

















**➔ AUTOPSY OF INFECTED BODIES  
FRAGMENTARY REMAINS AND  
SKELETONIZED BODY**



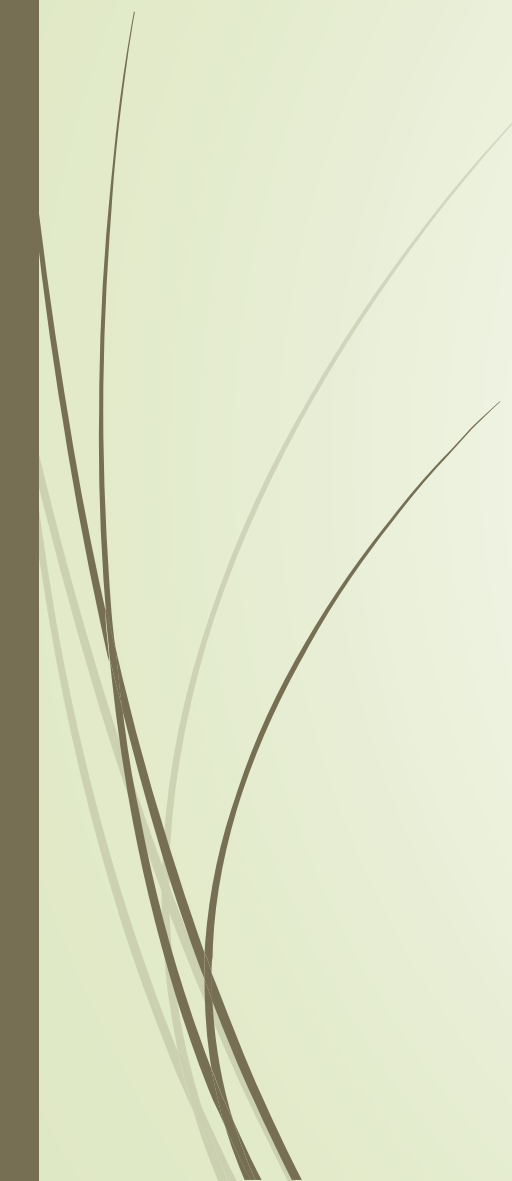
# Learning objectives

- Describe the protocols of autopsy of an infected body.
- Describe the precautions required for autopsy of an infected body.
- Define mutilated bodies/ fragmentary remains.
- Describe the procedure of autopsy of mutilated bodies fragmentary remains.
- Describe the samples collected from fragmentary remains.

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- Describe the steps of examination of a skeletonized body to assess its race, age, sex and stature.
  - Describe the protocol for autopsy of a skeletonized body.
  - Describe the cause of death in such cases.
  - Describe nature of injury and type of weapon used in such cases.
  - Describe time since death in such cases.



# Autopsy of infected body

- Special precautions are necessary at each stage
  - At the scene
  - In the autopsy room
  - In the laboratory
  - In the court
  - General precautions
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## At the Scene

- Disposable shoe protection by persons at the scene is necessary .
- Food or smoking should not be allowed at the scene.
- Blood contaminated clothing or other material should be handled carefully. Dried blood or wet blood material that is not to be stored as evidence should be decontaminated and properly disposed off by incineration.
- Non-disposable material used during the investigation and collection of evidence at the scene should be decontaminated by usual hypochlorite solution.




## In the autopsy room

- Admission: No unauthorized person should be admitted to the autopsy and body preparation rooms.
- Clothing: Protection includes complete covering of the body by wearing double gloves, gowns, water-proof aprons, caps, masks, goggles if eye glasses are not worn and shoe covers.
- Instruments: Minimum instruments as required, should be kept. At the start of the autopsy a scalpel, scissors and forceps are kept to start with. Scissors with slightly blunted points should be routinely used and the small sharp ones only when needed.
- Special care is necessary to handle sharp items such as needles and scalpels to prevent accidental pricks and cuts.

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- Disposal requirements: Instruments, working surfaces used in the procedure, associated gloves, protective clothing and waste materials must be disinfected, sterilized or incinerated as appropriate.
  - Handling specimens for laboratory examination: Gloves should be worn at all times by laboratory as well as autopsy room and mortuary personnel, when handling specimens from suspected cases.
  - Clean up procedure: New intact disposable gloves should be worn. Small spatters and spills of blood and other body fluids can be wiped up with disposable tissues or towels which are discarded in special bio-hazard bags and wiped clean.



