Imagining Life

Have you ever looked up at the night sky and wondered what other life might be out there, circling other stars? If so, you're thinking like an astrobiologist!

Astrobiologists study how life began and evolved on Earth, and what conditions are needed to make other worlds habitable. Part of their research includes the study of extreme Earth environments where life exists, and they use this information to make predictions about where in the universe we might find other life, and what those life forms might be like!

Explore some different extremophiles (living creatures whose habitats are too extreme for us!) and make your own predictions about what life might exist on another planet!

Supplies:

- Drawing sheet (attached) or blank piece of paper
- Markers or colored pencils
- Extremophiles Cards (attached)

Instructions:

1. Take a look at the different extremophiles cards and learn about organisms that thrive in places too extreme for humans.
2. Imagine a planet or moon in the universe where the environment is too harsh for people. Is it very hot? Very cold? Is the air too thick, or very thin? Is it too acidic? Use the provided drawing sheet or your own piece of paper to draw the landscape of your imagined world!
3. Think like an astrobiologist! What sort of organism would survive on your planet or moon? What adaptations would it need to live there? Would it look like an extremophile of Earth, or something completely different? Draw your life form in its extraterrestrial habitat!

NISE NATIONAL INFORMAL STEM EDUCATION NETWORK

This activity was adapted from the National Informal STEM Educator's Network (NISE Net). For more information visit http://www.nisenet.org.

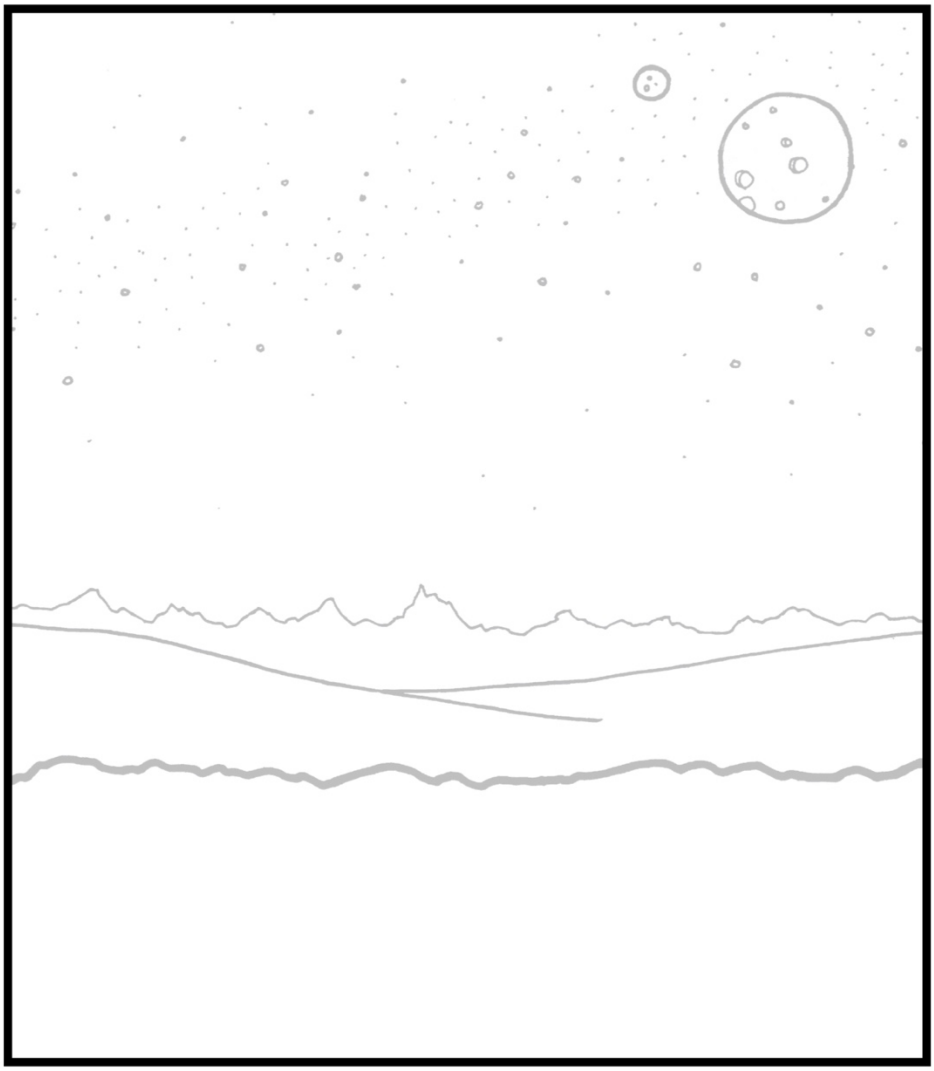
Are we alone in the universe?

