

Discovery Theater

The Smithsonian's Theatre for Young Audiences



Planet Hopping



A REPRODUCIBLE LEARNING GUIDE FOR TEACHERS

This learning guide is designed to help you and your students prepare for, enjoy, and discuss *Planet Hopping*. It contains background information, questions and activities. Appropriate for ages 3-7.

Presented in partnership with:

*The National Air and Space Museum and generously
underwritten by the Conrad N. Hilton Foundation*



The Smithsonian Associates

About the Artists

In 2011, **Kimi Maeda**, a theatre artist who specializes in intimate visual performances, created the puppetry duo **Belle et Bête** with **Lyon Forrest Hill**, a puppet maker and performer with the Columbia Marionette Theatre. Now they are joining with **Lunch Money**, a trio that brings the indie rock experience to family audiences, as your intergalactic guides for a one-of-a-kind adventure in space science. Original music, puppets, and elaborate video projections featuring real NASA footage help tell the tale of young pilot and her robot sidekick as they travel the solar system. Soar among the stars as you explore the mysteries of the planets and the importance of friendship and family.

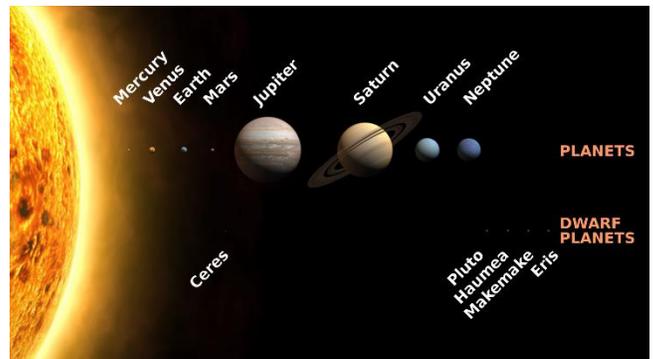
About this Program: *We are excited to partner with the National Air and Space Museum and the Flights of Fancy Early Education Program. Special thanks to the Conrad N. Hilton Foundation for their generous support. Admission is free, but reservations are required.*

Let's talk about planets!

There are eight **planets** that **revolve** around the sun in our **solar system**: Mercury, Venus, Earth (That's where we live!), Mars, Jupiter, Saturn, Uranus, and Neptune. Out of this list, which is in order from closest to farthest from the sun, the four nearest to the sun are rocky and small, and the four farthest are big and made of gas – we call them **gas giants**.

Without any tools, you can see five planets (other than Earth, of course!). With **binoculars** or a **telescope**, you can see the others! And we don't just know about the planets nearby. There are other solar systems, too, that are different shapes and sizes. We haven't explored the whole **universe** – not even close.

In fact, the universe is **expanding**, or getting bigger! So even though we haven't found **alien life** just yet, we have a lot more places to look.

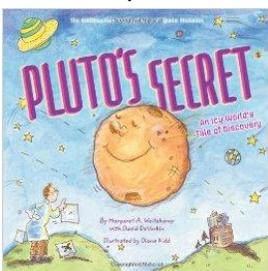


Find more information on our solar system at:

<http://kids.nationalgeographic.com/explore/space/what-is-a-planet/#planetary-lineup.jpg>

What about Pluto?

You might hear someone talk about Pluto as the ninth planet in our solar system. In fact, Pluto is not a planet, but a dwarf planet. Pluto's had a pretty hard time – in 2006 scientists decided it couldn't be considered a planet because it hadn't used gravity to force other objects out of its **orbit**, or path, around the sun. Some adults still get confused – when they were your age, they learned that there were nine planets!



For more information about Pluto, check out **Pluto's Secret** a children's book that explains the true story of this distant world. Written by Margaret A. Weitekamp and illustrated by Diane Kidd- Coordinator of the Flights of Fancy Early Education Program at the Smithsonian.

Ask the Mars expert!

Mars is the next farthest planet from the sun, after Earth. Can you find answers to these questions about the Red Planet?

Click on this website to find an online scientist based on a real person: <http://mars.jpl.nasa.gov/drc/>

Try to find the answers to the following questions... then use the highlighted letters to find our captain's name in *Planet Hopping*!



1. What are Mars's moons? (Hint: Answer question 3 now.)

_____ and _____

2. How long does it take to get to Mars (shortest amount of time)?

Six _____.

3. What type of animal were Mars's moons named after?

4. Is Mars bigger or smaller than the Earth?

5. What liquid does research show used to be found on Mars and now is still found in solid form under the surface and on Mars's poles?

Who runs the ship in *Planet Hopping*? _____!

Watch this video to learn about travelling to Mars!

