Al-Muthanna University
College of Pharmacy
Iraq

Medical physics

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For Bachelor’s degree of pharma
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Outline

- Introduction
- Forces on and in body
- Physics of the Skeleton
- Heat and cold in Medicine
- Energy work and Power of the body

Outline

- Pressure
- Physics of the lungs and breathing
- Physics of cardiovascular system
- Electricity within the body

Outline

- Sound in Medicine
- Light in medicine
- Physics of eyes and vision

Outline

- Physics of diagnostic x-ray
- Physics of nuclear medicine
- Physics of radiation therapy
- Pollution

Introduction

- The field of medical physics overlaps the two very large fields of medicine and physics. Medical physics refers to two major areas:

- The applications of physics to the function of the human body in health and disease.

- the applications of the physics in the practice of medicine

Terminology

- Several concepts will appear throughout our discussion of the human body.

- The relation between anatomical coordinate systems in medicine to coordinate systems that would be used by physicists to describe any physical system.

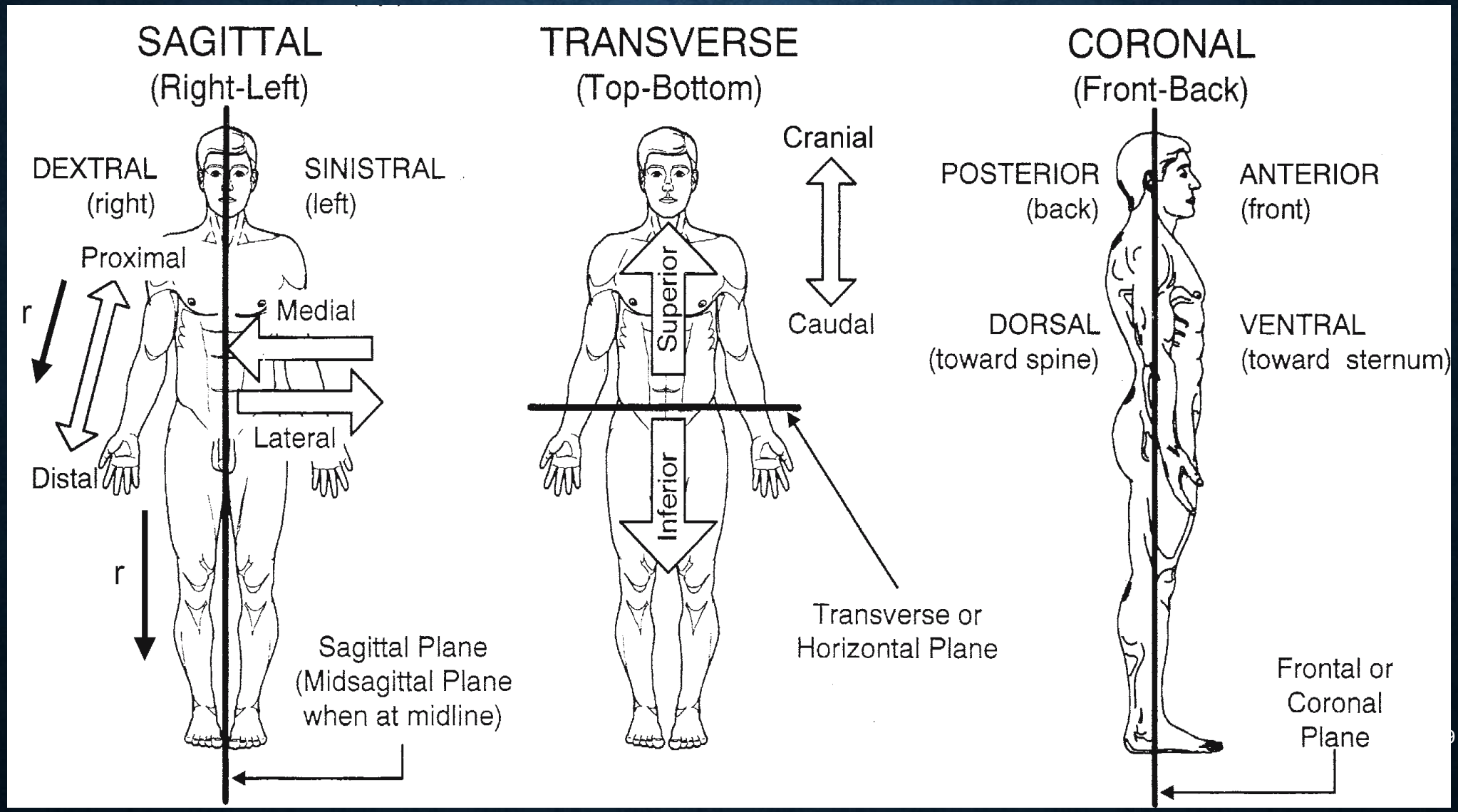
Terminology

- systems in medicine to coordinate systems that would be used by physicists to describe any physical system