We don't yet have scientific evidence for life in other parts of the universe, but there are some exciting possibilities in the Milky Way galaxy— and even our own solar system! Astronomers have found many potentially habitable planets in the Milky Way using NASA's Kepler telescope. These "Goldilocks" planets are just the right distance from the stars they orbit—not too close and not too far—to allow liquid water to exist on their surfaces, a critical ingredient for life as we know it. Citizen scientists also participate in Kepler's research through the Planet Hunters project!

Astrobiologists expect that alien life forms—if they're out there—will be specially adapted to their environment. Most of the alien worlds we've explored so far are very different from Earth, so any living things we find beyond Earth will probably be very different, too.

Does life exist beyond Earth?

Imagine an alien life form that lives on a far-off world. Where does your alien live? Is it hot or cold, dry or wet? How is your creature especially well suited to its environment?



When you imagine life on another planet, you're doing a little bit of science! Researchers use our knowledge about life on Earth to make predictions about what a habitable extraterrestrial planet might be like, and what kind of life could survive there.

Learn more about the search for life beyond Earth: https://astrobiology.nasa.gov/

THE AMAZING

POMPEII WORM

These worms thrive deep in the ocean on volcanic sea vents.

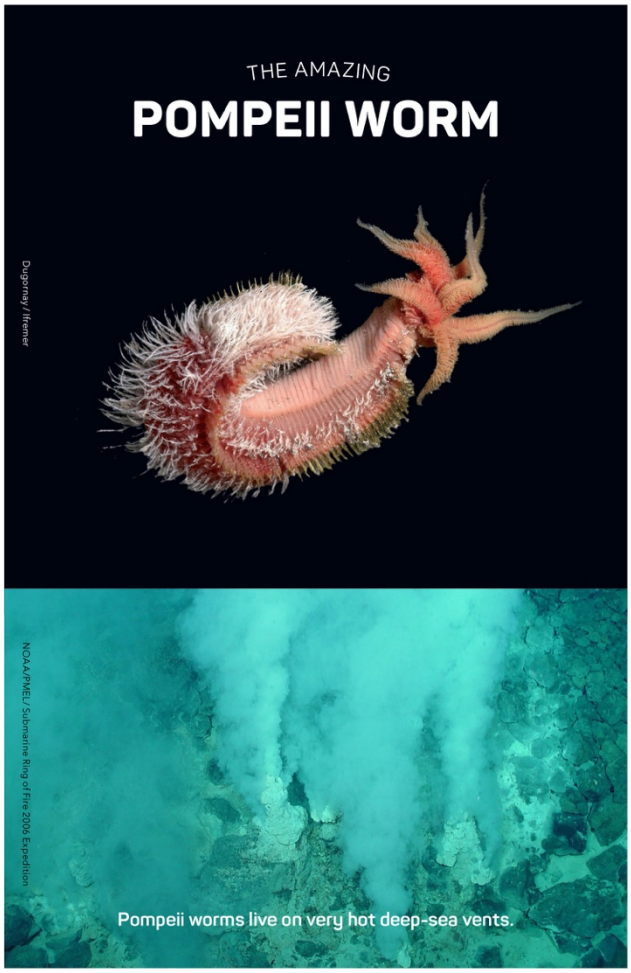
Pompeii worms attach themselves to “black smokers,” or geothermal heat vents, at the bottom of the ocean. They look hairy, but their bristles are actually colonies of bacteria that insulate the worm from extremely hot temperatures! They can grow to be about 13 centimeters (5 inches) long.

