

Chapter 13

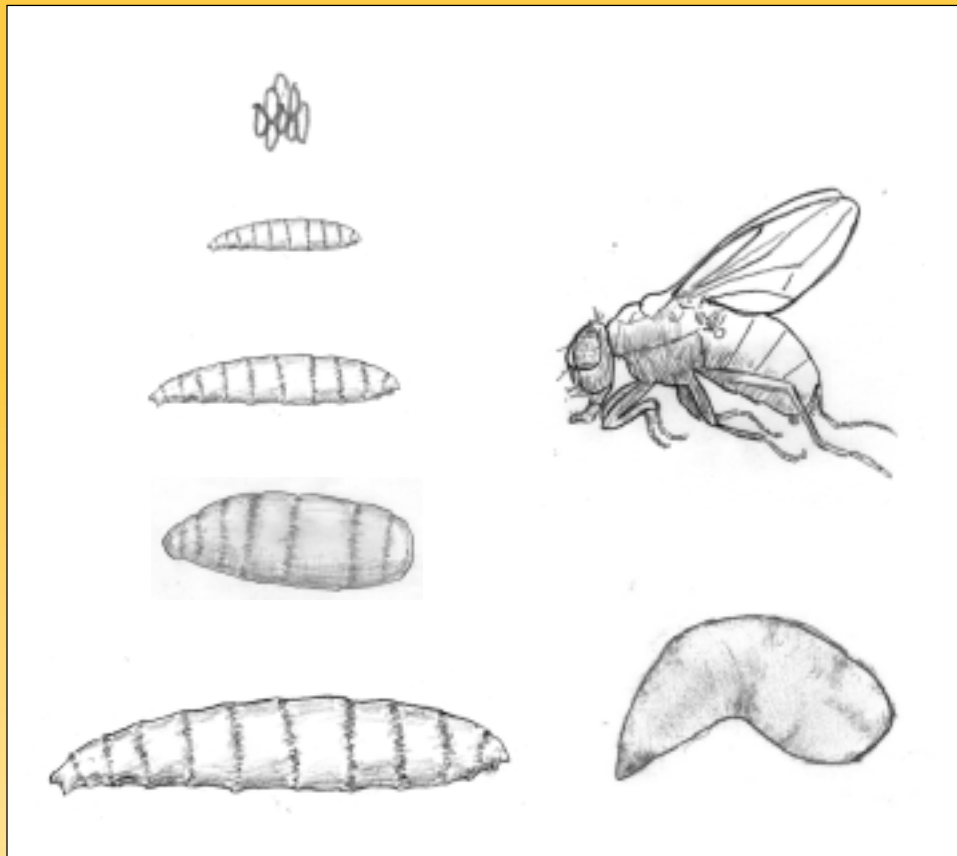
Forensic Entomology

**“When I was young I used to wait On
master and hand him his plate
And pass the bottle when he got dry
And brush away the bluetail fly
One day he ride around the farm The
flies so numerous they did swarm
One chanced to bite him on the thigh
The devil take the bluetail fly
The pony run, he jump, he pitch He
threw my master in a ditch He died
and the jury wondered why
The verdict was the bluetail fly
They lay him under a 'simmon tree
His epitaph is there to see 'Beneath
this stone I'm forced to lie
A victim of the bluetail fly!”**

*—from early American folk song,
“Jimmy Crack Corn and I Don't Care”*



Objectives



You will understand:

The stages of death.

The role insects play in the decomposition of carrion.

Postmortem interval and how it is estimated.

The life cycle of insects.

How variables affect results of scientific experiments.

Objectives, *continued*

You will be able to:

- Distinguish among major insect types associated with carrion.
- Identify the relationship between insect type and the stages of death.
- Perform the same experiments that forensic entomologists do.
- Estimate time of death.
- Rear flies from pupae and larvae to adult.
- Explore variables affecting the determination of time of death.



