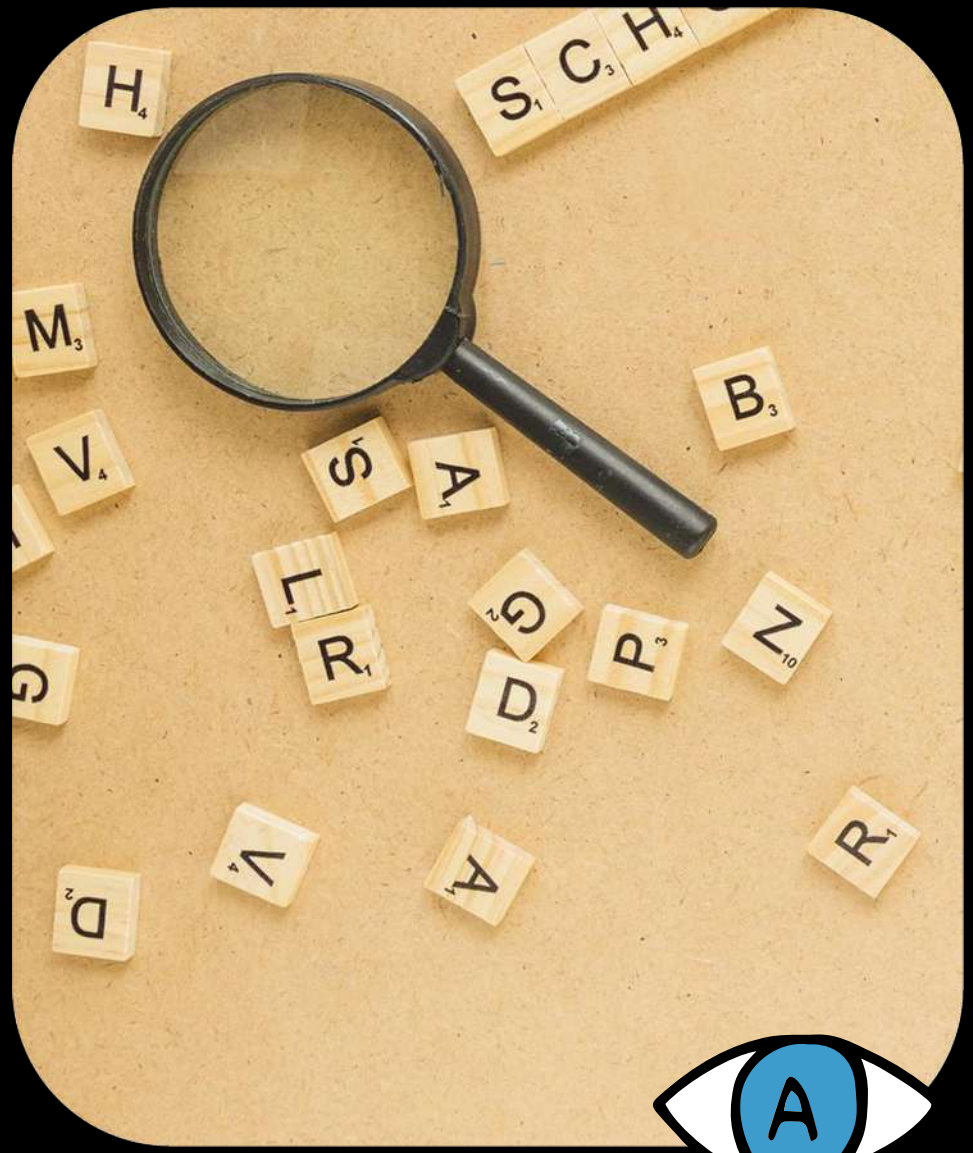
Unit -8

Physical Education



Course on

Fundamentals of Kinesiology and Biomechanics in Sports..!!

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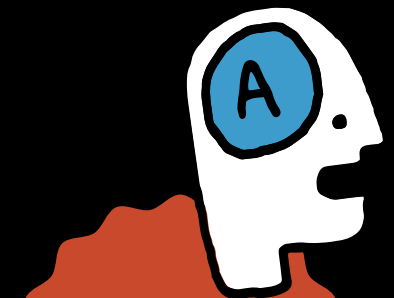

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8.1 : Definition and Importance of Kinesiology and Biomechanics in sports

Meaning of Kinesiology :

The word ‘Kinesiology’ has been derived from the Greek words, ‘Kinesis’ which means ‘movement’ and ‘logy ’ meaning ‘study’.

Accordingly, kinesiology can be defined as a the study of the mechanics of body movements.

Within this field, the experts study and assess how the human body moves and functions so as to understand how it affects our health and productivity.

Importance of Kinesiology :

1. Preparing Coaches and Physical Education Teachers
2. Promotion of Health and Fitness
3. Preventing Injuries
4. Rehabilitation : The treatment designed to facilitate the process of recovery from injury, illness or disease to as normal condition as possible is rehabilitation.
5. Developing New Equipments : Kinesiology helps to assess the suitability of the equipment.
6. Helps in Developing Motor Skills
7. Improves Performance : Kinesiology helps in improving and correcting the movements of the body.

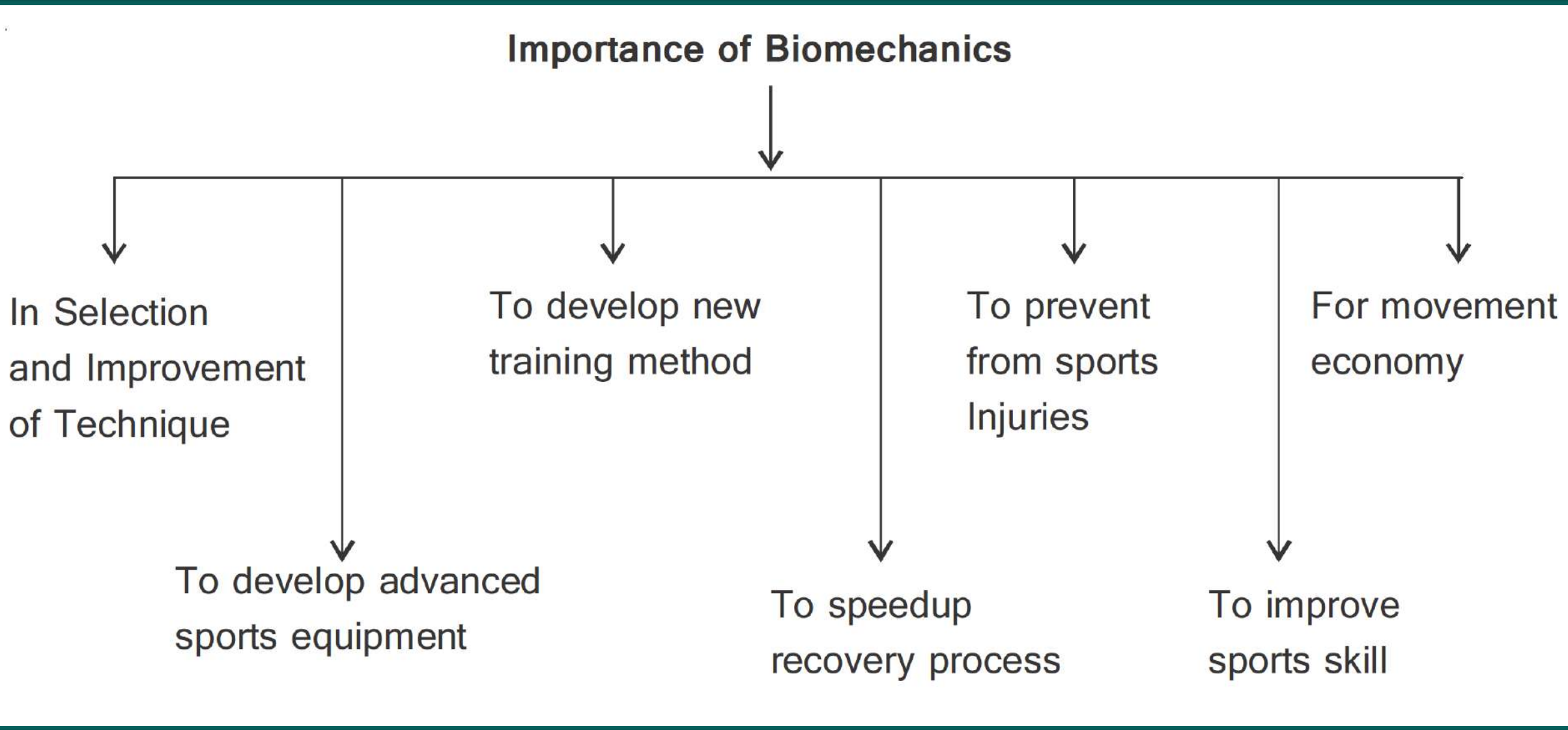
Meaning of Biomechanics

Meaning of Biomechanics :

Bio + Mechanics

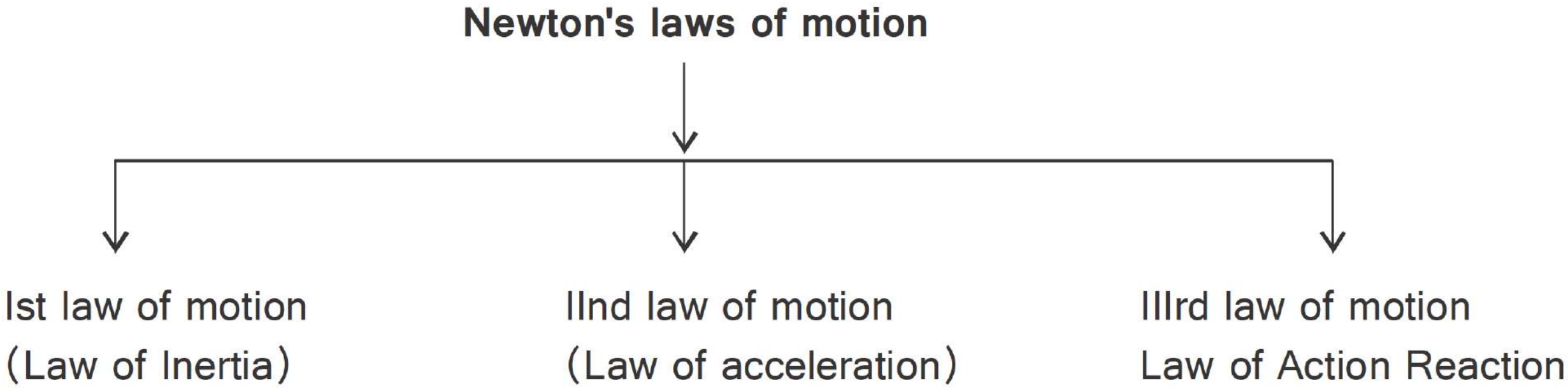
Bio = Living organism
Mechanics = Branch of Physical science which deals with force acting on a body in static condition or in moving condition.

Biomechanics : is the study of forces & their effects on human being is moving or in static condition.


