G46 Radiocarbon and Stable Isotope Results of Fingernails of Breastfed Mother-Infant Pairs to Investigate Deviation of Year-of- Birth Determinations Due to Diet

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The goal of this presentation is to find a possible explanation to justify outliers in ^{14}C results from a recent pilot experiment measuring human tissues to determine the year-of-birth of deceased individuals of known birth records.

This presentation will impact the forensic science community by exploring new methods and techniques to aid in human identification.

Researchers have investigated the possibility of acquiring the year- of-birth and year-of-death dates by using radiocarbon (^{14}C) measurements from a broad range of human tissues. This is possible due to high concentration of radiocarbon in the earth's atmosphere during the thermonuclear bomb testing carried out between 1953 and 1963, and its propagation into the food chain through photosynthesis. Measuring the magnitude of this ^{14}C concentration allows year-of-birth determinations for individuals that were born in this period. Recently, Hodgins (2009)[1] studied human tissues of 36 deceased individuals of known birth dates. To estimate the year-of-birth, Hodgins measured ^{14}C of tooth enamel. More than 50% of his results were consistent with the true birth dates, and uncertainties for most were as good as 1.5 years. However, a significant percentage of the measurements yielded estimated birth dates off as much as 4 years. Since diet life histories of individuals were unknown, Hodgins speculated that a ^{14}C depleted marine diet may have played a role in explaining some of these date deviations. Since some human non-turnover tissue, such as eye lens crystalline and tooth

enamel, start forming while *in utero* and stop at approximately age of 3 and 17 years, respectively, this notion raises the question of how much an individual's childhood diet can affect the age determinations. To examine this possibility isotopes d13C, d15N, and ^{14}C in fingernails collected from breast milk fed infants and their mothers from before birth through the weaning period were measured. In this study, the mother- infant pairs were from the same region in the United States and their protein diet was recorded during the course of sampling. Samples that would most likely show some differences from one another since they were from individuals with different protein dietary preferences were chose, but in this preliminary investigation no significant variability was observed. This may be attributable in part to the fact that the individuals sampled were from the same region, and so a more diverse population would possibly produce more variability. To further investigate the outliers that were observed by Hodgins, and to determine the magnitude of any dietary biases on ^{14}C measurements to estimate the year-of-birth, future research should be done directly on non-turnover tissue of individuals of varied recorded diets from different locations. **References:**

1. Hodgins, Greg. "Measuring atomic bomb-derived ^{14}C levels in human remains to determine Year of Birth and/or Year of Death". 2009. National Institute of Justice Final Report.

Isotopes, Diet, Fingernails

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