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- Disinfection: A 1:10 dilution of household bleach or freshly prepared sodium hypochlorite solution, the active ingredient in the bleach in equivalent concentration of 5000 ppm is recommended.
  - Accidental injury and prophylaxis: In the event of an accidental injury contaminated or not with blood and body fluids, either at autopsy or in the laboratory, the wound should be disinfected and the incident reported to the proper authority.
  - Bloods sample should be taken from the source of exposure and tested for HIV and hepatitis B.



## In the laboratory

- ▶ Disposable gloves should be worn and counter top covers used in areas where biological material is examined. This should be disposed off in an authorized manner.
- ▶ Food or smoking should not be allowed in the work area.
- ▶ All biological specimens should be considered contaminated and treated accordingly.
- ▶ Mouth-pipetting of biological material should not be allowed.
- ▶ If possible specimens to be destroyed should be burnt or chemically decontaminated.
- ▶ Hands should be washed before leaving the work area.



## In the court


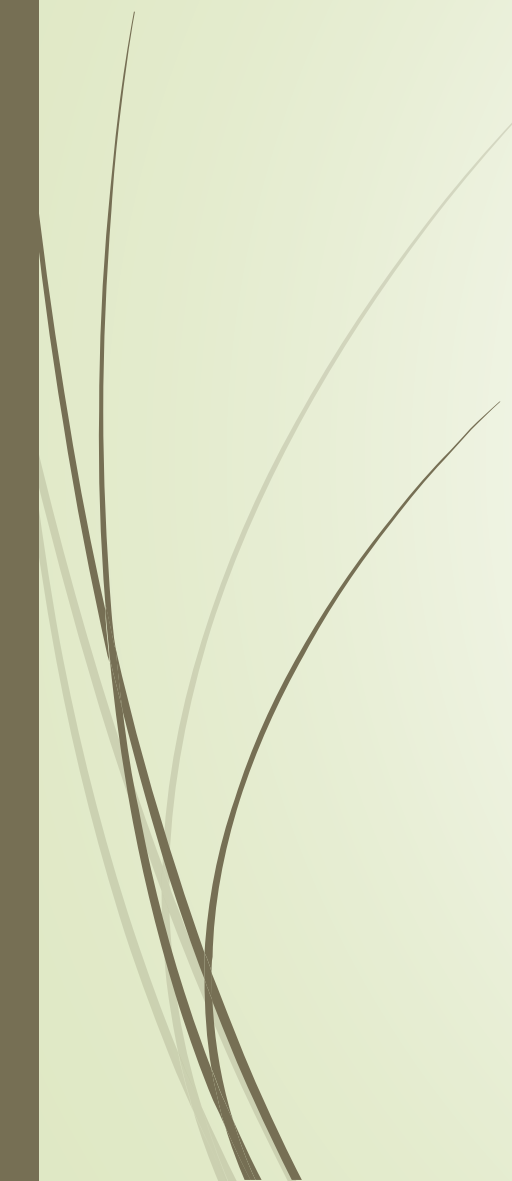
- ▶ Whenever possible biologically contaminated evidence should be referred by photographic or other means rather than presenting it in court.
- ▶ When necessary, bullets, clothing etc should be handled using disposable gloves and over paper, or the (dry-not wet/moist) evidence should be enclosed in a sealed clear plastic bag.
- ▶ The hands should be washed after handling the evidence.





## General precautions

- ▶ The best key to control the dissemination of infection (HIV or hepatitis B) is prevention-
- ▶ Prevention of unnecessary contamination of the work area and of injuries.
- ▶ Prevention requires strict attention to details, carrying out the required autopsy and body preparation procedures with care, neatly and cleanly, avoiding spattering and confining any flow of body fluids within limited bounds of the work area.

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- The major danger to all personnel would be any action that produces an aerosol of biological material, such as that produced by a saw during autopsy or by a blender in toxicology studies.
  - The most common known methods of accidental exposure include being pricked with a used needle or other contaminated material and the contamination of an area or surface which would not be expected to be so by the thoughtless techniques of a careless fellow employee.
  - Washing hands and cleaning floors, doors, door knobs, and telephone with a disinfectant, capable of killing viruses will protect the employees.








# Mutilated body / Fragmentary Remains

- ▶ A mutilated body is one which is disfigured, deprived of a limb or a part of the body.

