

Death



Manner, Mechanism and Cause

- **Manner of Death** - One of four means by which someone dies (natural, accidental, suicidal or homicidal)
- **Cause of Death** – The immediate reason for a person's death (heart attack, shooting, etc.)
- **Mechanism of Death** – The specific body failure that leads to death (heart stops, blood loss)

Defining the Time of Death (TOD)

- Physiological: when the person actually died
- Legal: when the Medical Examiner (ME) or Doctor pronounces the body dead.
- Estimated: ME's best guess based upon determination of the post-mortem interval (PMI)
- **Post-mortem interval:** The time between physiological death and legal death

Techniques for Measuring TOD

- Historical Record
- Algor Mortis
- Rigor mortis
- Livor Mortis
- Ocular Changes
- Degree of Digestion
- Autolysis/Putrefaction
- Saponification
- Mummification
- Entomology

Estimating Time of Death is far from
an exact science

Historical Record

- Interviews with witnesses may provide a timeline
- Work records
- School Attendance
- Appointments
- Travel

Algor Mortis

- Body Temperature after death
- Body temperature is produced by metabolism
- At TOD metabolism stops and the body cools
- Generally, the body cools at a rate of 1.4°F per hour for the first 12 hours
- After 12 hours the body cools at about $0.7^{\circ}\text{F}/\text{hour}$
 - until the body reaches the temp of surroundings
- Most useful during the first 24 hours after TOD

Calculating Algor Mortis

- For the first 12 hours, general formula is:

$$\frac{98.6^{\circ}\text{F} - \text{measured body temperature}}{1.4}$$

1.4

- Body Temperature is measured by rectal (anal) or hepatic (liver) methods
- A long thermometer or a digital thermometer is used

Heat is Lost From the Body by:

- Radiation
 - Transfer of heat to the air
- Conduction
 - Transfer of heat to other substances
- Evaporation
 - Transfer of heat by evaporation of water

Factors influencing Algor Mortis

- Size of the body
 - Heavier people lose heat more slowly due to:
 - Larger body mass to surface area
 - Adipose (fat) acts an insulator
 - Infants lose heat more quickly
- Body Position
 - Supine (face up) and extended loses heat quicker than fetal position

Factors Influencing Algor Mortis

- Clothing and coverings
 - Naked body cools twice as fast
 - More layers/thickness = slower cooling
- Air movement (wind) accelerates cooling
- Higher humidity accelerates cooling
- Immersion in water
 - Cooling in still water is 2X faster than air
 - Cooling in flowing water is 3X faster as air

