LESSON 3: WE GO WAY BACK

Module 1: **Space Explorers - An Introduction to Astrobiology**

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OVERVIEW	During this lesson, inspired by the book *We Go Way Back*, students will embark on a journey to understand the building blocks of life and explore how elements combine to form everything around us, including living organisms. Students will learn that life begins at a cellular level, understanding that all living things are composed of tiny cells and that these cells have evolved over time. The concept of microorganisms is introduced, emphasizing that these tiny living organisms are everywhere, even on Earth, prompting students to consider the existence of life on other planets. Through discussions and activities, students will contemplate how life adapts to different environments and how scientists search for evidence of life beyond Earth. This lesson aims to spark curiosity about the origins of life and the possibility of its existence elsewhere in the universe, emphasizing that the same building blocks that make up life on Earth could also be the foundation for life elsewhere. **Duration: 60 minutes.**

SUCCESS CRITERIA	• Representation of Elements and Compounds:
	  ◦ Students can draw at least one element and one compound, demonstrating an understanding that they are building blocks of life.
	  ◦ Students' drawings show recognizable representations of the concepts.
	• Representation of Organisms:
	  ◦ Students can draw a simple organism, showing their understanding of living things.
	  ◦ Students can draw a microorganism.
	• Animal Evolution (Past, Present, Future):
	  ◦ Students can draw a past or present animal, demonstrating their understanding of animal life.
	  ◦ Students can draw a prediction of what that animal might look like in the future, demonstrating creative thinking about evolution or change over time.
	  ◦ The future animal drawing shows that the student thought about how an animal might change over time.
	• Connection to "We Go Way Back":
	  ◦ Students' drawings reflect concepts discussed from the book and class discussion.
	  ◦ Students can explain their drawings.
	• Creative Expression:
	  ◦ Students use colors and details to enhance their drawings.
	  ◦ Students demonstrate effort and engagement in the activity.
	• Clear Communication:
	  ◦ Students can communicate what their drawings are depicting.

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K-2 AZ STATE STANDARDS	Kindergarten • Science (K.L2U1.8): Observe, ask questions, and explain the differences between the characteristics of living and non-living things.There is a wide variety of living things, including plants and animals. They are distinguished from non-living things by their ability to move, reproduce, and react to certain stimuli. • Science (K.L1U1.6): Obtain, evaluate, and communicate information about how organisms use different body parts for survival. • Science (K.L1U1.7): Observe, ask questions, and explain how specialized structures found on a variety of plants and animals (including humans) help them sense and respond to their environment. • Social Studies (K.SP1.1): Use a variety of words to reference time in the past, present, and future; identify the beginning, middle, and end of historical stories. • Social Studies (K.H2.1): Explain the benefits of cooperation and compromise as ways to solve problems. First Grade • Science (1.L4.U3.11): Living things can survive only where their needs are met. If some places are too hot or too cold or have too little water or food, plants and animals may not be able to live there. • Science (1.L4.U3.11): There are many different kinds of plants and animals in the world today and many kinds that once lived but are now extinct. Second Grade • Science (2.L2U1.9): Obtain, analyze, and communicate evidence that organisms need a source of energy, air, water, and certain temperature conditions to survive. • Science (2.L2U1.10): All living things need food as their source of energy as well as air, water, and certain temperature conditions.
MATERIALS	• We Go Way Back - book or YouTube video such as: https://www.youtube.com/watch?v=kaiMDQKELq4 • Chemical Reactions Video: ttps://www.instagram.com/reel/DHlhXiSC0hY/?igsh=bjh1b3RtbGZrMzZt • Past, Present, and Future of Life Worksheet • Picture of a Woolly Mammoth • Picture of an Elephant • “Planet in a Jar” Parent Letter (optional) • Microscope Camera (optional)

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VOCABULARY

- **Elements**: The tiny building blocks that make everything in our universe - like how LEGO pieces make a castle!
- **Cells**: The tiny parts that make up every living thing, like little puzzle pieces in your body.
- **Organism**: A living thing. That could be a person, an animal, a plant, and more.
- **Microorganism**: A very tiny living thing that you can't see unless you use a special tool called a microscope.
- **Life**: Anything that grows, eats, breathes, or moves on its own—like animals, people, and plants.
- **Change**: When something becomes different, like when a caterpillar turns into a butterfly.
- **Extinct**: When something alive is all gone and doesn't exist anymore, like dinosaurs.

