

# Determining the Time of Death (TOD)



# Reasons to know the TIME OF DEATH (TOD)

1. TOD can set the time of murder
2. TOD can set the time of an accident
3. Eliminate or confirm suspects
4. Confirm or disprove an alibis

# Time of Death

- Postmortem interval (PMI)-  
Time between the death and the attempt to determine the TOD
- Time that the fatal injury occurred is not always the TOD

# FOUR definitions to know:

1. Rigor mortis
2. Algor mortis
3. Livor mortis
4. Pallor mortis

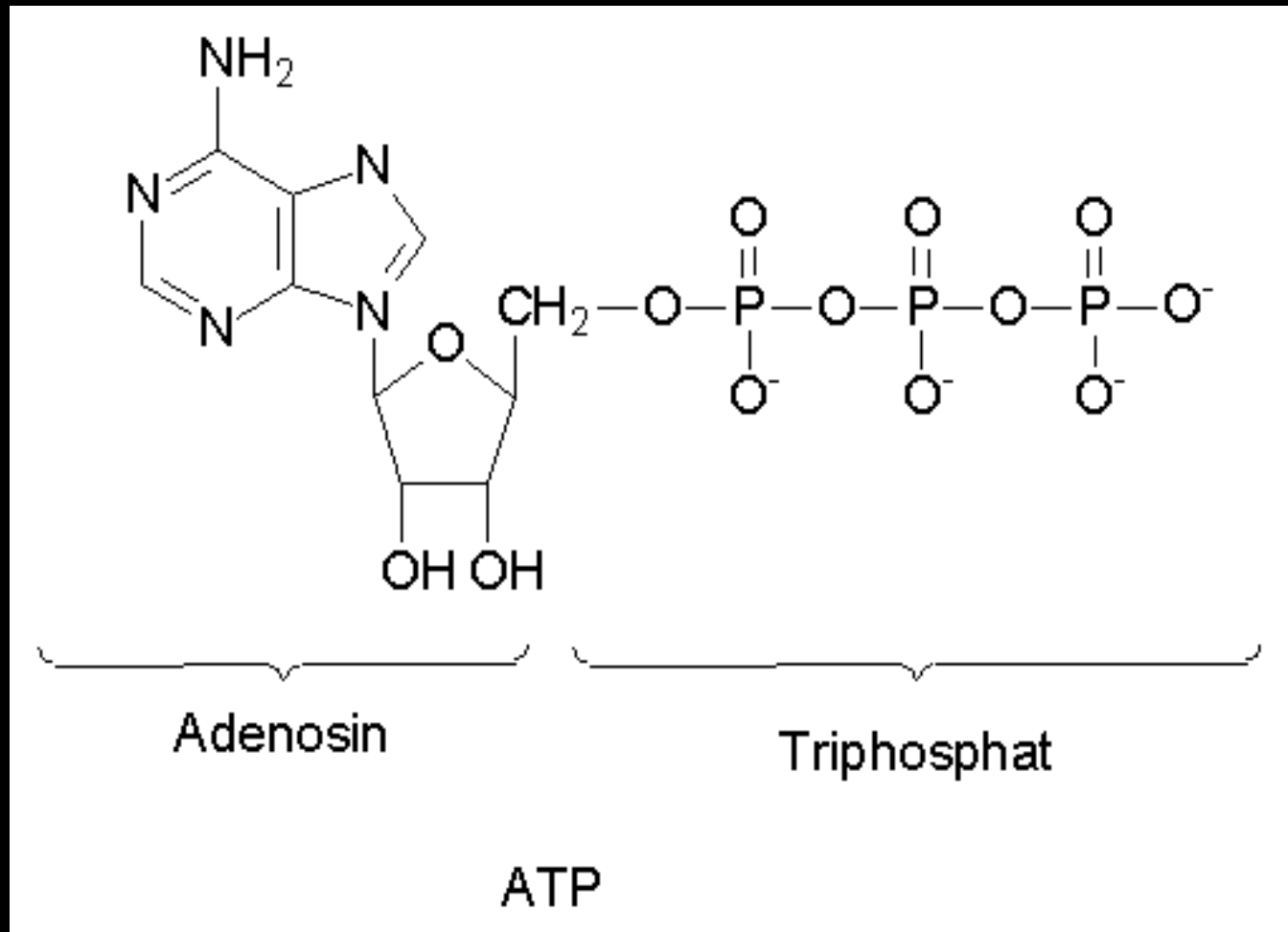
# Finding the Time of Death

- Factors that are helpful in estimating time of death are body temperature, rigor mortis, postmortem lividity, appearance of eyes, stomach contents, stage of decomposition and evidence of a change in the victim's normal routine.