In this condition the soft tissues, muscles and skin are still attached to the bones.


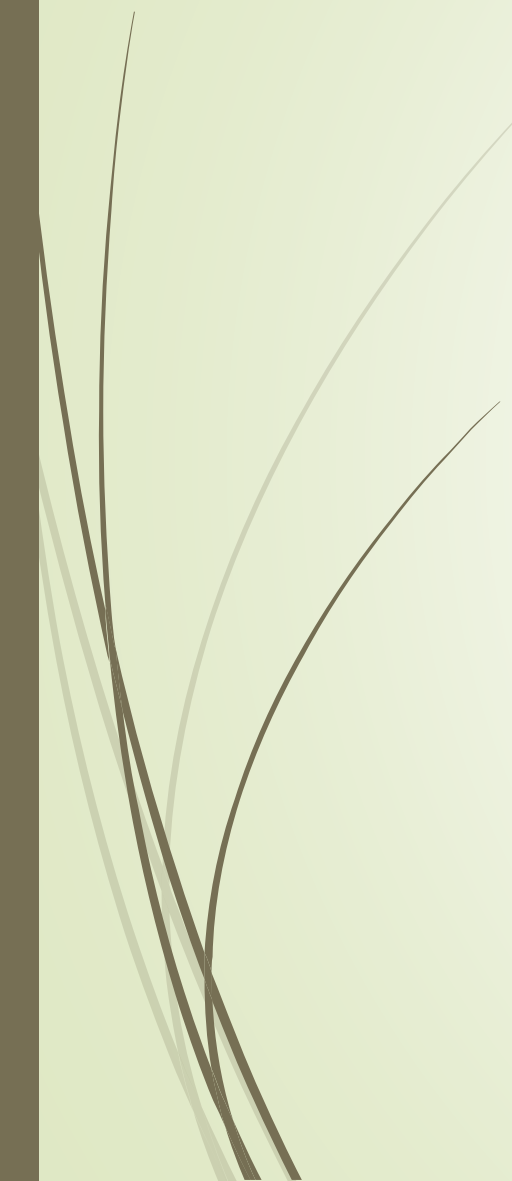
- ▶ Fragmentary remains include only fragments of the body such as head, trunk or limb.

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- A number of questions can be answered depending upon the type and condition of the material received for examination.
  - The following information is specially looked for:
    - Source whether human or animal
    - If parts belong to the same individual
    - Age
    - Sex
    - Stature
    - Race
    - Identity
    - Special features
    - Cause of death and
    - Time since death.



## Source

- ▶ This can be determined from knowledge of anatomy.
- ▶ In case of doubt, a part of the soft tissues, provided decomposition is not too far advanced, is sent in a dry condition and without adding any preservative to the forensic science laboratory for a precipitin test.
- ▶ The antiglobulin inhibition test is more sensitive than the precipitin test but requires more expertise.

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- ▶ In places situated near the medical colleges and anatomy dissection halls, Parts of human bodies improperly disposed off may be brought for examination.
  - ▶ It is easy to determine their source from the dark color, formalin odor and the presence of red lead in the blood vessels and nutrient canals of bones.





## If parts of belong to the same individual

- ▶ A mix-up of parts may occur in mass disasters. The parts belong to the same individual if they can be fitted together and there is no disparity or duplication.
- ▶ Testing for similarity of blood group and DNA from different parts is more conclusive.



# Age

- ▶ This can be determined from the state of epiphyses,
- ▶ state of teeth and lower jaw,
- ▶ calcification of laryngeal and sternal cartilages and hyoid bone,
- ▶ changes in the sacrum
- ▶ closure of the cranial sutures
- ▶ condition of the symphyseal surface of the pubic bone
- ▶ changes in the joints
- ▶ colour of hair on the scalp, beard, moustache and pubis.
- ▶ Histomorphometric methods based on correlation of the number of osteons per unit area of bone samples and age as established by researchers are helpful.



# Sex

- The prostate and non-pregnant uteri resist putrefaction for a long period.
- Gross and microscopic examination of internal genitals, if available is confirmatory.
- In their absence, the nature and characters of the soft parts and configuration of pelvis are helpful.
- If only the head is received, sex can be surmised from the presence or absence of beard.
- Sex can also be determined by nuclear sexing root sheath cells of head hair.