Scientists want to learn more about how organisms can survive in extreme heat. Some potentially habitable planets in other solar systems might be hotter than Earth.

CHECK IT OUT!

THE AMAZING

POMPEII WORM



Dugornay / Ifremer

NOAA/PMEL/ Submarine Ring of Fire 2006 Expedition

Pompeii worms live on very hot deep-sea vents.

THE AMAZING

EMPEROR PENGUIN

These birds have adapted to survive in bitter cold.

Many penguins live in the Antarctic, where temperatures are well below freezing. They often live in large groups, huddling together to keep warm. To get around in their chilly world, penguins swim, surf the waves, and use their bellies like sleds.

Penguins are an example of a complex life form adapted to an extreme environment. Beyond Earth, scientists think we’re more likely to find microscopic organisms.

CHECK IT OUT!

THE AMAZING

EMPEROR PENGUIN

NOAA NESDIS, ORA / Michael Van Woert

Emperor penguins live in the cold, icy Antarctic.

THE AMAZING

LICHEN

Lichens can survive almost anywhere.

Lichens can live for hundreds of years in a wide range of environments, from arctic tundra to hot deserts to rocky coasts. They can grow on trees, rocks, walls, and even toxic slag heaps. Because lichens are so tough and versatile, they are found blanketing around 6% of Earth's land surface!

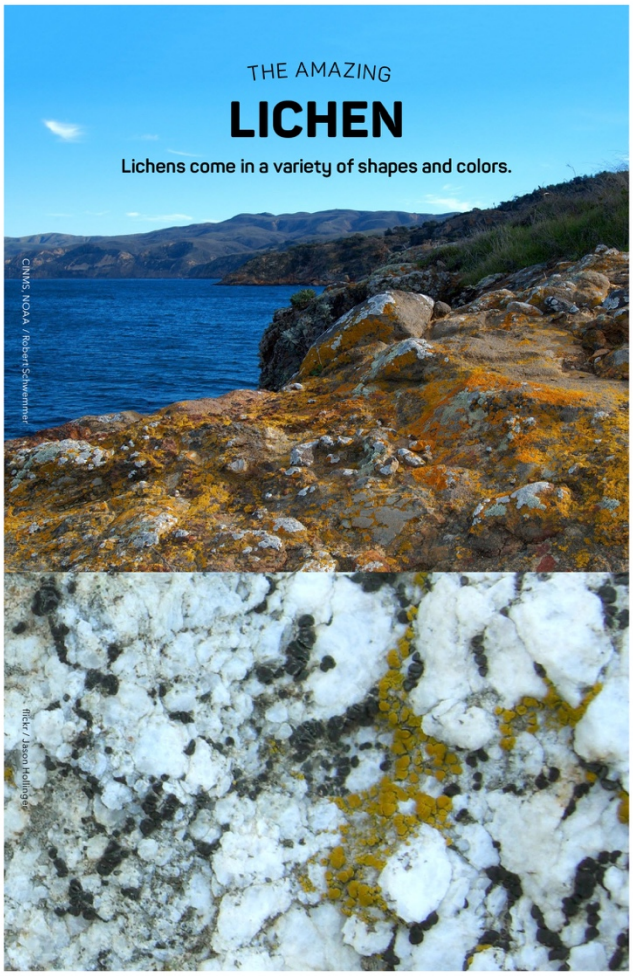
Lichens are a combination of more than one kind of life—usually a fungus with algae, bacteria, or both. Some scientists think that evidence for composite organisms could be discovered on Mars.

CHECK IT OUT!

THE AMAZING

LICHEN

Lichens come in a variety of shapes and colors.



CINMS, NOAA / Robert Schwemmer

flickr / Jason Hollinger

THE AMAZING

RUSHING FIREBERRY

This microbe is found in scorching hot marine volcanic sediments.

The hotter the better for this organism! The rushing fireberry can survive the burning temperatures of deep-sea volcanoes. It grows best at 100 degrees Celsius, and when conditions are good, it quickly reproduces and increases its population.

Some potentially habitable planets in other solar systems (exoplanets) might be closer to their sun than Earth is to ours, so scientists want to learn more about how organisms can survive in extremely hot places.

CHECK IT OUT!

