Death
&
Its medico-legal aspects

thanatology

Thanato: God of Death

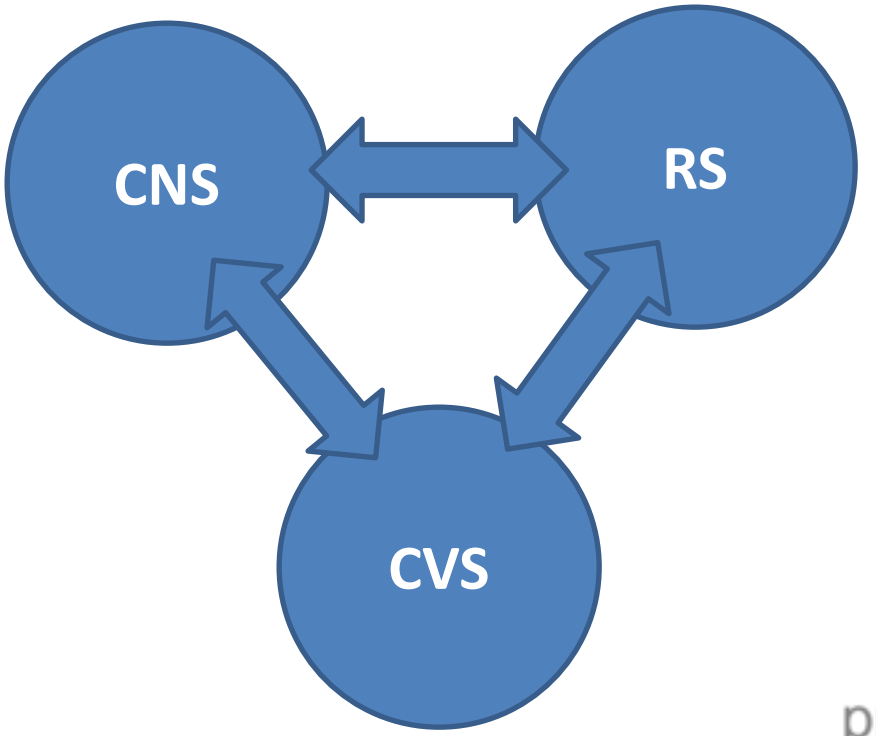
Forensic Thanatology

S 46 ,IPC

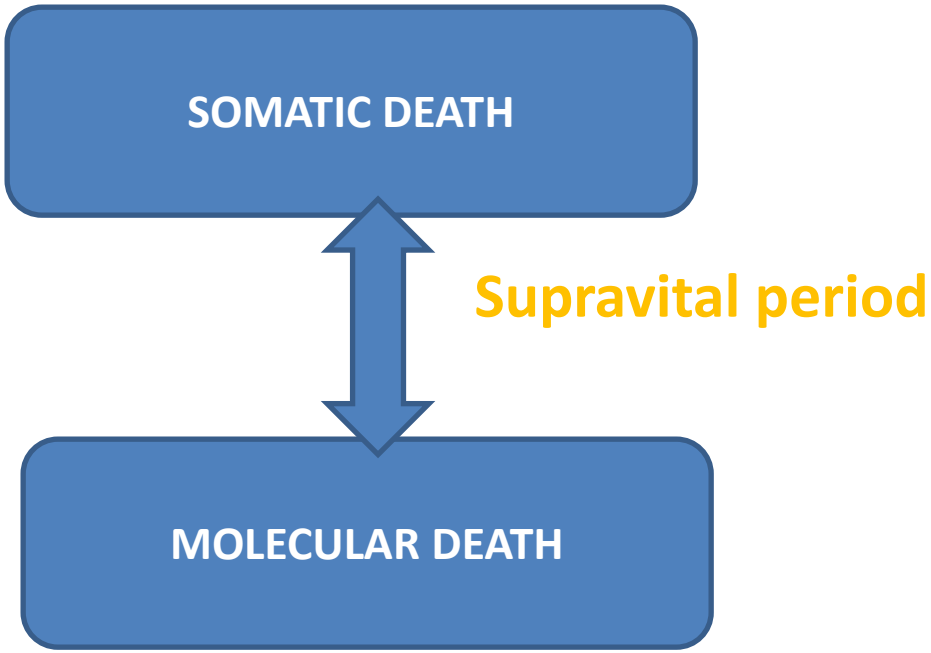
"Death" denotes the death of Human being

Bichats's tripod of life

[death's portals of entry: Atria mortis]



Complete and irreversible stoppage of functions of three vital systems . [Bichat's tripod for life.]



