

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

# 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!**



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**POMPEII WORM**

Dugornay / iFem'er



NOAA/PMEL / Submarine Ring of Fire 2006 Expedition

Pompeii worms live on very hot deep-sea vents.

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**EMPEROR PENGUIN**

NOAA NESDIS, ORA / Michael Van Woert



Emperor penguins live in the cold, icy Antarctic.

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**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  
**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!**





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**RUSHING FIREBERRY**



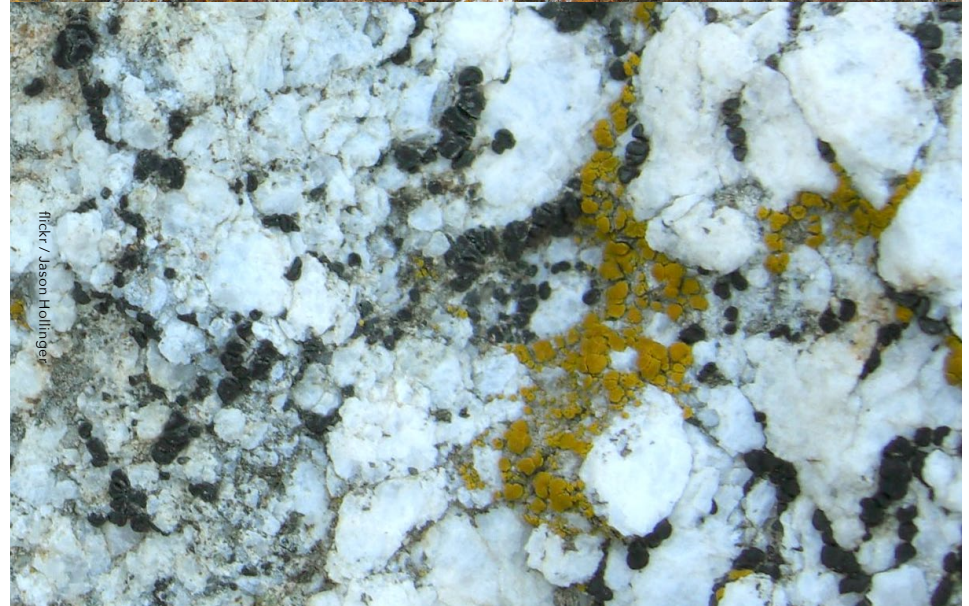
Wikipedia / Fulvio314

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

THE AMAZING  
**LICHEN**

Lichens come in a variety of shapes and colors.

CINMS, NOAA / Robert Schwemmer



flickr / Jason Hollinger

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**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!**



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**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.

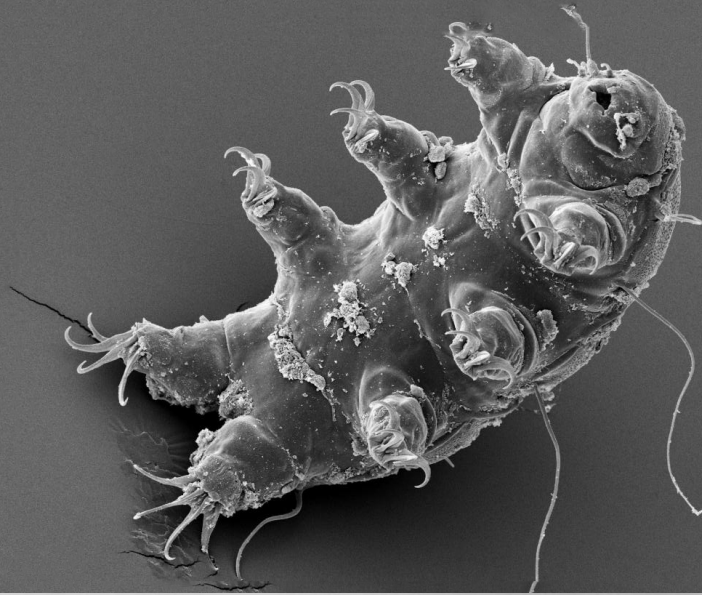
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**TARDIGRADE**

ESA / Dr. Ralph O. Schill



NPS / Diane Nelson



Tardigrades can survive a range of extreme environments.

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**SNOTTITES**

caveslime.org / Kenneth Ingham



Snottite colonies live in dark, wet, acidic caves.

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# 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!**



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# 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!**





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**YETI CRAB**

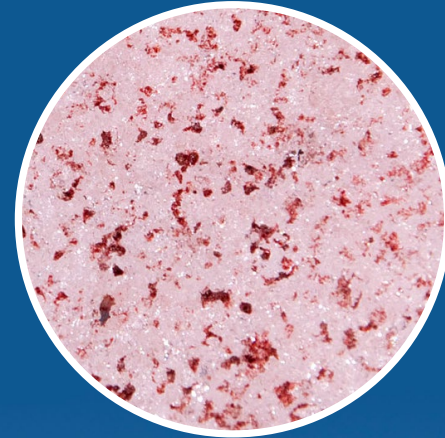


University of Hawaii Manoa, Moralab / Enrique MacPherson

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

THE AMAZING  
**SNOW ALGAE**

Snow algae live in the freezing water created by snowmelt.



naturetime.wordpress.com / Richard and Pam Winegar



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  
**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!**



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**BARREL CACTUS**



The barrel cactus lives in dry desert environments.

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**WOOD FROG**



flickr / Brian Gratwicke

The wood frog can survive freezing temperatures in the winter.