# RIGOR MORTIS

- MUSCLUAR STIFFENING
- Recognizable signs of death that is caused by a chemical change in the muscles after death, causing limbs of the corpse to become stiff and difficult to move or manipulate.
- Postmortem rigidity due to buildup of lactic acid and causing myosin and actin to harden
- Immediately following death-body is flaccid, followed by increasing rigidity due to lack of ATP and buildup of lactic acid
- Adenosine Triphosphate (ATP)-energy source produced in respiration in mitochondria of cells

# ATP-Adenosine Triphosphate



# Rigor Mortis

- Cadaveric spasm-instantaneous appearance of rigor mortis due to forceful death-ex. Drowning
- Arrector Pili contract-muscles surrounding hair follicle-hair is in upright position and does not continue to grow postmortem



# Finding the Time of Death

- **Rigor mortis** is the stiffing of the parts of the body after death because of enzyme breakdown.
- The degree of rigor mortis as an indicator of time of death is usually accurate to within four hours when used along with other factors.
  - Appears in head in 5 to 6 hours
  - Appears in upper body 12 hours
  - Appears in entire body 18 hours
  - Disappears in the same order 36 hours

# THE BODY

## Rigor Mortis

<b>Temperature of body</b>	<b>Stiffness of body</b>	<b>Time Since Death</b>
•Warm	•Not stiff	•Not dead more than 3 hrs
•Warm	•Stiff	•Dead between 3 and 8 hrs
•Cold	•Stiff	•Dead 8 to 36 hours
•Cold	•Not stiff	•Dead more than 36 hours

# Respiration



- Muscles need ATP for actin and myosin to interact
- Postmortem- body uses ATP, but stops making it
- ATP, actin, and myosin lock up until decomposition occurs
- Appears 2-4 hours after death and after 6-12 hours, rigor mortis is complete

# ALGOR MORTIS

- BODY COOLING
- Decrease in body temperature  $2^{\circ}\text{C}$  the first hour and then  $1^{\circ}\text{C}$  per hour until near or below the environment's temperature
- Postmortem cooling- $2-2.5^{\circ}\text{C}$  per hour for first hours,  $1.5-2^{\circ}\text{F}$  for first 12 hours, and then to one degree for next 12-18 hours

# Assumptions of Algor Mortis

- Body temperature was 98.6 degrees F at TOD
- Body cooling is constant
- Time of assault different than time of death
- Temp changes of “inner core”-rectal, liver or brain temp change is slower, predictable
- External factors affect rate of cooling-ex. Body fat and external temperature