Importance of Biomechanics
In Selection and Improvement of Technique
To develop advanced sports equipment
To develop new training method
To speedup recovery process
To prevent from sports Injuries
To improve sports skill
For movement economy

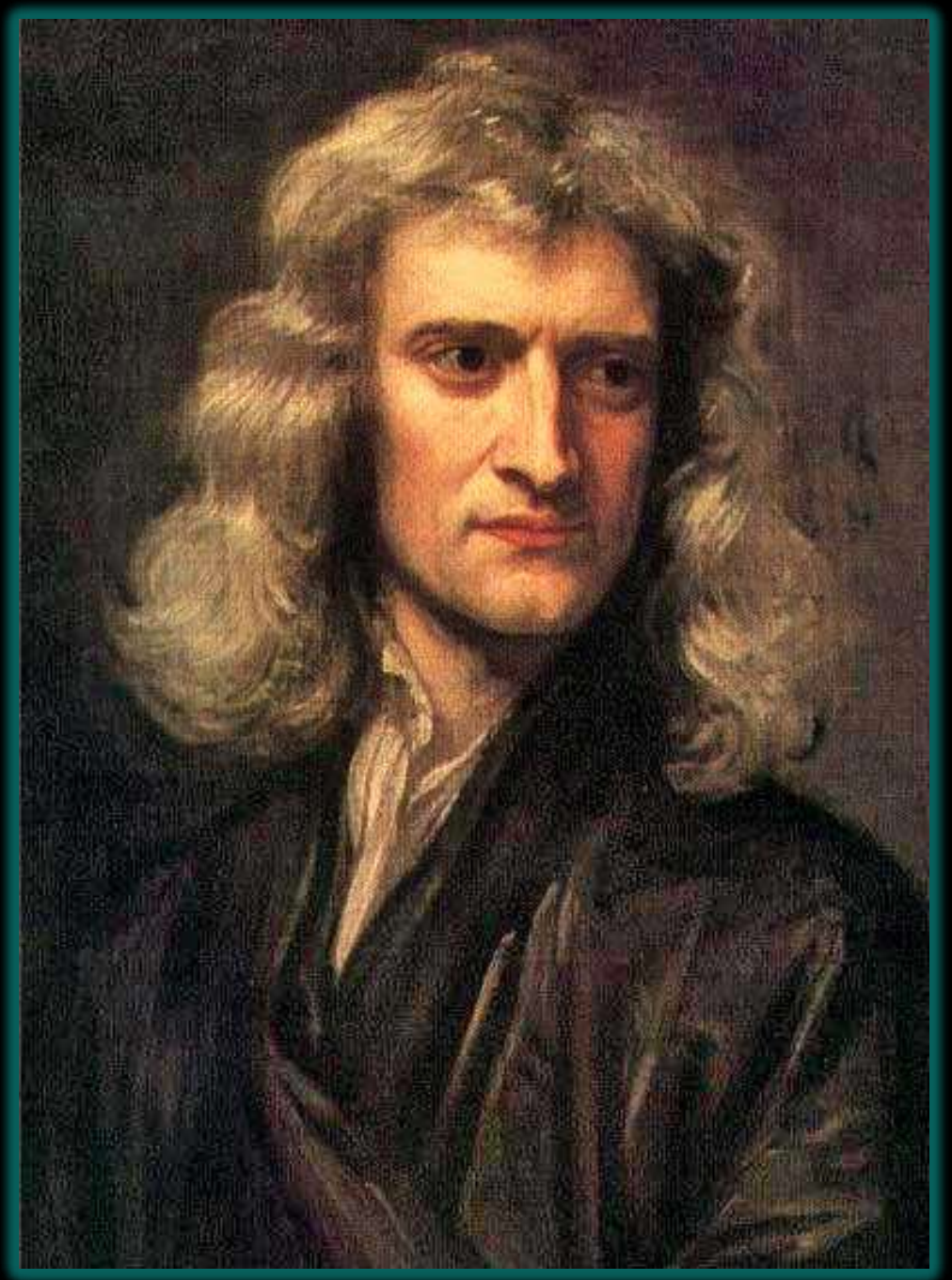
8.2 Principles of Biomechanics

Newton's Laws of motion and their application in sports :



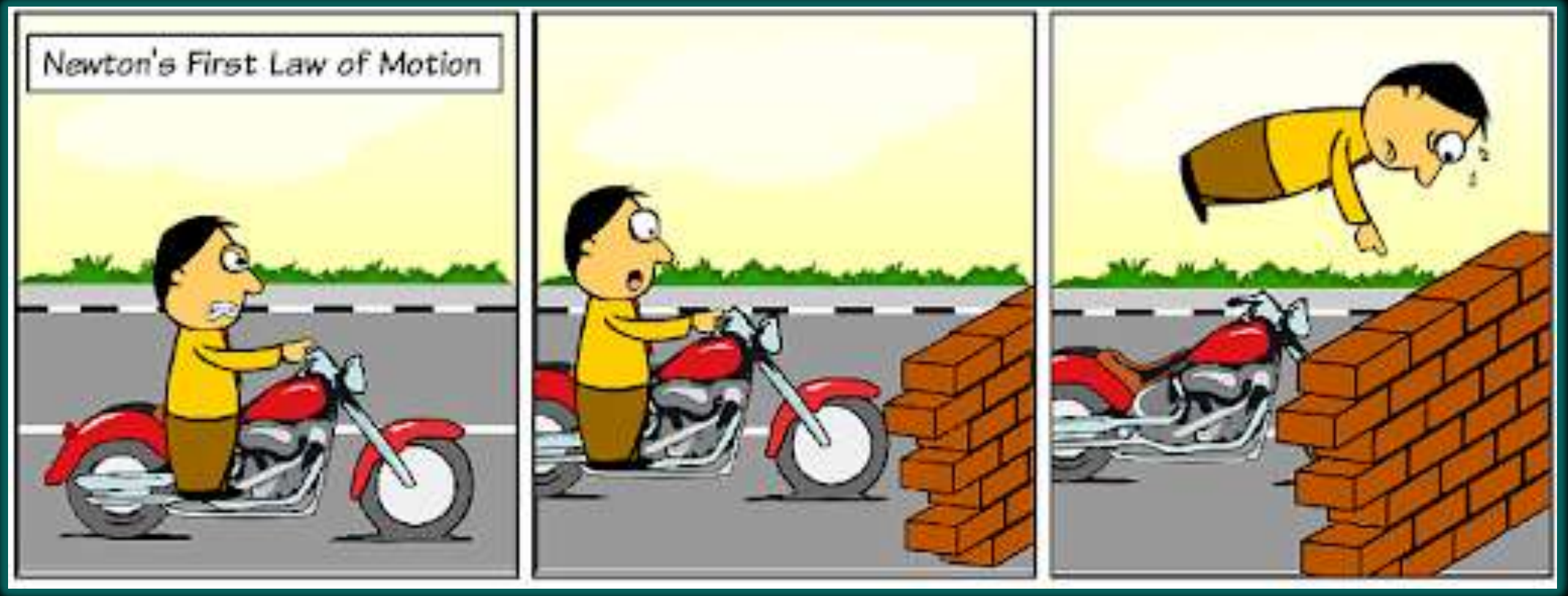
Sir Isaac Newton's three laws of motion describe the motion of massive bodies and how they interact.

Newton published his laws in 1687, in his seminal work "Principia Mathematica”



1st Law of Motion (Law of Inertia) :

Any object will be remains in its position until or unless any external force is applied on it.

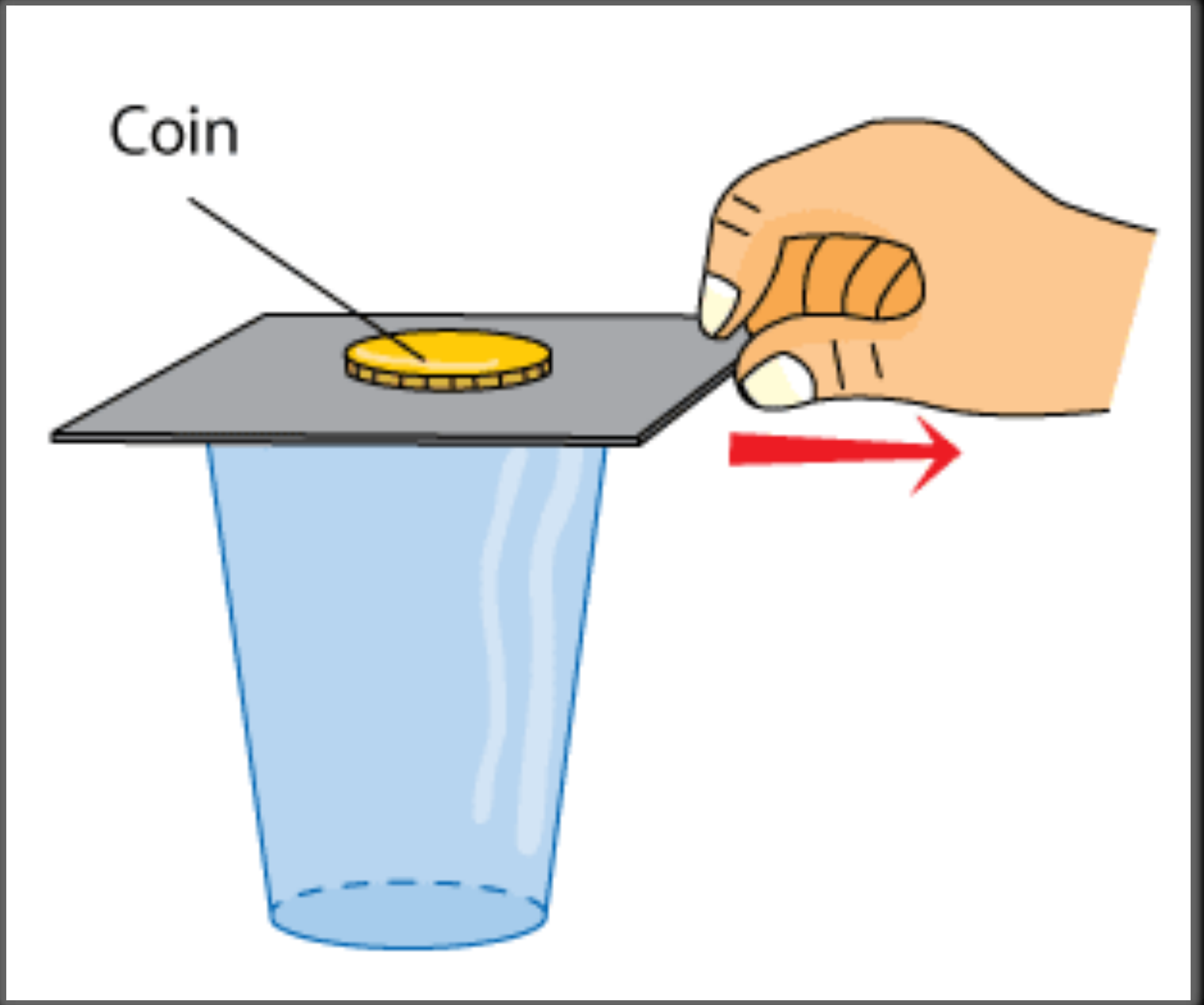


When a book is placed on a table , It remains stationary in position unless somebody acts to affect it and change its state .

