



Tardigrades Genes for Innovation

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Why in News?

Recently, researchers are exploring a range of **unique tardigrade features** to inspire advancements in **medicine**, [biotechnology](#), and **space exploration**.

What are the Key Facts About Tardigrades?

- **About:** Tardigrades (*Tardigrada*), also known as **water bears** or **moss piglets**, are **microscopic, eight-legged** creatures **without a backbone**.
- **Species and Evolution:** They belong to the **phylum Tardigrada**.
 - The earliest known fossils date from **around 90 million years ago**, in the [Cretaceous Period](#) (145 - 66 million years ago).
 - Molecular dating suggests they originated at **least 600 million years ago**.
- **Adaptations:** Tardigrades are known for their ability to withstand **extreme radiation**, starvation, lack of oxygen and water, and **subzero temperatures**.
 - They can inhabit extreme ecosystems like the **Arctic, deep-sea floors**, [deserts](#), and even the vacuum of **space**.
- **Cryptobiosis:** Tardigrades can enter [cryptobiosis](#), **halting biological activity** to survive extreme conditions like **dehydration, freezing, and radiation damage**.
 - The **DODA1 gene** helps synthesise **betalains**, a type of [antioxidants](#) that likely **protect cells from radiation damage** and allows them to **recover and resume** normal activities afterward.

Eutardigrade Tardigrade



How Tardigrade Properties Could be Applied for Human Use?

- **Intrinsically Disordered Proteins (IDPs):** Secretory-abundant heat-soluble IDPs synthesised in microbes **improve desiccation (completely drying up) tolerance**, potentially enabling resilient microbes and organisms.
- **Small Heat Shock Proteins:** When cloned into microbes, these proteins can improve microbial **survival and stability in hot or dry environments.**
- **Protein Stability:** Tardigrades' ability to stabilise their proteins in extreme environments could be used to improve the shelf life and effectiveness of [vaccines](#), [antibodies](#), and [enzymes](#) used in medicine.
- **Cell Preservation:** Tardigrades' mechanisms to **resist cellular damage** could be used for **cell therapies**, aiding in transport and storage, and ultimately improving treatment delivery.
 - Researchers may develop enhanced protective measures for **humans and materials in outer space.**