Death is not event, it is a process

Moment of Death

In past concept of death was that of "heart and respiration death"

"brain death"
HARVARD'S criteria for Death

Unreceptivity & Unresponsivity
No movement or Breathing
No Reflexes
Flat ECG

Ad Hoc Committee of Harvard Medical school

- Defined Death in 1968
- It recommended three criteria for determining permanent non-function of the brain ***[BRAIN DEATH]***
  - Unreceptivity & unresponsitivity
  - No breathing or movements : spontaneous : off respirator 3 min
  - No reflexes
    - Light reflex, dilated
    - Ocular m.m.
    - Corneal
    - Pharyngeal
    - Spinal
  - *added confirmatory test is flat or isoelectric EEG [objective test/mandatory]*
  - *Repetition after 24 hours*

Brain Death
Minnesota criteria for moment of death

- Cortical or Cerebral death : a vegetative state in which respiration continues with loss of power of perception : living cadaver :
- Brain stem death : coma and no respiration
- Whole brain death : combined

- By Mohandas & Chou

Brain stem death….Minesota criteria

- Medullary neurons are resistant to anoxia
- Vital centers
- Cortical pathway

  - Spontaneous movement
  - Spontaneous respiration
  - 5 major brain reflex
    - Pupillary response
    - Blinking…cornreal reflex
    - Grimacing:ciliospinal reflex
    - Eye movement: cold and warm water
    - Gagging or coughing