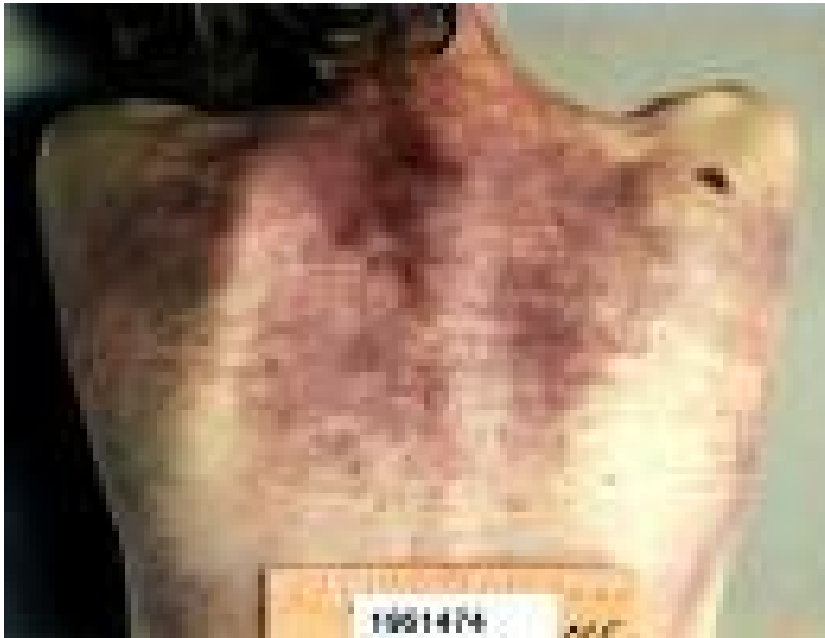
# LIVOR MORTIS

- CIRCULATORY FAILURE
- AKA Postmortem Lividity= dark purple discoloration due to gravity
- The settling of blood in the lower portion of the body causing a purplish red discoloration of skin
- Caused by accumulation of blood in vessels in dependent areas due to gravity...red blood cells are the heaviest part of the blood.

# LIVOR MORTIS

- Evident 30-120 minutes postmortem
- 8-12 hours (24-36 hours in cooler temps) postmortem- maximum color or “fixed” livor mortis due to hemolysis (blood vessels break down)
- May occur antemortem (before death) in slow deaths
- Can congest internal organs

# LIVOR MORTIS





# Postmortem Lividity



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# Livor Mortis

- By observing livor mortis you can tell if a victim has been moved after death.
- Example: If victim dies on the stomach and is found on the back then evidence of livor mortis would show a movement

# Livor Mortis

- Dependent areas resting against firm surface will be pale due to compression of blood vessels
- Prevents accumulation of blood
- Color may be red or pink due to carbon monoxide (CO) poisoning
- Red coloration due to predominance of oxygenated hemoglobin

# PALLOR MORTIS

- **PALENESS OF DEATH**
- Postmortem paleness which happens in those with light skin almost instantly (first 15-20 minutes after the death) because of a lack of capillary circulation throughout the body.
- The blood sinks down into the lower parts of the body creating the Livor mortis.
- **HELPS ONLY IF THE BODY IS FOUND WITHIN 30 MINUTES or LESS OF THE DEATH.**

# Factors used in determining the TOD

## CHANGES TO THE EYE

### Ocular changes

- Thin film appears over the cornea of opened eye within minutes of death (closed eyes- hours)
- Corneal cloudiness (2-3 hours in open eyes and 24 hours in closed eyes)
- Tache noire-blackish discoloration develops
- No intraocular fluid after four days

# Stomach Contents

- Digestion takes between ½ hour-6 hours depending on size and content of meal

Affected by many factors:

- Density-increase density-slower digestion
- Drugs and alcohol-alcohol slows down digestion and narcotics speed up digestion
- Medical Conditions-Diabetes delays digestion and shock causes content retention for days

# Chemical Changes in body fluids

Potassium in vitreous humor increases from TOD  
(increases as decomposition increases)

# Scene Markers/Environmental Evidence

- Any factor in the environment of the deceased which could determine TOD
- Ex. Uncollected mail, lights on/off, sales receipts in deceased's pockets, witness accounts



# Finding the Time of Death

- The most reliable way of establishing the time of death is by measuring body temperature.
- The temperature of the body falls from its normal level of **98.6** at a rate of *one and a half to three degrees per hour for the first 12 hours*.
- However, this also depends on the build of the victim, amount of clothing, and temperature. After 12 hours the rate of falling temperature falls to about 1 degree per hour up to about 18 hours after death.
- If the body had been submerged in water, its temperature can fall much more quickly.

# The 26 Stages of Death

- **Moment of Death:**

- 1} The heart stops

- 2} The skin gets tight and grey in color

- 3} All the muscles relax

- 4} The bladder and bowels empty

- 5} The body's temperature will typically drop

# The 26 Stages of Death

- **After 30 minutes:**

**6}** The skin gets purple and waxy

**7}** The lips, finger- and toe nails fade to a pale color or turn white as the blood leaves.

**8}** Blood pools at the lowest parts of the body leaving a dark purple-black stain called lividity

**9}** The hands and feet turn blue

**10}** The eyes start to sink into the skull

# The 26 Stages of Death

- **After 4 hours:**

**11}** Rigor mortis starts to set in

**12}** The purpling of the skin and pooling of blood continue

**13}** Rigor Mortis begins to tighten the muscles for about another 24 hours, then will reverse and the body will return to a limp state.

