Summary

Symplasmic communication through the presence of plasmodesmata (PD) is one of the postulated mechanisms involved in regulating cell differentiation. However, cell differentiation requires the severed integrative function and the emergence of symplasmic isolation in many cases. Thus, the formation of symplasmic domains is an essential factor in the determination of cell fate. During somatic embryogenesis under *in vitro* conditions, explant cells change the direction of differentiation that leads to somatic embryos formation. Thus, it is possible to analyses the relationship between symplasmic communication or isolation and cell fate determination. Somatic embryogenesis on the example of *Arabidopsis thaliana* (Columbia-0 ecotype and transgenic lines) was used to study the relationship between PD and symplasmic communication in explants during changes in the direction of cell differentiation and the development of somatic and zygotic embryos. The research was carried out using the following techniques: stereoscopic, fluorescence (including confocal), and electron microscopy. The results of the conducted analyses and experiments have shown: 1/ the relationship between the permeability, number, morphology of PD and changes in cell differentiation, 2/ the formation of symplasmic domains during somatic embryogenesis, which includes cells realizing different development programs, 3/ the importance of symplasmic isolation for cell differentiation, which was confirmed by studies on the callose localization and experiments with the inhibitor of callose synthesis 4/ spatio-temporal similarities and differences between the emerging symplasmic domains and the development of the apical-basal axis and tissue differentiation in zygotic and somatic embryos, 5/ differences in the number of PD between and within the symplasmic domains in explants and somatic embryos.