Raman imaging of a living multicellular organism: A study on the nature, source and function of pigments in Echiniscus Tardigrades

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Tardigrades, or water bears, are microscopic water-dwelling animals (100-1000 μm in length), most of which can be found in terrestrial habitats where they constitute the major component of the fauna in lichens and mosses [1]. Tardigrades are active only when surrounded by a water film; despite the fact that lichens and mosses are subject to periodic desiccation and/or freezing, these animals survive in these "hostile to life" habitats entering in a cryptobiotic ametabolic state, in which they can persist for years, withstanding several physical and chemical extremes [2]. Their ability to survive to harsh conditions aroused the interest of the scientific community and led to experimentation with these animals during the FOTON-M3 space mission in low Earth orbit, throughout which they endured exposure to solar/galactic radiation, vacuum and microgravity [3].

There is currently a lack of knowledge about many aspects of the biology and ecology of these animals, and in particular about the mechanisms underlying their endurance to harsh conditions. For instance, although many tardigrade species are pigmented, little is known about the nature and function of these pigments. We used Raman spectroscopy and imaging to study these pigments in living tardigrade specimens, determining their carotenoid nature, their distribution inside the animal's body and their dietary-origin. By quantifying the pigments decrease upon exposure to high oxidative stress, we hypothesize their anti-oxidants function, and therefore their possible involvement in the protective mechanisms which allow these animals to withstand extreme environmental conditions.

References

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