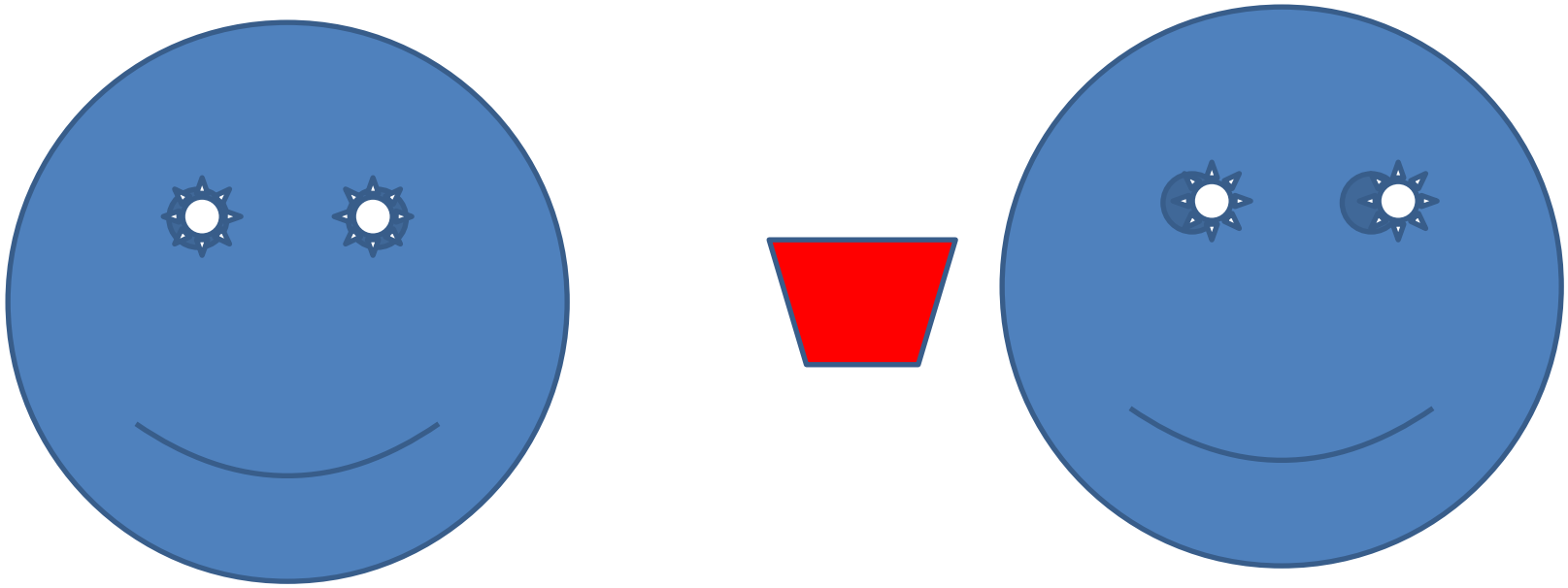
EEG

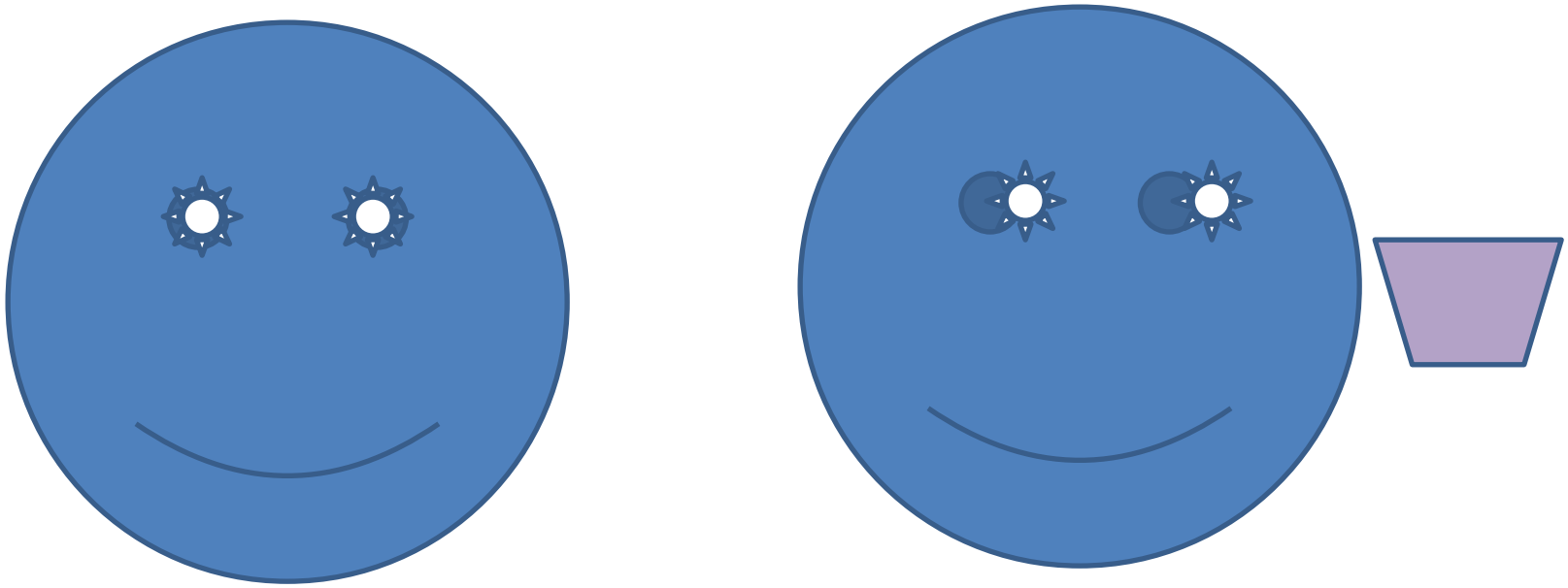
Spinal Reflexes

Repetition of test

Duration of testing RS

Vestibulo-ocular reflex





Transplantation of Human Organs Act, 1994

- In brain stem death… no spontaneous breathing

Brain stem death – certified by a board of doctors

- In-charge of hospital
- Independent doctor
- Doctor treating the patient
- Neuro surgeon or neuro physician

diagnosis

1. Dilated pupils
2. No reacting to light [2A-3E]
3. No motor response within cranial nerve distribution
4. No corneal reflex [5A-7E]
5. No vestibulo-occular reflexes [8A-3E/6E]
6. No gag reflex or cough reflex [9A-10E]
7. No spontaneous breathing: Apnoea Test

Preconditions

- Cause of death must be established
- Examination by team at different time
- No interested doctor
- Exclude
  - ✕Intoxication
  - ✕Depressant drugs
  - ✕Muscle relaxants
  - ✕Hypovolaemic shock
  - ✕Metabolic disturbance
  - ✕Endocrinal disturbance
  - ✕hypothermia

Organ transplantation

- Homologus
  - Live donation
  - Cadaveric donation
- Xenograft

Suspended animation

- Apparent Death

Voluntary
[death trance]
or
Involuntary

Metabolic needs are at low ebb……

Mode of Death

- Coma
- Syncope
- Asphyxia

Bichat's classification

Gordon's classification

on availabilty and utilization of O_2

- Anoxic anoxia
- Anaemic anoxia
- Stagnant anoxia
- Histotoxic anoxia
  - ✓ Extracellular
    - ✓ Cyanide, hypnotics, hydrogen Sulphide
  - ✓ Pericellular
    - ✓ Halogenated Hydrocarbons
  - ✓ Substrate
    - ✓ hypogycemia
  - ✓ Metabolic
    - ✓ CO_2 , Uraemia

- Mode of death: abnormal physiological state at time of death
- Manner of death: fashion or design in which death occurs
  - Natural or Unnatural
- Mechanism of death: physiological or biological or pathological derangement in relation to death
- Cause of death: pathology or injury responsible for starting chain of the events which produce final outcome …..
  - immediate- at time of death
  - Proximate- original
  - contributory

