Detecting and Quantifying Metallothionein Isoforms as Cancer and Metal Toxicity Biomarkers

The University of North Dakota has developed a mass spectrometry-based method to quantify metallothionein isoforms, a family of proteins that may be indicators of specific cancers and cancer subtypes and of exposure to metals.

Metallothioneins as Biomarkers:

Metallothionein (MT) proteins bind with high affinity to heavy metals. The twelve MT isoforms also appear to be differentially expressed in patterns that may be indicative of specific cancer and cancer subtypes (including subtypes of breast, bladder and kidney cancers), and exposure to specific metals. Precise identification and quantification of MT isoforms in a tissue sample could be used in cancer and heavy metal exposure diagnosis and prognosis. However, antibody-based methods have not provided reliable differentiation due to high sequence conservation among MT isoforms. RNA-based analysis doesn’t measure protein abundance or reflect post-translational modifications. The technology described here overcomes these limitations, and enables development of a kit to detect and quantify any MT isoforms present in a tissue sample.

Our Technology:

Mass spectrometry is often used to analyze proteins in biological samples, but MT isoforms have proven challenging because they are small and not easily quantifiable by conventional proteomics strategies. Our technology enables absolute and relative quantification of each MT isoform in a sample using Mass Spec. As sensitive as RNA detection, our method has the advantages of measuring protein directly and distinguishing post-transcriptional variants. This allows the presence and amount of each isoform to be determined at a precision needed for cancer diagnostics and prognostics, and for metal exposure and toxicity monitoring purposes.

Advantages:

- Simultaneously measure all human MT isoforms, with sensitivity to detect single amino acid differences
- Quantify relative or absolute levels of all MT isoforms by Mass Spec, including posttranslational modifications
- Use for research, diagnosis/prognosis of cancers, and monitoring heavy metal exposure

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