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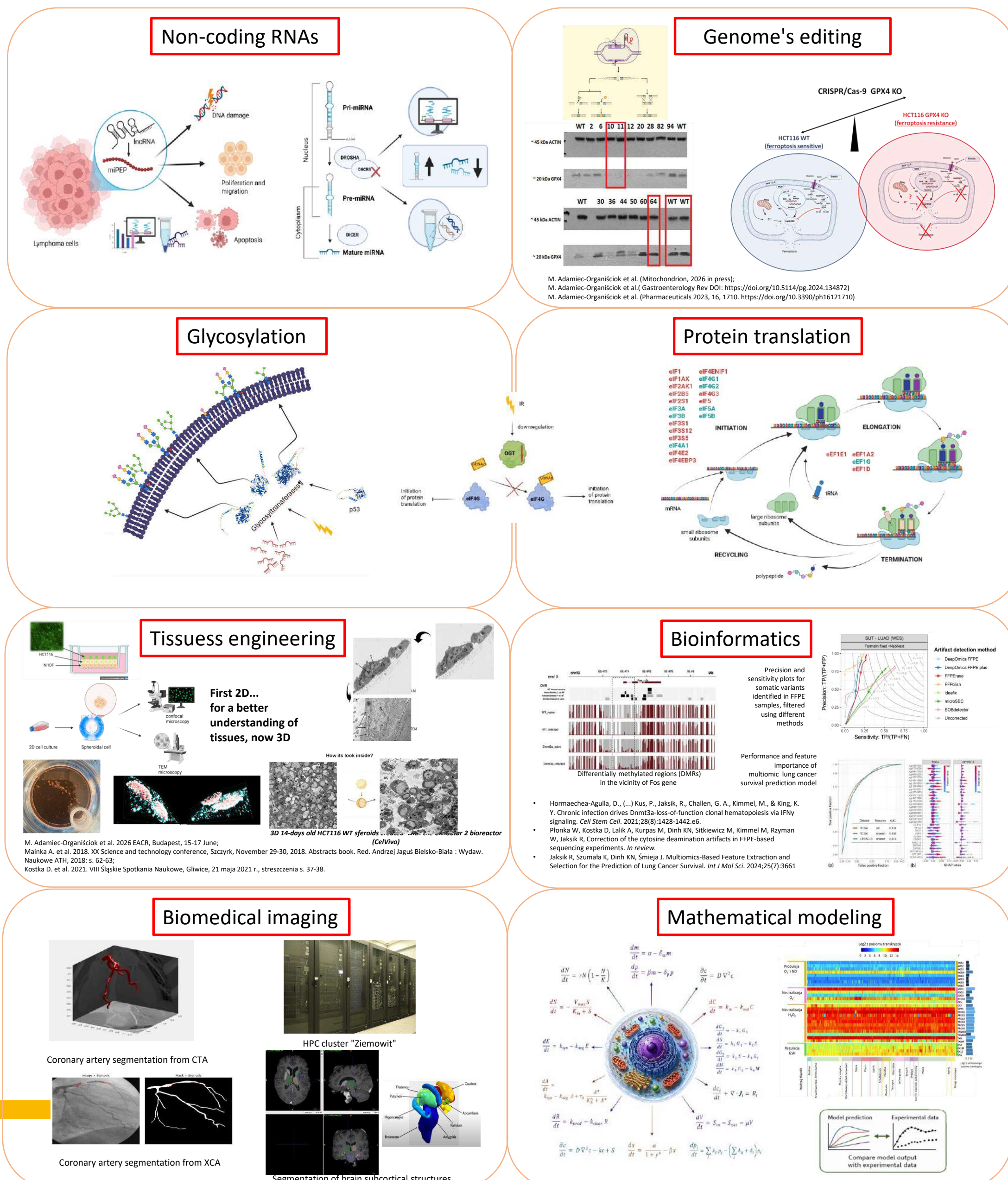
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General information about the group

The interdisciplinary team focuses on fundamental molecular research for bioinformatics, drug and chemotherapy protocol design, bioorganic and medicinal chemistry, and toxicology at the *in silico* and *in vitro* levels. New applications are focused on the tissue level using multilayer and three-dimensional *in vitro* cultures, with the goal of excluding *in vivo* (without direct animal testing). The main research area is the synthesis of data from cellular and molecular biology, microbiology, and biophysics, which translates into the development of advanced multiomics solutions, particularly visible in the development of research infrastructure, where scientists combine interdisciplinary techniques to design complex studies and conduct multiparametric observations.

