Coordination between chloroplast and nucleus.

Mgr. Mária Čížková, Ph.D.

Laboratory of Cell Cycles of Algae, Institute of Microbiology, CAS, Centre Algatech

The growth and chromosome cycle in green algae are intimately intertwined processes and need to be coordinated to prevent premature cell division. The entry point into the cell cycle has been denoted commitment point (CP) in algae and seems to be correlated with reaching a critical size of cells. After passing CP the cell cycle is completed even in the absence of an external energy source. In eukaryotic cells, the nuclear compartment, mitochondria, and in plant lineage also chloroplast are all essential for cell survival. Unicellular green algae contain only a single chloroplast, occupying above 50% of the cell volume, which needs to be divided between two or more daughter cells for the maintenance of its genetic material. In phototrophic conditions, the chloroplast is responsible for most of the cell growth in terms of volume, proteins, and energy reserves, suggesting that cell cycle entry could be mechanistically underpinned by signaling and correlation between the nucleus and the chloroplast. *Chlamydomonas reinhardtii* and *Desmodesmus quadricauda*, both dividing by multiple fission, have been chosen as model systems containing a single chloroplast to analyze 1) coordination between nuclear and chloroplast compartments in different trophic conditions, 2) the effect of chloroplast growth on cell cycle entry in the presence of inhibitors of chloroplast RNA and protein synthesis, and 3) the effect of DNA replication on cell cycle progression using a specific inhibitor of chloroplast DNA synthesis. For the data analysis on a single cell level, the dual fluorescent staining method and image analysis using ImageJ software were established.