water. Tell them that even though humans would die or be badly burned if they went into the water, there are actually living creatures in the water—creatures so small, you can only see them with a microscope!

Tell the students that scientists think that if we find life on another planet, it will probably not look like E.T. or Yoda or even like us. It is more likely that it will look like the tiny creatures that are found in a hot spring. That is why astrobiologists study weird creatures and weird places on Earth so we have a better idea of what might be out there in the Universe. These creatures are called **extremophiles**.

CONCLUSION AND PRESENTATION OF ITEMS

Tell the students that you enjoyed spending time with them. Ask the students if anyone might like to study astrobiology some day. Ask them if they will share what they learned with their families tonight and thank them for allowing you to come to their class.

*If you have copies of **Life is All Around Us** to distribute, ask the teacher what is the best way to distribute the book. He/she may want them all in a stack to hand out later. Or, help the students access the book online by sharing the Web address with the teacher.* (<http://abrc.montana.edu/outreach>)