Signs of Death

- Immediate
- Early
- Late

Immediate signs of death:1

- Insensibility & loss of voluntary power
  - Perception of touch, pain, temperature
  - Movement , tonicity
  - Reflexes
  - Pupils
  - Muscles

Immediate signs of death :2

- Stoppage of circulation
  - Pulse
  - Auscultation
  - Diaphanous test [transillumination test]
  - Magnus test
  - Icard’s test
  - Finger nail pressure test
  - Cut test
  - Heat test
  - ECG

Immediate signs of death:3

- Stoppage of circulation
  - Inspection
    - Feather test
    - Mirror test
    - Winslow's test
  - Palpation
  - Auscultation

Early changes :1

- Eye changes:
  - Corneal reflex
  - Opacity of cornea
  - Flaccidity of eyeball
  - Pupils dilated
  - Vitreous biochemistry [K]
  - Retinal vascular: Trucking , cattle trucking Kevorkian sign
  - Tache noire [Taches Noire De La Sclerotica]
  - Ripault sign
- Skin changes
  - Elasticity
  - Colour
  - Lips

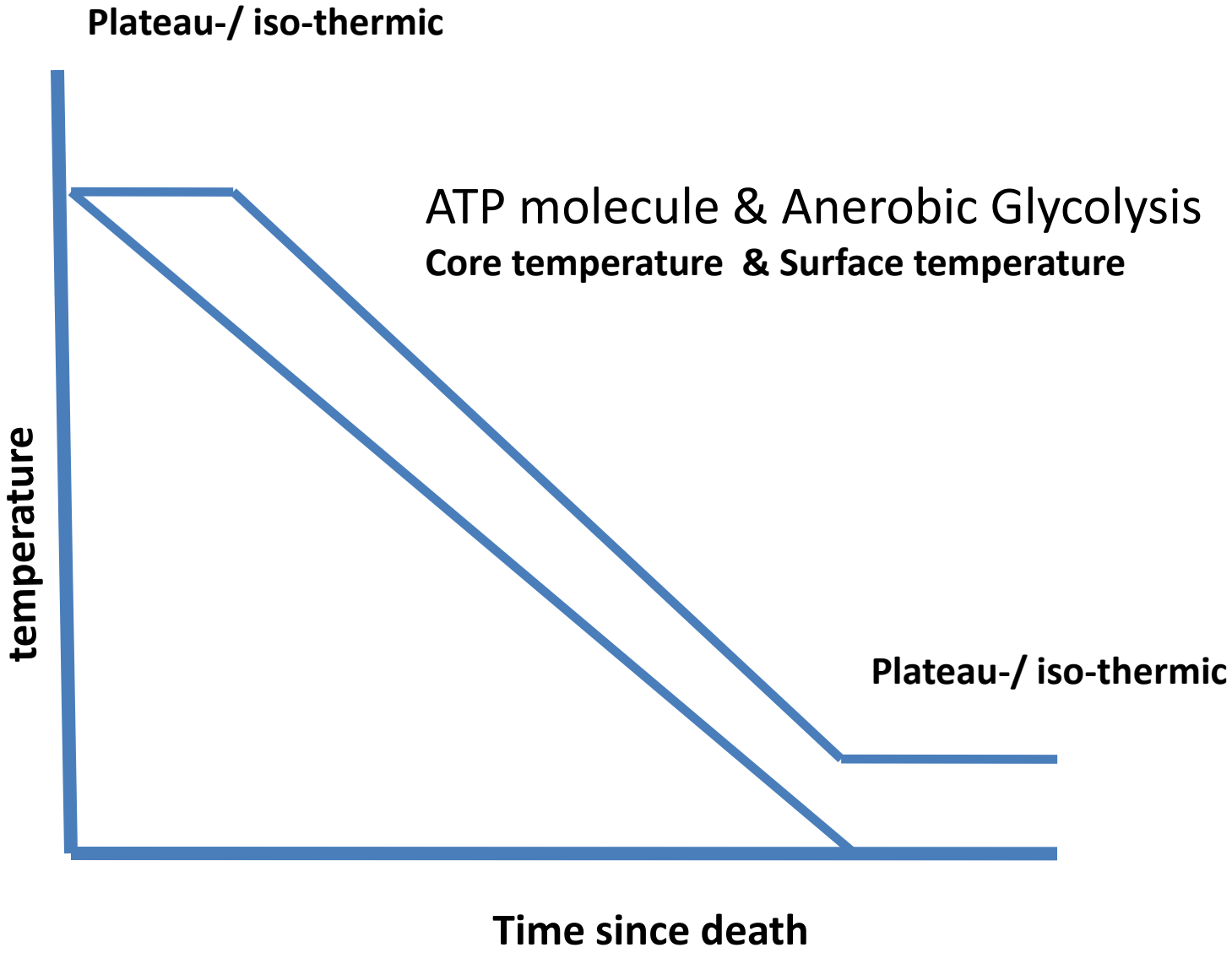
Early changes :3

- Post mortem cooling : algor mortis
  - algor = coldness , mortis = of death
- Mechanism
  - Normal body temperature 37. C [98.4 F]
  - During life time balance
  - Loss of heat after death

