

## **Mapping Brain Metals in Friedreich's Ataxia with Rapid-Scanning Synchrotron X-ray Fluorescence Spectroscopy**

Bogdan F. Gh. Popescu

Helen Nichol

Department of Anatomy and Cell Biology

University of Saskatchewan

Rapid-scanning X-ray fluorescence spectroscopy is a new imaging technique developed to simultaneously map multiple elements in large samples. We applied this technique to map multiple metals in Friedreich's ataxia (FRDA) human brain and spinal cord. FRDA is a mitochondrial disease in which iron is known to accumulate within the nervous system.

Formalin-fixed human brains, obtained at autopsy, were provided by the Human Brain and Spinal Fluid Resource Center and the Brain and Tissue Bank for Developmental Disorders following established ethical guidelines for the use of human tissue. The brains were sliced thinly (1 mm) and sealed in rigid, metal-free plastic sleeves. Brain slices were mounted vertically in the beam and raster scanned with continuous motor motion and detectors were read on the fly with count times of ~7 ms. The incident X-ray energy was at 13 keV and energy windows were set to collect K- $\alpha$  fluorescence from each element between manganese (Z=25) and selenium (Z=34). Excellent elemental sensitivity was achieved at greatly increased scan speed and a resolution of 50 microns. We applied this new technology to the study of FRDA, but this breakthrough technique holds great promise for understanding the role of metals in both normal and pathologic metabolic or neurodegenerative dis

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