

cAMP – A SECONDARY MESSENGER IN HIGHER PLANTS. THE EFFECTS OF cAMP LEVEL ON ENDOREDUPLICATION AND CELL SIZE GROWTH DURING ROOT CELL DIFFERENTIATION

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The multiplication of nuclear DNA content caused by endoreduplication is a process leading to the differentiation of cells with a high metabolic activity and/or of large size. During the growth and development of organisms, characteristic distribution patterns of cells with higher nuclear DNA content are created. This is related to the function of cells and tissues. The induction of not only mitotic but also overmitotic DNA replication is probably part of a morphogenetic plan controlled by genes. Investigations carried out on yeast, animal and plant cells showed differences between the regulation of the endoreduplication cycle and the cell cycle. Although there is a lot of information about the role of cAMP-dependent signaling pathways in the regulation of cell cycle, its role in the regulation of endoreduplication is not well known.

The aim of our study was to check whether changes in cAMP level in cells influence nuclear DNA content and cell growth during the differentiation of the root cells of dicotyledonous plants. The measurements were performed on epidermal cells. DNA content was estimated using Feulgen-cytophotometric methods. DNA content and cell size were estimated in successive fragments of the elongation zones of roots after a 24h incubation period.

An experimental increase in cAMP level (incubation with db-cAMP, forskoline or theophylline) may cause extra rounds of endoreduplication, contrary to the effect of a decrease in cAMP level (incubation with 2'-dAdo or 2'-d3'-AMP). These effects are more visible in species with higher endoreduplication during root cell differentiation. An increase in DNA content promotes the creation of larger cells. The data obtained indicate that in plant systems the cAMP signaling pathway participates not only in cell cycle regulation but in the endoreduplication cycle as well.