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EDITORIAL

In focus in Vienna: Microscopy and cellular organelles

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The COVID-19 pandemic has affected many conferences over the last 2 years and the joint conference of the quadrennial Dreiländertagung and the biannual 15th Multinational Congress on Microscopy, the MC2021, was no exception. The conference, organized by the Austrian Society for Electron Microscopy (ASEM), took place August 23–27, 2021, as a virtual conference. As is customary in the electron microscopy community, both material science and life science sessions were organized into a single conference. Such a format provides an excellent opportunity to improve one's knowledge of all facets of the fascinating world of microscopy. The conference was attended by more than 700 participants from over 35 countries who presented the latest results from their research.

This Special Issue of Histochemistry and Cell Biology contains a collection of Reviews and Original Articles reporting recent progress in advanced light and electron microscopic techniques and their application in cell biology research. In their review, Leitinger and colleagues and Rachel summarize papers presented at the session "3D S(T)EM for analysis of large-scale biological systems" (Radulović et al. 2022). As emphasized, a major challenge in the analysis of intact cells in 3D is to achieve not only high resolution but also to investigate a large volume, and the advantages and limits of cutting-edge methods applied alone or in combination to achieve this goal are scrutinized.

The review by Maria Müller and colleagues (Gasperl et al. 2022) covers the organelle-specific localization of glutathione in plants grown under different light intensities and spectra. The use of various analytical tools including immunocytochemistry and transmission electron microscopy, redox-sensitive dyes or probes and bright-field microscopy, confocal microscopy or fluorescence microscopy for the visualization and quantification of glutathione at the cellular and subcellular level in plants and the quantification of glutathione from isolated organelles is discussed. The effect of different light spectra and light intensities on the glutathione metabolism at the cellular and subcellular levels in plants is represented. Furthermore, their effect on the glutathione metabolism in wheat at the transcriptional level and genotype-specific reactions in *Arabidopsis* lines is reported.

In terms of location and function, the Golgi apparatus has an undisputed central standing in all eukaryotic cells (Berger and Roth 1997). The contribution of the Golgi apparatus to the formation of the blood–urine barrier in healthy urothelial cells was comprehensively treated in the contribution by Kreft et al. (2022). They describe the importance of the remodeling of the Golgi apparatus for the plasma membrane delivery of specific urothelial differentiation proteins, which are crucial for the formation of the blood–urine barrier during the differentiation of the superficial cell layer and the loss of the blood–urine barrier in bladder cancer.

Coronaviruses assembly occurs by their budding in the lumen of the intermediate compartment, a subcellular vesiculo-tubulo structure located at the endoplasmic reticulum–Golgi apparatus interface (Saraste et al. 1987). The poorly understood release pathway of coronaviruses from their host cells was investigated by Saraste et al. (2022) by employing confocal immunofluorescence microscopy. Virus infection resulted in the accumulation of recycling endosomes defined by the GTPase Rab11 next to the centrosome, which was intimately linked to virus-induced Golgi fragmentation and virus release. Hence, Rab11-positive recycling endosomes are proposed to act as intermediates in coronavirus egress from infected Vero cells.

A different endocytic structure, megapinosomes of human M macrophages (Bauer et al. 2020) and homologous elements in other hematopoietic cells such as peritoneal macrophages, megakaryocytes, and platelets was analyzed by Bauer et al. (2022). The detailed 3D structure of megapinosomes was established by STEM tomography from high-pressure-frozen and freeze-substituted cells and was shown

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to consist of highly branched trabecular meshworks, which may be connected by tubules. Although the function(s) of megapinosomes remains enigmatic, it was hypothesized that they may serve as a membrane reservoir or act as a filter. The investigations of Mioč et al. (2022) dealt with a member of the evolutionarily conserved family of the ATP binding cassette (ABC) proteins, ABCG2, which is a multidrug resistance transporter. ABC proteins may be upregulated in cancer cells, specifically in a subpopulation of cancer stem cells having high tumorigenic potential, resulting in their multidrug resistance. Hence, drugs with multidrug resistance reversing capacity may have therapeutic potential. In fact, the authors could identify crown ethers having such an effect due to conformational changes of the ABCG2. This was verified by real-time microscopic analysis of ABCG2-mediated transport of fluorescent substrates and other functional assays.

In their studies, Anapali et al. (2022) reported that the combined application of resveratrol and vitamin D ameliorated inflammation-related liver fibrosis, ER stress and apoptosis in a high-fructose diet/streptozotocin-induced type 2 diabetes mellitus rat model. They used immunohistochemistry to assess the expression of PCNA, NF-κB, TNF-α, IL-6, and IL-1β as well as GRP78 and Caspase-3, the TUNEL method for evaluating apoptosis and Sirius red staining to determine the extent of fibrosis in the liver.