- Balance
  - Production
  - Loss
    - Conduction
    - Convection
- After death
  - Loss
    - Conduction
    - Radiation
    - Evaporation

    - Conduction
    - Convection

Newton's law of cooling $q=ha[T_1-T_2]$



Sigmoid or Flipped "s" shape

- Measurement : Dowler

- Two measurement at 1 hour interval taken

Time since death in hours =

$$\frac{\text{normal body temperature} - \text{rectal temperature}}{\text{rate of fall of temperature}}$$

Winter 1.5F [0.4 C] /hr Summer 0.75F [0.7 c] /hr

Environment temperature must be lower than that of body

…. Temperate /cold climate ✓

…. Tropical conditions ✗

Post mortem caloricity

- Tropical conditions
- Sunstroke
- Pontine haemorrhage
- Tetanus
- Nux vomica poisoning
- Acute bacterial infections
- Acute viral infections

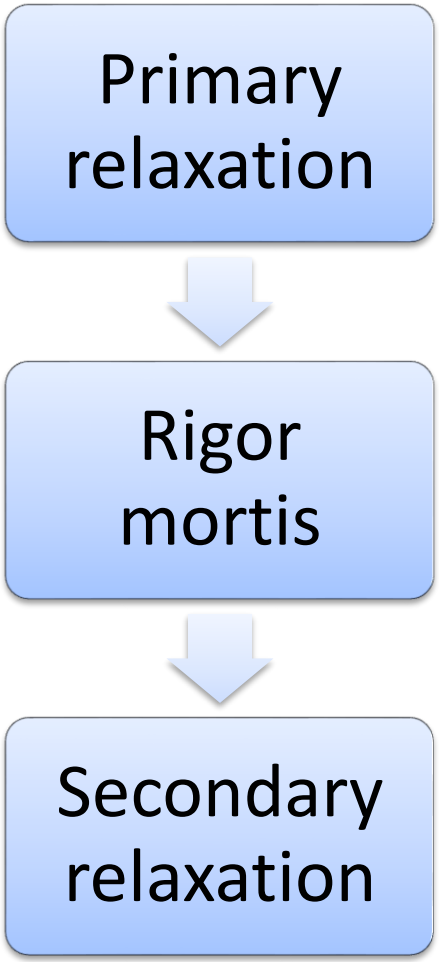
Factors which influence the cooling

- Environment temperature
- Disposal of body
- Built of body: Surface Area/Body weight
- Sex
- age
- Air
- Coverings
- Weather –dry or moist
- Position
- Causes of death

