



Understanding Membrane Dynamics and their Implications for Cancer with Correlative Optical Nanoscopy and Artificial Intelligence

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The MEDYCONAI project aims to combine complex optical, photonic and mechatronic approaches with sophisticated machine learning methods to achieve an innovative system for multimodal imaging named INTELINANO. This will take the form of a tabletop multimodal prototype nanoscope that offers easy operation and flexibility for imaging of the structure and chemistry of biological objects and advanced materials in 2D and 3D. INTELINANO will incorporate complementary state-of-the-art and novel imaging techniques to provide unprecedented possibilities for the label-based and label-free characterization of cells at micro- and nanoscale resolutions. Furthermore, INTELINANO will exhibit intelligent capabilities for the automated analysis of combined complementary data sets, data forecast & data simulation based on novel Deep Learning approaches. This combination of technologies, together with novel methods and protocols for correlative imaging, will enable a better understanding of eukaryotic cells, and of biological species in general. Politehnica University of Bucharest and Oslo University Hospital are actively engaged in identifying and exploring various critical structural and behavioral aspects of cells, poorly accessible to conventional imaging techniques, that can benefit of the resolving power of INTELINANO. Among others, during the project lifetime, and beyond, the two partners will employ this powerful tool, for expanding the current understanding of several key membrane dynamics processes of eukaryotic cells, to resolve their role in the emergence of aneuploid cells, which have an abnormal number of chromosomes, are genomically instable, and known to be correlated with the onset of cancers. Importantly, all these efforts are supported by access to other cutting edge imaging infrastructure in their labs, collectively employed to augment the outputs of MEDYCONAI.

The impact of the project derives from the potential of the developed imaging tools and methods to enable new knowledge on cell life and fate, with special emphasis on essential processes of cells associated to the onset and progression of cancers. This will be key for the advent of novel cancer diagnostic, prevention and therapeutic solutions exceeding current ones in terms of efficiency and ease of implementation.