

The body wall separates the interior of the body from the external environment and is a barrier that protects against the effects of various environmental stressors. On the other hand, it allows keeping contact with the environment. The integument is involved, among others, in the processes of secretion, respiration, ion exchange or in regulation of the body temperature. The integument is also responsible for the reception of stimuli from the environment and locomotion. Moreover, may also participate, among others in reproductive or defensive behavior. The integument plays many significant functions – even in such tiny microinvertebrates as tardigrades.

Tardigrades are a group of worldwide occurring animals of ca. 50–1200 µm in size. They can be found in marine, freshwater and terrestrial habitats. These animals are highly dependent on water and they need at least its thin layer to be active. Tardigrades have attracted the attention of researchers due to their extraordinary abilities, thanks to which they are able to survive not only periods of unfavourable environmental conditions on Earth (lack of water, large temperature or salinity fluctuations), but are also able to survive exposure to space conditions. Nowadays, these animals are seen as a source of information with great potential and the possibility of their use in various areas such as pharmacology, medicine, or astrobiology. Cryptobiosis and diapause in tardigrades are seen as states that are an adaptation developed to survive environmental stress. Cryptobiosis is directly caused by environmental stressors. Anhydrobiosis (one of a form of cryptobiosis) is induced by dehydration. During desiccation, the tardigrades able to anhydrobiosis transform into a tun – barrel-shaped form. Unlike cryptobiosis, diapause is controlled by both exo- and endogenous stimuli. During encystment (which is one of the forms of diapause), tardigrades undergo deep morphological changes that result in the formation of cysts. What is more interesting, during this process, the animals form a cuticular capsule inside which they are closed. So in the case of encystment, the animal is not only protected by the integument but also by the cuticular capsule. Tardigrades are able to moult multiple times during whole life. During this process, they shed a cuticle – the most external part of the integument. A part of tardigrades lay their eggs with thin chorion into exuvium, what makes that the eggs are additionally protected. Moreover, it also suggests synchronisation between egg deposition and moulting process.

Despite the fact that tardigrades have been known to science for almost 250 years, we still have many gaps in our knowledge about these microscopic creatures. Especially encystment process is a poorly understood phenomenon in the biology of tardigrades.

This project is dedicated to the analysis of selected aspects of the biology of tardigrades, which to a large extent have not been studied yet. **The aim of the project** is a multi-aspect analysis of cuticle and cuticular capsule in freshwater tardigrade *Thulinus ruffoi* (Tardigrada, Isohypsibioidea: Doryphoribiidae), which has the ability to encyst. The analysis will be focused on active individuals (not-encysted) and cysts of *T. ruffoi*. **The unique aspects of research** include: (1) analysis of the relationship between the formation of a new cuticle during moulting and the process of oogenesis based on ultrastructural studies, (2) ultrastructural analysis of the cuticular capsule in relation to the duration of encystment and (3) histochemical analysis of chemical components located in the cuticular capsule of the cysts. Research goals will be achieved using transmission electron microscopy and histochemical analyses dedicated to light microscope (LM), as well as, transmission electron microscopy (TEM). The effect of the analyses will be to provide new information on the biology of tardigrades, which will significantly contribute to expanding our knowledge not only about the cuticle, which is a barrier against environmental stressors in this group of animals, but also enrich our knowledge about such a poorly understood process of encystment.