When an object is pushed on the floor, It rolls for a certain distance , then slows down till it stops by the effect of frictional forces between the object and the floor that resist rolling (Friction is an external force that acts to change the object state) .

If these forces do not exist , the object would keep moving at a uniform velocity and would not stop .

Newton’s First Law is known as the **Law of Inertia** since the object can not change its state of rest or motion by itself .

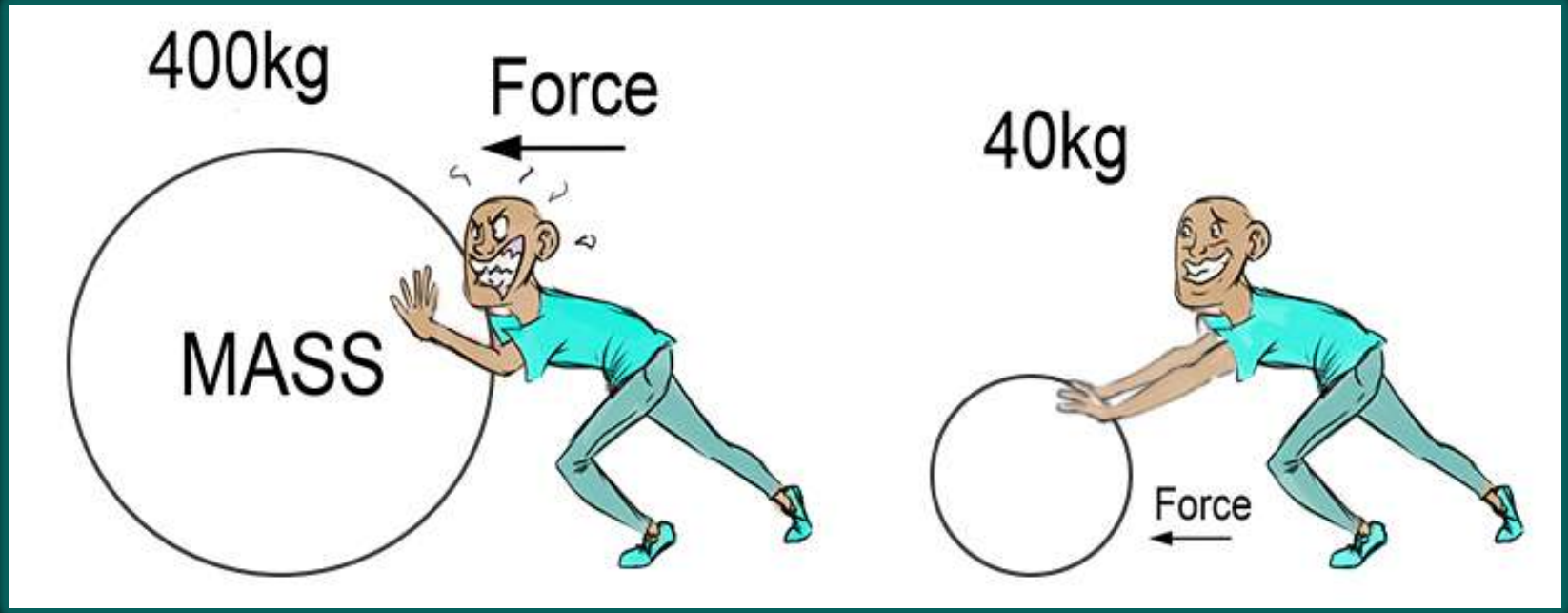


2nd law of motion (Law of Acceleration) :

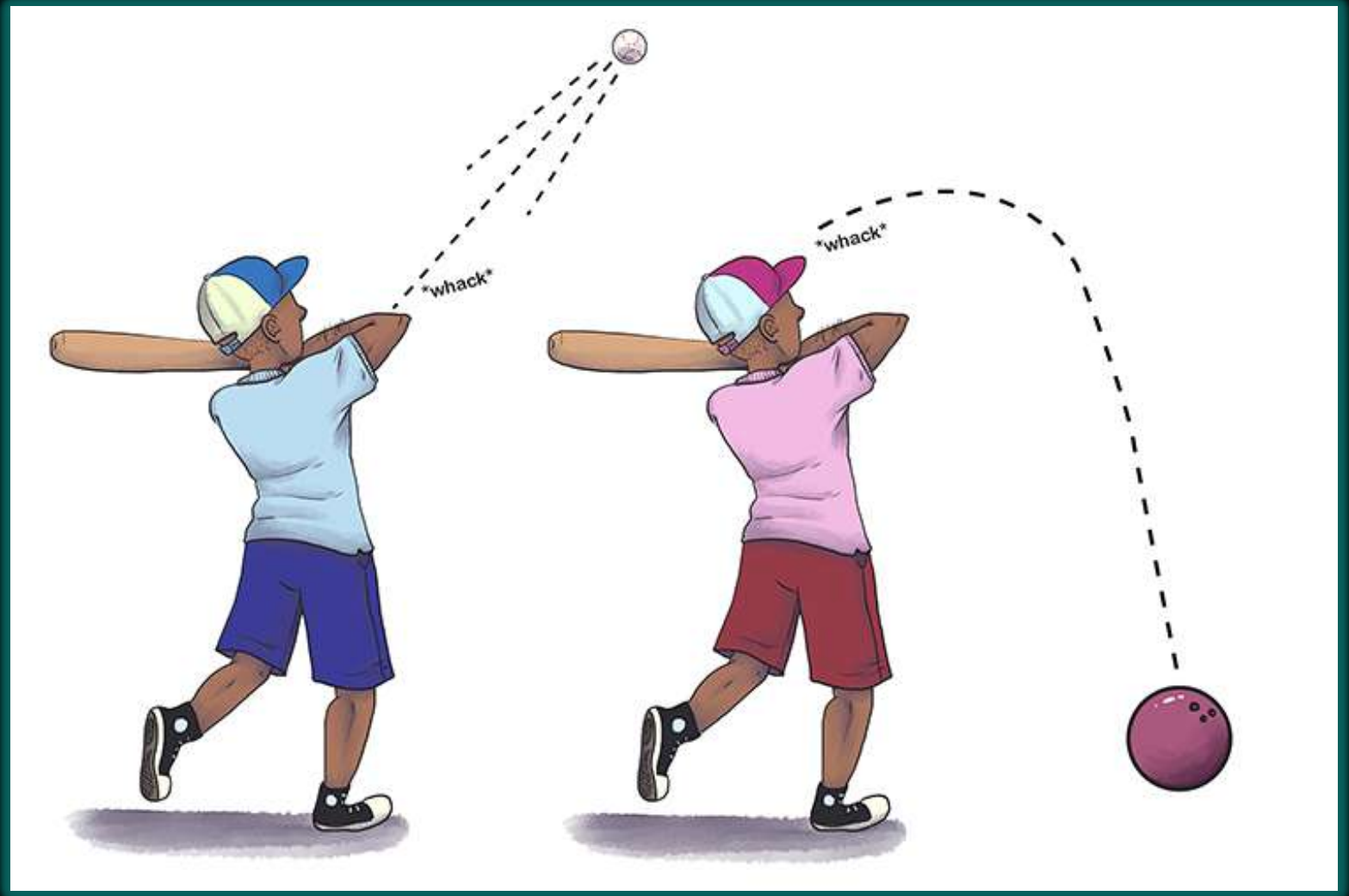
The rate of change of acceleration is directly proportional to the force applied on the object and Inversely proportional to the mass of the object.

F = ma

m = mass
a = acceleration

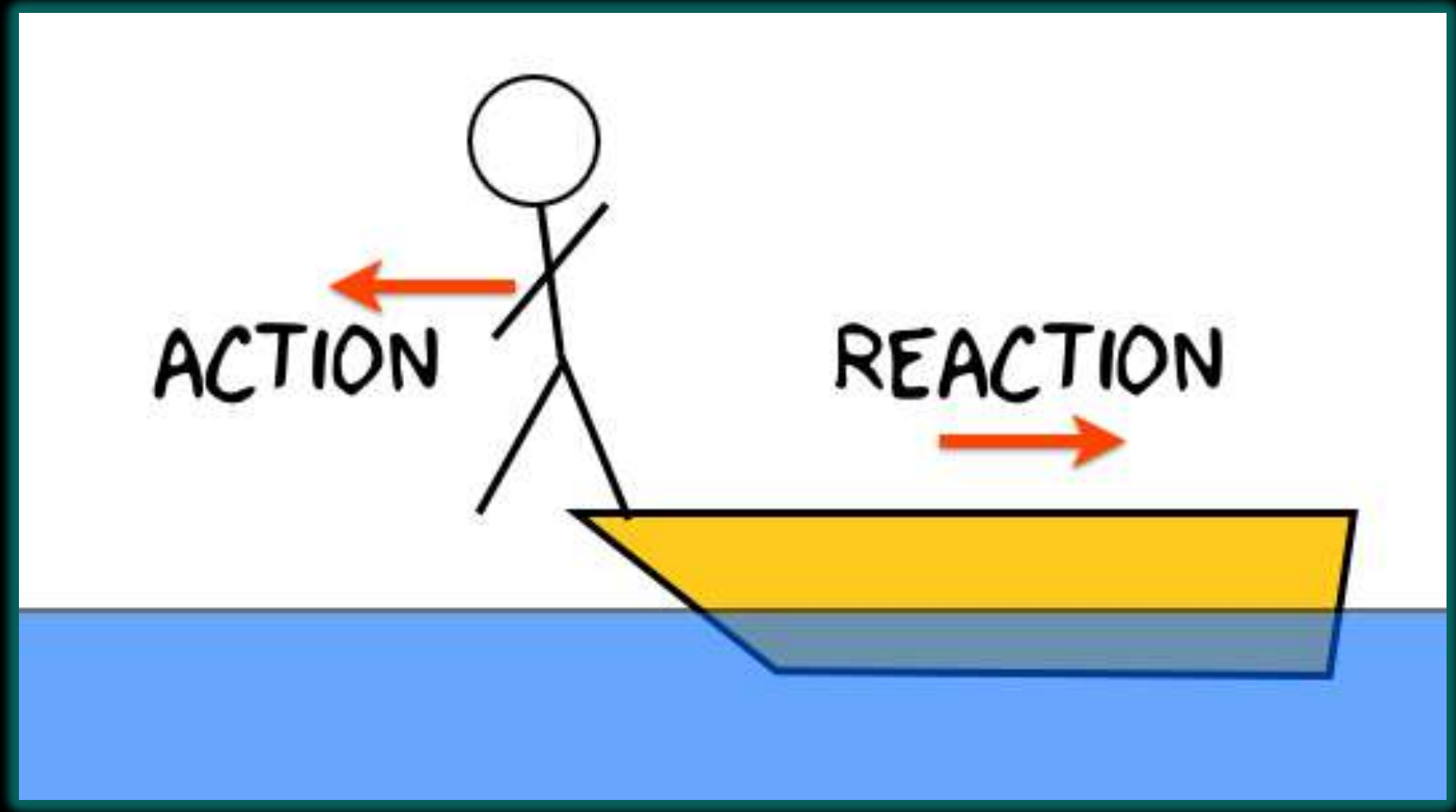


The second law shows that if you exert the same force on two objects of different mass, you will get different accelerations (changes in motion). The effect (acceleration) on the smaller mass will be greater (more noticeable).