Activities

Test Your Knowledge of the Insect World

Collection and Observation of Insects

The Potato Corpse

Estimating Time of Death

The Effects of Temperature on Rearing of Maggots

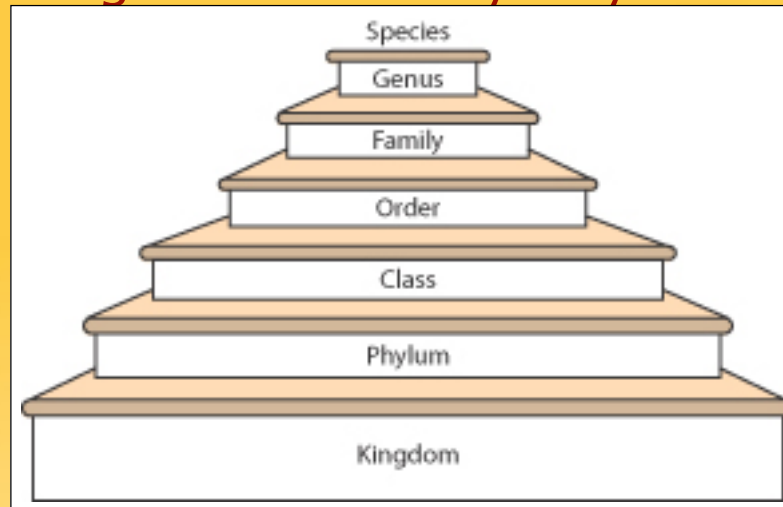
Fly Infestation as a Function of Habitat

Beetle Infestation of Carrion

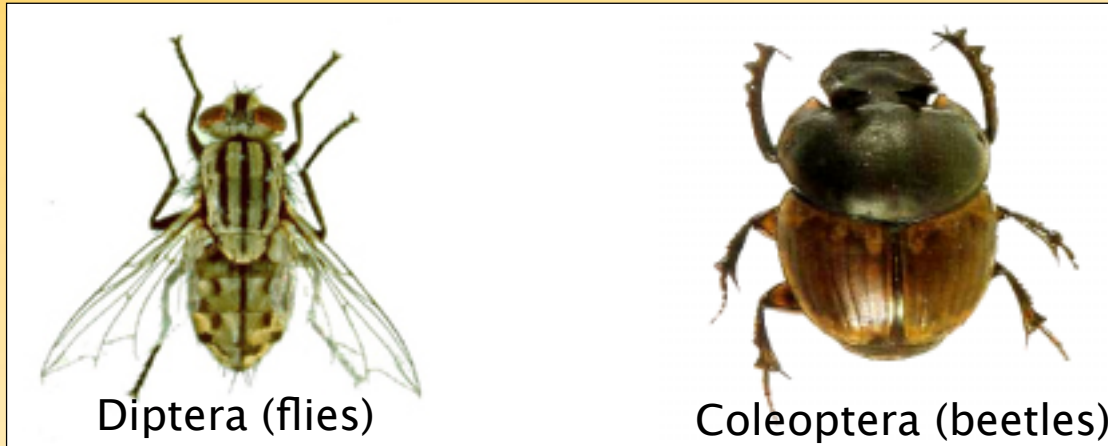
Maggot Ingestion of Drugs from a Corpse

Taxonomy

Classification of Things in an Orderly Way



We are interested in the **phylum**, Arthropoda; **class**, Insecta; **order**:



Diptera (flies)

Coleoptera (beetles)

Forensic Entomology

Entomology is the study of insects.

Forensic entomology involves the use of insects and other arthropods to aid in legal investigations.

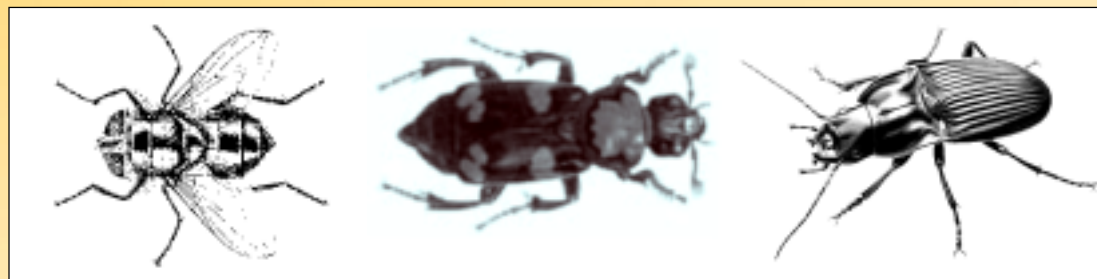
There are three areas of application:

Insect damage to structures

Infestation of foodstuffs

Insects that inhabit human remains

The latter category is the subject of this chapter.