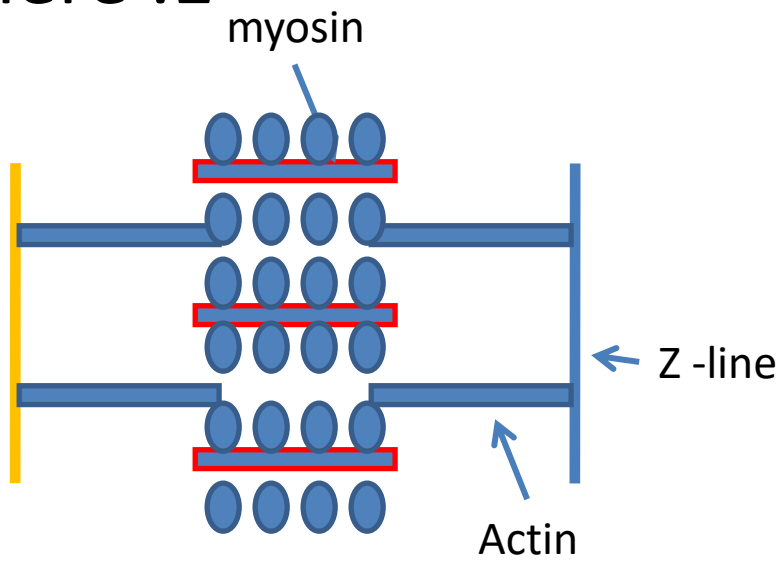
Medico-legal aspects

- Sign of death
- Time of death

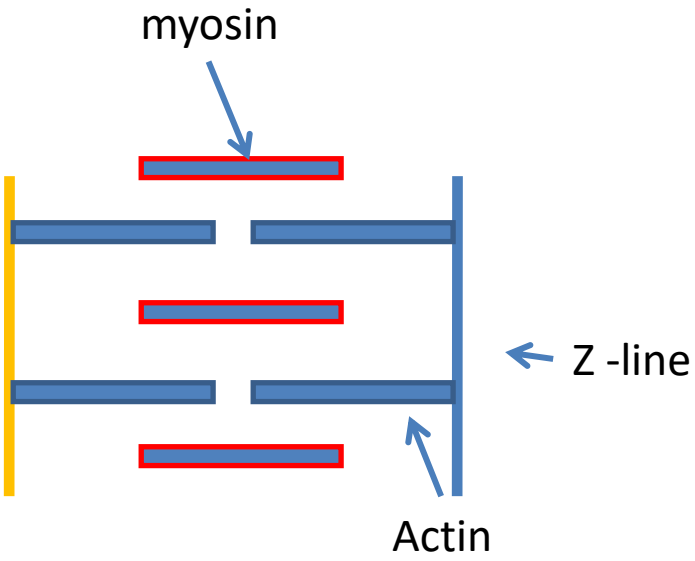
Rigor Mortis



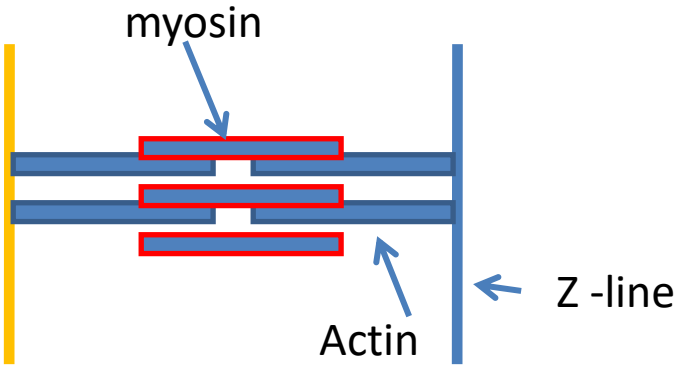
- Physio- chemical change after molecular death in Sarcomere :1



- Physio- chemical change after molecular death: ii



- Physio- chemical change after molecular death: iii



- Mechanism
- Muscles involved
- Reaction; 7.3 → 5.8 pH
- Breaking of
- March of rigor
  - Nysten's Law for Voluntary muscles : proximodistal progression
- nerve supply
- Cutis anserina [goose skin]
- 5 o'clock shadow

Factors influencing R M

- Age
- Mode of death
- Surroundings

Longer it takes , longer it last

Conditions simulating RM

- Cadaveric spasm
- Heat stiffness
- Cold stiffness
- Putrefaction

D/D

- Type of Death
- Primary relaxation
- Onset
- ATP exhaustion
- Predisposing conditions
- Ph [Muscle Reaction]
- Muscles involved
- Degree
- ML importance

PM Lividity

- Cadaveric lividity
- PM hypostasis
- Livor Mortis
- PM suggillation

- Define

- Causes
  - Circulation
  - Gravity
  - Venous flow
- Site
  - Contact pallor
- Skin layer
- Coloor
  - Bluish purple
  - Hb
  - On rest parts: antigravity regions
- VIBICES : d/d AM bleeding
  - Dependen on blood volume, posture and constriction {hydrostatic pressure]
- Difficult to perceive color: perception, light and colour vision
- Internal [congestion??] and external [Bruise???]
- Decomposition effect

- Time since death
  - Onset
  - Patch → coalesce
  - Fixation
    - Primary
    - Secondary
      - Complete
      - Partial
  - Reason
      - RM
      - Hb
      - Water from blood
      - Clotting **X**
      - Capillary action

Influencing factors

- **Complexion**
- **Intensity**
  - **More**
  - **Less**
- **Position of person**
- **Poisoning**
  - **Opium**
  - **H2S**
  - **Asphyxia**
  - **Co**
  - **Cyanide**
  - **Extreme cold**
  - **Phosphorous**
  - **Oxidizing**
    - **Potassium chlorate**
    - **Aniline**
    - **Nitrates**
    - **Bromates**

D/D

- Bruise
  - Cause
  - Ante mortem or post mortem
  - Site
  - Level
  - Swelling
  - Abrasion
  - Margins
  - Color
  - Cut section
  - Microscopic
  - MLC

D/D

- Congestion
  - Cause
  - Ante mortem or post mortem
  - Site
  - Swelling
  - Cut section
  - Microscopic
  - Hollow organs
  - MLC