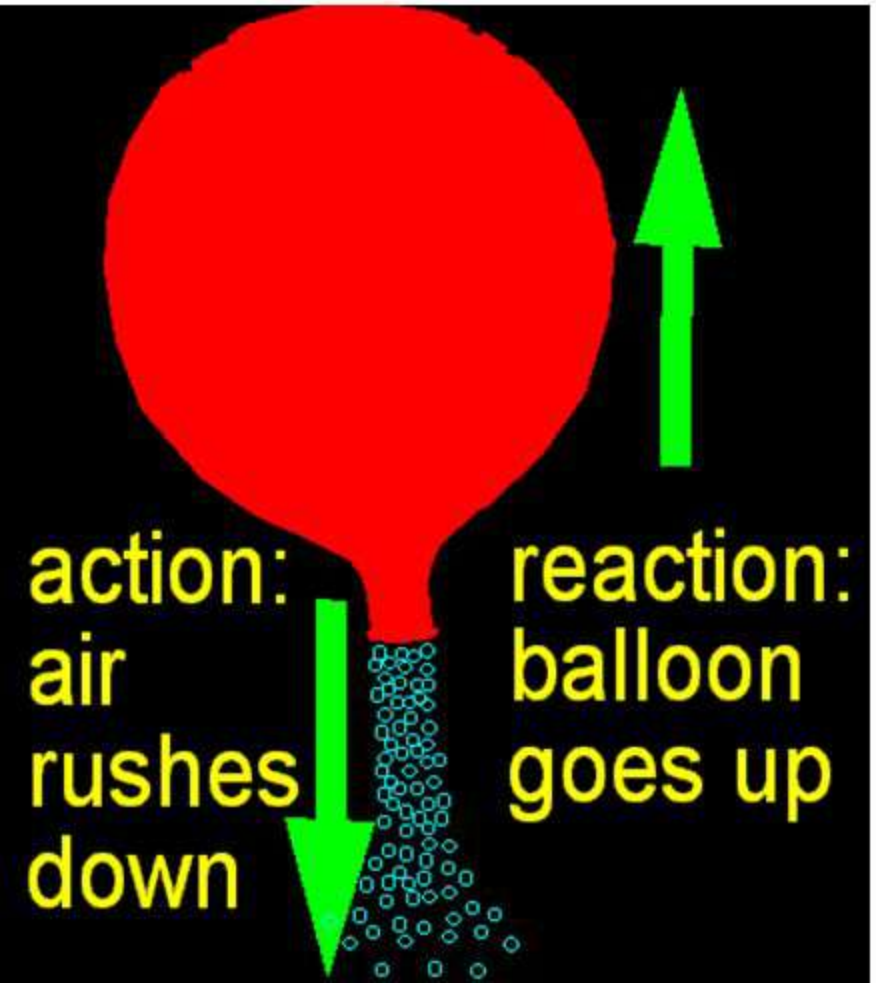


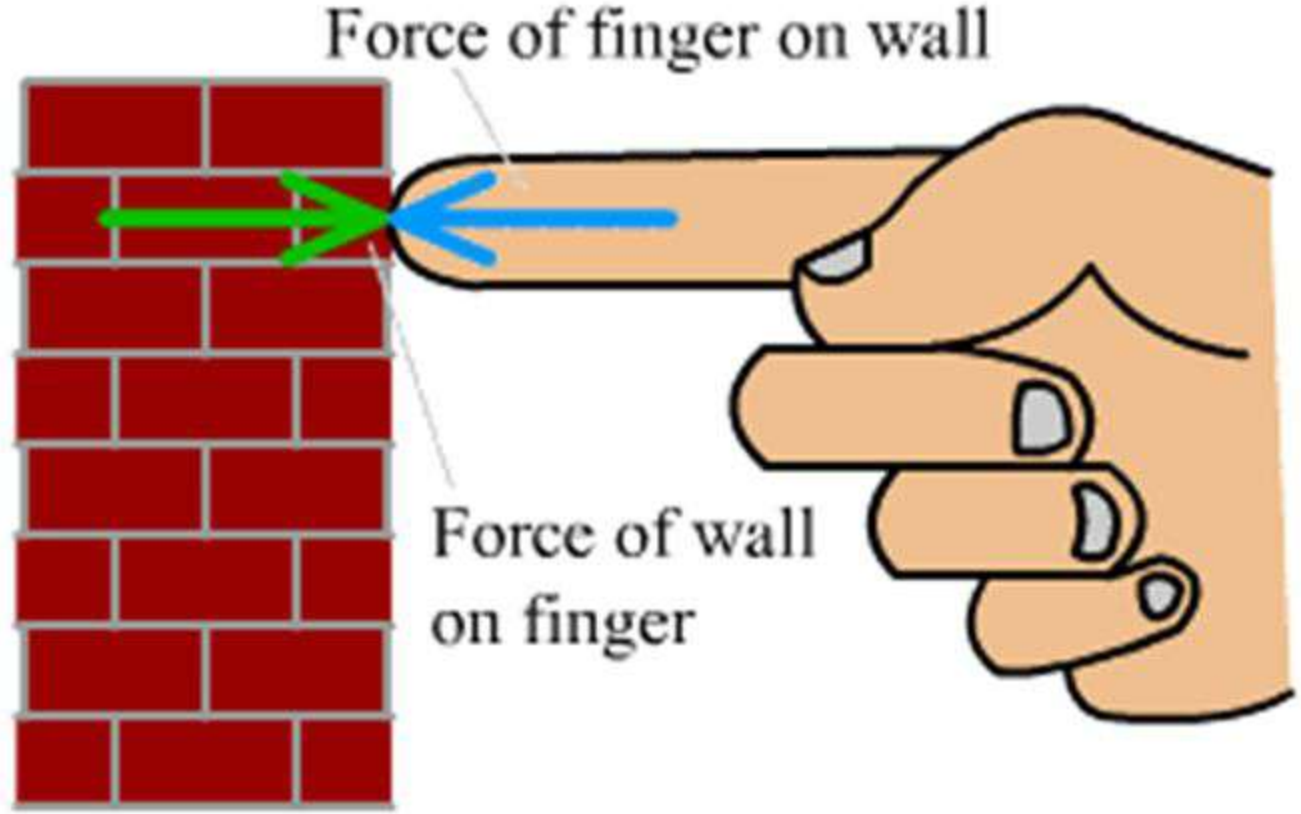
3rd law of motion (Law of action and Reaction) :

To Every action, There is equal & opposite reaction



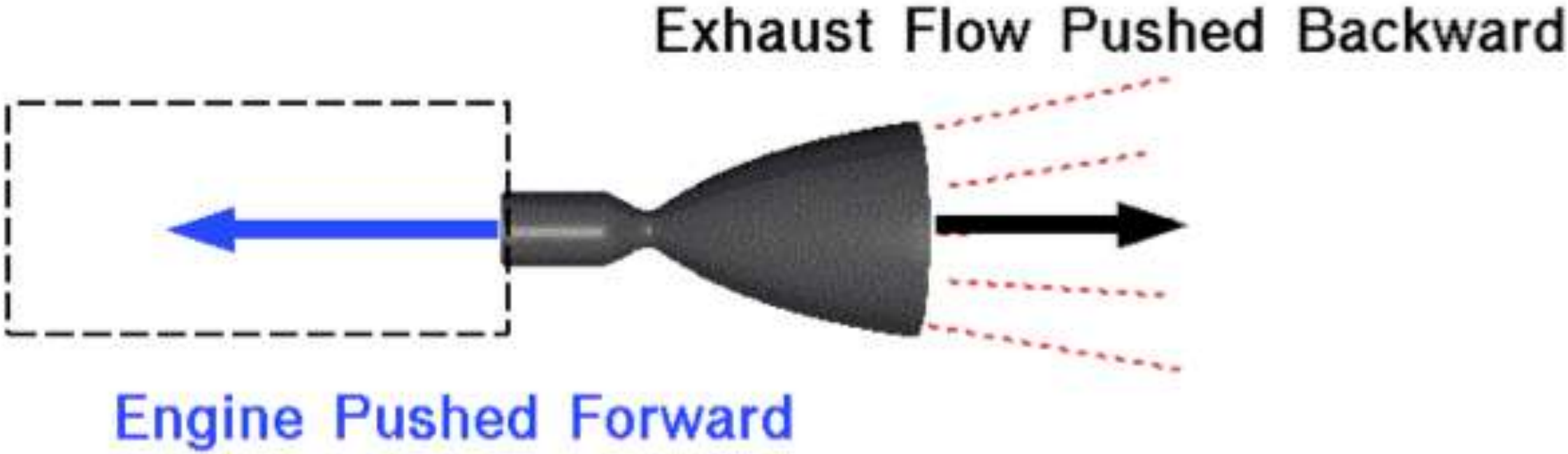
Newton's Third Law of Motion





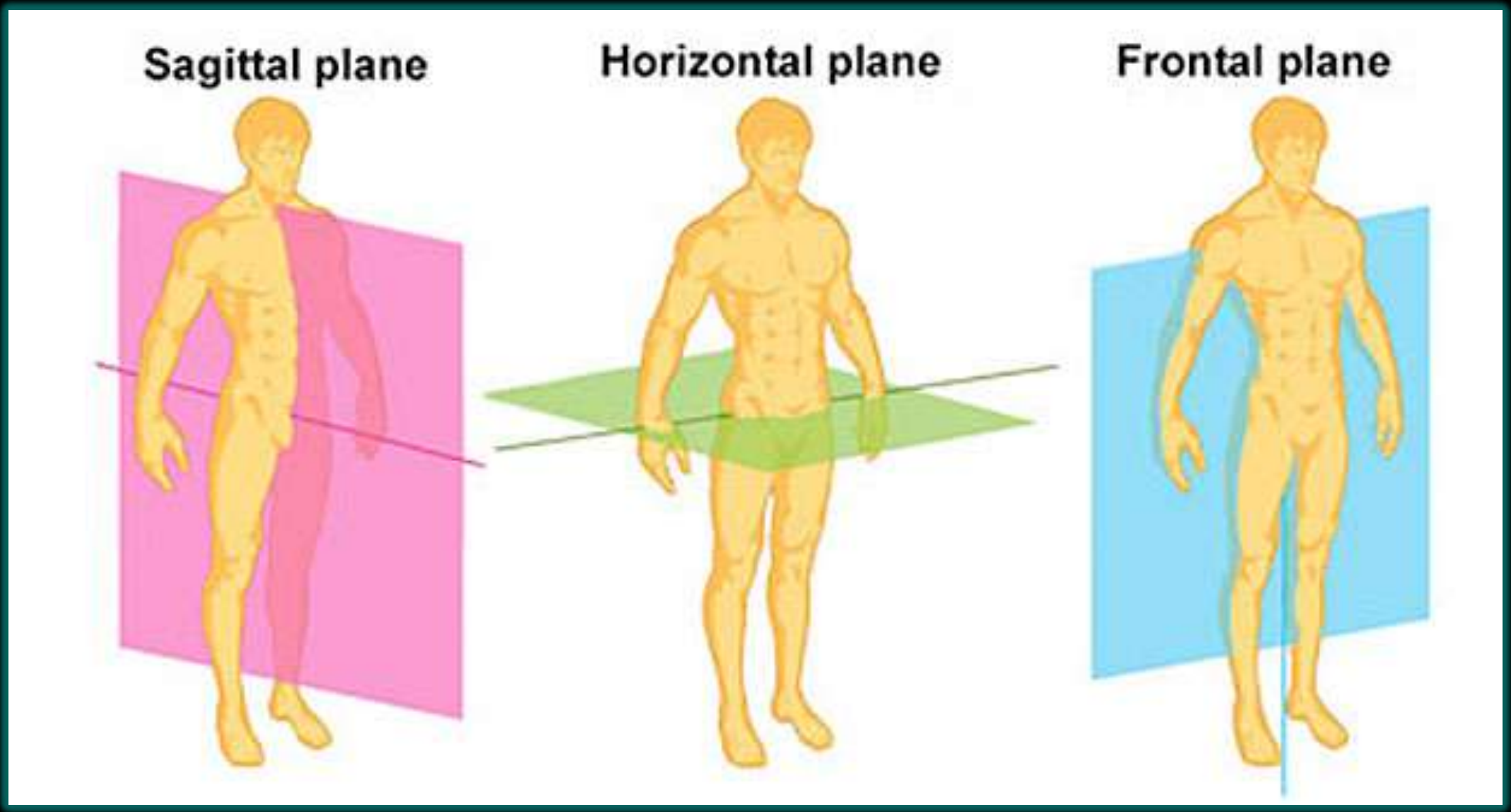
- When one object exerts a force on a second object, the second exerts a force on the first that is equal in magnitude but opposite in direction.

