

# Aspects Influencing the Entomological Postmortem Interval in Crime Scene Reconstruction

Tom Adair, MS

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## ABSTRACT

The pathological postmortem interval (PMI), or time since death estimate, is widely understood among crime scene reconstructionists, pathologists, and prosecutors. Unlike the pathological PMI, the entomological PMI is not strictly an estimate of the time since death. This paper will discuss the entomological PMI and the environmental and cultural factors that may influence it.

**Keywords:** Forensic entomology, post-mortem interval, period of isolation, time since colonization, crime scene reconstruction, forensic science

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Author Contact:  
sof32@comcast.net

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## Introduction

Crime scene reconstructionists are quite familiar with the concept of the postmortem interval (PMI) as it is frequently used in forensic pathology. In that context the PMI is an estimate synonymous with the time since death. The processes used to estimate the pathological PMI are the result of changes that begin to occur immediately after death. In contrast, the processes used to estimate an entomological PMI may not begin until long after death. For this reason, investigators should understand the factors influencing these processes if they want to accurately incorporate this estimate into their overall reconstruction.

## Discussion

The entomological postmortem interval is built upon two separate, but equally important, components. The first is the *period of isolation* [1]. Simply put, it is the time between death and the measurable arrival of forensically important insects. This period might be composed of minutes, hours, days, or even years. Bodies can be isolated from adult insects by the presence of either physical or environmental barriers. Physical barriers include things like closed containers (vehicles, homes, drums, etc.), burial, submersion, and wrappings (tarps, plastic sheeting). These items or conditions



physically prevent or delay adult female flies from laying eggs directly on the body.

Insects regulate their body heat exothermally. This means that the insect's metabolic activity is dependent upon the environmental temperatures surrounding it. Insect metabolic activity can be dampened or terminated under extreme weather conditions. Freezing temperatures are generally the most effective environmental barrier preventing adult female flies from reaching the dead body because the cold weather slows or stops their flight activity. Other conditions such as heavy rains or high winds may serve to delay adult insects but only for a relatively short period of time.

The second component is the *time since colonization*. This estimate is what most investigators think of when defining the post-mortem interval. Simply put, it is the estimated age of the insects collected from the body. The larvae of various species of flies will develop at different rates even under similar temperature regimes. Following the hatching of the egg, the larvae will progress through three growth phases called instars which are separated by a molting of their skin. The larvae will continue to develop in size and physical attributes through each of these instars. Following the third instar the larvae will enter into a pre-pupal or wandering phase before pupation. During the pupal stage the larvae continue complete metamorphosis eventually emerging from the casing as an adult fly. This development can be estimated based on an analysis of the available temperature data nearest the crime scene along with the known developmental data of the species from formal research. These analyses typically focus on the oldest species collected from the crime scene but may consider younger specimens under certain circumstances. Obviously, the accuracy of this estimate is dependant on the quality of the data collected but in theory, and in practice, it is a reliable methodology [1-5].

Investigators should consider the PMI as a minimum estimate of the time since death; never an absolute time since death. Investigators should also consider the possibility that certain barriers may have existed prior to the discovery of the body. For

example, if you develop information that the victim may have been stored in the back of a box van for three days prior to being dumped in a field then the entomologist must be made aware of this information as it may affect the previous estimate.

When physical barriers are clearly present then the subsequent age of the living insects relates only to the minimum time since the barrier was defeated. For example, in cases where vertebrate scavengers (*i.e.*, coyotes) have exposed a buried body then the subsequent insect colonization may correspond only to the time since exposure (scavenging) not the actual time since death or burial. Similar considerations may exist with bodies dumped during the winter months in a snow covered environment. Increases in latitude and elevation generally correspond to decreases in temperature and harsher weather conditions during the winter months in North America. So bodies deposited during these times may not be accessible to common forensic insects until daily air temperatures consistently stay above 50 °F (10 °C) at a minimum. This may be months after the original deposition.

## Conclusion

A postmortem interval estimate is an important component of any crime scene reconstruction. It provides a useful timeline from which all other evidence may be evaluated. Certainly there are times when a lack of data complicates efforts to fully understand the forensic time line, but failure to recognize evidence which may affect the entomological time line creates potential inaccuracies that may prevent a proper resolution to the case.

When employing a forensic entomologist it's important to provide them with any information, regardless of when that information was developed, related to the crime scene environment. Investigators should recognize that not all species of insects react to the same environmental conditions in the same manner. Temperatures or conditions that may be survivable for one species may be deadly to another. Entomologists can not be expected to incorporate this data if it is not furnished to them. All parties (reconstructionist, medical



examiner, prosecutor, entomologist, etc.) should maintain an open dialog with each other, regardless of who first solicited the entomologist. Entomologists should also be involved in the final trial preparations to ensure that all discovered information has been properly evaluated.

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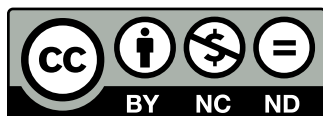
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