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Editorial: Life and death: new perspectives and applications in forensic science, volume II

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Editorial on the Research Topic
Life and death: new perspectives and applications in forensic science, volume II

Introduction

Death is a universal process that applies to every organism and understanding this process has important applications in forensic science research. With technology, research applications advancing the knowledge of death and the subsequent biological changes has been expanding at an exponential rate, providing innovative data important to death investigations. This Research Topic covers some of the most recent advanced techniques defining forensic ecology, the necrobiome, thanatomicrobiome and soil microbial community research that bridges gaps within and among forensic disciplines and further strengthens the applications in the criminal justice field.

The Research Topic

This Research Topic examines relevant studies that characterize the structure and function of thanatomicrobiome and the microbial components of the necrobiome (Benbow et al., 2019), soil communities (Finley et al., 2016) associated with understanding postmortem decomposition dynamics of vertebrate carrion which are often used as surrogate models for cadavers and forensic understanding. This Research Topic also ventures into the forensic applications of the hemp microbiome and the detection and differentiation between industrial hemp and marijuana (as discussed by Finley et al.) Further, there is an active natural use of bodies after death by microorganisms in internal organs (Javan et al., 2016) as well as those that have evolved to detect, colonize, and use the now available resource, or the necrobiome (Tomberlin et al., 2011), defined as the diversity of organisms associated with carrion decomposition (Benbow et al., 2019). Insects and

microbes are the two main groups of communities that interact with carrion resources and each other (Jordan et al., 2015). It is only recently that the basic principles governing these interactions are beginning to be understood. This includes host, scavenger, entomological, and microbial processes (Newsome et al., 2021). Despite the abundance of microbial decomposers in decaying biomass, details on specific microbial communities and how they affect invertebrates, is complex within the broader processes of vertebrate carcass decomposition and continues to be active areas of research by many investigators, several of those as authors of papers in this Research Topic.

The forensic science community is actively conducting research on microbial and insect roles in carrion decomposition. This work expands from studies of gene expression to bacterial and fungal associations with carcasses and how their taxonomic structure and genomic function affect the detection, location, and colonization of carcasses by insects as developed by Tarone et al. Along with the expansion of the knowledge of these communities, and their molecular underpinnings, have come new forensic applications, including new basic research into understanding the cadaveric stem cells and how this information can inform forensic investigation as reviewed by Cieśla and Tomsia. Interrogation of nucleic acids existent in relevant tissues generates various amplicons that may be directly used as a monitoring tool for microbial ecology. Similarly, microRNA and proteomics from forensically important blow flies and other necrophagous insects, are actively being studied to provide more accurate and precise postmortem estimations. Once dead, vertebrate bodies are rapidly changed by microbial communities that were once part of the living organism and those that are brough to the carcass via insects and vertebrate scavengers. The timing and species composition of the necrophagous insects colonizing bodies have historically been used for making estimates of time since death and so this new research on these organisms and how the interact with microbial communities holds promise for new advances to applied to forensics like that evaluated by Meeds et al. and Tarone et al. in this issue. In this Research Topic, the research problem is to investigate how the microbial, soil, and invertebrates in and/or around the vertebrate body changes postmortem as a function of time and temperature. Thus, the practice of freezing decomposing human bodies to preserve the abundance and composition of associated microbial communities was explored by Ogbanga et al.

Bridging research knowledge gaps

Sources of error and uncertainty in forensic disciplines are constantly being discovered and examined to further strengthen the field and the knowledge that can be provided. One such field, forensic entomology, incorporates basic insect science with criminal law, advancing technologies and data science. While the field has advanced greatly within the several decades (Lei et al., 2019), much research is still needed to bridge fundamental knowledge gaps such as survey data and the impact of insect presence on microbiome. One such area, as highlighted in this Research Topic, is the Pacific Southwest of the United States. With the use of human donors at several anthropology research facilities, it has allowed researchers to answer certain questions that were not previously possible with mammalian surrogates, especially in forensic decomposition, postmortem research, and field experiments including microbiome in human decomposition.

With cutting-edge technology advancing, this fosters knowledge development in new cross disciplinaries which then strengthens methods applied in forensic science. This Research Topic highlights advanced technologies that are being applied in the forefront of several disciplines (decomposition, microbiome, and the hemp industry in forensic science). The topics bring fresh and innovative science for aiding death investigations, using next-generation technologies concerning the community of organisms that detect and use carcasses in ways that can be studied to inform forensic investigations.

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