Research

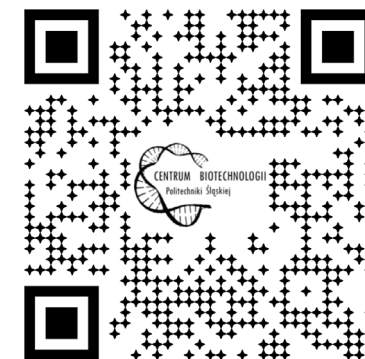
We have started with: Mechanisms of cellular responses to ionizing and ultraviolet radiation. Grant NCN (N N518 497639) – Prof. J. Rzeszowska; Changes in glycosylation and the expression of related genes induced by ionizing radiation in human cancer cells. Grant MEIN (POL-POSTDOC II, PBZ/MEIN/2006/49) – Dr eng. Anna Lalik; Analysis of gene regulation processes in cells exposed to ionizing radiation. Grant NCN: Preludium (DEC-2011/01/N/NZ2/05358) – Dr eng. hab. Roman Jaksik; Parallel algorithms for creation and simulation three-dimensional vascular network. Grant NCN: Opus (UMO-2011/03/B/ST6/04384) – Dr eng. Krzysztof Psiuk-Maksymowicz; The influence of cellular stress on miRNA biogenesis. Grant NCN: Sonata (2015/19/D/NZ1/03443) – Dr Izabella Ślęzak-Prochazka; Applications of three-dimensional vascular network models. Grant NCBR (TANGO3/420990/NCBR/2019) – Dr eng. Krzysztof Psiuk-Maksymowicz; Mathematical modelling of neutralization processes of reactive oxygen species in different types of cells. Grant NCN: Preludium (2019/35/N/ST6/04281) – Dr eng. Sylwia Ciesielska; Development of methods for bias correction of gene expression measurements. Grant NCN: Sonata (2016/23/D/ST7/03665) – Dr eng. hab. Roman Jaksik; Mathematical modeling of micro-RNA control of transcript levels and translation efficiency in irradiated cells. Grant NCN: OPUS (2022/45/B/NZ2/03599) – Prof. M. Kimmel





