



Entomology

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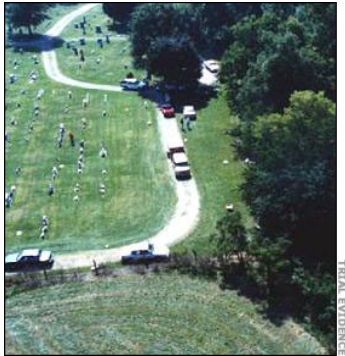
Insects are creatures of rigid habit and limited preferences. They are very specific about when and where they will lay their eggs, and the larvae that emerge and mature from those eggs do so. Because of the regularity and measurability of an insect life cycle, forensics entomologists can control for other variables including weather, moisture, and clothing. Scientists can use the information left behind by bugs to provide police with guidance about time of death, whether a body was moved, etc...

The use of bugs to solve crimes dates back to 1300 A.D. by Sung T'zu, a Chinese mandarin.



Kevin Neil

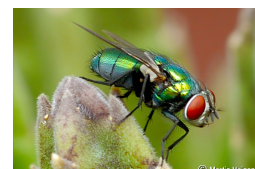
<http://prezi.com/4szxtsxa49ea/kevin-neal-case/>



Forensic Entomology is the use of the insects, and their arthropod relatives that inhabit decomposing remains to aid legal investigations.

Forensic entomologists apply their knowledge of entomology to provide information for criminal investigations. Their job includes:

- Identification of insects at various stages of their life cycle, such as eggs, larva, nymphs, pupa, and adults.
- Collection and preservation of insects as evidence.
- Determining an estimate for the postmortem interval (PMI) = the time between death and discovery. Entomologists use factors such as insect evidence, weather conditions, location and condition of the body.



Forensic Scientist Video

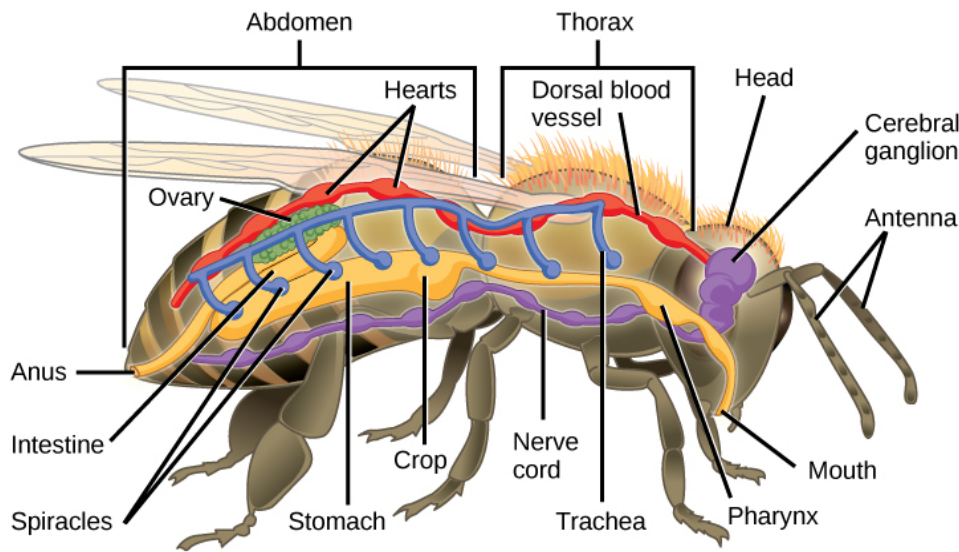
Arthropods

Insects are a class of Arthropods that have three segments to their body, one pair of antennae, three pairs of legs, compound eyes and breathe air via small holes of spiracles along the side of their body.

Most arthropods are insects BUT there are also bugs that are NOT insects such as spiders (Arachnida), (Crustacea) and millipedes & centipedes (Diplopoda & Chilopoda).

