

GEORGINIA

A Microscopic Clock

The process of human decomposition is highly variable and contingent upon numerous factors, including temperature, moisture availability, and insect and animal activities. Standard methods of determining the post mortem interval or time of death include rigor mortis, livor mortis, algor mortis, insect activity, botanical evidence, and skeletal remains. Some of these methods work in better situations than others. For example, it is challenging to determine PMI if a body has been left indoors for an extended period. Insect activity is limited, and methods like rigor or algor mortis for an extended time frame. Recently, researchers have discovered a new potential way of determining the time of death: bacteria. Despite their vital role in decomposition, research regarding microbiome succession during the decomposition process is limited, especially in superficial openings and cavities of the body. However, a few significant studies have seen breakthroughs with using microorganisms and bacteria as a marker for post mortem intervals.

One of the first major findings to support this theory was done in 2013 at the Southeast Texas Applied Forensic Science Laboratory. Two cadavers were placed and sampled four times over four months through the pre-bloat, bloat, and post-bloat intervals. Although this was a preliminary and limited study, it showed that there was an overall shift from aerobic (oxygen-dependent) to anaerobic (oxygen-independent) bacteria as the cadavers progressed in decomposition. Specifically, a shift from Staphylococcus and Enterobacteriaceae to Clostridia and Bacteroides between pre-bloating and post-bloating of the body was identified. Clostridia are theorized to play a role in decomposition by breaking down lipids and complex carbohydrates. The shift

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is plausibly from the aerobic bacteria using up all the oxygen, and then the anaerobic bacteria flourishing from the absence of oxygen.

Since the 2013 study at Southeast Texas, numerous other studies have supported this theory as well. A study of the brain, heart, liver, and spleen, buccal cavities, and blood showed that *Clostridium novyi* was more prevalent in earlier PMI. A different, unknown species of *Clostridium* was present at later intervals. Another study showed that bacteria in the oral cavity through decomposition contained Firmicutes and Actinobacteria during the fresh stage, Tenericutes during the bloating stage, and a different species of Firmicutes was during advanced decay. In 2016, a study with both mice and human cadavers found bacteria from the abdomen showed a clear increase in bacteria involved in nitrogen recycling and amino acid degradation as time progressed from death.

Because of the growing interest of the connection between microorganisms and PMI, researchers have also started producing databases, models, and regressions to predict time of death from microorganisms accurately. The Human Postmortem Microbiome Project is a growing database of microorganisms involved in the decomposition process, cataloging species, abundance, and location found in order to standardize the use of microbes for forensics. In 2015, *Bacteroides* and *Lactobacillus* were found to decline at a predictable, exponential rate in the gut, which produced a relative abundance equation to determine time of death. A Random Forest Regression model has also been created in order to predicted time of death most accurately by using cadaver skin microbiome and grave soil. However, for these models to be more accurate, larger-scale studies need to be executed. Due to the large quantities of species that must be identified and categorized, the microorganisms present is usually determined by sequencing the 16s rDNA gene, a gene that is unique to different bacterial species.

Although more research and testing need to be done before bacteria can be considered a concrete method for determining PMI, it is becoming a viable and useful option. The future of microorganisms in forensics is growing more plausible with every study completed. Before long, swab kits could be invented

JOIN the Georgia Division of the International Association for Identification (GAIAI)

The Georgia Division of the International Association for Identification (GAIAI) is a professional, non-profit law enforcement organization dedicated to promoting training and research in the application of scientific methods for the purpose of crime detection. As an organization, we seek to develop uniform and state-wide professional standards in such areas as:



Bloodstain Pattern Interpretation

Fingerprint Identification

Forensic Photography

Laboratory Analysis

Tool marks Identification

Crime Scene Investigation

Firearms Identification

Forensic Art

Polygraph Examination

Voice & Acoustic Analysis

Electronic Imaging

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Innovative / General Techniques

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The Georgia Division of the IAI welcomes **Investigators, Detectives, and Civilian Crime Scene Investigators** that are involved in the crime scene processing, evidence collection, and forensic analysis. The GAIAI offers two one-day training sessions during the year and an Annual Fall Conference.