BioMicroSys Research Team

Microscopy • Microfluidics • Image Analysis • Rapid Prototyping

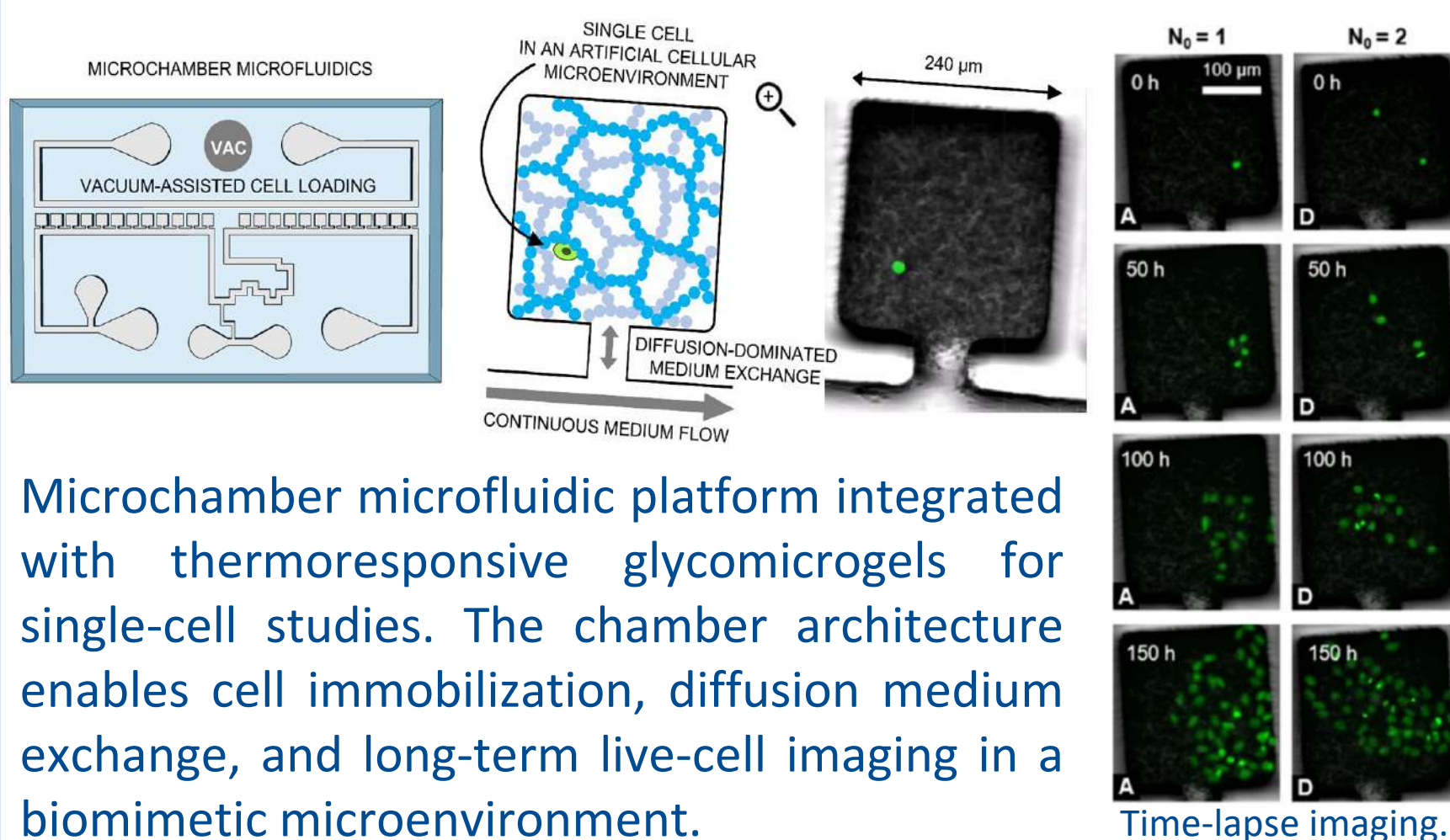


Emilia Witek-Żelazny, Zofia Bosowska, Alicja Stańczak, Olga Kocikowska, Weronika Losa, Piotr Bartosz, Sebastian Student / sebastian.student@polsl.pl



We study biological systems at the microscale using advanced microscopy. Our microfluidic systems enable drug testing and cell-based experiments in miniaturized, precisely controlled environments. Beyond experiments, we design, prototype, and fabricate custom 3D microfluidic devices, including laser-cut components produced using our in-house laser system. We also develop computational models and dedicated image analysis and system control software covering the entire path from idea to a fully functional device.

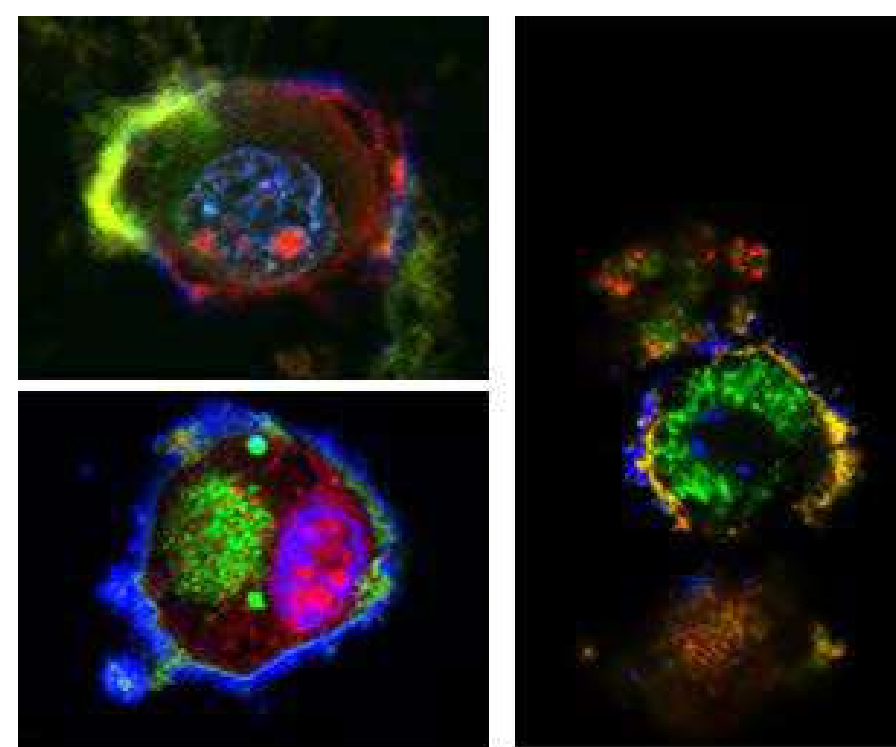
3D CELL CULTURE IN GLYCOMICROGEL MATRICES



