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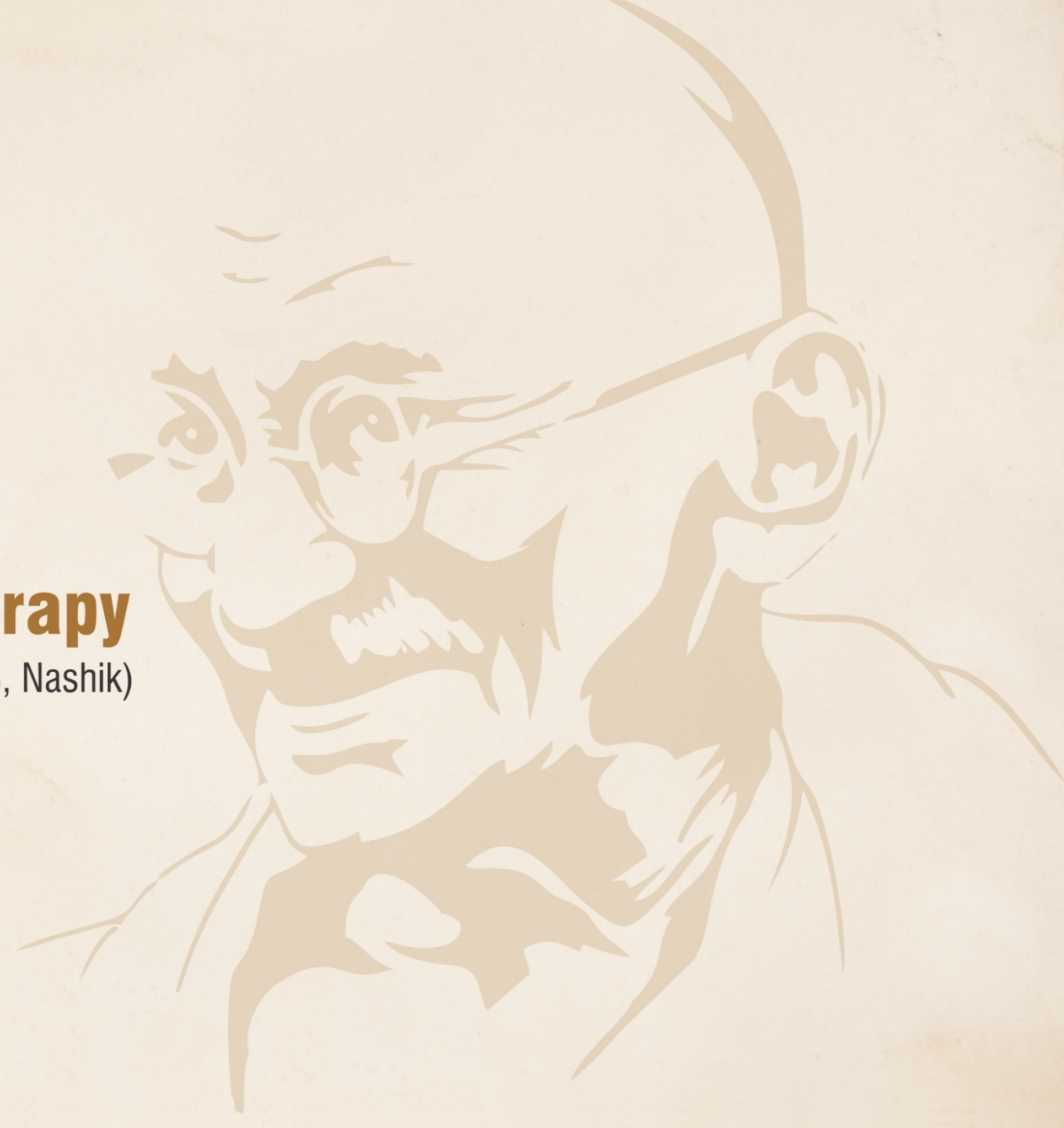
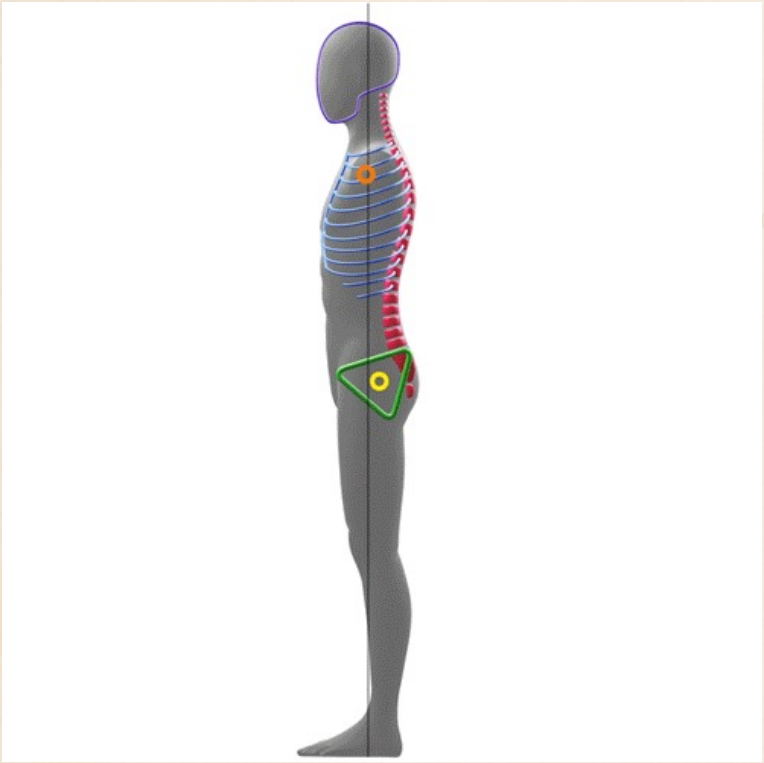
# MGM Institute of Physiotherapy