<http://mars.jpl.nasa.gov/msl/multimedia/videos/index.cfm?v=32&a=2>

Finding Life in Space

Even though we still haven't found life anywhere except Earth, scientists have a pretty good idea of the conditions a planet needs to be able to have living things grow there. *What do you need to stay alive?*

As far as we know, living things need a temperature that's not too extreme to survive or have life start – chemical reactions that can start life won't happen unless the temperature is right. Living things also seem to need oxygen – every living thing we've seen on Earth has needed it. Lastly, water also seems to be important because it provides oxygen and protects organisms from the sun's ultra-violet radiation, which breaks apart molecules.

For information on why Mars could not accommodate life from Earth, see:

http://www.nasa.gov/audience/forstudents/postsecondary/features/mars_life_feature_1015.html

Life Matching Game

1. Cut out the cards on the following two pages and separate into "Can Living Things Live Here?" and "Extreme Life!".
2. Read the descriptions on the cards and try to match up the organisms with the elements in which they can survive!

Astrobiology: Science Learning Activities for Afterschool
Can Living Things Live Here?

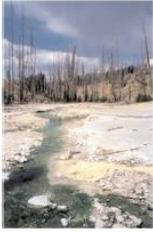


Image by Kathy Shehan
Courtesy of Microscope <http://microscope.mbl.edu>

Lemonade Spring in Yellowstone park has acidic (acid-like) water that can burn your skin.

Astrobiology: Science Learning Activities for Afterschool
Can Living Things Live Here?



Photograph by Kristan Hutchison
National Science Foundation

McMurdo Dry Valleys in Antarctica have average temperatures of -20°C (-4°) and get less than 10 cm (4 inches) of rain each year.

Astrobiology: Science Learning Activities for Afterschool
Can Living Things Live Here?



Photo by Brett Leigh Dicks Courtesy of Microscope <http://microscope.mbl.edu>

Mono Lake in California is two and a half times saltier than the ocean.

Astrobiology: Science Learning Activities for Afterschool
Can Living Things Live Here?



OAR/National Undersea Research Program (NURP); NOAA

Under water volcanoes known as black smokers add extremely hot water (as high as 400°C, 725°F) to the ocean environment.

Astrobiology: Science Learning Activities for Afterschool
Can Living Things Live Here?



Image by Linda Amaral-Zettler Courtesy of Microscope <http://microscope.mbl.edu>

Rio Tinto (River of Fire) in Spain is one of the most naturally acid-like rivers in the world.

Astrobiology: Science Learning Activities for Afterschool
Can Living Things Live Here?



National Park Service
U.S. Department of the Interior

Hot springs in Yellowstone. Water underground can be heated to boiling by nearby magma (the word for lava that's underground).

Astrobiology: Science Learning Activities for Afterschool
Can Living Things Live Here?



NASA Image Exchange

Salt domes in Iran. These domes of salt are usually found over underground stores of oil and gas.

Astrobiology: Science Learning Activities for Afterschool
Can Living Things Live Here?



Radiation is a kind of energy that can be harmful to people in large doses. In space, radiation from the Sun is stronger than on Earth and spaceships must be built to protect astronauts.

Astrobiology: Science Learning Activities for Afterschool
Extreme Life!



Courtesy of Microscope <http://microscope.mbl.edu>

This algae was found in acidic (acid-like) springs in Yellowstone National Park. They can live in water acidic enough to burn human skin.

Astrobiology: Science Learning Activities for Afterschool
Extreme Life!



Courtesy of Microscope <http://microscope.mbl.edu>

Algae can be found under the ice in lakes in the Arctic and Antarctica.

Astrobiology: Science Learning Activities for Afterschool
Extreme Life!



Courtesy of Microscope <http://microscope.mbl.edu>

This microscopic life form, Artemia monica, can be found in the "hypersaline" (high salt to water ratio) waters of Mono Lake.

Astrobiology: Science Learning Activities for Afterschool
Extreme Life!



NOAA

Tube worms like these grow near hydrothermal vents in the ocean.

Astrobiology: Science Learning Activities for Afterschool
Extreme Life!



Courtesy of Microscope <http://microscope.mbl.edu>

These microscopic creatures, known as euglenia mutabilis, were found in the acid-like Rio Tinto in Spain.

Astrobiology: Science Learning Activities for Afterschool
Extreme Life!



Courtesy of Microscope <http://microscope.mbl.edu>

Some bacteria, like these found in Yellowstone National Park, can live in boiling water (100°C, 212°F).

Astrobiology: Science Learning Activities for Afterschool
Extreme Life!



U.S. House of Representatives Committee on Resources <http://resourcescommittee.house.gov/subcommittees/emr/ia/gswweb/>

Very old bacteria has been found living inside salt crystals.

Astrobiology: Science Learning Activities for Afterschool
Extreme Life!



NASA

Deinococcus radiodurans (shown on an agarplate) can survive radiation levels thousands of times greater than what would kill humans.