- **After 12 hours:**

**14}** The body is in full rigor mortis.

# The 26 Stages of Death

- **After 24 hours:**

**15}** The body is now the temperature of the surrounding environment

**16}** In males, the semen dies

**17}** The head and neck are now a greenish-blue color

**18}** The greenish-blue color continues to spread to the rest of the body

**19}** There is the strong smell of rotting meat

**20}** The face of the person is essentially no longer recognizable

# The 26 Stages of Death

- **After 3 days:**

**21}** The gases in the body tissues form large blisters on the skin

**22}** The whole body begins to bloat and swell grotesquely. This process is speeded up if victim is in a hot environment, or in water

**23}** Fluids leak from the mouth, nose, eyes, ears and rectum and urinary opening

# The 26 Stages of Death

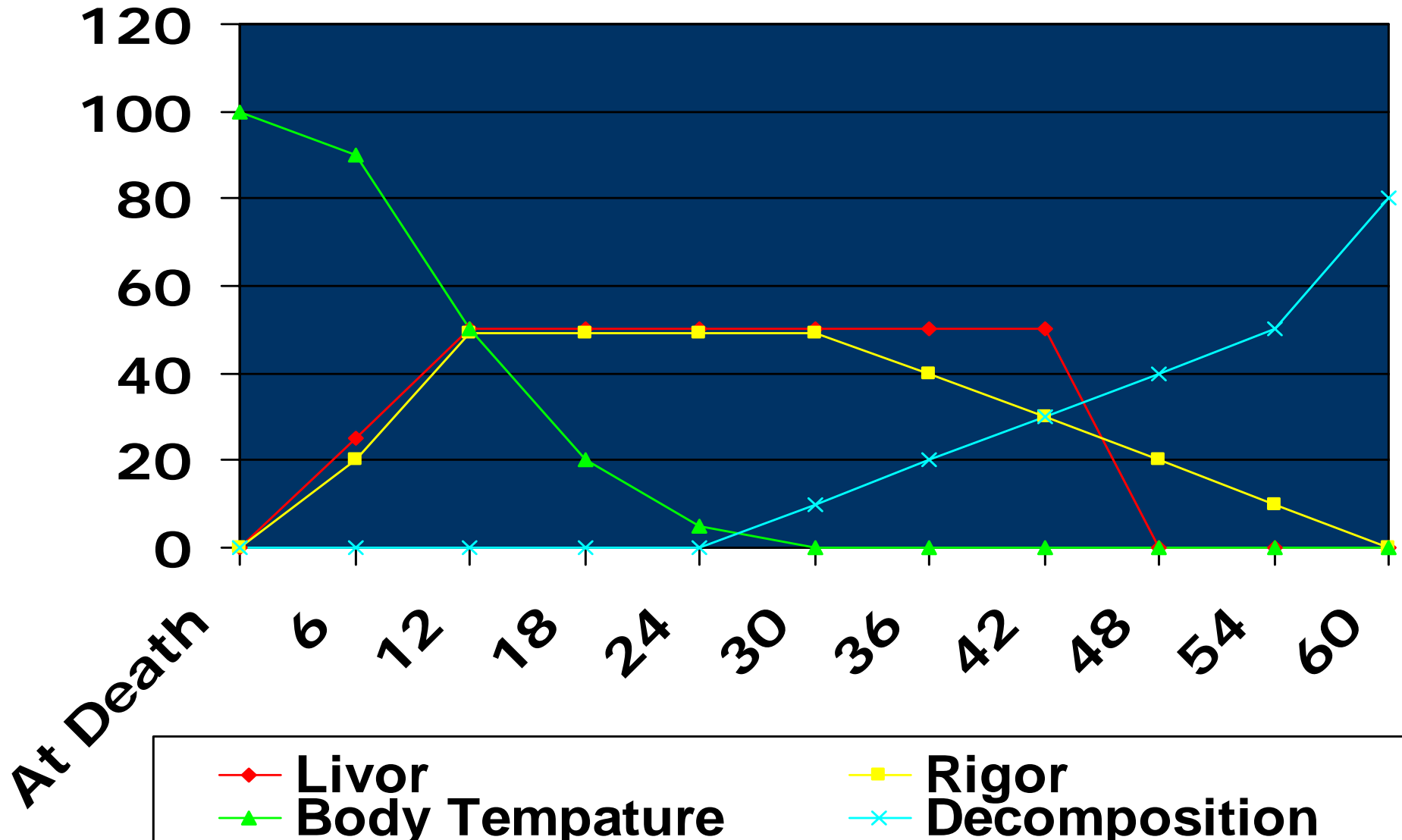
- **After 3 weeks:**

**24}** The skin, hair, and nails are so loose they can be easily pulled off the corpse

**25}** The skin cracks and bursts open in many places because of the pressure of Internal gases and the breakdown of the skin itself

