H129 The Human Postmortem Microbiome and Manner of Death

M. Eric Benbow, PhD, Michigan State University, Depts of Entomology & Osteopathic Med Specialties, 288 Farm Lane, East Lansing, MI 48824; Jennifer L. Pechal, PhD, Michigan State University, 243 Natural Science Bldg, East Lansing, MI 48824; Carl J. Schmidt, MD, Wayne County MEO, 1300 Warren, Detroit, MI 48207; and Heather R. Jordan, PhD, Mississippi State University, PO Box GY, Mississippi State, MS 39762*

After attending this presentation, attendees will understand how the human postmortem microbiome varies among individuals and if the manner of death affects these microbial communities. In addition, attendees will have a better appreciation for the challenges associated with the potential use of the postmortem microbiome in forensic investigations. While several studies have demonstrated that the process of describing changes in microbial communities during the decomposition process of vertebrate remains has the potential for use in estimating the minimum Postmortem Interval (PMI_{min}) range, it is less understood how the postmortem microbiome varies among individuals in general and if the circumstances of death affect these communities. This presentation will include data from the largest set of human remains that have been swabbed from six places on each body, providing information on the human microbiome from real-world death investigations.

This presentation will impact the forensic science community by providing the largest database to date of the human postmortem bacterial communities found on human cadavers during routine death investigations at a medical examiner's office. Determining the PMI_{min} can be a critical process following homicides or unwitnessed deaths, and resolving the precise window of time and location of both the decedent and witness(es) is then essential for the investigative process. Because microorganisms are ubiquitous in the environment but difficult to characterize, they have historically received little research attention for their potential use in forensics, especially in such activities as estimating a PMI_{min} range. Further, little is known about postmortem microbiology and biodiversity in human cadavers, particularly the microbial heterogeneity of indigenous microflora residing on or in the human body throughout decomposition or related to the manner of death; however, recent work suggests that the healthy human microbiome is quite dynamic in both space (different parts of body) and time (community changes on or in a person). One of the first steps in evaluating the true potential of the postmortem human microbiome in forensics is to establish a baseline database of known bacterial taxa found on cadavers resulting from various manners of death and in differing progressions of the decomposition process. The goal of this study was to describe the human postmortem microbiome swabbed from different anatomic regions and assess patterns in relation to manner of death and autopsy-estimated PMIs from routine cases in a major metropolitan city — Detroit, MI. In this presentation, the largest baseline database of the postmortem microbiome developed from human remains investigated by a medical examiner's office is presented.

Bacterial samples were collected from human remains received into the Wayne County Medical Examiner's Office in Detroit, MI; each cadaver represented different circumstances of death and progression of decomposition. Individual DNA-free sterile cotton-tipped swabs were used to aseptically collect individual bacterial communities from six body areas: the external auditory canal, nose, mouth, umbilicus, rectum and the trabecular space between the inner and outer tables of the occipital bone. DNA extractions were performed using standard kits and quantified. All bacterial DNA samples were sequenced using a 2x250bp paired-end approach. Library construction and sequencing of the 16S ribosomal RNA (rRNA) V4 gene region was performed by the Michigan State University Genomics Core Facility using a modified version of the protocol adapted for high-throughput metagenomic sequencing. Samples were collected from 100 human cadavers representing the following manners of death: homicide, suicide, accident, and natural. There were distinct microbiomes among the sets of remains that varied based on sex and time of death; however, microbiomes were most different among the areas of the body that were swabbed compared to overall variation among individual microbiomes, suggesting additional research for evaluating the potential use of these communities in forensic investigations.

This project greatly expands previous research of the postmortem microbiome by partnering with a medical examiner's office to characterize bacterial communities associated with human cadavers during routine death investigation. These data offer a transformative way to solve common practical issues associated with studying human decomposition while moving the science of the human postmortem microbiome in a direction that addresses the importance of replication and understanding the initial variability in real-world cases.

Postmortem Microbiome, Medical Examiners, Death Scene Investigation

*Presenting Author