THE AMAZING

RUSHING FIREBERRY

Wikipedia / Fulvio314

The rushing fireberry lives in the boiling vents of deep-sea volcanoes.

THE AMAZING

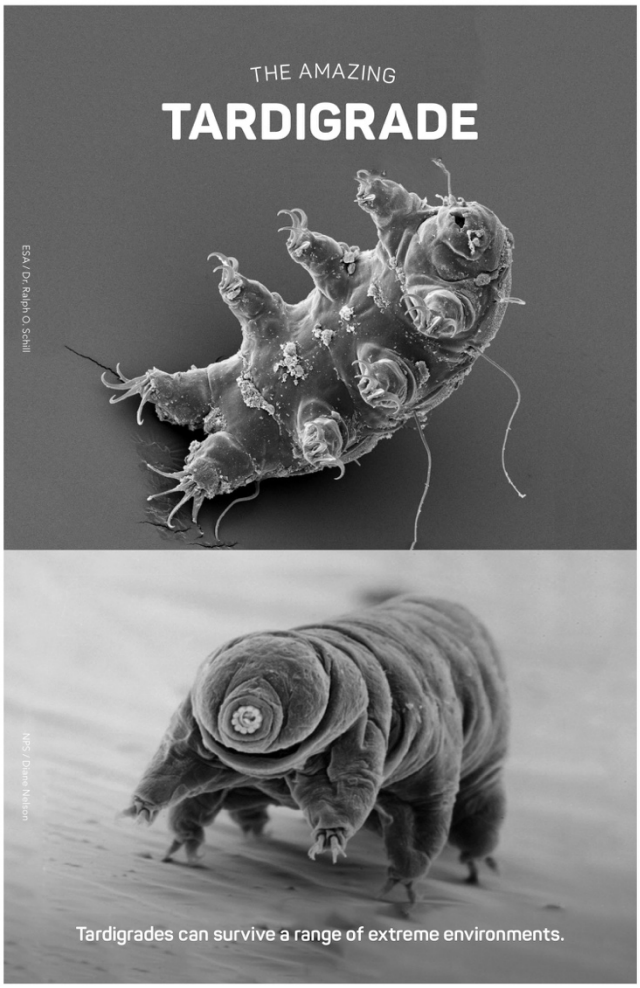
TARDIGRADE

This eight-legged micro-animal is one of the most durable life forms on Earth.

Tardigrades (also called water bears or moss piglets) can live in a variety of extreme environments, including high mountains, rainforests, and deep seas. They can endure freezing temperatures, high pressure, and very dry air, sometimes by entering a state of suspended animation. As a research experiment, tardigrades were exposed to the radiation and vacuum of space for ten days—and they survived!

NASA researchers are studying tardigrades to understand what alien forms of life might be like.

CHECK IT OUT!



Tardigrades can survive a range of extreme environments.

THE AMAZING

SNOTTITES

These microbe colonies flourish in very acidic environments.

Snottites are single-celled bacteria that live in colonies in dark, wet caves. “Snotties” look like small stalactites but have the consistency of mucus. They get their energy through chemosynthesis of volcanic sulfur, and their waste is highly acidic.

Some planets, such as Venus, have toxic clouds and atmospheres. They may be the perfect place to look for life forms that love acidic environments!

CHECK IT OUT!

Snottite colonies live in dark, wet, acidic caves.

THE AMAZING

YETI CRAB

This crab thrives on the deep, dark ocean floor.

Sightless, hairy yeti crabs live near hydrothermal vents deep in the ocean. Bacteria coating their hairs eat toxic minerals emitted from the vents. The crabs may eat the bacteria, or they may scavenge on dead things falling from above.

Scientists think life in other parts of the universe won't look very much like life here on Earth. But we haven't found any scientific evidence of extraterrestrial life yet!

CHECK IT OUT!

THE AMAZING

YETI CRAB

University of Hawaii Manoa, MoraLab / Enrique MacPherson

The yeti crab lives deep in the ocean, away from sunlight.

THE AMAZING

SNOW ALGAE

Snow algae survive on mountaintop snow and ice.