The Process of Death

Algor Mortis: Body cooling rate

$$\text{Hours since death} = \frac{98.4^{\circ}\text{F} - \text{internal body temperature}}{1.5}$$

Livor Mortis: skin discoloration caused by pooling of blood

Rigor Mortis: rigidity of skeletal muscles

Temperature of body	Stiffness of body	Time since death
Warm	Not stiff	Not dead more than 3 hours
Warm	Stiff	Dead between 3 and 8 hours
Cold	Stiff	Dead between 8 and 36 hours
Cold	Not stiff	Dead for more than 36 hours

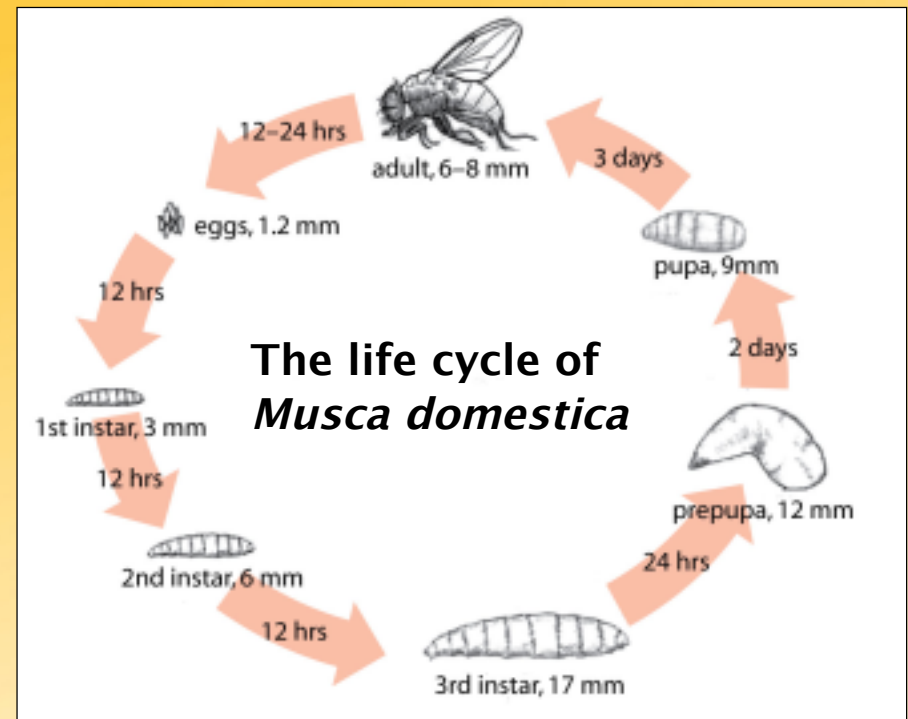
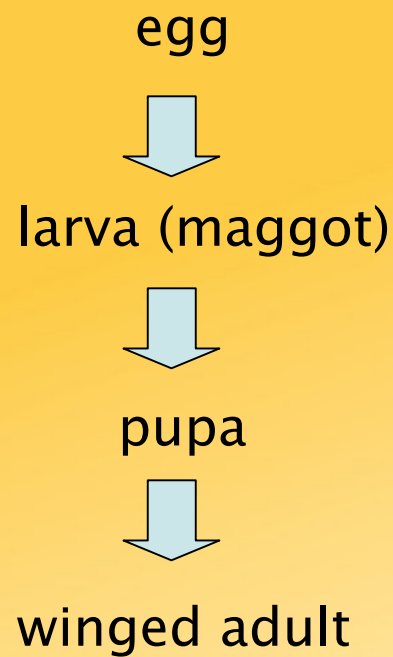
A pathologist estimates time of death from these factors.

The Process of Death, *continued*

Stage	Description
Initial or fresh decay (autolysis)	The cadaver appears fresh externally but is decomposing internally due to the activities of bacteria present before death (0–4 days).
Putrefaction or bloating	The cadaver is swollen by gas produced internally, accompanied by the odor of decaying flesh (4–10 days).
Black putrefaction	Flesh of creamy consistency, with exposed body parts black. Body collapses as gases escape. Fluids drain from body. Odor of decay very strong (10–20 days).
Butyric fermentation	Cadaver drying out. Some flesh remains at first; cheesy odor from butyric acid (20–50 days).
Dry decay (diagenesis)	Cadaver almost dry; slow rate of decay. May mummify (50–365 days).

