X-Ray Fluorescence Spectrometry in Medicine

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1 INTRODUCTION

Some elements have toxic effects on the human body, and some are essential but have adverse effects at high levels. Monitoring these elements is critical for scientists to assess the association between exposures and health outcomes, and for clinicians to diagnose disease related to exposure (1,2). X-ray fluorescence (XRF) and neutron activation analysis (NAA) are the two main non-invasive methods for *in vivo* and *in vitro* element analysis (3–6). The XRF technology for *in vivo* element measurement will be described in detail in this chapter. In an *in vivo* element measurement, the subject/patient is positioned in front of an XRF device by a trained researcher or technician for a fixed time, and the concentration of the element in a target tissue is determined from an XRF spectrum.

The first *in vivo* XRF measurement was performed in the 1960s to measure iodine in the thyroid (7). Later in the 1980s, a technique to measure iodine in human tissue *in vivo* from X-ray contrast agents was reported (8). Ahlgren et al. (9) made the first bone lead measurement in the 1970s, and since then a number of XRF techniques have been developed, among which XRF bone lead measurement is the most intensively studied and applied. Bone lead has been used to investigate the association between

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