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Better Diagnosis of Oxidative Stress Using Metal-Isotope Profiles

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Chronic diseases such as diabetes, cardiovascular diseases and cancer are among the most common causes of death in Western Societies. So-called "oxidative stress" is believed to be a major factor in the pathology for development and progression of these chronic diseases. Harmful Oxidative Stress occurs when the balance of oxygen free radicals and antioxidants in the human body is disturbed. It is caused from both endogenous factors such as metabolic imbalances (e.g. diabetes) and inflammation as well as exogenous factors such as exposure to intense UV light, air pollution, or radiation as part of cancer therapy. The ability to diagnose and monitor the development of harmful oxidative stress in an individual has the potential to guide preventive or therapeutic measures against chronic diseases.

However, currently established methods for the determination of oxidative stress do not allow a comparable quantification over time even analysing the same individual. The development of new methods for the sensitive and quantitative determination of oxidative stress are therefore of great interest for the medical treatment of chronically ill people.

Our approach is to determine the isotope ratios of stable metal isotopes in human blood as a “biomarker” for oxidative stress. These isotope ratios are sensitive to changes in oxidative balance. Our hypothesis is that deviations from a metal isotope and concentration profile defined as "normal" allow the degree of oxidative stress to be determined sensitively, quantitatively and comparably.

In order to test the hypothesis three cohorts are investigated: (1) apparently healthy (normal); (2) pre-diabetic (no insulin therapy); (3) prostate cancer undergoing radiation therapy.

The results of isotope measurements are compared to established markers of oxidative stress based on organic chemical approaches as well as established medical parameters for overall health.