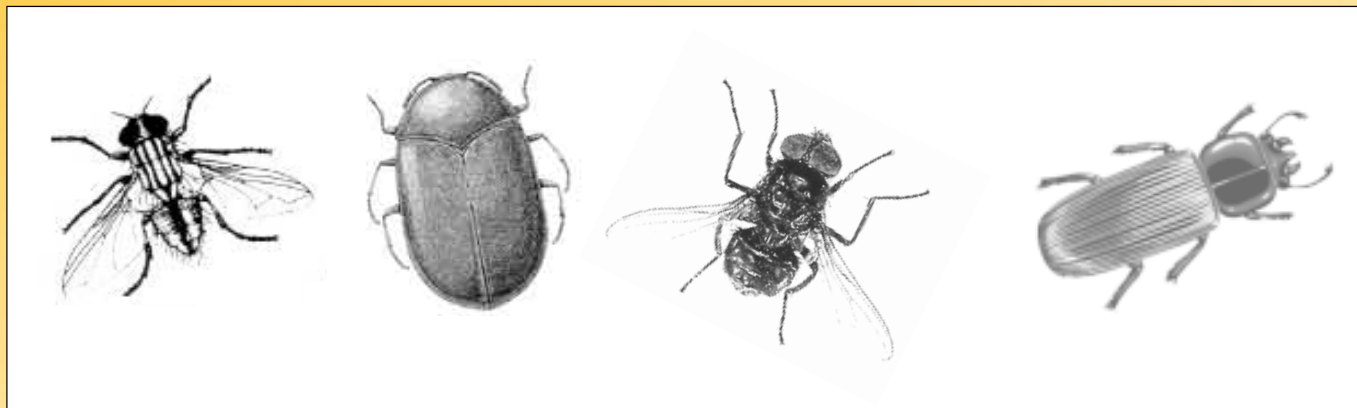
Life Cycle of Insects

Metamorphosis



Time of Death

Insects arrive at a decomposing body in a particular order (*succession*) and then complete their life cycle based on the surrounding temperature. By collecting and studying the types of insects found on a body and their metamorphic stage, a forensic entomologist can estimate the time of death.

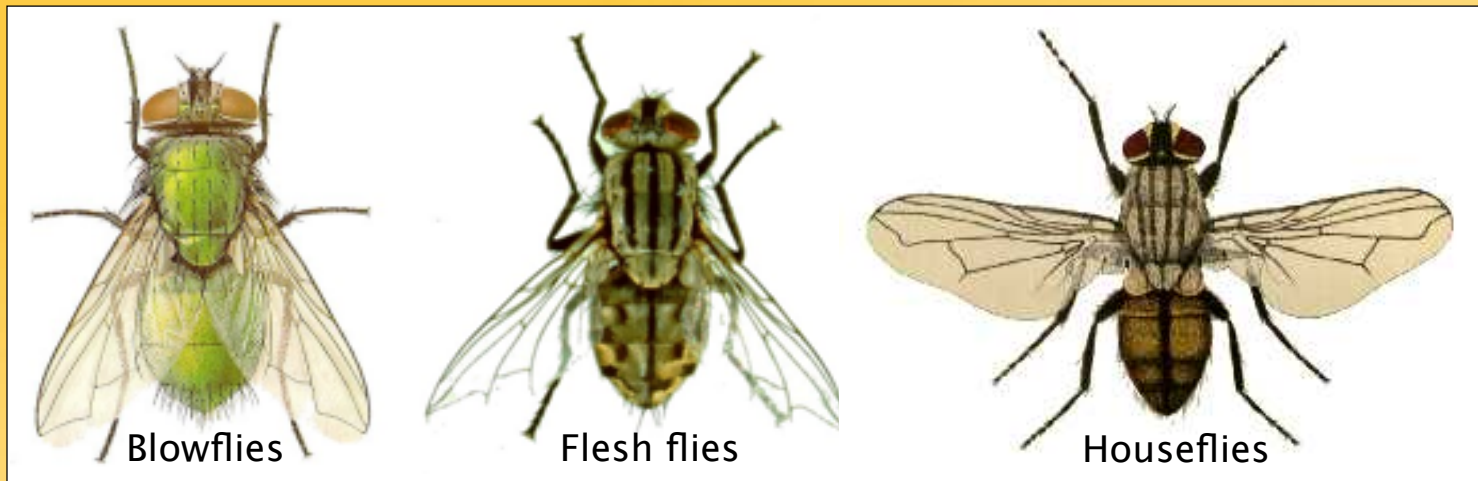


Insects of Death

Diptera

First to arrive

Then



Blowflies

Flesh flies

Houseflies

Flies can arrive within minutes. They lay eggs that hatch to maggots. Maggots feed on soft, mushy body parts. More insects arrive to feed on the body and each other.

