Movement Terminology & Biomechanical Principles

Kinesiology
RHS 341
Lecture 1
Dr. Einas Al-Eisa

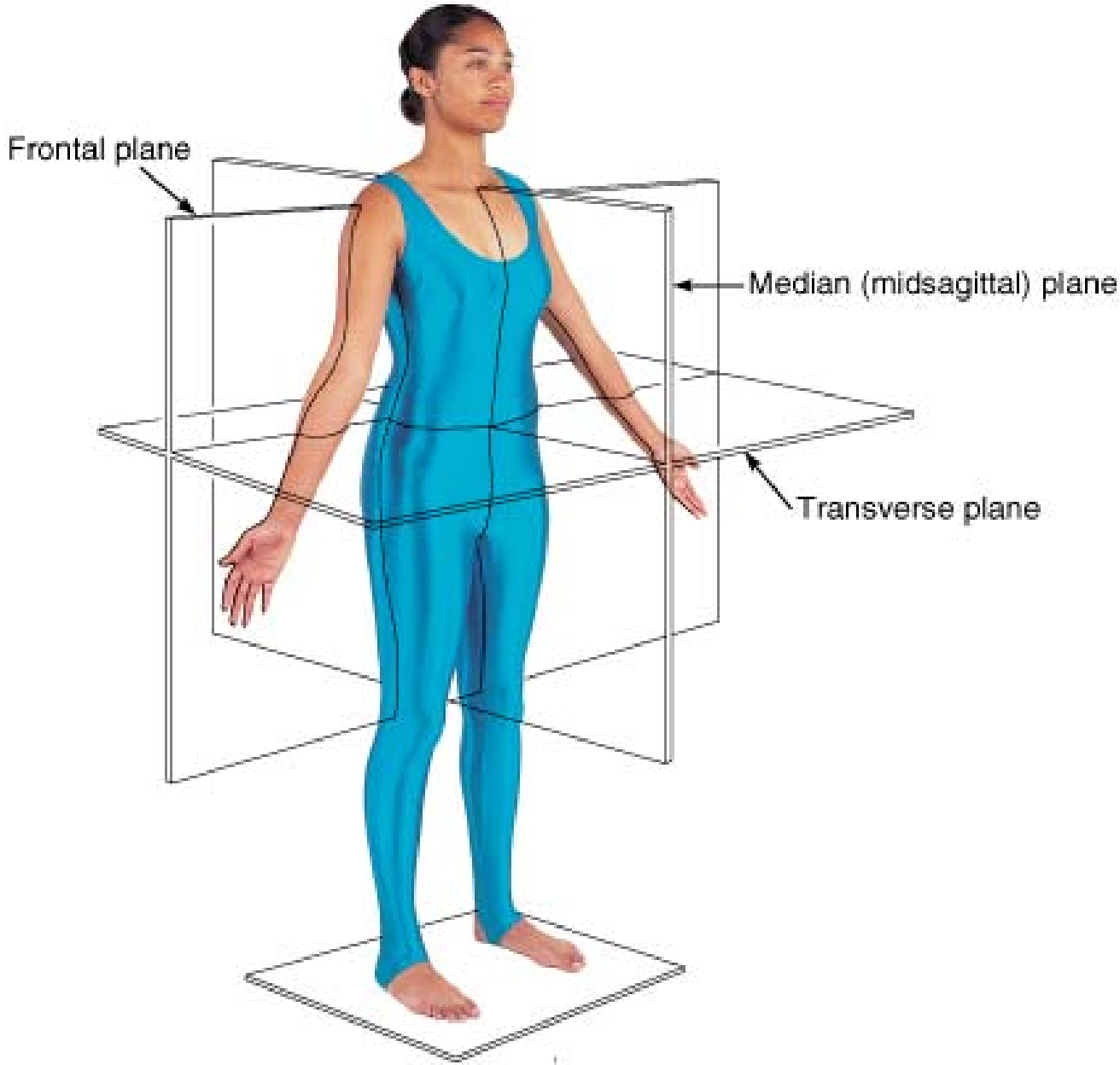
What & Why?

- Kinesiology = the study of movement
- It is not enough to know if a movement occurred or not. You have to know how the movement was produced, and if it was normal.
- If not, what was the cause of the abnormality, and what must be done to correct or improve it.

Reference Position

- Anatomical position = person standing upright, facing straight ahead, feet parallel and close, and palms facing forward.

- Fundamental position = palms facing the body.



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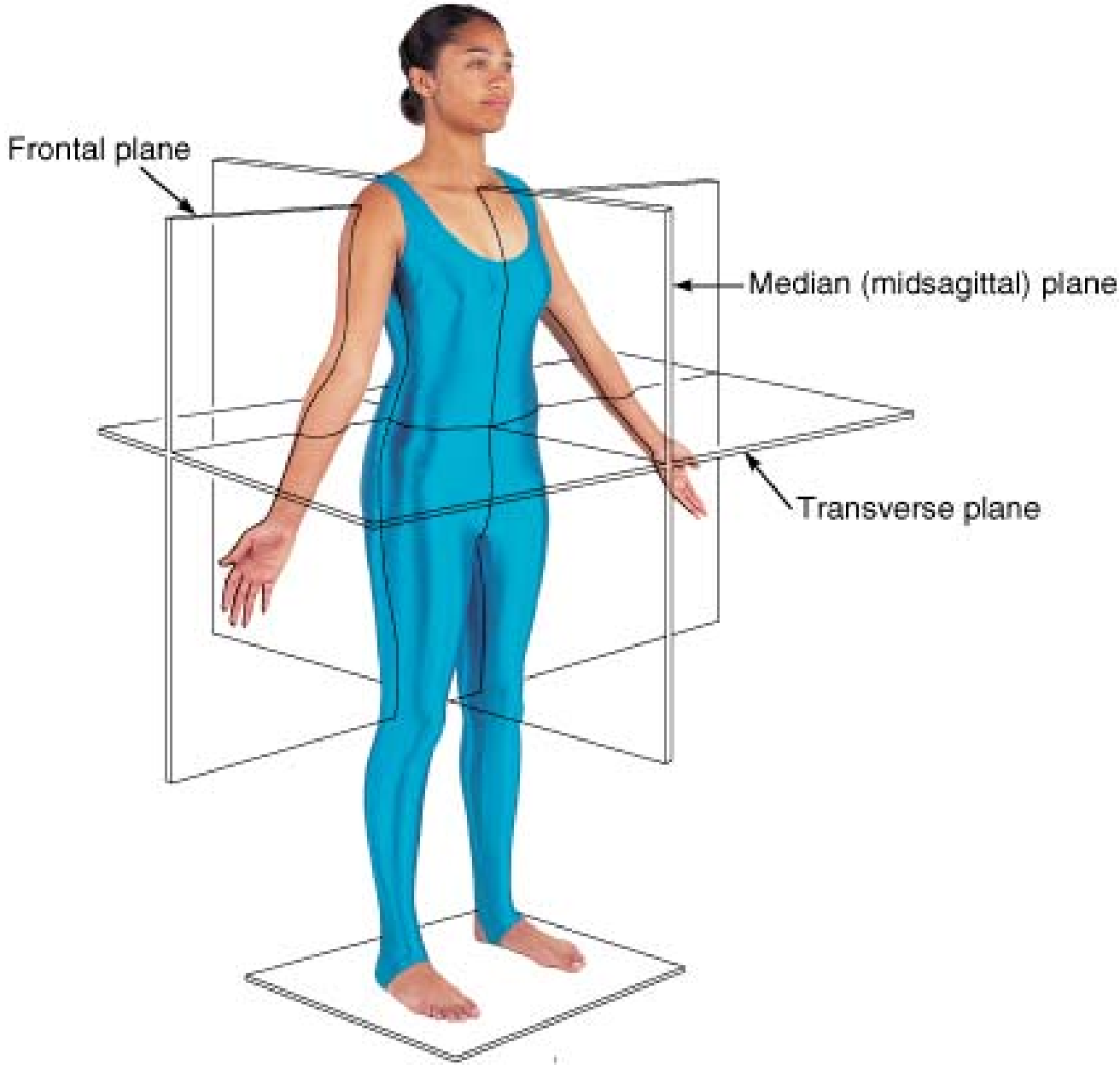
Motion occurs in a plane about an axis