# Stature

- ▶ Stature can be determined by using multiplication factors for different parts of the body available.
- ▶ In general humerus represents 20%, tibia 22%, femur 27% and the spine 35% of the stature.






# Race

- ▶ This can be determined from hair and skin if available
- ▶ From nasal bridge height, nasal aperture shape
- ▶ Facial prognathism, palate shape
- ▶ Incisors
- ▶ The skull (cephalic index, height index,) and
- ▶ Limb bones etc.



# Identity

- ▶ This can be determined from fingerprints, dental status and personal property or articles in close proximity to the body.
- ▶ Also helpful are the congenital features like moles and acquired peculiarities like tattoo marks, condition of the palms, scars, deformities and amputation marks.
- ▶ Evidence of any disease e.g gall stones, uterine fibroids and appendectomy scar when present is corroborative.

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- ▶ Determination of blood group antigens A, B and H from teeth pulp might help to establish identity if the blood group is known.
  - ▶ Selected X-rays and /or total body X-rays are helpful if ante mortem x-rays are available for comparison.


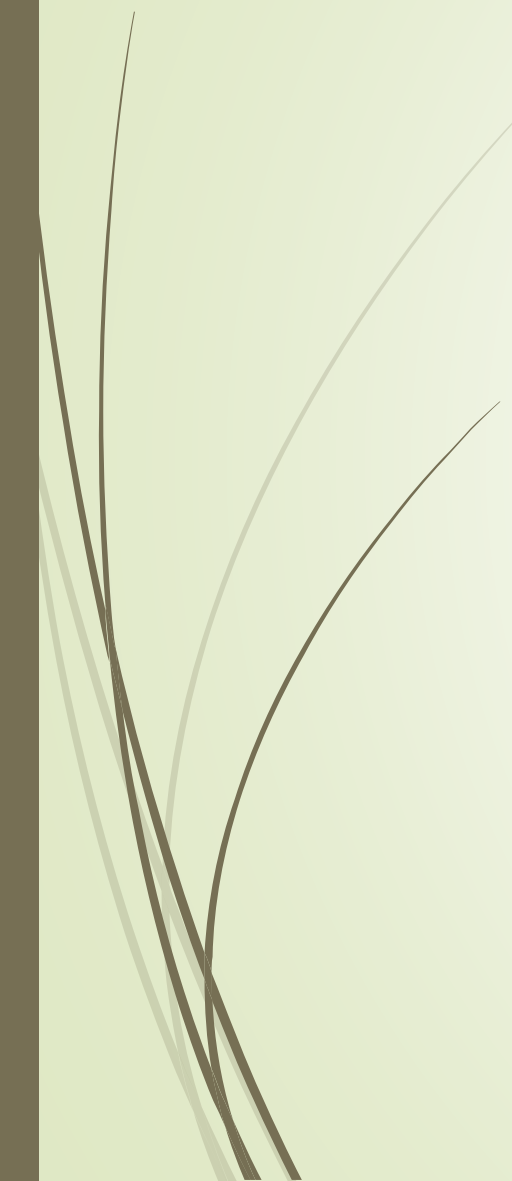



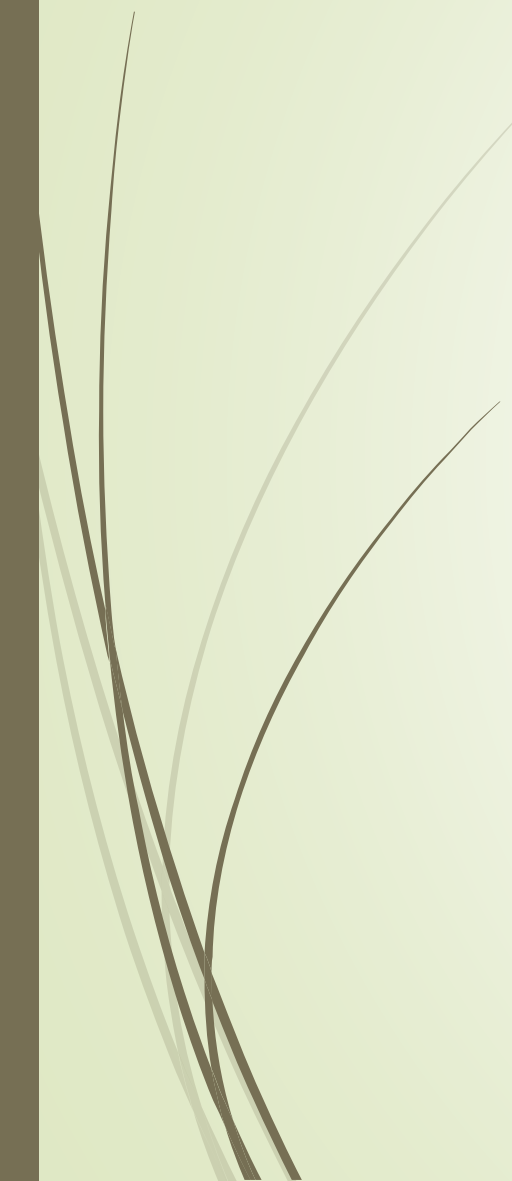
# Special features

Mutilation may be the work of :

- ▶ Persons with anatomical knowledge
- ▶ Other without such knowledge
- ▶ Animals or
- ▶ May result from decomposition changes.
- ▶ Each has its own characteristics and therefore the manner in which the parts are mutilated is quite important.



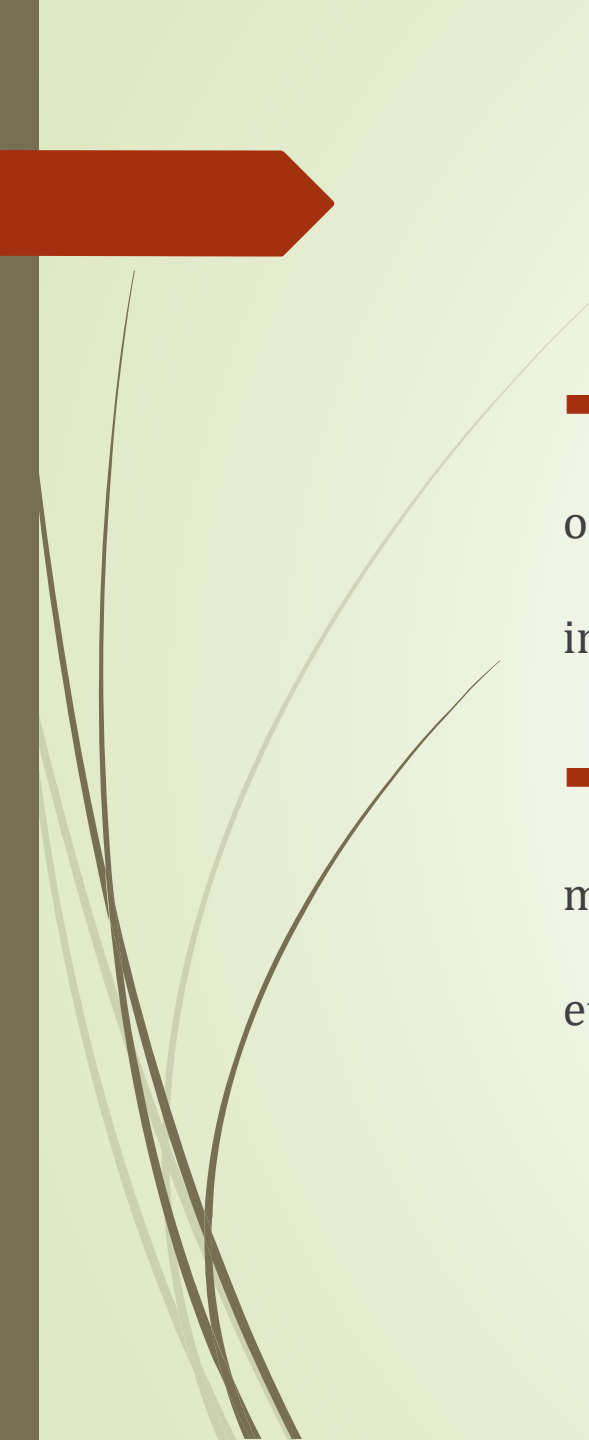
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- ▶ Persons with anatomical knowledge destroy identifying features.
  - ▶ Others without such knowledge disfigure the body haphazardly as for example by use of saw, axe or any heavy weapon.
  - ▶ Animals generally attack the exposed parts and produce wounds resembling haphazard mutilation. However careful examination will reveal if the bones are gnawed through, by animals or cut by sharp weapons.

