

Alekseev, De Stasio & Gilbert (eds.): *Diapause in Aquatic Invertebrates*

The Big Sleep

Some aquatic organisms possess the odd ability to enter a reversible state of dormancy to overcome harsh living conditions. A new text book offers a detailed insight but has also some shortcomings.

How wonderful it would be to have the ability to pause life when the going gets tough and go on living when it becomes convenient again. Some aquatic and semi-terrestrial metazoans, including several rotifers, nematodes, tardigrades, and crustaceans, found in a variety of habitats within marine, freshwater and terrestrial ecosystems, can do just this at different stages of life. To survive in habitats that are prone to variable conditions, these organisms possess the ability to enter a reversible state of dormancy, the suspension of their vital functions for a sometimes very long duration, to overcome harsh environmental situations. The best-defined types of dormancy are diapause and quiescence. These two remarkable abilities are discussed in the new book *Diapause in Aquatic Invertebrates* edited by Victor R. Alekseev, Bart De Stasio, and John J. Gilbert.

The editors begin with various definitions, a difficult but necessary basis for discussion. One of them is the term “cryptobi-



Unfortunately not covered in the book: *Cosztazia costazi*, a coralline bryozoan, whose proximal zooids are usually dormant.

osis”. In 1959 David Keilin defined cryptobiosis as the state of an organism when it shows no visible signs of life and when its metabolic rate becomes hardly measurable or reaches a reversible standstill. There is, presumably, a difference between a hardly measurable metabolism and one that is at a reversible standstill that is of considerable significance. In that sense the or-



The brine shrimp *Artemia* (often sold as ‘Sea Monkey’ novelty gifts) produces, when under stress, encysted embryos with very low metabolic activities that can survive a complete lack of oxygen for up to 17 months.

ganism is not alive, yet neither is it dead, since after dormancy a living organism still exists.

Current state of knowledge

The book, written by 20 authors, examines the current state of knowledge over 14 chapters and two major parts. Part 1 describes the strategies and mechanisms of diapause in aquatic invertebrates, using rotifers, crustaceans, and aquatic insects as examples. Of course, crustaceans are one of the best investigated organisms and thus take centre stage in many chapters. The encysted embryo of the brine shrimp *Artemia* is particularly well covered. Its motile stages are arguably the best example of all animal osmoregulators, enabling success in severely hypersaline environments, while the encysted embryos, or cysts, are unequalled when it comes to tolerating high doses of UV and ionizing radiation, surviving years of continuous anoxia, thermal extremes and desiccation-hydration cycles.

The overview of molecular mechanisms of diapause in aquatic insects is, unfortunately, rather brief. To date, few studies have been conducted on the molecular processes involved in diapause or on genes and proteins coding diapause induction and termination. However, in this chapter the authors cite recent studies on the celebri-

ty nematode *Caenorhabditis elegans*. Why there is no information on other invertebrates remains a mystery.

Second part features applied research

The second part of the book deals with the role of diapause in science and its human uses. Cultivation of live food, like rotifers and *Artemia*, organisms which can be stored for months in their dormant state, is an expanding application of diapause in modern aquaculture. For example, *Artemia* cysts are harvested from Great Salt Lake, Utah, at an average of 4,000 tons a year, equivalent to about 500 trillion cysts. Dormant organisms are big business.

Another chapter covers the advantages of colonising new environments by passively transporting invasive species in their resting stage, and the possibility of establishing artificial ecosystems outside the Earth’s biosphere using dormant organisms. A possible step forward for space exploration?

The best available resource with a few holes

All in all, the book is the best available on the phenomenon of diapause. Nevertheless, information about a few groups of organisms is completely missing. What happened to freshwater sponges and their gemmules, bryozoans and their statoblasts, and tardigrades and their cysts? Hopefully, the editors will produce a second book about them. This interesting volume, however, still has something to say about the nature of life.

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