For many years people thought the reddish color on high alpine snowfields was caused by a mineral, but researchers have discovered that it's actually huge colonies of algae. Snow algae grow in the freezing water created by melting snow. The algae look and even smell a little like watermelon!

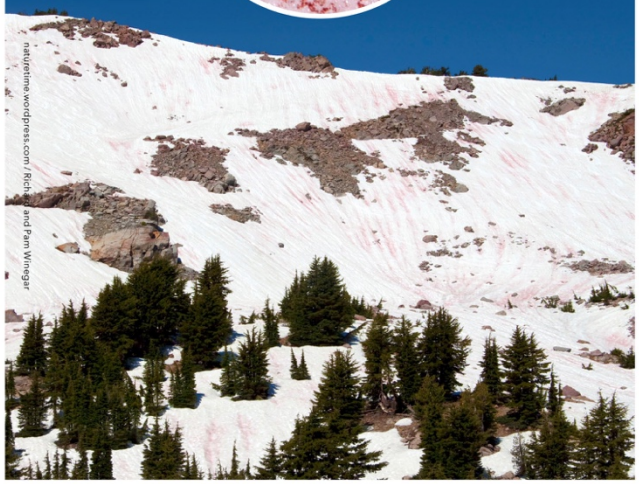
Scientists are trying to determine if Jupiter's icy moon Europa might have the right mix of conditions to harbor forms of life that tolerate cold.

CHECK IT OUT!

THE AMAZING

SNOW ALGAE

Snow algae live in the freezing water created by snowmelt.



naturetime.wordpress.com / Richard and Pam Winegar

THE AMAZING

BARREL CACTUS

These special plants are well suited to the high, dry desert.

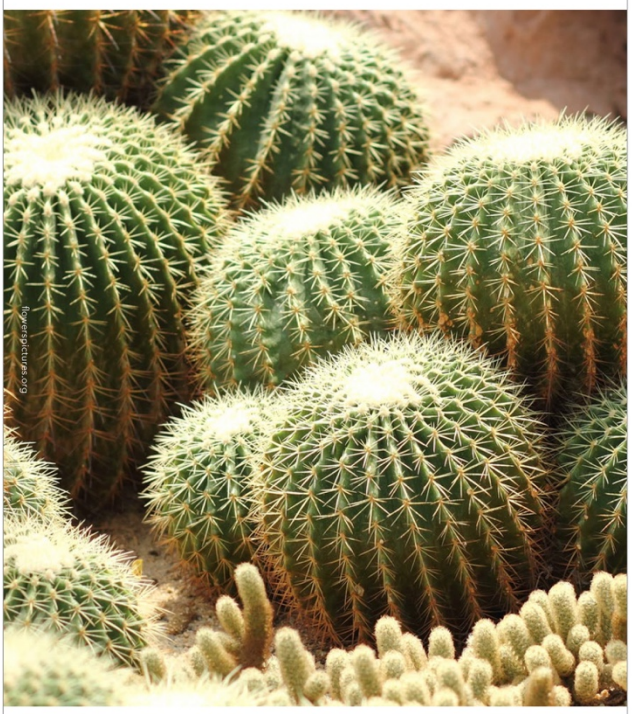
Many different kinds of barrel cactus grow in the Sonoran Desert of Baja, California. Each one is specially adapted to its own micro-environment. They can withstand huge changes in temperature—hot during the day and very cold at night—and they need very little water. The barrel cactus is protected by sharp spines.

Scientists are learning more about how some living things can survive the extreme environments found on other planets and moons. But we haven't yet found signs of life anywhere other than Earth!

CHECK IT OUT!

THE AMAZING

BARREL CACTUS



The barrel cactus lives in dry desert environments.

THE AMAZING

WOOD FROG

These frogs survive frigid temperatures by hibernating.

During the winter, wood frogs burrow into the ground. Their breathing and heartbeat stop, and up to two-thirds of their body may freeze. When it gets warmer, they thaw out, wake up, and hop away!

Scientists don't think we'll find complex life forms like frogs on other planets or moons in our solar system. We're more likely to find microscopic life forms.

CHECK IT OUT!

THE AMAZING

WOOD FROG

The wood frog can survive freezing temperatures in the winter.