- Plane of motion = an imaginary two-dimensional surface through which a limb or body segment is moved.

- Axis of rotation = the axis which has a 90^{o} relation ship to the plane of motion and around which the movement takes place



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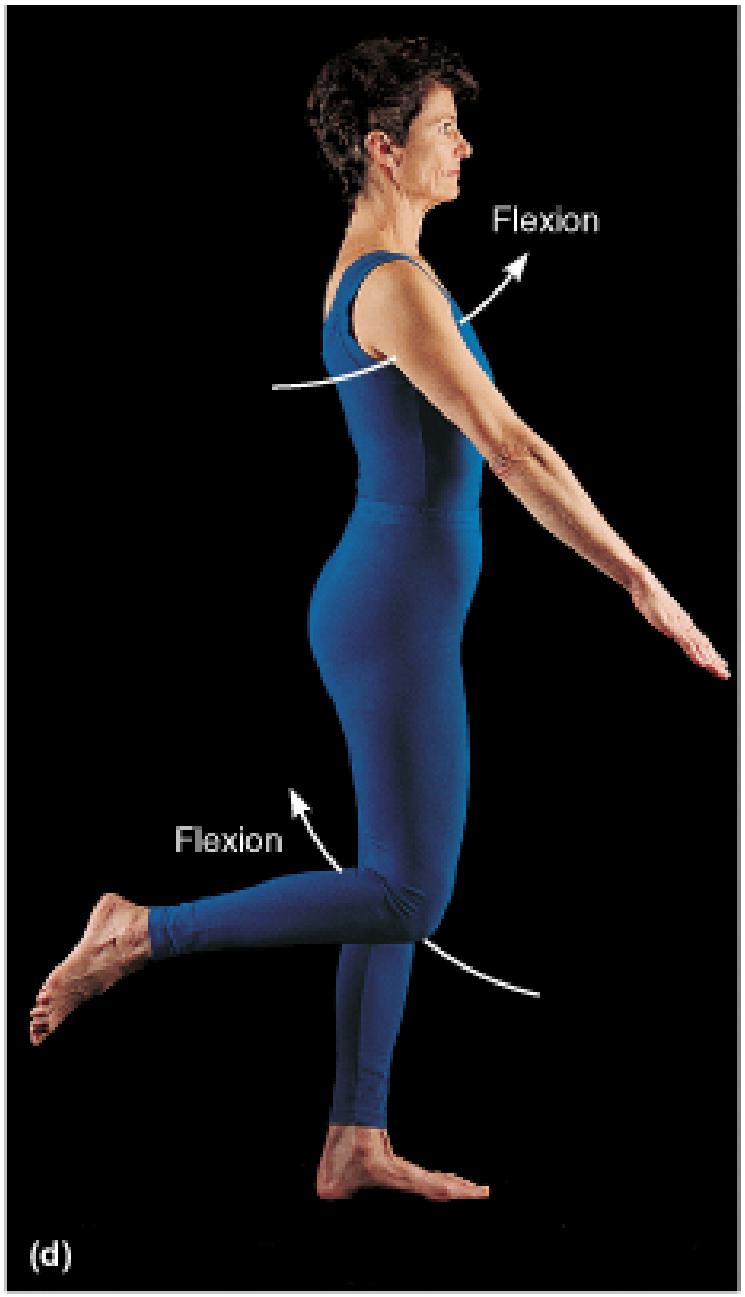
Planes of motion

Plane	Divides the body into:
Frontal (coronal)	Front & back halves
Transverse (horizontal)	Superior & inferior halves
Sagittal (median)	Right & left halves

Flexion = movement in the sagittal plane away from the anatomical position



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<u>Extension</u> = movement in the sagittal plane bringing the body part back to the anatomical position and beyond

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Frontal plane motion:

<u>Abduction</u> = away from the midline

<u>Adduction</u> = toward the midline

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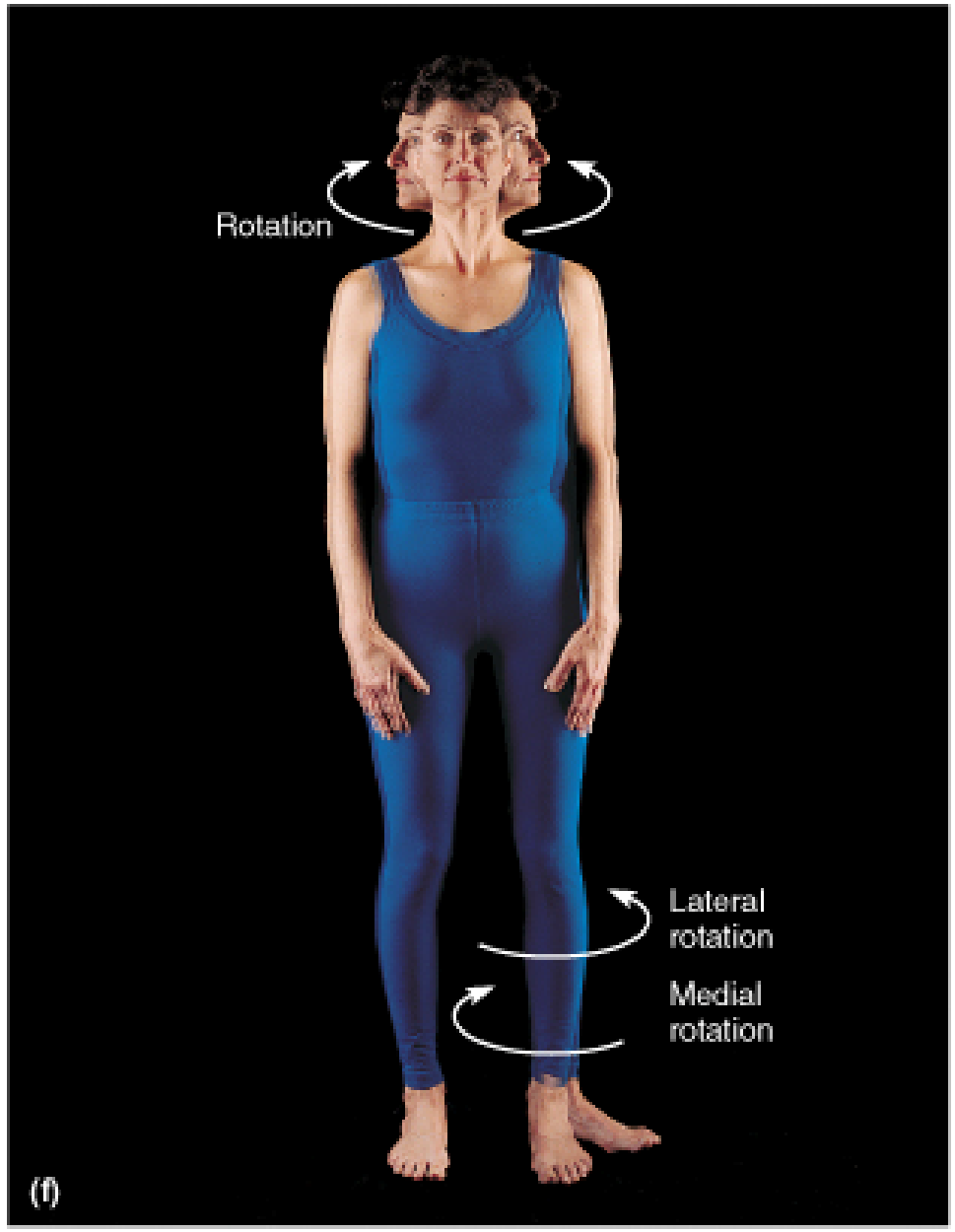
<u>Rotation</u> = movement in the transverse plane

<u>Lateral (external) rotation</u> = when the bone rotates away from the midline

<u>Medial (internal) rotation</u> = when the bone rotates towards the midline



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<u>Circumduction</u> = flexion, abduction, extension, & adduction

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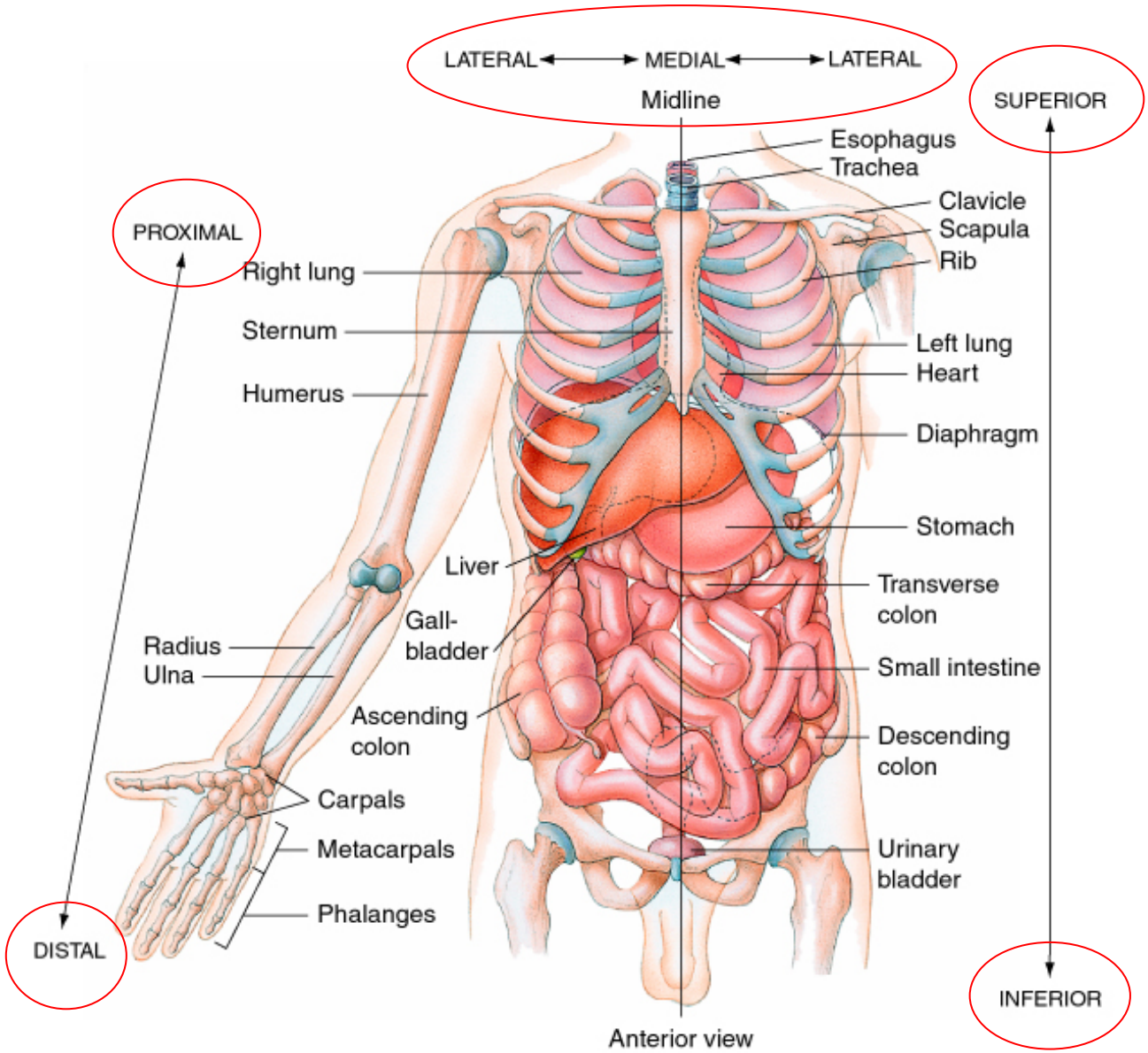
Planes of motion

Plane	Divides the body into:	Example	Axis
Frontal (coronal)	Front & back halves	• Abduction/ adduction • Spinal lateral flexion	Anetroposterior (sagittal) axis
Transverse (horizontal)	Superior & inferior halves	• Rotational movements (pronation/ supination)	Vertical (longitudinal) axis
Sagittal (anteroposterior)	Right & left halves	• Flexion/ extension • Sit-ups	Mediolateral (frontal) axis

- Most human movements take place in multiple planes.

- Although each specific joint movement can be classified as being in one of the three planes of motion, our movements are usually not totally in one specific plane but occur as a combination of motions in more than one plane, which is often called a diagonal plane.

Directional Terms



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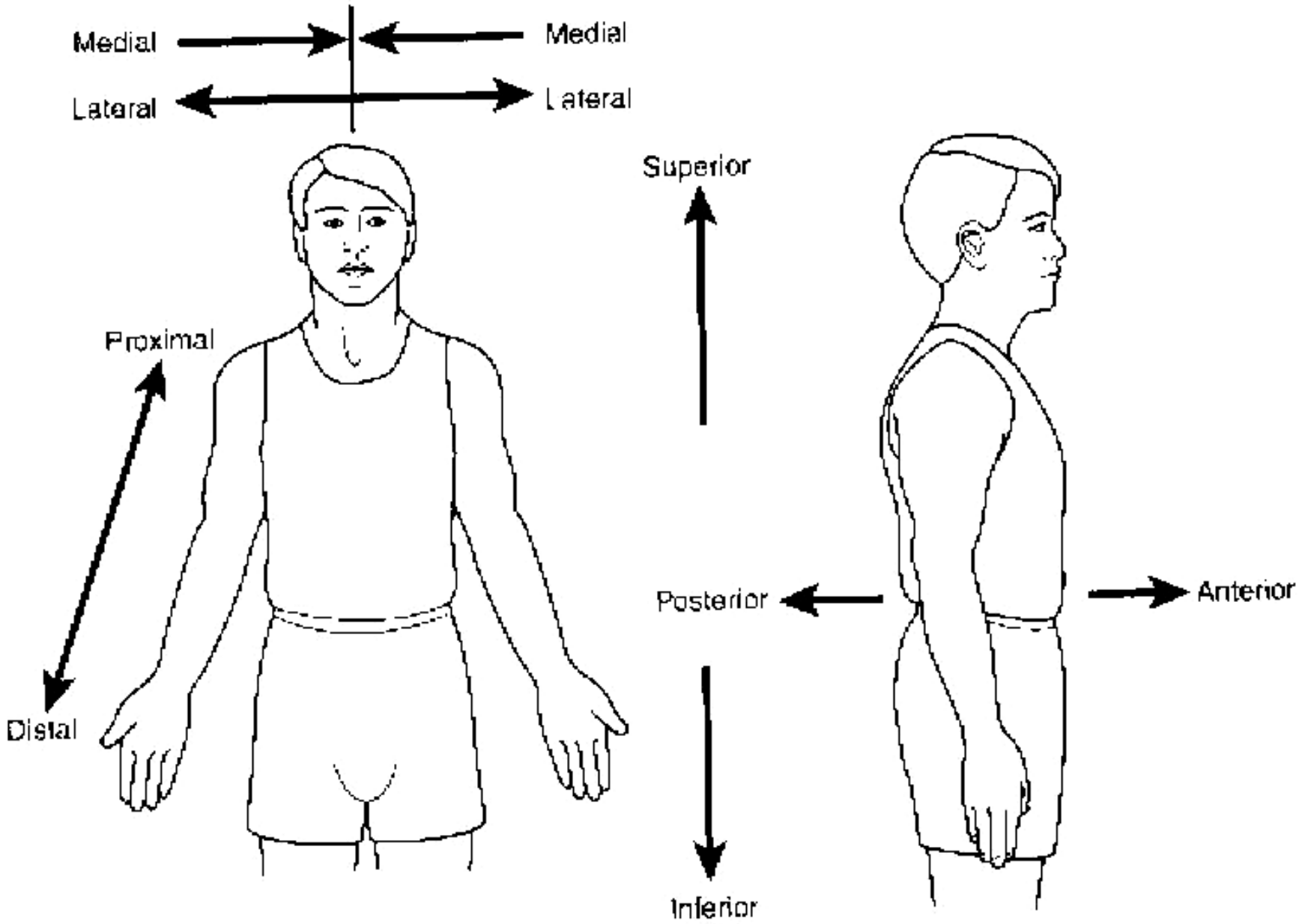

Medial
Medial
Lateral
Lateral
Proximal
Distal
Superior
Posterior
Anterior
Inferior

Table 1.1 Orientation and Directional Terms

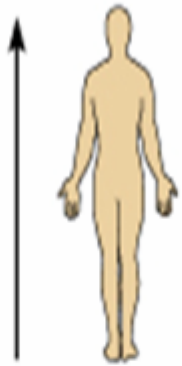
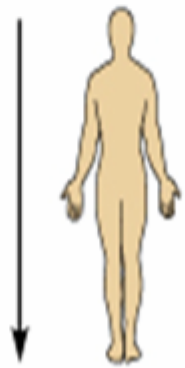
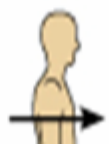
Term	Definition		Example
Superior (cranial)	Toward the head end or upper part of a structure or the body: above		The head is superior to the abdomen
Inferior (caudal)	Away from the head end or toward the lower part of a structure or the body; below		The navel is inferior to the chin
Anterior (ventral)*	Toward or at the front of the body; in front of		The breastbone is anterior to the spine

Table 1.1 Orientation and Directional Terms

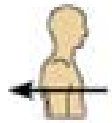
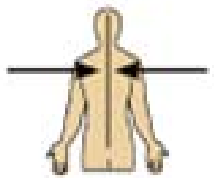
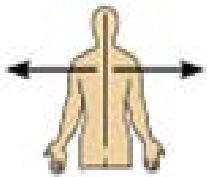
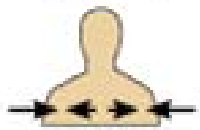
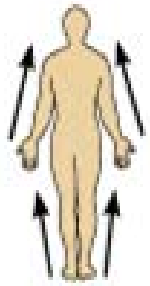
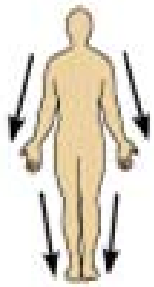
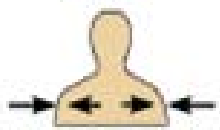
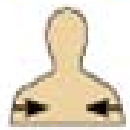
Term	Definition		Example
Posterior (dorsal)*	Toward or at the back of the body; behind		The heart is posterior to the breastbone
Medial	Toward or at the midline of the body; on the inner side of		The heart is medial to the arm
Lateral	Away from the midline of the body; on the outer side of		The arms are lateral to the chest
Intermediate	Between a more medial and a more lateral structure		The collarbone is intermediate between the breastbone and shoulder

Table 1.1 Orientation and Directional Terms

Term	Definition		Example
Proximal	Closer to the origin of the body part or the point of attachment of a limb to the body trunk		The elbow is proximal to the wrist
Distal	Farther from the origin of a body part or the point of attachment of a limb to the body trunk		The knee is distal to the thigh
Superficial (external)	Toward or at the body surface		The skin is superficial to the skeletal muscles
Deep (internal)	Away from the body surface; more internal		The lungs are deep to the skin

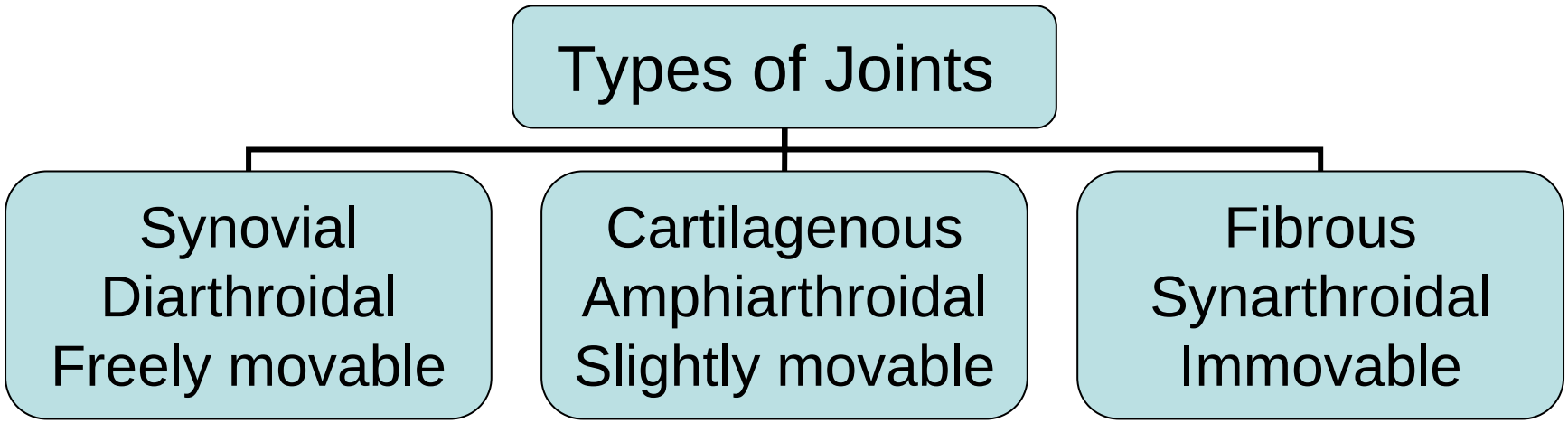
A biomechanical analysis can be conducted from 2 perspectives:

- **Kinematics** = description of motion from a spatial & temporal perspectives without reference to the forces causing the motion (position, velocity, acceleration).

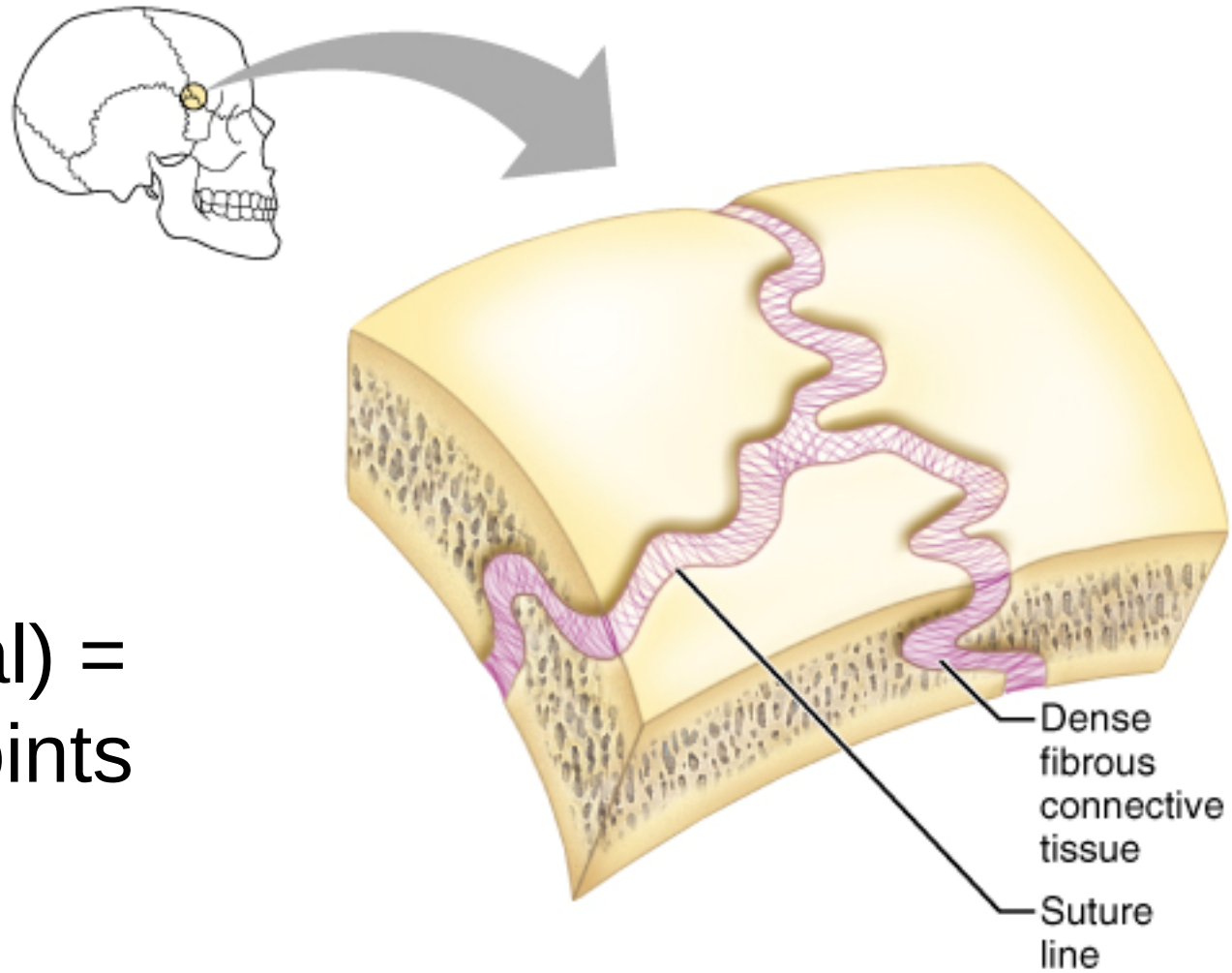
- **Kinetics** = description of forces acting on the body or any object.

Body movements occur at joints

- Joints = articulations between two or more bones.
- Bone structure determine the amount of movement in each joint.
- Some joints have no movement, other have slight mobility, and others are freely movable (depending on the joint type).


Types of Joints
Synovial
Diarthroidal
Freely movable
Cartilagenous
Amphiarthroidal
Slightly movable
Fibrous
Synarthroidal
Immovable

Fibrous (Synarthroidal) = Immovable joints



(a) Suture

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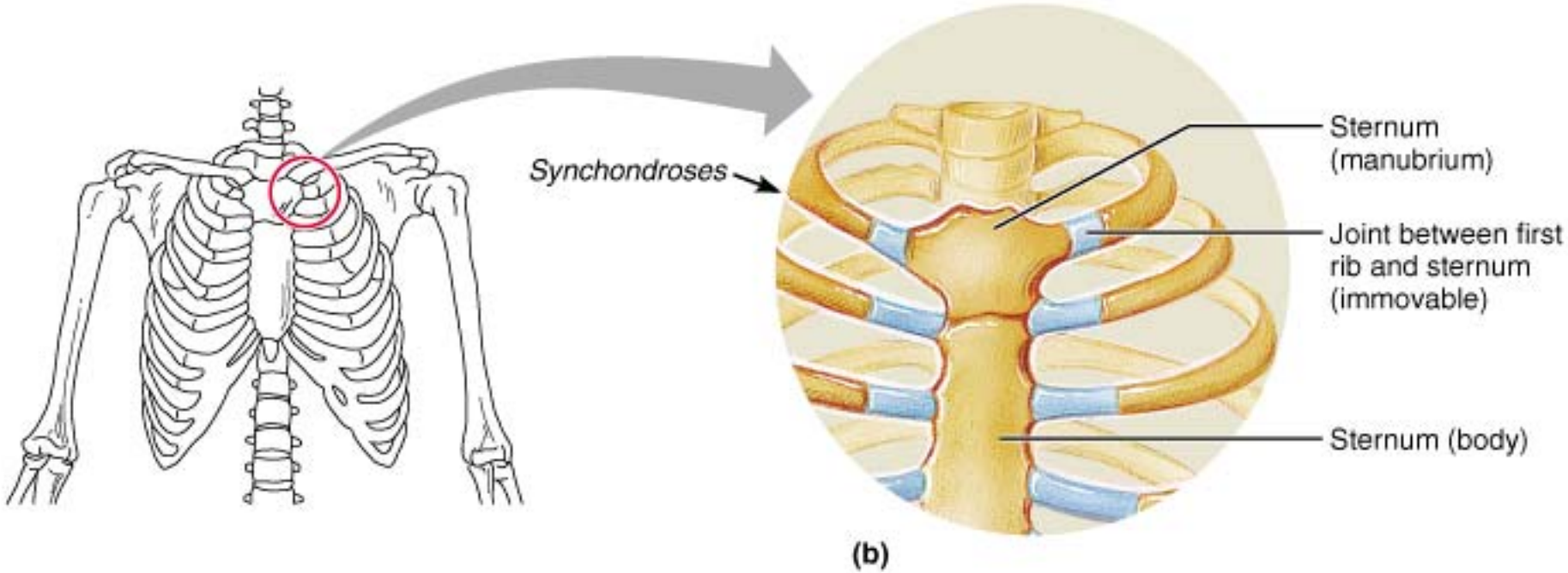
Synchodroses =
Fibrocatilagenous joint that
allows very slight movement