Rocket Engine Thrust



For every action, there is an equal and opposite re-action.

8.4 Axis and Planes – Concept and its application in body movements



Axis and its Application in Body Movements :

An axis is an imaginary straight line around which an object rotates. Movement at a joint takes place in a plane about an axis.

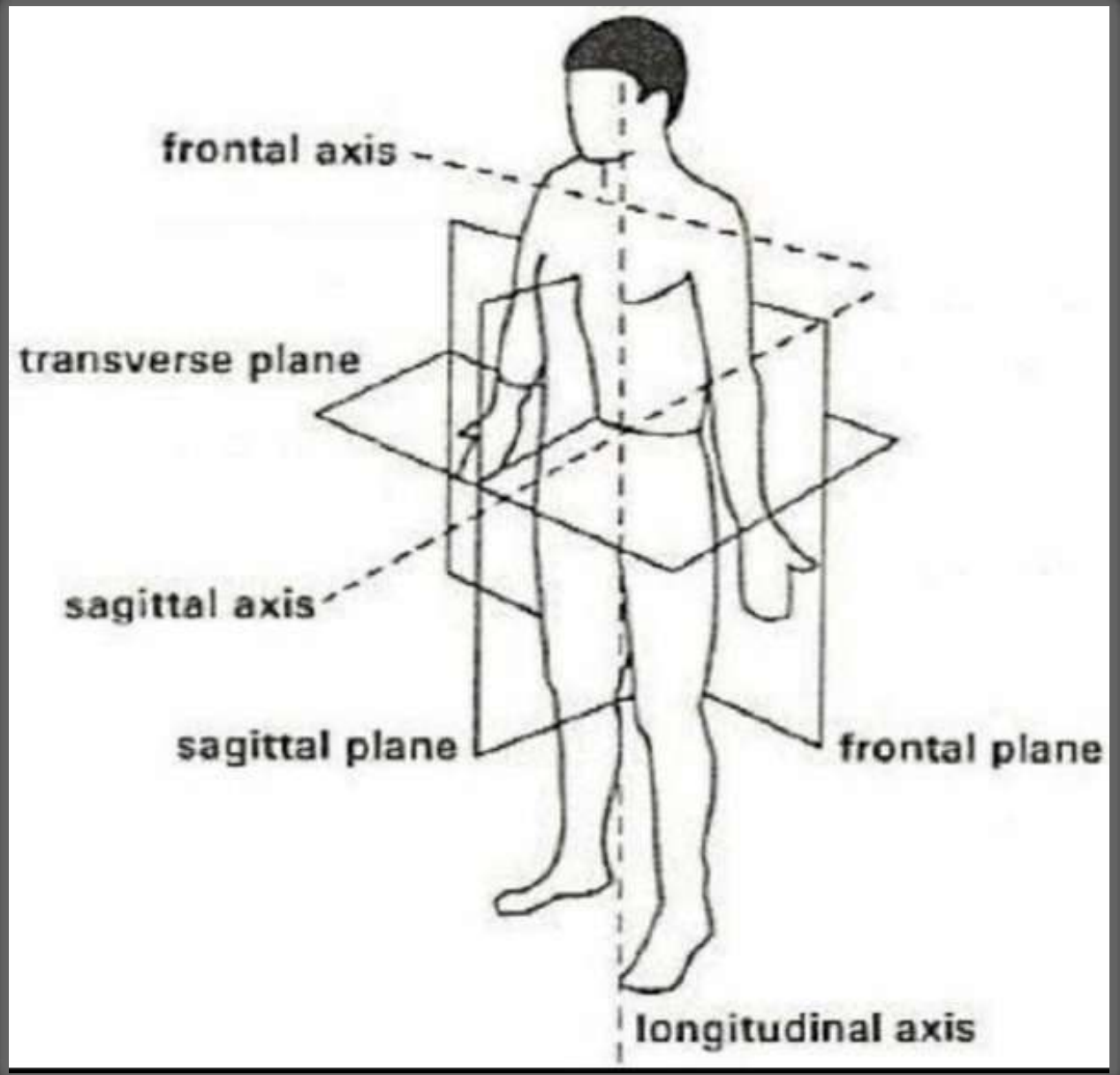
There are three axes of rotation :

1. Sagital Axis :

The sagital axis passes horizontally from posterior to anterior and is formed by the intersection of the sagital and transverse planes.

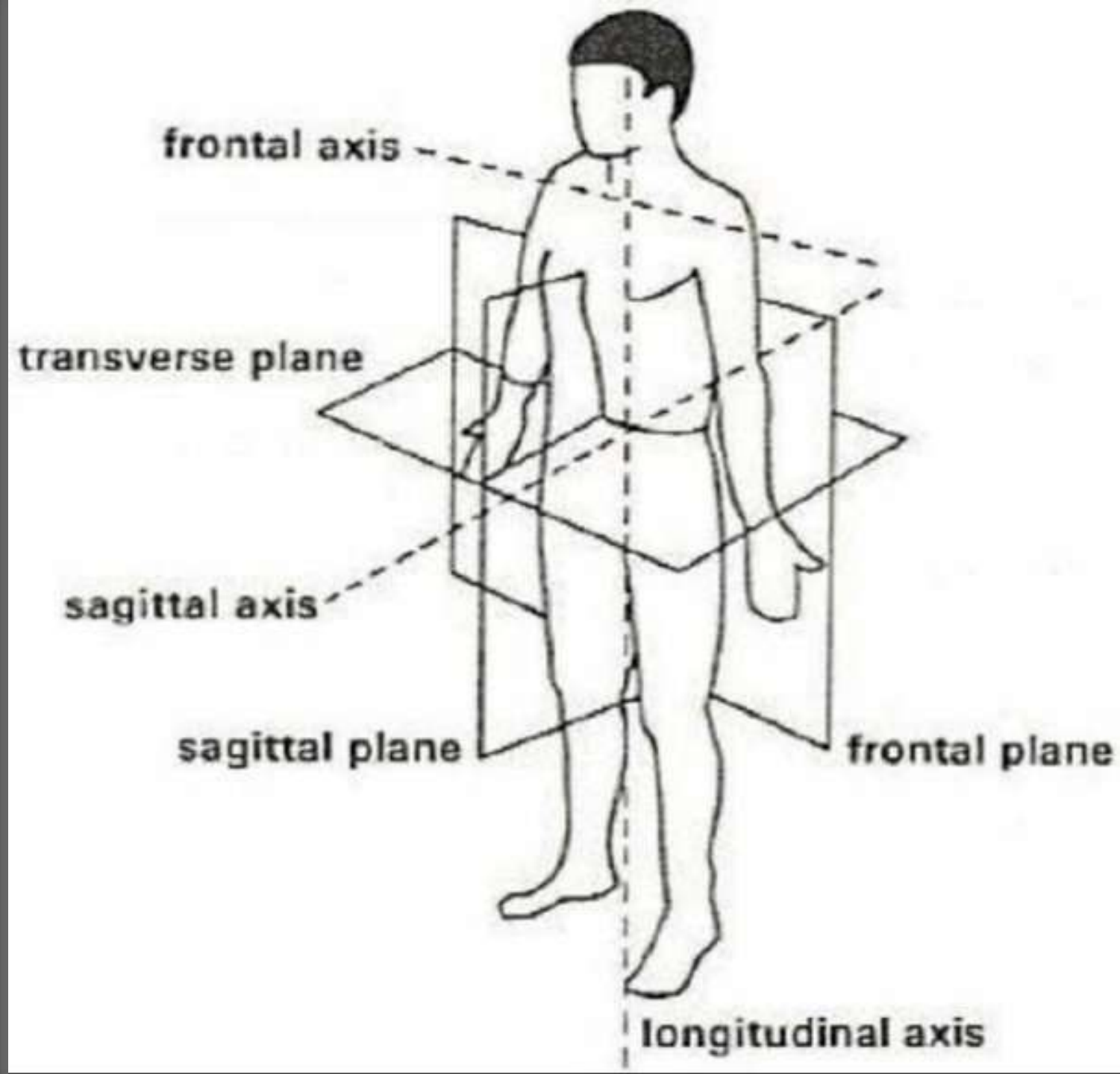
2. Frontal Axis :

The frontal axis passes horizontally from left to right and is formed by the intersection of the frontal and transverse planes.



3. Vertical Axis :

The vertical axis passes vertically from inferior to superior and is formed by the intersection of the sagital and frontal planes.



