Understanding how intrinsically disordered proteins make tardigrades tough

Cherie Hesgrove
Thomas C. Boothby

Video Byte

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Abstract

The microscopic tardigrade is one of the toughest known organisms in the animal kingdom, capable of surviving environmental extremes such as near-complete desiccation, freezing and high temperatures, and ionizing radiation. Exactly how these tiny creatures are able to withstand these stresses has remained largely a mystery. Now, research is showcasing the role of three protein families not found in other organisms, collectively referred to as tardigrade disordered proteins (TDPs). Unlike typical folded proteins, in solution many TDPs lack a stable 3D structure. This lack of structure may allow them to adopt different conformations under different environmental conditions. Although seemingly diverse, the stress conditions that tardigrades can tolerate are actually quite similar. Similarly to desiccation, freezing removes water from proteins and membranes, and irradiation induces genome damage like that observed during drying. TDP evolution could provide tardigrades elegant armor against extreme environmental conditions. Experiments probing the dynamics and structure of TDPs could help scientists understand where they came from and how they evolved and explain just how tardigrades have remained one of the hardiest animals on our planet.