The Stages of Death

BEFORE AND AFTER DEATH

- Before death: ante-mortem
- Moment of death: agonal period
- After death: post-mortem

- Determination of Post Mortem Interval (PMI)

STAGES OF DECOMPOSITION

- In terrestrial environment the stages are loosley divided into four stages:
  - Fresh
  - Bloat
  - Putrefaction
  - Putrid dry remains

- Sometimes the single body is at different stages of decomposition

FRESH BODY

- At time of death
  - The heart stops
  - The skin gets tight and grey in color
  - Cell start to die (brain 3-7 min; skin up 24 hours)
  - All the muscles relax
  - The bladder and bowels empty
  - Nails **do not** grow

COOLING OF THE BODY-ALGOR MORTIS

- Algor mortis-coldness of death
- Temperature drop depends on may factors and it is less reliable for determination of PMI
- On average the body cools at rate of 0.32°C/hour

- Cooling Enhancers:
  - Small body size
  - Low fat content
  - Body Stretched
  - Body dismembered
  - Serious Blood loss
  - Lack or wet clothes
  - Strong air current
  - Dry atmosphere

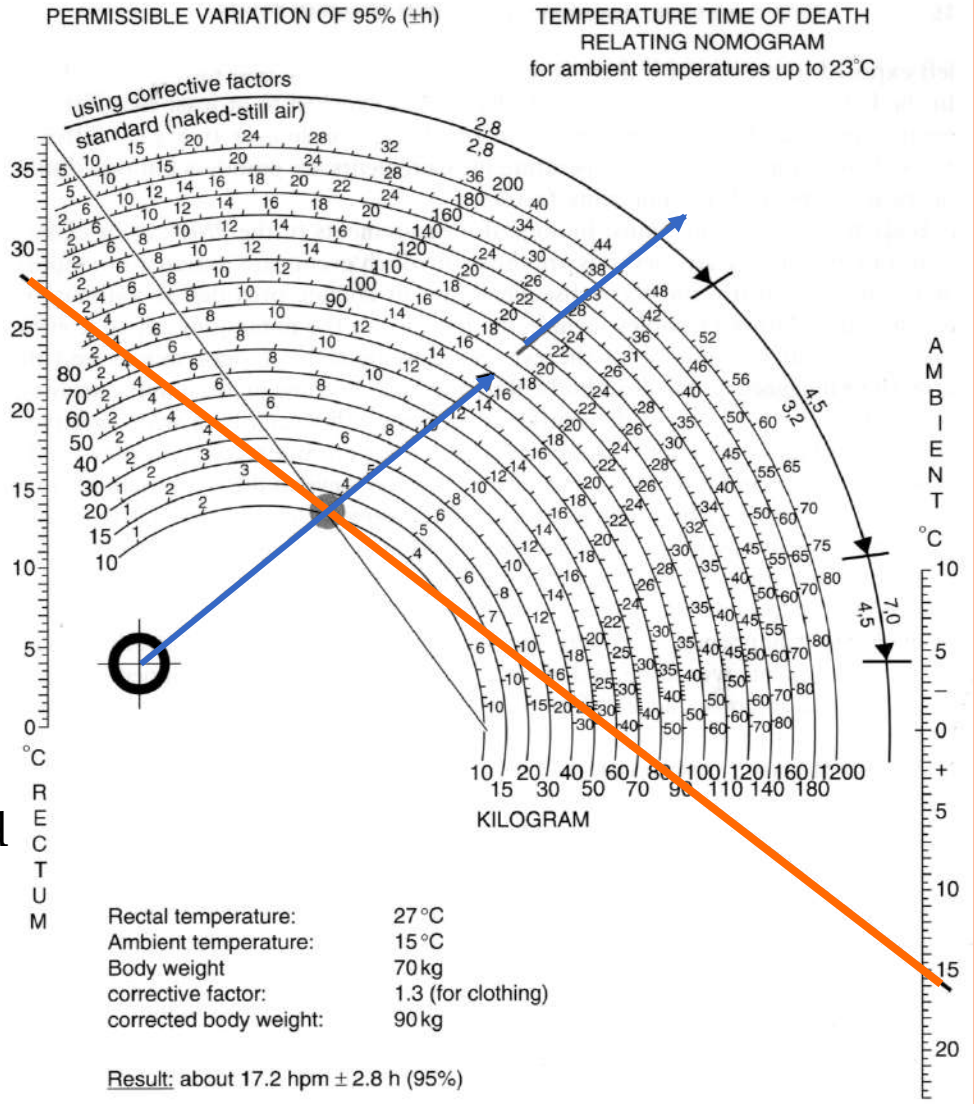
- Cooling delayers:
  - Opposite of the enhancers

And

  - Type of clothes
  - Insulative coverings
  - Exposure to sun

HENSSGE' NOMOGRAM FOR DETERMINATION OF PMI

- Strait line (orange) is drawn between rectal to and ambient to (27 and 15)
- Corrective factor for various deviations from the standard' (naked extended body, still air) in this case 1.3 due to three layers of clothes
- The weight of the body is multiplied by 1.3 (70x1.3=91kg)
- Second line (blue) is drawn from center of circle trough the intersection with nomogram's diagonal line (gray) all the way to the outer circle (95% confidence) and read the number ate intersection with 90kg line)



HIPOSTASIS (LIVOR MORTIS OR LIVIDITY)

○ The discoloration of the body after death due to the gravitational settling of blood.

○ 30 minutes after death

● The skin gets purple and waxy

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

● The hands and feet turn blue

●The eyes start to sink into the skull

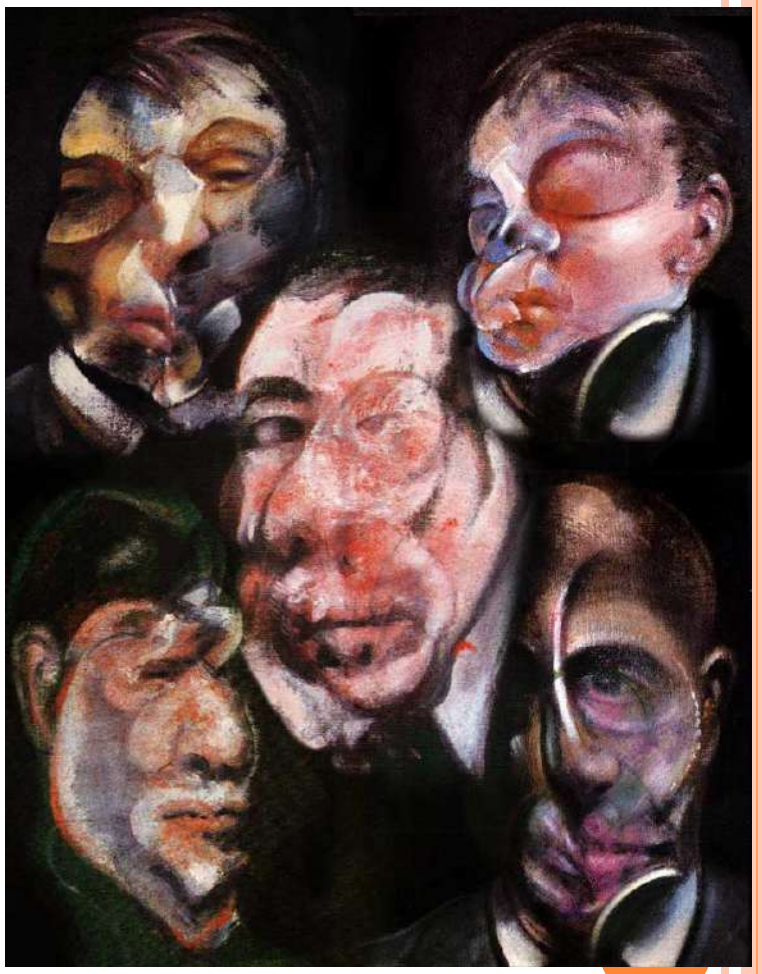
RIGOR MORTIS

- 3-4 hours after death the stiffening of the body becomes apparent and the whole body becomes completely rigid after about 12 hours
- Rigor mortis completely disappears after about 36 hours
- It is affected by environment, sex, age and cause of death:
  - Temperature
  - Men have stronger rigor mortis compared to women
  - Children tend to develop Rigor sooner than adults
  - Asphyxiation and CO poisoning can delay onset
- Time of death based solely on rigor mortis appearance can be imprecise if the body was manipulated after death

- Cadaveric rigidity is based on the conditions of death (grasping objects just before death)

AFTER 24 HOURS

- These are the changes:
  - Body temperature is equal to environmental
  - The head and neck are now a greenish-blue color that spreads over the whole body
  - There is the strong smell of rotting meat
  - The face of the person is essentially no longer recognizable



BLOAT

- After about 3 -4 days:
  - Gases in the body makes the skin blistered
  - The front of the body swells
  - Tongue may protrude
  - Fluid from the lungs oozes out of the mouth and nose
  - Terible smell from the various gases (hydrogen sulphide and mercaptans)

PUTREFACTION (DECAY)

- The soft tissues rapidly disappear due to autolysis, bacterial, insect and other animal activity
  - The body collapses on itself as the skin is compromised and cannot hold the gases.
- Adipocere (corpse wax) formed during the decay process under suitable conditions.
  - Influences further decay
  - Inhibits further decay
  - Result of acumulation of saturated fatty acids which lower the pH and inhibit microbial growth.

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MUMMIFICATION

- Decay in dry conditions, both warm and cold, with strong air current leading to increased water loss
  - In deserts, cold places
  - Murder victim placed in chimneys
  - Can be preserved for hundreds and thousands of years (provided there are no insects feedeing on them).

PUTRID DRY REMAINS

- The stage where the skin and soft tissues are no longer present (or in very limited amounts)
- Bones, tendons, hair and fingernails remain
- Still smell of decay

- Bones also decay (diagenesis)
  - Chemical and structural (microscopic)

FACTORS AFFECTING SPEED OF DECAY

- Microbial, insect and vertebrate activity on the dead body can be influenced by:
  - Geographical location
  - Time of year
  - Exposure to sunlight
    - Combination of sun and humidity will lead to different outcomes
  - Wrapping and confinement
  - Burial
    - Type of soil (clay, pH, mineral composition)
    - Burial dept
  - Hanging above ground
  - Burial underwater
  - Wounds
  - Infections
  - Burning
  - Chemical treatment

SUMMARY OF FACTORS

PROMOTING DECAY	DELAYING DECAY
Oxygen supply not restricted	Oxygen supply restricted
Warm temperature (15-37°C)	Cold temperature (<10°C; decay will cease below 0°C)
Humid atmosphere	Dry atmosphere
Presence of invertebrate detritivores (e.g. blowfly larvae)	Absence of invertebrate detritivores
Wasp, ant and other invertebrate predators feeding on corpse	Wasp, ant and other invertebrate predator sfeeding on detritivores
Wounds permitting invertebrates easier access to internal body tissues	Inability of detritivores to gain access to all or part of the corpse
Surface burning causing skin to crackand thereby allowing easier access of invertebrates and oxygen to internal tissues	Intense burning resulting in tissues becoming carbonized and drying out.
Obesity	Burial on land or underwater (rate of decay declines with increasing depth)
Suffering from septicaemia or myiasis before death	Body suspended above ground (e.g. hanging)
Body exposed to the environment above ground	Formation of adipocere
Body resting on soil	Mummification
	Embalming

How do forensic scientists determine the time of death?

The eyes of a victim can hold answers to the time of death, as a thin cloudy film is developed over the eye within 3 hours after death has occurred.