Plane and its Application in Body Movements :

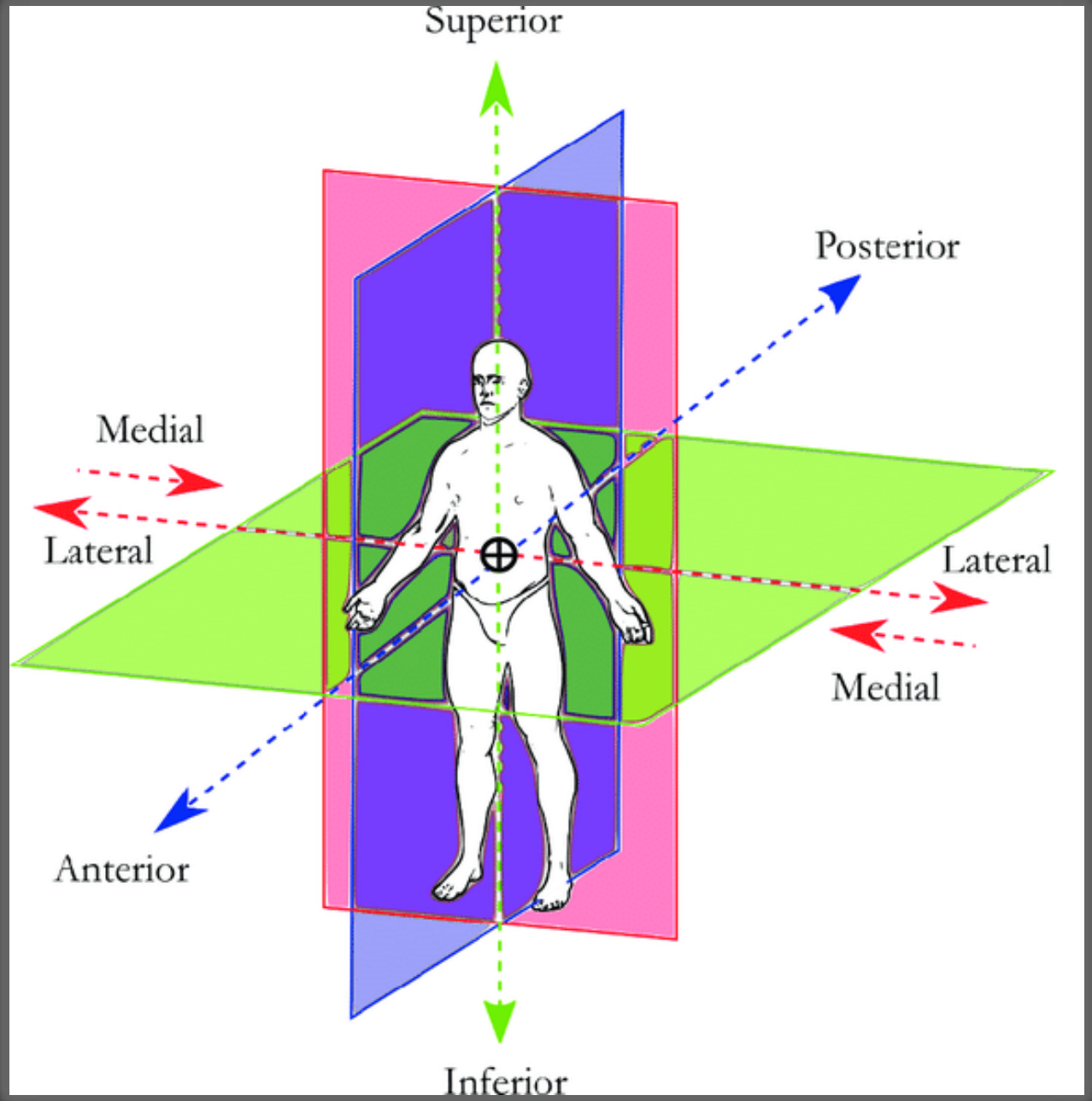
A plane is best described as an imaginary surface which divides the body into equal parts.

Human movements are described in three dimensions based on a series of planes and axis.

There are three planes of motion that pass through the human body

1. The Sagital Plane :

The sagital plane lies vertically and divides the body into right and left parts

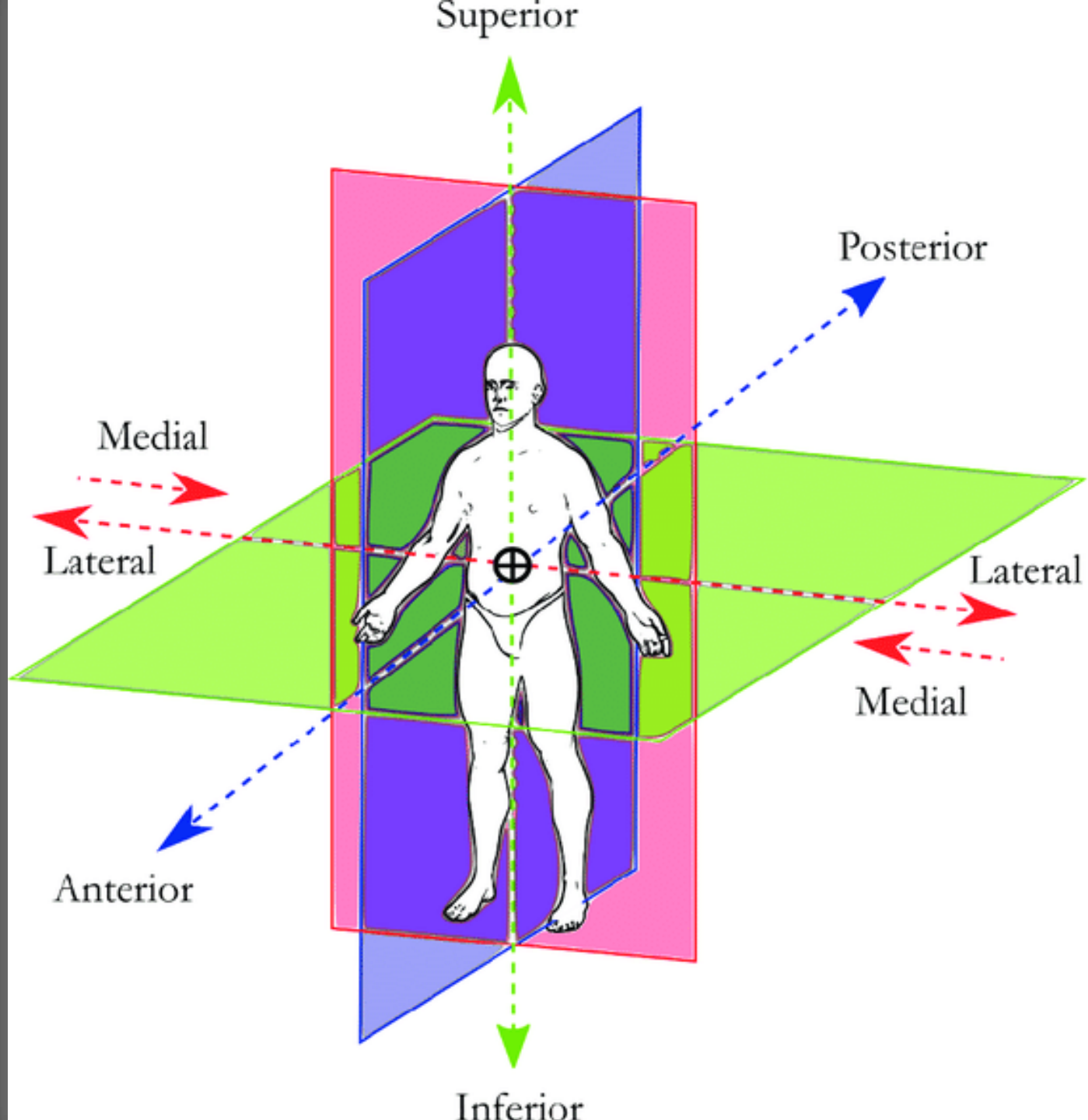


2. The Frontal Plane :

The frontal plane also lies vertically and divides the body into anterior and posterior parts (i.e. back and front).

3. The Transverse (horizontal) Plane :

The transverse plane lies horizontally and divides the body into superior and inferior parts.



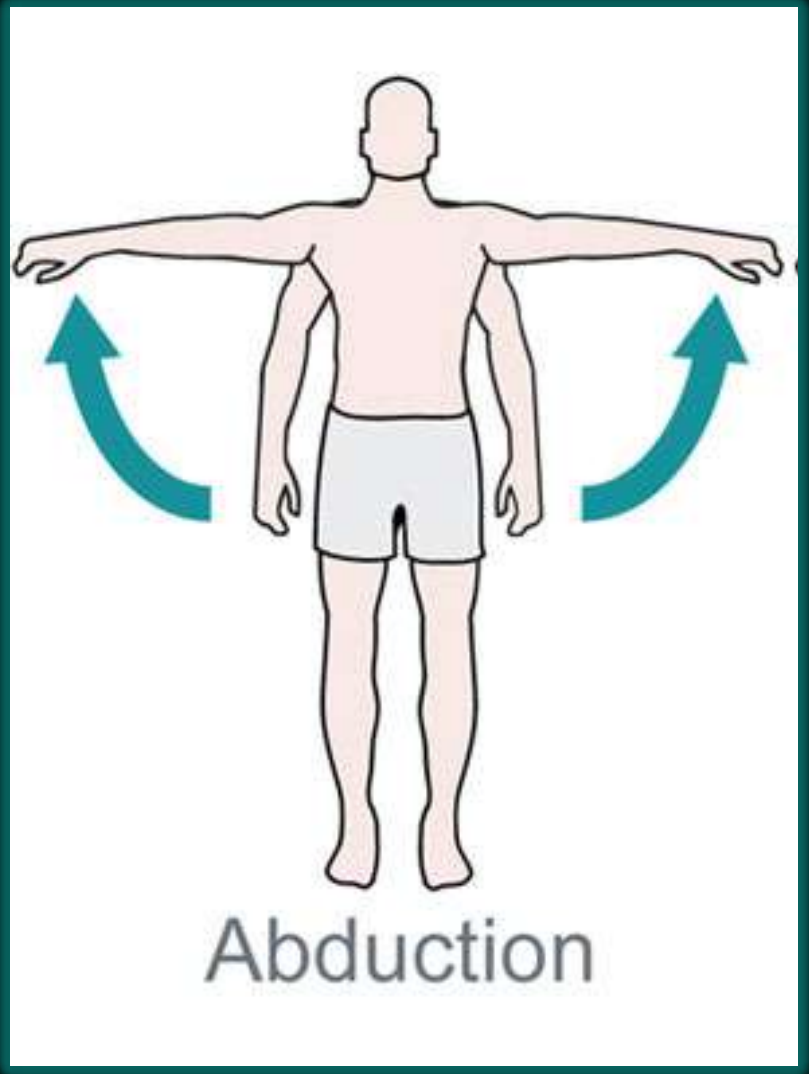
8.3 Types of Body Movements - Flexion, Extension, Abduction, Adduction, Rotation, Circumduction, Supination & Pronation

1. Abduction :

It is that Movement in which moving body part **move away from the midline of body**.

It always occurs on frontal plane & sagittal axis.

Example: Moving of hand in sidewise dissection i.e. hand going away from body.