Case Scenario

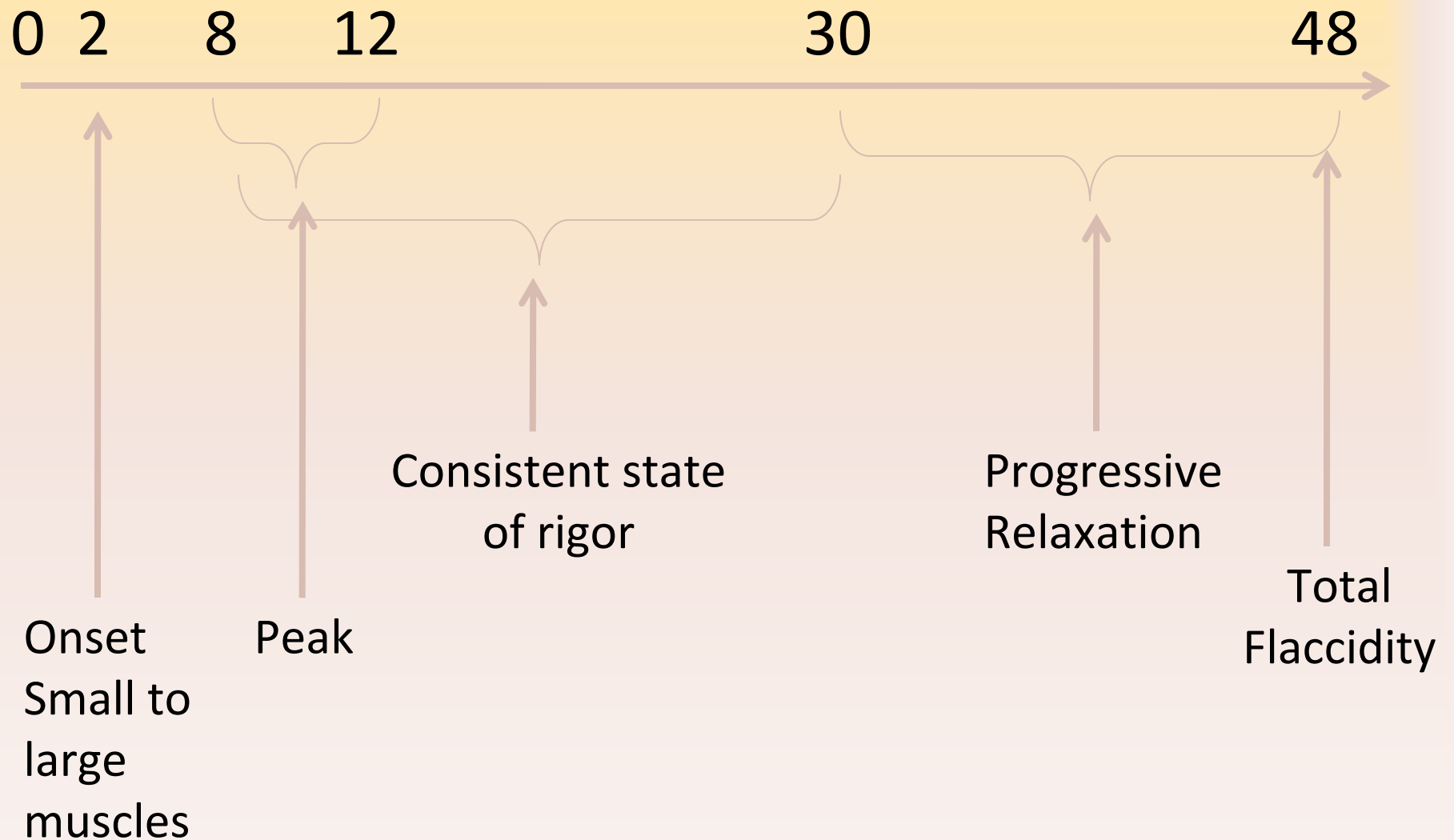
- A female is found dead in an apartment in Albany, on July 23rd at 8pm. The ME reports her body temperature to be 90.2°F.

What is the approximate Time of Death?

Rigor Mortis

- Immediately after death there is total muscle relaxation
- Muscle stiffening progresses from:
 - Small to larger muscles
 - Begins in the face
- Tightening is due to loss of ATP
- Muscle relaxation occurs in the same progression as stiffening

Rigor Mortis



Factors Affecting Rigor Mortis

- Ambient Temperature
 - Higher speeds it up
 - Lower slows it down (can even stop it)
- Degree of pre-mortem muscle activity
 - Heavy exertion: rapid onset/short duration
 - No exertion: slow onset/long duration
- Rapid onset/short duration in children and elderly
- Rapid onset in septicemia (think fever)
- Delayed in asphyxial deaths (lack of oxygen)
 - Hanging, strangulation, carbon monoxide, etc

