



PHYSICS FOR PHYSIOTHERAPY

FORCE SYSTEM

Ms.P.SABEENADEVI/AP/PHY/SNSCT



Force in Physiotherapy



Force is simply a push or a pull exerted by one object on another.

For an example, when a muscle contracts it creates a **force** that is transferred to the tendon to pull on the bony attachment, thus resulting in motion.

An important consideration with **force** is that it is a vector quantity.



Types of Forces



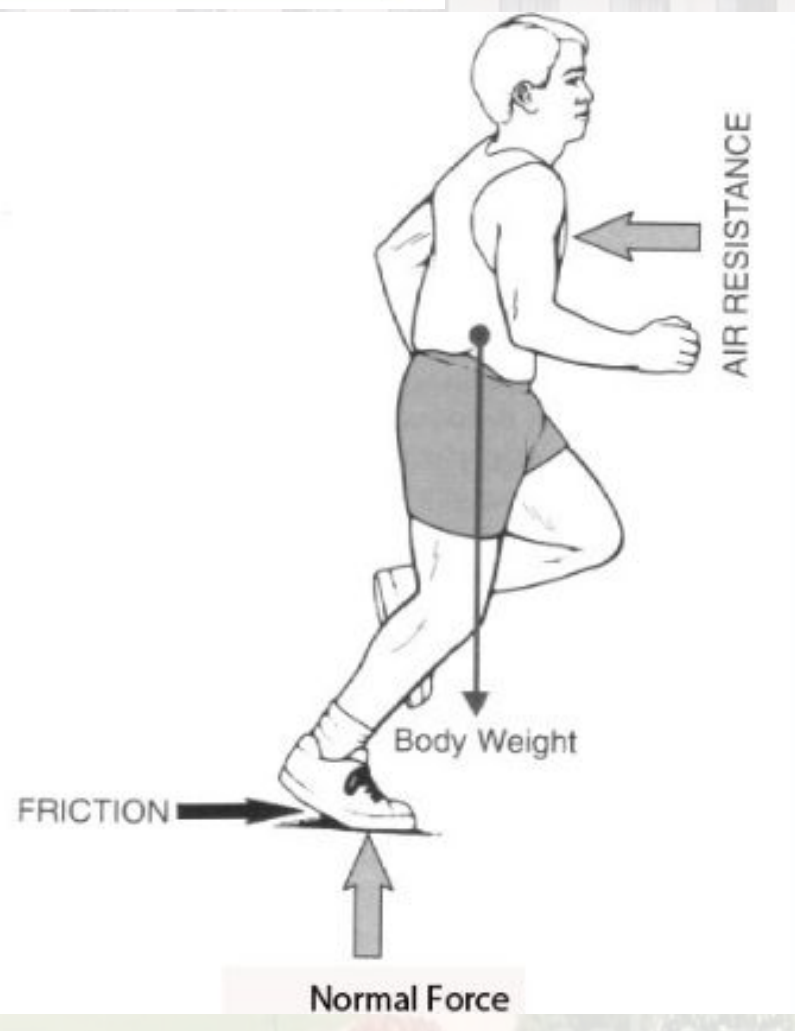
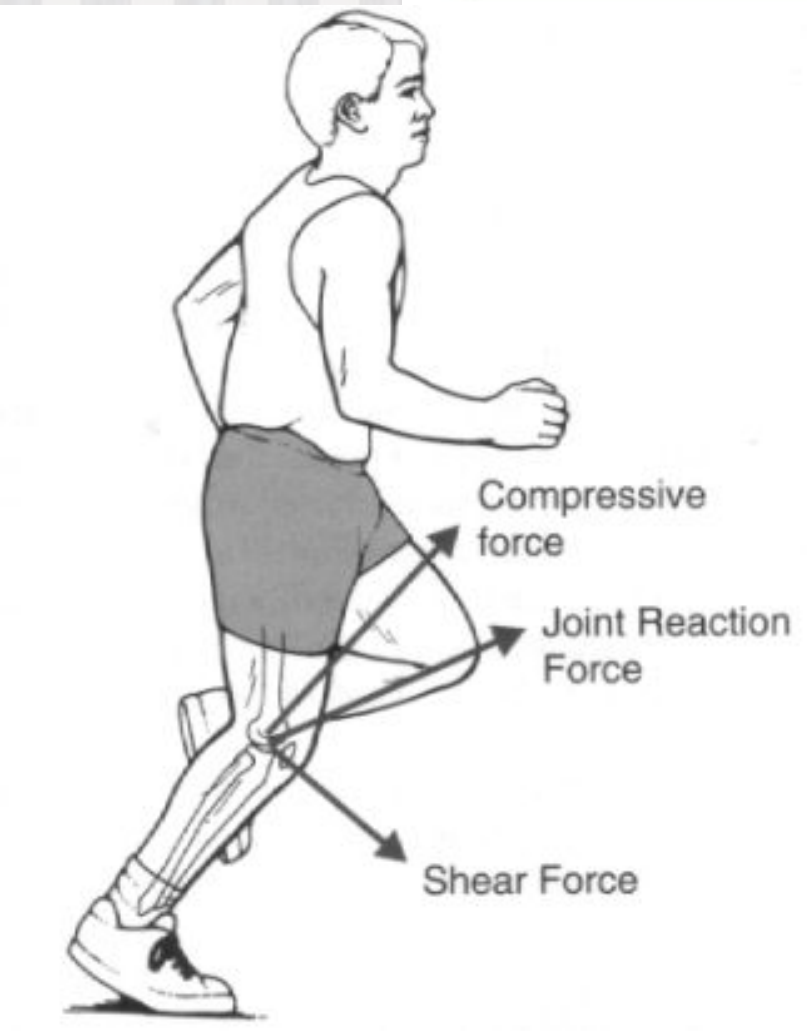
- **Motion Forces** -Rotatory, Tranlatory, Curvilinear.
- **External Forces** – Gravity, Wind, Objects, Other People.
- **Internal Forces** – Muscles, Connective Tissue (Elastic), Bone.
- **Reactionary Forces** – Ground Reaction, Joint Reaction, Gliding/Shear/Friction.



