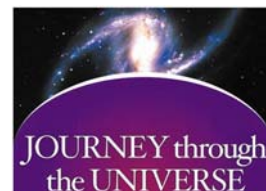


Introduction to the *Journey through the Universe* Program and the *Are There Other Neighborhoods Like Our Own?* Module's Grade 5-8 Lessons



1. The Program

Journey through the Universe (<http://journeythroughtheuniverse.org>) is a national science education initiative that engages *entire* communities—students, teachers, families, and the public—using education programs in space exploration and the space sciences to inspire and captivate. The initiative embraces the notion that—*it takes a community to educate a child*.

Journey through the Universe programming is tailored to a community's strategic needs in science, technology, engineering, and mathematics (STEM) education, and is a framework for partnership between school districts, museums and science centers, colleges and universities, civic and business organizations, and the public. The cornerstone philosophy for all programming is—*inspire... then educate*.

2. The Grade K-12 *Are There Other Neighborhoods Like Our Own?* Education Module

Are There Other Neighborhoods Like Our Own? Searching for Abodes of Life in the Universe is one of several Education Modules developed for the *Journey through the Universe* program. The Module contains activities at three grade levels (K-4, 5-8, 9-12). Each grade level package is called an **Education Unit**. The Module also includes one Family and Home activity, and one activity on the Process of Science, both of which are suitable for use at all grade levels. Note that the Module currently uses an old lesson format.

The Module focuses on the search for abodes of life in the universe. Considering that life is found in just about every environment on Earth—from frozen Antarctica to sun-deprived hydrothermal vents at the bottom of the ocean to the interior of nuclear reactors—life flourishes over a wide range of environs. If it is conceivable for species to adapt to living conditions that are unthinkable for human survival, then similar adaptations might be possible for life on another world. Mars, with frozen water beneath its surface, and Jupiter's icy moon Europa, may seem like harsh environments to us, yet they may be abodes of life.

The storyline approach adopted for this Module is to address three questions at each grade level:

- *What* makes our neighborhood an abode of life, and might these conditions be present in other neighborhoods beyond our own?
- *Why* do we want to search for other neighborhoods like our own?
- *How* will we explore other neighborhoods beyond our own?

Each grade-level Education Unit has a lesson addressing each of these questions.

At the elementary level 'our neighborhood', a case study of a familiar life-bearing environment, is one's hometown and 'other neighborhoods' are other possible abodes of life within the Earth-Moon system. At the middle school level 'our neighborhood' is the Earth-Moon system and 'other neighborhoods' encompass those found across the Solar System. At high school 'our neighborhood' is the Solar System as an abode of life, and the search for 'other neighborhoods' spans the entire galaxy. The nature of a neighborhood at each grade level is based on the National Science Education Standards and Benchmarks for Science Literacy.

3. The *Are There Other Neighborhoods Like Our Own?* Grade 5-8 Lessons

This document provides a description of each lesson for the *Are There Other Neighborhoods Like Our Own?* **middle school (grade 5-8)** Education Unit. Also provided are connections to grades 5-8 National Science Education Standards.

**ARE THERE OTHER NEIGHBORHOODS LIKE OUR OWN?
THE 5–8 EDUCATION UNIT PROGRESSION**

Lesson Title	Lesson Description
Lesson 1: Earth vs. Other Worlds	<p><i>Storyline question addressed: What makes our neighborhood an abode of life, and might these conditions be present in other neighborhoods beyond our own?</i></p> <p>Students will identify characteristics of Earth that are important for life as we know it. They will then research other planets and moons and compare these worlds' characteristics to those of the Earth. They will then select, and provide justification, for a planet or moon that they believe would be worthwhile to investigate for signs of life.</p>
Lesson 2: Exploring the Neighborhood of the Solar System	<p><i>Storyline question addressed: Why do we want to search for other neighborhoods like our own?</i></p> <p>Throughout history we have pondered whether we are alone in the universe, whether life is unique to our world. The tantalizing possibility of life elsewhere is one driver for exploration beyond Earth. We now have the ability to travel to other worlds in our Solar System and search for life. If we can show life evolved separately on another planet, then the implication might be a universe teeming with life.</p> <p>In this lesson, students will investigate factors that influence whether a planet in our Solar System can have an environment suitable for life as we know it. First, students will hypothesize how the temperature of a black body (in this case, a small, very dark rock) should vary as it is moved farther from the Sun. Students will then use actual data to plot the temperature of a blackbody object at different distances for the Sun, and will compare these data to the temperatures at which life is found on Earth. This allows students to estimate the distance range from the Sun within which a life-bearing planet might be found, and determine if other planets besides Earth fall within this range. Finally students plot the actually observed temperatures of the planets and discover that, in most cases, reality differs significantly from the simple blackbody-equilibrium model. With this information, the students will present hypotheses regarding the differences between expected and actual planetary temperatures, and will use this information to propose a plan for future searches for life in the Solar System.</p>
Lesson 3: Searching for Signs of Life	<p><i>Storyline question addressed: How will we explore other neighborhoods beyond our own?</i></p> <p>Students are presented with three soil samples representing simulated Martian soil. After visual inspection of the soil samples they 'feed' the samples with nutrient solution and assess if this causes any observable activity. They then explore the nature of the observed activity and determine if it represents chemical or biological processes.</p> <p>The lesson is a direct analog to the life science experiments conducted by the Viking Landers on the surface of Mars in 1976 to look for photosynthesis, respiration, and gas exchange. The nature of the observed activity on Mars, once soil samples were fed 'chicken soup', allowed researchers to distinguish with high confidence between chemical and biological processes at the landing sites.</p>

CONNECTION TO STANDARDS

This Education Unit has been mapped to the National Science Education Standards (National Research Council, National Academy Press, Washington, DC, 1996). A complete explanation of the Standards can be found at: <http://www.nap.edu/html/nse/html/>. Core standards for each lesson are indicated by a “√.”

EDUCATION STANDARDS IN ARE THERE OTHER NEIGHBORHOODS LIKE OUR OWN? 5-8 EDUCATION UNIT										
National Science Education Standards										
	Standard A: Science as Inquiry		Standard B: Physical Science	Standard C: Life Science			Standard D: Earth and Space Science		Standard G: History and Nature of Science	
	A1: Abilities necessary to do scientific inquiry	A2: Understandings about scientific inquiry	B3: Transfer of energy	C1: Structure and function in living systems	C3: Regulation and behavior	C5: Diversity and adaptations of organisms	D1: Structure of the Earth system	D3: Earth in the Solar System	G1: Science as a human endeavor	G2: Nature of science
Lesson 1: Earth vs. Other Worlds	√	√					√	√	√	√
Lesson 2: Exploring the Neighborhood of the Solar System	√	√					√	√	√	√
Lesson 3: Searching for Signs of Life	√	√	√	√	√	√		√	√	√