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- In addition animals generally eat away the medulla of long bones and spicules of cortical bone are found depressed in the medullary cavity.
  - Separation of body parts is brought about by decomposition also. The natural sequence is: soft parts, articular cartilages and ligaments.
  - Separation of joints of the hyoid as a result of decomposition may be mistaken for fracture.



# Cause of death

- ▶ An opinion as to the cause of death is possible when there is some evidence of ante mortem violence such as injury to some large blood vessel or some vital organ, or the recovery of a bullet.
- ▶ It must however be remembered that mutilated fragments of the body decompose quickly and ante mortem changes disappear or become indistinguishable from postmortem ones.

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- ▶ Sometimes there may be some clues such as a depressed fracture of the skull, fracture of hyoid, fracture-dislocation of cervical vertebra, severe injury to bones by cutting instrument or fractures of several ribs.
  - ▶ Sometimes chemical examination of the available material for evidence of poisoning may also help. Obvious signs of disease such as a malignant growth of soft tissues, bones etc should be looked for.





# Time since death

- ▶ The probable time since death can be ascertained from the progressive changes in the body after death.



# Samples collected from a Mutilated body/ Fragmentary remains

- ▶ Stomach
- ▶ Stomach contents
- ▶ Small intestine
- ▶ Small intestine contents
- ▶ Liver
- ▶ Spleen
- ▶ Kidneys
- ▶ Blood
- ▶ Urine
- ▶ Vitreous
- ▶ Hair
- ▶ CSF
- ▶ Muscle
- ▶ Maggots
- ▶ Nails
- ▶ Skin
- ▶ Bone
- ▶ Bone marrow






# Steps of examination of skeletonized body

- ▶ A complete list of bones received for examination is prepared preferably along with the photograph of each bone.
- ▶ The bones are cleaned if necessary then arranged in the normal anatomical manner and the reconstructed skeleton photographed.
- ▶ The scheme of the examination of bones is similar to that for mutilated bodies.









➤ An anatomist, dentist, anthropologist and radiologist with medico legal experience should be consulted. An opinion can be given on the following aspects

- 1. Source whether human or animal
- 2. Belong to one or more individuals
- 3. Age
- 4. Sex
- 5. Stature
- 6. Race
- 7. Identity
- 8. Special features
- 9. Cause of death
- 10. Time since death



# Source :

- ▶ This can be determined from:
- ▶ Gross anatomical characteristics of human and animal bones.
- ▶ Microscopic characteristics
- ▶ Chemical analysis of bone ash. In case of doubt, a precipitin test may settle the issue



# One or more individuals

- ▶ This can be determined from the number of bones received for examination, noting the side to which they belong, and checking for their fitting, duplication and morphological similarities.
- ▶ There can be only one right humerus.
- ▶ If mix up of bones is suspected, they can be subjected to short wave ultraviolet lamp to separate them by the difference in color emission.



# Age

- ▶ This can be determined from state of epiphyses, state of teeth, and lower jaw.
- ▶ Calcification of laryngeal and sternal cartilages and hyoid bone.
- ▶ Changes in sacrum
- ▶ Closure of cranial sutures
- ▶ Condition of symphyseal surface of pubic bone
- ▶ Changes in joints
- ▶ Histological examination of teeth and
- ▶ Cross section of mid shaft area of femur, tibia or fibula.