Chh. Sambhaji Nagar, Maharashtra (Affiliated to MUHS, Nashik)





# POSTURE- Introduction

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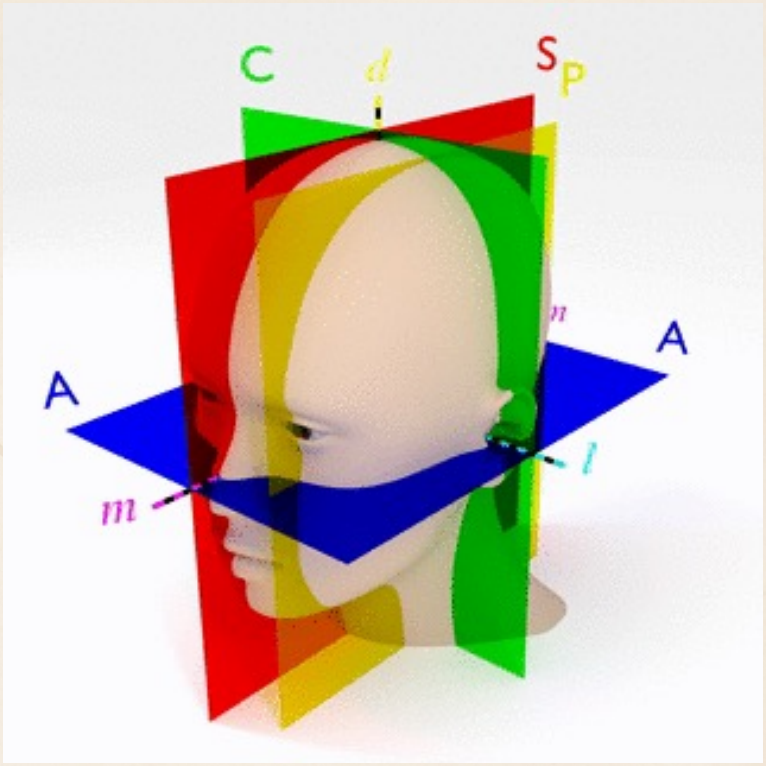