Livor Mortis

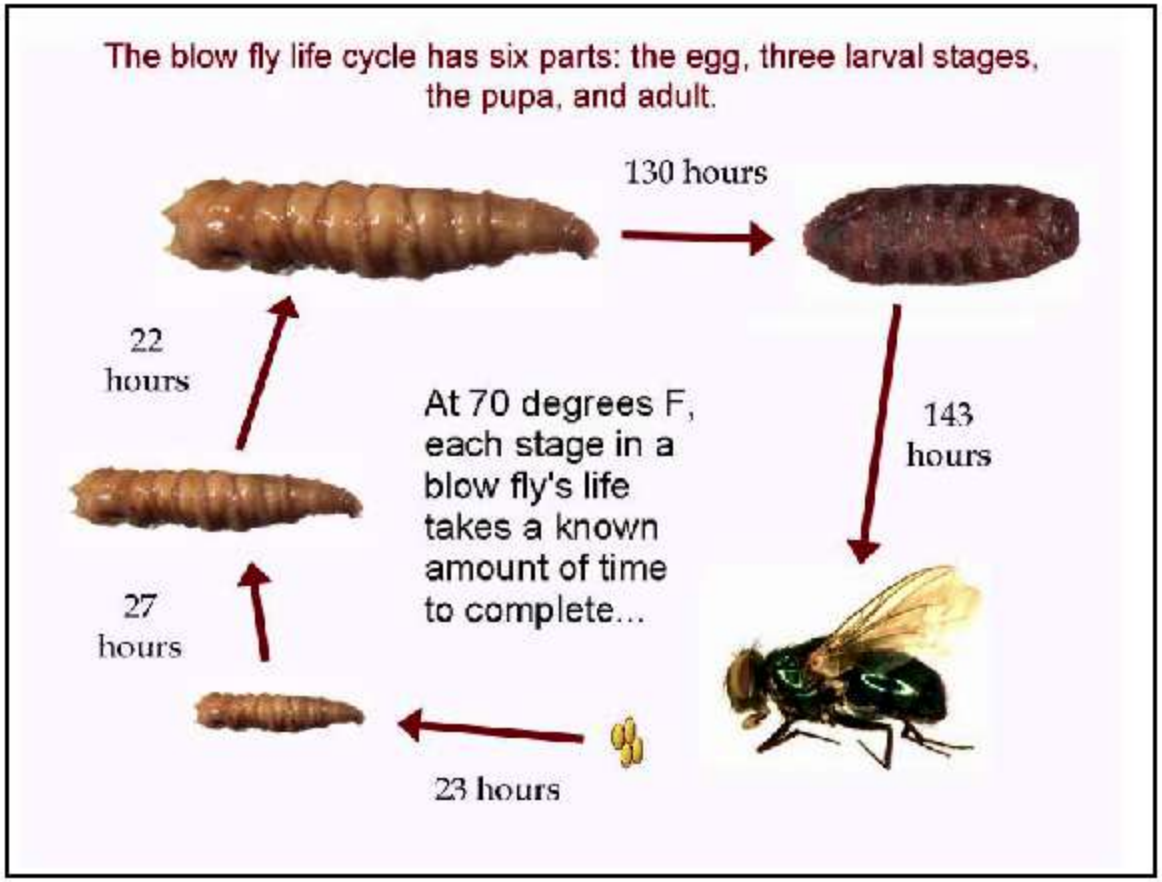
Rigor Mortis

Algor Mortis

The digestive system and gut contents of a victim can provide important clues to the time of death of a victim.
After 3 hours, the food then leaves the stomach and heads toward the small intestines.
6 hours after eating a meal, the food will have traveled half way through the small intestines and begin moving through the large intestine.
Where the victim's small intestine is empty, it suggests that the victim ate his or her last meal approximately 8 hours before death.

Forensic Entymology

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.



TimePhysical Appearance of BodyInsects Present at that Stage

0-3 days

Proteins and carbohydrates in the Blowflies e.g. Bluebottle flies, Syrphidae flies deceased body begin to break down.

4-7 days

Body is starting to decay and causes the Fly larvae and beetle e.g. Rove Beetles abdomen to inflate because of the gases
inside.

8-18 days

Decay is well and truly setting in; the Ants, cockroaches, beetles and flies abdomen wall begins to break down.

19-30 days

The decaying body enters a stage know Beetles and mites e.g. Springtail b[illegible], as 'post-decay'; in wet, humid conditions, Nematocera (present only during the winter months), the body is sticky and wet; in hot dry Brachycera
conditions, the body is dried out .

31 and over days
The bones, skin and hair that remain no longer give off a powerful stench and smell just like the soil surrounding it.

The Body Farm

The research farm, known as The Body Farm, was established in 1981 by Bill Bass, a professor of forensic anthropology.

By having decaying bodies readily available to study, Bass and his students discovered a number of factors contributing to body decay.

http://video.nationalgeographic.com/video/player/science/health-human-body-sci/human-body/body-farm-sci.html

THE BODY FARM

- **PRIMARY GOAL**: To understand the processes & timetable of postmortem decay, primarily to improve determining the "time since death“ -Perimortem interval (PMI) in murder cases.

- The Body Farm is a simulation of various crime scenes using real human bodies.

- Started in 1970-80’s to study Forensic Anthropology (the study of human decomposition after death).

THE BODY FARM

- Used by Law Enforcement, Medical Examiners, Entomologists, Cadaver Dogs, Anthropologists & FBI for Crime Scene Training.
- The BF uses unclaimed cadavers & volunteers (who donate their body to science after death)
- Only 2 Facilities in the U.S.
  - Univ. of Tennessee (original)
  - Western Carolina University

TYPES OF RESEARCH

How does the decomp rate compare in:

- sunshine vs shade?
- In cool weather vs hot weather?
- In a shallow grave vs on the ground?
- In water?
- Inside a car?
- What effect do other variables have—humidity, insect activity, clothing, body weight, and so on?

WHY IS TSD SO IMPORTANT?

- 1st question at most murder scenes: "How long has this person been dead?“

- It's crucial to know when the crime was committed.
  - it can help narrow the search for a suspect or
  - it can help rule out potential suspects who had alibis at the time the victim was killed.