G103 The Microbial Ecology of Carcass Decomposition Between Habitats and Through Time

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After attending this presentation, attendees will have a better understanding of the role of microbial ecology that drives the rate and biological dynamics of decomposing remains during different seasons and between years. Attendees will also be introduced to a growing knowledge foundation on how this information can be used to better understand and predict the stages of carcass decomposition, with direct application to estimates of a minimum postmortem interval (mPMI) using microbial communities. Attendees will learn how changes in the metabolic use of different carbon sources by the microbial community during decomposition succession can be utilized to estimate the stages of decomposition.

This presentation will impact the forensic science community by providing an introduction to the potential use microbial communities in crime scene investigations.

Microbial communities are fundamental to decomposition ecology of carrion and human remains. Studies in both aquatic and terrestrial systems have shown that microbial communities follow a pattern of succession by metabolizing and modifying resources in a way that makes them usable or unusable to other subsequent colonizing organisms. While there have been studies describing the succession and diversity of microbial communities involved in carrion decomposition, none have evaluated their potential use for making estimates of the mPMI in criminal investigations. In this study an economical method was employed for understanding changes in environmental microbial communities using Biolog EcoPlates™, microarray plates with 31 different carbon sources that are differentially used by microbial communities, providing a metabolic signature that acts as a surrogate for the functional diversity of the communities being evaluated. These profiles are often called microbial community level physiological profiles (MCLPPs) and can be calibrated with temperature and genomic sequencing to provide ecological data for predicting the duration of body decomposition.

The objectives of this study were to describe microbial community metabolic changes during decomposition (i.e., succession) in two different natural settings during multiple seasons and between years. The hypothesis was tested that MCLPPs from decomposing remains, the soil beneath and 1m away would change during decomposition as a function of microbial community succession, and that these changes would vary depending on season and year, but not with habitat for the carcass communities. It was predicted that successional changes in MCLPPs could be validated with the 454-pyrosequencing of the microbial communities.

Microbial samples were taken from carrion (swine) (N = 3–9), the soil underneath (treatment soil) and 1.0m away from each carcass (control soil). To understand microbial community structure differences on the carcass, swabs of the buccal, urogential and shoulder skin were evaluated, and MCLPPs were described using Biolog EcoPlates™. Three experiments were performed to test the above hypothesis: (1) seasonal decomposition of swine carcasses during 2009 in a rural forested lot (Habitat 1) in Ohio; (2) a decomposition experiment in July/August 2010 in a different rural forested lot (Habitat 2) about 25 km away from Habitat 1; and, (3) a repeated 2010 experiment in July/August 2011 to provide an assessment of annual variation in succession on swine carcasses. In the 2010 experiment, matched samples of each individual sample were taken and evaluated using the bacterial tagged encoded FLX amplicon pyrosequencing (bTEFAP) method with a pyrosequencing platform.

Using a tiered multivariate statistical analysis approach we found significant differences in the microbial communities both on the carcass and in the soil beneath and 1.0m away from carcasses, with significant differences in decomposition succession between seasons and habitats. There were not significant differences in MCLPPs among body regions or among replicate carcasses within a season, habitat or year, indicating consistency of MCLPPs among carcasses within the same habitat during the same time of year. However, within each season, habitat and year there were significantly different daily MCLPPs during decomposition that corresponded with established stages of decomposition described in the literature. Although more studies are needed to verify our findings, these results indicate that microbial metabolic profiles on carcasses have excellent potential for use in estimating stages of decomposition, and thus, time since death in localized habitat conditions and within specific timeframes. However, the data indicate that comparisons of metabolic profiles among locations or among seasons and years would be difficult or unrealistic. Validation and comparisons of MCLPPs with metagenomic sequencing is ongoing.

mPMI, Period of Insect Activity, Nocturnal Oviposition

 ** Presenting Author*