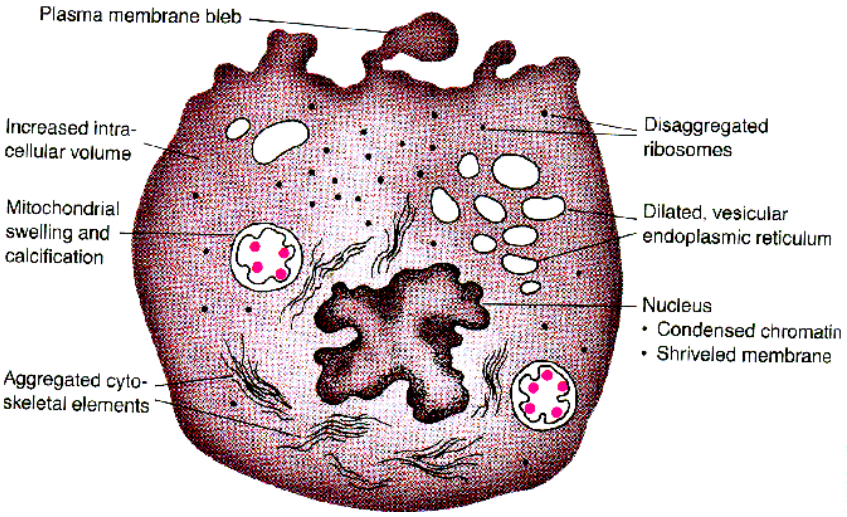
Death: Meaning, Manner, Mechanism, Cause and Time

Chapter 11

Introduction:



- Death is a process rather than an instant event:
  1) First stage – stoppage
     - Nerves, muscles, organs, brain stop due to lack of oxygen to cells.
  2) Second stage – autolysis
     - Cell breaks down
     - Cell membrane dissolves and enzymes and other cell contents spill out and digest surrounding tissues.

http://health.discovery.com/videos/dr-g-tools-of-the-trade.html

Discoveryhealth.com
“Dr G tools of trade”

Introduction:

- Forensic Pathologist:
  - Medical doctor
  - Cases of suspicious or unnatural deaths
  - Conducts autopsy to determine:
    - Manner of death
    - Cause of death
    - Mechanism of death

The Manner of Death

- According to the death certificate, there are 4 ways a person can die, called the manner of death:
- 1) Natural:
  - Interruption or failure of body functions
  - Most common manner of death.
- 2) Accidental death: unplanned events
- Ex: car accident or fall from ladder

- 3) Suicidal Death: Person takes own life
- Ex: drug overdose
- 4) Homicidal Death: death caused by another person

4+) Undetermined Death:

- – Sometimes difficult to determine
- Ex. Did a person take an overdose or were they given an overdose?

Cause of Death

- ● The reason for the death is the cause of the death.
- – Ex: disease, stroke, injury
- Ex: shooting, drowning, strangulation

Mechanism of Death:

- The specific change in the body that brought about the cessation of life is the mechanism of death.
- Ex: if shot mechanism may be blood loss

Time of Death:

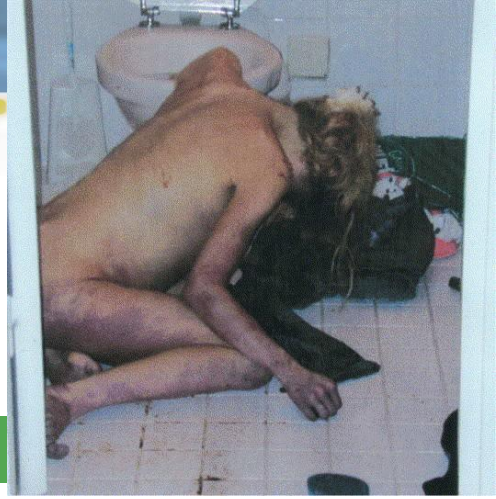
- When did a person die?
  - Why do we need to know this?
    - Can prove a suspect innocent, link a suspect to a victim, etc.…
- Many factors are used to determine the time of death.