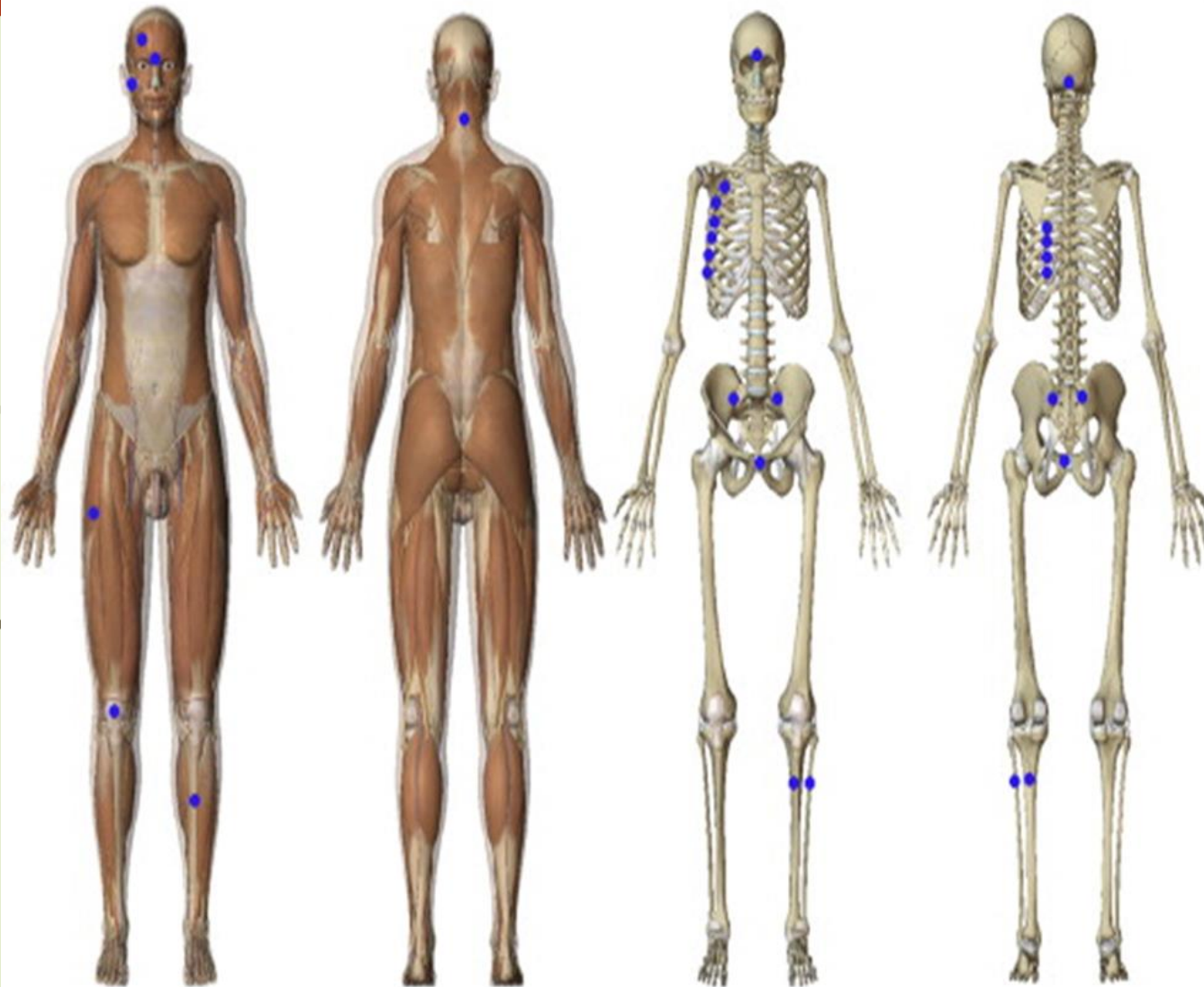


# Stature

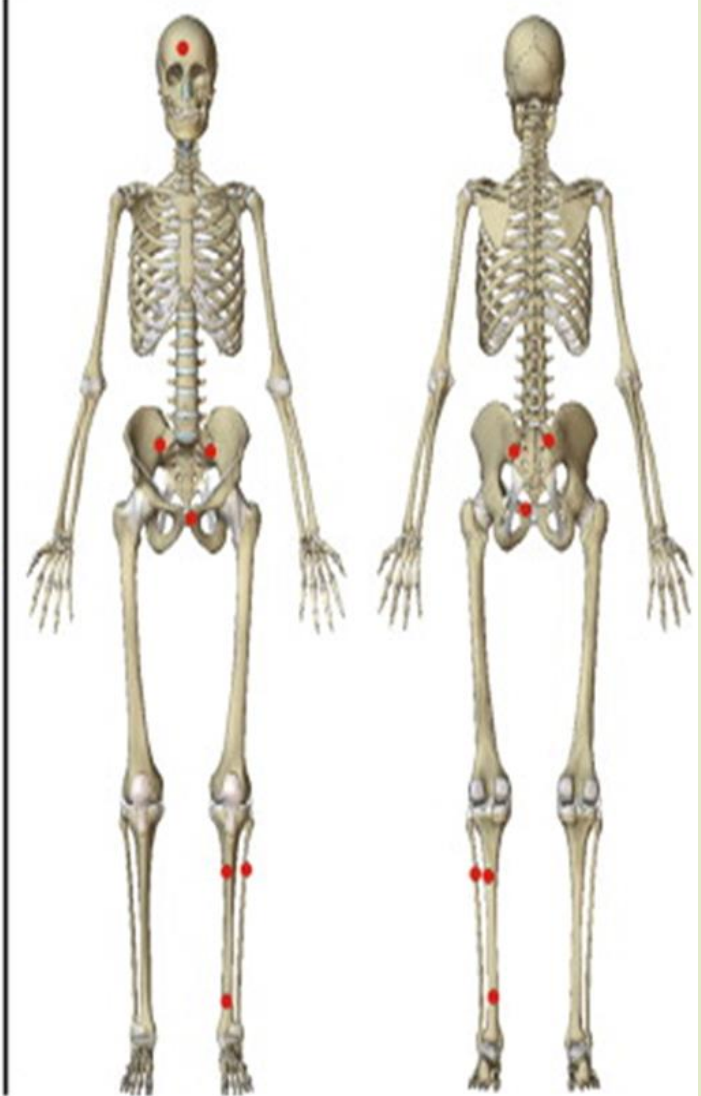
- ▶ This can be calculated, if a long bone such as femur, tibia, humerus or radius is available in its entirety.
- ▶ Using the formulae of Dupertius and Hadden and Trotter and Glesser for Americans
- ▶ Breitinger for Germans; Teltkka for Finns and multiplication factors devised by Indian workers for Indians.
- ▶ While applying the various formulae, due account needs to be taken of the sex and race of the deceased by reference to appropriate tables.
- ▶ Simple means to estimate the stature of a person in general is: Humerus represents 20% ,tibia 22% femur 27% and the spine 34% of the stature.



Autopsy data



Anthropological data





# Race

- ▶ An expert can determine this in a high proportion of cases from an examination of :
- ▶ skull,
- ▶ Mandible and teeth
- ▶ pelvis and
- ▶ limb bones.



# Identity

- ▶ Malunited fractures, healing fractures, or deformity of bones when present, are helpful.
- ▶ When the skull is available, superimposition photography and facial reconstruction may be attempted.
- ▶ An X-ray of any bone taken during life may be compared with an X-ray of the same bone.
- ▶ Determination of blood group antigens A,B and H from teeth pulp might also help in establishing identity, if the blood group is known.
- ▶ DNA profiling also helps. It may be possible to obtain material for blood grouping and DNA profiling from cancellous bone.



# Special features

- ▶ By a meticulous examination of the ends of long bones, one can determine if the bones are cut by a sharp instrument or sawn through or whether they are gnawed through by animals and medulla eaten away.
- ▶ In bones that are gnawed through, spicules of cortical bone will be found depressed into the medullary cavity.



