

Zinc isotopes as a potential biomarker for breast cancer

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Humans use essential trace metals, such as copper and zinc, as part of metabolic processes fundamental for life. By investigating how these elements are taken up, used and stored by the body, we can improve understanding for illnesses such as cancer, dementia and diabetes. The highly sensitive isotopic methods routinely used in geochemistry are now emerging in medical sciences due to their potential to access previously elusive metabolic processes.

An early diagnostic biomarker for breast cancer is essential to improve outcome. For the first time, the natural intrinsic zinc and copper isotopic compositions of various tissues in breast cancer patients and controls were determined [1]. The tumours of breast cancer patients were found to have a significantly lighter Zn isotopic composition than the blood, serum and healthy breast tissue of both cancer patients and healthy controls [2]. The light Zn isotopic composition of tumours suggests that metallothionein, a sulfur rich protein capable of binding up to seven zinc ions per molecule dominates the isotopic selectivity of a breast tissue cell, rather than Zn-specific proteins. Both healthy and tumour breast cells have vesicles that are used to sequester excess zinc [3]. The isotope composition of the tumour cells reveals a possible mechanism of Zn delivery to Zn-sequestering vesicles by metallothionein. This change in intrinsic isotopic compositions due to cancer has the potential to provide a novel early biomarker for breast cancer.

[1] Larner, F. *et al.* (2015) *Metallomics* **7**, 112-117. [2] Samples provided by The Imperial College Tissue Bank and supported by ECMC Network. [3] Lopez, V. *et al.* (2011) *Cancer Lett.* **304**, 41-51.