# Learning objectives

Analyse normal Human Posture [static &dynamic]

# Content

- Definition
- Human Posture: Changes from quadruped to biped
- Correct & faculty posture
- Posture pattern & postural mechanism
- Factors affecting posture
- Physiological deviation

# PRE-ASSIGNMENT

- Define posture
- Mention the types of posture
- Factors affecting posture

# DEFINING POSTURE

Attitude assumed by body

Either with

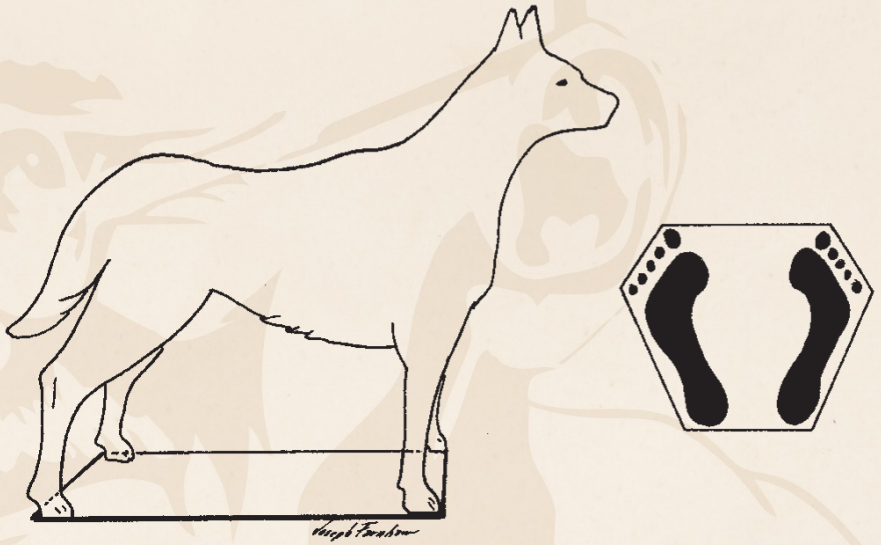
Support during muscular inactivity

OR

Coordinated action of many muscles working

to maintain stability

# UNIQUE CHARACTERISTICS OF HUMAN POSTURE



## ERECT BIPEDAL STANCE

**BOS:** Posteriorly by tips of heels & anteriorly by a line joining tips of the toes

**CoG**: Point where the mass of the body is centered & not constant

# BIPEDAL STANCE OF HUMAN POSTURE

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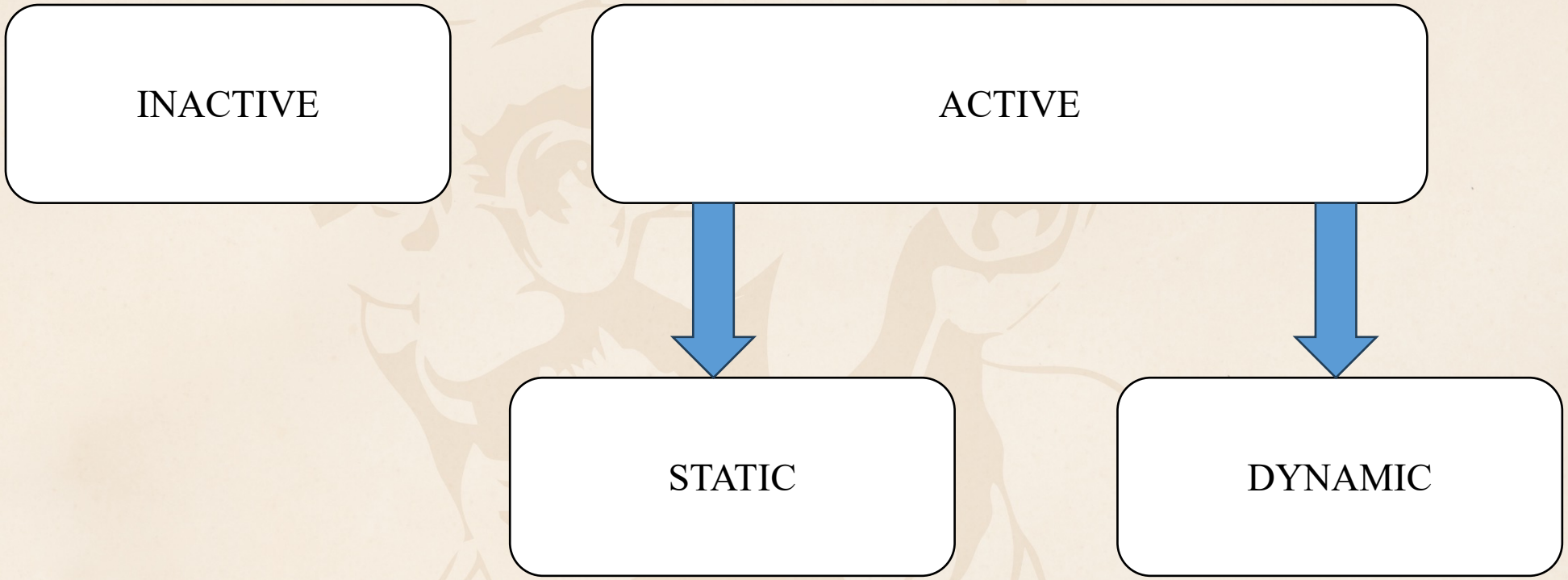
**ADVNATAGES**