Time of Death
Livor Mortis

Livor Mortis means death color. As a body decomposes:

- the red blood cells break down, contents spill out, and turn a bluish-purple.
- blood seeps down and settles (pools) in the lower parts of a body:
  - Called lividity.
  - Purplish-blue discoloration on the skin
  - Begins 2 hours after death (if skin is pressed down, color disappears)
  - Permanent after 8 hours (if skin is pressed down, color remains)

Time of Death
Livor Mortis cont…



- The ambient temperature at which a person dies impacts the time it takes for lividity to set in:
  - Heat increases the rate of livor mortis.
  - Very important to record environmental conditions surrounding a dead body.
- Extent of livor mortis can be affected by anything impeding the flow of blood.
  - Ex: wristwatch, belt, etc….

Time of Death
Livor Mortis cont…

- Liver mortis can provide other important clues. Because gravity pulls blood down, lividity can
  - reveal the position of the body during first 8 hours.
    - Ex: Blood pooled in lower arm and hands, lower legs and feet:
      - Corpse wedged into standing position.
  - reveal if a body has been moved.
    - Ex: Dual lividity
      - Face, chest, abdomen, front surface of legs
      - Back of thighs, buttocks, and bottom of feet.

      Moved from lying face down to sitting in chair or vice versa during hours 2 to 8. Not uncommon in murders.

Time of Death
Rigor Mortis

Rigor mortis means death stiffness.

- At death, skeletal muscles cannot relax.
- Without oxygen, calcium accumulates in these muscles.
- The muscles become stiff within 2 hours after death.
- This starts in the head and works its way down to the legs.
- At 12 hours after death, the body is at its most rigid state.
- After about 15 hours, the muscle fibers begin to dissolve, and softening begins (head first then downward).
  - Time varies based on environmental conditions.
- This stiffness will have disappeared for the most part after 36 hours (48 hours max).

Time of Death
Rigor Mortis cont…

Many factors affect when rigor mortis sets in and how long it lasts. When trying to estimate time of death, these need to be taken into account:

1) Ambient temperature
   - Cooler the body, the slower the onset of rigor.
2) The weight of the body
   - Body fat slows down the onset of rigor since it stores oxygen.
3) The body's clothing or lack of it
   - More clothes = faster onset of rigor (keeps body warmer)

Time of Death–*Rigor Mortis cont…*

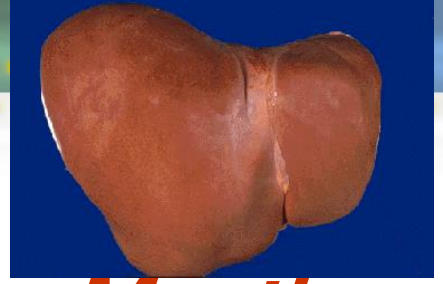
Factors cont…

4) Any illness the person had at the time of death
   - Hypothermia = slower onset of rigor
   - Fever = faster onset of rigor
5) The level of physical activity at the time of deat
   - Exercising or struggling = faster onset of rigor
     - Increased body temp
     - Decreased cell oxygen
   - Sleep = slows rigor (more oxygen in cells)
6) Sun exposure
   - Warmer body = faster onset of rigor

Because of all of these factors, a precise time of death cannot be determined, it can only be estimated.

Time of Death–*Rigor Mortis*

- If a body has no visible signs of rigor, it probably has been dead:
  - less than 2 hours OR
  - more than 48.
- If the body exhibits rigor only in the head and neck:
  - the time of death is just over 2 hours.



Time of Death—*Algor Mortis*

Algor Mortis means death heat. It describes the temperature loss in a corpse.

- In death a body no longer generates warmth and begins to cool down.
- To find the standard temperature of a corpse, a thermometer is inserted into the liver.
- Body heat is lost:
  - 0 hrs to 12 hours, body cools at a rate of about 1.4 degrees F per hour (0.78 degrees C/hour).
  - 12 hours till body reaches surrounding temperature, body cools about 0.7 degrees F per hour (0.39 degrees C/hour).

Algor Mortis Example 1

1) Approximately how long has a victim been dead if his body temperature is 35.6 degrees C?

- Know: normal 37 C
  now 35.6 C
  0 – 12 hours loss of 0.78 C

  – Solution:
  Find temp difference:
  37 – 35.6 = 1.4 C
  Less than 12 hours so:
  0.78 x = 1.4
  x = 1.79 hours

Algor Mortis Example 2

1) Approximately how long has a victim been dead if her body temperature is 22.9 degrees C?

- Know: normal 37 C
  now 22.9 C
  0 – 12 hours loss of 0.78 C
  over 12 hours loss of 0.39 C

Solution:

Find temp difference:
37 – 22.9 = 14.1 C

During 0 - 12 hours:
12 x 0.78 = 9.36 C lost

From 12 hours and up:
14.1 – 9.36 = 4.74 C

Additional hours:
0.39 x = 4.74
x = 12.15 hours

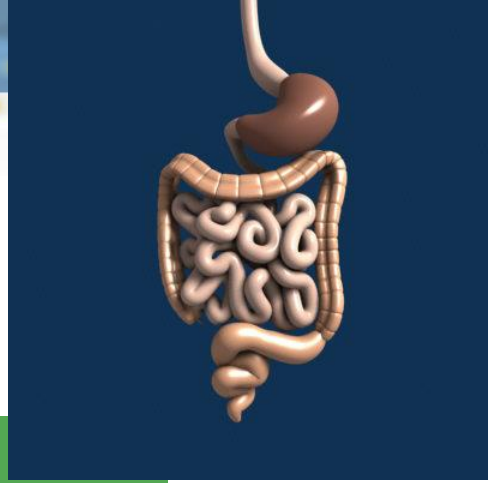
Total hours:
12 + 12.15 = 24.15 hours since death

Time of Death: *Algor Mortis*

Algor Mortis cont…

- Rates vary with surrounding temperature and conditions:
  - Temp
    - Cooler environment = faster heat loss
    - Windy = faster heat loss
    - Body fat = slower heat loss
    - Clothing = slower heat loss
- Time of death determined by temperature calculations is expressed as a range of time since it cannot be calculated exactly.

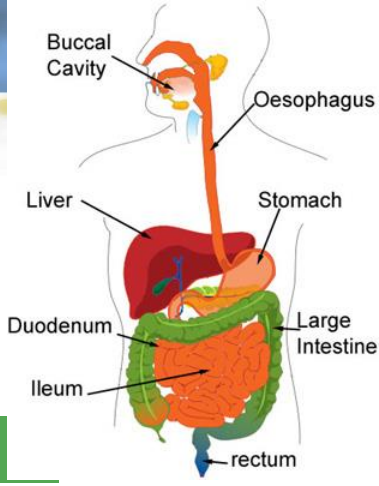
Stomach and Intestinal Contents



Medical examiners help determine time of death by studying the corpses stomach contents:

- It takes about 4 to 6 hours for the stomach to empty contents into small intestine.
- Another 12 hours for the food to leave the small intestine.
- Total of 24 hours from when meal was eaten until all undigested food is released from the large intestine.

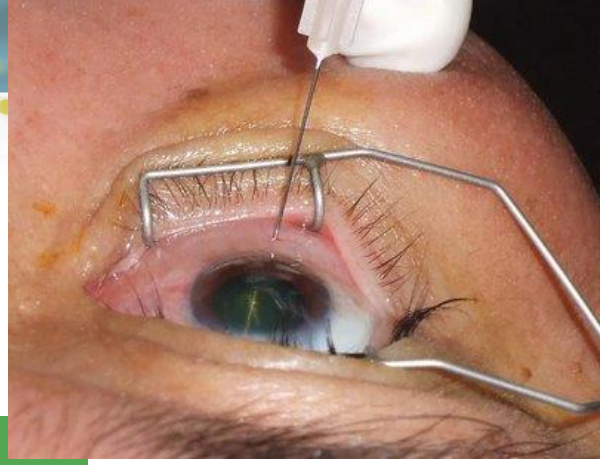
Stomach and Intestinal Contents



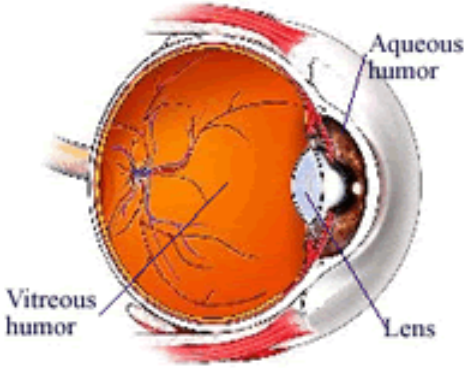
Based on these specifics, give an estimate for each of these on how much time has passed since the meal was eaten:

1. Undigested food is still present in the stomach.
   - Death occurred 0 to 2 hours after last meal
2. The stomach is empty but food is found in the small intestine.
   - Death occurred at least 4 to 6 hours after a meal.
3. The small intestine is empty but waste is present in the large intestine.
   - Death occurred 12 or more hours after a meal.

Changes of the Eye Following Death:



- In life, eye is kept moist by blinking.
- Following death:
  - Eye dries out.
  - Thin film is observed:
    - 2 to 3 hours if eyes open at time of death.
    - Within 24 hours if eyes were covered at time of death.



Stages of Decomposition:

Decomposition means rotting.

1) Within 2 Days of Death:
   a) Cell autolysis begins following death.
   b) Green and purplish staining occurs from blood decomposition.
   c) Skin takes on a marbled appearance.
   d) Face becomes discolored.

Stages of Decomposition:

2) Within 4 Days of Death:
   a) Skin blisters
   b) Abdomen swells with the gas carbon dioxide
      - released from bacteria living in intestines
3) Within 6 to 10 Days of Death:
   a) Corpse bloats causes chest and abdominal cavities burst and collapse
   b) Fluids begin to leak from body openings as cell membranes rupture.
   c) Eyeballs and other tissues liquefy
   d) Skin sloughs off

Stages of Decomposition:

More information:

- Initial Decay:
  - Corpse appears normal on outside
  - Starting to decompose on inside due to bacteria and autolysis
- Putrefaction:
  - Odor of decaying flesh is present
  - Corpse appears swollen.
- Black Putrefaction:
  - Very strong odor
  - Parts of flesh appear black
  - Gases escape
  - Corpse collapses

Stages of Decomposition:

More information cont…

- Butyric Fermentation:
  - Corpse begins to dry out
  - Most of flesh is gone
- Dry Decay:
  - Corpse is almost dry
  - Further decay is very slow from lack of moisture

Decomposition:

Speed of decomposition depends on:

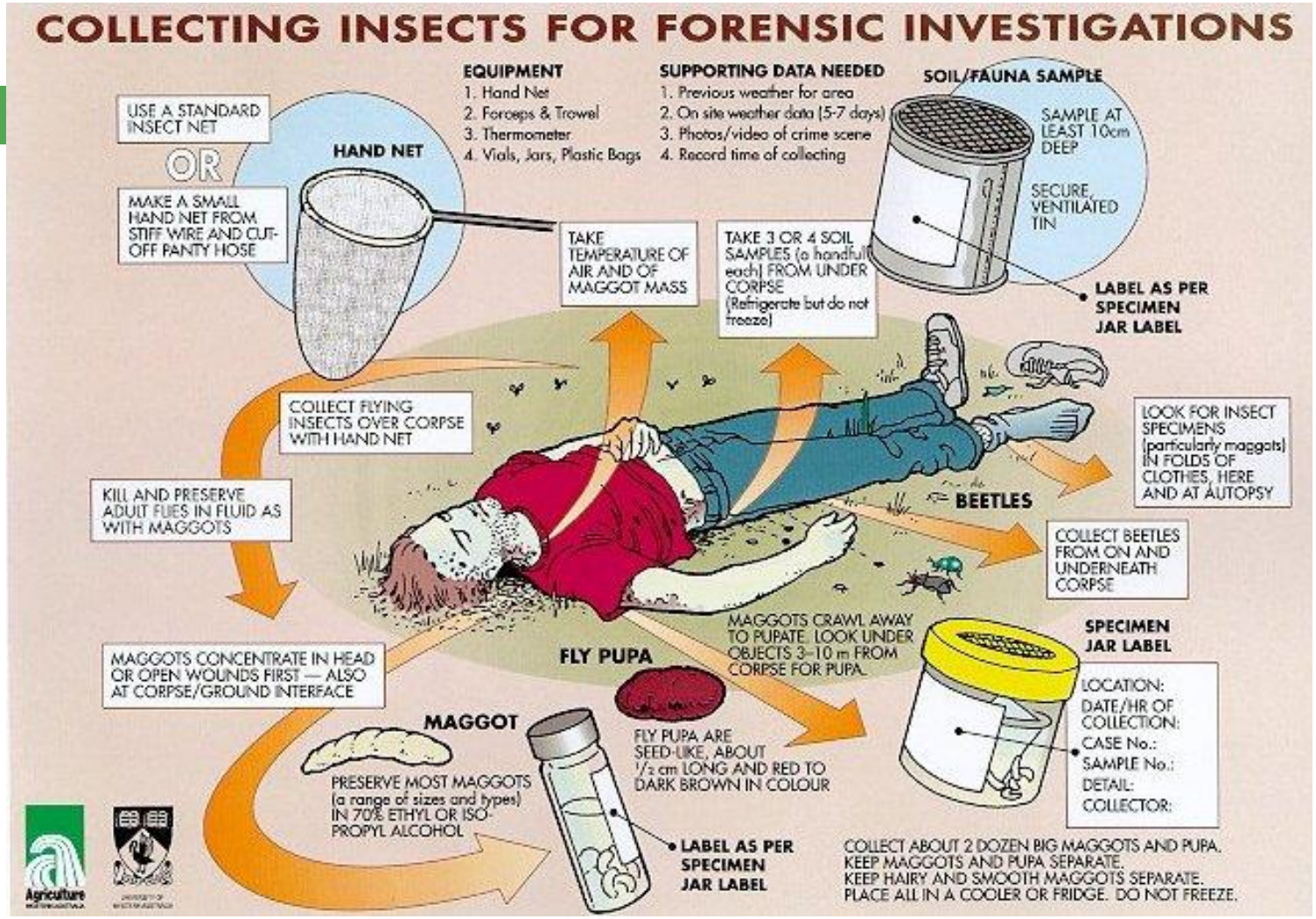
- Age
  - Young decay faster
- Size of body
  - Heavier decay faster
- Health
  - Sick decay faster
- Clothing
  - Clothed decay slower
- Temperature
  - Higher temps decay faster
- Humidity
  - More moisture means faster decay
  - Dry air dries out and preserves bodies
- Location of body:
  - Decay most quickly in air
  - Decay slower in water or buried

Insects

Forensic Entomology is the study of insects as they pertain to legal issues.

- A **forensic entomologist:**
  - Records data about environmental conditions around the body as well as below it:
    - Temperature
    - Moisture
    - wind
  - collects insect evidence.
    - On body
    - Above and below body
    - Immediate area around victim

Insects:



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Insects

- Within minutes of a death, certain insects arrive to lay their eggs on the warm body.
  - Blowflies are a common example.
  - Attracted to two gases of decomposition:
    - Putrescine
    - Cadaverene

Insects

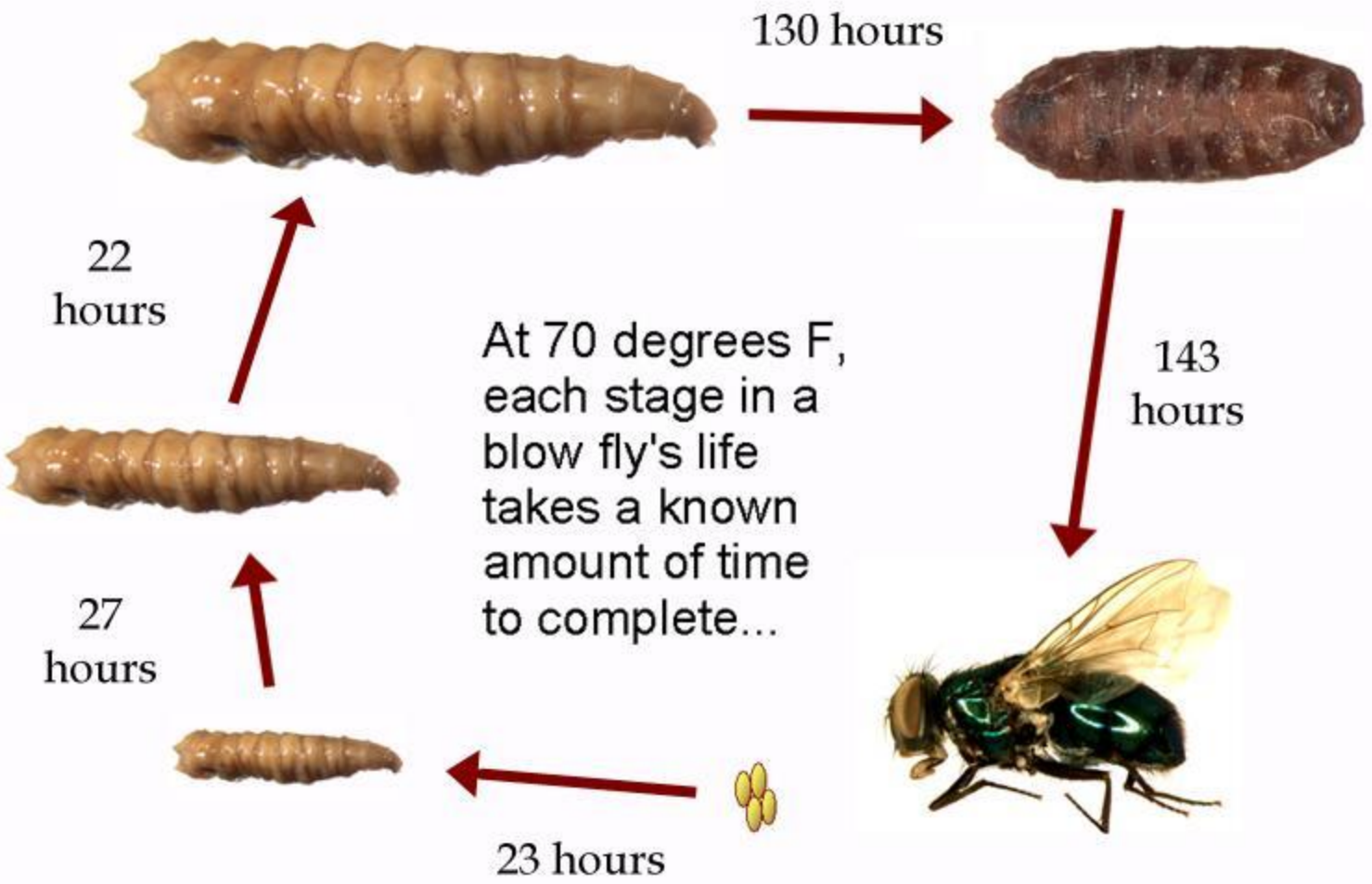
- As a corpse progresses through the stages of decomposition, other kinds of insects arrive.
  - Tiny wasps lay eggs on maggots already on body
  - Cheese skippers arrive with seepage of body fluids
  - Last to arrive are mites and beetles:
    - feed on dry tissues and hair.

