

Forensic Entomology



Insects as Evidence

Warning: Some material in this presentation and related videos may be too graphic for some people.

T. Trimpe 2009 <http://sciencespot.net/>

The Forensic Entomologist

Forensic entomologists

apply their knowledge of entomology to provide information for criminal investigations

What do they do?

A forensic entomologist's job may include:

- Identification of insects at various stages of their life cycle, such as eggs, larva, and adults.
- Collection and preservation of insects as evidence.
- Determining an estimate for the **Postmortem Interval or PMI** (*the time between death and the discovery of the body*)

Use the following factors:

- insect evidence
 - weather conditions,
 - location and condition of the body, etc.
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- Testifying in court to explain insect-related evidence found at a crime scene.

Did you know? Maggots can be used to test a corpse for the presence of poisons or drugs. Some drugs can speed up or slow down the insect's development.



Cool Jobs: Forensic Entomology
Discovery Video

Insects as Evidence

Forensic entomologists use their knowledge of **insects** and their

1. **Life cycles**
 2. **behaviors**
-to give them clues about a crime.

Most insects used in investigations are in two major orders:

- 1 – Flies (**Diptera**) and
- 2 – Beetles (**Coleoptera**)



Blow Fly



Carrion Beetle

Insects as Evidence

- **Species succession**

- Species can:

1. Feed on a fresh corpse
2. Feed on an old corpse
3. Prey on the insects feeding on the corpse.

| Succession wave | Principle insect fauna | State of corpse | Age of corpse |
|-----------------|------------------------------------|----------------------|----------------|
| 1 | Flies (blow flies) | Fresh | First 3 months |
| 2 | Flies (blow flies and flesh flies) | Odour | |
| 3 | Dermestid beetles | Fats are rancid | 3-6 months |
| 4 | Various flies | | |
| 5 | Various flies and beetles | Ammonia fermentation | 4-8 months |
| 6 | Mites | | 6-12 months |
| 7 | Dermestid beetles | Completely dry | 1-3 years |
| 8 | Beetles | | 3+ years |

Taken from Smith, K. G. V. 1986, A manual of forensic entomology. Cornell Univ. Press, Ithaca, NY.

Other Factors

Weather

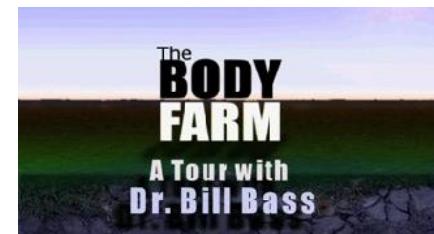
Investigators will make note of the temperature of the:

1. Air
2. ground surface
3. the interface area between the body and the ground
4. the soil under the body as well
5. the temperature inside any maggot masses.

They will also collect weather data related to daily **temperature** (highs/lows) and **precipitation** for a period of time before the body was discovered to the time the insect evidence was collected.

Did you know...

The “Body Farm” in Knoxville, Tennessee is a university research facility to investigate human decomposition under various conditions in order to understand the factors which affect its rate.



Click the image to view a video about the Body Farm!

Other Factors That May Affect PMI Estimates

1. Was the body enclosed in an area or wrapped in a material that would have prevented flies from finding the corpse and laying eggs?
2. Were other insect species present that may have affected the development of the collected species?
3. Were there drugs or other poisons in or on the body that might have affected the larvae's development?

Blow Fly Metamorphosis

Blow flies are attracted to dead bodies and often arrive within minutes of the death of an animal. They have a **complete** life cycle that consists of **egg, larva, pupa, and adult** stages.

1st – Adult flies lay **eggs** on the carcass especially at wound areas or around the openings in the body such as the nose, eyes, ears, anus, etc.

2nd – Eggs hatch into **larva** (maggots) in 12-24 hours.

3rd – Larvae continue to grow and **molt** (shed their exoskeletons) as they pass through the various instar stages.