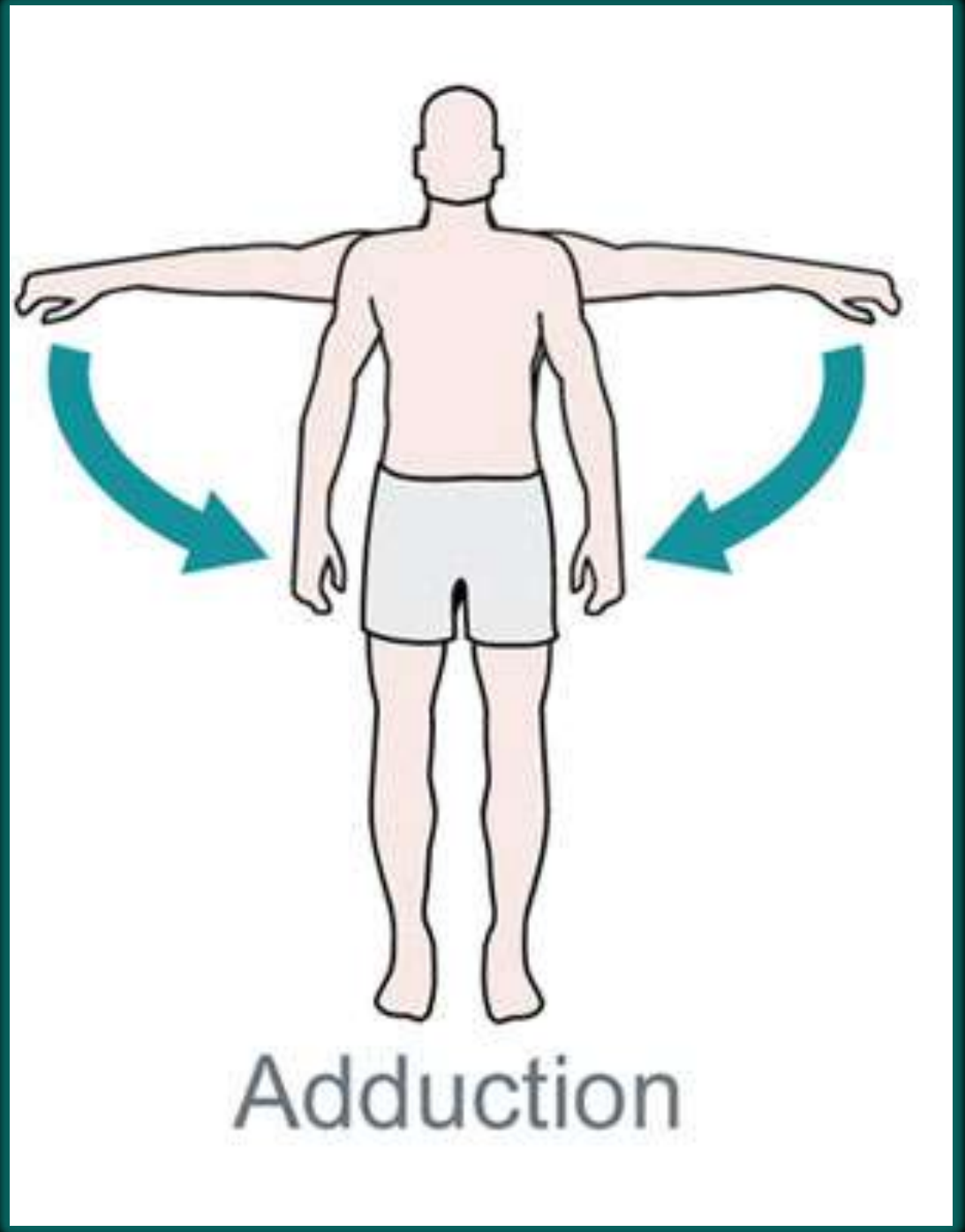
2. Adduction :

It is that Movement in which Moving part **come towards the midline of body.**

It always occurs at frontal plane sagittal axis.

Example :

Hands opening sides wise



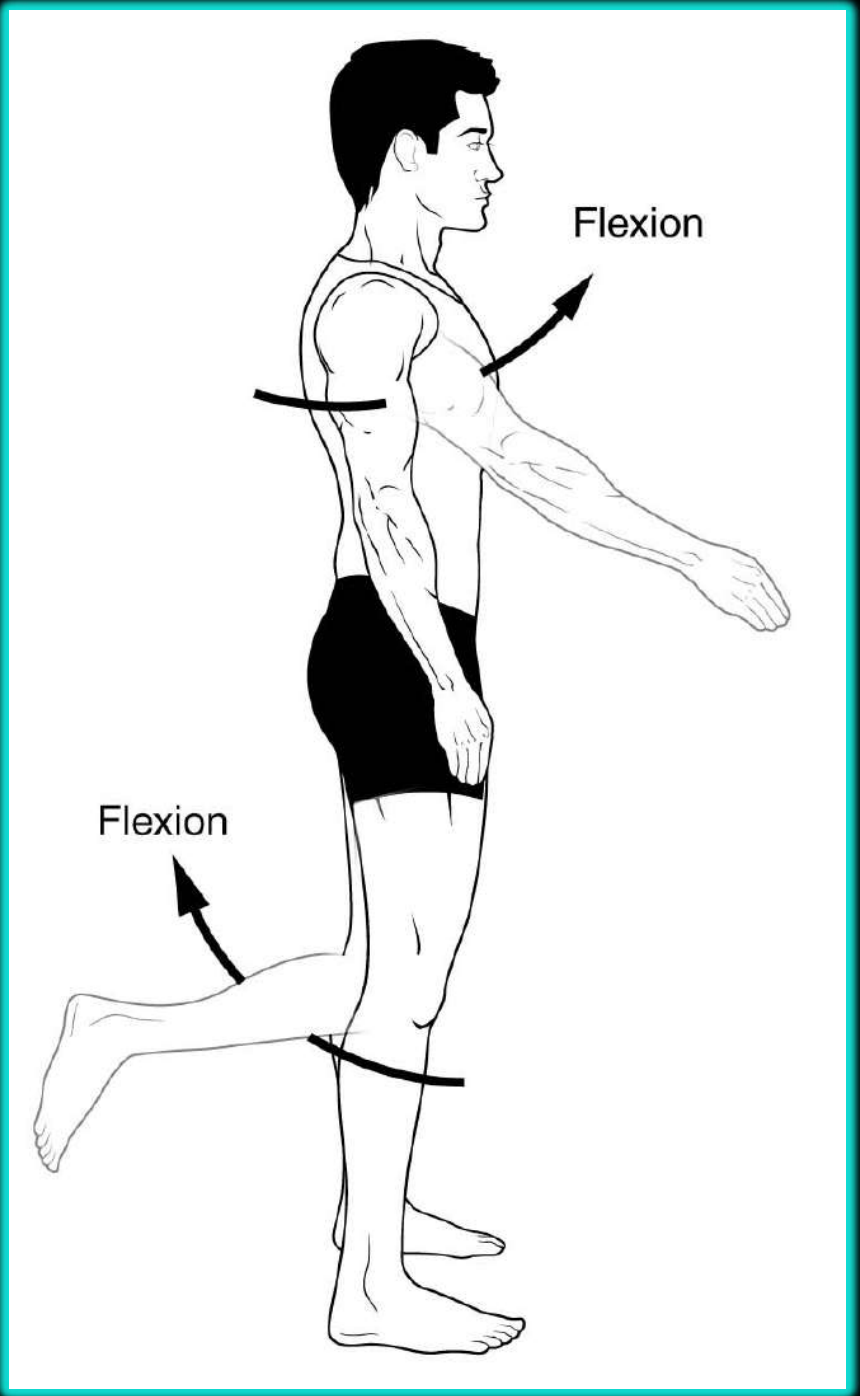
3. Flexion :

It is that movement in which the joint on which the movement occurs.

There will be decrease in the angle between the bone of that joint.

It always occurs at sagittal plane & frontal axis.

Example: Bending of Elbow and bending off knee.



4. Extension :

It is that movement in which the angle between the bone of that joint on which movement is occurred increase.

It always occurs at sagittal plane & frontal axis.

Example: Straitening of elbow from bending position.
Straitening of knee from bending position in leg press exercise

5. Circumduction :

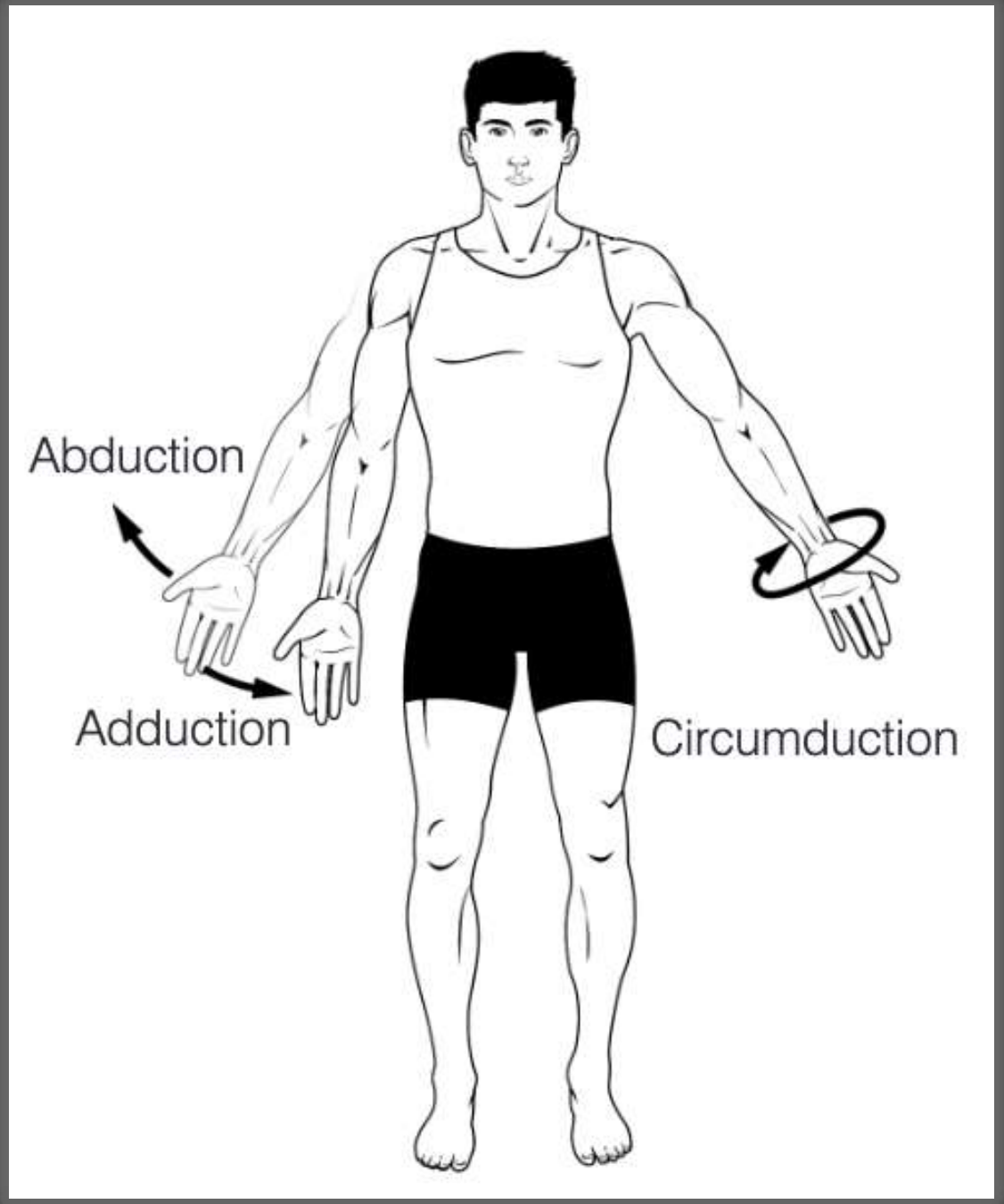
It is the movement of a body region in a circular manner, in which one end of the body region being moved stays relatively stationary while the other end describes a circle.

It involves the sequential combination of flexion, extension, adduction and abduction at a joint.

This kind of motion can be best seen in the shoulder and hip joints.

For example :

Circumduction occurs at the shoulder during the execution of a cricket ball.