- Frees UE-------Performance of small & large motor tasks

**DISADVNATAGES**

- ↑ work of heart
- ↑ stress on vertebral column
- Smaller BOS
- Moving CoM

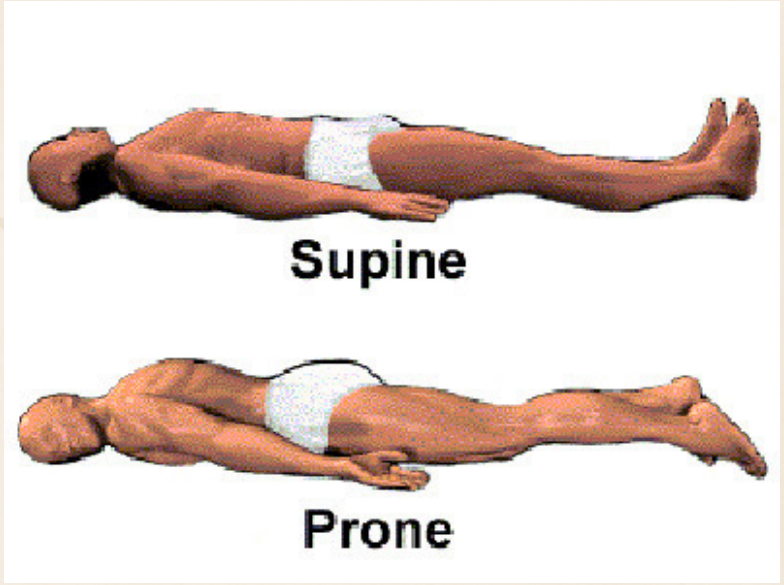
# TYPES POSTURE



# TYPES POSTURE

INACTIVE

- Resting or sleeping
- When all the essential muscular activity required to maintain life is reduced to a minimum