Insects of Death, *continued*

Coleoptera

In rough order of appearance, from within hours to dry decay:



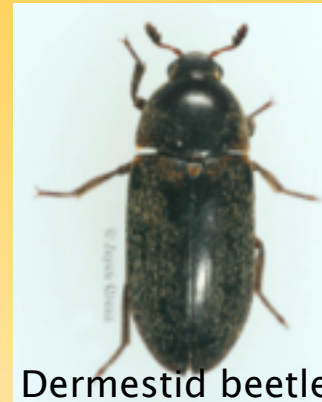
Rove beetle



Sexton beetle



Clown beetle



Dermestid beetle



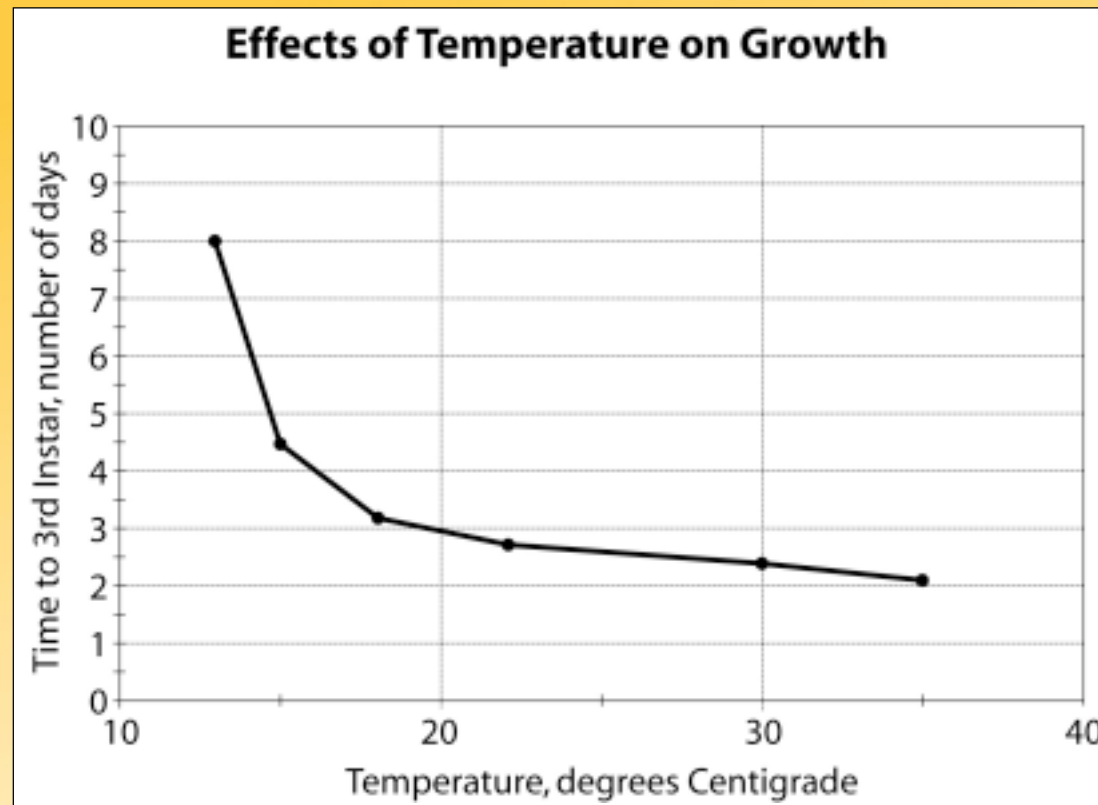
Hide beetle

Some beetles feed on the corpse, some on maggots, some on other beetles.

Variables Affecting Metamorphosis

Temperature

The higher the temperature (within limits), the faster the growth.



Variables Affecting Metamorphosis, *continued*

Habitat

Fly species can vary geographically according to climate, season, and habitat.



For example, the fly pictured on the left prefers shade; the one on the right, sunlit areas.