The Special Issue of the journal was initiated and compiled under the guidance of Prof. Margit Pavelka, who passed away unexpectedly in March 2022, and by myself. Prof. Margit Pavelka was a member of the Austrian Society for Electron Microscopy since 1974, its president from 2001 to 2005, and its vice-president from 2005 to 2009.

Born in 1945, Margit Pavelka studied Medicine at the University of Vienna, finished her studies in 1970 and, after some years working as a physician in different hospitals and specializing in internal medicine, started her scientific career at the University of Vienna under the guidance of Prof. L. Stockinger at the "Institut für Mikromorphologie und Ultrastrukturforschung". In 1987, she received the *venia docendi* from the University of Vienna and was then appointed as the first Ordinaria (Full Professor) in 1992 at the Institute of Histology and Embryology of the University of Innsbruck. She returned to the University of Vienna in 1998 and was appointed Professor of Histology and Embryology. From 2011 until her retirement in 2013, Margit Pavelka was head of the Center for Anatomy and Cell Biology of the Medical University of Vienna (Fig. 1).

During her scientific career, she wrote more than 100 scientific papers and authored six books, of which "*Functional Ultrastructure-Atlas of Tissue Biology and Pathology*" is already in its third edition (Pavelka and Roth 2015) and can certainly be called a standard textbook. Still being active in research, she took part in many international

Fig. 1 Prof. Margit Pavelka, 1945–2022

conferences as scientific advisor and session chair. Always interested in the latest developments, she quickly learned to handle the digital format of virtual meetings during the hard time of the COVID-19 pandemic. Her curiosity about new developments was the pre-requisite for her to organize a session and a workshop in the digital format on the virtual MC2021 dealing with her great scientific passion: the Golgi apparatus.

With her sudden death, we have lost a great scientist and a friendly and helpful colleague. We will miss her.

References

Anapali M, Kaya-Dagistanli F, Akdemir AS, Ulutin T, Ozturk M (2022) Combined resveratrol and vitamin D treatment ameliorates inflammation-related liver fibrosis, ER stress, and apoptosis in a high-fructose diet/streptozotocin-induced T2DM model. Histochem Cell Biol. https://doi.org/10.1007/s00418-022-02131-y

Bauer A, Frascaroli G, Walther P (2020) Megapinosome: Morphological description of a novel organelle. Struct Biol 210:107505. https://doi.org/10.1016/j.jsb.2020.107505

Bauer A, Frascaroli G, Walther P (2022) Megapinosomes and homologous structures in hematopoietic cells. Histochem Cell Biol. https://doi.org/10.1007/s00418-022-02124-x

Berger E, Roth J (1987) The Golgi apparatus. Birkhäuser Verlag, Basel

Gasperl A, Zellnig G, Kocsy G, Müller M (2022) Organelle-specific localization of glutathione in plants grown under different light intensities and spectra. Histochem Cell Biol. https://doi.org/10.1007/s00418-022-02103-2

Kreft ME, Mironov AA, Hudoklin S (2022) Golgi complex—an organelle that determines urothelial cell biology in health and disease. Histochem Cell Biol. https://doi.org/10.1007/s00418-022-02121-0

Mioč M, Telbisz Á, Radman K, Bertoša ŠT, Sarkadi B, Kralj M (2022) Interaction of crown ethers with the ABCG2 transporter and their implication for multidrug resistance reversal. Histochem Cell Biol. https://doi.org/10.1007/s00418-022-02106-z

Pavelka M, Roth J (2015) Functional ultrastructure—atlas of tissue biology and pathology. Springer, Vienna (**3rd edition. ISBN: 978-3-7091-1829-0**)

Radulović S, Sunkara S, Rachel R, Leitinger G (2022) Three-dimensional SEM, TEM, and STEM for analysis of large-scale biological systems. Histochem Cell Biol. https://doi.org/10.1007/s00418-022-02117-w

Saraste J, Palade GE, Farquhar MG (1987) Antibodies to rat pancreas Golgi subfractions: identification of a 58-kD *cis*-Golgi protein. J Cell Biol 105:2021–2029. https://doi.org/10.1083/jcb.105.5.2021

Saraste J, Enyioko M, Dale H, Prydz K, Machamer C (2022) Evidence for the role of Rab11-positive recycling endosomes as intermediates in coronavirus egress from epithelial cells. Histochem Cell Biol. https://doi.org/10.1007/s00418-022-02115-y