G103 Identification of Flesh (Carrion) Source From the Stable Isotope Analysis of Blow Fly Larvae, Pupae, and Adult Flies

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After attending this presentation, attendees will learn about the ability of stable isotope measurements to link blow fly (*Calliphora vicina* Robineau-Desvoidy) larvae, pupae, and adult flies to different carrion sources. *C. Vicina* plays a major role in carrion decomposition and corpse colonization throughout the U.S. Attendees will also gain insight into systematic changes of stable isotope ratios through the different stages of development.

This presentation will impact the forensic science community by helping to understand that the relationship between the stable isotope ratios of carrion sources, larvae, pupae, and adult flies will enable forensic entomologists and criminologists to classify or identify the food sources of immature and/or adult blow flies. This capability would enable standoff or remote species determination of decaying carrion via the collection of dispersing adult blow flies.

The variations of the carbon, nitrogen, sulfur, oxygen, and hydrogen isotopes in different objects are widely used by forensic chemists to prove the authenticity of the objects, to find their origins, or to discriminate between endogenous and exogenous compounds in drug abuse cases. Because the isotope ratios of carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) are good representatives of a food source, they are frequently used in criminology to predict the previous geographic locations of an unidentified body. Ecologists often use isotope ratio analysis to determine the trophic level of organisms and their primary food sources. However, such analyses are rarely interested in linking adult insects to a specific meat source in a forensic context. This study begins with a proof-of-concept study to test the hypothesis that immature and/or adult blow flies can be linked to specific food sources via their stable isotope ratios.

Adult flies of a commercial strain of blow fly (*Calliphora vicina* Robineau-Desvoidy, Diptera: *Calliphoridae*) were allowed to oviposit on raw pork muscle, raw beef muscle, raw chicken liver, or a 20% human blood agar. The eggs were allowed to hatch, feed, and develop into adult flies. Ten individuals from each meat source were arbitrarily selected at the following stages: postfeeding third instar; pupa and associated puparium, and newly-emerged unfed adult flies. The bulk $\delta^{13}C$ and $\delta^{15}N$ values for the different stadia were established using an Elemental Analyzer-Isotope Ratio Mass Spectrometer (EA-IRMS). The differences between the isotope ratios for each life-cycle stage were determined by 1-way Analysis of Variance (ANOVA) and post-hoc pairwise comparisons.

In most cases, the bulk $\delta^{13}C$ and $\delta^{15}N$ isotope ratios were significantly different between the larvae, pupae, and adult flies for every type of meat source, indicating a significant degree of isotope fractionation at each stage of development. The $\delta^{13}C$ values for the pupae from the pork and chicken samples were the only exceptions. Although fractionation measurable, the extent of fractionation was typically an order of magnitude smaller than the initial differences between the original meat sources, indicating that it is indeed possible to link each meat source directly to each stage of *C. Vicina* life cycle. Due to the multiple biological processes in the organisms throughout their development, the bulk $\delta^{13}C$ and $\delta^{15}N$ values for the larvae, pupae, and flies differ significantly from the initial meat source, but the changes in the $\delta^{15}N$ values throughout the biological development stages had the same trend for each carrion type, which can eventually lead back to the original meat source. The planned Compound-Specific $\delta^{13}C$ Analysis (CSIA) of larvae, pupae, and flies will give additional information about the relationship of the flesh type and the species grown on them. Furthermore, CSIA will allow elucidation of the amino-acids which are most representative of the initial food source.

Isotope Ratios, Flesh Source, Blow Flies

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