- the characteristics of a "typical" human, and how body properties and responses scale with parameters. Most of that will be in anatomy relates to directions and positions

- extend this terminology to describe the degrees of freedom of rotational motion about the joints

COORDINATE SYSTEMS



Anatomical Terminology

Superior & Inferior

cranial & caudal

right vs. left

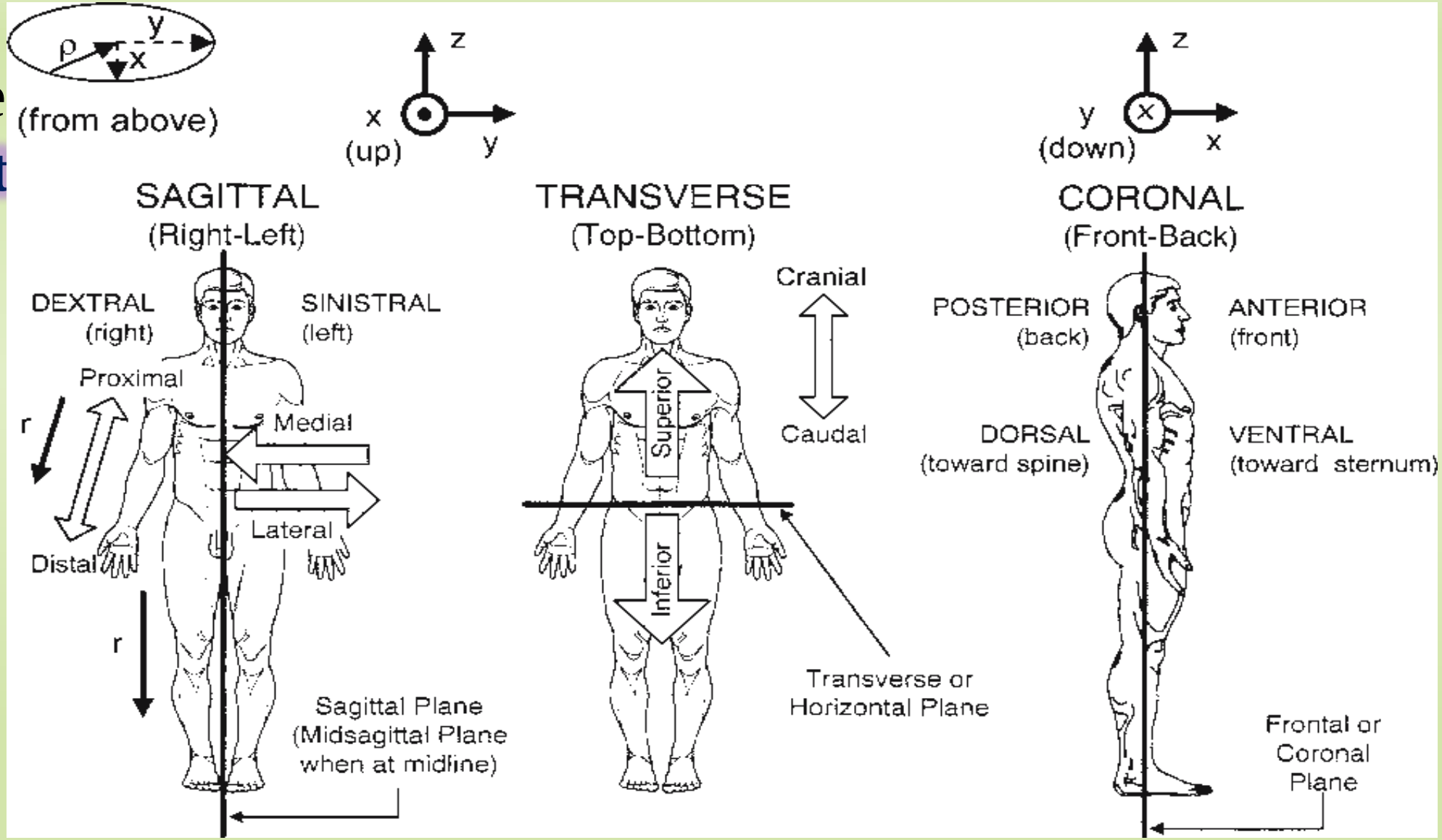
Dextral & sinistral

Anterior & Posterior

Ventral & dorsal

Anatomical Terminology

- The
  syst
- xyz

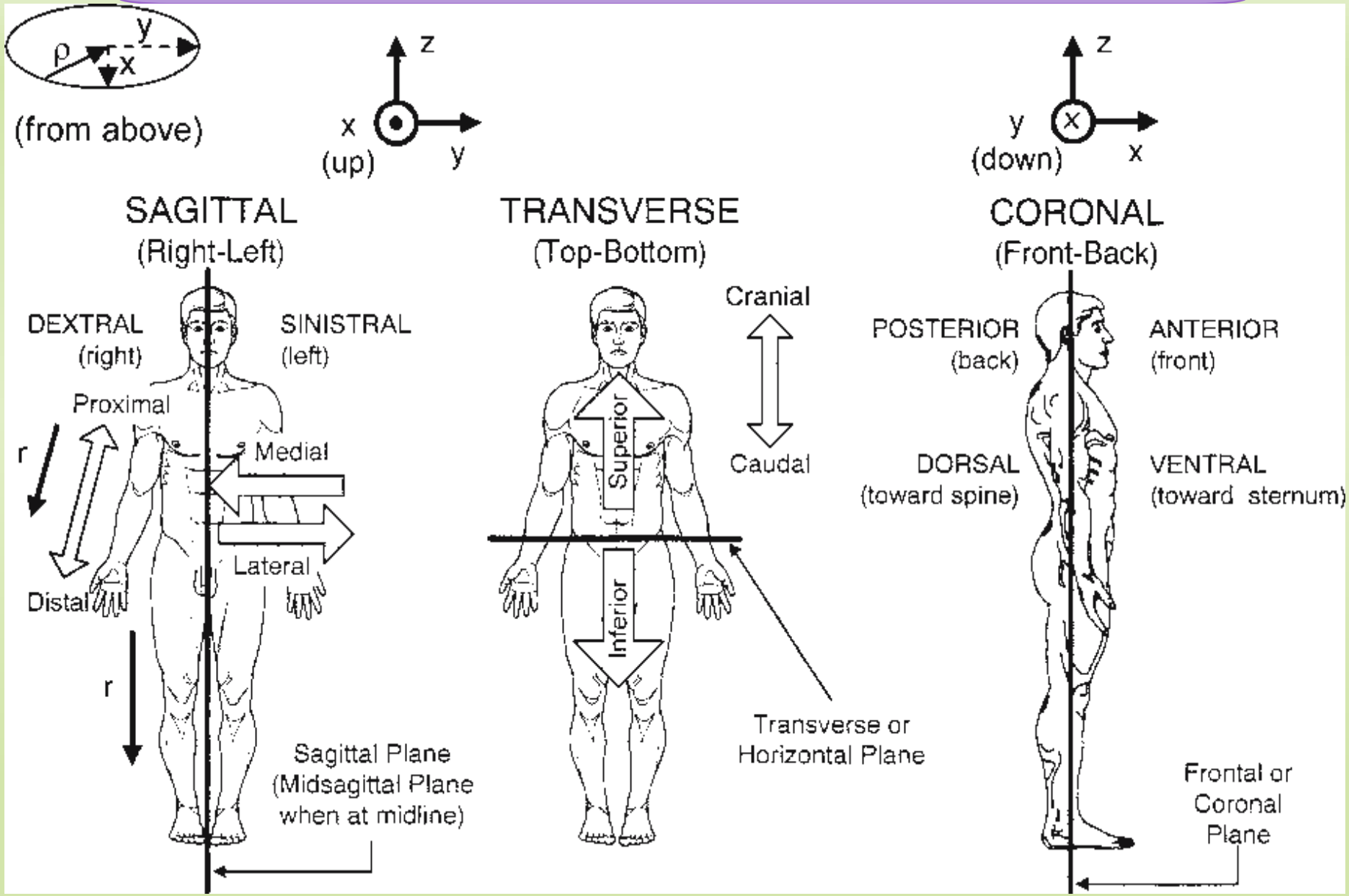


Anatomical Terminology

- we encounter is right (Dextral) vs. left (Sinistral)
- The second direction is superior (or cranial), which means towards the head or above i.e., larger z. Inferior (or caudal) means away from the head, i.e., to smaller(z –) in an
- Anterior (or ventral) means towards or from the front of the body, i.e., to larger x. Posterior (or dorsal) means towards or from the back

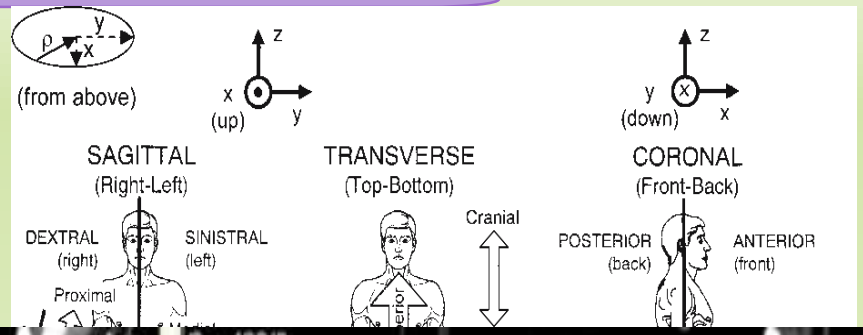
- *Medial* means nearer the midline , *Lateral* means further from the midline
- *Proximal* means near the point of attachment, i.e., to smaller *r*. *Distal* means further from the point of attachment, or larger *r*.

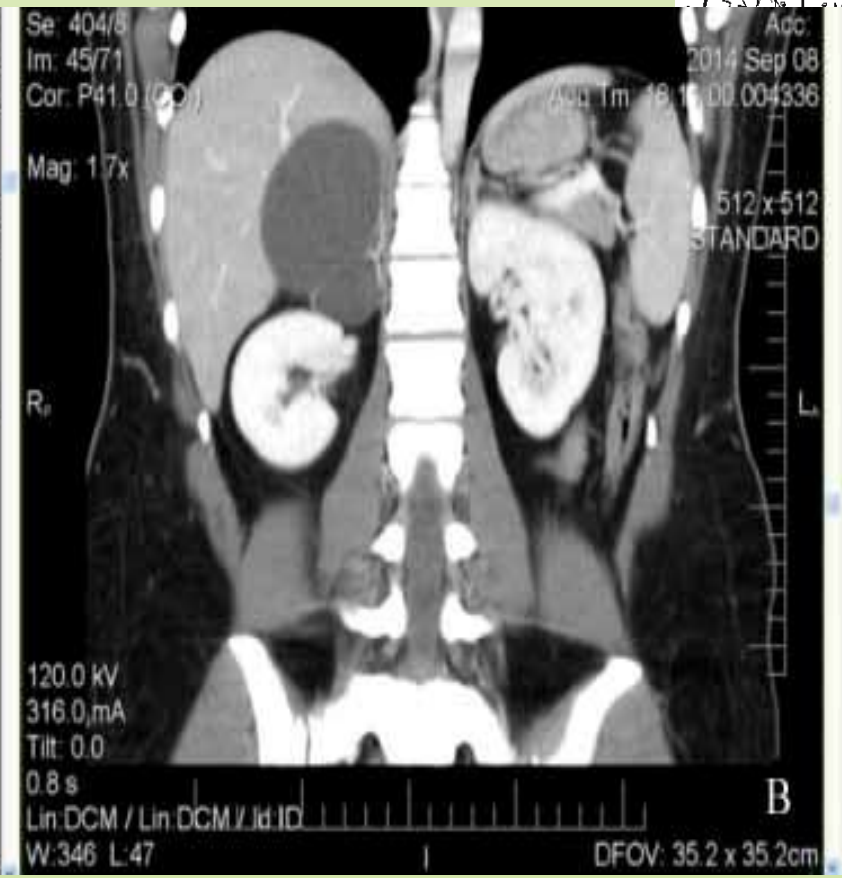
Anatomical Terminology



Motion in the Human Machine

- whether it is at rest or in motion??
- W
- e
  r





Motion in the Human Machine

- Anatomical terms refer to the body locally whether it is at rest or in motion. Since we are concerned about how we move, we need to address human motion. The movement can be described by examining the *degrees of freedom* (DOF)

- such motion is usually provided by joints

Motion in the Human Machine

- any object is relocated by changing center of mass and its angular orientation of (x, y, z) from $(0, 0, 0)$ to (a, b, c). Since three coordinates are needed to describe this change

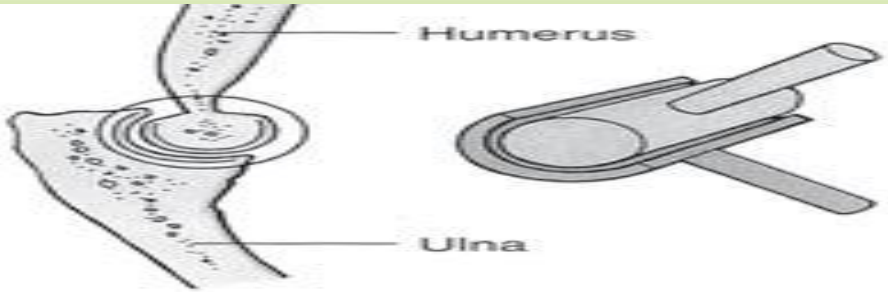
- there are three "translational" degrees of freedom. Similarly, the angular orientation can be changed by changing the angles of these three axes: θx, θy, and θz, respectively. Therefore, there are six (three plus three) degrees of freedom are independent of each other.

Degrees of freedom

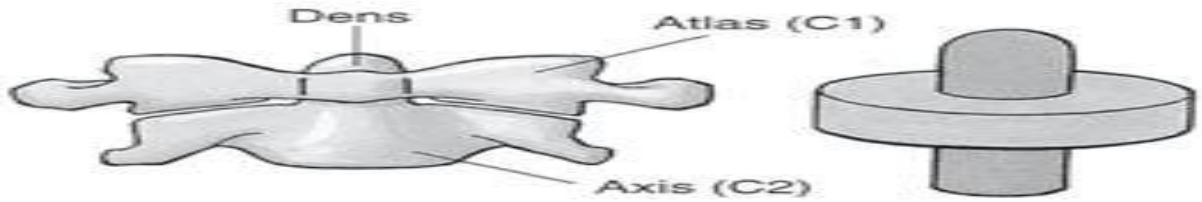
any of a limited number of ways in which a body may move or in which a dynamic system may change

- describe how we move by examining the *degrees of freedom* (DOF) of motion
- providing such motion by joints:
- fibrous (bones joined by connective tissue)
- Cartilaginous (bones joined by cartilage) joints
- synovial joints

Synovial Joints

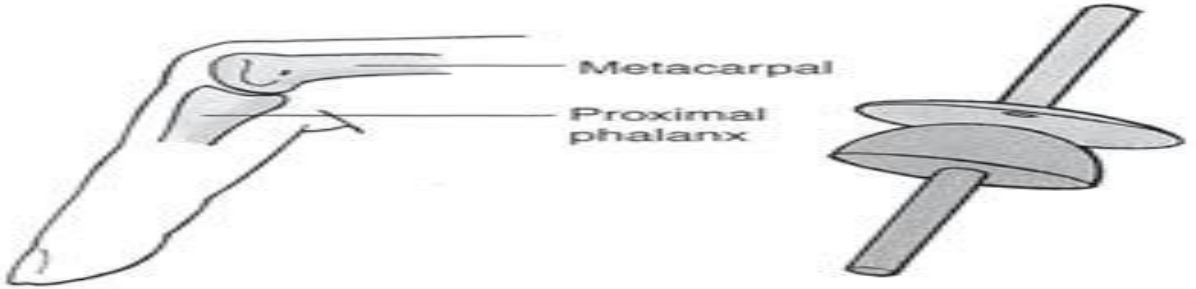


(a) Hinge joint (1D)



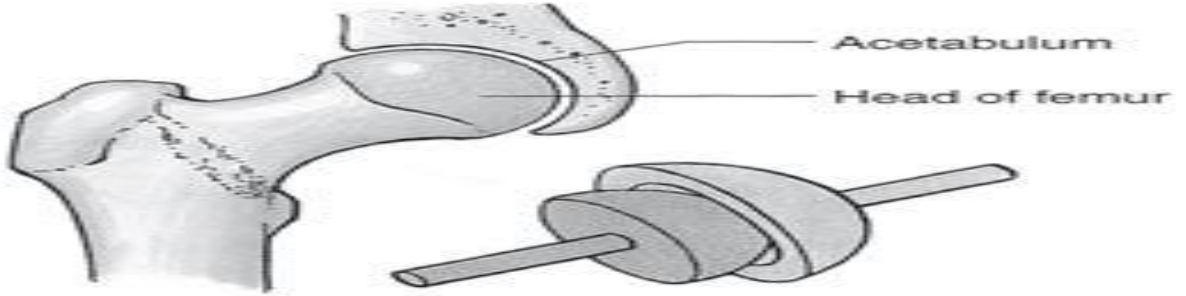
(b) Pivot joint (1D)

(c) Saddle joint (2D)



(d) Condyloid (ellipsoidal) joint (2D)

(e) Plane joint (2D)



(f) Ball-and-socket joint (3D)

Clever and good Physics

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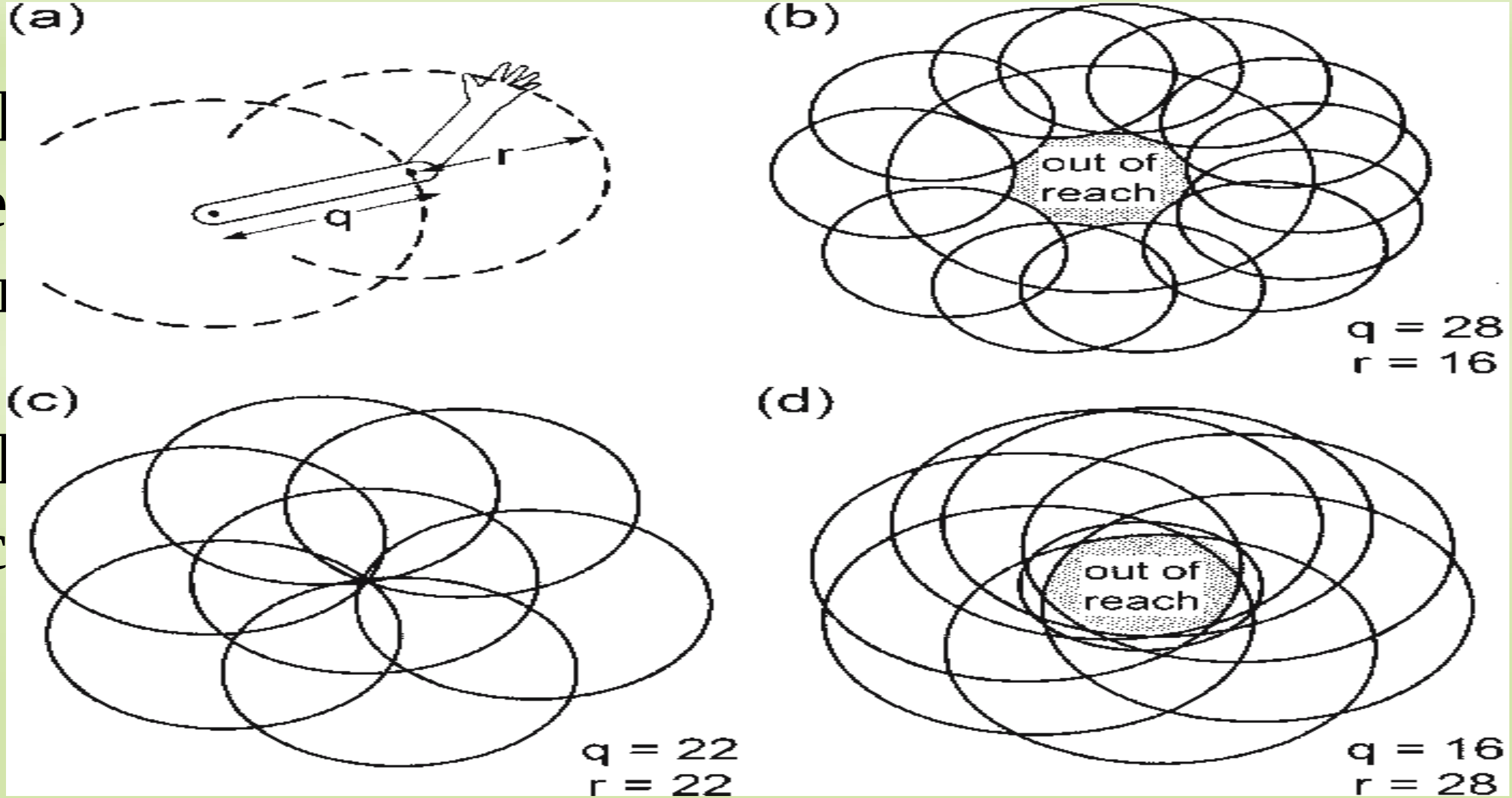


statics and motion of the body

- there are four types of components:

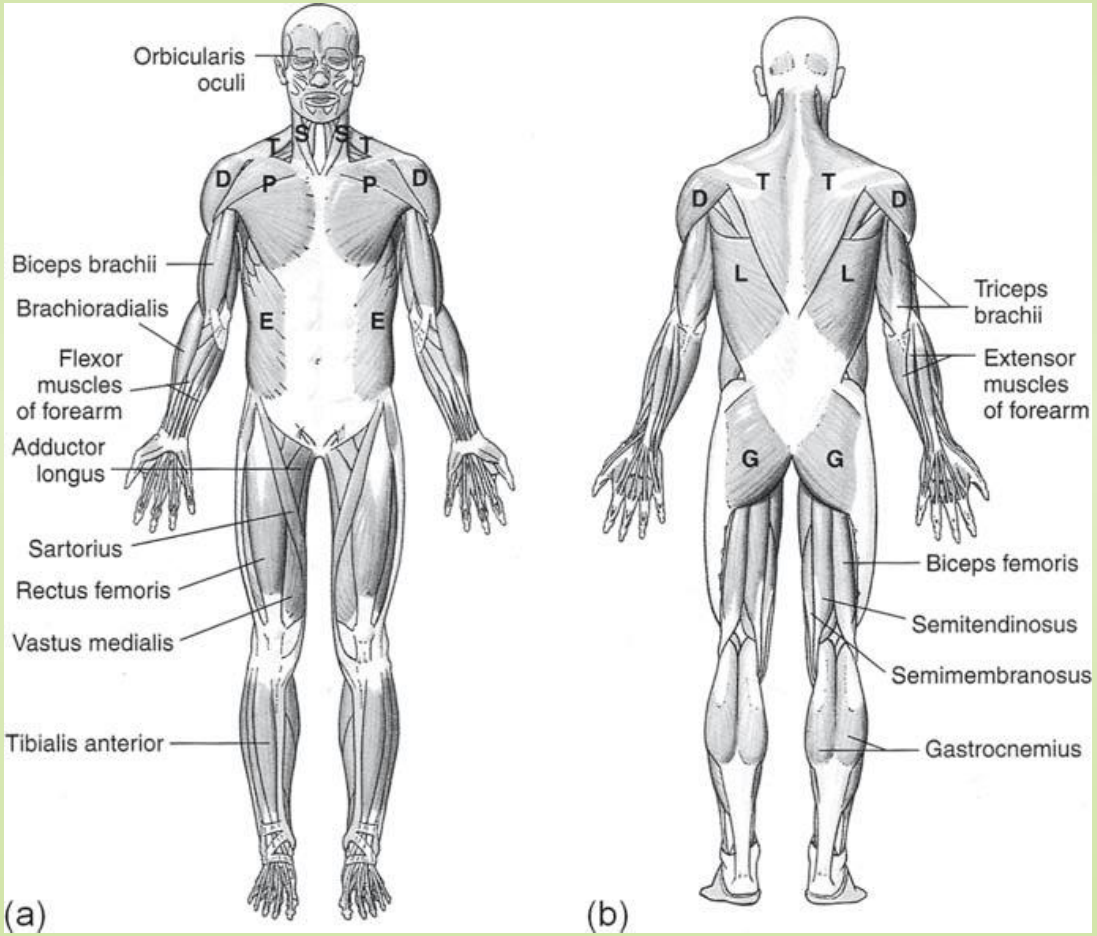
❖ **Bones** are often lined with hyaline articular cartilage at the synovial joints

❖ **Ligaments** hold bones together.

❖ **Muscles** are the motors that move the bones about the joints

❖ **Tendons** connect muscles to bones.

Each one has a very different function and mechanical properties



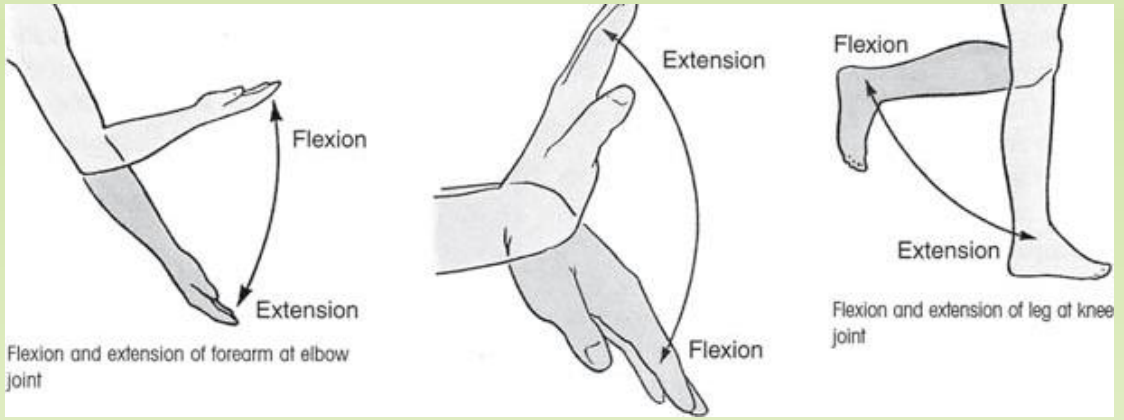
Muscles work

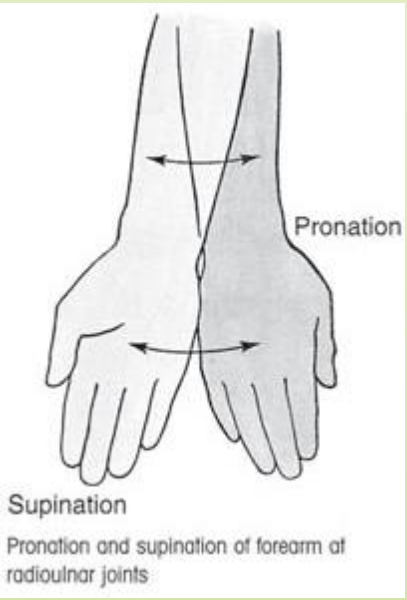
- Muscles work by contraction only to be able to move such as the elbow

➢ increases it is called *extension* and when it decreases it is *flexion*

➢ Rotating legs away from the midline of body, it is *abduction*

➢ bring is closer to the midline, it is *adduction*.



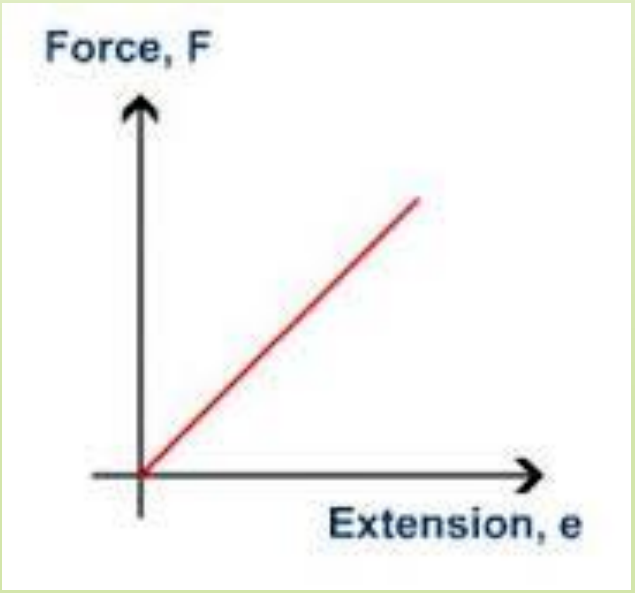


Experiment:1
Hook's Law

- Medical Effect:

- every starching and contraction that happened to the muscles is working as the same principle as Hooks law

- the Hook's law has the same effect on the spinal column




Thank you