# TYPES OF POSTURE

**ACTIVE**

**STATIC**

Body & its segments are aligned
Maintained in certain positions

Standing
Sitting
Lying
Kneeling

**DYNAMIC**

Body & its segments are moving

Walking
Running
Jumping
Lifting

# TYPES OF POSTURE

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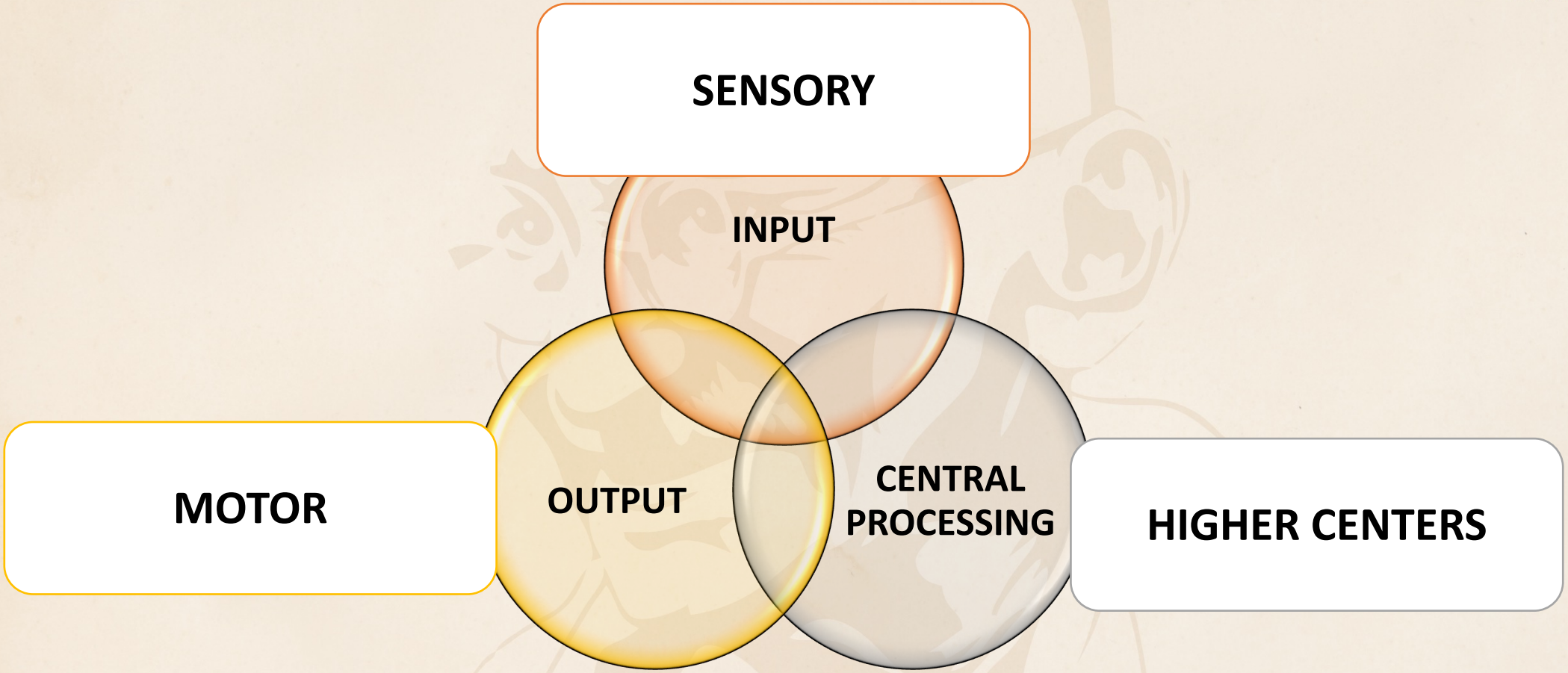
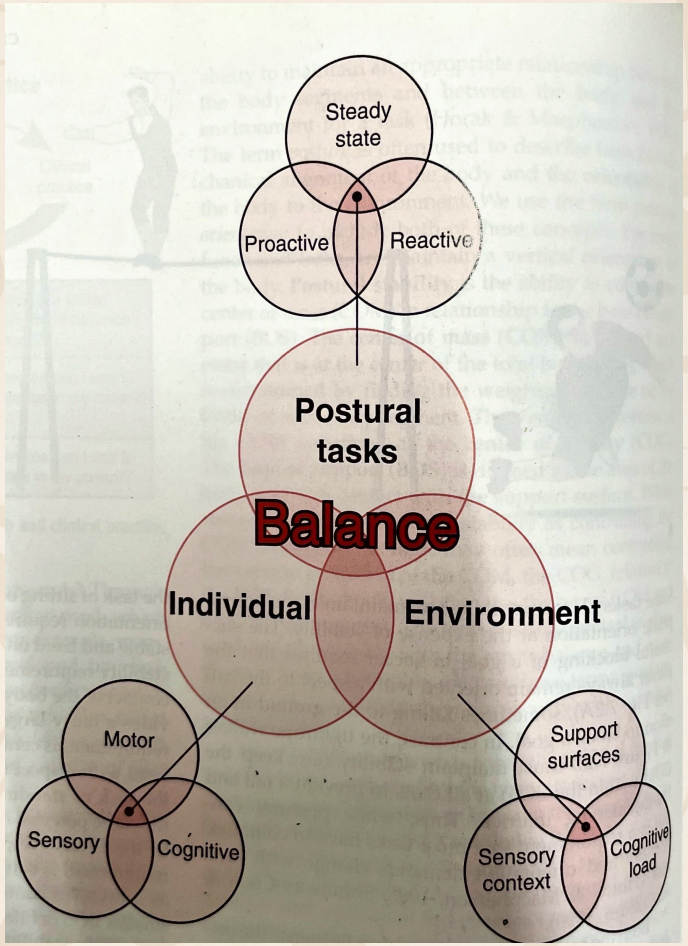
## Static Posture

# POSTURAL CONTROL

- Person's ability to maintain stability of body & body segments in response to forces that threaten to disturb the body's equilibrium
- Major goals of postural control
  - Control body's orientation in space
  - Maintain the body's CoM over the BoS
  - Stabilize head with regard to vertical so that eye gaze is appropriately oriented


SENSORY
INPUT
MOTOR
OUTPUT
CENTRAL PROCESSING
HIGHER CENTERS

# FACTORS DETERMINING POSTURE



# FACTORS DETERMINING POSTURE

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**Task constraints**

- Steady state balance: Ability to control CoM relative to BOS predictable & non changing condition (Sitting, Quiet standing, Walking at constant velocity)
- Reactive balance: Ability to recover stable---- unexpected perturbation(tripping over obstacle)
- Proactive balance: Ability activate muscle in advance to potentially destabilizing voluntary movements (Lifting heavy objects)

# FACTORS DETERMINING POSTURE

**Individual: Motor**

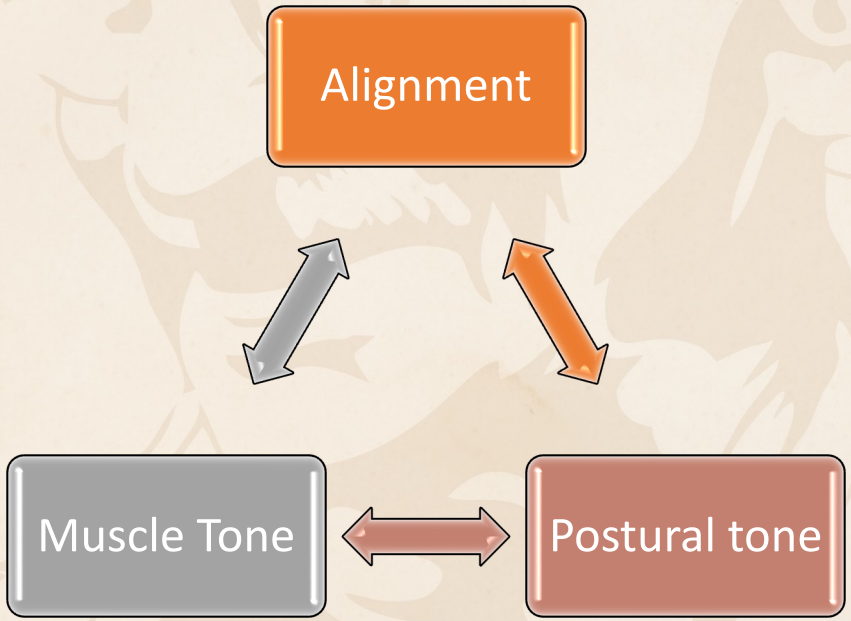
- Motor System Components

1. Higher level planning systems: Frontal cortex +Motor Cortex
2. Coordination system: Brainstem +Spinal network coordinating postural muscle synergies
3. Force generating system: Motor neuron +Muscles

# FACTORS DETERMINING POSTURE

**Individual: Motor:** Steady State Balance (Static Posture):

- Factors contributing to stability

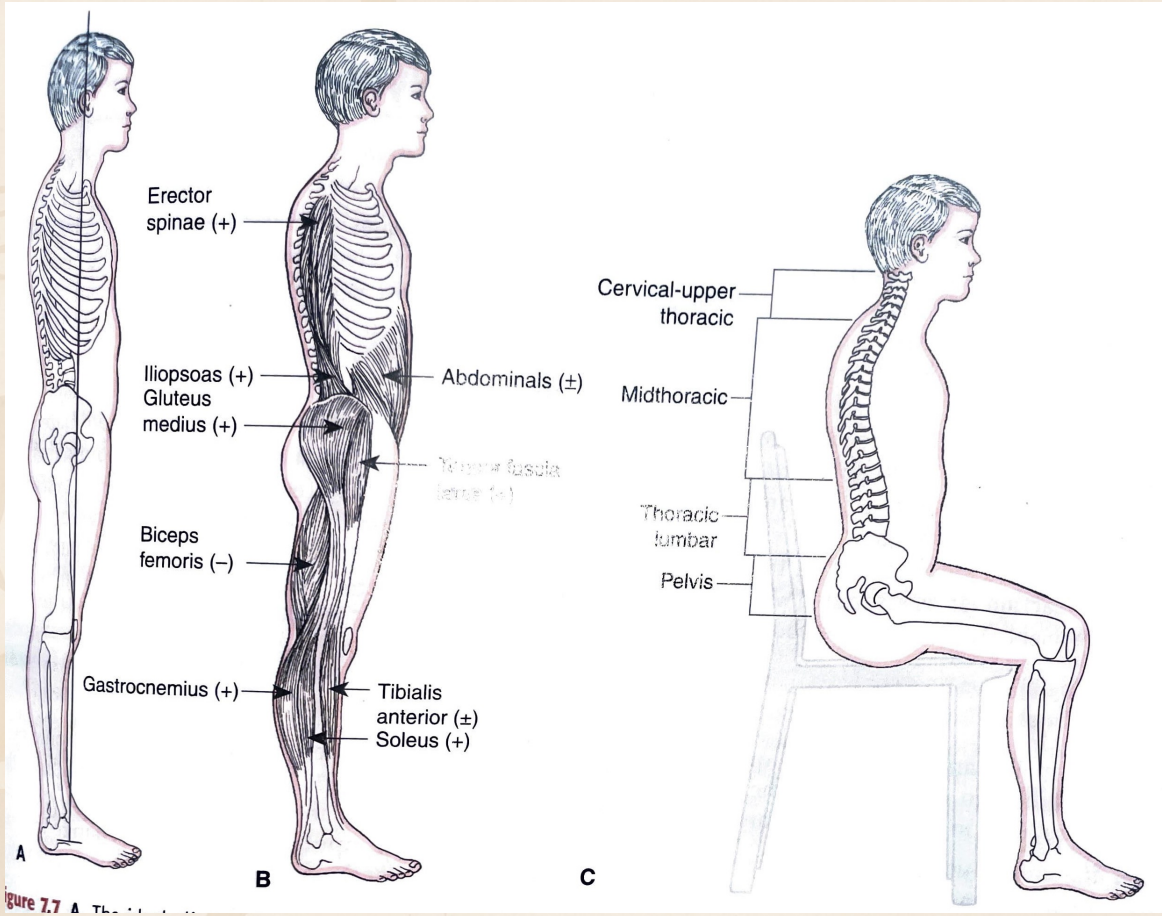


# FACTORS DETERMINING POSTURE

**Individual: Motor:** Steady State

Balance (Static Posture):