Microchamber microfluidic platform integrated with thermoresponsive glycomicrogels for single-cell studies. The chamber architecture enables cell immobilization, diffusion medium exchange, and long-term live-cell imaging in a biomimetic microenvironment.

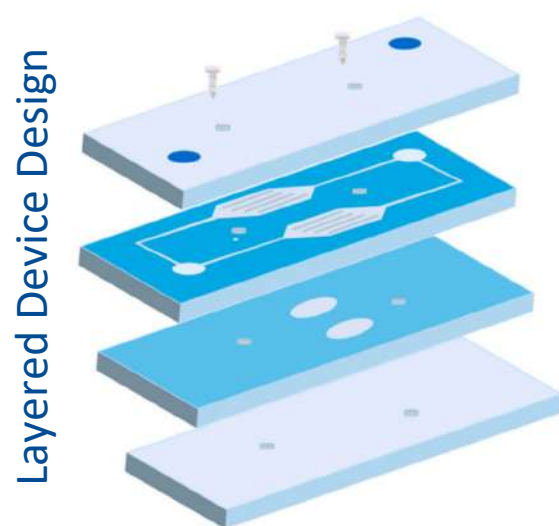
MICROSCOPY AND IMAGE ANALYSIS

- Brightfield, fluorescence and confocal microscopy
- Live-cell and time-lapse imaging
- 3D/4D visualization and reconstruction
- Automated image processing and quantitative analysis
- Cell morphology, proliferation and viability assessment

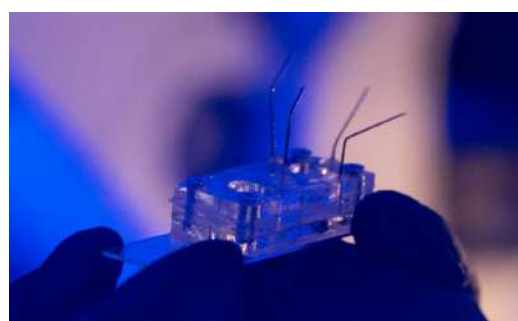
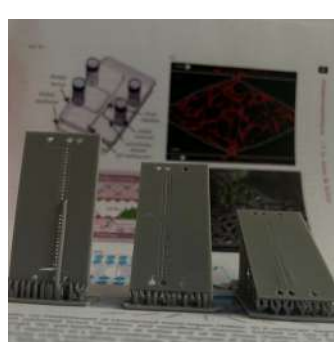
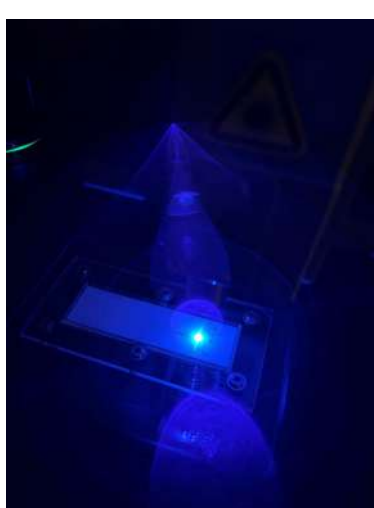


Fluorescence Imaging of Cellular Structures

LASER CUTTING, PROTOTYPING AND DEVICE FABRICATION



Custom-designed laser micromachining system enabling high-precision fabrication and prototyping of microfluidic device components. The platform allows the development of fully customizable solutions tailored to specific research and application needs.



Fabricated custom devices.

In-house laser cutting platform

MEMBRANE-BASED CO₂ DELIVERY SYSTEM

Membrane-based CO₂ delivery enables stable gas exchange, improving control of the cellular microenvironment in microfluidic culture systems.