Cadaveric Spasm

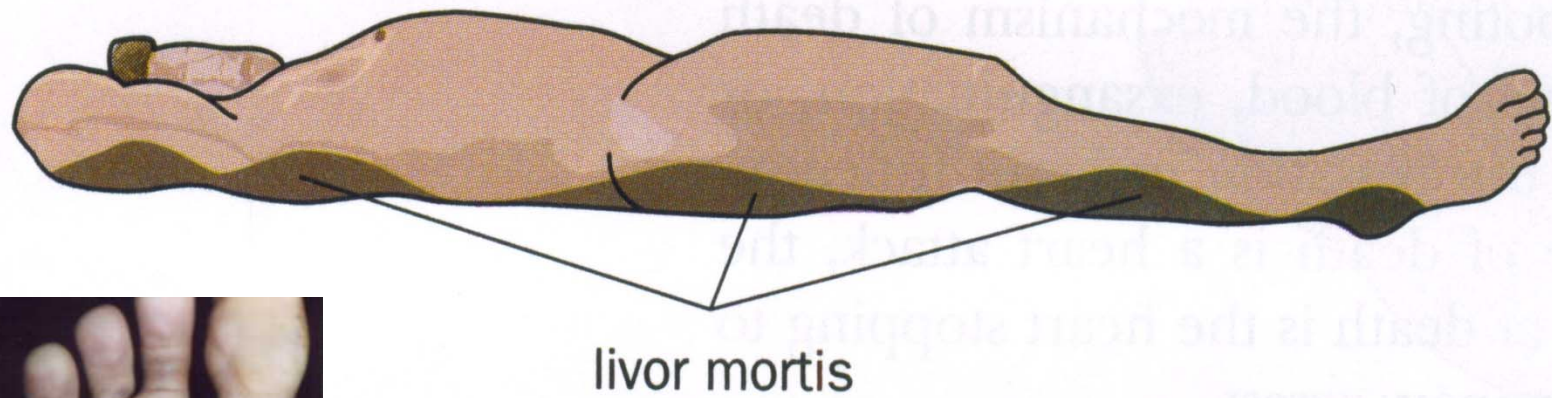
Death Grip

- AKA instantaneous rigor (locked in the posture of death)
- Usually associated with violent deaths with intense emotion
 - Weapon held in hand
 - Weeds in hand of drowning victim
 - Hair or clothing of assailant in victim's hand

Livor Mortis (lividity)

- Dark purplish discoloration of the skin
- From gravitational pooling of blood in blood vessels
- Begins 2 hours post-mortem
- Fixed by 8-12 hrs
- If body is moved after onset – secondary lividity can occur
- Red color with cold exposure, carbon monoxide, cyanide (high oxygen)
- Deep purple with heart failure, shock, asphyxia (low oxygen)

Figure 11-4. The location of livor mortis can reveal the position of the body during the first eight hours after death.

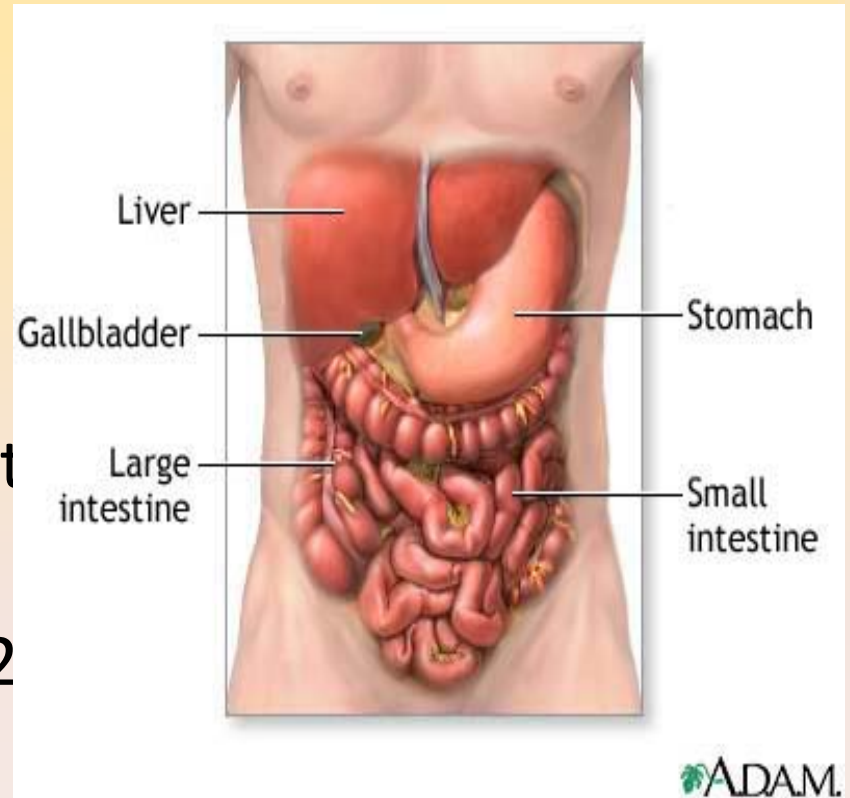


Ocular Changes

- The cornea of the eye becomes clouded
 - 2-3 hrs if eyes are open
 - 24 hrs if eyes are closed
- The potassium levels of the vitreous humor increase during the PMI
 - Useful within the first 3-4 Days