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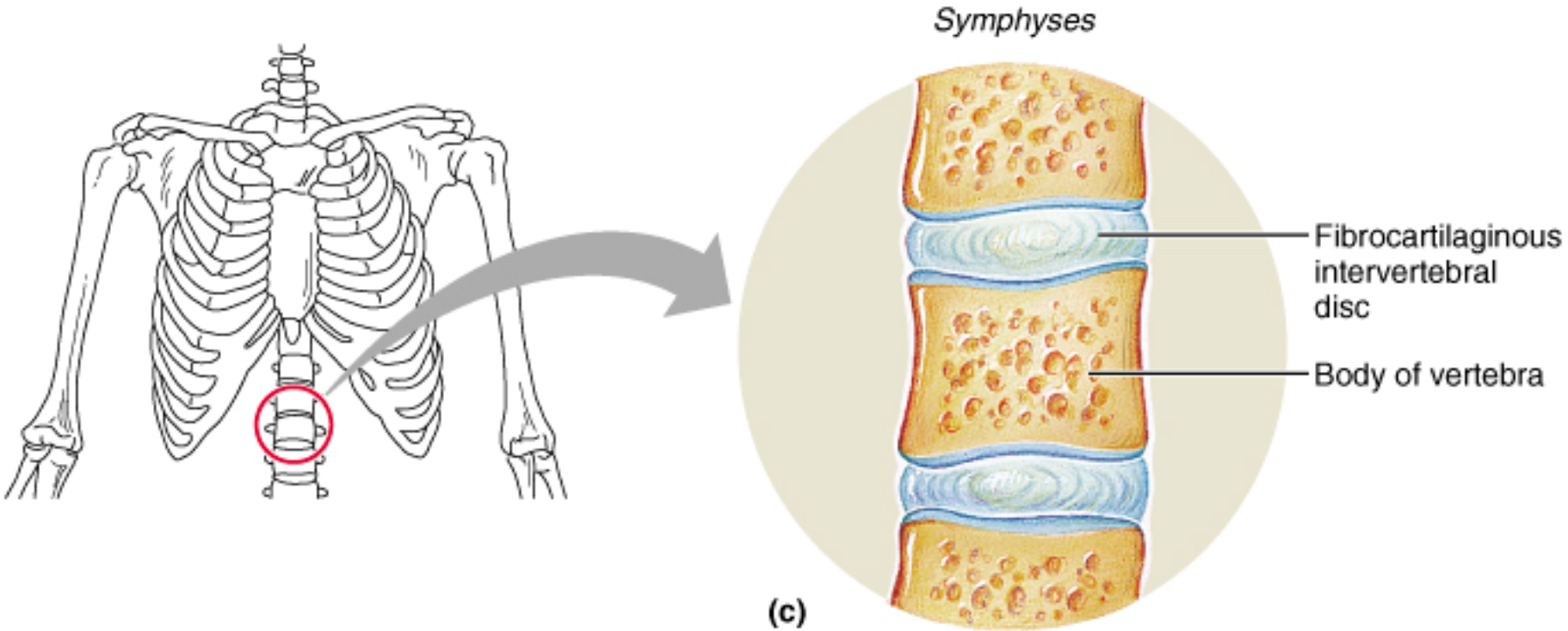
Fibrocartilagenous joint



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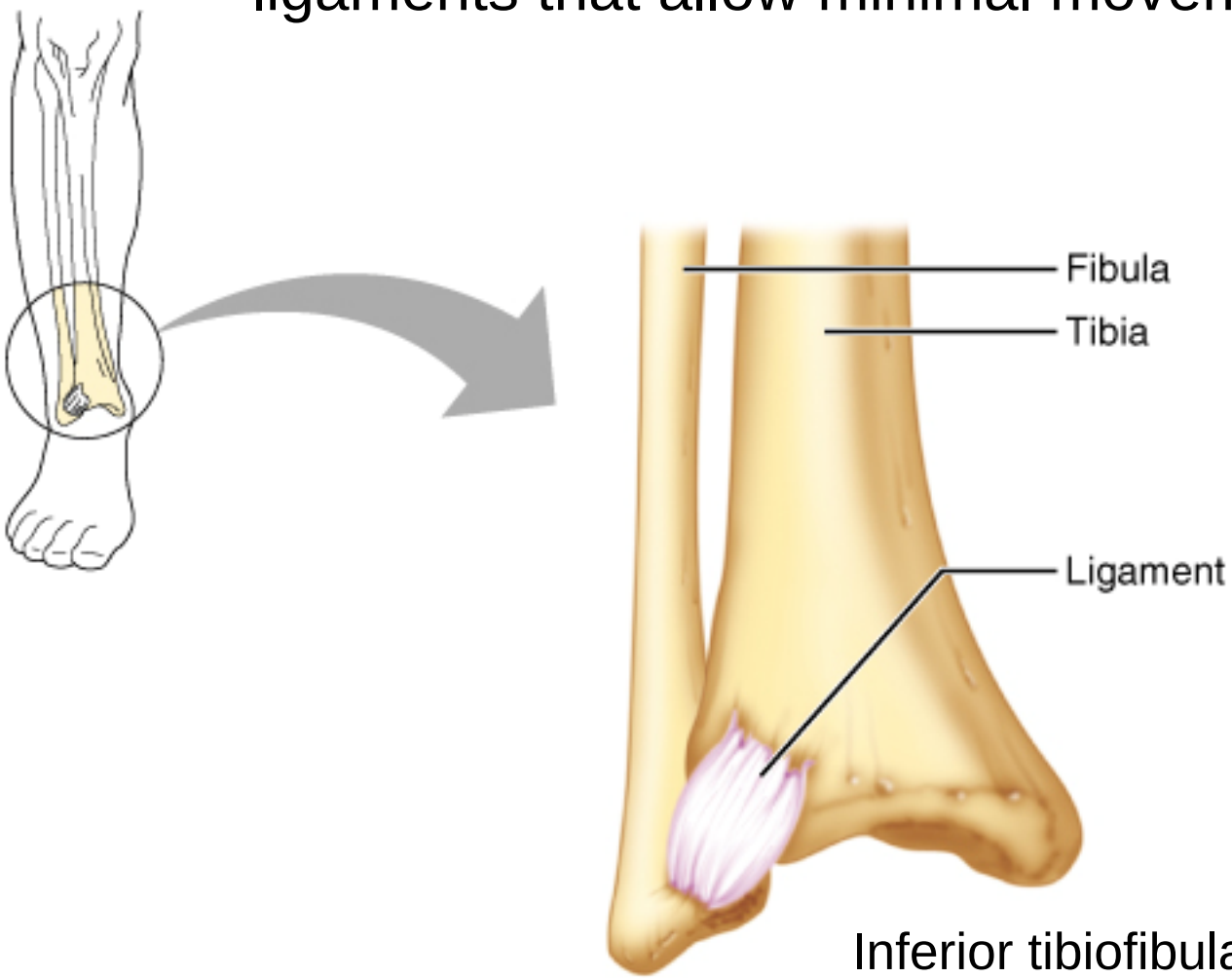
Syndesmosis = bones held together by strong ligaments that allow minimal movement