Types of forces

Internal forces

External forces





Forces in your Body



- When you walk, there is 2 to 3 times your body weight transmitted through each foot.
- When you run, this is 7 to 8 times
- The foot has 26 bones – everything must be functioning correctly to avoid injury



Forces in your Body

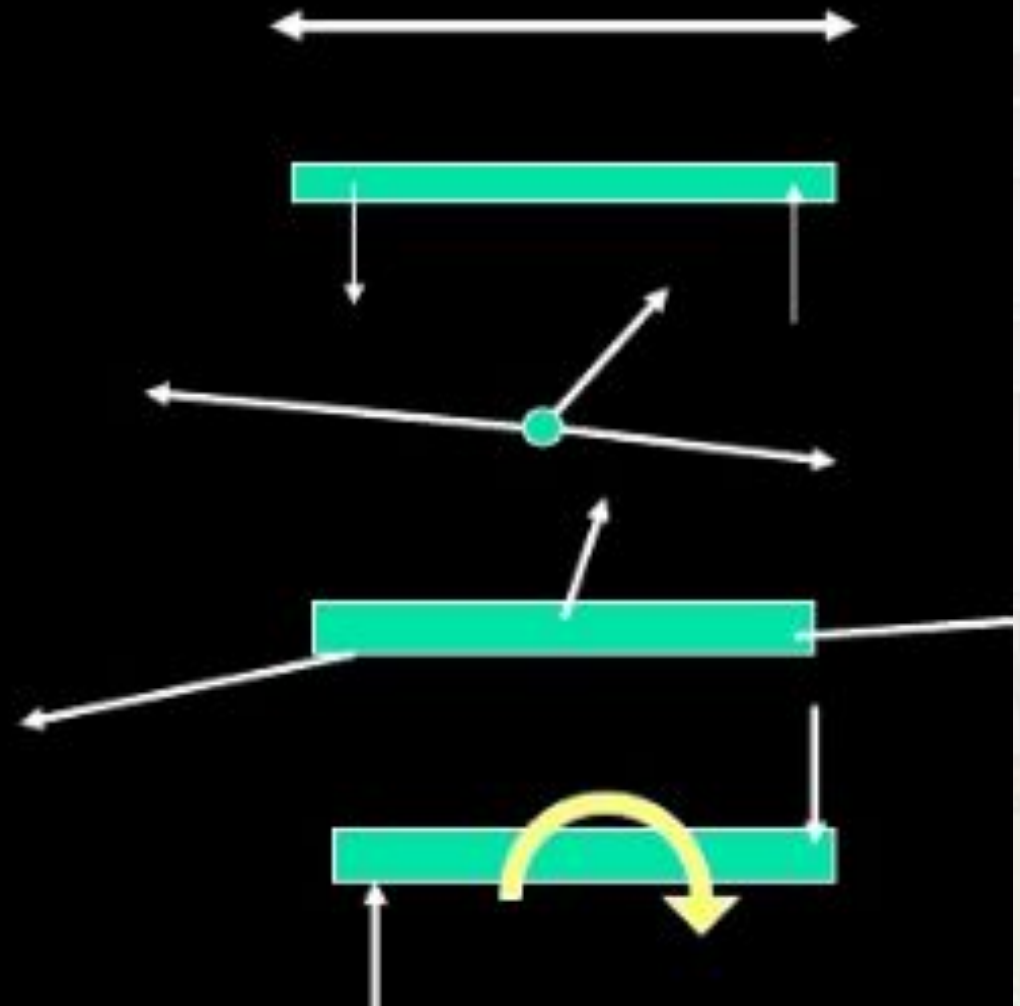


- When you sit with bad posture, there is a 200% increase pressure in your spine.
- Reaching for your toes is a 300% increase
- Human movement is very complex. There may be dozens of joints and muscles working to achieve a desired movement.