**26}** Decomposition will continue until body is nothing but skeletal remains, which can take as little as a month in hot climates and two months in cold climates. The teeth are often the only thing left, years and centuries later, because tooth enamel is the strongest substance in the body. The jawbone is the densest, so that usually will also remain

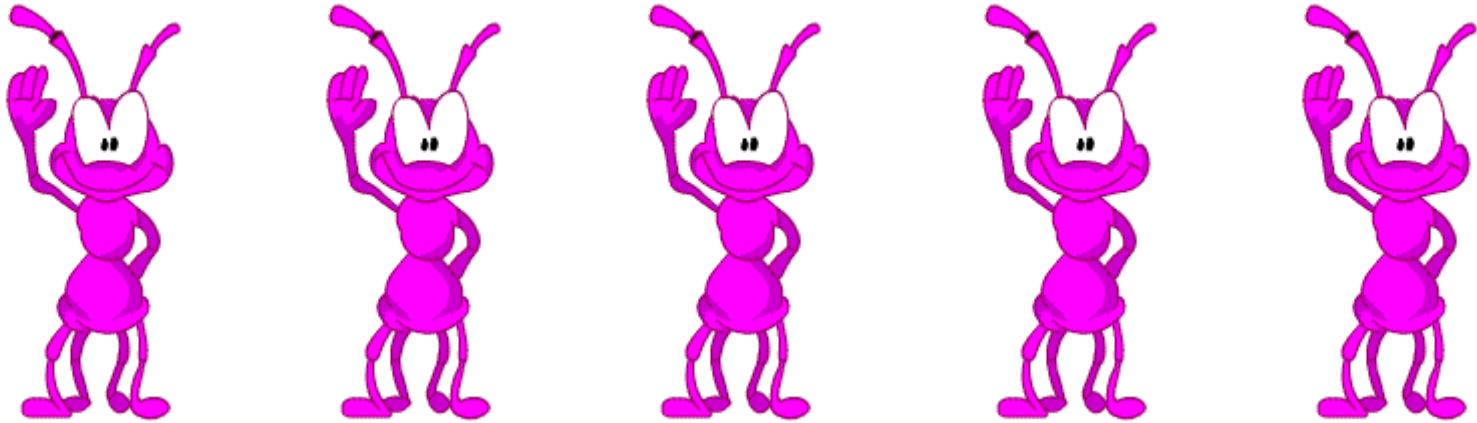
# Hours Postmortem





# FORENSIC ENTOMOLGY

- The study of BUGS
- The presences of certain bugs/ flies/ insects can determine TOD



# Forensic Entomolgy

- Flies and *maggots* also provide an approximate time of death, very useful for cases where the body has been LONG dead.
- Only certain insects will feed and lay eggs on a dead corpse and forensic entomologists study these insects, their *larvae* cycles and thereafter can determine whether a body has been dead for just one day or up to 3 or 4 weeks.