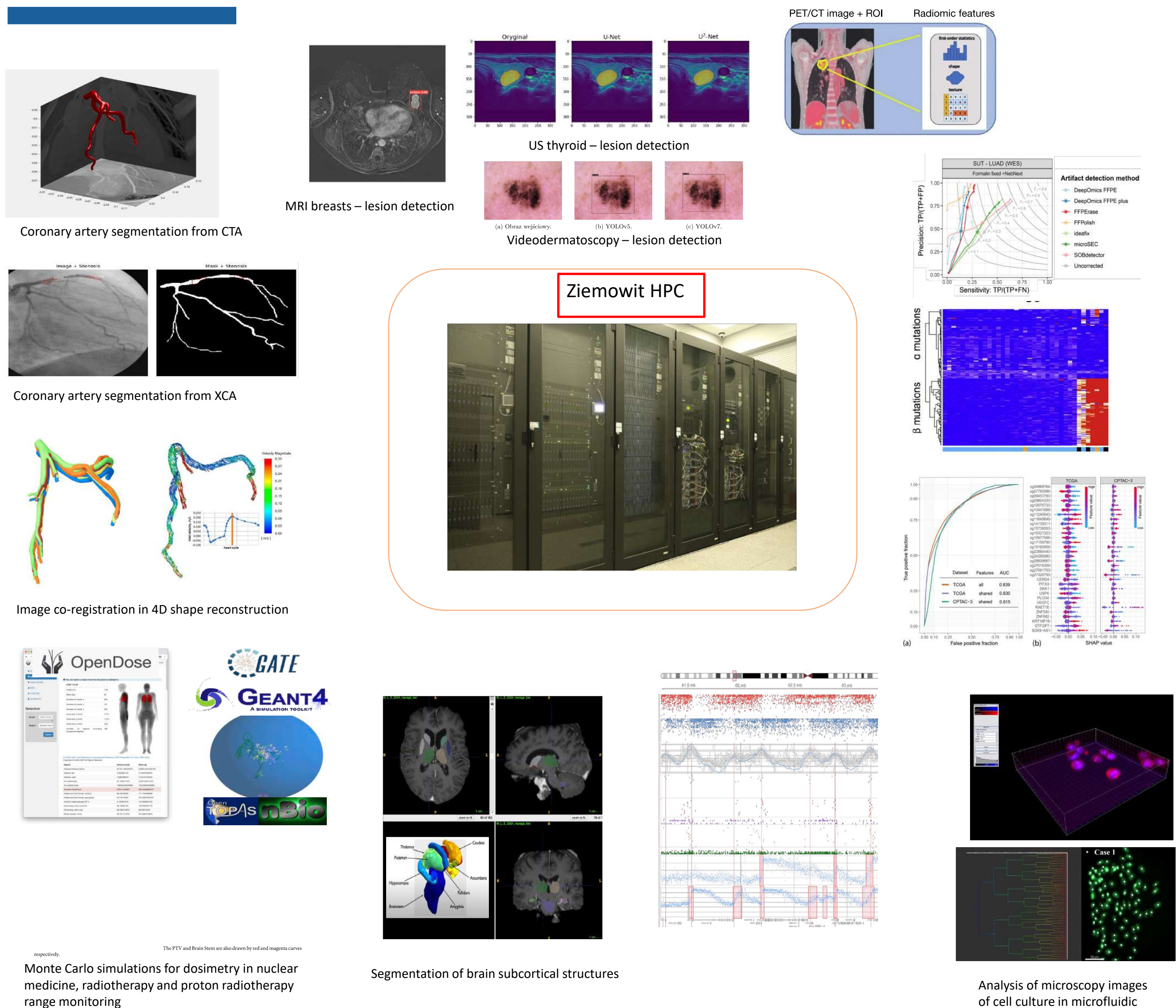
Acknowledge



Damian Borys, Krzysztof Psiuk-Maksymowicz, Roman Jaksik,
Sebastian Student

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Our research group focuses on leveraging the computational power of the Ziemowit HPC cluster for advanced scientific applications. We specialize in large-scale processing and analysis of genomic data, medical imaging, and Monte Carlo simulations for medical physics and dosimetry. We also develop and accelerate deep learning and AI methods using modern hardware accelerators. By integrating high-performance computing with cutting-edge methodologies, we enable efficient and scalable solutions to complex biomedical and computational challenges.



Acknowledgments, our Partners and Co-operators: