Bone Radiology

Part I

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RADIOLYGY REPRESENTS A BRANCH OF MEDICINE, THAT DEALS WITH RADIANT ENERGI IN THE DIAGNOSIS AND TREATMENT OF DISEASES

A PHISICIAN, WHO SPECIALIZES IN RADIOLOGY IS CALLED RADIOLOGYST

MEDICAL RADIOLOGY

- Diagnostic radiology
- Therapeutic radiology (is also called radiation oncology or radiation therapy)
- Interventional radiology

WHO DISCOVERED X-RAYS?

On 8 november, in 1895, a German physicist, Wilhelm Conrad Rontgen produst and detected electromagnetic radiation, known as **X-rays** or Rontgen rays.

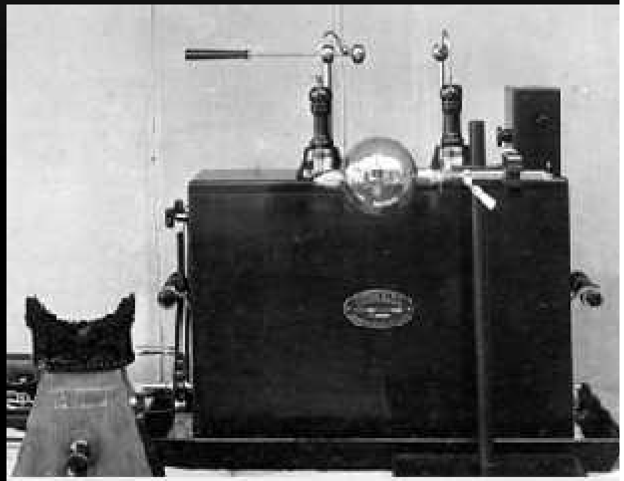
He named the new ray-x-ray,because in mathematics "X" is used to indicated the unknow quantity

1845-1923yy.

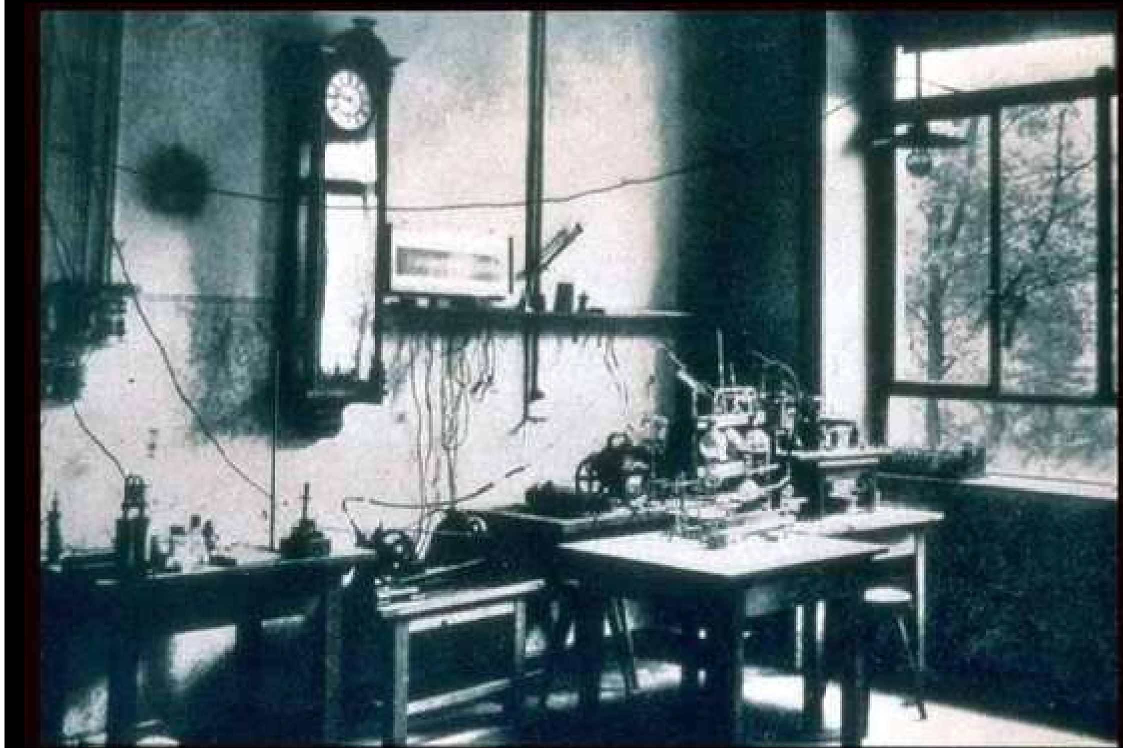
A BIT HISTORY

Roentgen was experimenting whith a crooker “ cold cathod” tube.

He notesed,that a fluorescent screen in his lab started to glow, whern the electron beam was turned on. Fluorescent material normally glows in reaction to electromagnetic radiation, but Roentgen tube was surrounded heavy black cardboard. Roentgen assumed this would have blocked most of the radiation



He found, that the X-ray would pass througt the tissue of humans leaving the bones and metals visible.



All bodies are transparent to this agent.... For brevity's sake I shall use the expression 'rays'; and to distinguish them from others of this name I shall call them 'X-rays.

(Wilhelm Röntgen)

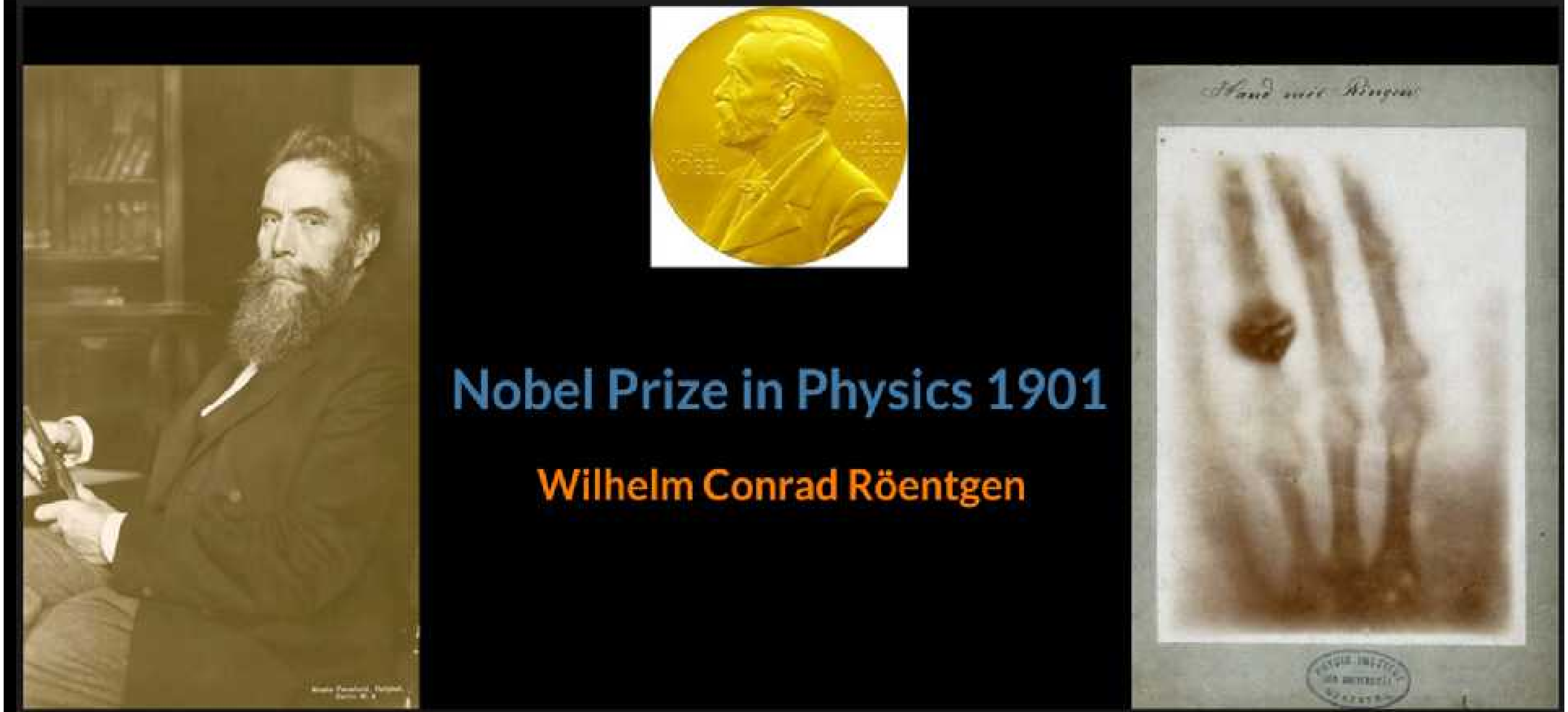
After his discovery, he took first picture using X-rays of his wife-Anna Bertha's hand (22-nd Dec.1895). (he put his wifes hand in front of the tube. So he saw the silhouette of her bones project on the screen)

When she saw her skeleton, she exclaimed: "I've seen my death"

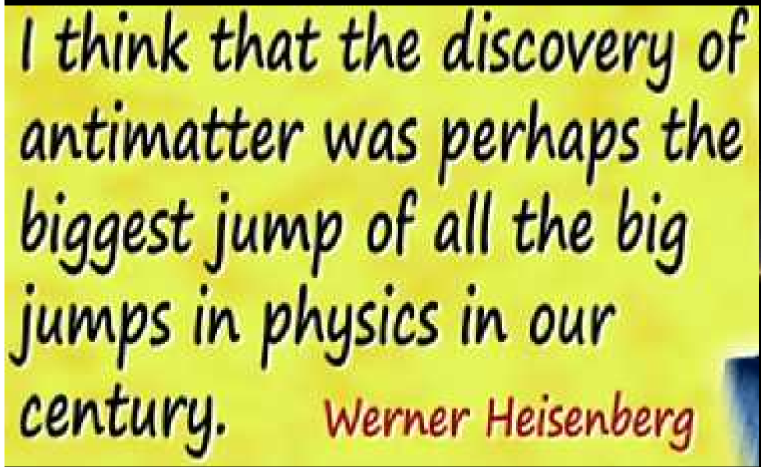
Used to diagnose Eddie Mccarthy's fractured left wrist on 3-rd Feb 1896.

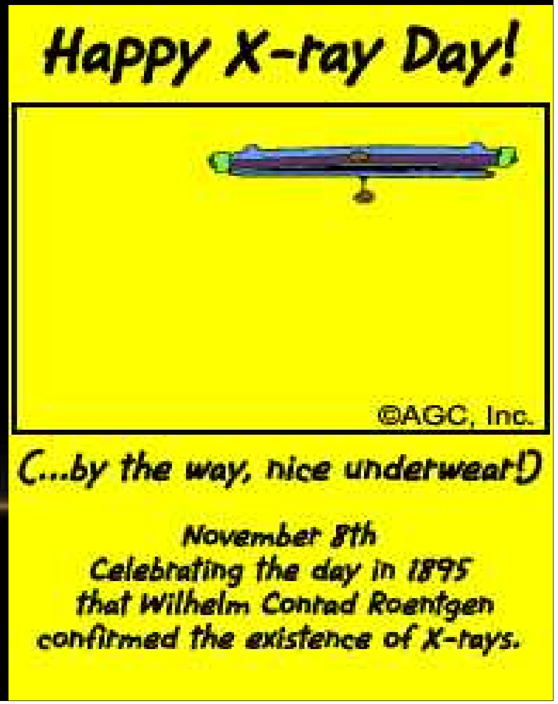
New Orleans dentist C. Edmond Kells Takes the first DenTal X-ray in 1896

For his discovery, he aworded the first **Nobel Prize** in physics in 1901.



BIRTHDAY-8 NOVEMBER

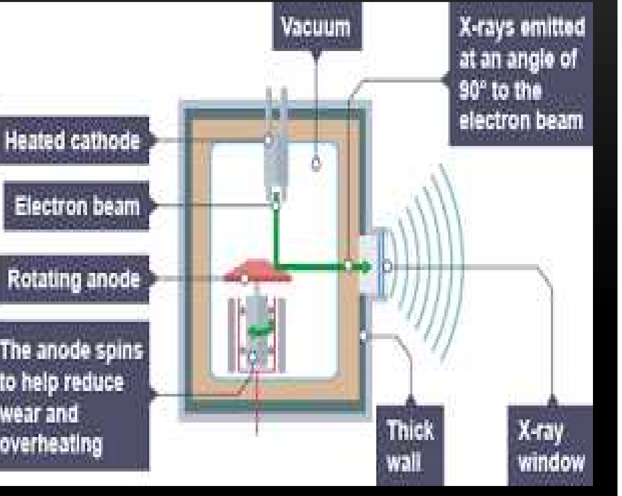


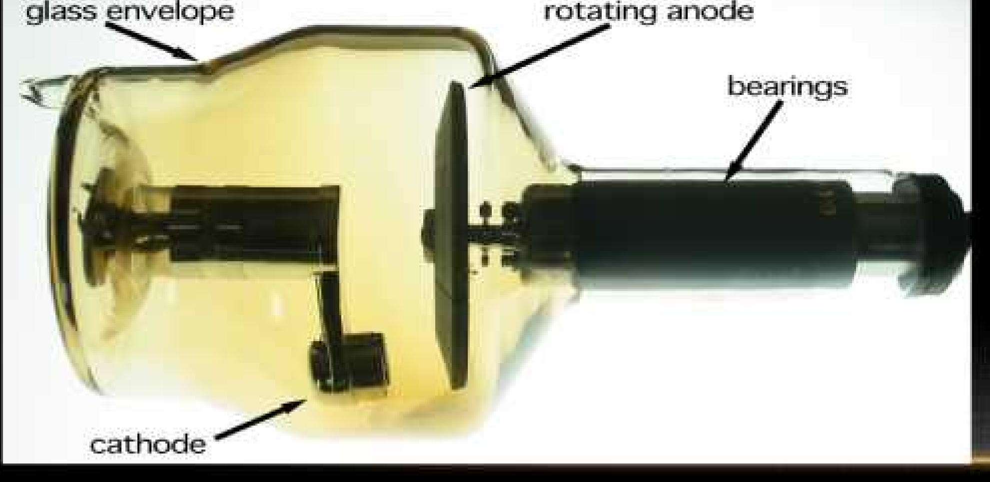


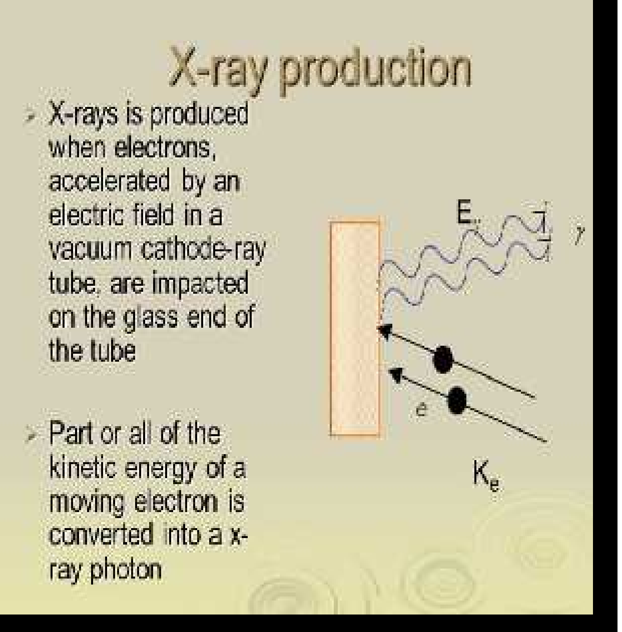
WHAT IS CROOKES TUBES (ROENTGEN'S TUBE)?

HOW PRODUSE THE BEAM?

- Crooks tube is a seald glass cylinder,with two embedded electrodes operated whith rarefied gas.
- The potentional difference between the two electrodes produces discharge in the rarefied gas causing ionization of gas molecules.
- Electrons (cathode rays) are accelerated toward the positive electrode producing x rays upon striking it.



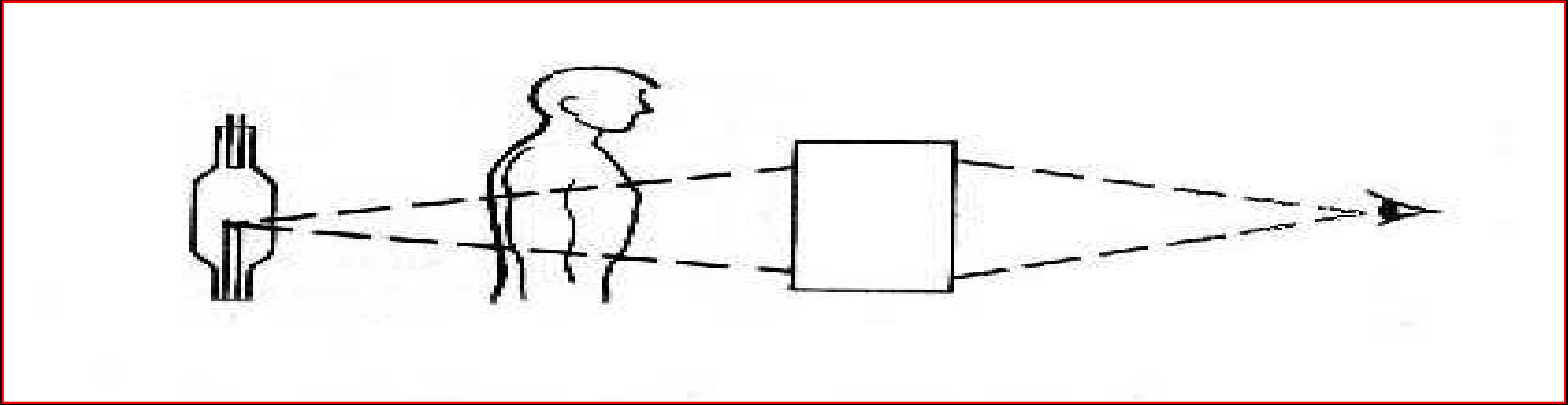




X-RAY

X-ray is high energy radiation.

X-ray beams can pass through our body, But they are absorbed in diferent. It depending density of the material.



Organs absorb x-rays differently and thus their shadow on the film is different.

As x-rays pass through the body, they are **attenuated** (absorbed and scattered) by interaction with body tissues

Tissues with a higher density will attenuate more x-rays and appear lighter (**radiodense**) on a plain film

Tissues with a lower density will attenuate fewer x-rays and appear darker (**radiolucent**) on a plain film

RADIO-OPACITY

- 1. Air, as found, for example, in the trachea and lungs, the stomach and intestine, and the paranasal sinuses.
- 2. Fat.
- 3. Soft tissues, e.g., heart, kidney, muscles (these are all approximately the density of water).
- 4. Calcific (due to the presence of calcium and phosphorus), for example, in the skeleton.
- 5. Enamel of the teeth.
- 6. foreign bodies, for example, metallic fillings in the teeth. Also radio-opaque

DIFFERENT TISSUES IN OUR BODY ABSORB X-RAY AT DIFFERENT EXTANTS:

- Bone-high absorption (white or gray) -
  Bones contain dense mineral-calcium. It blocks the x-rays.

- Tissue- moderate absorption (gray)

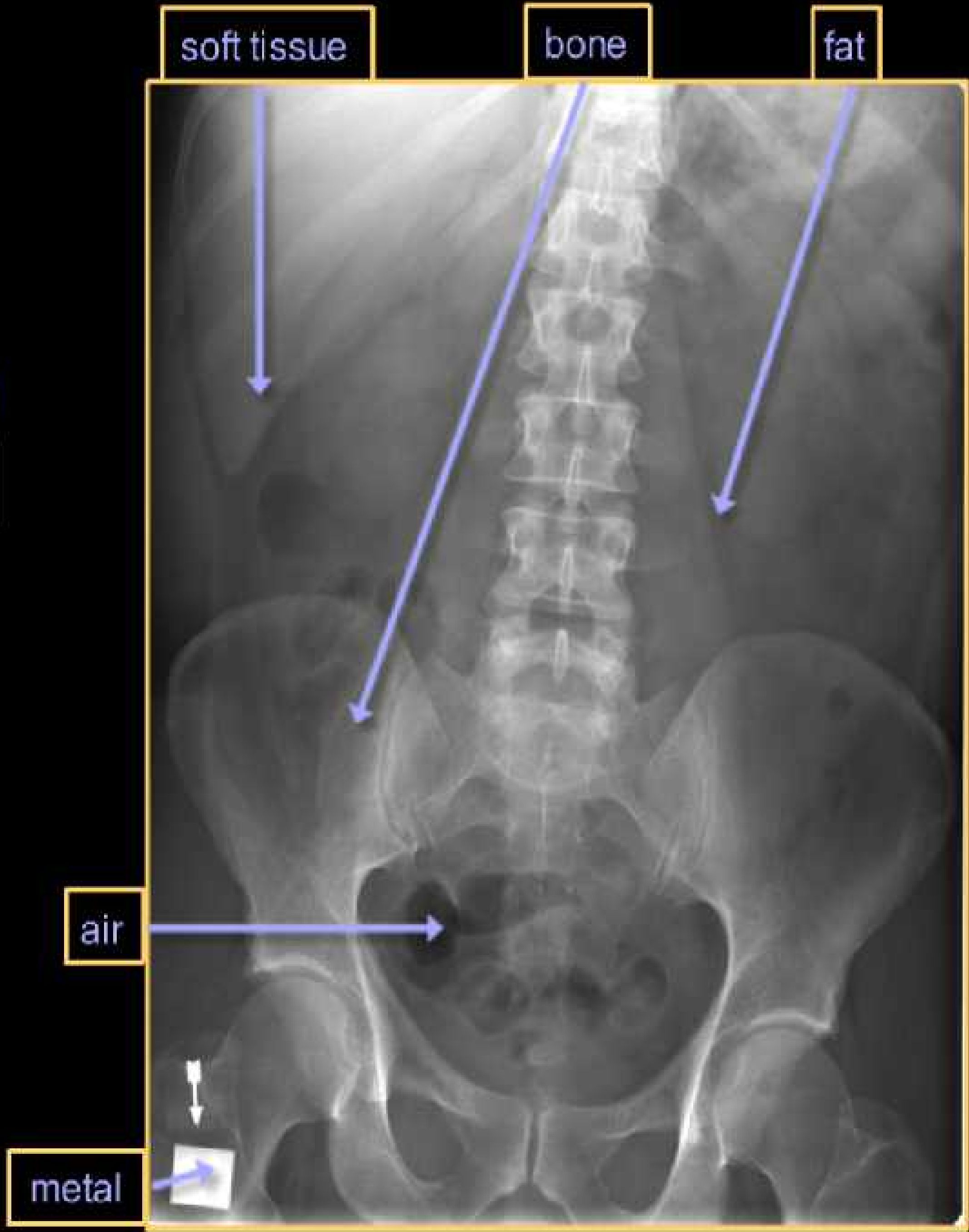
- Air- low absorption (black)

The 5 major densities found on radiographs are demonstrated in this image

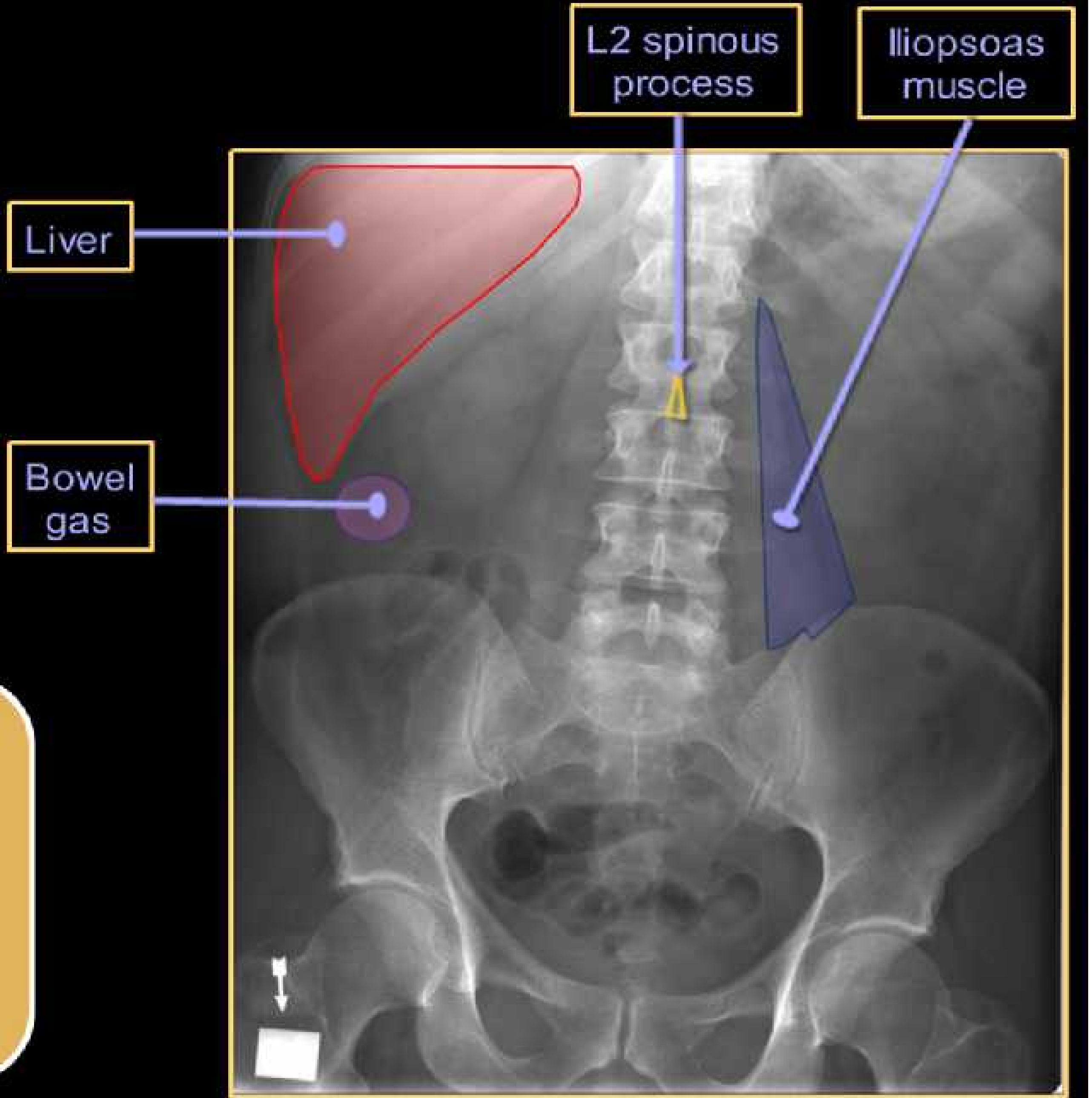
air - fat - water - bone - metal

Lower — Higher

Note that **THICK** structures attenuate more radiation than THIN structures of the same composition



Radiography



Anatomic structures are visible when they are outlined in whole or part by tissues of different x-ray densities

- Air- Black
- Fat- Dark gray
- WaTer (soft tissue, organs, muscles) -Light gray
- Bone (calcium) – White
- Metal- Very white

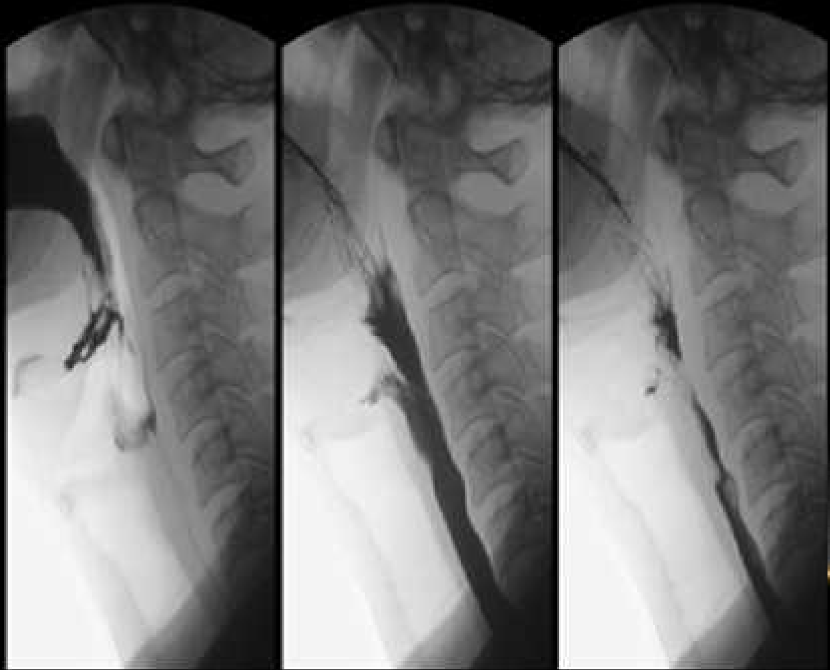
METAL IS THE MOST RADIODENSE OR RADIOPAQUE……AIR IS THE MOST RADIOLUCENT

MeTal is the most Radiodens or Radiopaque

Air is the most Radiolucent

- When the density of a structure is too similar to that of adjacent structures, it is possible to use contrast media to enhance or outline its contours.
- Contrast media are classified as radiolucent (e.g., air) and radio-opaque (e.g., barium or iodinated contrast media).

Barium Swallow



Contrast Agents

Intracavitary contrast (e.g. barium) for the GI tract (taken orally or introduced per rectum)

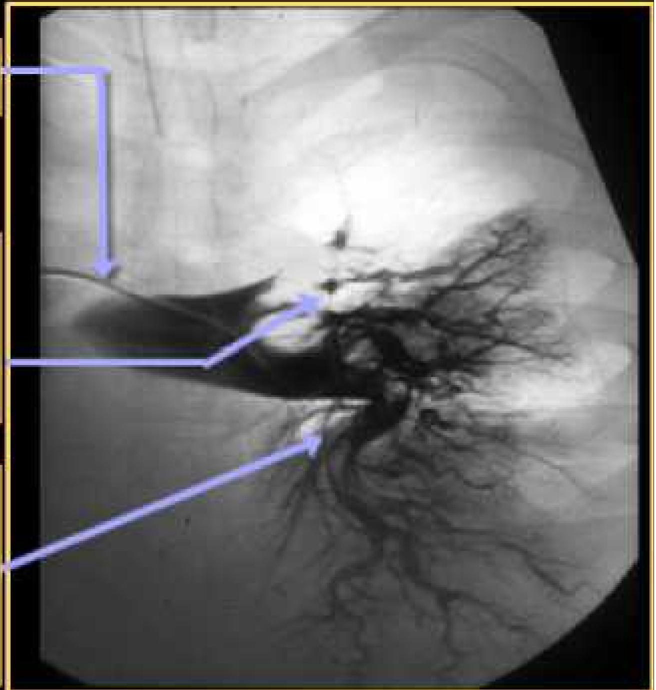
GI is normally full of air or fecal matter, but with barium appears radiodense

Intravenous agents to visualize arterial system (angiography)

Catheter

Filling defect: embolus in left pulmonary artery

Normally cannot visualize blood vessels without contrast



Adventages of X-ray imaging

- quick.
- painless
- non invasive test
- doesn't require special preparation
- X-rays don't remain in body after an x-ray examination, so the amoun of radiation is very small,
- It doesn't have side effects.

Disadventages of X-ray imaging

- pregnant women, because x-ray has harm influence for fetus (causing mutation).
- A higher risc of getting cancer
- X-rays makes demage of blood cells

Risks associated with radiation exposure

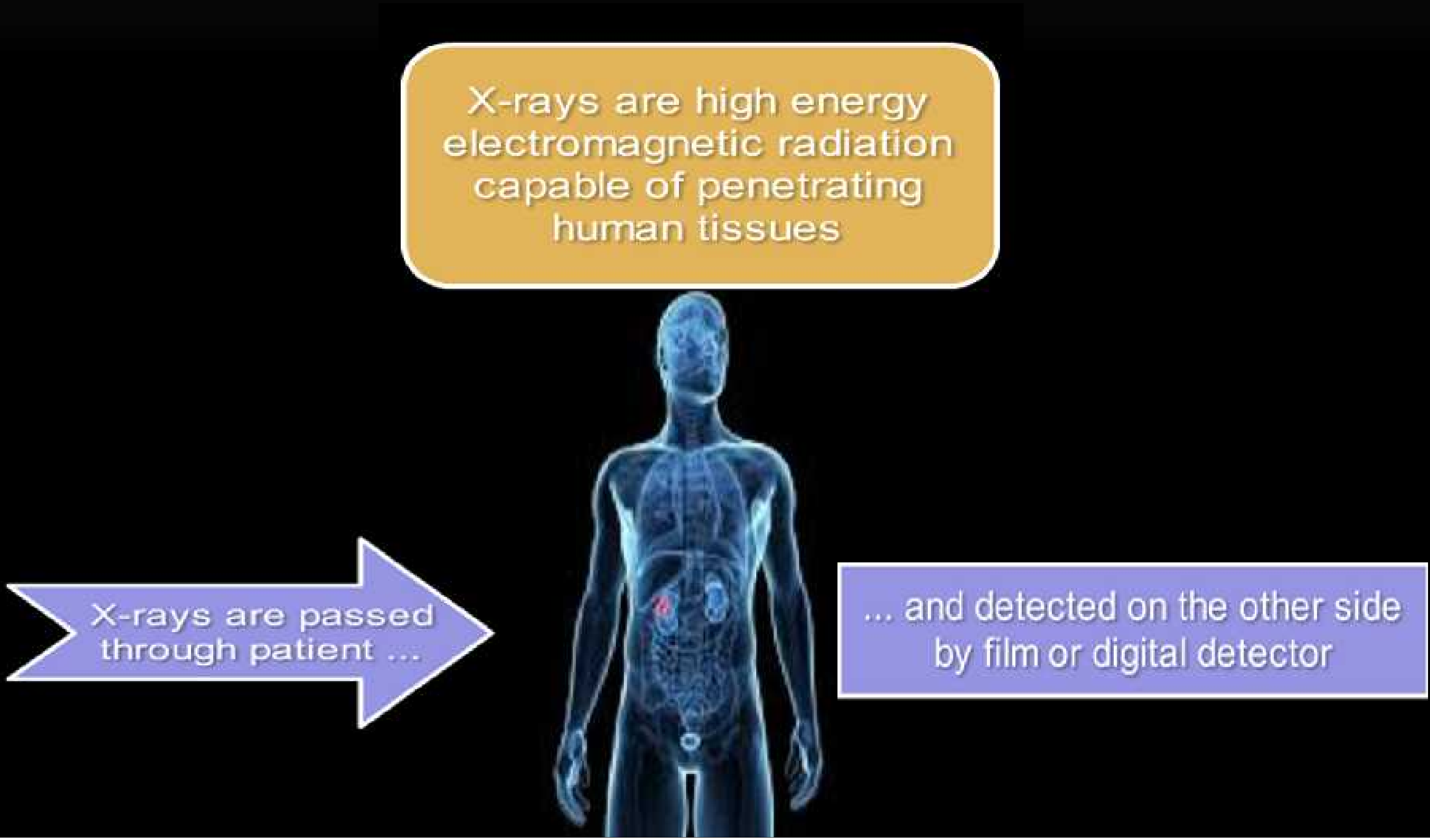
- It has long been known that radiation can cause a number of effects through genetic changes:
    - Cancer
    - Skin damage
    - Fetal abnormalities
- At the doses of radiation used in diagnostic Imaging the risk of these effects are normally very low

Overview of imaging modalities

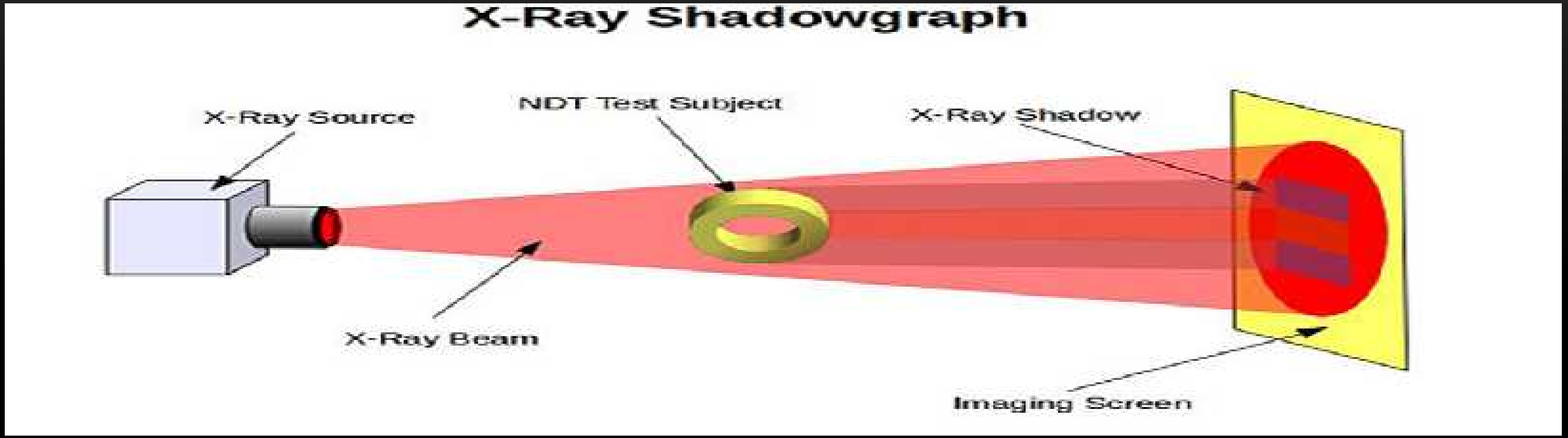
- X-ray Systems
    - Radiography (plain films, fluoroscopy, angiography)
    - Computed Tomography (CT)
- Magnetic Resonance Imaging (MRI)
- Ultrasound
- Nuclear Medicine (NM) / Positron Emission Tomography (PET)

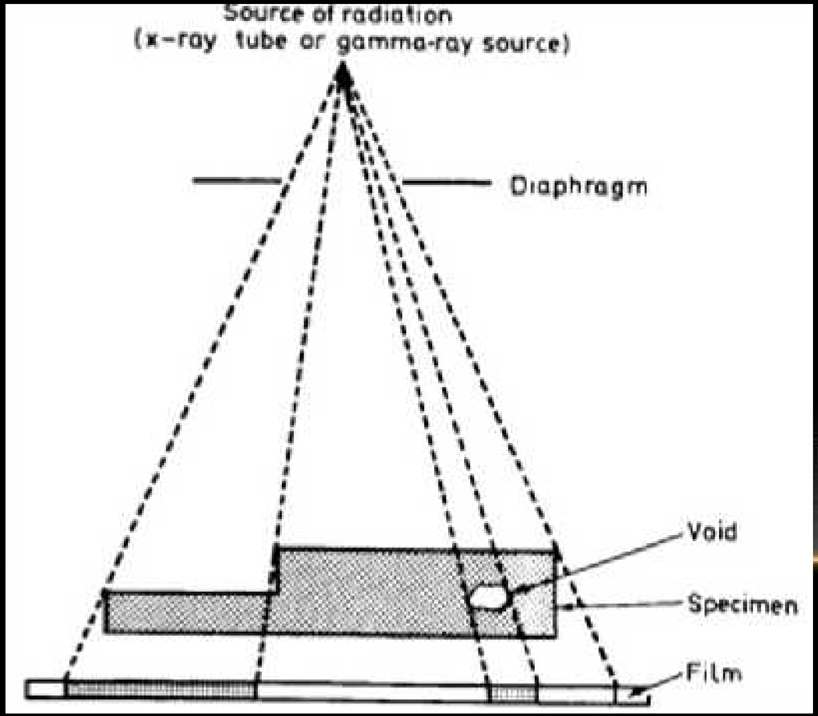
<u>Radiography</u> *(The most common examination in radiology)*

It's method, which uses penetrating radiation



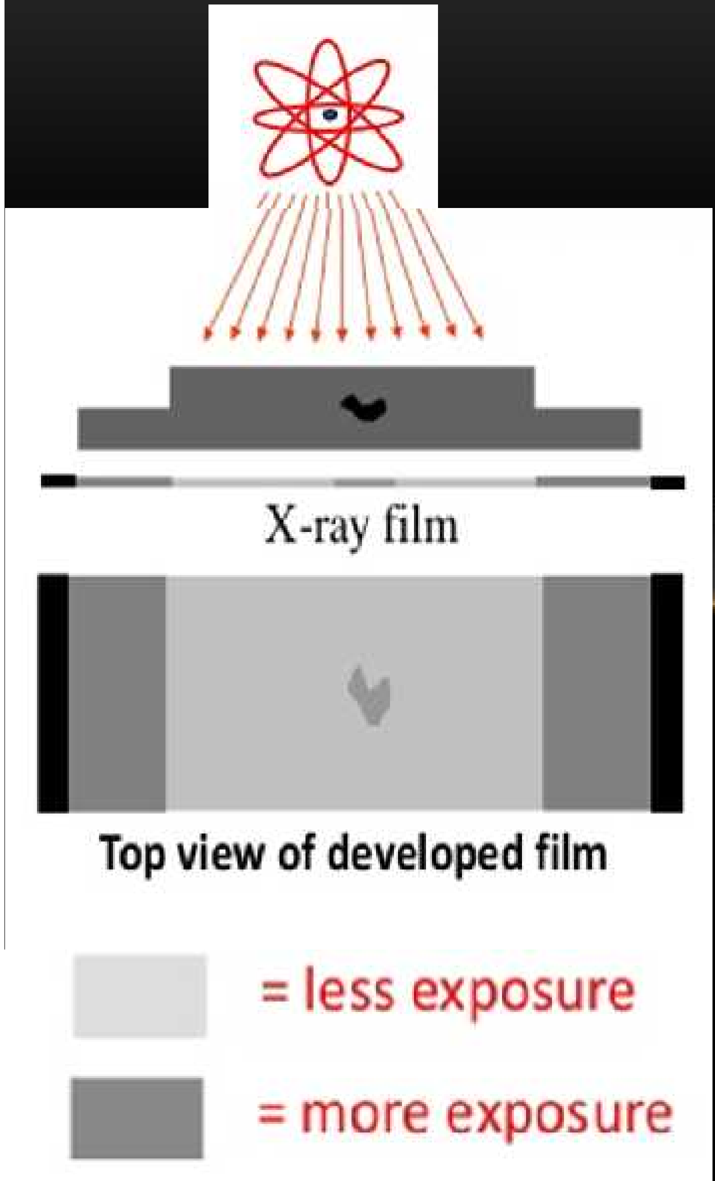
BASIC PRINCIPLE



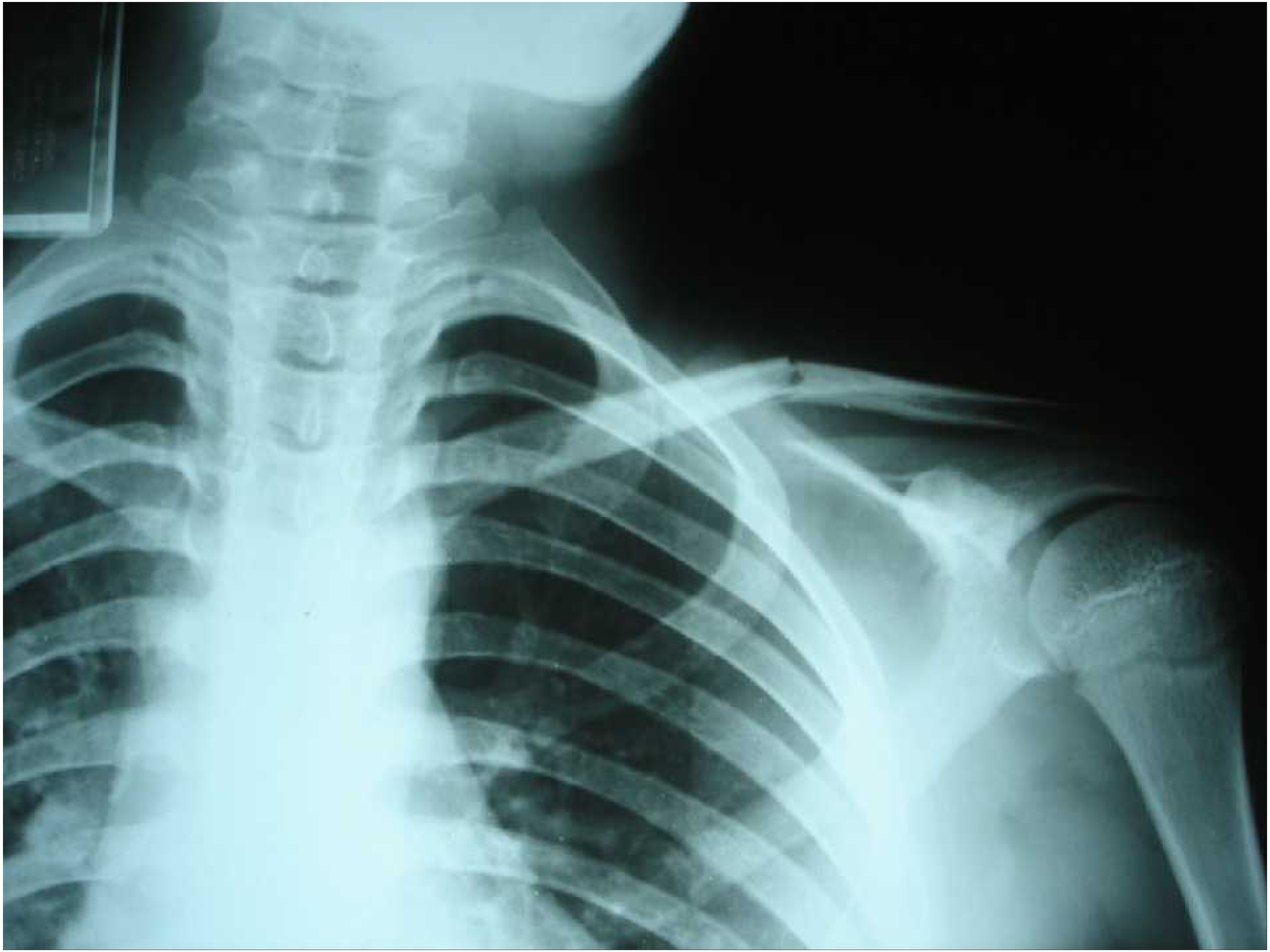


The part is plased between the radiation sourse and a piece of film. The part will stop some of the radiation. Thicker and more dense area stop more of the radiation

FILM DIAGRAM



The film darkness (density) will vary whith the amount of radiation reaching the film through the body material



Stationary X-ray Equipment

Portable X-ray Equipment

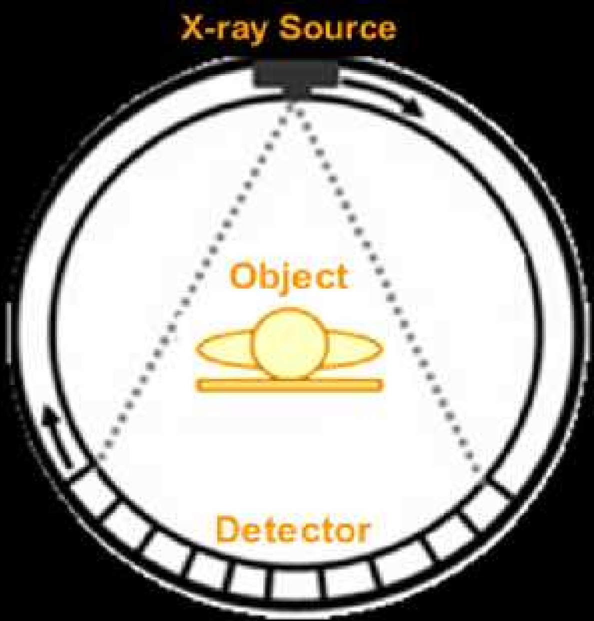
COMPUTERIZED TOMOGRAPHY (CT SCAN)

was the first of these revolutionary cross-sectional imaging procedures. In the 1950s, Sir Godfrey Newbold Hounsfield began working on the mathematical problem of using density calculations derived from x-ray beams directed through the body in multiple directions along a 360 degree arc (tomography) to construct a cross sectional image of the body. **The original CT scanners had a source of x-rays** on one side of the body and a detector on the other. After density measurements were made for this beam, the tube was rotated and another beam was passed through the patient and measured. This was continued around the entire patient (therefore, the “doughnut” shape of the CT scanner). The first functional CT scanner was constructed in 1972 and there was rapid development of this technology thereafter. Dr. Hounsfield received the Nobel Prize for this work in 1979 (along with Allan Cormack who independently worked on this problem). CT scanners have become significantly faster in creating the image by using multiple radiographic sources and detectors, but the principle of modern CT scanners are identical. A series of cross-sectional images (or “slices”), usually taken at 3mm to 1cm intervals, are collected through the body part. It is an important skill to be able to mentally visualize how the stack of slices fit into a 3-dimensional whole. Modern CT scanners, in addition to creating the common 2-dimensional images can mathematically reconstruct these images into a 3-dimentional images of the organ or body part of interest.

Limitations for the technology include the necessity for the patient to be quite still (although the speed of the test is improving) and also that the images can only be created in the plane of the gantry (the doughnut-shaped machine). It also uses ionizing radiation (x-rays) so it is not without hazard. Its ability to resolve difference between tissues of similar radiographic density has limits. However, it is of particular utility in trauma situations where it may detect fractures that are invisible to conventional radiographs and where clotted blood (for example due to traumatic hemorrhages) has a high radiographic density that can be easily seen.

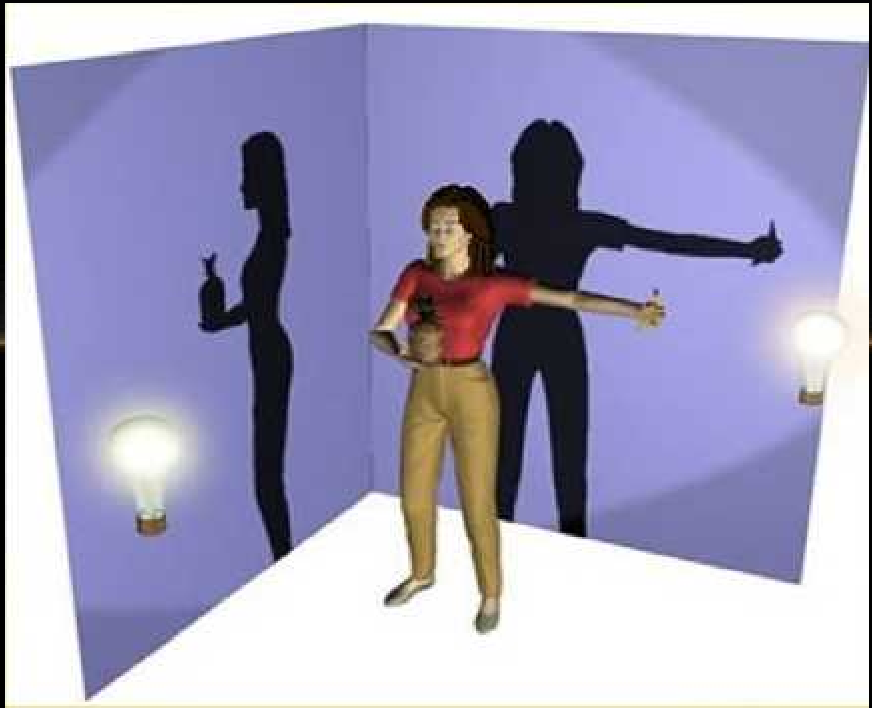
Computed tomography

- Similar to radiography in that it uses ionizing radiation from source to produce an image.
- Source and detector rotates 360° around patient (modern scanners less than 0,5s)
- cross-sectional image, computer uses number of profiles to constract 3D information in 2 slices



COMPARISON OF CT WITH CONVENTIONAL RADIOGRAPHY

A conventional X-ray image is basically a shadow. Shadows give you an incomplete picture of an object's shape



In ct scan machine, the X-ray beam moves all aroun the patient and scanning defferent angles.

Ct-slice thikness is very thin, from 1mm to 10mm.

Sir Godfrey Newbold Hounsfield.

1919-2004.

CT for brain: 1972-73.

CT for whole body: 1975.

Worked on NMR.

EMIDEC 1100.

Magnetic films for information storage.

Nobel prize in 1979.

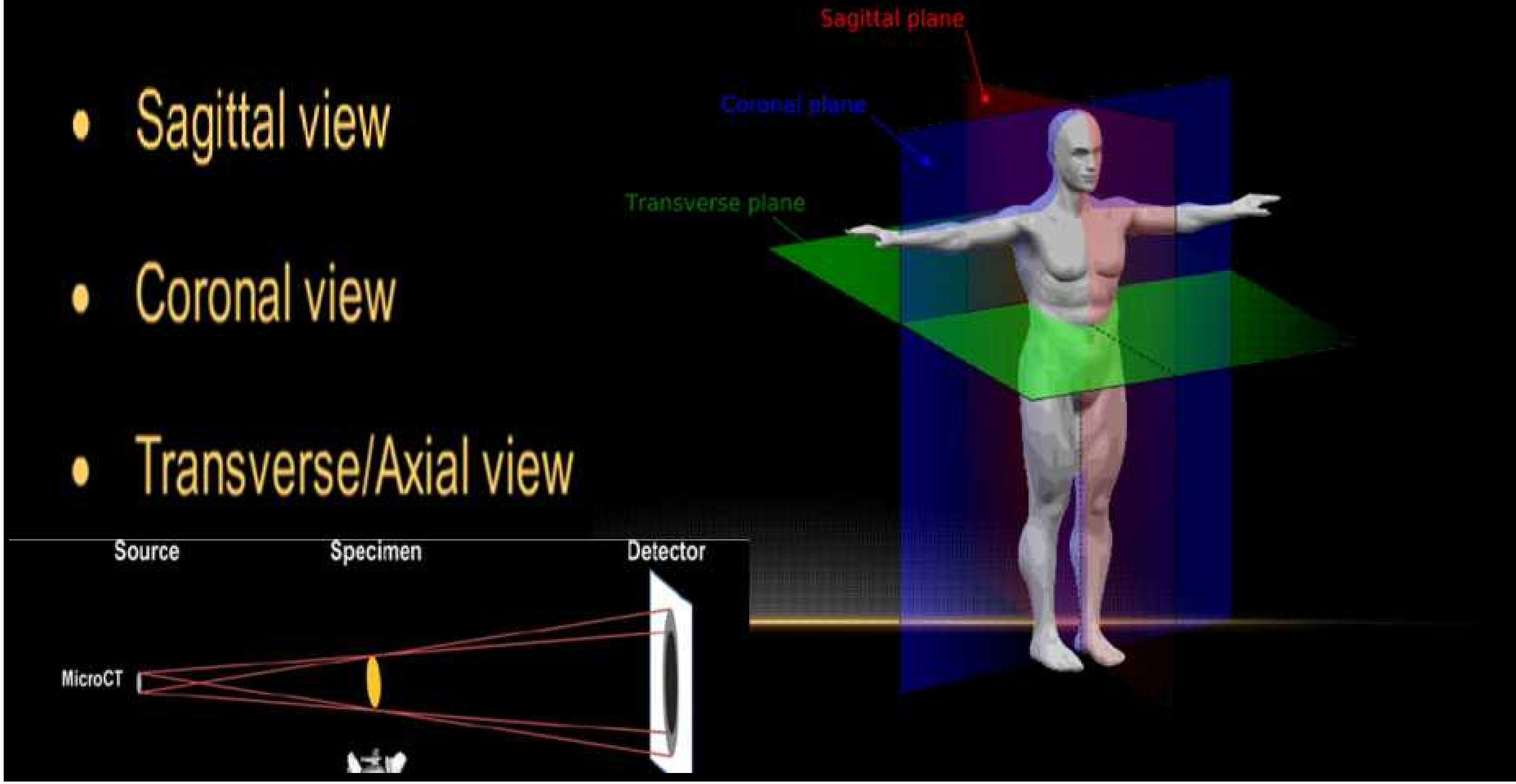
Knighted in 1981.

GN Hounsfield with his initial working prototype CT machine

- A **complete scan** is formed by rotating the x-ray tube completely around the body and projecting many views.
- Each view produces one **"profile" or line of data.**
- The complete scan produces a **complete data set.**
- In principle, **one scan produces data for one slice image.**
- However, with spiral/helical scanning this is not true.

COMPUTERIZED TOMOGRAFI (CT SCAN)

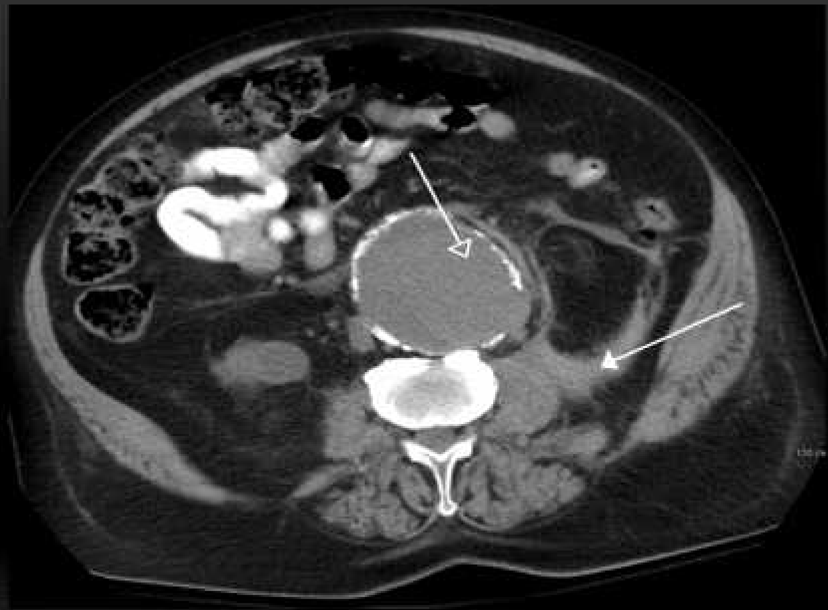
combines a series of x-ray views taken from many different angies to produce cross sectional images of the bones and soft tissues

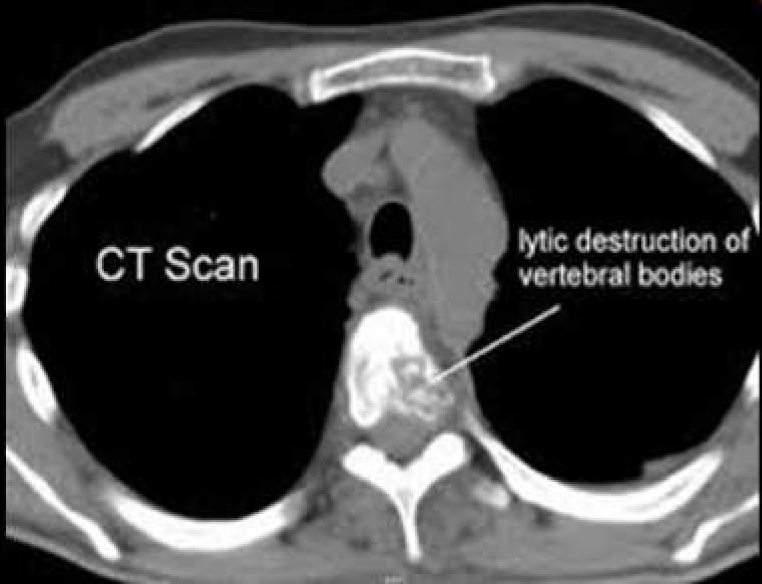


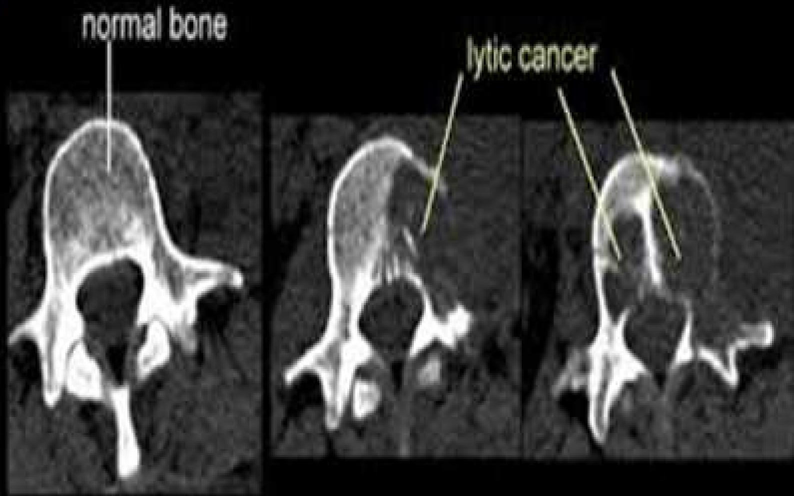
Computed Tomography (CT)

When X-rays are irradiated on the human body, some of the rays are absorbed and some pass through the body to produce an image.

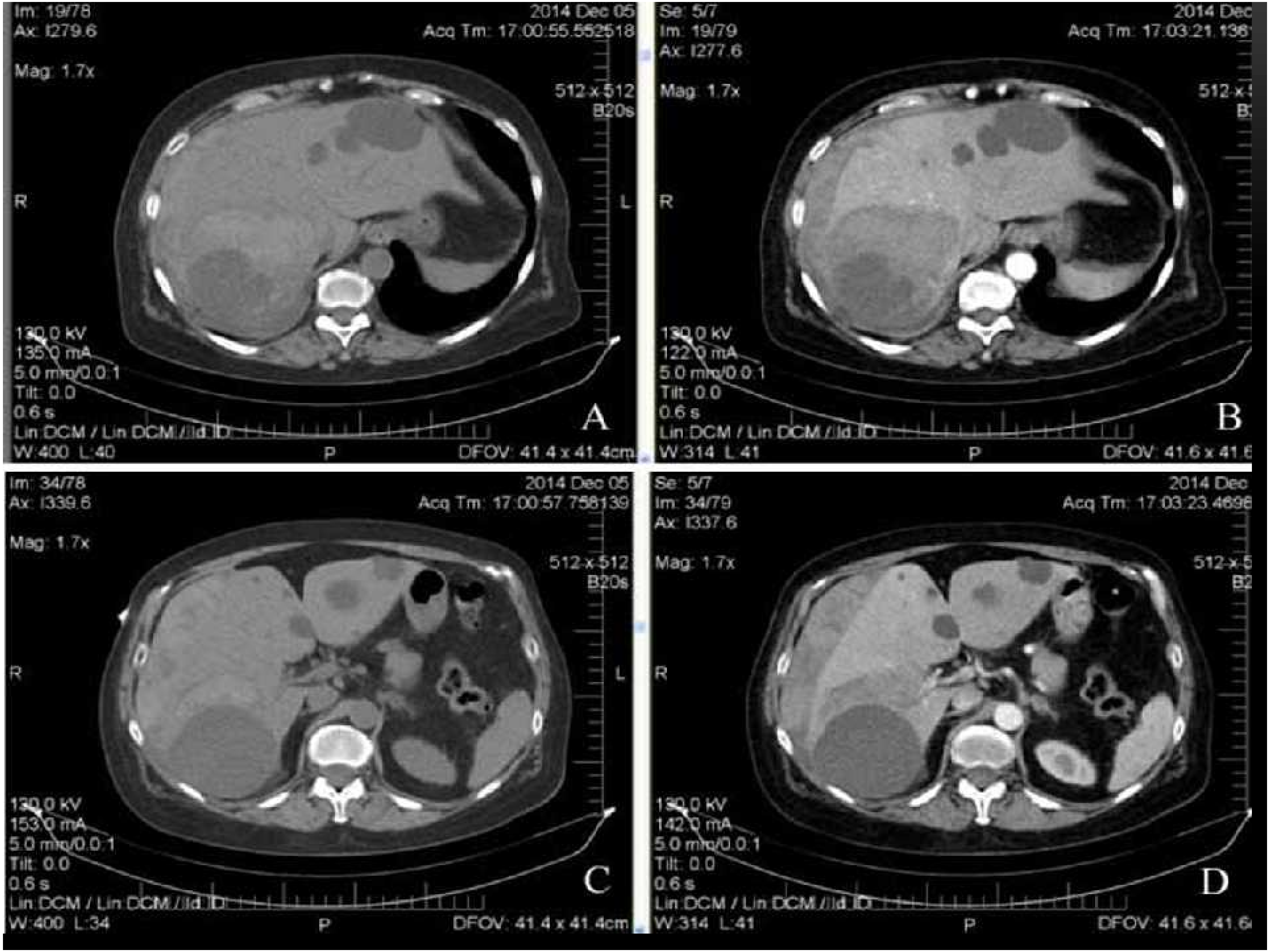
In CAT scanning, an electronic device called a "**detector array**" absorbs the penetrated X-rays, measures the X-ray amount, and transmits the data to a computer system. A sophisticated computer system, in turn, calculates and analyzes data from each detector in each level, and finally reconstructs multiple, two-dimensional, cross-sectional images.







Renal Cell Carcinoma Metastatic to Lumbar Vertebrae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DFOV: 41.4 x 41.4cm
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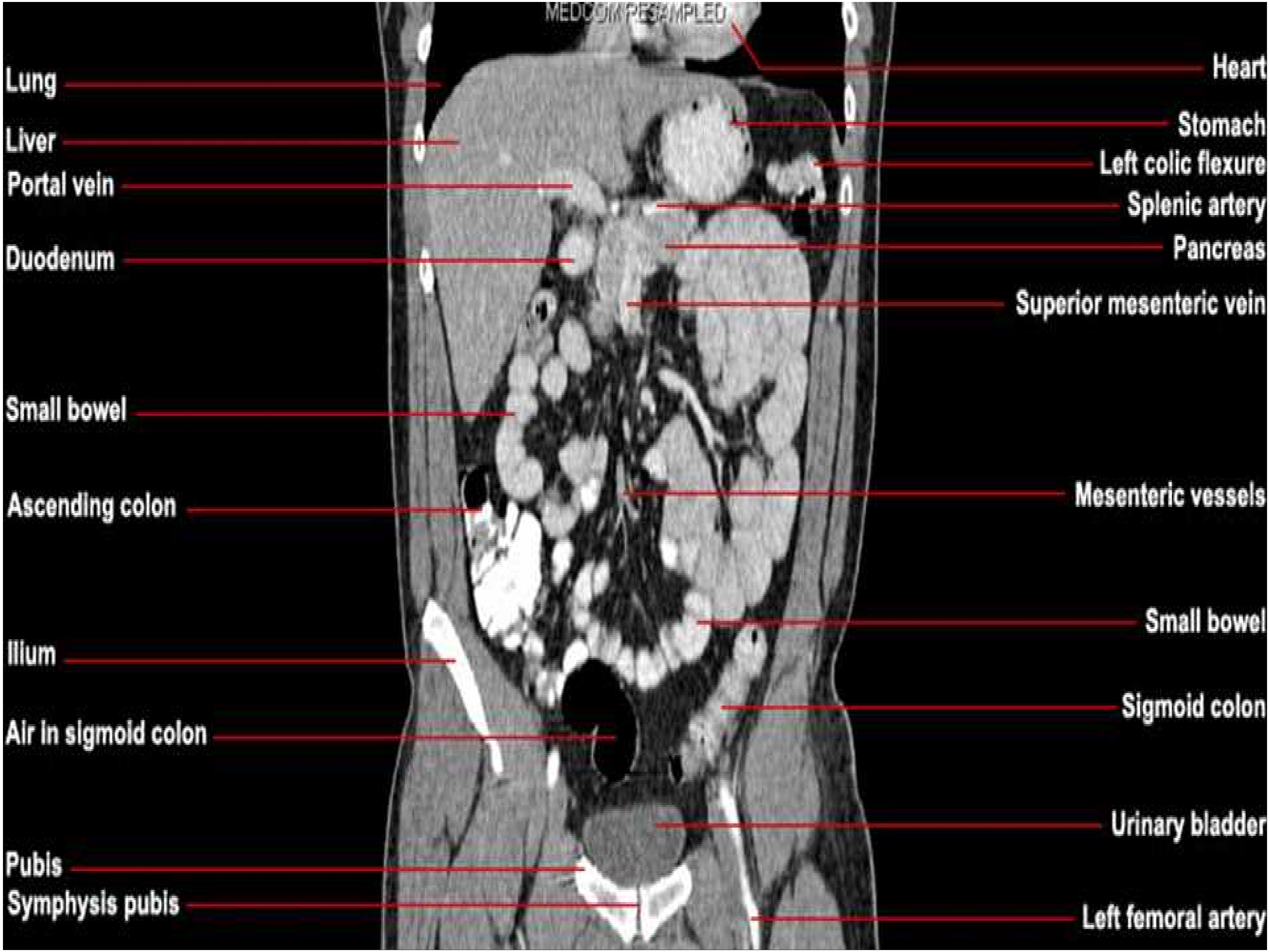
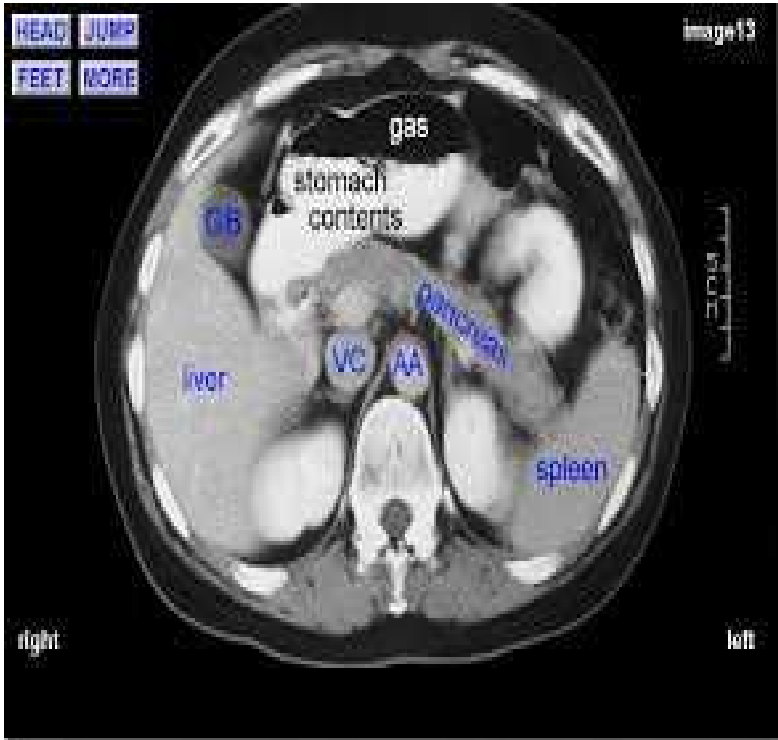


MEDCOM RESAMPLED
Lung
Liver
Portal vein
Duodenum
Small bowel
Ascending colon
Ilium
Air in sigmoid colon
Pubis
Symphysis pubis
Heart
Stomach
Left colic flexure
Splenic artery
Pancreas
Superior mesenteric vein
Mesenteric vessels
Small bowel
Sigmoid colon
Urinary bladder
Left femoral artery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JUMP
FEET
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gas
stomach
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AA
liver
spleen
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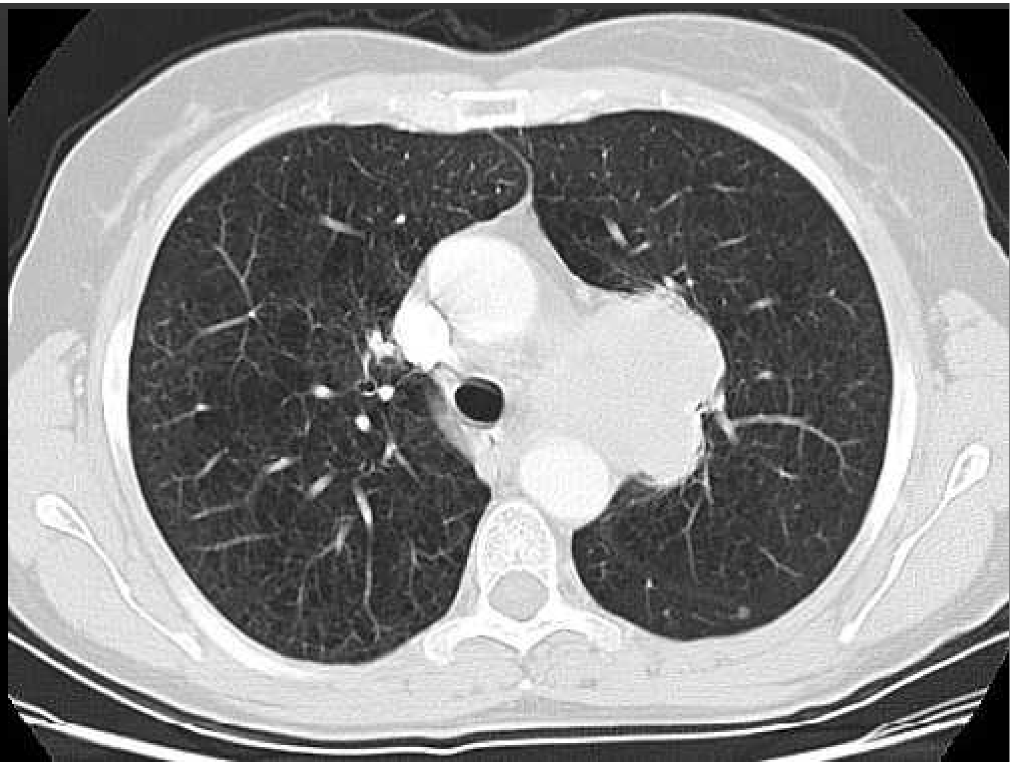
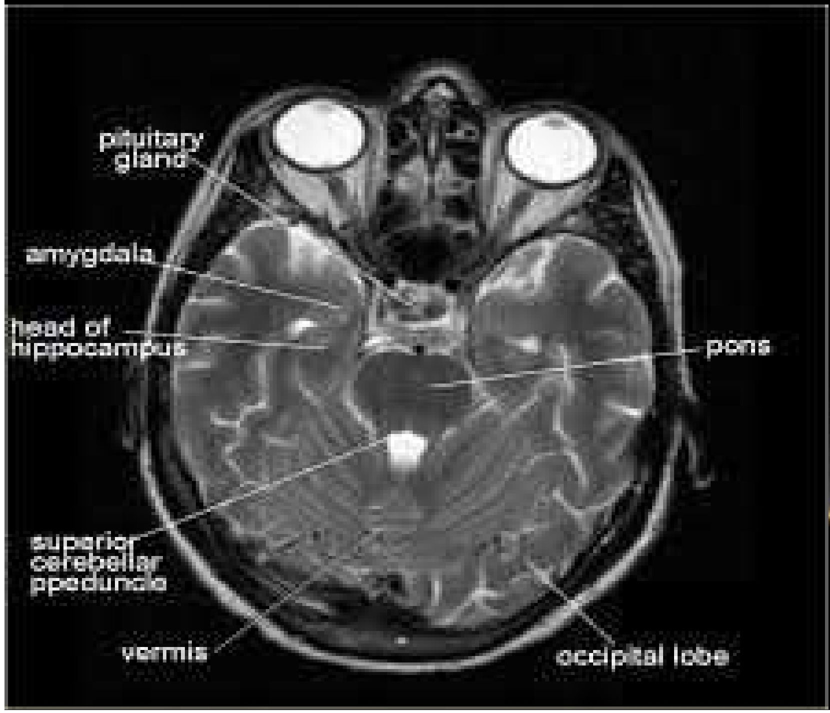
left




pituitary
gland
amygdala
head of
hippocampus
pons
superior
cerebellar
ppeduncle
vermis
occipital lobe




Radiation Exposure

- The organ most radio-sensitive is the thyroid gland
- Tumors likely to occur after exposure to ionizing radiation include leukemia, thyroid, breast, lung and skin
- A rad is a measure of absorbed dose
- Radiation associated with head CT is greater than that associated with chest x-rays (4000 vs. 12 millirads)

Methods to reduce radiation exposure

- Reduction in unnecessary examinations (e.g. daily ICU films)
- Dose reduction (CT)
- Exposure time reduction (fluoroscopy)
- Use of US and MRI (non-ionizing)

THANK YOU FOR YOUR ATTENTION!

BONE RADIOLOGY

(Part II)

MAJOR TYPES OF IMAGING

- X Ray systems

  -Radiography

  -Combputed Tomography (CT)
- Magnetic Rezonance Imaging (MRI)
- Ultrasound
- Nuclear Medicine (NM)/ Positron Emission Tomography (PET)

- Bone scan (scintigraphy)
- Bone densitometry

Similar imaging theme (for all modalities)

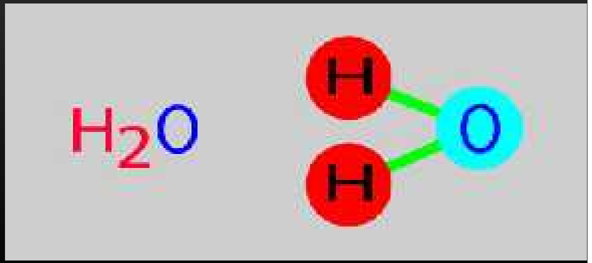
Signal (x-radiation or sound) is projected at or through tissue

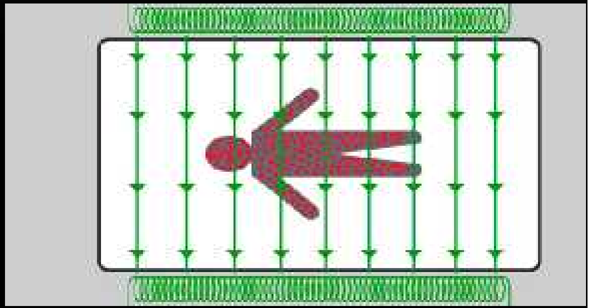
Tissue changes signal (absorbs, scatters, reflects, selectively takes up source, etc)

Changed signal provides information that is used to construct an image

MAGNETIC RESONANCE IMAGING

Magnetic resonance images are another method, creation of cross-sectional images. However, this does not involve the use of ionizing radiation. In the 1970s, Paul Lauterbur described the possibility for using magnetic fields for creating images of the human body, while much of the mathamatics of the process was worked out by Peter Mansfield. These investigators received the Nobel Prize in 2003 for their work and the applications of magnetic resonance in medicine have explod





The fundamental principle behind MRI is that polarized molecules in the body (the most ubiquitous being water) will align themselves when placed in a strong magnetic field. When subject to a pulse of radio waves, many of these aligned molecules will absorb energy and will be displaced from their aligned position. As these molecules return to alignment they will give up their energy, which can be detected. Additionally, the molecules will wobble their way back to alignment giving up successive small bursts of energy (termed "echos"). The ability of water molecules to move within the magnet vary with the chemical environment of the molecules. Therefore, each tissue will have its own characteristics as will each type of pathology. Variables in the creation of the image include the duration and frequency of the radio pulse as well as the timing of collection of the returning signal. The returning signal is collected by detectors arrayed around the body part and a series of images can be created by computer modeling in any desired plane.

Limitations to the technology include the fact that some objects are interfered with (such as pacemakers) or can be displaced (such as certain types of metal clips) by the magnetic field. Additionally, since it takes quite a long time to create an image, any movement can degrade the quality.

History of MRI

In 1937, Columbia University Professor Isidor I. Rabi working in the Pupin Physic Laboratory in Columbia University, New York City, observed the quantum phenomenon dubbed nuclear magnetic resonance (NMR). He recognized that the atomic nuclei show their presence by absorbing or emitting radio waves when exposed to a sufficiently strong magnetic field.

The method is based on measuring the spin of the protons in the atom's core, a phenomenon known as nuclear magnetic moments

theProfessor Isidor I. Rabi received the Nobel Prize for his work. He is one of 28 Nobel Laureates from the Pupin Physics Laboratory in New York City.

Raymond Damadian, a physician and experimenter working at Brooklyn's Downstate Medical Center discovered that hydrogen signal in cancerous tissue is different from that of healthy tissue because tumors contain more water. More water means more hydrogen atoms. When the MRI machine was switched off, the bath of radio waves from cancerous tissue will linger longer then those from the healthy tissue.Less than two

Felix Bloch

Edward Mills Purcell

Paul Christian Lauterbur

MRI is an imaging technique used primarly in medical setting to produce high quality images of the soft tissues of the human body

It is based on the principles of nuclear magnetic resonance

Magnetic resonance imaging (MRI), or nuclear magnetic resonance imaging (NMRI), is primarily a medical imaging technique most commonly used in radiology to visualize detailed internal structure and limited function of the body.

Looks like a CT but much different!

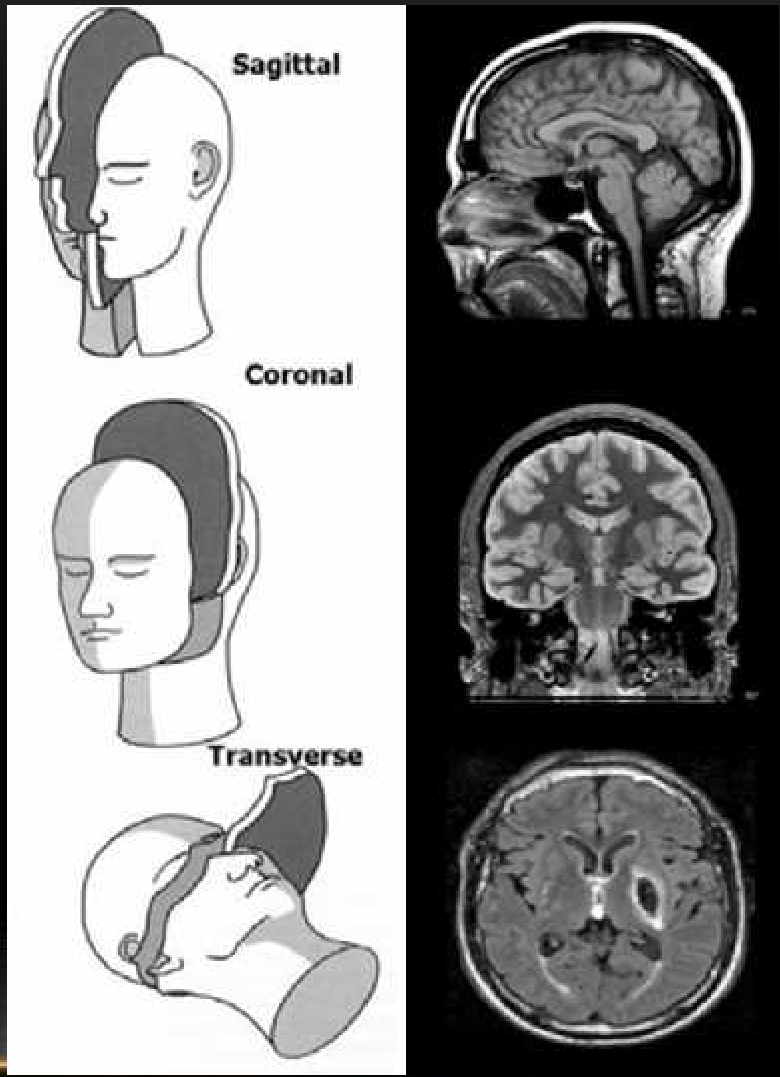
Magnetic Resonance Imaging (MRI)

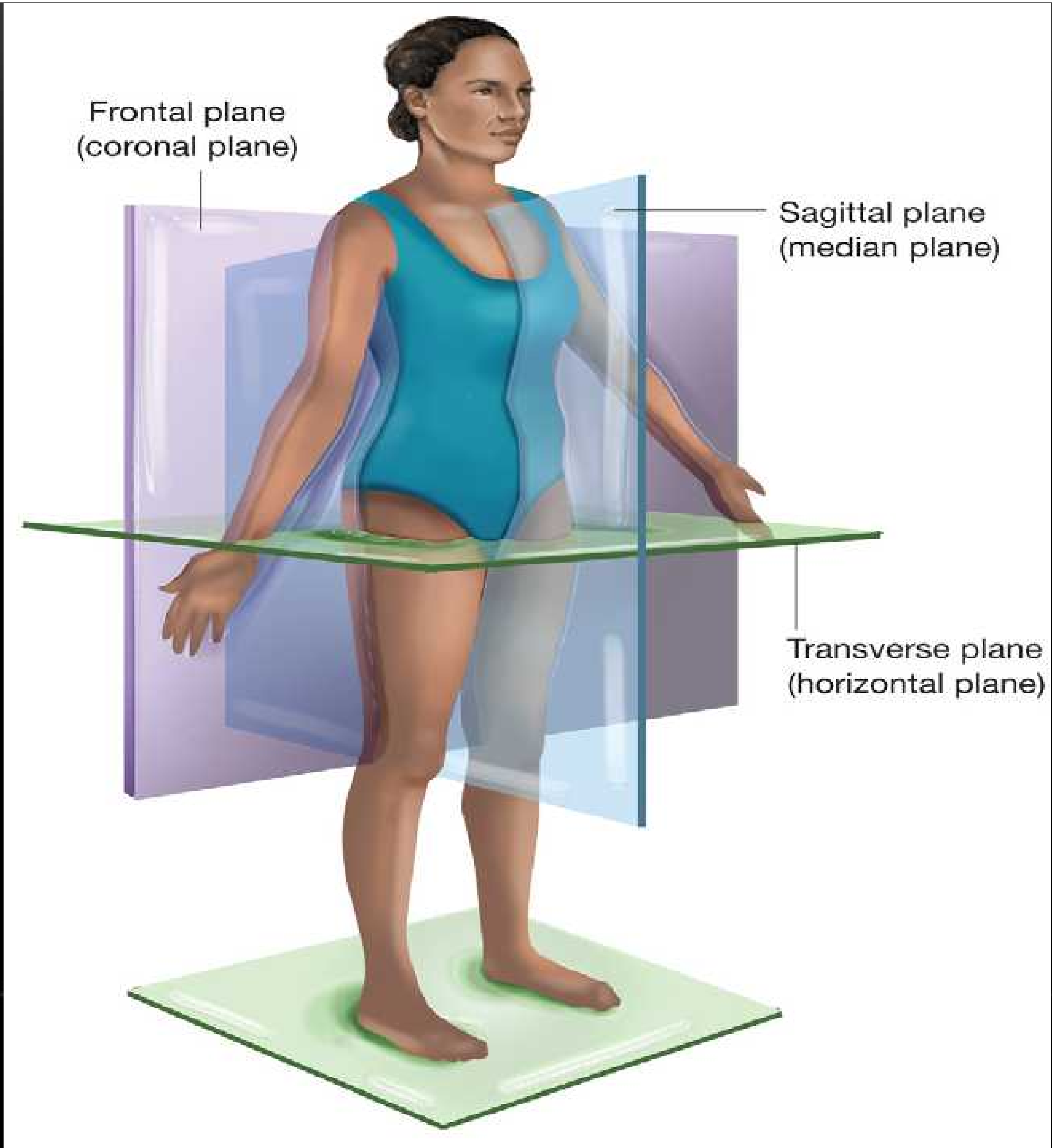
- Protons in a strong magnetic field are bombarded with low energy (**non-ionizing**) radio waves

- In different tissues (environments) they absorb and release the energy at different, detectable, and characteristic rates

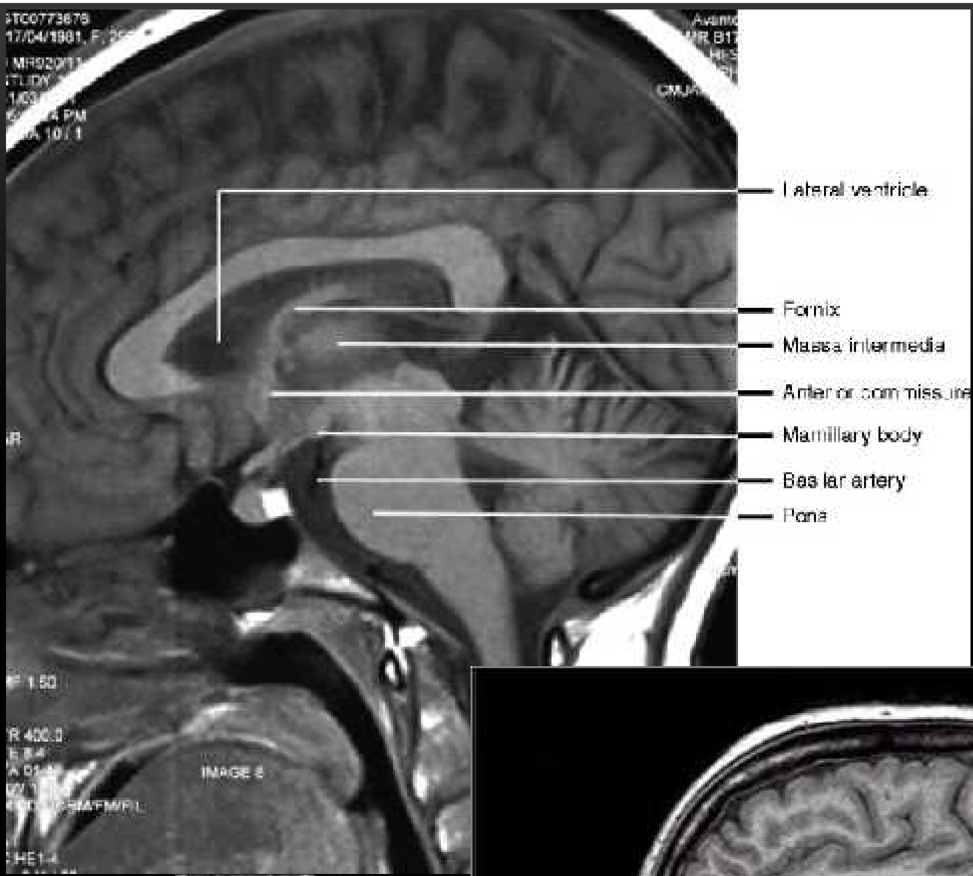
Mri views

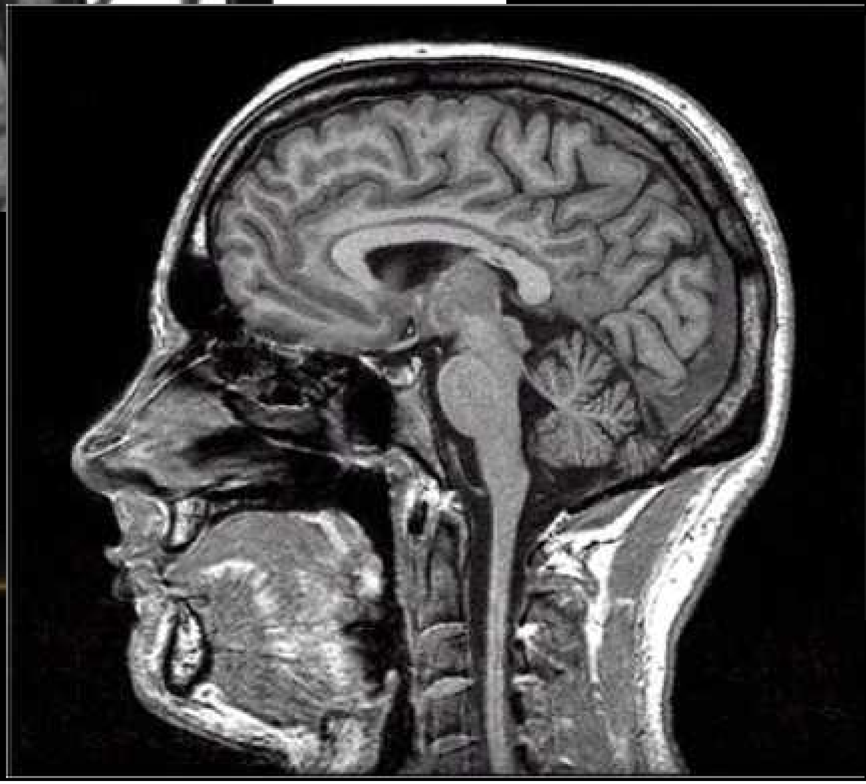
- Sagittal view
- Coronal view
- Transverse/Axial view

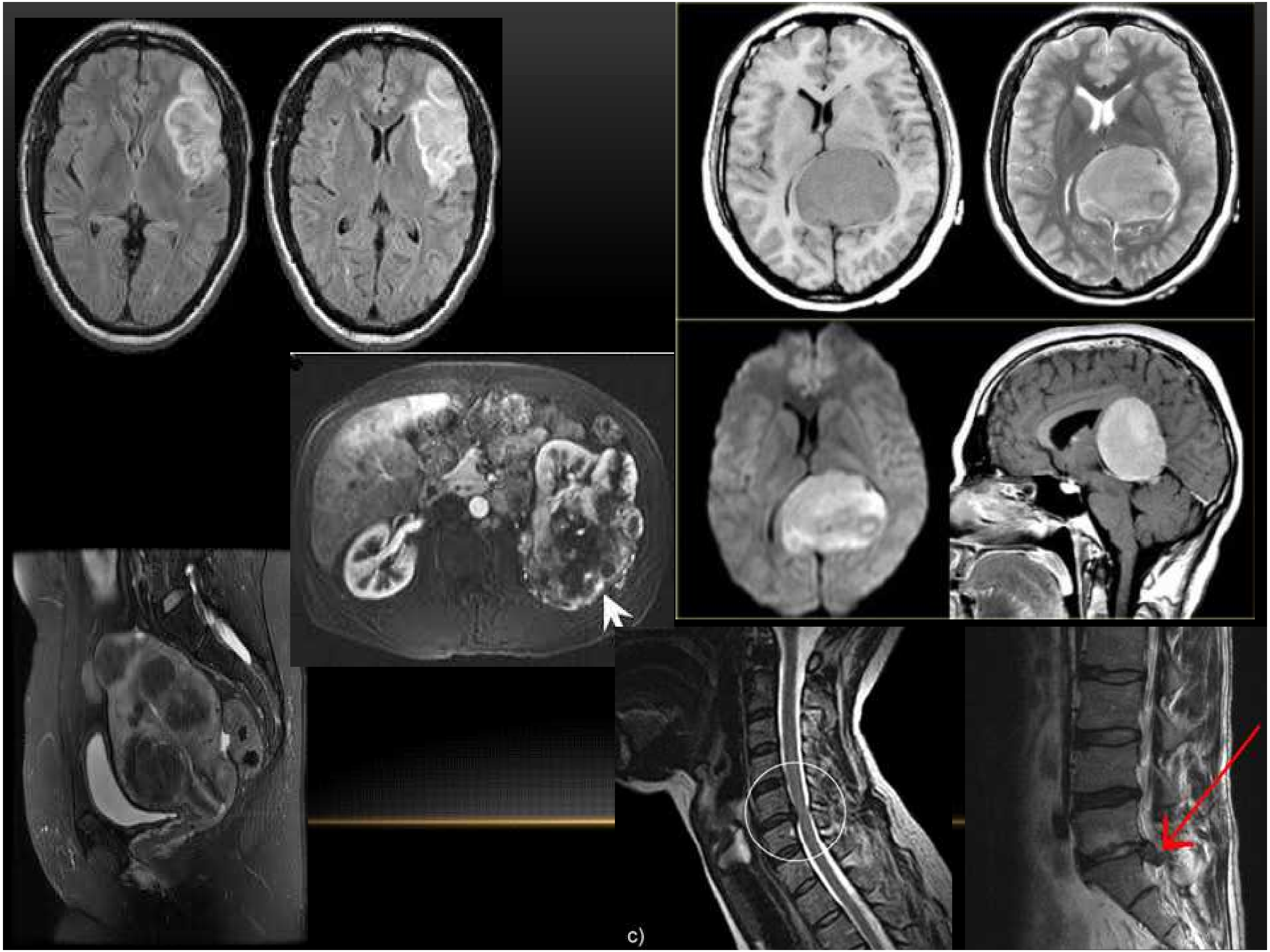



Frontal plane
(coronal plane)
Sagittal plane
(median plane)
Transverse plane
(horizontal plane)

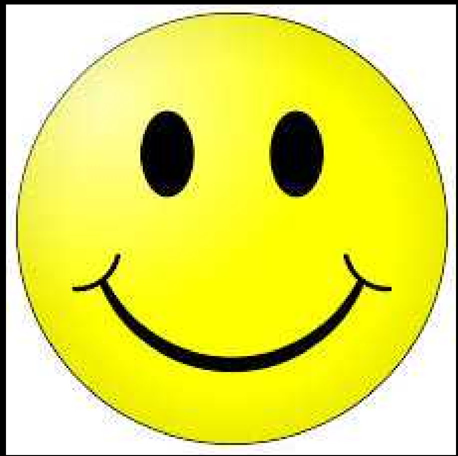



Lateral ventricle
Fornix
Massa intermedia
Anterior commissure
Mamillary body
Basilar artery
Pons
IMAGE 6




c)

STRENGTHS AND WEAKNESSES



RADIOGRAPH STRENGTHS AND WEAKNESSES

- Quick
- Painless
- Non invasive test
- Doesn't require spetial preparation
- X rays don't remain in body after an x ray examination, so the amount of radiation is very small
- It doesn't have side effects
- chief

- Pregnant women, because x-ray has harm inffluence for fetus (causing mutation)
- Higher risc of getting cancer
- No 3D reconstraction

CT STRENGTHS AND WEAKNESSES

- Excellent bone detail
- Good soft tissue contrast
- CT angiography (use of contrast in blood vessels
- 3D image rendering

- AvailabilitY
- Cost (though less expensive than MRI)
- Radiation
- Weight limitation 160 kg
- Contrast complication (allergies, nephrotoxicity)
- Artefact with metal

MRI STRENGTHS AND WEAKNESSES

- Excellent soft tissues contrast
- No radiation
- MR angiography
- *Godolinium IV*-contrast isn't neprotoxic and may be used in setting of renal failure

- Availability/cost (very expansive)
- Procedure time (immobile, elderly, sick patients, children… Movement can severly affect image quality
- Poor for bone details
- Metal and other artifacts
- Risk of complications related to magnetic metal implants (pacemakers, aneurysm clips etc.)
- Rare serious contrast reaction

CT versus MRI

CT

+Excellent bone imaging

+Excellent new acute hemorrhage detection

+Skull fracture, calcified lesion

+Short scan time, metal devices allowed

-Poor contrast and resolution

-Radiation

MRI

+Excellent grey/white matter contrast & spatial resolution

+Better for old hemorrhage (and new with Diffusion?)

-Long scan time

-Pts cannot have metal devices

-Claustrophobia, obesity problems

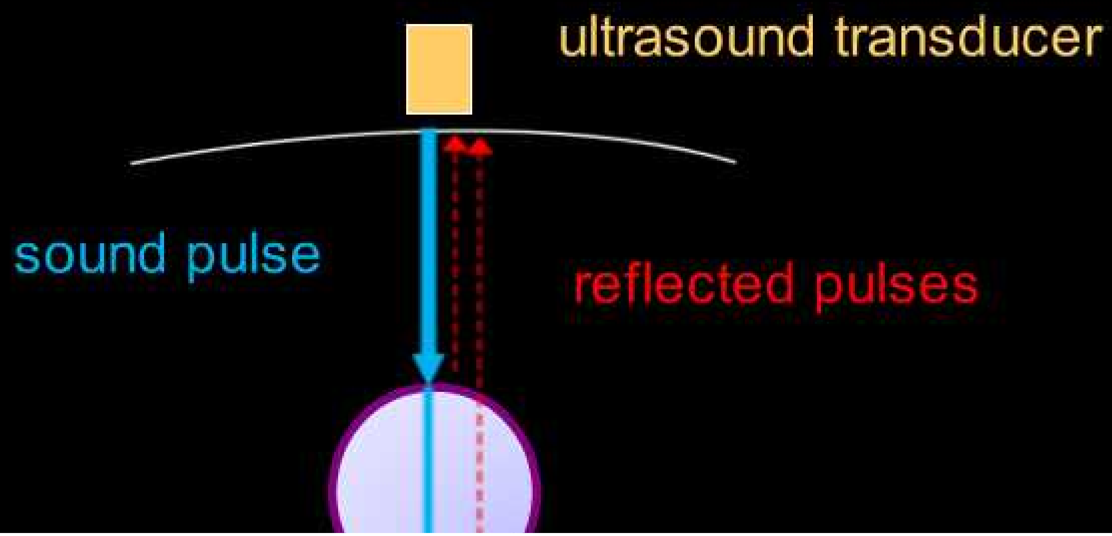
+No radiation

Ultrasound (US)

- High frequency sound waves
- Sound reflected by body structures is converted to grey image
- Doppler ultrasound uses the principal that flow changes the sound frequency, can detect blood flow
- First line imaging for heart

Ultrasound (US)

- Ultrasound imaging relies on sound echoes from tissue interface the body
- Strength of reflections depends upon the difference in acoustic properties of the interface tissues
- **Bone and air reflect virtually all the sound** so US cannot be u near bone or the lungs very well.

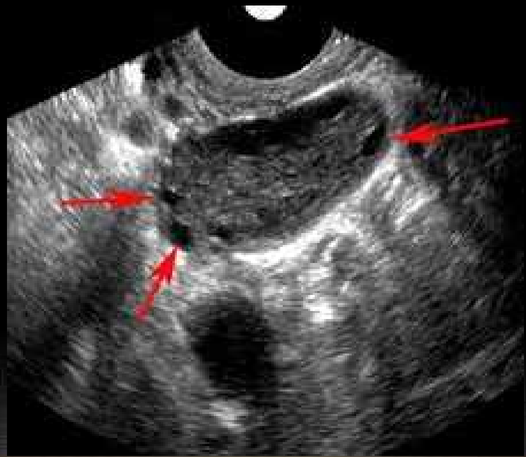


Ultrasound Imaging

- Determination of cystic (fluid-filled) vs. solid structures - cysts do not reflect sound and are anechoic
- Evaluation of:
    - bile ducts
    - gall bladder
    - renal/ovarian/breast cysts
    - hydronephrosis, etc.
    - evaluation of stones
    - gall stones
    - renal calculi
- Evaluation of abdominal and pelvic organs

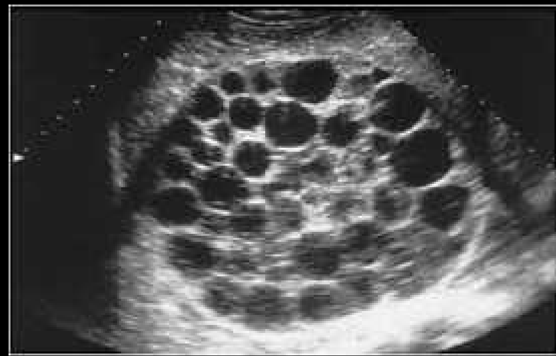

Abdomen
Liver / hepatic veins


Abdomen
Kidney




GB DECUB


MULTIPLE LIVER MASSES




Abdomen
Renal stone

Fetus estimate

X - R A Y

we can’t performed radiation during pregnancy, because it harmful to the fetus

Imaging in pregnancy

No proven risk to fetus of ultrasound

No proven risk to fetus of MRI, but avoid in first trimester if possib

Importance of performing examinations if medically necessary

Importance of re-evaluating "set protocols" e.g. trauma protocols in a
pregnant patient

- Dose reduction
- Shielding

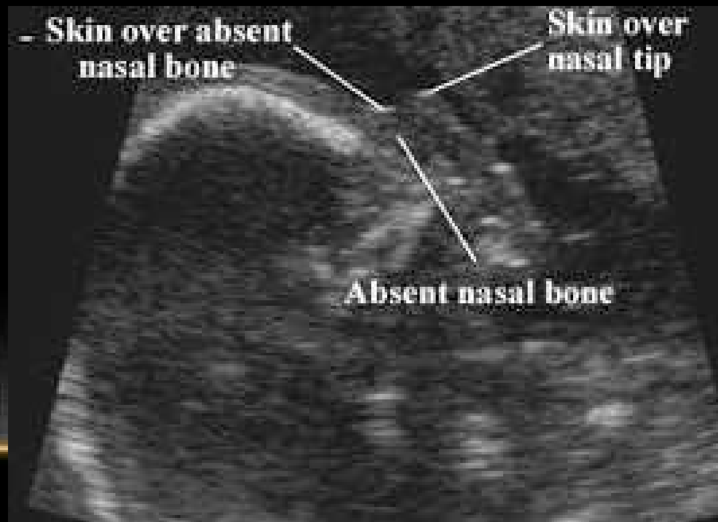
Note shielding **unhelpful in nuclear medicine** - bladder emptying ar
hydration most helpful

Studies that should be performed only if absolutely necessary with
shielding if possible


HAND


TW B
TW A

Figure 1. Image of fetal facial profile with nasal bone length.



ULTRASOUND STRENGTHS AND WEAKNESSES

- No radiation
- Chief
- Modality of choice to examine the heart
- Real time
- Can be performed at bedside
- Most sensative for fluid

- Difficult in obese patient
- View often obscured by air-lungs, bowel, bone
- Operator dependent

Nuclear Medicine

Branch of radiology that utilizes **intravenous radio-pharmaceuticals** for imaging

↓

Radio-pharmaceuticals which may be deposited in certain tissues **emit gamma rays**

↓

The rays are **detected by a gamma camera**

NUCLEAR MEDICINE

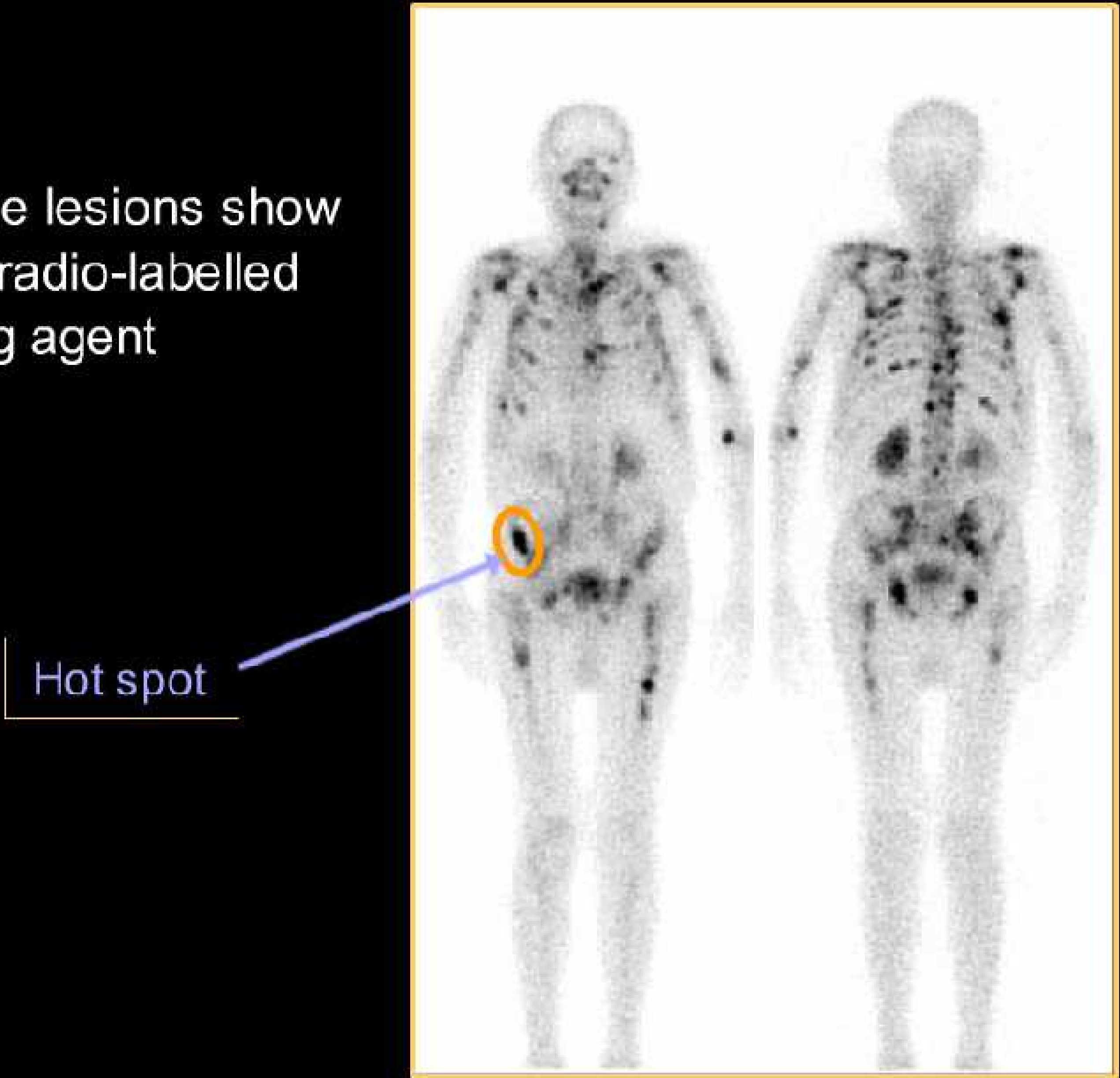
Nuclear medicine scans bridge the border of anatomy and physiology. They typically involve the delivery of a radioactive contrast medium to the patient and collecting the products of radioactive decay. These may be detected in a single plane, much like a conventional radiographic image or in a manner similar to the creation of a CT scan, where a computer can depict the locations of concentration of the radioactive tracer in cross-sectional planes or even in three-dimensional reconstructions. The latter procedures typically utilize SPECT (single photon emission computerized tomography) technology.

The specificity of the scan depends on the particular substance to which the radioactive tracer is bound (the ligand). In some cases, the radioactive tracer itself provides this specificity. So, for example, radioactive iodine will be taken up by the thyroid gland, which can then be imaged, because the thyroid accumulated iodine. A radioactive tracer that is taken up by osteoblasts will show bone, with the greatest concentration at sites of active bone formation (such as around fractures or metastastatic tumors that are stimulating bone repair). If a radioactive tracer is bound to a compound that remains within the intravascular space, blood flow can be measured, while if radioactive tracers are incorporated within the patient's white blood cells, it may be able to determine the location of an infectious process.

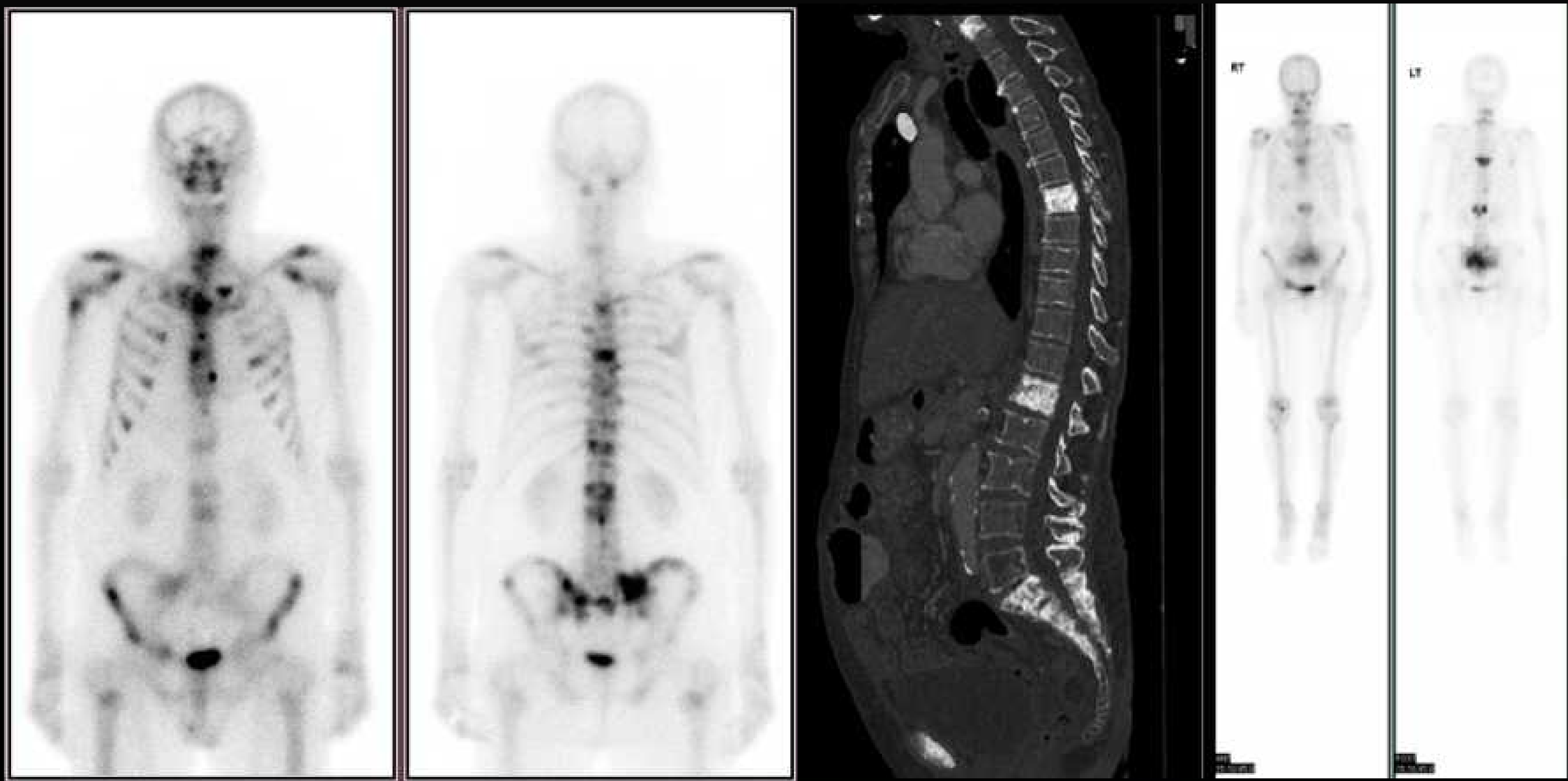
More recently, very short half-life, positron-emitting compounds, have been applied to the study of function (positron emission tomography - P.E.T). These compounds decay with the release of a positron that travels for only a short distance in the tissues before being annihilated, with the release of a gamma ray that can be detected. The location of concentration of the positron emitter can then be calculated and a map created. Some positron emitters (such as a particular isotope of oxygen) can be used directly to create a map of oxygen delivery in the body, the positron emitters can be incorporated in many other metabolites or pharmacologic agents to show their distribution in the body. The most common uses of the procedure are for mapping brain function during cognitive tasks and for detecting malignant tumors (which usually have relatively high metabolic activity).

Nuclear Medicine - Bone Scan

Multiple metastatic bone lesions show higher retention of radio-labelled bone seeking agent



BONE SCINTIGRAPHY



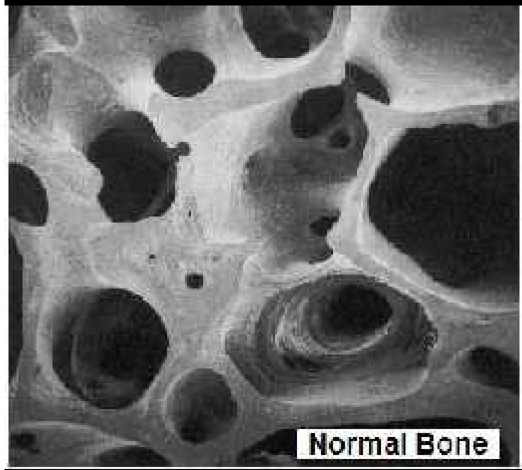
NUCLEAR MEDICINE
STRENGTHS AND WEAKNESSES

- Excellent specificity
- Provides physiologic information

- Expensive
- Availability of service
- Hight radiation

BONE DENSITOMETRY

Bone densitometry is a test like an X-ray that quickly and accurately measures thedensity of **bone.** It is used primarily to detect osteopenia or osteoporosis, diseases in which the **bone's** mineral and **density** are low and the risk of fractures is increased.



X-RAY IMAGING OF SKELETAL ANATOMY

HUMANS USUALLY HAVE APPROXIMATELY 206-214 BONE

Function of the skeletal system and bones include:

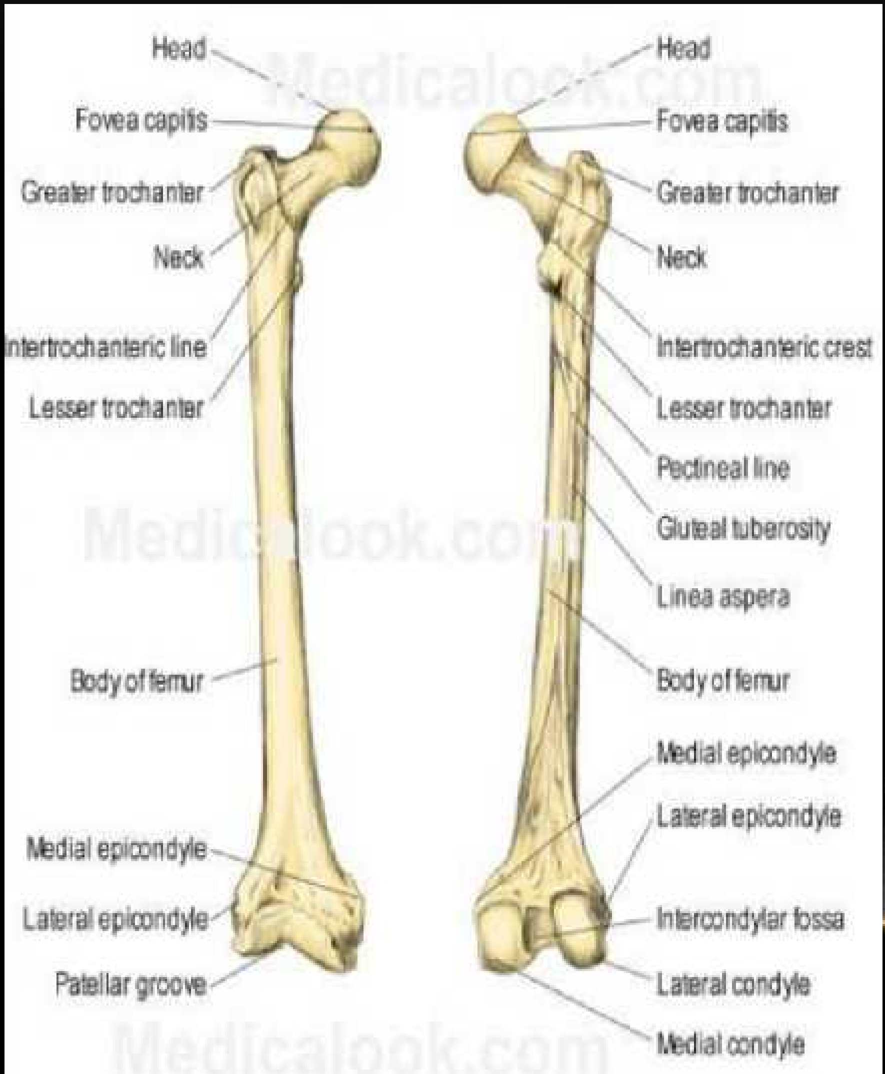
- Supporting the body
- Protecting vital tissues and organs
- Providing a mechanism for movement
- Storing calcium (99% of the body's calcium is stored in bones)
- Providing a supply of blood cells (many bones possess central cavity, that contains the bone marrow)

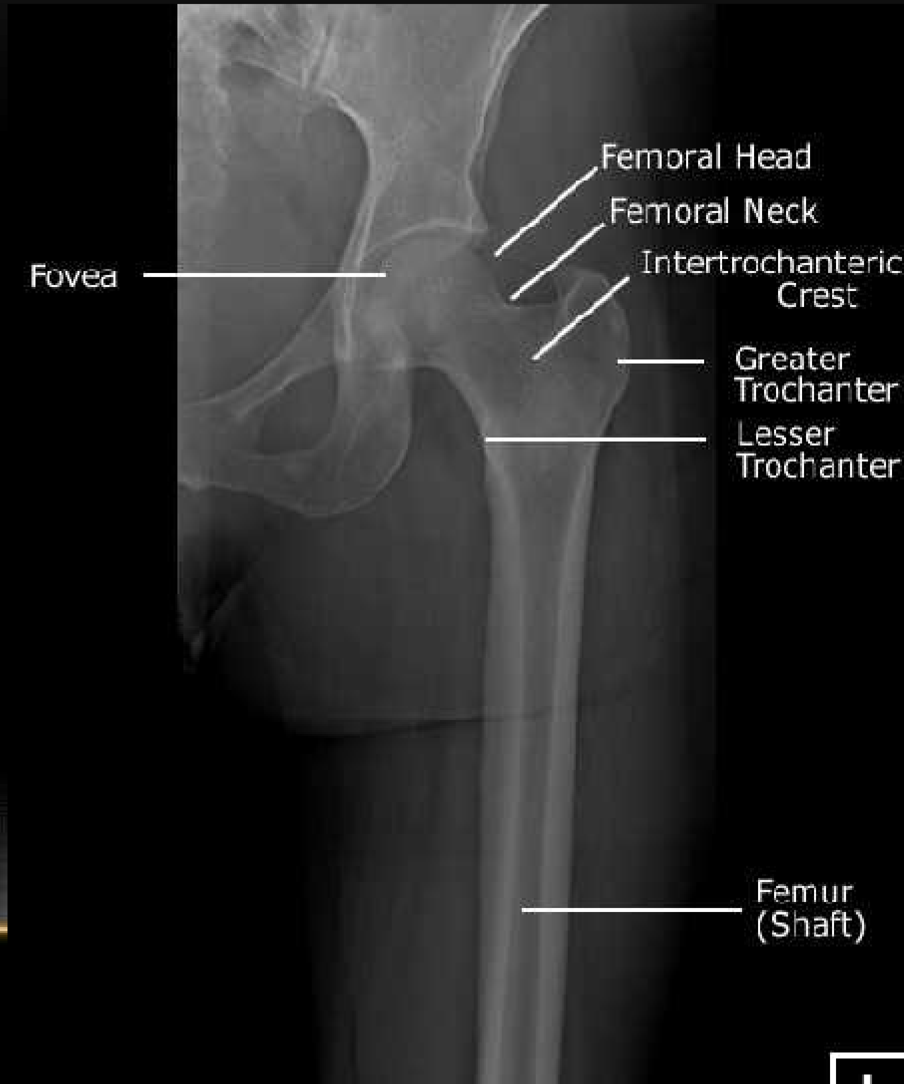
BONE CLASSIFICATION:

- Long bones
- Short bones
- Flat bones
- Irregular bones
- Sesamoid bones

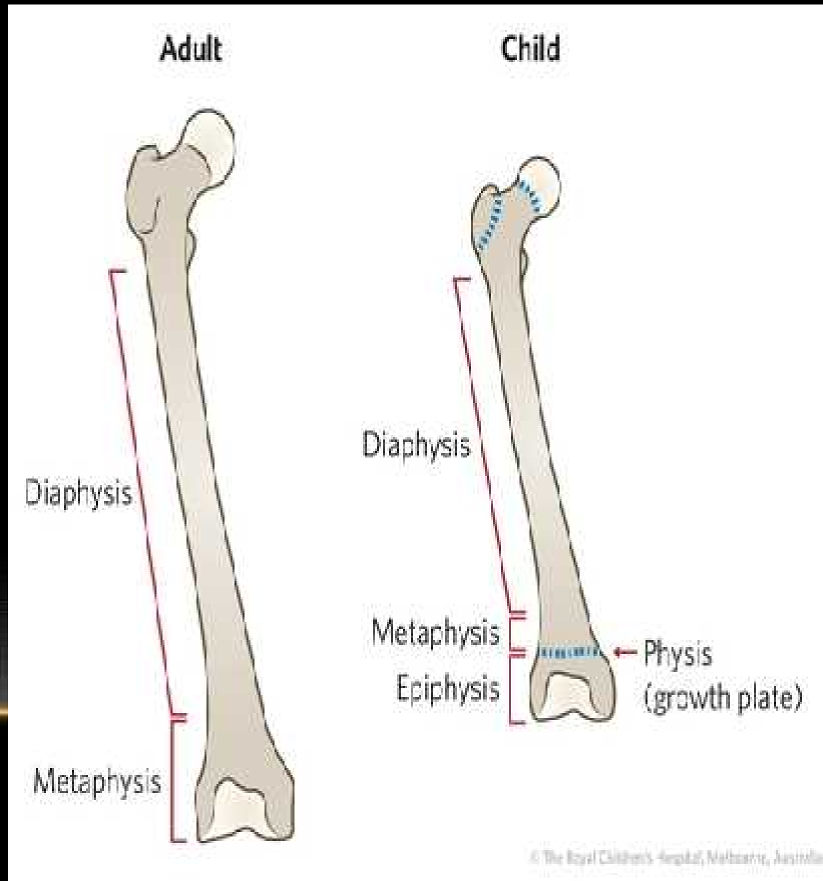
LONG BONES- ARE LONGER, THAN THEY ARE WIDE

(femor, hummer, tibia, fibula, radial, ulnar)



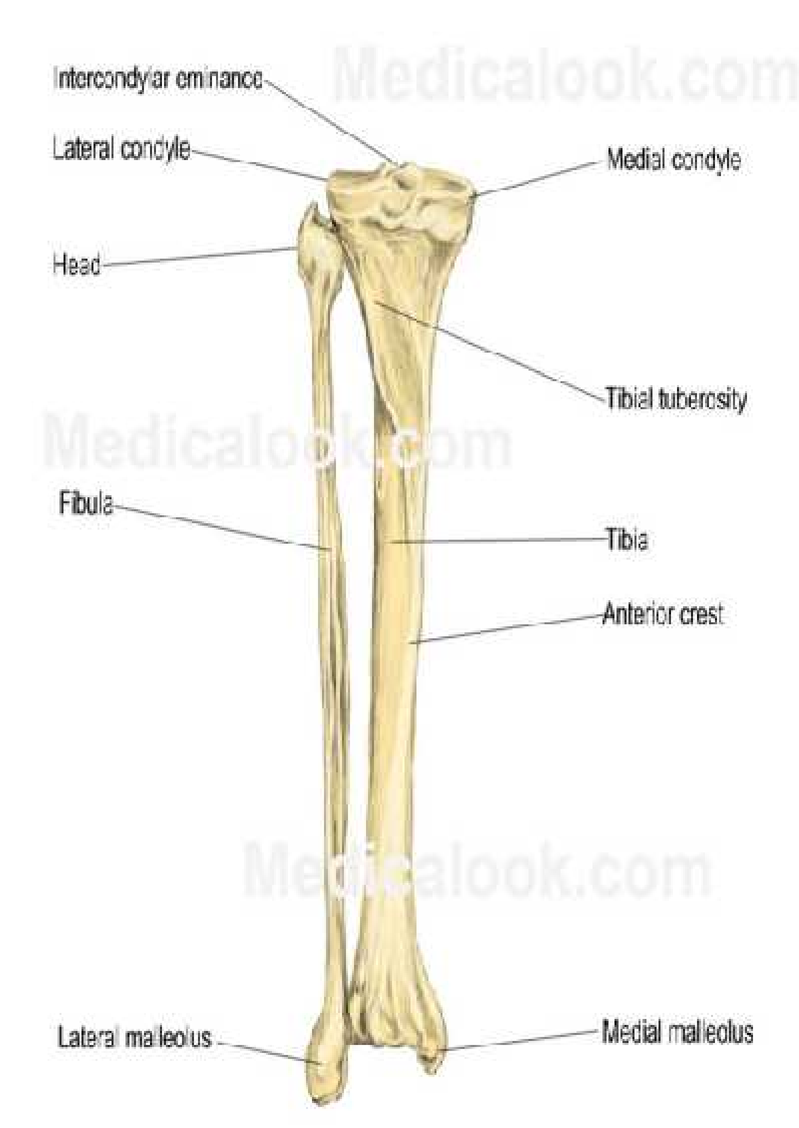


- Long bones comprise diaphysis, metaphysis and epiphysis;
- The growth plate separates the metaphysis from the epiphysis until fusion in adult
- An apophys is a normal bony outgrowth of a bone



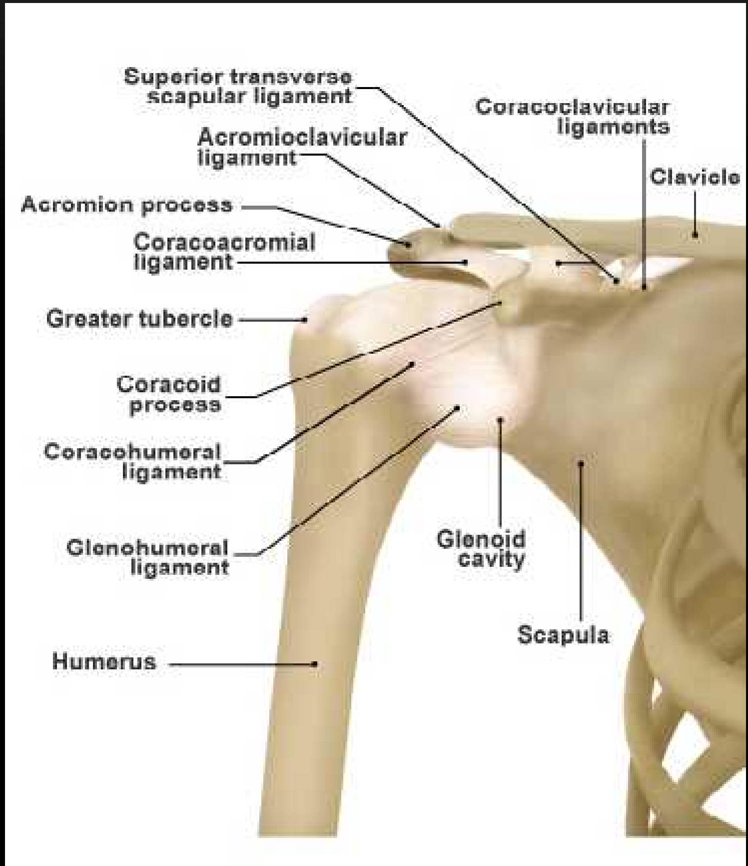
The growth plate separates the metaphysis from the epiphysis

An apophys is a normal bony outgrowth of a bone

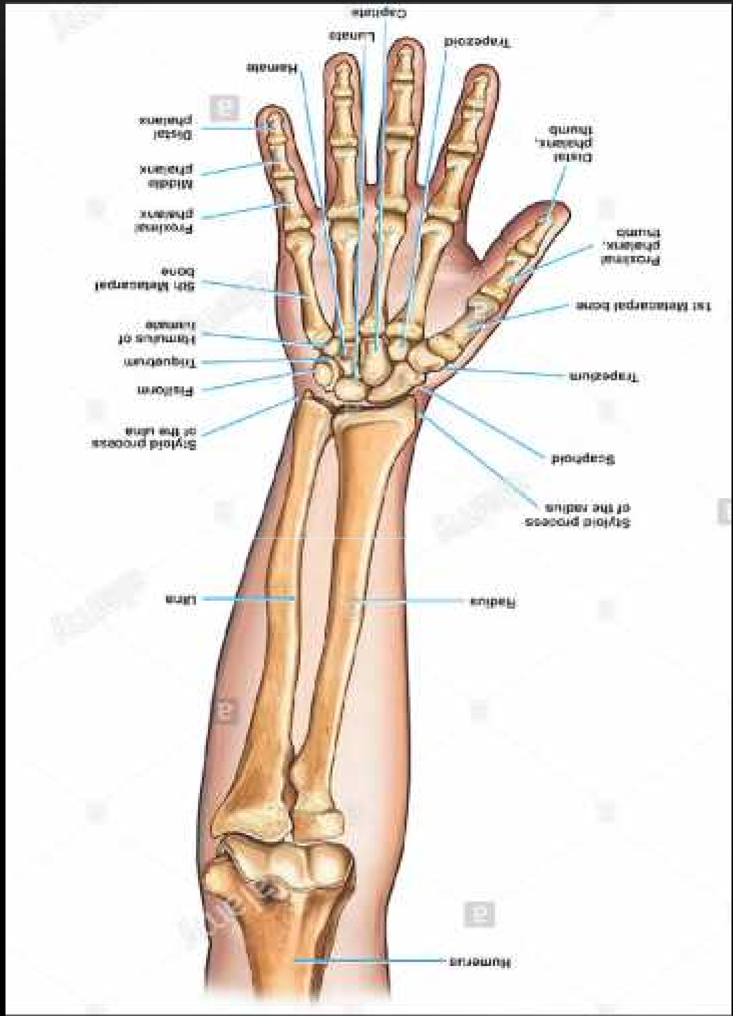


Intercondylar eminance
Lateral condyle
Medial condyle
Head
Tibial tuberosity
Fibula
Tibia
Anterior crest
Lateral malleolus
Medial malleolus
Medicalook.com

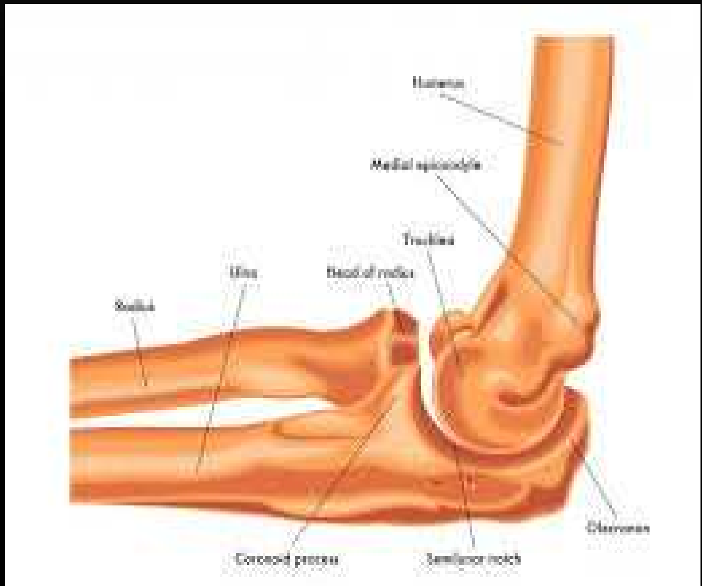
Femur
Medial Epicondyle
Lateral Epicondyle
Patella
Intercondylar Notch
Lateral Femoral Condyle
Medial Femora Condyle
Lateral Tibial Condyle
Medial Tibial Condyle
Intercondylar Eminence
Head of Fibula
Tibia
Fibula
R

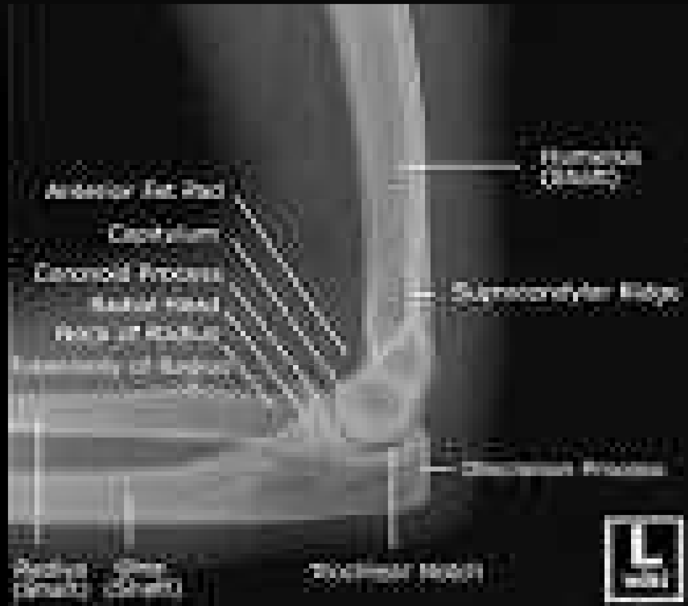

Superior transverse scapular ligament
Coracoclavicular ligaments
Acromioclavicular ligament
Clavicle
Acromion process
Coracoacromial ligament
Greater tubercle
Coracoid process
Coracohumeral ligament
Glenohumeral ligament
Glenoid cavity
Scapula
Humerus

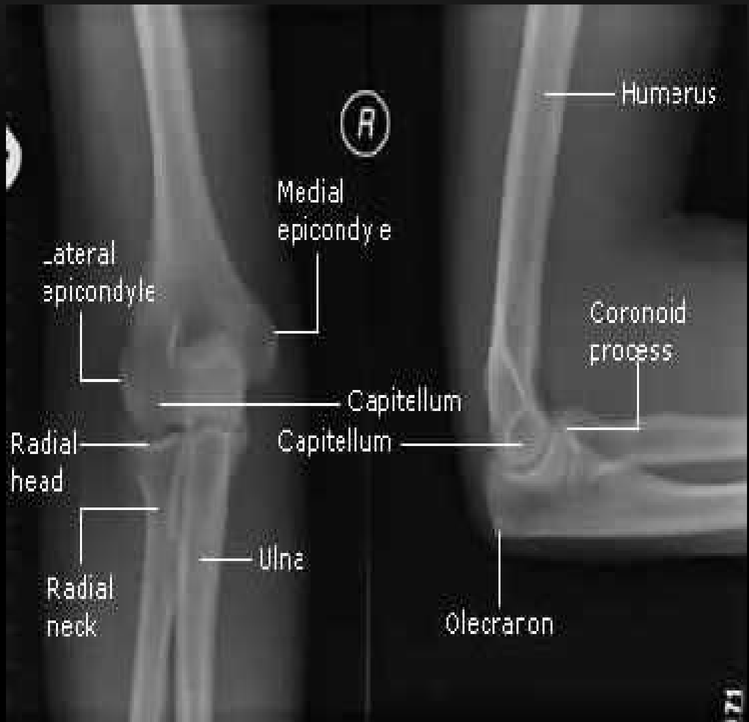

Normal Shoulder
(AP View)
Coracoid Process
Clavicle
Acromion Process
Humeral Head
Glenoid
Body of Scapula
Humerus
Lateral Border Scapula
EBM CONSULT


Capitate
Lunate
Trapezoid
Hamate
Distal phalanx
Middle phalanx
Proximal phalanx
5th Metacarpal bone
Hamulus of hamate
Triquetrum
Pisiform
Styloid process of the ulna
Distal phalanx, thumb
Proximal phalanx, thumb
1st Metacarpal bone
Trapezium
Scaphoid
Styloid process of the radius
Ulna
Radius
Humerus

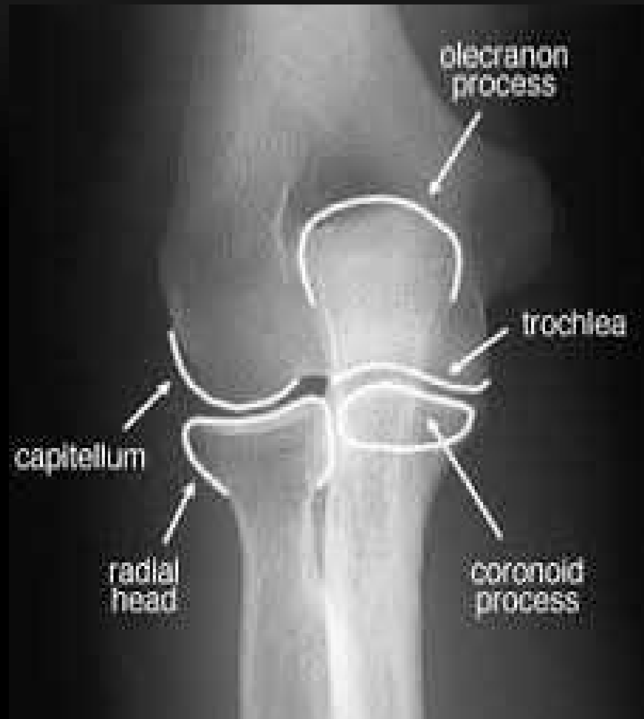

R wiki
Carpal Bones
Styloid Process
Ulna Head
Styloid Process
Ulna
Radius
Radial Tubercle
Radial Neck
Radial Head
Capitulum
Trochlea
Olecranon Process
Humerus


Humerus
Medial epicondyle
Trochlea
Ulna
Head of radius
Radius
Olecranon
Coronoid process
Semilunar notch


Humerus
(Shaft)
Anterior Fat Pad
Capitulum
Coronoid Process
Radial Head
Neck of Radius
Supracondylar Ridge
Olecranon Process
Trochlear Notch
L



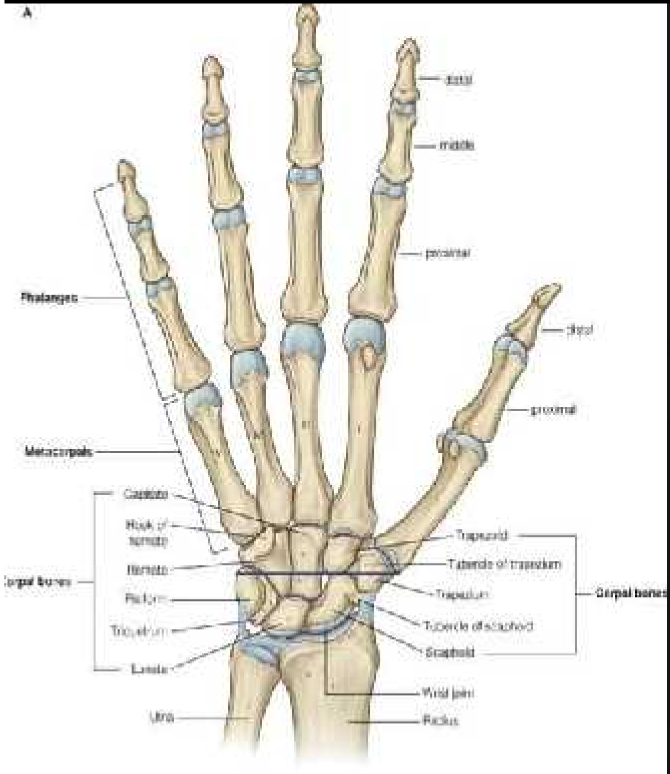
Humerus
Medial
epicondyle
Lateral
epicondyle
Coronoid
process
Capitellum
Radial
head
Capitellum
Ulna
Radial
neck
Olecranon

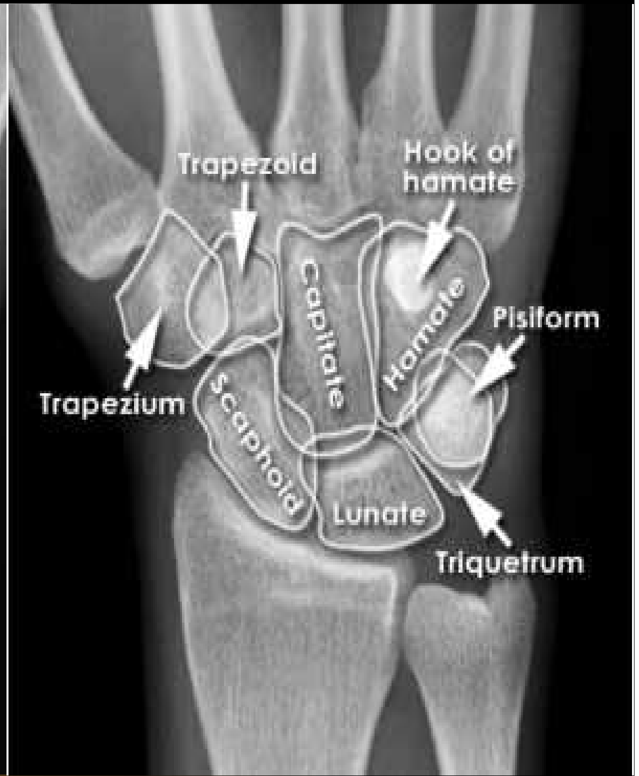


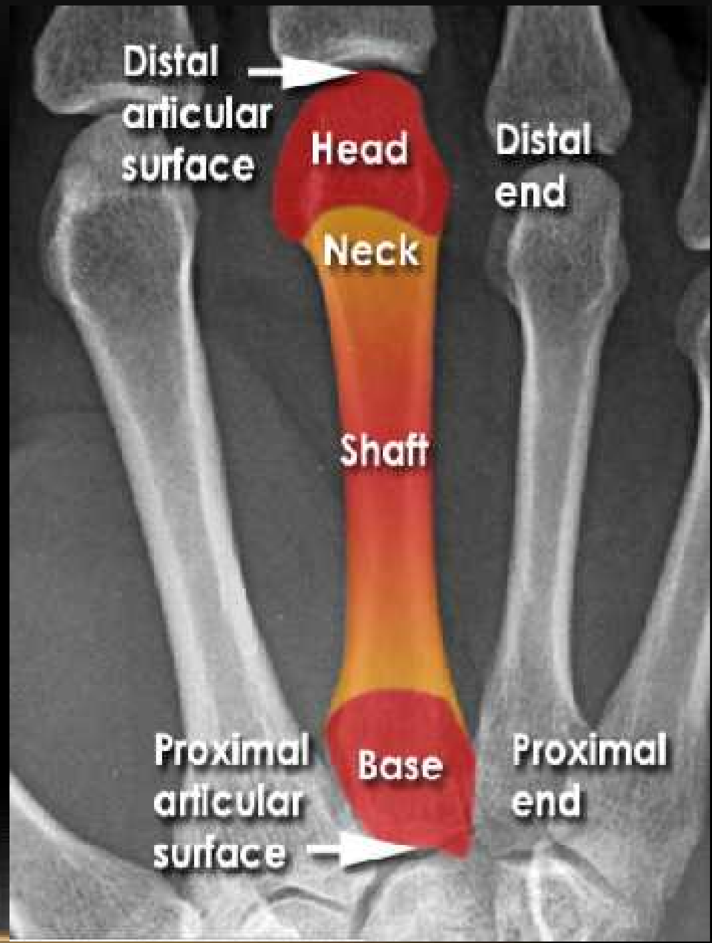
olecranon
process
trochlea
capitellum
radial
head
coronoid
process

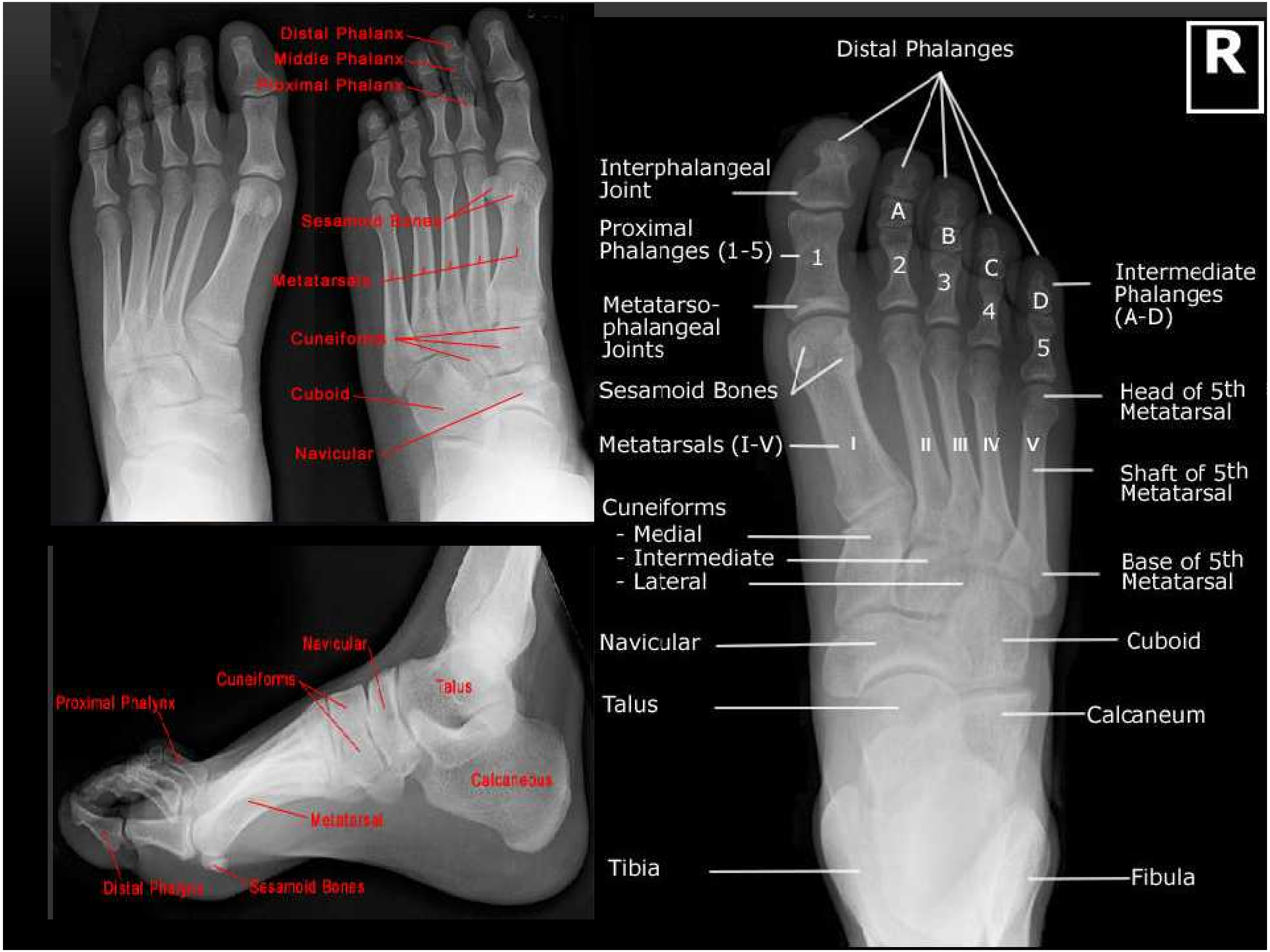
SHORT BONES-MOST OF THEM ARE CUBE SHAPED

(Tarsals, Carpals, Metatarsal, Metacarpals, Phalenges)





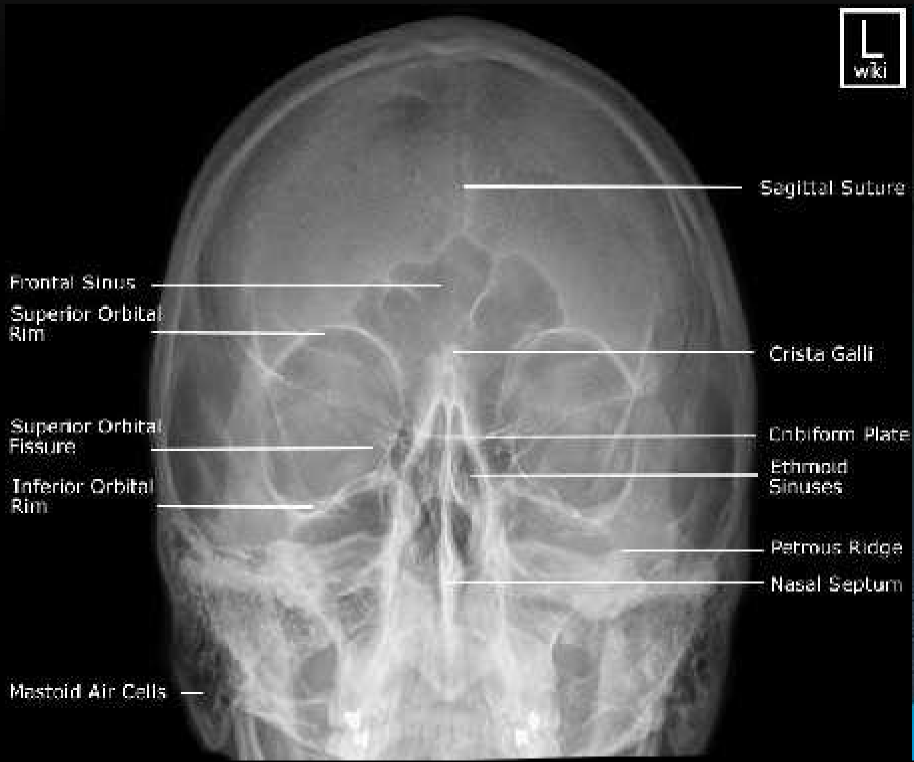

Distal
articular
surface
Head
Distal
end
Neck
Shaft
Proximal
articular
surface
Base
Proximal
end

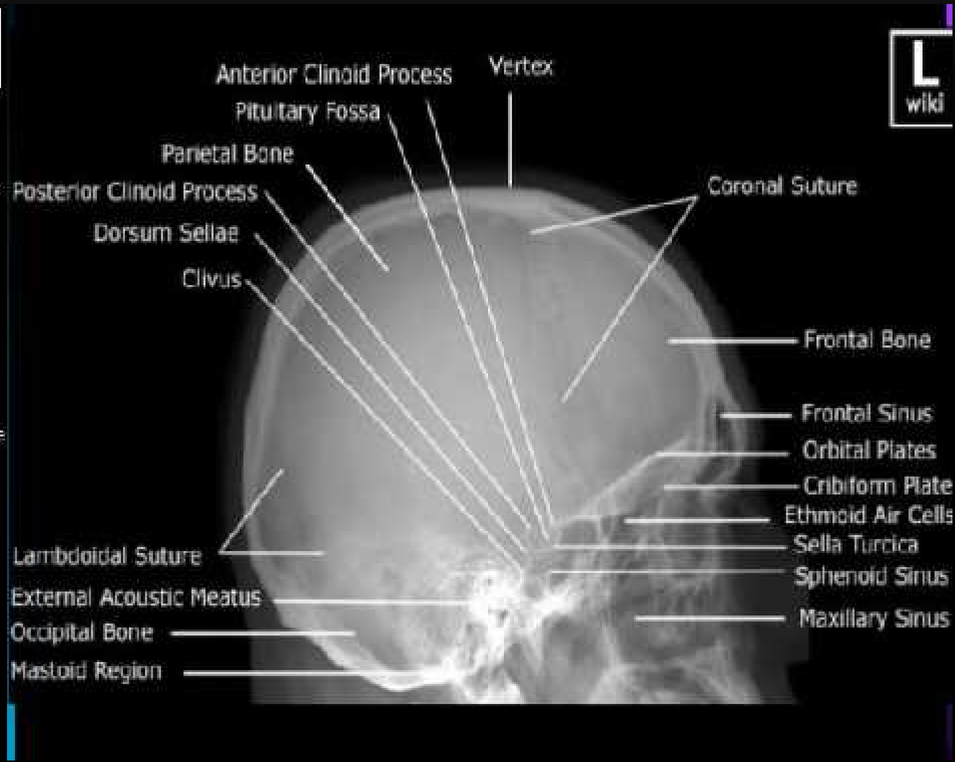


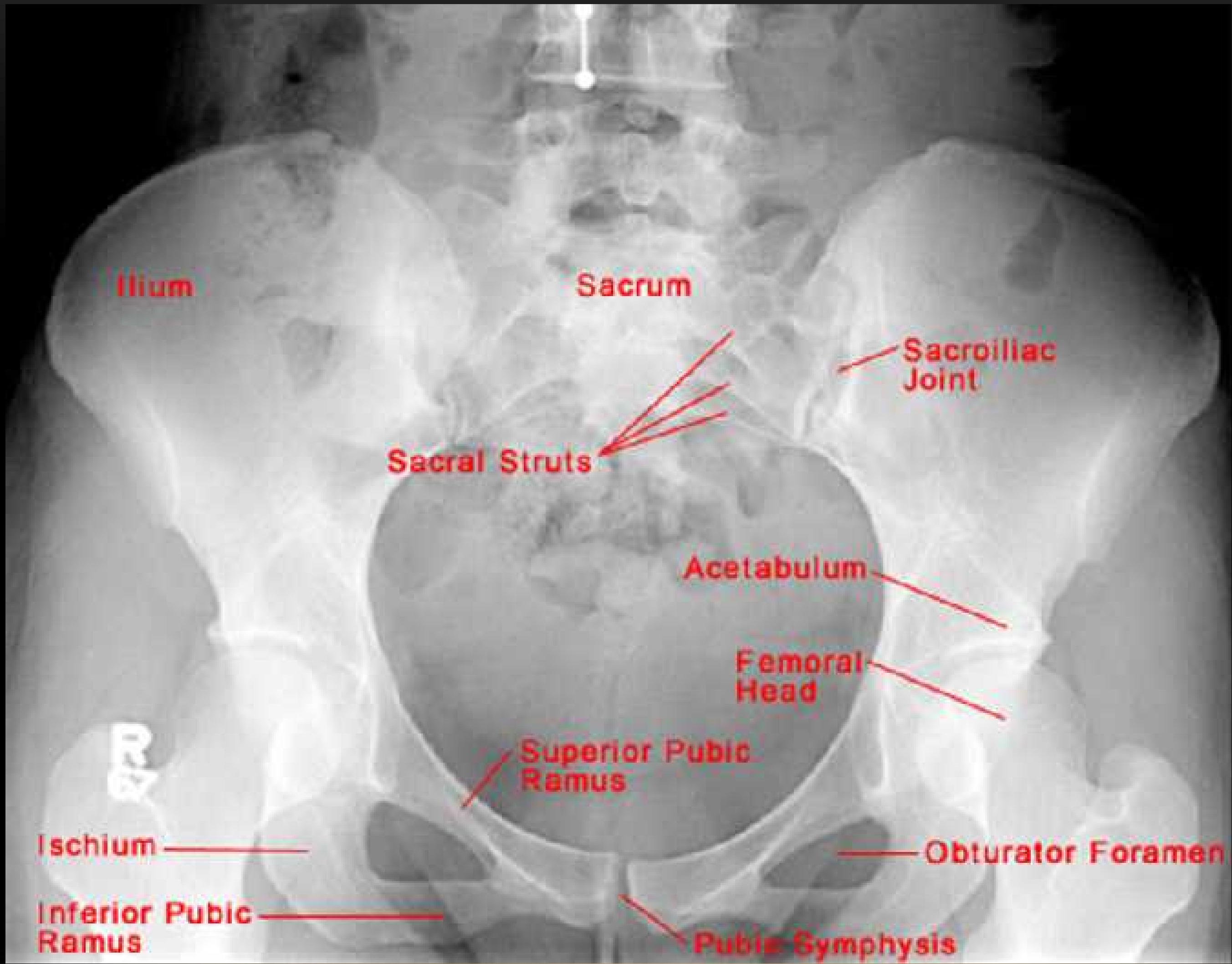
Distal Phalanx
Middle Phalanx
Proximal Phalanx
Sesamoid Bones
Metatarsals
Cuneiforms
Cuboid
Navicular
Navicular
Cuneiforms
Talus
Proximal Phalynx
Calcaneus
Metatarsal
Distal Phalynx
Sesamoid Bones
R
Distal Phalanges
Interphalangeal Joint
Proximal Phalanges (1-5)
1
2
3
4
5
A
B
C
D
Intermediate Phalanges (A-D)
Metatarso-phalangeal Joints
Sesamoid Bones
Head of 5th Metatarsal
Metatarsals (I-V)
I
II
III
IV
V
Shaft of 5th Metatarsal
Cuneiforms
- Medial
- Intermediate
- Lateral
Base of 5th Metatarsal
Navicular
Cuboid
Talus
Calcaneum
Tibia
Fibula

FLAT BONE
THEY ARE THIN AND OFTEN CURVE
THEY HAVE BROAD SURFACES FOR PROTECTION OF ORGANS

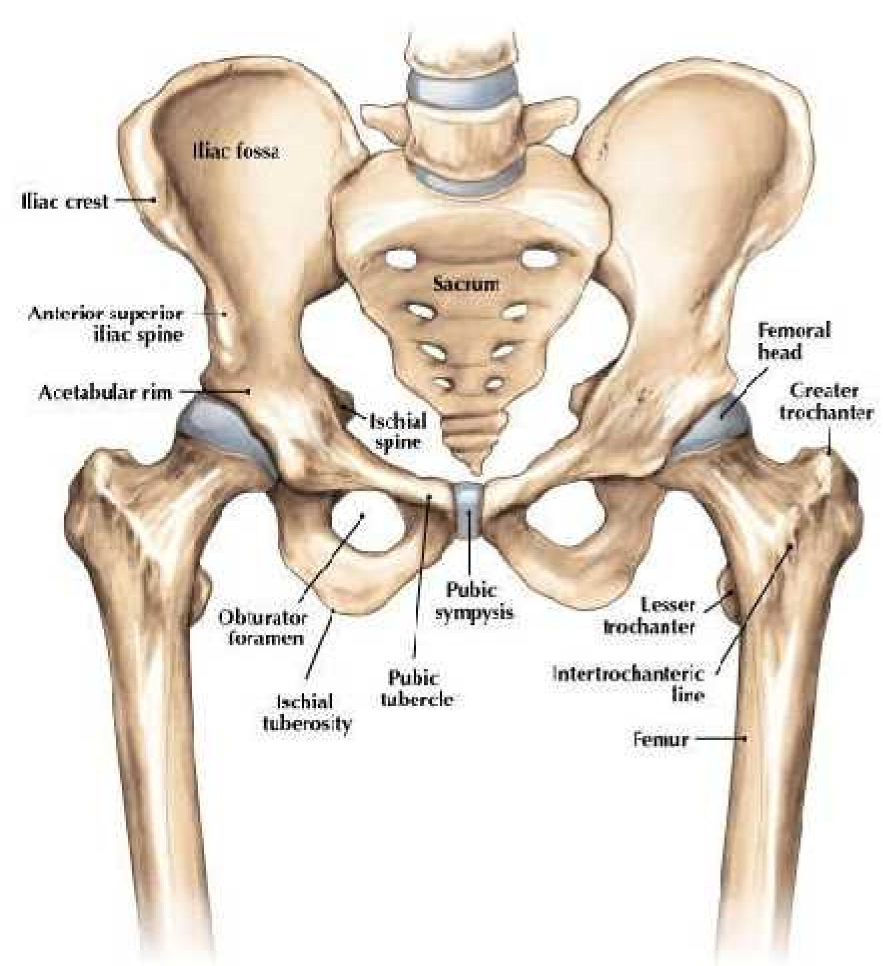
(Cranium, Scapular, Clavicle, Pelvis, Sternum, Ribs, Facial bones)

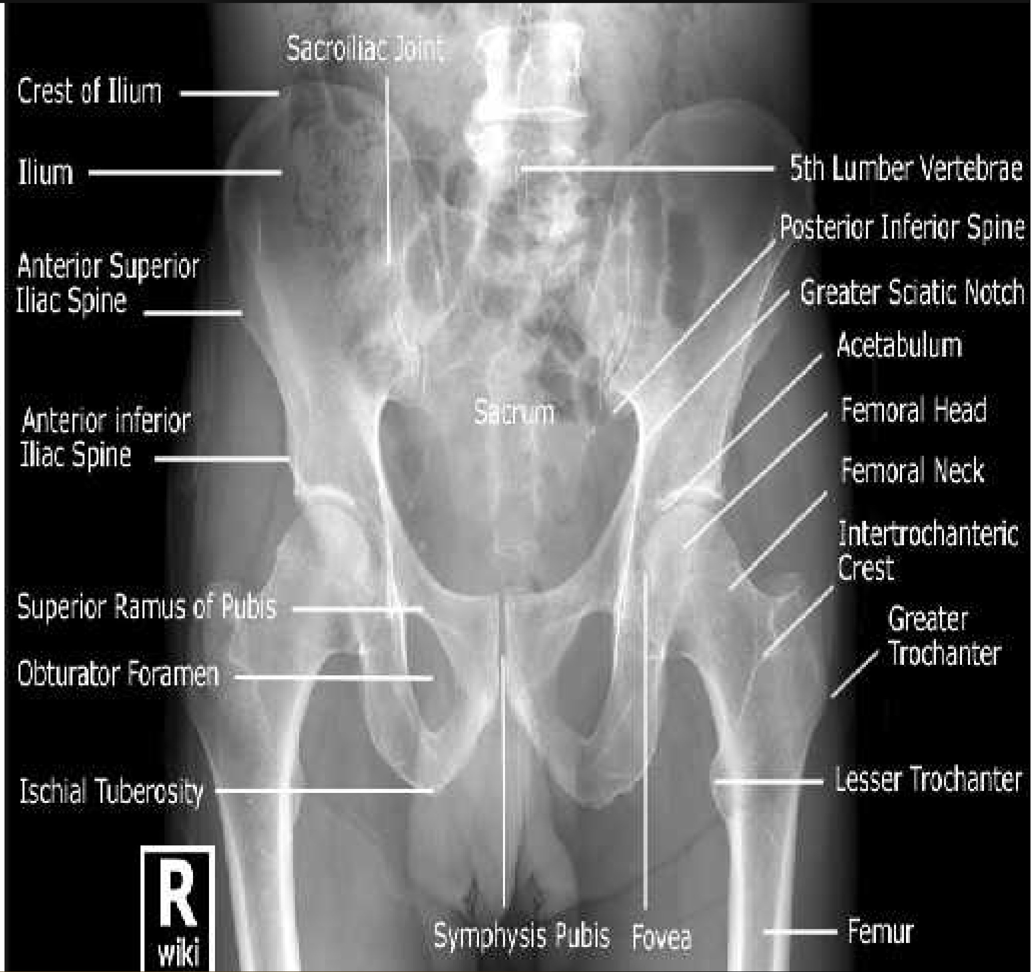

L wiki
Sagittal Suture
Frontal Sinus
Superior Orbital Rim
Crista Galli
Superior Orbital Fissure
Cribiform Plate
Ethmoid Sinuses
Inferior Orbital Rim
Petrous Ridge
Nasal Septum
Mastoid Air Cells

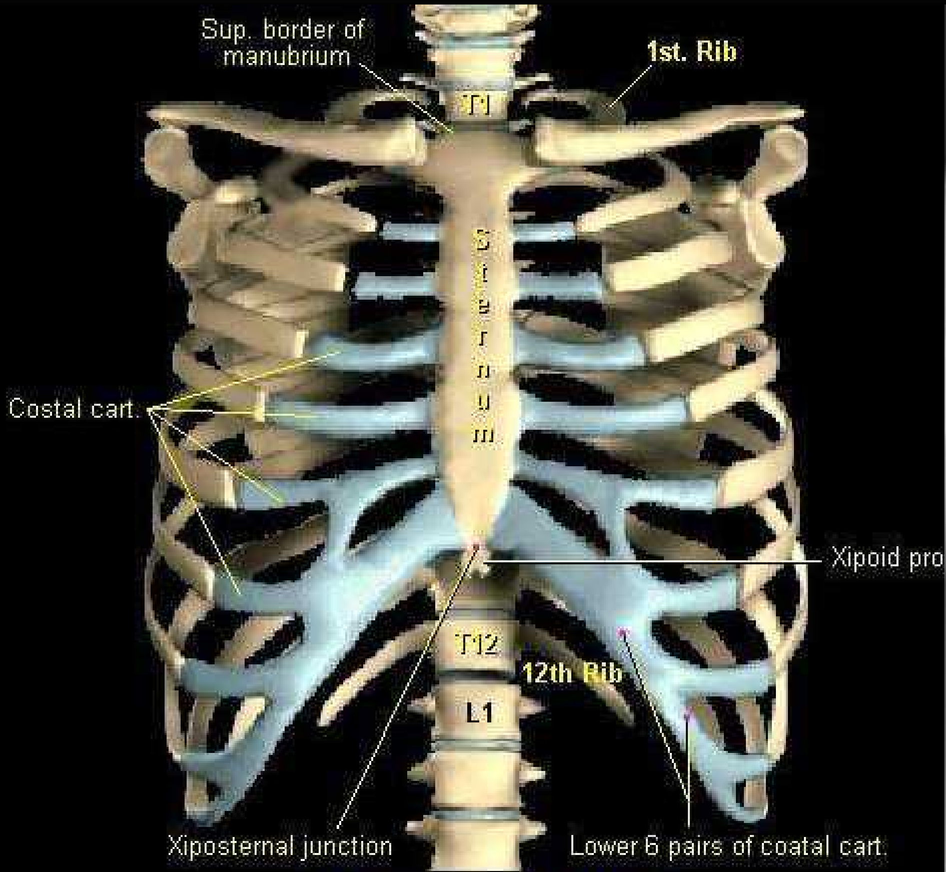

L wiki
Anterior Clinoid Process
Vertex
Pituitary Fossa
Parietal Bone
Posterior Clinoid Process
Coronal Suture
Dorsum Sellae
Clivus
Frontal Bone
Frontal Sinus
Orbital Plates
Cribiform Plate
Ethmoid Air Cells
Sella Turcica
Lambdoidal Suture
Sphenoid Sinus
External Acoustic Meatus
Maxillary Sinus
Occipital Bone
Mastoid Region



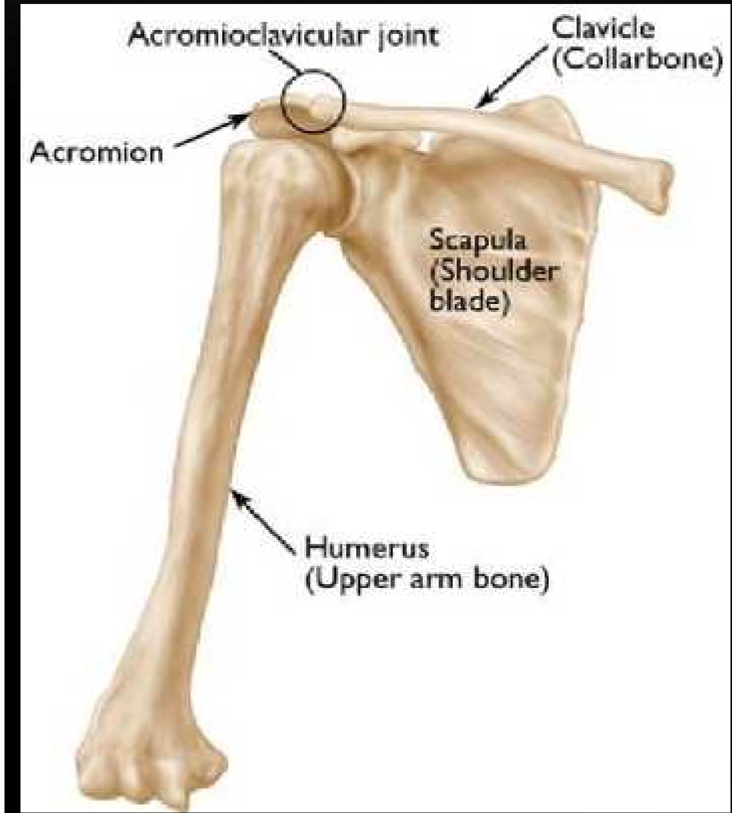
Ilium
Sacrum
Sacroiliac Joint
Sacral Struts
Acetabulum
Femoral Head
Superior Pubic Ramus
Ischium
Obturator Foramen
Inferior Pubic Ramus
Pubic Symphysis

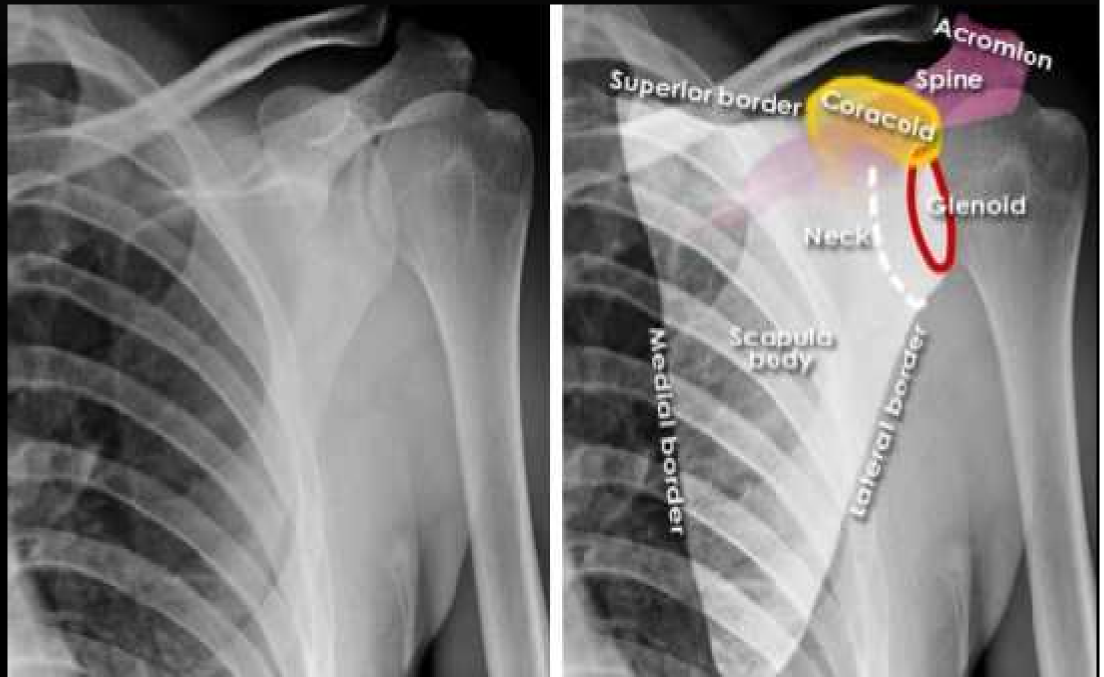

Iliac fossa
Iliac crest
Sacrum
Anterior superior iliac spine
Acetabular rim
Ischial spine
Femoral head
Greater trochanter
Obturator foramen
Pubic symphysis
Lesser trochanter
Pubic tubercle
Ischial tuberosity
Intertrochanteric line
Femur


Sacroiliac Joint
Crest of Ilium
Ilium
5th Lumber Vertebrae
Posterior Inferior Spine
Anterior Superior Iliac Spine
Greater Sciatic Notch
Acetabulum
Sacrum
Femoral Head
Anterior inferior Iliac Spine
Femoral Neck
Intertrochanteric Crest
Superior Ramus of Pubis
Greater Trochanter
Obturator Foramen
Lesser Trochanter
Ischial Tuberosity
R wiki
Symphysis Pubis
Fovea
Femur


Sup. border of manubrium
1st. Rib
T1
Sternum
Costal cart.
Xipoid pro
T12
12th Rib
L1
Xiposternal junction
Lower 6 pairs of coatal cart.

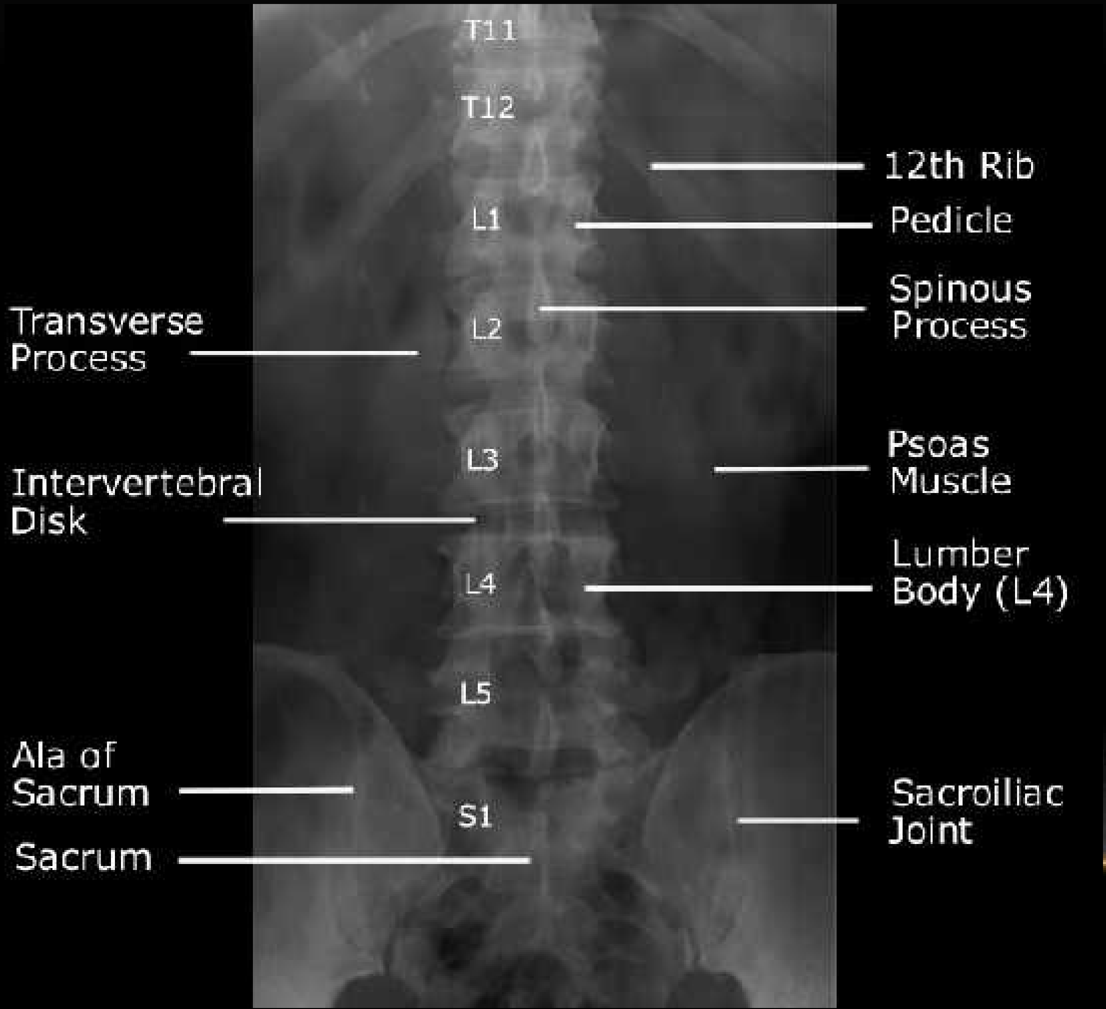

R

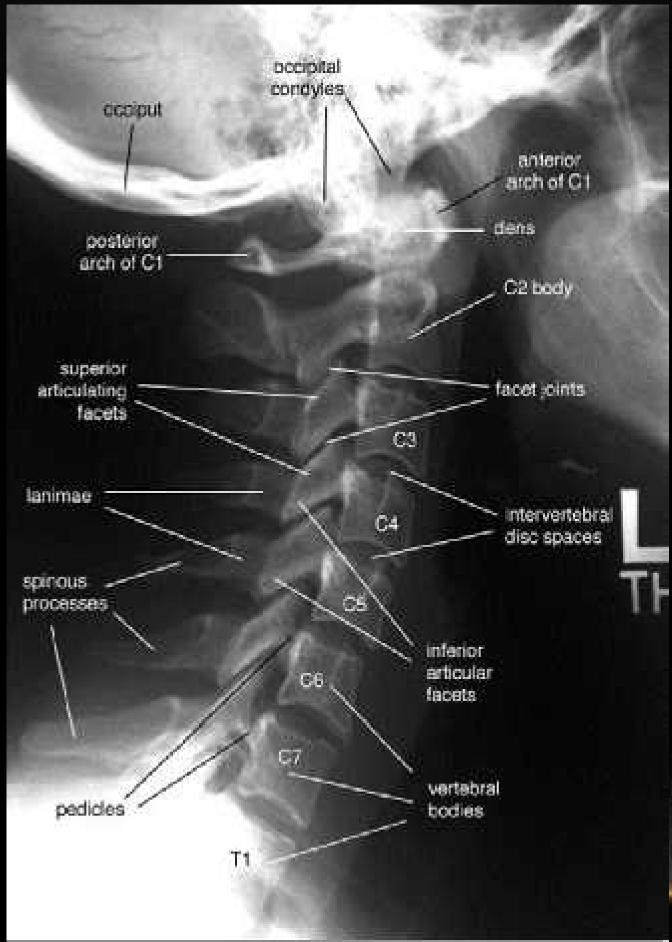

Acromioclavicular joint
Clavicle
(Collarbone)
Acromion
Scapula
(Shoulder
blade)
Humerus
(Upper arm bone)

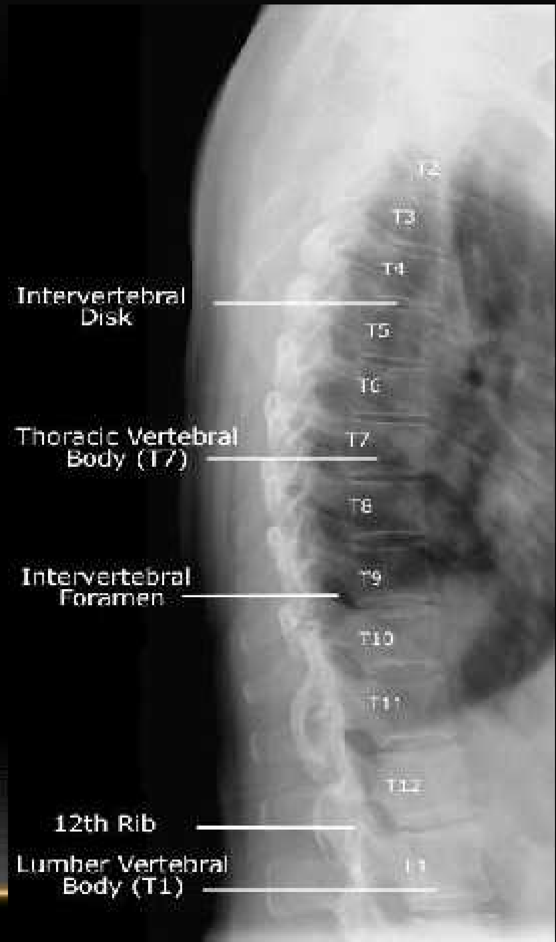

Acromion
Spine
Superior border
Coracoid
Glenoid
Neck
Scapula
body
Medial border
Lateral border

IRREGULAR BONES- AS THEIR NAME THAY HAVE MORE COMPLEX SHAPES

(vertebrea, coccyx, facial bone)




occipital condyles
cociput
anterior arch of C1
dens
posterior arch of C1
C2 body
superior articulating facets
facet joints
C3
lanimae
C4
intervertebral disc spaces
spinous processes
C5
inferior articular facets
C6
C7
vertebral bodies
pedicles
T1


T2
T3
T4
Intervertebral Disk
T5
T6
Thoracic Vertebral Body (T7)
T7
T8
Intervertebral Foramen
T9
T10
T11
T12
12th Rib
Lumber Vertebral Body (T1)

SESAMOID BONES- -IS A SMALL, ROUND BONE, THAT AS THE NAME SUGGESTS IS SHAPED LIKE A SESAM SEED

Sesamoid bones vary in number and placement from person to person, but typically found in tendons (ossifies whithin a tendon) associated whith the feet, hands and knees.

The patella is the only sesamoid bone, which found in common whith every person

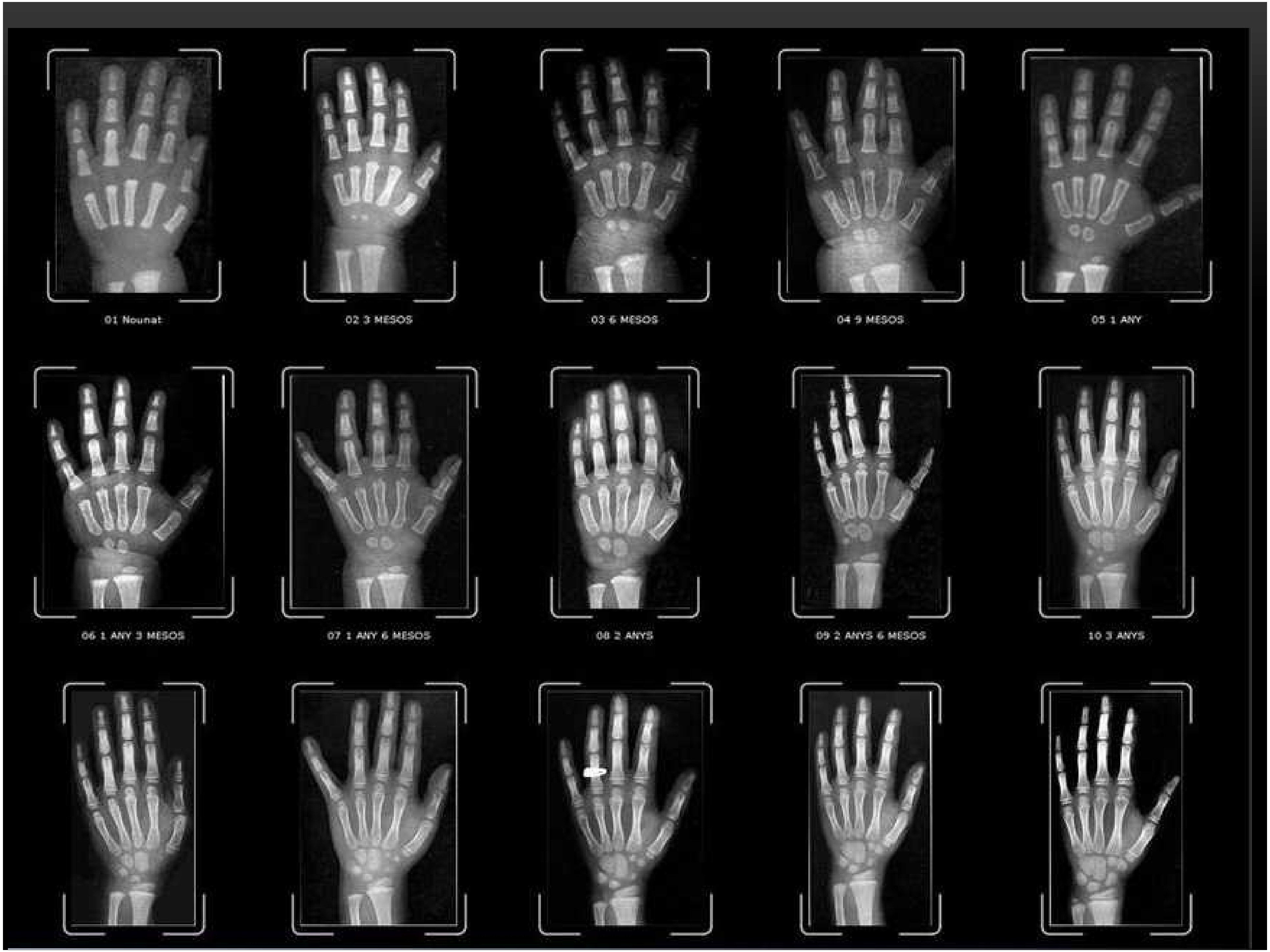
PEDIATRIC BONES

HOW TO ASSESS GROWTH?

To assess skeletal age by comparing degree of ossification of carpal bones of wrist,metacarpals of hand and phalanges of the fingers

THERE ARE THREE STAGES OF OSSIFICATION OF THE PHALANGES:

- First stage: epiphysis shows the same width as the diaphysis
- Second stage: Capping stage-the epiphysis surrounds the diaphysis like cap
- Third stage: bony fusion of epiphysis and diaphysis

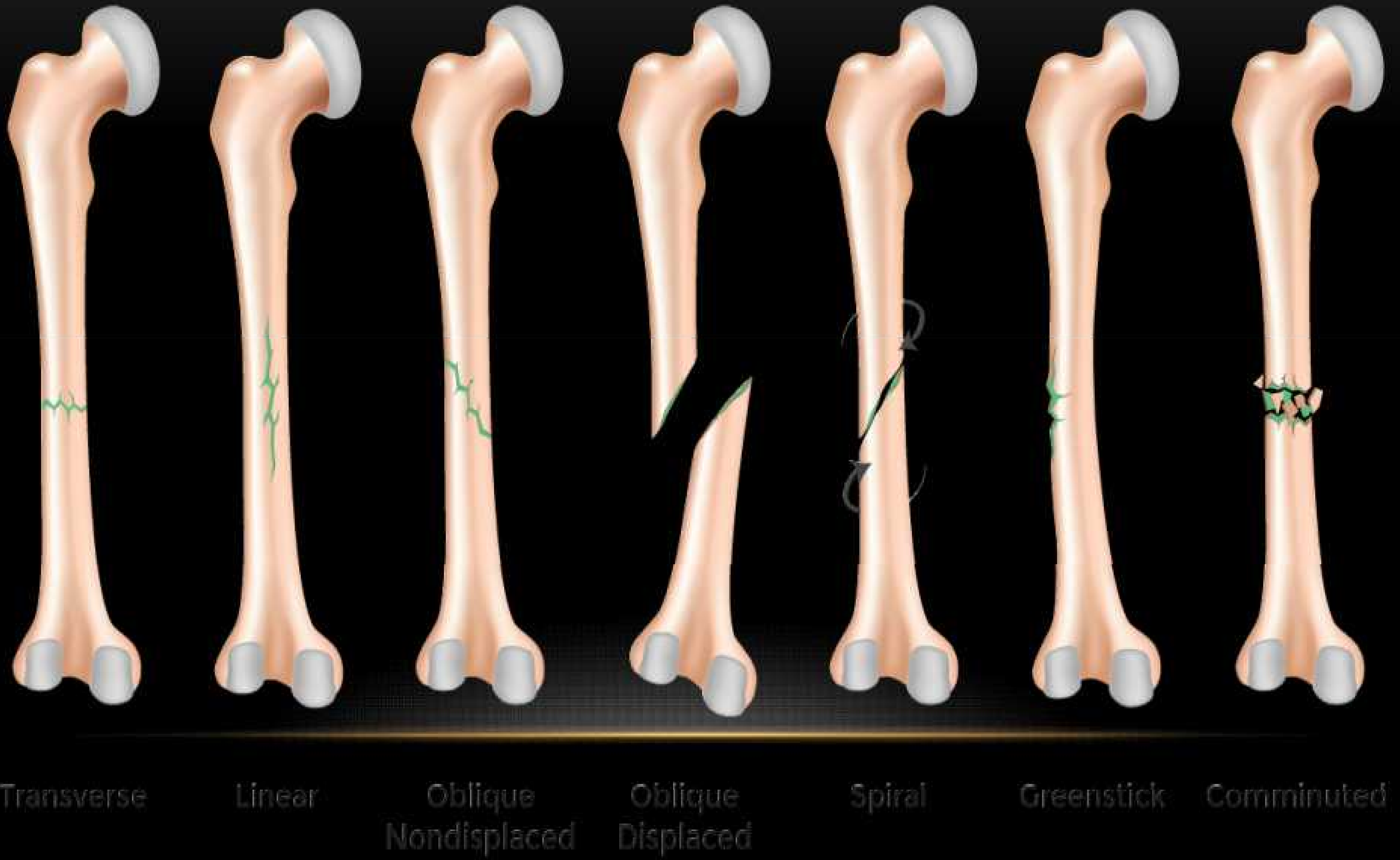

01 Nounat
02 3 MESOS
03 6 MESOS
04 9 MESOS
05 1 ANY
06 1 ANY 3 MESOS
07 1 ANY 6 MESOS
08 2 ANYS
09 2 ANYS 6 MESOS
10 3 ANYS

INJURIES

- **Fracture- A disruption in all or part of the cortex of a bone**

  (completely, incomplete)
- **Dislocation- The bony components of joint aren't contact with each other (there is completely disraption of the join)**
- **Subluxation (The bony componens of a join are partially in contact whith each other (there is partial disruption of the join)**

FRACTURES TYPE



HOW TO FRACTURES ARE DESCRIBED

- By the direction of the fracture line
- By the relations of the fragments
- By the number of fragment
- By the communication with the atmosphere

BY DIRECTION OF FRACTURE LINE





BY THE RELATIONS OF THE PRAGMENTS

- Angulation (the fracture fragment is angulation of the proximal component)
- Shortening (overlapping of the ends of the fracture fragments)
- Displaced (the amount of off-sef of the distal fracture fragment relative to the proximal
- Rotated (fracture fragment is rotation of the distal component)

BY THE NUMBER OF FRAGMENT

- Two fragments- Simple
- More than two fragments- Comminuted

BY THE RELATIONSHIF OF THE FTACTURE TO THE ATMOSPHERE

- Closed
- Open

FRACTURE IN CHILDREN

- Green-stick fracture- Fracture one cortex
- Epiphysiolysis-Epiphyseal separation (Epiphysis separated from the metaphysis)

HEALING OF FRACTURE AND CALLUS FORMATION

Acute phase 2W 2M

DISLOCATION

DEFORMITY OF BONE

Enlongated finger

Multiple exostoses

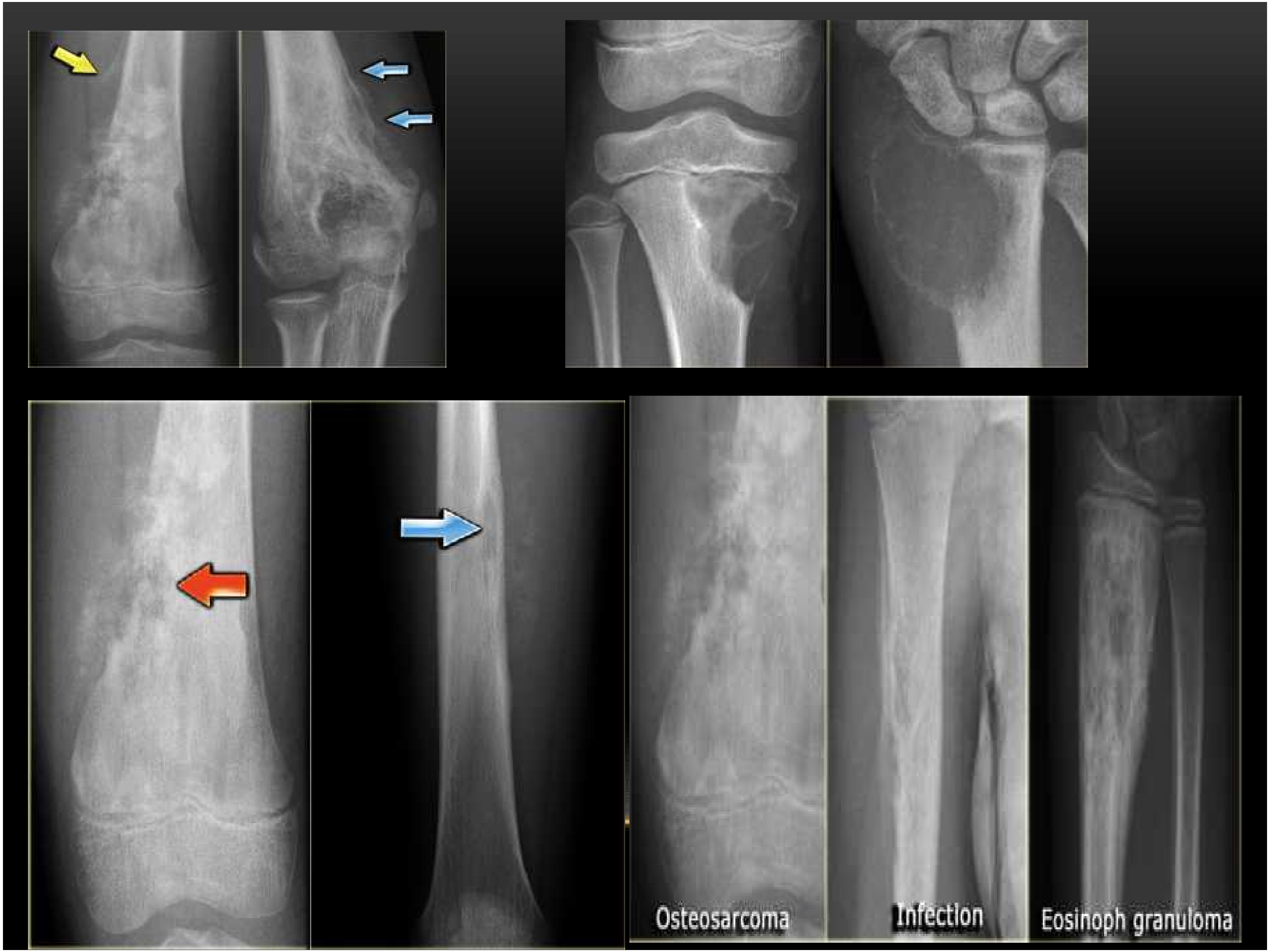
OSTEOMALASIA

Rickets- Bone densiti decreased, bone softening and bowed

Cartilage changes

- Decreased joint space
- Increased joint space
- Chondrocalcinosis

CHONDROCALCINOSIS


Osteosarcoma
Infection
Eosinoph granuloma

THANK YOU FOR YOUR ATTENTION!