NIJ and the National Museum of Health and Medicine

Understanding the Ecology of Human Decomposition
Methods for Estimating Postmortem Interval

Moving Knowledge from Research to Impact

"In life and death the body is its own ecosystem."

Franklin Damann, PhD
National Museum of Health and Medicine

Synopsis of Problem and Solution

To date, very little has been known or understood about the role microbes play in a particular environment during human decomposition and, in turn, how that changing environment affects the decomposition process. To that end, data on the microbiome of decomposing and skeletonized remains are providing an avenue for understanding how microbial communities may be used to augment medicolegal investigations.

Through a research grant from the National Institute of Justice (NIJ), the American Registry of Pathology developed a novel baseline dataset of bacterial communities and physicochemical parameters associated with human decomposition. For those engaged in identifying human remains, the dataset helps support decisions about when and where to invest resources in specific areas of postmortem investigations (e.g., identifying victims by defining the time-since-death window).

Benefits

- Provides a framework for improving time-since-death estimates based on the succession of microbial communities of human decomposition

The Future

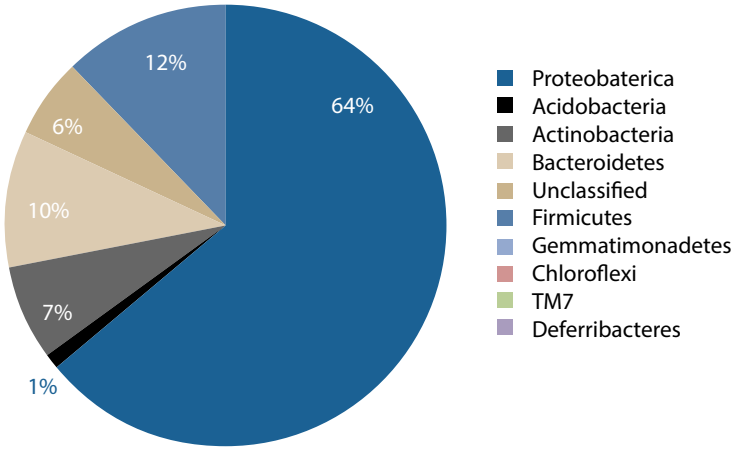
- Postmortem microbiology requires further study in order to fully implement microbial community succession as a means for better estimating postmortem interval.
- Continued experimental and evidence-based data collection will more thoroughly identify patterns of change in the physicochemical and microbiological constituents of gravesoils and bones.
- Methods of collecting, recording, and analyzing the data should be standardized to facilitate comparison between and among the various recovery sites and decomposition facilities across the United States.

NIJ-Funded Research

Through this research grant from NIJ awarded to the American Registry of Pathology, Franklin Damann, PhD, anatomical curator at the National Museum of Health and Medicine, collaborated with the Armed Forces DNA Identification Laboratory and the University of Tennessee (UT), Knoxville, Anthropology Research Facility (ARF).

Bringing Research to Practice

- The dataset created a new understanding of human microbial ecology and gravesoil characteristics in relation to human decomposition.
- Microbial diversity of gravesoils and bone were detected in a greater magnitude than previously described, with bacterial community membership changed with advancing time and skeletal decay.
- Information is essential for developing new models that estimate postmortem interval (PMI) based on the succession of microbial communities.



This graph shows the distribution of 124,164 classified sequences at the bacterial phyla level from human bones. Results from a bacterial community analysis suggest a consistency in the presence of specific bacterial phyla across all bone samples. According to Dr. Damann's study, the distributions of certain bacterial phyla demonstrate "the potential use of bacterial metagenomic analyses as postmortem temporal benchmarks." Source: https://www.ncjrs.gov/pdffiles1/nij/grants/241440.pdf

Publications

Damann, F. E. (2015, in press). *Bacterial symbionts and taphonomic agents of humans.* In E. Schotmans, N. Marquez-Grant, & S. Forbes (Eds.), Taphonomy of human remains: Forensic analysis of the dead and the depositional environment. West Sussex: Wiley-Blackwell.

Damann, F. E., Williams, D. E., & Layton, A. C. (2015, in press). Potential use of bacterial community succession in decaying human bone for estimating postmortem interval. *Journal of Forensic Science.*

Damann, F. E., & Carter, D. O. (2013). *Human decomposition ecology and postmortem microbiology*. In J. Pokines & S. Symes (Eds.), A manual of forensic taphonomy. Boca Raton, FL: CRC Press, 37–50.

The complete 16S dataset (available at MG-RAST http://metagenomics.anl.gov/)

More Information

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Development of Methods for Estimating Postmortem Interval and Body Relocation based on Biomarkers of Human Decomposition Ecology