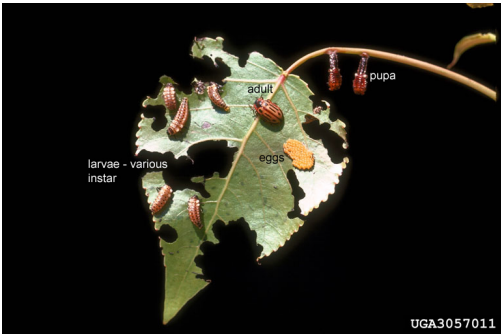
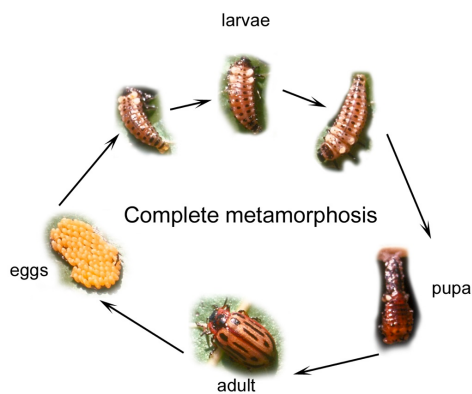


Anatomy of an Arthropod

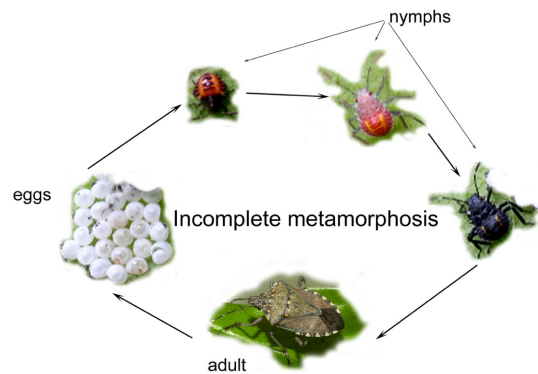


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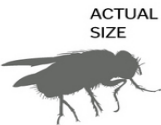


What is the same? Different?



The life cycle of a blowfly

It never takes these insects long to make their way to a decomposing body, and the first thing they do when they get there is lay eggs. This timeline is based on a constant temperature of 70 degrees.



DAY 1

Adult fly lays eggs on body.

TWO WEEKS

Emergence of adult fly.

DAY 2

Eggs hatch and larvae emerge.

DAYS 3-7

DAYS 8-9

Prepupation. Larva forms a hard, cocoonlike shell and begins developing adult features.

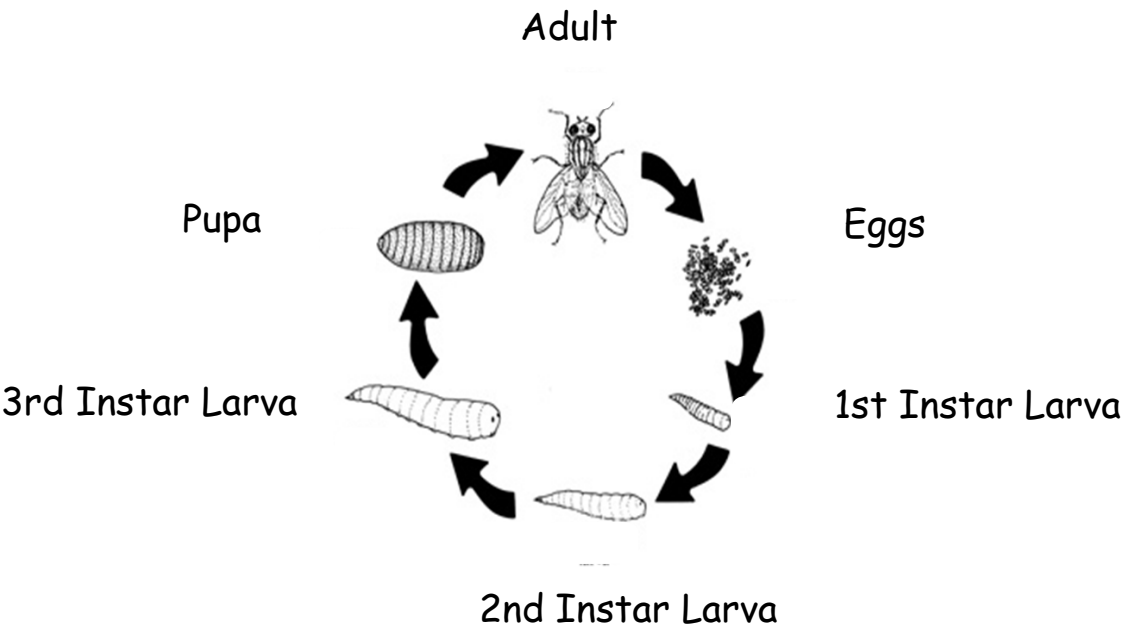
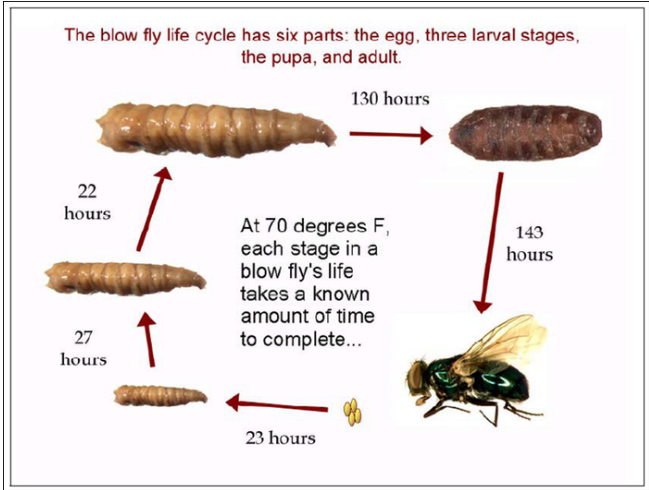
Their measured life cycle allows **forensic entomologists** — bug specialists — to roughly calculate when a victim died based on the developmental stage of the blowflies when the body is discovered.

