Feature Client

Michael Cifra

Dr. Michal Cifra is the young, dynamic team leader of the Bioelectrodynamics team at the Institute of Photonics and Electronics Academy of Sciences (Czech Republic). His lab has recently purchased Nanolive's 3D Cell Explorer-Fluo microscope and published his first paper using it in the scientific Journal of Photochemistry and Photobiology B: Biology (see here). Dr. Cifra was kind enough to meet with us to discuss the focus of his lab, the findings of his paper and give us a preview into some of the exciting plans he has in store for his new purchase.

"We want to understand how various electromagnetic fields affect the remodeling of the cytoskeleton in real-time with all associated physiological events and Nanolive imaging is an excellent commercial solution for this.

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"The current goal of my lab is to develop chip-based methods which employ electric and electromagnetic pulses to modulate the function of reconstituted cytoskeleton-based protein nanostructures outside of the cell." The chip-based experimental systems essentially send very short (ns) electric pulses to these structures, which modulate their function and so, the response of the cell. Dr. Cifra's lab recently demonstrated this using tubulin. The work was conducted by a former postdoc Dr. Djamel Eddine Chafai, where he showed that the electric pulses modified tubulin conformation so that it temporarily formed structures that were very different from microtubules. Moreover, the effect in cells resulted in the remodeling of the microtubule cytoskeleton. Dr. Cifra's lab was awarded a prestigious grant worth almost €2 million over the next five years to further explore this topic using very high frequency (sub-terahertz) pulses. "We want to understand how various electromagnetic fields affect the remodeling of the cytoskeleton in real-time with all associated physiological events and Nanolive imaging is an excellent commercial solution for this".

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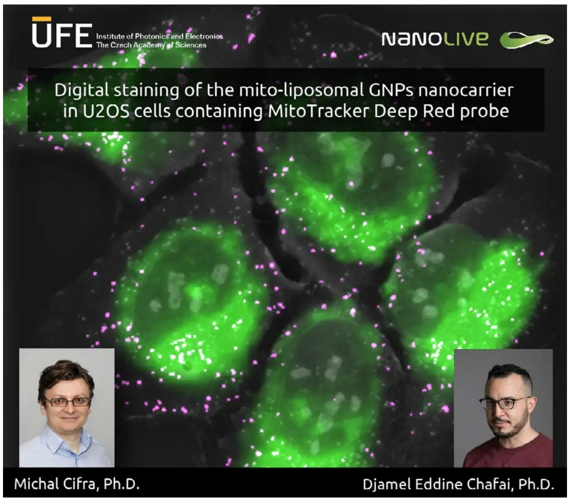

“One part of our research is dedicated to understanding biological autofluorescence (BAL) and how we can modulate it physically”. The main sources of BAL are reactive oxygen species (ROS), generated by mitochondria. The strength of the BAL signal is thus likely linked to the state of the health of a living cell/tissue/ system. Detecting and measuring the signal, however, is difficult, especially when the signal strength is low. “In this paper we show that one way to boost the signal is to use mitochondria-targeted nanoparticles”. The 3D aspect of the Cell Explorer-Fluo was used to determine the nanocarriers were internalized and localized in the mitochondria within the cell, and that they had no impact on the structure or morphology of the cell.

“Going 3D” Dr. Cifra advises me, is a particularly hot topic in applied physics at the moment. Scientists are extremely interested in understanding the behavior of active matter, such as microtubules. I ask him whether he has an experiment in mind. “It would be very interesting to study the polymerization and self-organization of microtubules bundles, which should contain enough matter to generate a nice refractive index signal using Nanolive imaging”. I ask whether this research has any applied relevance. “Of course, one of our end goals is to develop new electromagnetic nanobiotechnological tools that can be used to complement standard chemotherapy treatment. Most anti-cancer drugs target microtubules and so our technology could either increase the efficiency of the anti-cancer drugs or reduce the dosage of drug that is required.”

Nanolive would like to wish Dr. Cifra and his lab luck with their future research and to thank him for taking the time to talk to us.