Life at the limits – Teachers Notes

Tardigrades

Tardigrades, often called **water bears** or **moss piglets**, are near-microscopic animals with long,

plump bodies and scrunched-up heads.

They have eight legs, and hands with four to eight claws on each. While strangely cute, these tiny

animals are almost indestructible and can even survive in outer space.

Tardigrade is a phylum, a high-level scientific category of animal (humans belong in the Chordate

phylum — animals with spinal cords.)

There are over 1,000 known species!

Size

These creatures can range from 0.05 millimetres to 1.2 mm (0.002 to 0.05 inches) long, but they

usually don't get any bigger than 1 mm (0.04 inches) long.

Habitat

Water bears can live just about anywhere. They prefer to live in sediment at the bottom of a lake, on

moist pieces of moss or other wet environments. They can survive a wide range of temperatures and

situations.

They can survive temperatures of lows of -270 degrees!

They can also survive for a few minutes at temperatures of 150 degrees.

They can also survive radiation, boiling liquids, massive amounts of pressure of up to six times the

pressure of the deepest part of the ocean and even the vacuum of space without any protection.

Habits

In 1776, Italian clergyman and biologist Lazzaro Spallanzani discovered that water bears survive

extreme conditions by making a transformation.

In many conditions, they survive by going into an almost death-like state called **cryptobiosis**. They

curl into a dehydrated ball, called a **tun**, by retracting their head and legs. If reintroduced to water, the

tardigrade can come back to life in just a few hours.

While in cryptobiosis, tardigrades' metabolic activity gets as low as 0.01 percent of normal levels, and

their organs are protected by a sugary gel called trehalose. They also seem to make a large amount

of antioxidants, which may be another way to protect vital organs.

In cold temperatures, they form into a special tun that prevents the growth of ice crystals.



Diet

Tardigrades eat fluid to survive. They suck the juices from algae, lichens and moss.

Studies show that some species are carnivores and even cannibals — they can prey on other

tardigrades.

Offspring

Tardigrades reproduce through sexual and asexual reproduction, depending on the species. They lay

one to 30 eggs at a time. During sexual reproduction, the female will lay the eggs and the males will

fertilize them. In asexual reproduction, the female will lay the eggs and then they will develop without

fertilization.

Classification/taxonomy

**Kingdom**: Animalia

**Phylum**: Tardigrada

Other facts

• Tardigrades were discovered by a German pastor, Johann August Ephraim Goeze, in 1773.

He named them Tardigrada, which means "slow stepper."

• The water bear's mouth can telescope outward to reveal sharp teeth that are used to grab

onto food.

• They swim! Their multiple legs propel water bears forward to reach food.

• Tardigrades must have at least a thin coating of water around their bodies to prevent turning

into a tun.

Videos / activities

Christmas Lectures: How Tardigrades Survive in Space

http://www.rigb.org/christmas-lectures/teaching-resources/2015-how-to-survive-in-space/tardigrades

This video from the Royal Institution focusses on the following:

• Microscopy

• DNA

• Mutation

• Radiation

• Extremophiles

This clip could be used as a starting point to discuss the causes and effects of DNA damage.

Research Project

Students research the limits of different extremes that tardigrades can tolerate, eg maximum

pressure, and think about how that could be useful in searching for life beyond the Earth.

Relevant Images