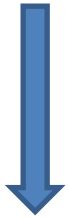
ML Importance

- Sign of death
- Time since death
- Position of dead body
- COD
- PM movement if any

Decomosition

- Putrefaction

Organic complex body tissue



Inorganic simple elements

Distension, discoloration, degradation, dissolution

Aseptic & septic

- Defense wall is lost after death
  - Environment factors
    - Physical agents
    - Chemical agents
  - Internal factors
    - Chemical agents
    - Enzymes*
      - Lipolytic
      - Glycolytic
      - Proteolytic
  - Saprophytic bacteria

* glandular organs

- Flora in GIT
- Open wounds
- Fungi [Penicillium, Aspergillus]
- insects

- After RM [Molecular death]
- Bacteria
  - Cl welchii
  - Staphylococci
  - Streptococci
  - B coli
  - B proteus
  - B aerogens
  - B capsulates
  - diptheroids
- Spread through

- Lecithinase → hydrolyse of cell wall and RBC → haemolysis
  - O_2 <
  - H+ >
  - Proteins, Carbohydrates, fats
  - After death bacterial activity increased

External findings

- Green discoloration [S:24, W:36]

- Sulphar containg AminoAcids
  - Cysteine
  - Cystine
  - Methionine

Sulphar Released

H_2S

$H_2S + Hb \rightarrow$ Sulfhemoglobin

- Deamination of L-phenylalanine

NH_3 & Phenylpyruvic acid

with Iron ions

- Diffusion of Bile

- Later on H_2S + sulphar

GREEN

- Starts at
  - Internally
  - externally
- Starts from
- Then spread

- Marbling [36-48]

Fluid is ideal medium for bacteria

colony in venous vasculature

haemolysis

Sites

Foul smelling gases and its effects

- CH_4, CO_2, CO, H_2, NH_3, Mercaptans, PH_3, **amino acids from P & C [complex to simple]**
- Inflammable & smell is due to Ptomains [cadaveric alkaloids : decarboxylation of amino acids: cadaverine[(ysine) & putrecine (ornithine)]
- Preternatural combustion
- Spontaneous human combustion

A: Distension of abdomen[24:36]

B: Blisters [36-48]

- AM and PM blisters
- Peeling of epidermis

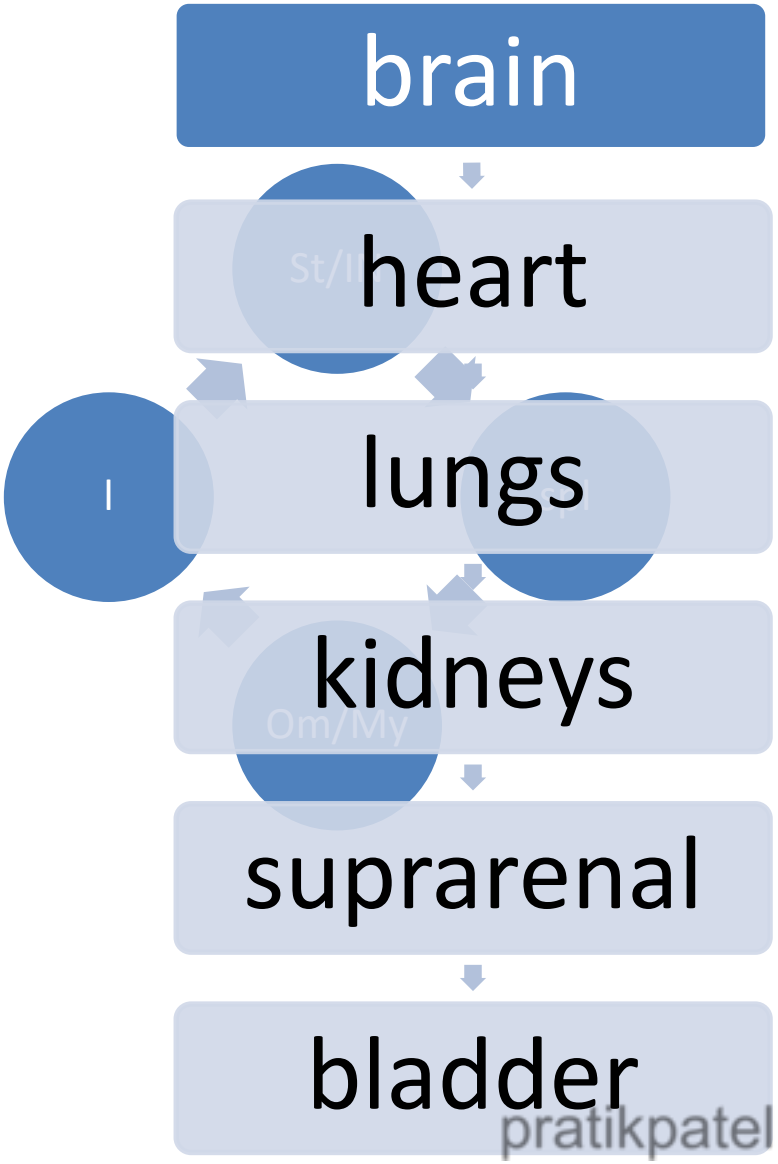
C: Bloated facial features[48-72]

