

Selected research topics in Biomedical Engineering:

**Medically Relevant Experiments with Synchrotron Radiation**

Wednesday, November 18, 2020, 16:00-17:00, via zoom

**Microbeam radiation therapy and radiosurgery**

*Alberto Bravin*

*European Synchrotron Radiation Facility, Grenoble, France*

**Abstract.** One of the major limitations of therapeutic radiation treatment of patients with brain or central nervous system cancers is the well-known risk of developing severe cognitive deficits and damages, which will have unacceptable iatrogenic consequences. Radiotherapy-induced brain damages and related dementia are associated with major deficits in hippocampal-dependent functions of learning and memory. It was discovered that, instead, even high doses of radiation, when delivered by spatially fractionated beams, can significantly protect tissues from radio-induced damage. This effect is due to a minimal dose spreading outside the beam path. At the European Synchrotron Radiation Facility, a station for preclinical investigations using high-dose-rate microbeams is made available to applications in radiotherapy and radiation surgery. Multi-energy X rays with a dose rate larger than 10,000 Gray/s are spatially fractionated in arrays of microscopic beams 25 to 600  $\mu\text{m}$  wide and 50 to 1200  $\mu\text{m}$  spaced and delivered with submillimeter precision in preclinical trials for medical interventions in a wide variety of applications including oncology, epilepsy and chronic pain. After a brief introduction, highlights on the application of microbeams and the state-of-the-art in radiotherapy and radiosurgery using synchrotron radiation will be presented.

**Curriculum.** Alberto Bravin is senior scientist at the European Synchrotron Radiation Facility (ESRF) in Grenoble, France. After he earned a Ph.D. in physics for a pioneering work on the development of X-ray phase-contrast imaging in 1999, he moved to the ESRF and, in 2003, became responsible for the biomedical X-ray laboratories. His research activities at the ESRF focus on X-ray imaging techniques for 3D-4D biomedical diagnostics performed in-vitro, ex-vivo and in-vivo, and original radiosurgery and radiotherapy methods using X-ray microbeams. The scientific results have been published in more than 180 peer-reviewed papers. He chaired the SYRA3 EU COST project (2013-2017) on innovative radiotherapy and radiosurgery methods using synchrotron radiation. Since 2016, he is a Fellow of the American Association of Medical Physics and member of editorial boards of several journals in the field. In 2018, he was awarded with the Outstanding Scientist prize by the Italian Association of Synchrotron Radiation research.