Degree of Digestion

- If undigested stomach contents are present, then, death occurred 4-6 hrs after the last meal.
- If the stomach is empty but Food is in small intestine, Death occurred more than 12 Hrs after last meal.
- If the small intestine is empty and wastes are found in the large intestine, then death occurred 24-48 hrs after last meal.



Jogger Case Scenario

A 24 year old fully clothed male is found in the woods on Sept. 17, 2005 by a jogger at 5pm. His body temperature at 5:30pm is determined to be 91.1°F. Partial rigor is noted in the muscles of the face and hands. The ME finds food in his stomach and beginning of small intestine. Ambient temperature that day was 72°F.

What was his approximate TOD?

Jogger case scenario

1. Body temperature 91.1°F

$$\frac{98.6-91.1}{1.4}$$

1.4

= 5.4 hrs

2. Partial rigor mortis

At least 2 hrs but less than 8 hrs

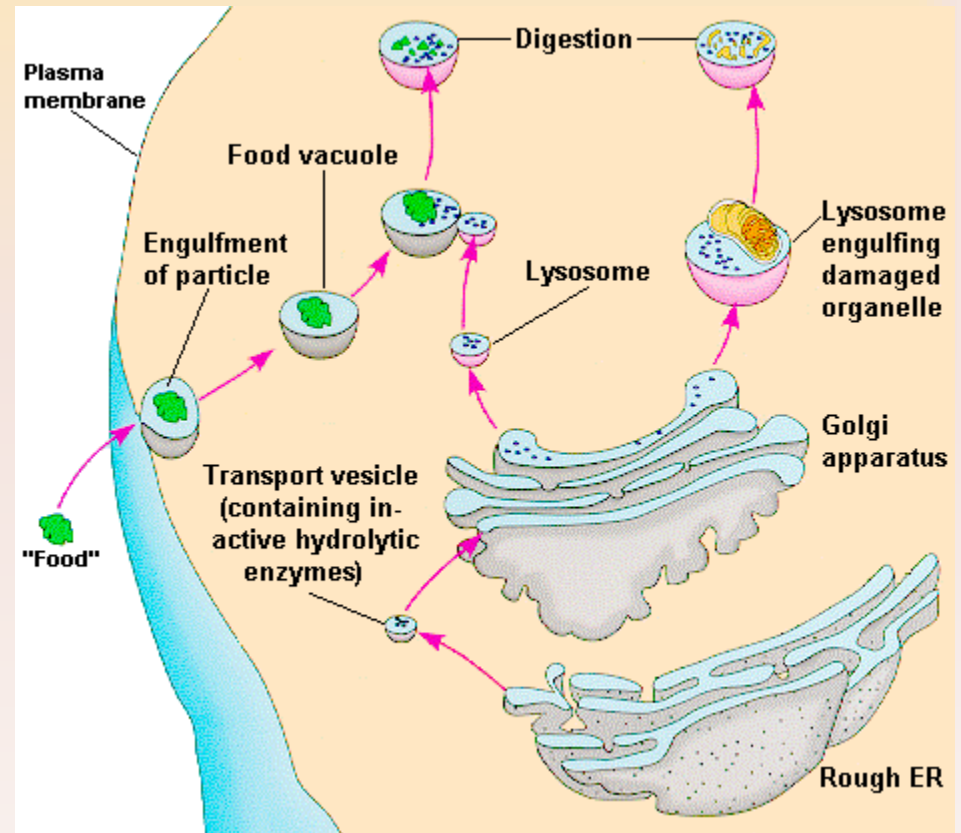
3. Food in stomach and small intestine

At least 2 hrs but less than 6 hrs

Probable TOD was between 11am and 3pm and most likely around 12pm

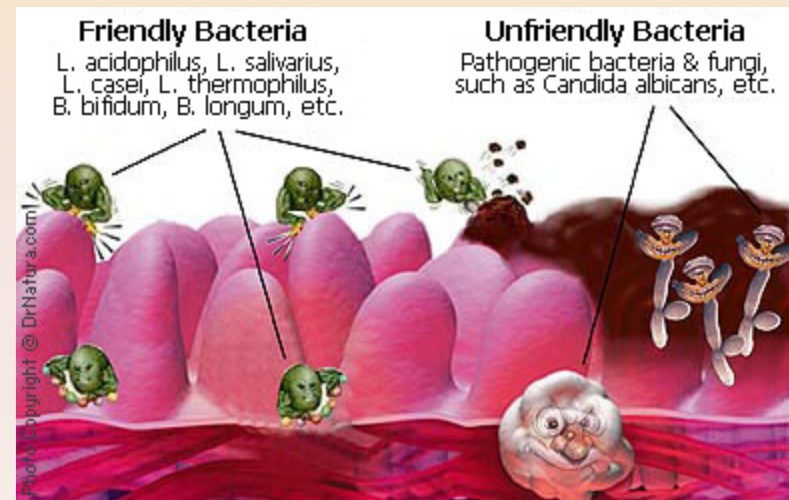
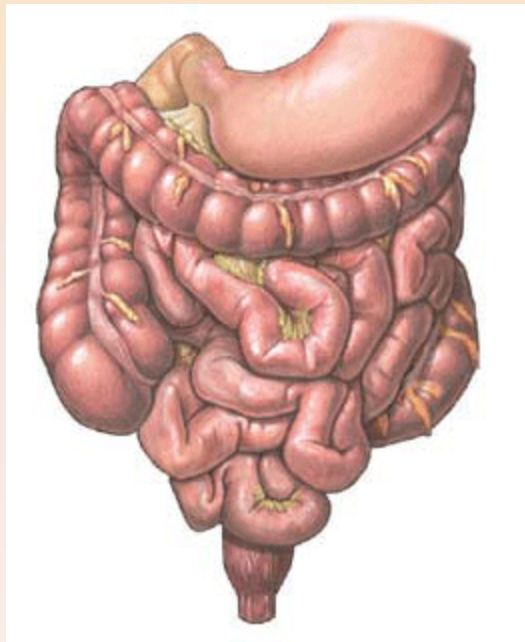
Post-Mortem Decomposition

- Autolysis: Enzymes in the body cells digest the cells and tissues
- Typically begins in the stomach and lower esophagus within a few hours after death



Post-mortem Decomposition

- Putrefaction: bacteria from the digestive tract invade and digest the body



