## G101 Insect Pupal Cases as Decay-Resistant Reservoirs of Human Soft Tissue Radiocarbon Content

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After attending this presentation, attendees will understand how above-ground nuclear testing in the 1950s and early 1960s dramatically increased environmental levels of radiocarbon. These elevated levels have been incorporated into all organisms living since that time and thus can serve as temporal markers. Potentially, radiocarbon measurements of postmortem human tissues can be used forensically to establish year-of-birth and/or year-of-death. One advantage of this approach is that it functions independently of chemical or biological methods for the determination of postmortem interval or age-at-death and thus might augment current methods for establishing these parameters.

This presentation will impact the forensic community by outlining the possibility of determining year-of-death of human remains in advanced stages of decay based on the radiocarbon content of insect pupal cases obtained from the surrounding soil. Remains in advanced stages of decay pose particular challenges for determining postmortem

interval, and other temporal parameters. The presentation has two objectives: (1) to outline a hypothesis and an experimental design, and (2) to canvas the forensic science community for suitable samples.

Over the past sixty years, environmental levels of radiocarbon have been rapidly changing. Previous work in this laboratory has established that radiocarbon levels in human soft tissues essentially reflect levels in the contemporary environment. Therefore measuring radiocarbon levels in postmortem tissues and correlating these with known levels in the past environment can indicate Year-of-Death. Direct measurements on tissues from known age/known year-of-death donors have shown promise and quantified the potential precision of this approach to approximately ± 2.5 years.

The paradox of suggesting such an approach is that in many environments, soft tissues disappear within short spans of time due to natural process of decay. What are required are decay-resistant proxies of soft tissue radiocarbon content. The hypothesis of this study is insect pupal cases might fit the bill. Just as humans take on the radiocarbon content of ingested foods, insect larvae feeding on decaying human remains take on the remains' radiocarbon content. Although emergent adult insects leave, pupal cases are left behind. Large numbers are often encountered in the soil surrounding decayed remains long after soft tissues have disappeared.

Preliminary measurements on samples generated from field tests will be presented as well as measurements on paired samples of soft tissues and pupal cases obtained from a Medical Examiner's Office archives. The design of future experiments will be discussed.

Admittedly, the approach is potentially complex. For example, direct measurements of radiocarbon levels in different human tissues show tissue-specific variation. These differences are the consequence of rapidly changing environmental levels and differences in metabolic turnover rates. Consequently, one might expect that insect larvae feeding on different tissues of the same individual might be differentially labeled. On the one hand, this might reduce the precision of Year-of-Death estimations. However, if species-specific differences in larvae feeding behaviors exist among the succession of insects that infest decaying remains, this might result in species-specific differences in pupae radiocarbon levels. Such differences might be exploited to advantage. Clearly experimental data is required.

The approach is intriguing. It would require a trivial modification of existing sample collection practice: merely collecting a larger than normal number of pupae. It is potentially a new avenue for the forensic estimation of Year-of-Death.

**Radiocarbon, Year-of-Death, Pupal Cases**

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