Blowflies:

First to arrive on body. Very useful in determining time of death since forensic scientists know how long it takes for the various stages at given temperatures

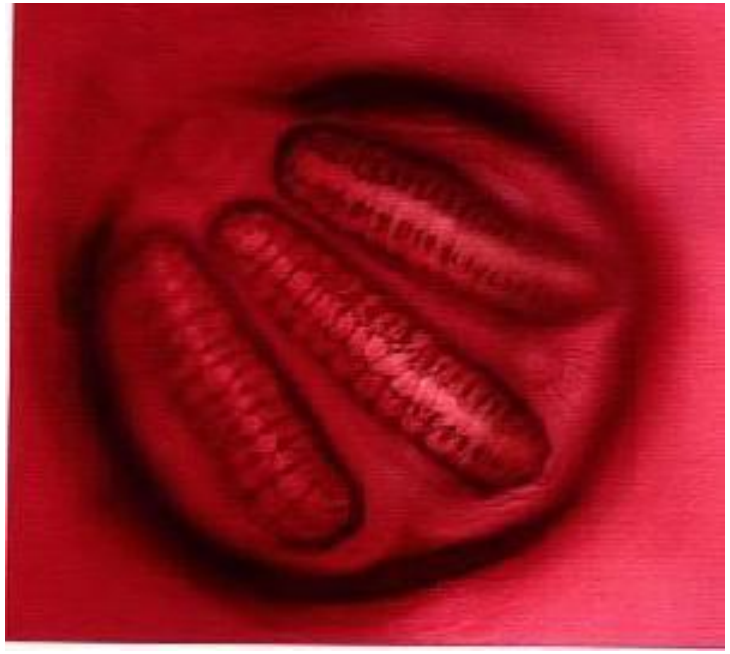
- **Exhibit different stages as they develop**
  - Egg
  - Larva also known as instars (maggot)
  - Pupa
  - Adult

The blow fly life cycle has six parts: the egg, three larval stages, the pupa, and adult.



Blowflies:

- Easy to identify stage based on:
  - Change in size
  - Color
  - Mobility
  - Number of spiracle slits



Blowflies:

1. Egg:
    a. 2 mm long
    b. White
    c. Appears soon after death
    d. Phase lasts 8 hours
    e. Found moist warm areas of body:
        a. Mouth, eyes, anus, ears

Blowflies:

2) Larva 1st Instar:
   a. 5 mm in length
   b. White
   c. Appears 1.8 days after death
   d. Stage lasts 20 hours
   e. One spiracle slit near anus

Larva is a maggot

Blowflies:

3) Larva 2nd Instar:
   a. 10 mm in length
   b. White
   c. Appears 2.5 days after death
   d. Stage lasts 15-20 hours
   e. Two spiracle slits near anus

Blowflies:

4) Larva 3rd Instar:
   a. 17 mm in length
   b. White
   c. Appears 4-5 days after death
   d. Stage lasts 36-56 hours
   e. Three spiracle slits near anus

Blowflies:

5) Pupa:
   a. 9 mm in length (football shaped)
   b. Brown
   c. Larva migrates away from body to a dry area
   d. Appears 18 -24 days after death
   e. Stage lasts 6 -12 days
   f. Immobile
   g. Does not feed

Blowflies:

6) Adult Fly
   a. Length varies
   b. Green or black
   c. Appears 21-24 days after death
   d. Lives several weeks
   e. Cannot fly first few hours

Blowfly examples:

1) If corpse contains blowfly eggs then approximate time of death is:
   - Less than 1.8 days ago
2) If corpse contains 2nd instar larvae then approximate time of death is:
   - 2.5 to 3.5 days ago
3) If corpse contains pupa then approximate time of death is:
   - 18 to 24 days ago

Time of Death–*Insects*

- Life cycles are affected by fluctuations in the daily environmental conditions:
  - temperature - moisture -wind
  - time of day - season -exposure to elements

- insect evidence cannot provide an exact time of death but can yield a close estimate.