- More in dependent position
- Venous congestion in asphyxial death
  - Features
  - Eyes
  - Lips
  - Tongue
  - Cheeks
  - Orifices
- Prolapse
- Hair & nails
- Postmortem bleeding
- Surgical wounds

- 3-5 days
  - Abdomen
  - Skull
- 5-10 days
  - Colliquative decomposition

Internal findings [24:36 to 48:72]

- **Organs affected**
  - **Soft**
  - **Vascular**
  - **Bacterial proximity**
- **Larynx & trachea**
- **Stomach& intestine**
- **Spleen**
- **Omentum & mysentry**
- **Liver**
- **Brain**
- **Heart**
- **Lung**
- **Kidney**
- **Suprarenal**
- **Bladder**
- **Esophagus**
- **Pancreas**
- **Diaphragm**
- **Blood vessels**
- **Gall bladder**
- **Prostate & uterus**



D: Skeletonization

- Last stage
- Time variable

Factors affecting rate

- External
  - Air
    - Stagnant or moving
    - Mosit
  - Temperature: by bacterial growth and chemical breakdown
    - Summer or winter
    - 0-10 -**21-38**-45-48 C
  - Clothing
    - Summer or winter
    - Tight or loose : temperature and invasion
  - Casper Rule 1:4:8 [A:W:B]
    - Buried body
      - Time of burial
      - Dry or moist lost
      - Type of soil
      - Coffin

Forensic entomolgy

stages	summer	winter
Fly lay Eggs 120-150, 1mm L, pearly white	Minutes	Hours
Larva or maggots White segmented 1-2 mm **1st INSTAR** **1:Lipase & collagenase** **2: mouth hook**	8 hr	1 d
1st molting: 2nd INSTAR	1 d	4 d
2nd molting: 3rd INSTAR , 12 mm	1 d	4 d
Pupae: after crawling away [Dark Brown Cocoon]	3 d	8 d
Adult fly emerge	5 d [total 10-11 d]	5 d [total 22 d]

Internal factors

- Age
- Sex
- Body built
- COD
- Injury
- Poisons
  - Acids, Aconite
  - Barbiturate
  - Cyanide, Carbolic acid
  - Datura
  - Ethyl Alcohol
  - Flexidil, Formalin
  - Glycerin , Glycol
  - Heavy metals

ML importance

- Sign of death
- Time of death

Arrested & modified

Mummification

Absorption of water and fat

- Dry
- Brittle
- Tough
- Contracted
- Adherent
- Leathery, parchmentized
- Shrunken
- Wrinkled
- Yellow → yellowish brown → black

Preconditions

- Temperature
- Air
- Moisture
- Contact of body
- Burial
- COD → dehydration

- Starts at….progress….disintegrate ….
- Time required

Medico legal

- Sign of death
- Time since death
- Identification
- COD
- Place of disposal

Adipocere

adipo=fat , cera=wax

corpse or grave or mortuary wax

breakdown of fat → fatty acid

In heat and water → hydrolysis and hydrogenation of fat [fatty acids + gycerol]

- Glycerol removed , fatty acids retained [oleic, palmitic, stearic, hydrostearic acids] + Ca iron → insoluble salt [oleiate..etc of Ca] acidic inhibiting decomposition
- Endogenous lipase and bacterial enzyme [cl.perfringens]
- Wax..whit, soft, moist and translucent → dry brittle, hard, yellow, burnt with yellow flame, Insoluble in water, soluble in alcohol , ether , Floats
- 0.5/20/70 %
- Friable
- Crumbly
- Grayish white
- Epidermis –nt, dark dermis
- Amoniacal → sweetish smell

- External and internal
  - Where
  - When

Preconditions

- Temperature
- Air
- Moisture
- Anaerobic condition
- Contact of body
- Enzymes
  - Endogenous lipase
  - Bacterial [cl.perfringens] → lecithinase→hydrolysis & hydrogenesis
- Burial
- COD → dehydration
- Running water

- Time required

Medico legal

- Sign of death
- Time since death
- Identification
- COD
- Place of disposal