

Selected research topics in Biomedical Engineering:

Medically Relevant Experiments with Synchrotron Radiation

Location: Grosser Hörsaal, ZLF, University Hospital Basel

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Hard X-ray nano-tomography for deep and precise exploration of biological samples

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Abstract. Recently, hard X-ray microscopy has opened research avenues by improving the resolving power in biological tissues and cells. Thanks to a coherent and brilliant nano-focused beam combined with precise tomographic scanning, X-ray holography can probe the three-dimensional structure of relatively thick biological tissues with a spatial resolution better than 100 nm. X-ray fluorescence offers nanoscale mapping of native chemical composition with a sensitivity down to ppm level. At the beamline ID16A, these two techniques are combined to obtain complementary information for the same sample. Imaging at cryogenic temperatures enables the visualization of water-containing samples with increased spatial resolution. The talk will demonstrate how the application of these sophisticated techniques contributes to a detailed understanding of diseases such as cancer, Alzheimer, diabetes, and multiple sclerosis. For example, X-ray holography has enabled reconstruction of dense neuronal wiring in tissues of millimeter sizes, leading the way to untangling neural circuits in whole mammalian brains. In August 2020, ESRF has inaugurated an upgraded source, which will speed up the data collection with improved data quality.

Curriculum. Alexandra Pacureanu has a background in electrical engineering and signal processing. In 2012, she completed her Ph.D. on nanoscale X-ray tomography of the bone cell network at the European Synchrotron Radiation Facility (ESRF) and INSA Lyon, France. She then pursued a postdoctoral fellowship at Uppsala University and the Science for Life Laboratory in Sweden, where she developed image analysis methods for *in situ* gene sequencing and high throughput microscopy. For the following five years, she returned to ESRF to develop X-ray cryogenic nano-tomography for three-dimensional imaging of biological tissues and cells. In 2019, she was a researcher in the neurobiology department at Harvard Medical School in Boston, and at the University College London and the Francis Crick Institute in UK. Since the beginning of 2020, she has been leading the X-ray neuroimaging at nanoscale research unit at ESRF.