Inferior tibiofibular joint

(b) Syndesmosis

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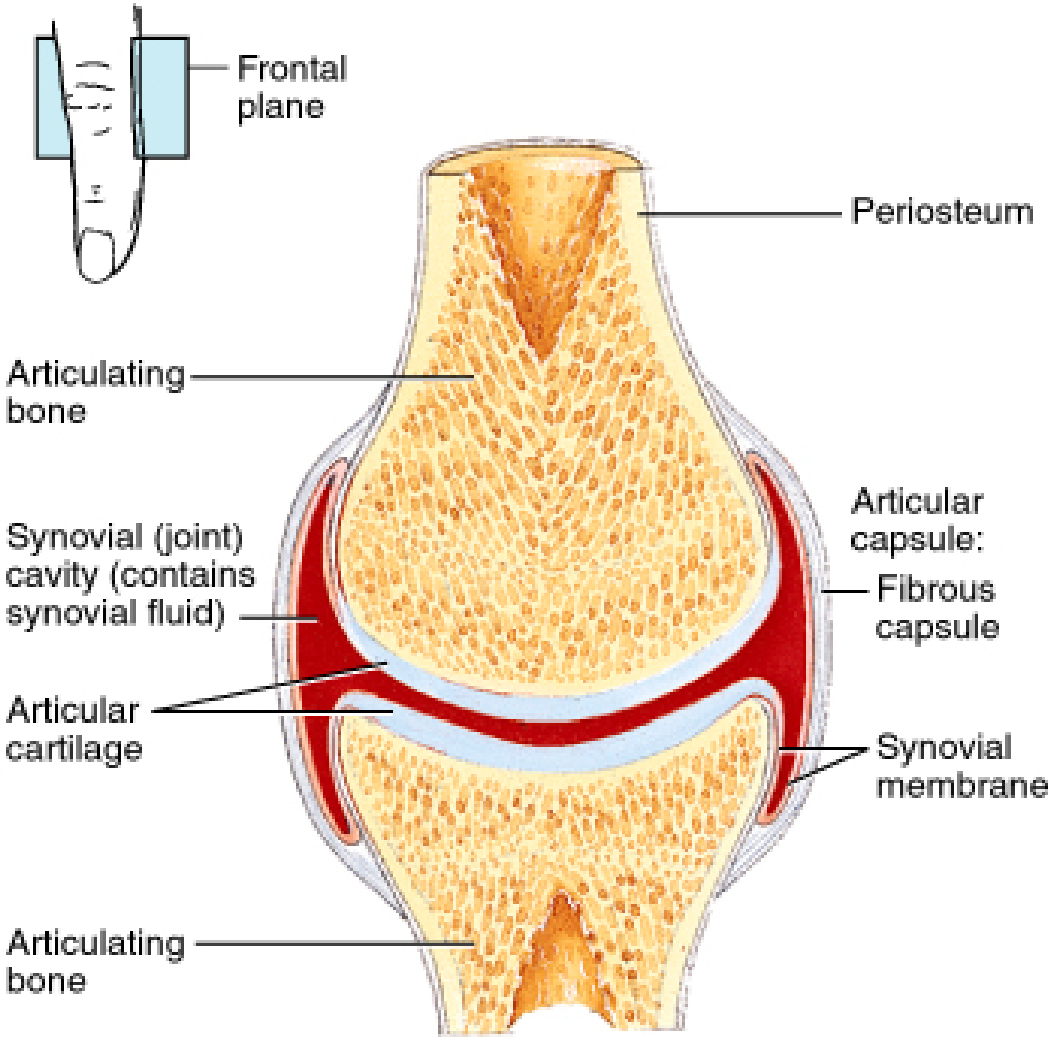
Synovial joint =
Freely movable



(a) Diagram of frontal section of a typical synovial joint

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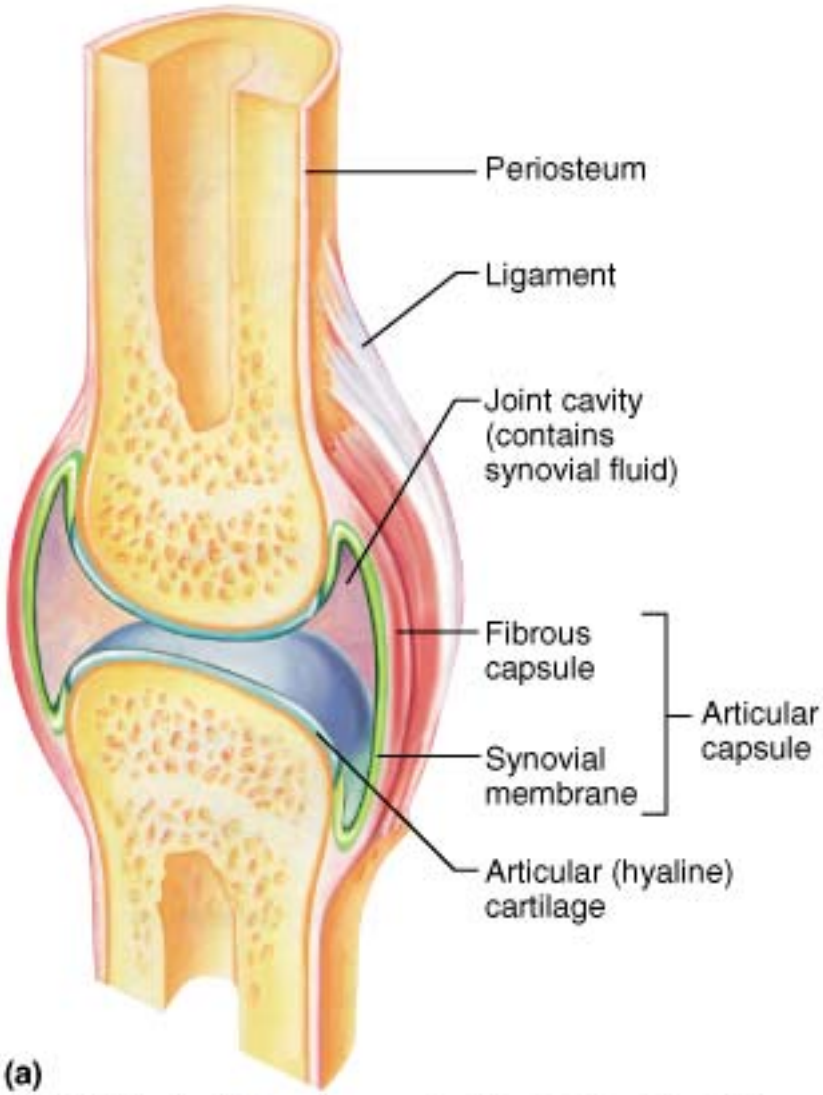

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