Force System

- Linear
- Parallel
- Concurrent
- General
- Force Couple





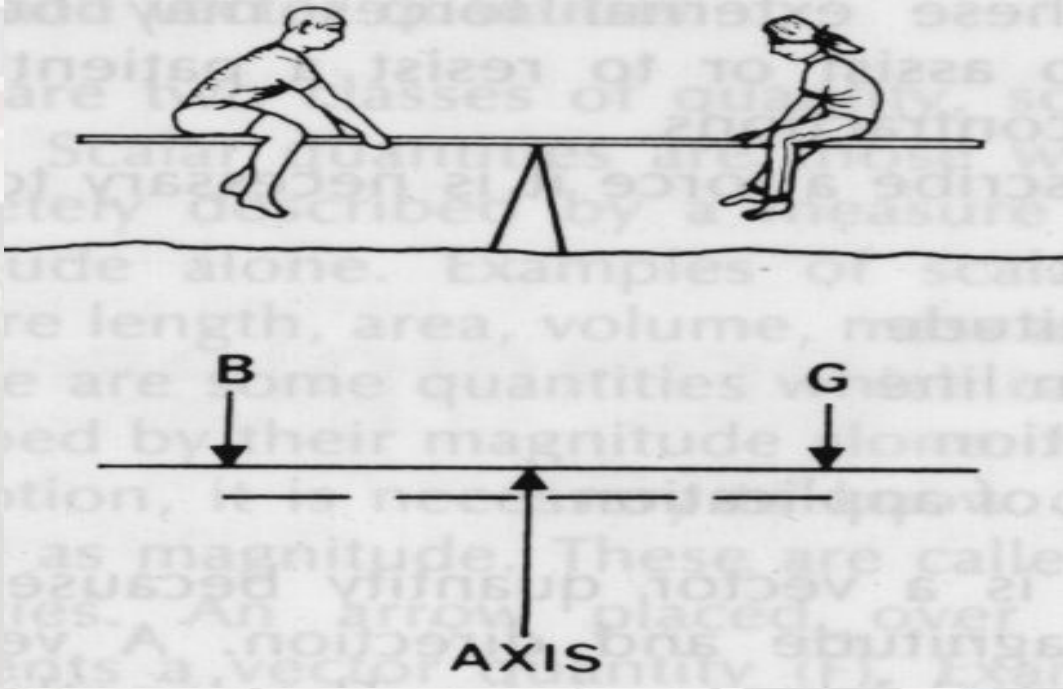
Parallel Forces



- When all the forces are **coplanar** (acting at the same plane), at **two different points**, and **parallel** to each other, but do **not** share the same action line
- Forces produce rotatory effects



PARALLEL FORCE SYSTEM

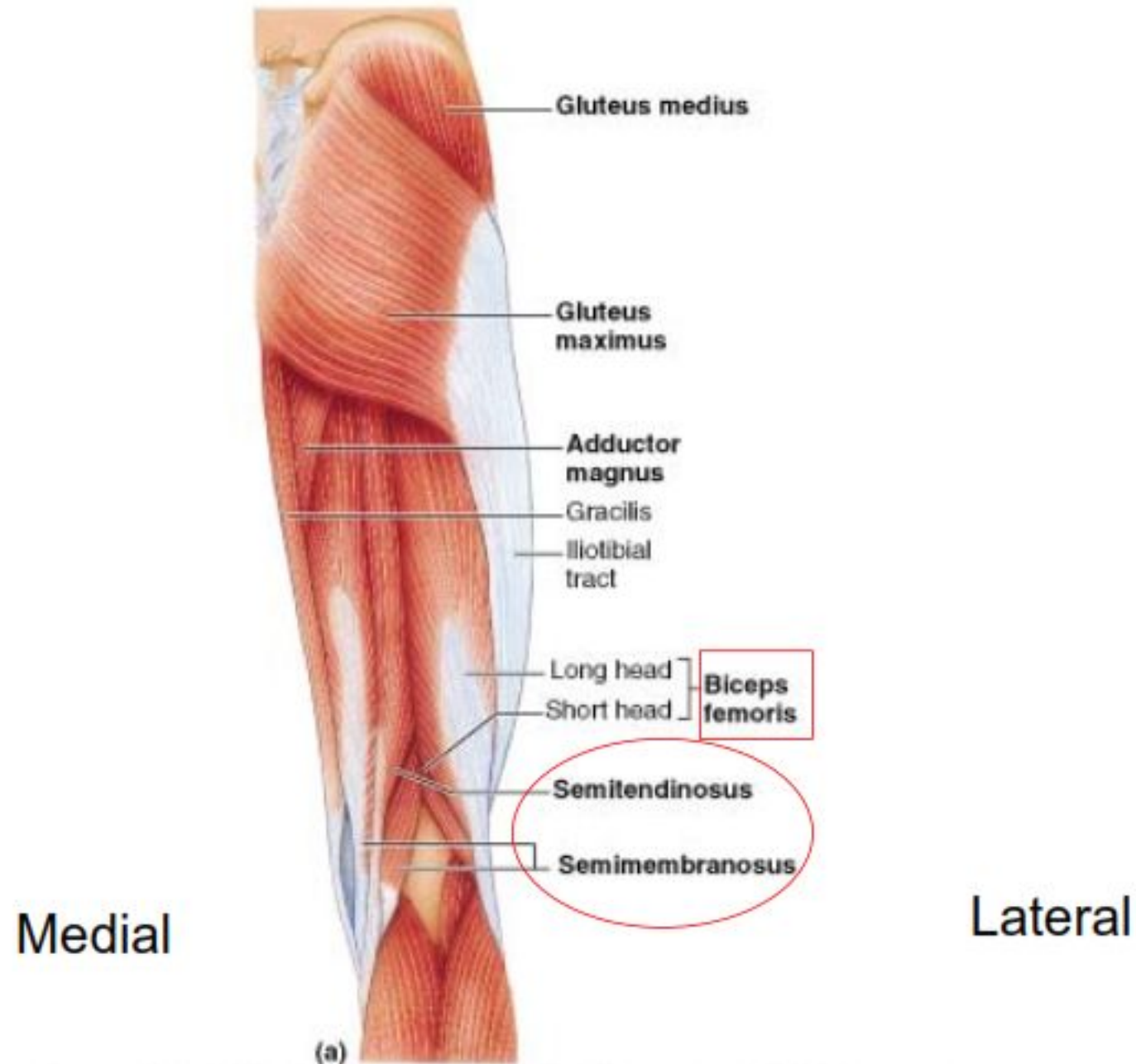


- Two children on a teeter-totter exert downward forces that are parallel to one another.
- At equilibrium, the sum of their combined weights must be opposed by the upward force at the axis of the board.
- Moment arm (lever arm) = the distance from the point of application of force to the axis of rotation

• A force acting on a rigid body at a distance from a fixed point tends to **rotate** the body



- **Hamstring** muscles components: medial (semitendinosus & semimembranosus) and lateral (biceps femoris)
- The medial and lateral forces act in the same direction to produce knee flexion
- If the forces are equal to each other → the resultant is located in the middle producing pure knee flexion





- If the medial hamstring is weak and the lateral hamstring is strong —————→
the resultant force is directed towards the lateral hamstring —————→
the person tends to flex the knee with the leg directed laterally



FORCE COUPLE



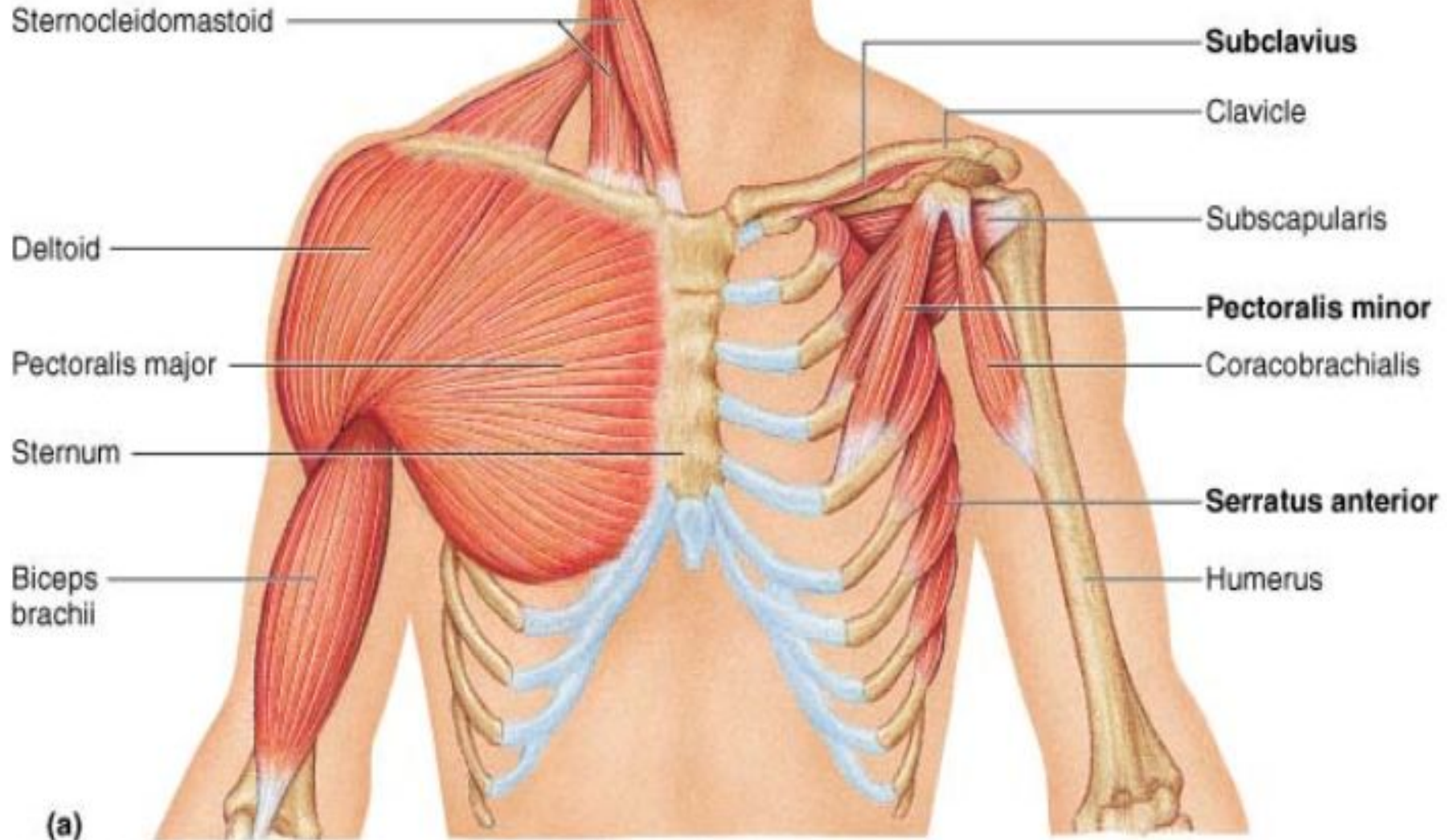
- Rotation of the pelvis in the sagittal plane:
 - **Anterior pelvic tilt:** hip flexors and back extensors
 - **Posterior pelvic tilt:** abdominal muscles and hip extensors
- Weak abdominals →
inability to tilt the pelvis posteriorly →
excessive anterior pelvic tilt (lordosis)

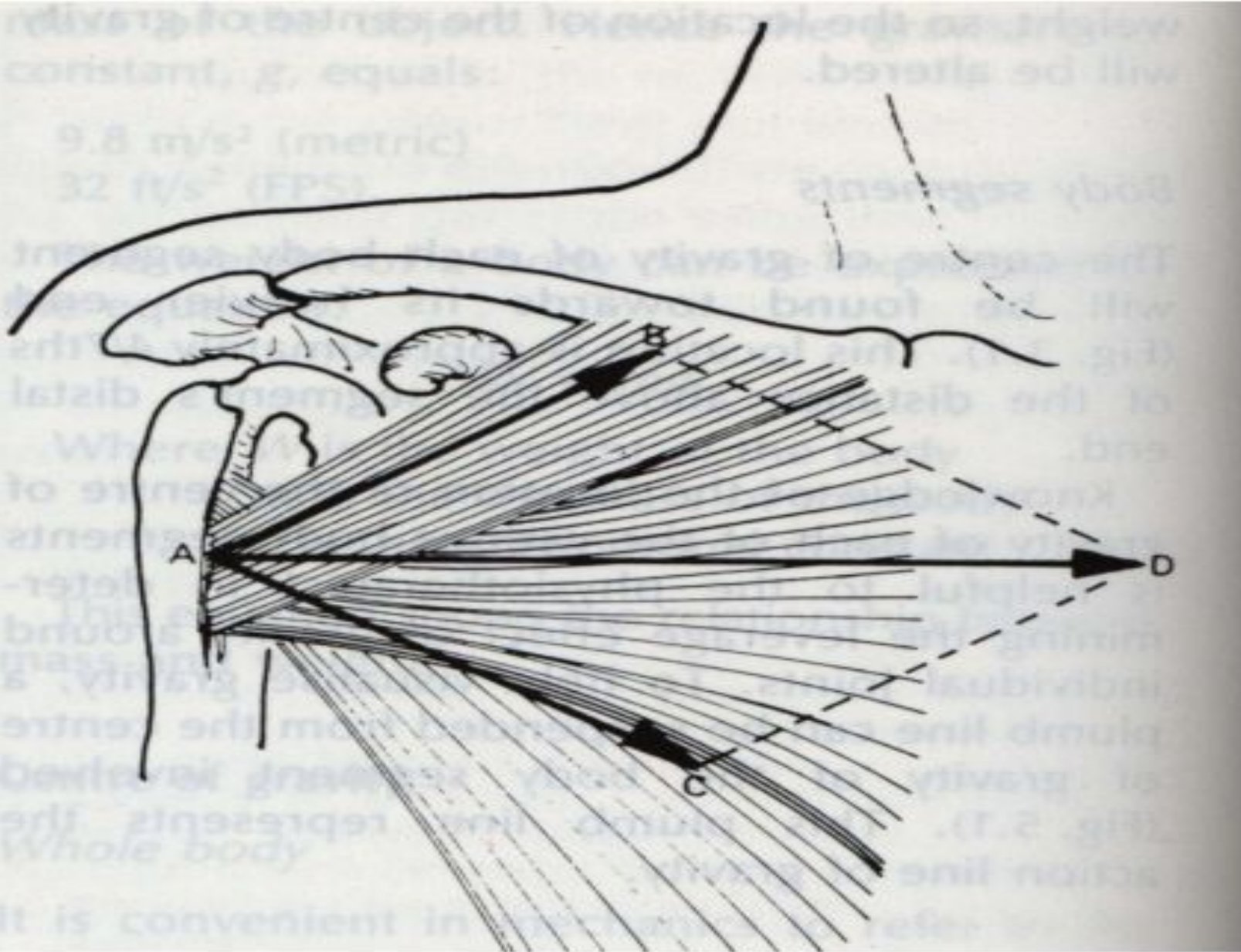


CONCURRENT FORCE SYSTEM



- When all the forces meet at the same point of application
- Forces do not lie along the same line of action, but form an angle with each other
- Example: sternal and clavicular parts of the **pectoralis major**





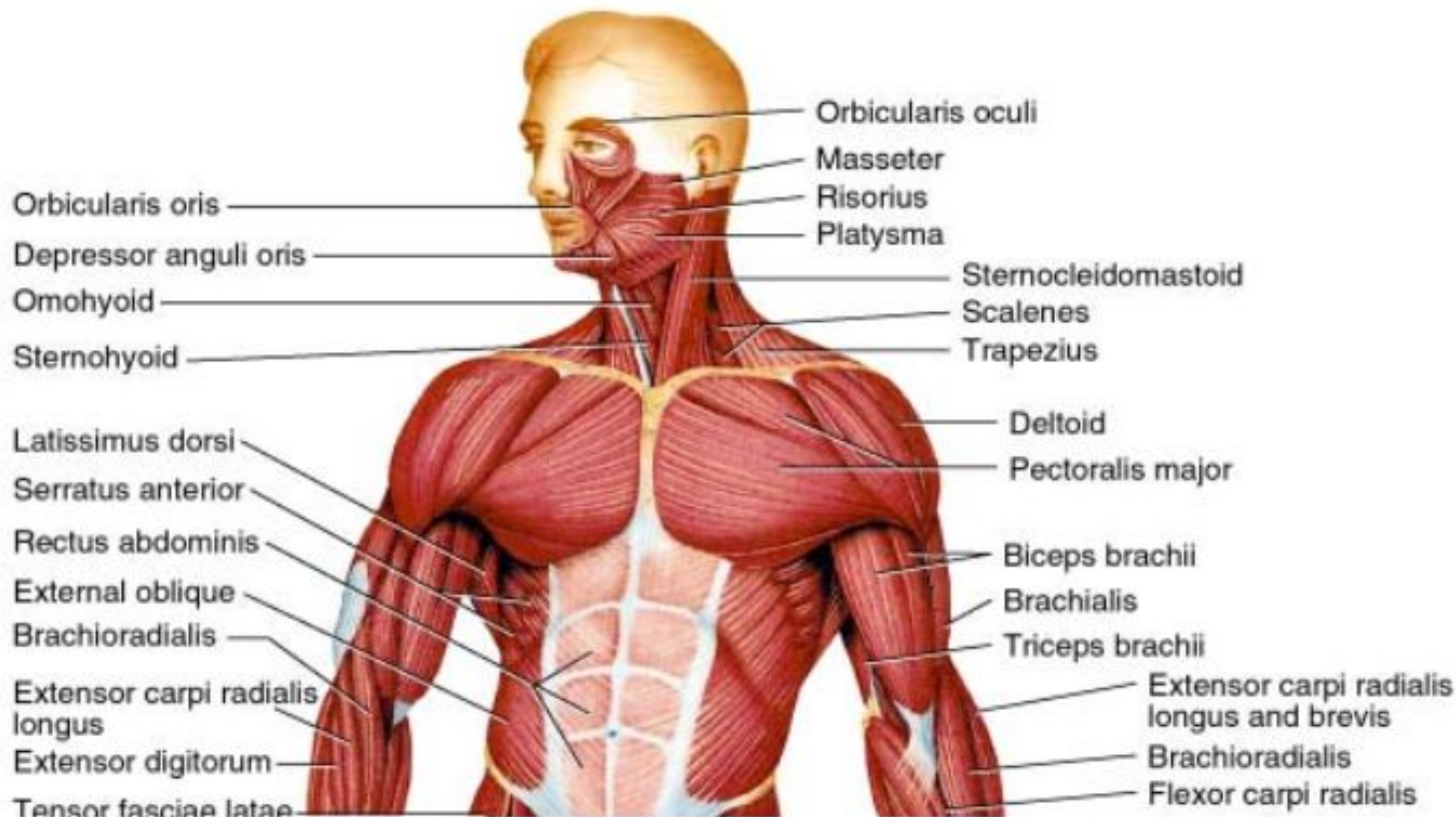
Concurrent force system
Example: Pectoralis major

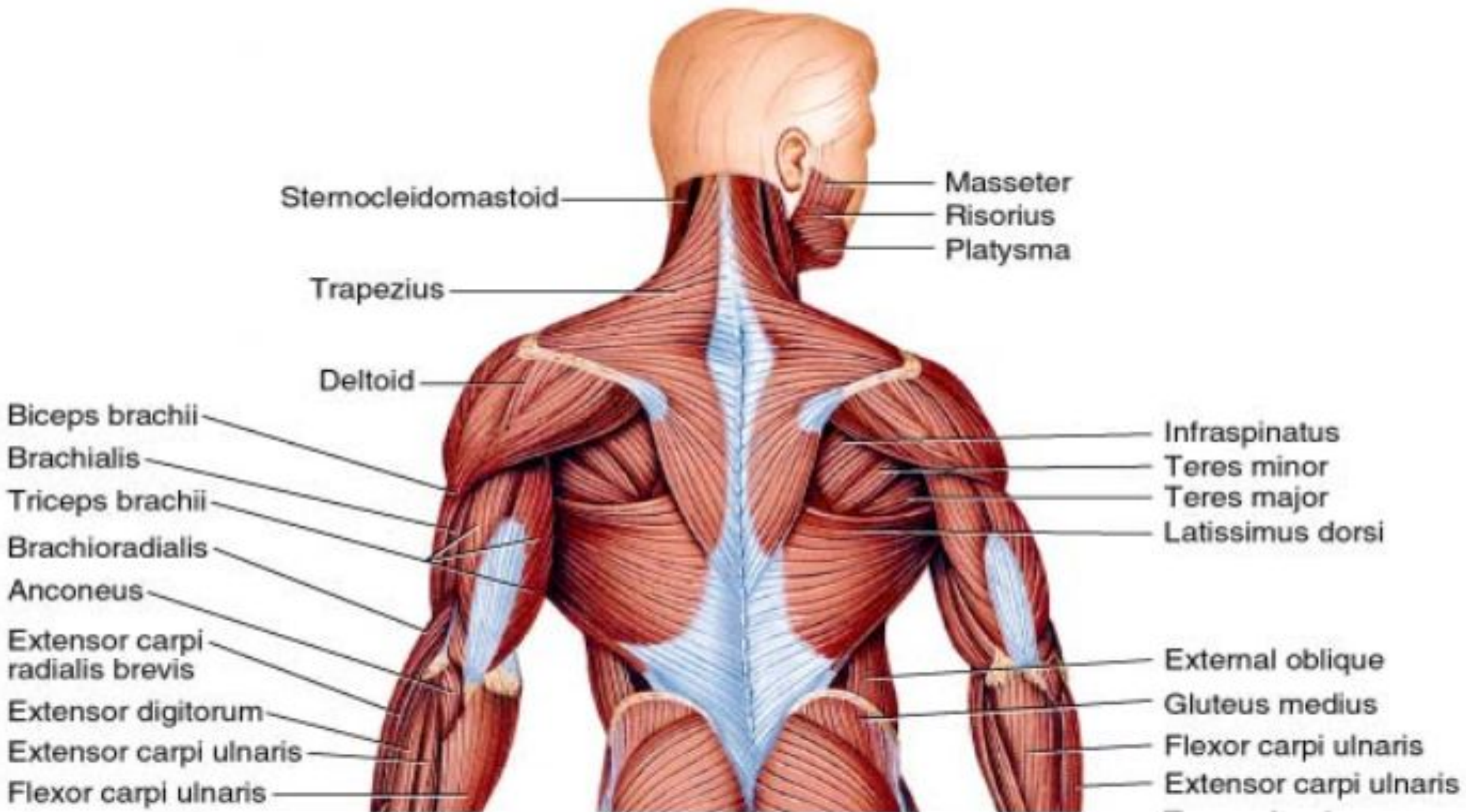


CONCURRENT FORCE SYSTEM



- **Deltoid muscle:**
 - Anterior fibers: flex the arm
 - Posterior fibers: extend the arm
- The combined action of the anterior and posterior fibers will abduct the arm







Force & Injury factors



■ Force & Injury factors

- Magnitude
- Location
- Direction
- Duration
- Frequency
- Variability
- Rate

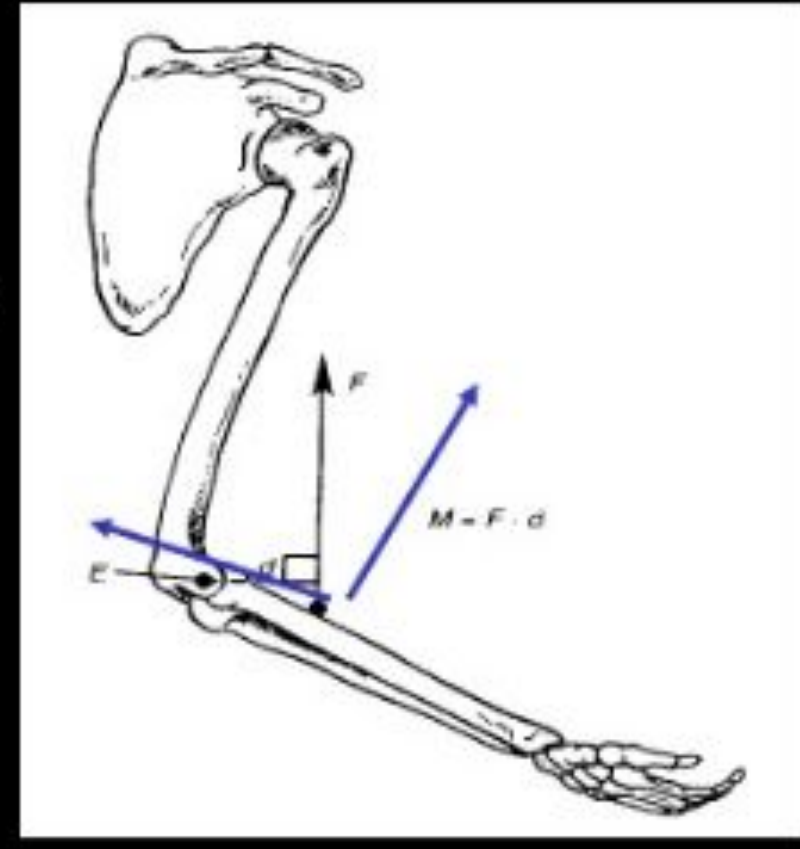




Force Components

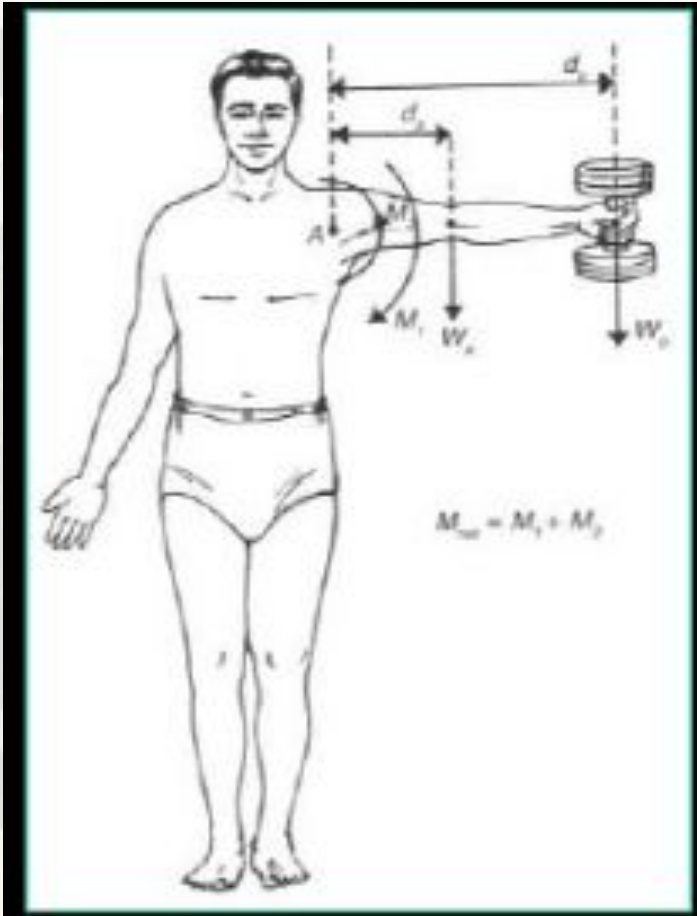


- Force components
 - Rotation
 - Stabilizing or destabilizing component





Moments of Force



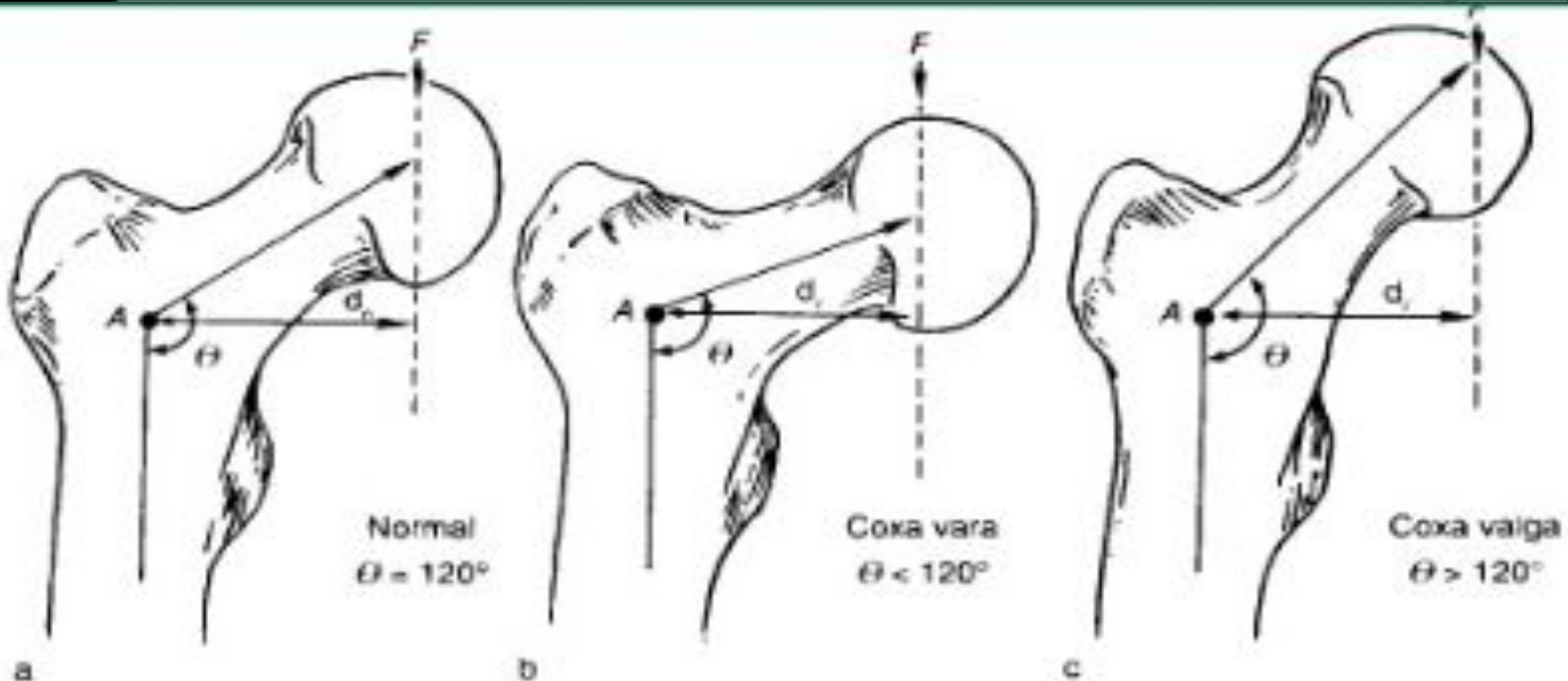
- Net Joint Moment
 - Sum of the moments acting about an axis
- Human: represent the muscular activity at a joint
 - Concentric action
 - Eccentric action
 - Isometric



Moments of Force



- Large moments tends to produce injuries on the musculo-skeletal system
- Structural deviation leads to different MA's





Thank you

FORCE SYSTEM/PHISIO/SABEENA /AP/PHYSICS/SNSCT