



## PhD in Medical Sciences

### Research Area: Pathology

**Title:** Profiles of elemental concentrations in human and animal tissues: contribution of X-ray fluorescence to discrimination between healthy and diseased tissues and prediction of alterations in malignant tissue

Studies show that some elements, for example K, Ca, Cu, Fe, and Zn, are involved in important physiological processes such as proliferation of cancer cells or protection of cells against oxidative effects, and their concentrations may differ significantly between the healthy area and the tumour area in the same human tissue. Most studies conducted so far are focused on specific elements which are a priori known to be involved in physiological or pathological processes, and thus risk to neglect the potential role of the excluded elements those processes. The investigation of the role of elements considered in isolation has been questioned because it ignores the important interactions among the various elements. However, even when concentrations of various elements are obtained in the same study, comparisons between healthy and diseased tissues, or correlations between the various elements, both intrinsically multivariate, are often implemented with univariate methods, which may result in observed effects or the inability to detect such effects. The methodologies proposed in this study, which complement multielement determinations by X-ray fluorescence spectroscopy (XRF) in several types of biological samples, with multivariate data analysis methodologies, provide an important contribute to fill existing gaps in current knowledge of the role elements in such metabolic pathways. In the work to be developed, the XRF technique will be applied in the determination of the concentration profile of several elements of interest, in (i) samples of healthy tissue and tissue with carcinomas of various types, with the objective of developing a classification system based on the profile of elemental concentrations that allows to discriminate between healthy tissue and carcinoma, and thus clarify the role of these elements in the etiology of the disease, and in (ii) samples of diabetic animal tissue exposed to low-frequency noise, aiming at assessing the musculoskeletal impact of the synergy effects of an environmental factor and a disease with recognized systemic effects.

**Keywords:** Elemental composition, X-ray fluorescence, carcinoma, bone

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