SOURCE: Michigan State University
Dept. of Entomology

THE PLAIN DEALER



Blowflies are attracted to dead bodies and often arrive within minutes of the death of an animal. They have complete life cycles consisting of egg, larvae, 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.

Stage	Features	Time after death	Inhabited by
Fresh	Immediate, no odour	1-3 days	Eggs
Bloat	Swelling, bloat, leaking fluids, odour	2-7 days	Larval stages
Decay	Strong odour, putrefaction	1-3 weeks	All stages
Dry	Dry skin and bones	>1-3 months	Empty pupae, beetles

The rate of decomposition is affected by a number of factors including temperature, oxygen availability, cause of death, burial, humidity, clothing and the extent that scavengers and insects have access to the body. The most important variable is a body's accessibility to insects, particularly flies.

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	Dermostid 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	Dermostid 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.

Did you know?????

Maggots can help detect if a dead person had poison or drugs in the body at the time of death. When the maggots feed on tissues, any toxins or drugs they eat will be built into their own bodies. A "maggot milkshake" is prepared by a forensic entomologist, which is then analyzed for the presence of poisons or drugs.



Effects of season and sun exposure

Seasons have a large impact on the weather and the fauna in an area and as such faunal succession is affected greatly by season. Studies in Australia have shown that season and sun exposure has a large effect on pig carcass decomposition. Many blow flies have different sized populations depending on whether it is summer or winter. Other insects are also affected and have specific activity peaks. In order to estimate correct post mortem intervals, scientists should perform controlled experiments throughout the year. This will avoid generating data for only one season. In one case, a body was discovered ten years after the victim's disappearance and there was no insect evidence on the body.

This indicated to investigators that the person had died in winter. In winter, a high level of moisture will often destroy insect evidence. When a body is placed in sunlight, it will heat up faster and decompose faster which will affect the rate of development of colonising insects. Certain species of blow flies prefer shaded conditions while other species are found more commonly in open areas. This distribution affects the faunal succession of a corpse. There have been many studies into the effects of shade vs. sun on pig carcasses and large differences have been found in the faunal succession. Season and sun exposure are both important factors to consider when determining a PMI.

The Baby in the Box

In March 1944, the dead body of a newborn child was found wrapped in a blanket and newspaper in a cardboard box. The body had been placed in a pit dug in the forest floor and was covered with leaves. The forensic investigator who examined the body thought it had been abandoned for only a few hours because of the condition of the baby's body. The discovery of more than 20 beetles in the wrappings around the baby demonstrated that the time of death had to be much earlier than this. Recent cold weather had kept the body preserved and had disguised the real time of death.