SET UP

- If you don't have a physical copy of We Go Way Back, you can pull up a read aloud on YouTube such as: https://www.youtube.com/watch?v=kaiMDQKELq4
- Prepare microscope camera, if applicable
- Review any previously taught lessons before giving this lesson.

LESSON PROCEDURE

Introduction (20 minutes)
Review the word "astrobiology" with students. Explain that astrobiologists study how life began on Earth, because understanding life on Earth helps us to learn how life might develop on other worlds, too.

Read the book *We Go Way Back* to the class. This book provides a fantastic springboard for exploring elements, cellular life, and microorganisms with young learners! During the reading, pause frequently to highlight and emphasize some of the following concepts and questions:

- Elements and the Building Blocks of Life:
  - The book talks about how everything is made of tiny pieces. What are those tiny pieces called? (Elements/atoms)
  - Do you think the same elements that make up rocks and water also make up living things? Why or why not?
  - The book mentions the 'soup' where life started. What do you think was in that soup? (Elements, water, etc.)
  - We need certain elements to live, like oxygen. Do you think other planets might have different elements that could support different kinds of life?
  - If we were to look at a tiny cell, what elements might we find inside?

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LESSON PROCEDURE

- Life at a Cellular Level:
  - The book shows how life started with tiny, tiny things. What are those tiny things called? (Cells)
  - Do you think all living things are made of cells? Are we made of cells? Are trees made of cells?
  - The book talks about how cells changed over time. Do you think cells are still changing today?
  - What do cells need to survive? (Water, nutrients, etc.) Do you think cells on other planets might need different things?
  - "In the book, some cells started working together. Why do you think they did that?"
- Microorganisms:
  - The book mentions that the very first living things were very small. What are very small living things called? (Microorganisms)
  - We can't see most microorganisms with our eyes. Where do you think they live? (Everywhere!)
  - Do you think there are microorganisms on other planets? What might they look like?
  - The book talks about how microorganisms changed the Earth. How do you think they did that?
  - Are all microorganisms bad? Or are some good? How do they help the earth?
  - If we sent a robot to another planet, how could it look for microorganisms?
- Connecting to the Book's Themes:
  - The book shows how life on Earth took a very long time to develop. Do you think life on other planets might also take a long time to start?
  - The book shows how life changed and adapted to Earth's conditions. Do you think life on other planets would have to adapt to their conditions?
  - The book ends with us. What do you think life will be like in the future?
  - After reading this book, does it make you wonder if life could exist in other places?

Activity 1: Life on a Tiny Scale (15-25 minutes)

1. Pass out the "Life of the Past, Present, and Future" worksheet.
2. Have students watch this video of elements being added into a drop of water demonstrating the relationship between elements/reactions/changes: https://www.instagram.com/reel/DHlhXiSC0hY/?igsh=bjh1b3RtbGZrMzZt
3. After watching, have them draw one of the reactions they saw in the video. Discuss that life, elements, and cells operate on a tiny scale, so tiny we often cannot see it.

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6. Have students draw their own microorganism. It can be based on something they have seen in the book or video, or it can be creative.
7. If time allows, have students collect samples of tiny objects, then examine them together using a microscope camera (sand, dust, the tip of a pencil, a human hair, etc.). Ask: "Do you see anything tiny? Do you think any living things could live on this tiny object?"

Activity 2: Changing Life (15 minutes)

1. Show the students a picture of a wooly mammoth and discuss that it is extinct. Woolly mammoths went extinct about 4,000 years ago due to climate change, habitat loss, and possibly human hunting.
2. Have the students draw a woolly mammoth on their worksheet.
3. Show the students a picture of a modern day elephant. Discuss the following:
    - How do you know these two animals are related?
    - What common features do they share?
    - What features are different?
4. Have students draw a modern day elephant on their worksheet.
5. Next, tell students that they will be imagining what they think an elephant might look like in the future. Before they come up with an idea, explore some of the following questions with them:

- Focusing on Environmental Change:
    - Think about the woolly mammoth. What kind of environment did it live in? (Cold, icy)
    - And the elephant? What kind of environment does it live in now? (Warm, grassy)
    - What if the Earth got much hotter, or much colder? How might the elephant need to change to survive?
    - What if the elephant's home became very dry, with very little water? How might it change to find water?
    - What if the elephant's home became a dense, thick forest? How might it change to move through the trees?
- Focusing on Food and Resources:
    - What does an elephant eat now? (Plants, leaves, fruits)
    - What if the plants that elephants eat became very rare? How might the elephant change to find new food?
    - What if the elephant needed to reach food that was very high in trees? How might its body change?
    - What if the elephant needed to dig for food underground? How might its tusks or trunk change?
- Focusing on Protection and Survival:
    - What dangers do elephants face now? (Humans, predators)
    - What if there were new, very dangerous predators in the future? How might the elephant change to protect itself?

LESSON PROCEDURE

- What if elephants needed to travel very long distances to find food or water? How might their bodies change to help them travel?
- What if the elephants needed to hide from predators? How might their color change?

- Encouraging Creative Thinking:
  - What if elephants could fly? What would they need to have?
  - What if elephants lived underwater? What would they need to breathe?
  - What if elephants could talk? What would their mouths look like?
  - What if elephants had super long necks like a giraffe? Why would they need that?
  - What if elephants had super strong legs to jump really high? Why would they need that?

6. Have each student design a future elephant. Emphasize that these are imaginative predictions, not scientific facts, and encourage them to think outside the box and be creative. You may also want to remind them that evolution or changes over time within a species takes a very long time.

Connecting the Two Stories (10 minutes)

If you read both *Horton Hears a Who* and *We Go Way Back*, you might choose to bridge the concepts between both lessons with these discussion questions:

- Bridging the Size and Scale:
  - In 'Horton Hears a Who,' we learned that life can be incredibly tiny. 'We Go Way Back' tells us life started with tiny cells. Do you think those tiny cells could live on a speck of dust like the Whos' world?
  - Just like Horton heard the Whos, even though they were small, scientists are trying to 'hear' tiny signals from microorganisms on other planets. What tools could they use?
  - The Whos lived in a world too small for most to see. Just like the Whos, microorganisms are often invisible. Do you think there could be whole 'cities' of microorganisms on other planets?
- Connecting Elements and Habitats:
  - The Whos' world was made of dust, and 'We Go Way Back' tells us Earth is made of elements. Do you think the Whos' dust world was also made of elements?
  - Horton protected the Whos' habitat. If we found microorganisms on another planet, would we need to protect their 'habitat' too?
  - The Whos needed their speck of dust to survive. Microorganisms need certain elements and conditions to survive. What kinds of 'specks of dust' or planets might have those conditions?

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LESSON PROCEDURE	• Relating Communication and Discovery:
	  ◦ The Whos had to shout to be heard. Microorganisms might send 'signals' in ways we don't understand. How can we learn to 'listen' to them?
	  ◦ Horton believed there was life, even when others didn't. Scientists believe there might be life on other planets, even if we haven't found it yet. Why is it important to keep looking?
	  ◦ If the Whos were made of cells, like the cells in We Go Way Back, how would we prove that they were alive?
	• Expanding on the Idea of "Life":
	  ◦ Both stories show us that life can be very different from what we expect. Does this make you more curious about what life might be like on other planets?
	  ◦ Both stories talk about communities. The Whos had their city, and 'We Go Way Back' talks about cells working together. Do you think alien life might also live in communities?

EXTENSION AND TAKE-HOME ACTIVITIES	• Planet in a Jar At-Home Activity
	• Ask students to create another “animal of the future” using their favorite animal.
	• Ask students to bring some tiny objects from home that they’d like to see in the microscope camera.
	• Explore the concept of cells in more detail with these YouTube videos:
	  ◦ What Are Cells? | Science for Kids (https://www.youtube.com/watch?v=ex0x-w00Uy4)
	  ◦ Cells for Kids | Learn about cell structure and function in this engaging and fun intro to cells (https://www.youtube.com/watch?v=kcG1F88KQA0)
	  ◦ The Cell For Kids - The Cell and its Parts (Learning Videos For Kids) (https://www.youtube.com/watch?v=YY5ciDx7Y3Q)

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