Other Applications of Forensic Entomology

Damage to structures, clothing, foodstuffs

Location of wounds on a corpse

Linking suspect to scene of crime

Source of contraband

Type of insects can trace vehicle movement

Presence of drugs in corpse

Lab Activity

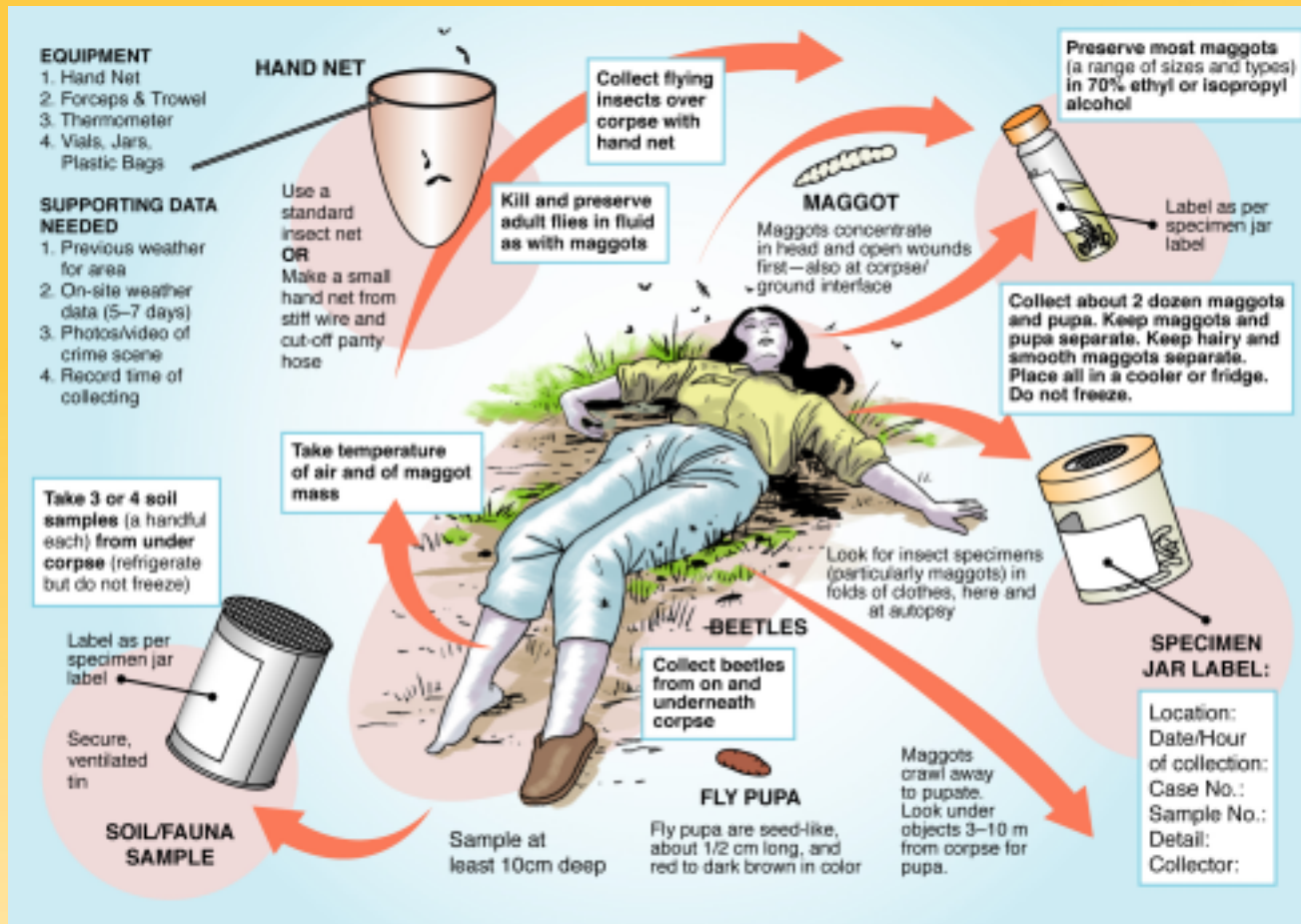
Maggot Ingestion of Drugs from a Corpse

Flesh-eating insects concentrate drug residues in their bodies.

- 1. Dose liver with simulated drugs.*
- 2. Add pupae and rear to 3rd instar.*
- 3. Mash up larvae and apply spot tests.*



Collection of Evidence



A Case Study

Man exonerated of murder after 47 years based on data and photographs interpreted by Richard Merritt, forensic entomologist at Michigan State University

