DOI 10.18699/SBB-2022-375

Processing of serial microscopic images for 3D reconstruction of plant tissues

Mursalimov S.[1]*, Ohno N.[2, 3], Deineko E.[1]

[1] *Institute of Cytology and Genetics, SB RAS, Novosibirsk, Russia*

[2] *Jichi Medical University, Shimotsuke, Japan*

[3] *National Institute for Physiological Sciences, Okazaki, Japan*

* *mursalimovsr@gmail.com*

Volume microscopy is a new rapidly developing technique used in cell and developmental biology. Both light and electron volume microscopes generate hundreds and thousands of serial microscopic images. Regions of interest (ROIs) containing particular cells, organelles or structures should be analyzed on every single image. Thus, there is a need to develop protocols for the fast and precise ROI detection and visualization. We used both light and electron volume microscopies to analyze male meiocytes inside plant anthers. ImageJ, Microscopy Image Browser, Dragonfly, UNI-EM and Amira software were used for the image alignment, segmentation and 3D modeling. Manual, semi-automatic and automatic types of image segmentation were used. Unusual behavior of nuclei in the developing male meiocytes of tobacco and rye was detected on 3D models. It was shown that at certain meiotic stages intercellular nuclear migration (cytomixis) occurs in most normal tobacco and rye male meiocytes. The obtained results suggest that there are still many unexplored features of meiosis hidden by limitations of common types of microscopy and that volume microscopy can turn over a new leaf in meiosis research. Development of deep learning image analysis tools is crucial for this research.

Acknowledgements: The reported study was funded by the Russian Foundation for Basic Research and the Japan Society for Promotion of Science according to the research project No. 21-54-50001 and JPJSBP120214813.