

Introduction:

Tardigrades, also known as water bears or moss piglets, are grub-like 8-legged animals with 4-6 claws per foot. Their scientific name is Tardigrada, meaning “slow stepper”. Their domain is Eukaryota, their Kingdom is Animalia, their phylum is Tardigrada, and their superphylum is Ecdysozoa. They are about 0.05 mm-1.2 mm in body length. They have 2 very tiny eyes on their head that can only sense light, not color. They have a long tube-shaped mouth that has teeth inside and kind of look like the mouths of a leech. They can be found anywhere on earth and they mainly eat moss and flowering plants but some are carnivorous and might eat other tardigrades. They use their mouth to pierce plant cells and suck out it's content. Some predators of tardigrades include Nematodes (a kind of worm), amoebas, and sometimes even other tardigrades. Tardigrades have lived for over 600 million years and have survived all five mass extinctions and are believed to live after humans go extinct.

The Superpower:

Tardigrades have a very amazing superpower that has attracted scientists since it was discovered by J.A.E. Goeze in 1773. They are truly aquatic animals, so they require water to surround their bodies to allow the exchange of oxygen and carbon dioxide. Without water, they stop metabolizing and curl up and have the ability to “die”, also known as the tun state. They can also repair their cells, but scientists still don't understand how, it's all in the genetics. The process whereby an organism temporarily suspends its metabolism is known as cryptobiosis. Only some groups of species can undergo cryptobiosis and they can stay in that state for 30 years! During this tun state, and because they only need water every 30 years, tardigrades can survive in the scorching deserts and freezing antarctic to the deep sea, and mountains. They can survive unbelievable amounts of pressure and temperatures from minus 328°F up to 304°F. Also, we can't forget about the fact that they can survive in OUTER SPACE! And the cool thing is that they only need a drop of water to be restored.

Difficult with Tardigrade Genome:

The tardigrade genome varies in size from 50 bases to 44 million bases, which is relatively small. The inherent nature of the tardigrade – its microscopic scale – makes it impossibly difficult to study. Each tardigrade contains just 0.2 nanograms of DNA. Their DNA is locked within their tough exoskeleton, making it difficult to get at.

Things to clarify:

Just because of their amazing abilities, doesn't mean they are immortal. They only live for a few months sadly. The reason we call the "half-dead" during the tun state is that according to all traditional definitions of life, there must be some form of reproduction and metabolism involved. In their tun state, tardigrades are doing nothing that we would associate with being alive – they are not making or consuming ATP at all. They are indistinguishable from dead or inorganic matter. So, are they alive? This is yet another debate that tardigrades have.

A Step Forward:

How can we use tardigrade power to help us? One medically important application of tardigrade research could be in vaccine development. Vaccines are required to be stored in low temperatures, but maintaining that can cause several potential issues and is also very costly. One alternative could be to use the inherent properties of intrinsically disordered proteins to allow vaccines to be stored at room temperature, experimentation about this has already started by Thomas Boothby. Another astonishing experiment is tardigrade "sunscreen" that protects humans from UV light and radiation. This was caused when in 2020, researchers came across a new species of tardigrades that were able to survive very intense amounts of ultraviolet radiation. They were absorbing the shorter wavelengths of light and emitting longer ones, protecting their cells from radiation damage in the process. The researchers decided to mush up the tardigrades into a paste and apply it to *C. elegans* worms. Amazingly, these worms were then able to tolerate much higher doses of UV radiation.

Main Source:

<https://frontlinegenomics.com/everything-you-need-and-want-to-know-about-tardigrades/#:~:text=One%20of%20the%20biggest%20appeals,to%20students%20the%20world%20over.>