Post-mortem Decomposition

- **Putrefaction:**
- After 36 hrs the first visible sign is greenish discoloration of the skin and abdomen
- Spreads to other superficial veins causing “marbling” of the body
- Light contact can cause “skin-slip”
- Skin blisters develop
- Bloating After about 1 week (Trapped CO₂)
- Organs eventually breakdown

Post-mortem Decomposition



Factors Affecting Decomposition Rate

- **Body Conditions**

- Septicemia (body infection) increases rate
- Obesity increases rate
- Children decompose faster
- Heavy clothing increases rate (retains heat)
- No clothing can decrease rate
- Injuries increase rate (introduce bacteria)

Factors Affecting Decomposition Rate

Environmental Conditions

- Temperature
 - Increased speeds decay
 - Decreased slows it
 - Freezing arrests it
- Humidity
 - Increased speeds decay
 - Decreased slows it
- Casper's Dictum
 - **1 week in air = 2 weeks in water = 8 weeks if buried**

Saponification (Adipocere)

- The body fat turns into soap
- Creates mannequin-like appearance
- Occurs in warm, damp conditions
- Can take 3-6 months to develop
- AKA “Grave Wax”



Mummification

- Usually in hot dry environments
- Body dries out (desiccates)
- Creates a leathery dark colored corpse
- Flesh looks like it was shrink-wrapped

<http://www.hbo.com/autopsy/interactive/#>

<http://www.deathonline.net/movies/mm/autopsy.cfm>