Member Benefits:

- Continuing education in multiple forensic disciplines and crime scene processing
- Networking with other Crime Scene and Forensic professionals

Membership Cost: \$30.00 Annually

Membership Application: <http://gaiai.org/membership-application/>

For Questions about membership or more information about our organization contact:

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to swab for microorganisms as DNA is swabbed today.

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Literature:

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Welcome, 2020 New Members!

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Sabrena Dorsey, DeKalb County PD
Jane Jean-Francois, DeKalb County PD
Ashanti Jefferson, DeKalb County PD
Tachelle Lawson, DeKalb County PD
Holly Joan Lester, DeKalb County PD
Breanna Sawyer, DeKalb County PD
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William Turner Jr, DeKalb County PD
Tangela K Willis, DeKalb County PD
Wendy Smith, District Att. Office Valdosta
Kenneth Gleaton, Jones County SO
Kenneth Allen, Jones County SO
John David Simmons, Jones County SO

Analyzing the Correlation between Hypertension, Diabetes, and Decomposition

Livor mortis is the phase of decomposition where blood pools to the dependent parts of the body following death. Skin discoloration develops as the blood settles, becoming more prominent over time. The first signs of livor mortis, on average, begin 30 minutes after death, are fully visible after 3–4 hours, and are fixed approximately 8–12 hours following death. However, the livor mortis process can be altered if a person's blood vessels are weakened ante mortem; diseases such as diabetes and hypertension have been known to damage the cardiovascular system.

The aim of this research is to determine the effects of diabetes and hypertension on decomposition, with a specific focus on the livor mortis process. A weakened cardiovascular system would likely have a significant impact on the livor mortis process, consequently altering both the PMI (post-mortem interval) of other decomposition processes and estimated TOD (time of death). If these diseases influence the livor mortis process, then all other decomposition processes may be affected as well.

Case files of twenty-four people with visible signs of livor mortis were used in this research. Twelve of these individuals had a medical history of either diabetes or hypertension; the others had no diagnosed cardiovascular illness. The LKA (last known alive) time and EMS call time were used to determine an approximate TOD. By examining scene photographs of the bodies and checking for markers of specific points in the lividity process, a more accurate PMI was determined and then compared to the standard PMI for livor mortis. The new PMI combined with the person's medical history was used to establish the correlation, if any, between the livor mortis process and diabetes or hypertensive disease. A t-test was then used to determine the statistical significance of the variance in "actual" versus standard PMI.

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GAIAI One Day Training

Spring Training March 2020

No Fee for Attending

South Georgia Meeting

March 18, 2020
South Georgia Technical College
402 North Midway Rd
Cordele, GA 31015
8:00am-5:00PM

Training Topic: Digital Forensics an
Overview for Investigators

Speaker: Lisa Maxwell
Thomasville Police Department

North Georgia Meeting

March 24, 2020
Piedmont College-Stuart Hall Auditorium
1021 Central Ave, Demorest, GA 30535
8:00am-5:00pm

Training Topics:
Post Mortem Determinations a research
presentation- Veronica Capps & Breanna
Kramer

Successful Homicide Investigation- Bruce
Willis, Senior Fellow of Forensic Science

Please contact us to preregister, so we have appropriate seating.

RSVP North: Katrina Willis, kwillis@bankscountysoga.org

RSVP South: Lisa Maxwell, lm Maxwell@thomasville.org

Post Credit will be given for completing the training.

2020 Summer Meeting: TBA

2020 Fall Conference

Jekyll Island

Villas by the Sea

1175 N Beachview Drive

Jekyll Island, Georgia 31527

October 18-22, 2020

Room rates Island side/Oceanside Number of Rooms

mini villa \$99 15

one bedroom \$109/\$119 - 35

two bedroom \$179/\$189 - 50

three bedroom \$209/\$220 - 20