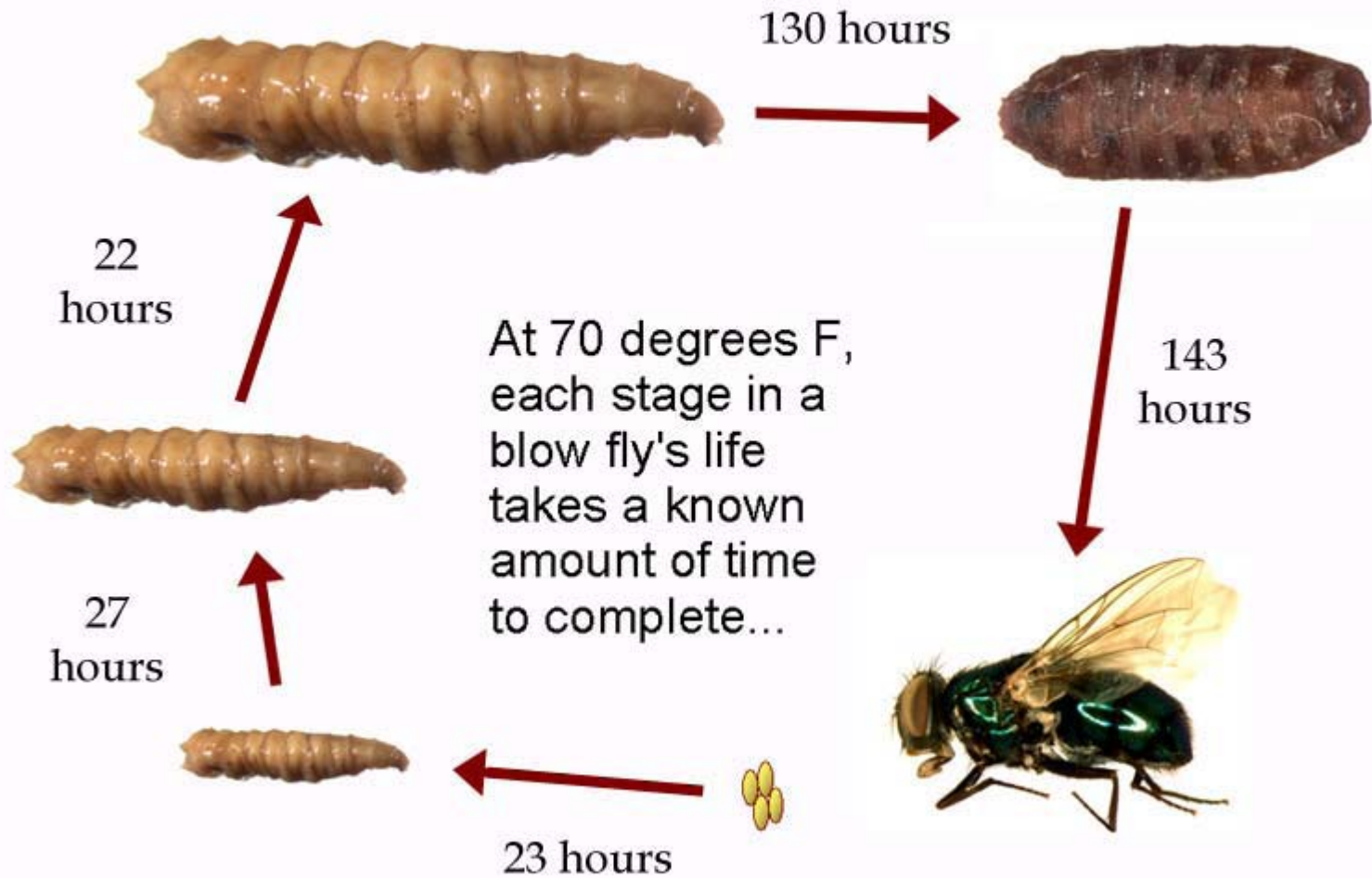


# TIME: 0-3 DAYS

- Proteins and carbohydrates in the deceased body begin to breakdown
- BLOWFLIES present
- Example: Bluebottle flies, syrphidae flies



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



# TIME: 4-7 DAYS

- Body is starting to decay and causes the abdomen to INFLATE because of the gases inside.
- FLY larvae and beetles present
- Example: Rove Beetles



# TIME: 4-7 DAYS



- FLY larvae and beetles present



- Example: Rove Beetles



# TIME: 8-18 DAYS

- Decay is well and truly setting in; the abdomen wall begins to break down
- ANTS, cockroaches, beetles and flies present



# TIME: 19-30 DAYS

- The decaying body enters a stage known as “post-decay”, in wet, humid conditions, the body is sticky and wet...in hot dry conditions, the body is dried out
- MITES and beetles present
- Example: Springtail beetle, Acari, Nematocera (winter months)





# TIME: 19-30 DAYS

**MITES and beetles  
present**

Example:

1. Springtail beetle
2. Acari
3. Nematocera (winter months)



# TIME: over 31 DAYS

- The bones, skin and hair that remain no longer give off a powerful stench and smell just like the soil surrounding it.
- Many beetles, flies, mites and other such insects are not present