# Cause of death

- ▶ This is difficult to determine unless there are some clues.
- ▶ Fractures especially of skull, hyoid, ribs and other bones should be looked for.
- ▶ Knife scratches on cervical vertebral bodies and other bones or joint surfaces, if found are informative.
- ▶ An opinion on these features, however, is difficult since antemortem evidence disappears rapidly after death.
- ▶ A foreign body, such as a bullet when present in bones is helpful.
- ▶ Bones or their charred remains may be subjected to chemical analysis for the detection of metallic poisons such as arsenic as these are not destroyed by heat.
- ▶ Neutron activation analysis technique helps to detect certain metallic poisons in quantities far below the limits of conventional analysis.





# Time since death

- ▶ This is also difficult to estimate.
- ▶ Bodies exposed on the ground may be skeletonised even in a day if attacked by animals.
- ▶ However an inference can be drawn from the following:
- ▶ In the process of skeletonisation, soft tissues disappear first, then articular cartilage and finally the ligaments.
- ▶ In case of a fracture, examination of the callus after dissecting it longitudinally may give some clue as regards time.



# Carbon dating

- ▶ Radioactive carbon(C-14) is formed in atmosphere by the action of cosmic radiation and enters in all living beings through various channels, which gradually diminishes after death.
- ▶ It is reported that weakening of C-14 radioactivity takes more than 5000 years to reach half its initial activity.
- ▶ A simple carbon compound, such as CO<sub>2</sub> or acetylene, or even carbon itself is prepared from bones, and radioactivity is estimated.
- ▶ This means dating of skeleton can be done even after burials for several years by this method, giving clues on time since death.