Forensic entomologists use their knowledge of insects and their life cycles and behaviours to give them clues about a crime. Most insects used in forensic investigations are in two major orders:

Diptera (flies)

Early Stage Decomposition



Life Cycle of a
Calliphoridae Fly



Flesh Fly
(Sarcophagidae)
Striped thorax



Blow & Greenbottle Flies
(Calliphoridae)
Metallic thorax and abdomen

Late Stage Decomposition



House Fly
(Muscidae)



Cheese Skipper
(Piophilidae)

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



Hide Beetles (*Scarabidae*)

Usually the last to arrive



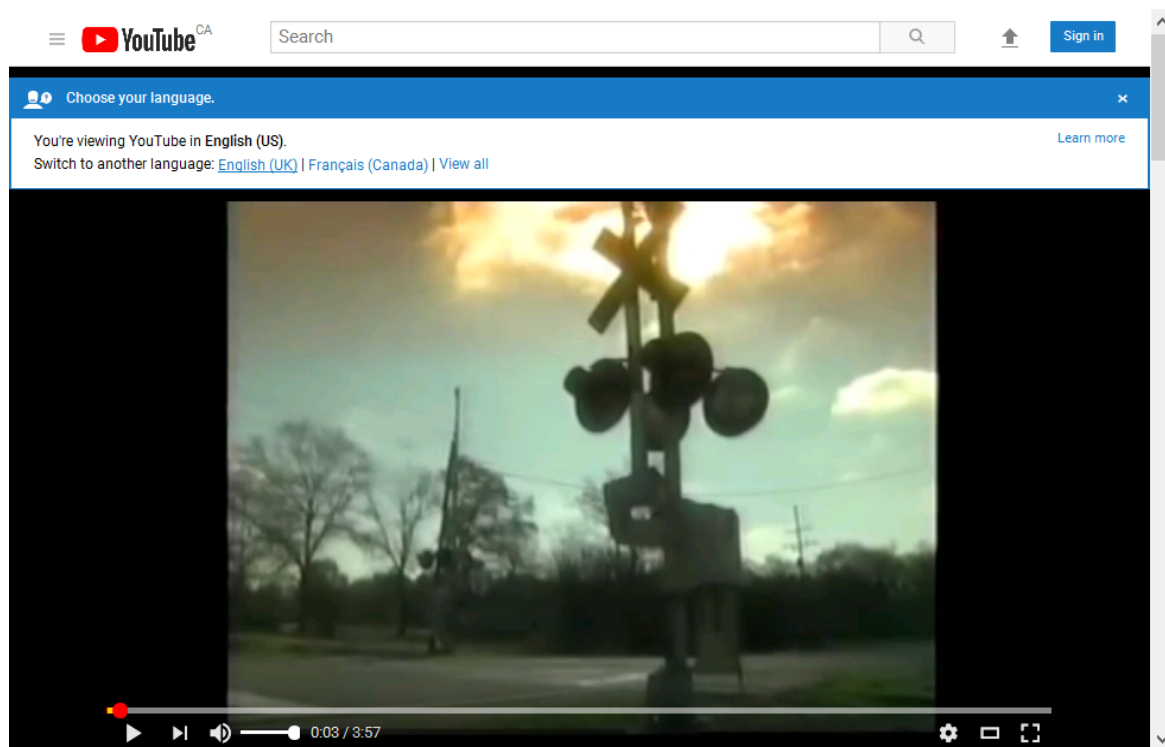
Skin Beetles (*Dermestidae*)

Feed on dried skin & tissues

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

Species succession may also provide clues for investigators. Some species may feed on a fresh corpse, while another 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.



Many factors affect insect development, including temperature, moisture, wind, time of day, season, exposure to the elements, and variation among individual insects. Because life cycles are affected by fluctuations in the daily environmental conditions, insects cannot provide exact time of death, only a close estimate. Insects collected at a crime scene and then raised in a laboratory under the same environmental conditions as those found at a crime scene. This process can provide a more accurate estimate time of death, called Accumulated Degree Hours (ADH).

This is how it is done:

- 1) Immediately preserve some insects from the crime scene so you know exactly how old they are at the time of discovery of the body.
- 2) At the crime lab, raise some of the insects from the crime scene in the same conditions as those found at the crime scene.
- 3) Record the length of time for development under the specific conditions.
- 4) Compare the insects raised at the crime lab to those found at the crime scene.

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Bugs, Bones and Botany

Attachments

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