SUMMARY

The environment affects living organisms, and this influence can be observed even in microscopic animals like tardigrades. Encystment, a form of diapause, is a relatively poorly understood phenomenon in tardigrades. It is seen as an adaptive process that evolved to survive adverse environmental conditions and as an example of epigenetic phenotypic plasticity associated with moulting. This process is controlled by environmental and, as yet, unknown internal factors.

Thulinius ruffoi is a freshwater parthenogenetic tardigrade capable of forming cysts. Therefore, it has been chosen as a model for the research included in this dissertation. Although the presence of ovoid-shaped cysts of this species has been recorded in nature, their extraction as research material would be tedious or even impossible due to the dynamics of the process. Therefore, an important part of the study was the development of a methodology to obtain cysts of this species under laboratory conditions. This method was helpful in the research included in this thesis and is currently being used successfully by researchers at Keio University (Tokyo, Japan). The multi-aspect analyses of the encystment process were based on observations of living specimens and material analysis using varied optical microscopy techniques (brightfield, differential interference contrast (Nomarski interference contrast), or fluorescence microscopy) but also scanning and transmission electron microscopy. The analyses were also enriched with three-dimensional visualisations of the whole organism based on serial scans using a serial block-face scanning electron microscope. This dissertation addresses not only the obtaining of cysts but also the cytological, histological, anatomical, morphological, physiological, and behavioural aspects of the encystment process.

The encystment process is associated with forming a specific cuticular capsule surrounding the animal's body and isolating it from the environment. This capsule consists of three sheaths,

and each of them is morphologically and structurally distinct. These sheaths remain connected to each other through numerous cuticular connections. The formation of the cuticular capsule during cyst formation in *Thu. ruffoi* proceeds in a completely different way from that described in the literature. This allowed describing an alternative model of cuticular capsule formation during encystment in tardigrades. Based on the collected data, including a 3D reconstruction of the whole animal, the general anatomy, as well as external and internal morphology of encysted animals, were analysed to determine how the animal changes during cyst formation. The cells and organs typical for the active non-encysted animals were observed within the encysted individuals. Musculature was actively involved in the cyst formation process. The somatic muscle activity projected onto the animal's morphology and changes taking place simultaneously affected its internal organisation. The disintegration of the tissues and organs is not characteristic of the course of encystment in *Thu. ruffoi*.

The data presented in this dissertation significantly expand knowledge about the encystment in tardigrades and shed new light on the anatomy of encysted animals and the changes that occur during cyst formation.