For bigger cards and more activities, go to page 32 of:

http://www.nasa.gov/pdf/145916main_Astrobiology.Guide.pdf

Smithsonian Connection

Want to look through telescopes at astronomical objects during the day? Come by the **Phoebe Waterman Haas Public Observatory** at the **Smithsonian National Air and Space Museum** to look through telescopes and discover craters on the Moon, spots on the Sun (using safe solar filters), the phases of Venus, or other wonders of the universe. When the weather is clear, the Public Observatory is open for daytime telescopic viewing, guided by a staff of astronomy educators. Portable telescopes provide different views of the Sun and Moon. You can also participate in hands-on, interactive activities, learn more about astronomy and telescopes, and sometimes talk with a research astronomer during Astronomy Chat.

While you're here, don't forget to participate in all of the other hands-on activities the museum offers! Watch an IMAX movie, attend a story time session, or come on a Family Day for special activities!

For more information, visit:

<https://airandspace.si.edu/visit/mall/things-to-do/public-observatory.cfm>

<http://airandspace.si.edu/visit/families.cfm>

The Moon and NASA

A **moon** is an object in space that revolves around a planet, in much the way planets revolve around the sun. Most planets have moons, but when we say "The Moon," we are referring to Earth's moon.



NASA, which stands for National Aeronautics and Space is a government organization that controls projects that deal with space or airplanes. One of NASA's most famous programs was the **Apollo program**, a series of spaceflights and moon-landings that included Apollo 11, the first spacewalk on the moon.

On July 20, 1969, as part of Apollo 11, American Neil

Armstrong was the first person to set foot on another object in space. He was shortly joined by "Buzz" Aldrin. Together they spent 21 hours on The Moon. *How would you have felt?* Imagine you were alive in 1969.

For more information, see:

<http://www.hq.nasa.gov/office/pao/History/ap11ann/introduction.htm>

<http://www.nasa.gov/audience/forstudents/5-8/features/nasa-knows/what-was-apollo-program-58.html>

<http://www.nasa.gov/audience/forkids/kidsclub/flash/>

What's with the face?

When we see the light mountains and dark volcanoes as we look at the moon, we often see the shape of a face. There isn't really a man in the moon –our brains are just trying to recognize familiar images. Do you ever see shapes in the clouds? It's a similar idea!

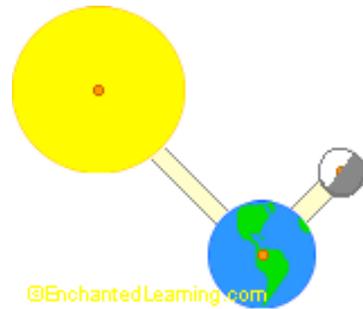
For more information, visit:

<http://news.nationalgeographic.com/news/2014/04/140412-moon-faces-brain-culture-space-neurology/>

Moon Revolution Activity

Materials:

- White cardstock
- Optional yellow paper plate
- Scissors
- Three brads (metal paper connectors)
- A compass for drawing circles, or print a template.
- Crayons or markers



Directions:

1. Use the compass to draw and cut out three circles (small, medium, and large) from cardstock or cardboard from a cereal box. If available, a yellow paper plate makes a nice Sun. You'll need a large circle for the Sun, a medium one for the Earth, and a small one for the Moon.
2. Cut out two strips of cardstock (any color) about 1 inch thick (you can use the marked margins of the templates above). One strip should be about 8 inches long and one should be about 5 inches long.
3. Color the Sun yellow, color the Earth blue and green, and keep the Moon white.
4. Connect one end of the short (roughly 4-5" long) strip of paper to the center of the back of the Moon using a brad.
5. Connect the other end of that strip of paper to the center of the Earth (but don't close the second brad yet).
6. Connect one end of the long (roughly 8" long) strip of paper to the center of the back of the Earth with the already-open brad.
7. Connect the other end of that short strip of paper to the center of the sun.

Although the relative sizes of the Earth and the Moon are roughly accurate (about 3:1), the Sun should be much, much larger (the Sun is over 100 times bigger than the Earth). Also, the Earth is over 370 times farther from the Sun than it is from the Moon. If this model were accurate, the Earth and the Sun should be over 90 feet apart (given that the Earth-Moon distance in the model is about 3 inches).

For a template and images for each step, go to:

<http://www.enchantedlearning.com/crafts/astronomy/sunearthmoon/>

About Discovery Theater

Discovery Theater has presented live educational performances at the Smithsonian to young people throughout the Washington, D.C., area and beyond since 1979. With programs that enrich the Smithsonian experience for nearly 50,000 children annually, Discovery Theater is a gateway to the exhibits, collections, and themes contained in the museums and galleries on the National Mall and in our community. There's so much to do and explore at the Smithsonian—and Discovery Theater is the ideal place to begin!

For more information, please visit our website www.discoverytheater.org.

