

### 3. Streszczenie w języku angielskim

Somatic embryogenesis (SE) is the formation of embryos from vegetative cells. This process, as an example of the extraordinary plasticity of plant organisms, has fascinated researchers for over 60 years. Despite the enormous progress made during this time, the question of how a single somatic cell changes its developmental program to become a complete plant has not been sufficiently clarified so far. Experimental system developed in 2015 in tree fern *Cyathea delgadii* is characterized by single-cell origin of somatic embryos induced on media without plant growth regulators. These particular qualities has opened the way for research on the induction and early expression of SE. The aim of the dissertation was to describe determinants related to the acquisition of embryogenic potential by *C. delgadii* explants at the level of cell structure and ultrastructure, physiological relationships and symplasmic communication. The experiments were conducted on *C. delgadii*, the one fern in which SE was discovered so far. Stipe and internode explants excised from etiolated sporophyte and stipe explants taken from non-etiolated plants, were analyzed.

High-performance liquid chromatography analysis shown that the light conditions in which donor plants develop significantly affect the level and balance of endogenous hormones and sugars. It also proved that abscisic acid (ABA) is the main hormone inhibiting SE and sudden increase in the concentration of endogenous sucrose is a signal inducing developmental change of somatic cells. Hormone transport and biosynthesis inhibitors used in SE-inhibitory concentrations, significantly changed the level of endogenous IAA and/or ABA and/or CK. Their application also caused change in the concentration of endogenous sugars, especially critical for SE induction, sucrose. Experiments with low molecular weight fluorochromes of symplasmic transport have shown the restriction in the cellular communication of stipe explant just before the divisions giving rise to somatic embryos occurred. The changes in the cytoplasm flow were accompanied by remodeling in epidermal and cortical cells structure observed using various microscopic techniques. The development of the somatic embryo was also associated with the restriction of fluorochromes movement between its cells and the explant as well as within the embryo body. By testing a number of factors that may influence the course and efficiency of SE, it was found that depending on the type of explant used for culture initiation, somatic embryos of *C. delgadii* were uni- (on the stipe explants) or multi-cellular (on the interstitial implantation) in origin. Short term treatment of internodes with sucrose solutions increased the SE efficiency by many times. That was related to the change of the embryo differentiation pathway from multi-cellular to uni-cellular.

Studies provided new, comprehensive knowledge on the cellular changes accompanying the transition of somatic cell to the embryonic state and related to the early stage of differentiation of the fern embryo.