Laser Induced Fluorescence Spectrometer for Determination of Isotopes

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Publications:

Channon et al – Bone 2015
Gordon et al – Leukemia 2014
Romaniello et al – NTRS 2016

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Invention Description

The relative concentrations of various calcium and metal isotopes in the body can be an important diagnostic marker for numerous medical conditions. Certain Ca isotopes in blood or urine can be used to detect bone lesions/cancers, multiple myeloma and other metastases to bone, as well as to provide information regarding bone mineral balance (BMB). BMB is important in diagnosing and tracking certain metabolic bone diseases and can be useful for detecting bone density loss and monitoring BMB changes resulting from cancer treatments. Isotopic analysis is currently performed using mass spectrometry, which, while effective, is slow and expensive. To facilitate more widespread utilization of isotope analyses, a portable and cost effective method needs to be established.

Researchers at Arizona State University and their colleagues have developed a novel non-mass spectrometry based isotope measurement technique using laser induced fluorescence. This technique enables the detection of diseases including multiple myeloma, bone lesions and cancers originating in and metastasizing to the bone. Additionally, this can be used to monitor changes in BMB in cancer patients treated with certain medicines known to affect BMB. This technique is highly sensitive, provides fast results and is much less expensive than mass spec-based techniques. Further they have adapted the technology into a bench top system which is highly portable.

Isotope analysis provides a powerful means to detect disease, monitor bone loss and therapeutic efficacy of treatment, and may allow for new and quicker diagnostics.

Potential Applications

- Monitoring the relative isotope abundances of calcium or metal isotopes to diagnose diseases including but not limited to:
  - Bone lesions
  - Bone cancers
  - Multiple myeloma
  - Breast cancer metastases to bone
  - Prostate cancer metastases to bone
- Assessment of bone cancer treatment effectiveness
- Continuous monitoring for BMB changes resulting from cancer treatments
- Accelerating the pace of discovery of new treatments for bone cancers and cancers metastasized to bones
- Could also be used in geochemistry, planetary science, climate science, etc.

Benefits and Advantages

- Fast results
- Low-cost
- Compact and portable (low-mass components) – enables field deployment or even space deployment for space-based bone density monitoring
- Greater detection sensitivity than mass spectrometry-based methods