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## SHINING SYNCHROTRON LIGHT AT THE NANOSCALE: NANOMATERIALS IN THE BIOSPHERE

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### Abstract

The ID21 beamline at the European Synchrotron Radiation facility (ESRF) is dedicated to micro X-ray fluorescence ( $\mu$ XRF) and micro X-ray absorption spectroscopy ( $\mu$ XAS) in the tender X-ray range (2-10keV). It has an important scientific activity in the fields of life and environmental sciences, in particular for studying the fate of metals in the environment. This includes, e.g. the study of pollutants, nutrients and innovative drugs, with increasing applications in the field of nanotechnology. Elemental speciation determines the distribution at tissue and cellular level, and ultimately the various mechanisms of action. The chemical form and distribution of elements are also important to environmental risk assessment. ID21 offers a reliable and easy-to-operate passively cooled cryogenic stage, as well as the required auxiliary equipment for sample transport, storage and preparation. Thus, cryo-fixed samples are better preserved under intense X-ray beams and the elemental distributions, chemical states, and sample morphologies are close to the in-vivo state under frozen-hydrated conditions. This presentation will highlight experiments performed at ID21 taking full advantage of these beamline capabilities to investigate the distribution and speciation of engineered nanomaterials in complex biological samples (plant, animal tissues, cells). Finally, the future capabilities expected with the refurbishment of ID21 in the context of ESRF-EBS upgrade will be presented.

### About

PhD in Environmental Science and Engineering in 2011 from the University of Texas at El Paso, USA. His research interests focus on the use of synchrotron X-ray fluorescence (XRF) and X-ray Absorption spectroscopy (XAS) at the micro and nano scale to study the distribution and biochemical modifications of trace elements and nanomaterials in biological systems. In 2011, he arrived at ESRF beamline ID21 as post-doctoral researcher. He participated on the development and optimization of cryogenic sample preparation and analysis protocols for XRF and XAS micro-spectroscopy at ID21. He was the responsible scientist of the Infrared branch at ID21 (dismounted in 2017). Since 2013, he is scientist at ID21 (permanent since 2017) where he develops an in-house research program focusing on the characterization of nanomaterials in biological samples and their impact on the environment, particularly on agricultural systems. He is currently the project coordinator of the upgrade program of ID21 that will deliver a new end-station for XRF and XAS nano-analysis with optimized cryogenic environment compatible with biological samples. He has authored and co-authored 90 peer reviewed and 2 book chapters (h-index 26, 2660 citations google scholar). He has co-supervised 2 master thesis, 4 PhD students, and 2 post-doctoral fellows since 2013.

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