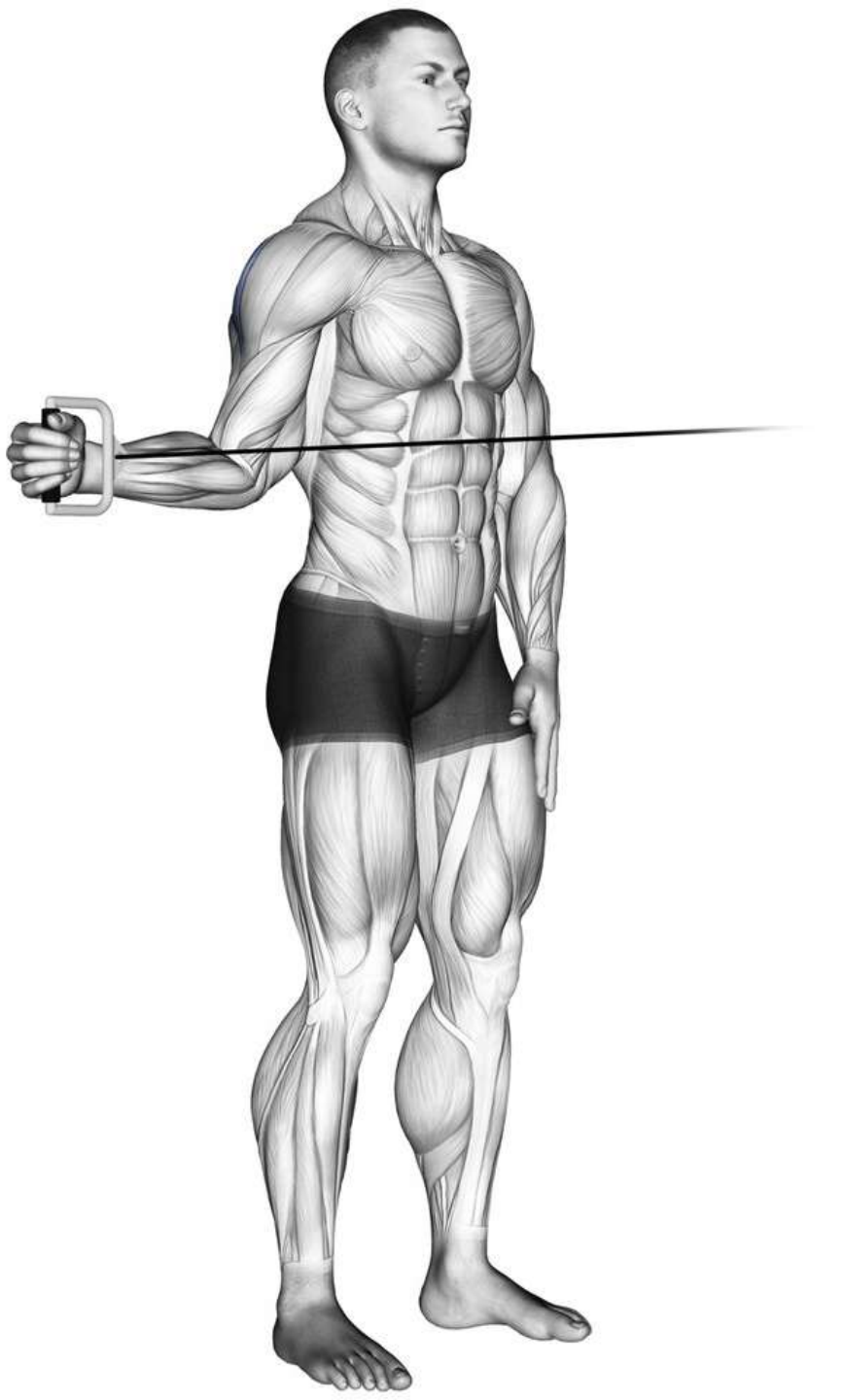


6. External Rotation :

This is a rotatory movement around the longitudinal axis of a bone away from the midline of the body.

This movement occurs in a transverse plane and is also known as rotation laterally, outward rotation and lateral rotation.

Example : External rotation is evident during the tennis serve.



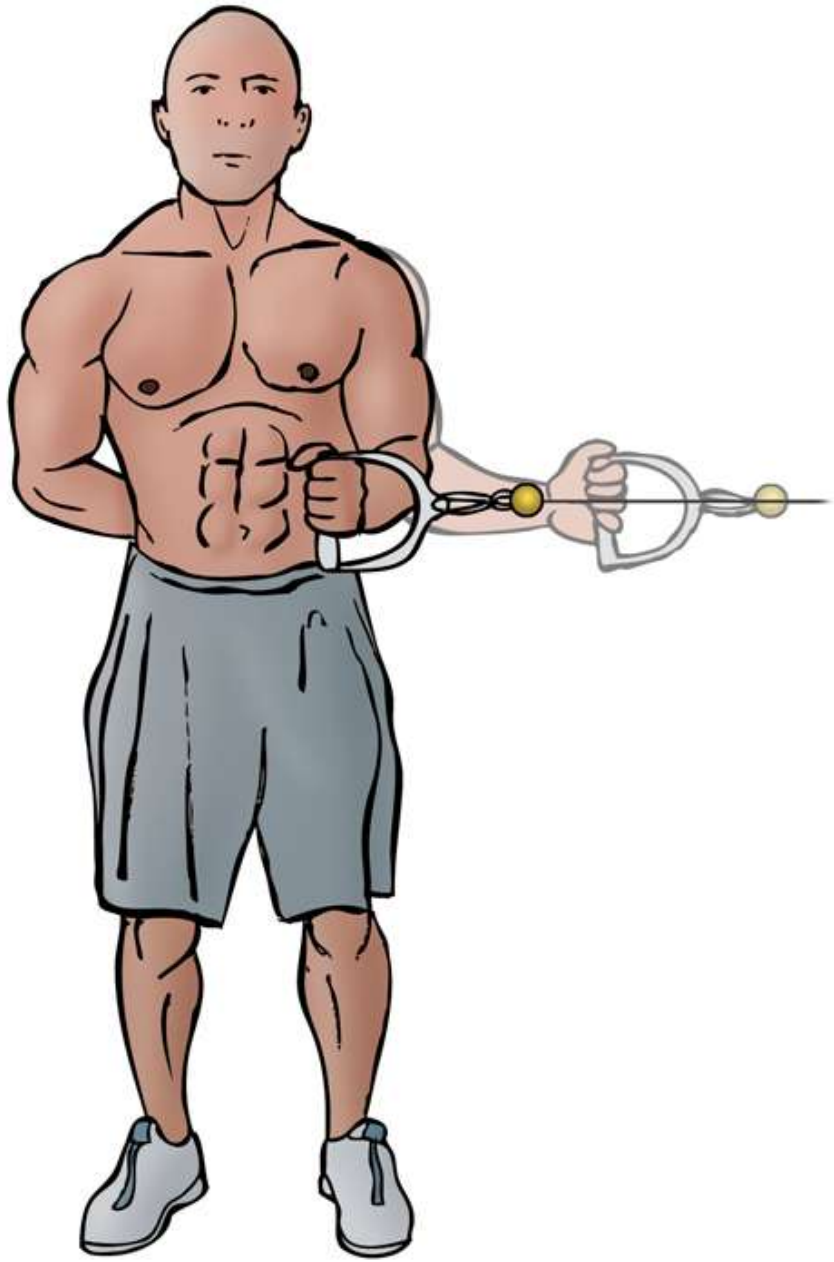
7. Internal Rotation :

This is a rotatory movement around the longitudinal axis of a bone towards the midline of the body.

It occurs in the transverse plane and is also known as inward rotation.

Internal rotation is very common movement in the human body.

Example : Javelin throw



8. Pronation and Supination :

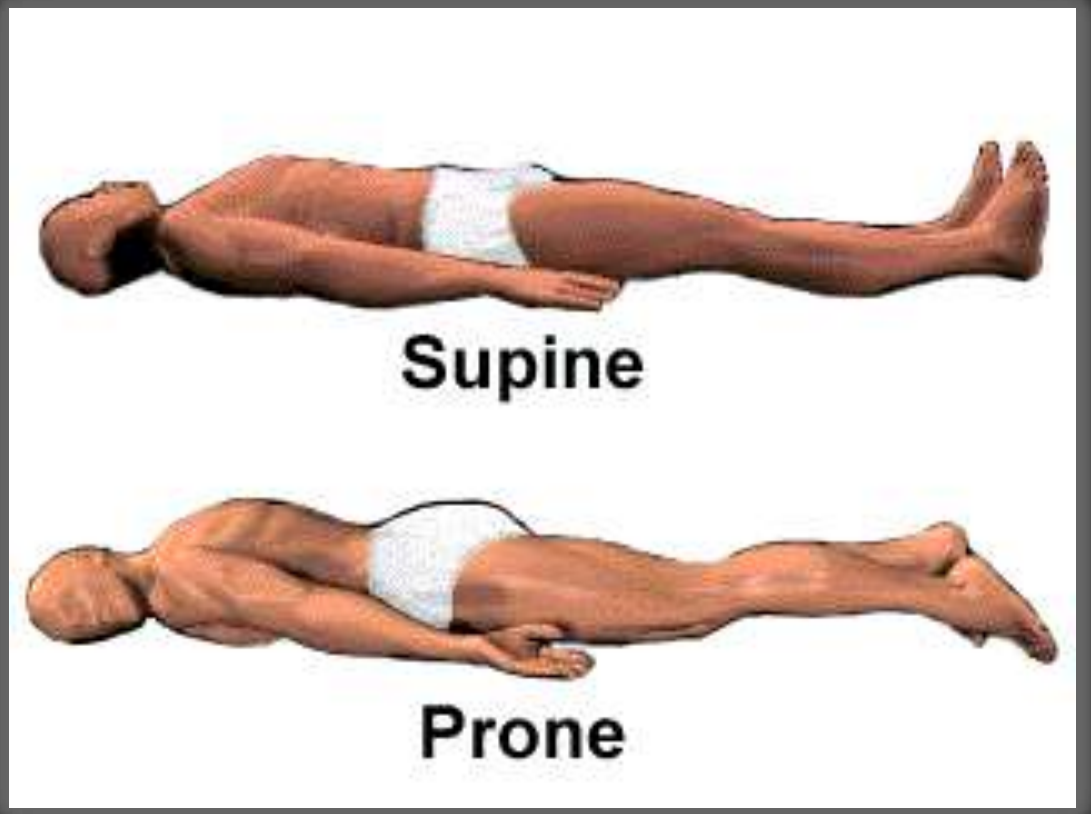
Prone is a person **laying face-down** on a surface.

Supine is a person **laying face-up** on a surface.

Pronation and supination generally refers to **assuming prone or supine positions**, but often they are used in a specific sense referring to rotation of the forearm or foot.

Pronation at the forearm is a rotational movement where the hand and upper arm are turned inwards.

Pronation of the foot refers to turning of the sole outwards, so that weight is borne on the medial part of the foot.



Supination of the forearm occurs when the forearm or palm are rotated outwards.

Supination of the foot refers to turning of the sole of the foot inwards, shifting weight to the lateral edge.