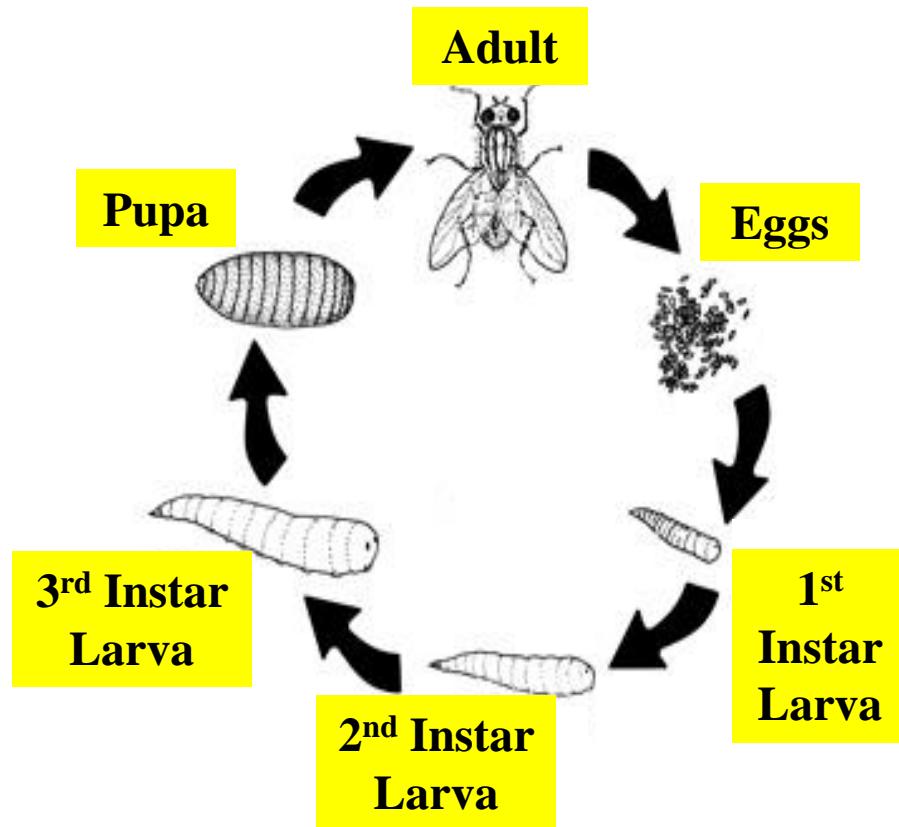
1st Instar - 5 mm long after 1.8 days

2nd Instar - 10 mm long after 2.5 days

3rd Instar – 14-16 mm long after 4-5 days

4th – The larvae (17 mm) develop into pupa after burrowing in surrounding soil.

5th – **Adult** flies emerge from pupa cases after 6-8 days.



It takes approximately 14-16 days from egg to adult depending on the temperatures and humidity levels at the location of the body.

Examples of Diptera (Flies)

Early Stage Decomposition



Life Cycle of a
Calliphoridae Fly

Late Stage Decomposition



Blow & Greenbottle Flies
(*Calliphoridae*)

Metallic thorax and abdomen



Flesh Fly
(*Sarcophagidae*)
Striped thorax



House Fly
(*Muscidae*)



Cheese Skipper
(*Piophilidae*)

Examples of Coleoptera (Beetles)

Early Stage Decomposition



Carrion Beetles (*Silphidae*)
Adults & larvae feed on fly larvae

Early to Late Stage Decomposition

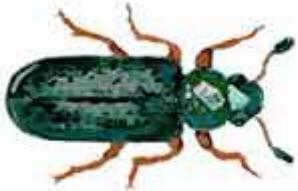


**Rove Beetles
(*Staphylinidae*)**
Predator of fly eggs



**Clown Beetles
(*Histeridae*)**
Predator of fly eggs

Late Stage Decomposition



**Ham & Checkered Beetles
(*Cleridae*)**

Predator of flies & beetles;
also feed on dead tissue



Skin Beetles (*Dermestidae*)
Feed on dried skin & tissues



**Hide Beetles
(*Scarabidae*)**
Usually the last to arrive



Let's give it a try ...

Crime Scene Creatures - Introduction

A body has been discovered. A fatal gunshot wound to the chest indicates homicide. As a forensic entomologist, your job is to examine the crime scene, collect and analyze the evidence, and determine the PMI (postmortem interval)—the minimum elapsed time between death and discovery.

These are the tools you'll need to collect the evidence.

Roll over each tool to learn how it is used.

The image shows a collection of forensic tools on a textured, yellowish-brown cobblestone ground. The tools include a small hand trowel, a blue bucket, a digital thermometer displaying '00.0', a pair of grey forceps, two clear plastic jars with black lids, and a tall, multi-directional weather vane or wind gauge. In the background, a human figure lies face down in a shallow grave.

Click the image above or click here to visit the website at
<http://www.pbs.org/wnet/nature/episodes/crime-scene-creatures/interactive-determine-the-time-of-death/4390/>