

Forensic Entomology



Insects as Evidence

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

What do they do?

Forensic entomologists apply their knowledge of entomology to provide information for criminal investigations.

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) using factors such as insect evidence, weather conditions, location and condition of the body, etc.
- 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 **life cycles** and **behaviors** to give them clues about a crime.



Blow Fly



Carrion Beetle

Most insects used in investigations are in two major orders:

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

Species succession may also provide clues for investigators. Some species may feed on a fresh corpse, while another species may prefer to feed on one that has been dead for two weeks. Investigators will also find other insect species that 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 | Dermeid 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 | Dermeid 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.

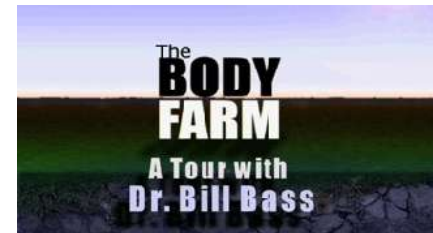
Weather data is also an important tool in analyzing insect evidence from a corpse. Investigators will make note of the temperature of the **air**, **ground** surface, the **interface area** between the body and the ground, and the **soil** under the body as well as the temperature inside any **maggot 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.

Other factors that might affect their 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?

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!

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.

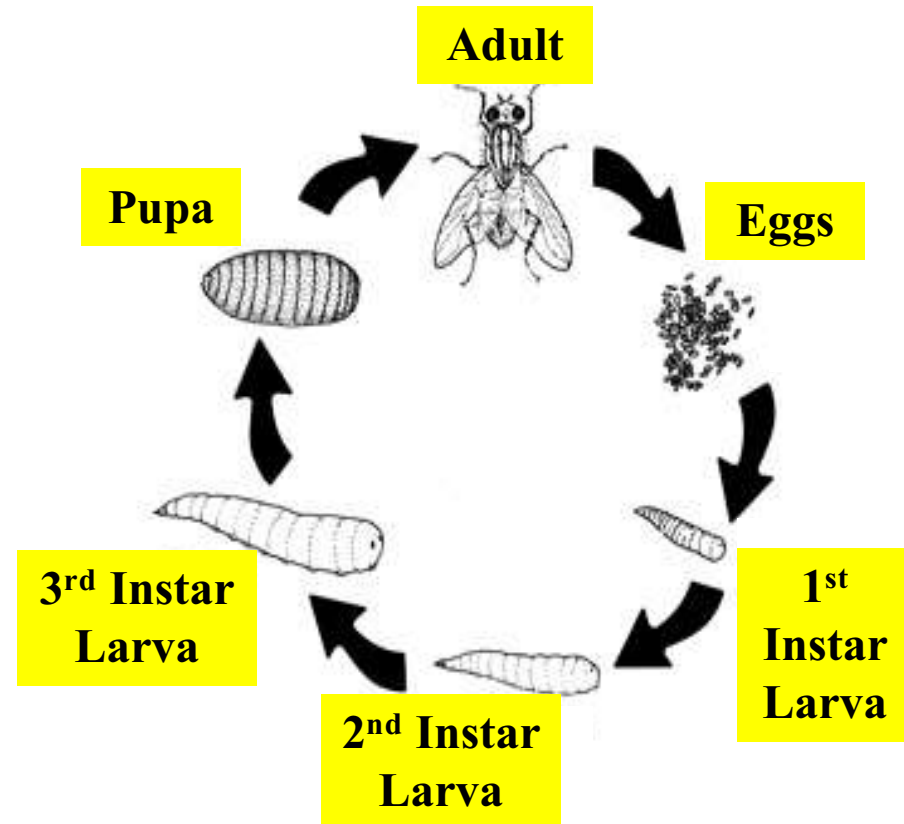
1st Instar - 5 mm long after 1.8 days

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**



**Blow & Greenbottle Flies
(Calliphoridae)**
Metallic thorax and abdomen



**Flesh Fly
(Sarcophagidae)**
Striped thorax

Late Stage Decomposition



**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

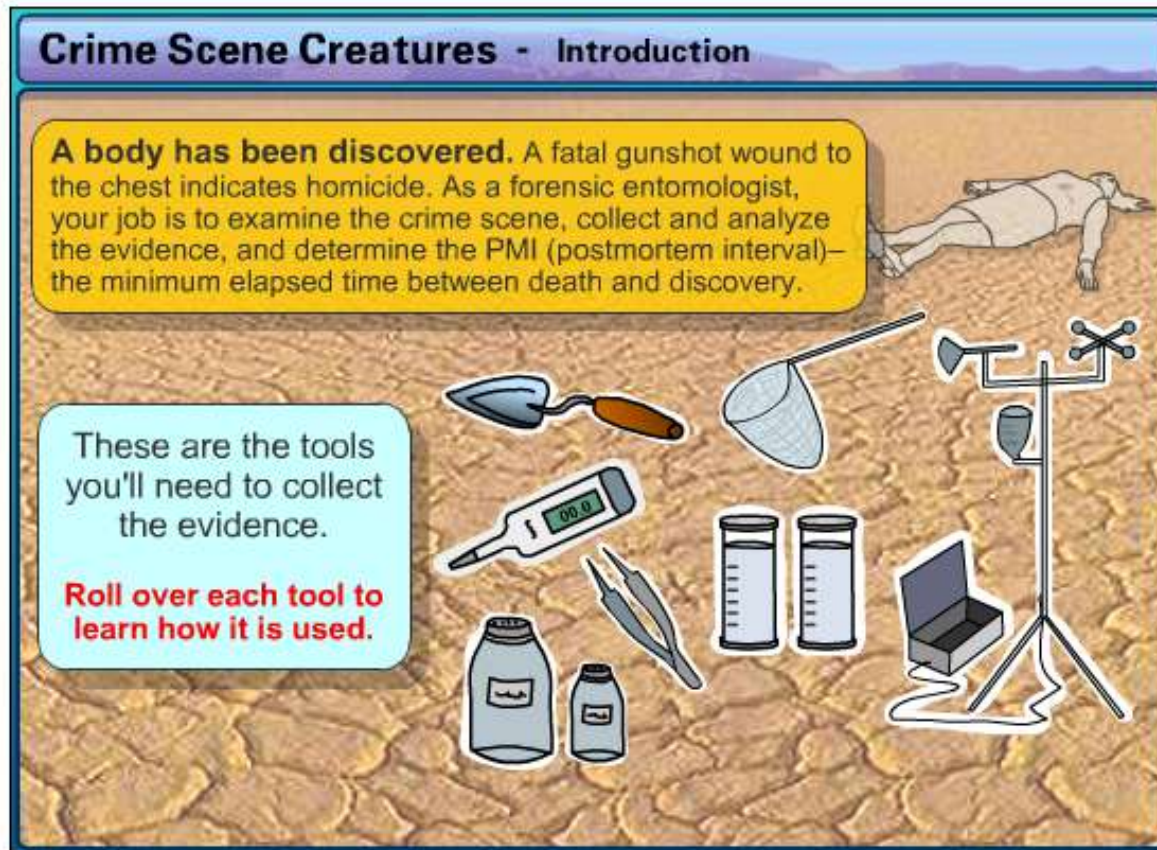
Let's give it a try ...

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 illustration shows a crime scene in a desert-like environment with a body lying on the ground. Various tools are scattered around, including a shovel, a net, a digital thermometer, tweezers, two graduated cylinders, two evidence bags, and a tripod-mounted scale. A small box is also visible on the tripod.

[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/](http://www.pbs.org/wnet/nature/episodes/crime-scene-creatures/interactive-determine-the-time-of-death/4390/)