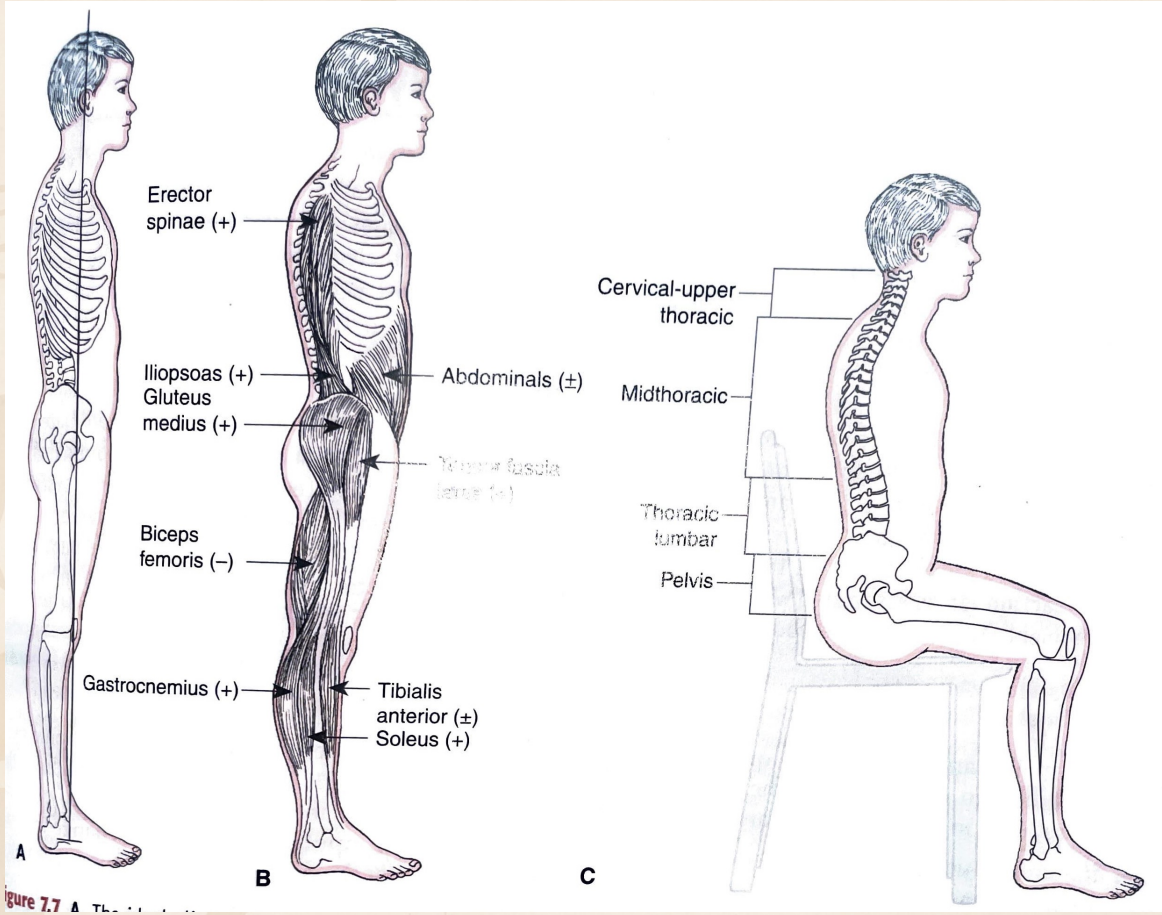
- ✓ Alignment: LOG falls in midline b/w mastoid process + pt infront of shoulder jt +just behind hip joint +a point infront center of knee joint+pt infront of ankle jt



# FACTORS DETERMINING POSTURE

**Individual: Motor:** Steady State
Balance (Static Posture):

- ✓ Muscle tone :
  - Force with which muscle resists being lengthened
  - Assessment: Ω to Passive movement
  - Certain amount of tone: Conscious & relaxed state
  - No activity on EMG on relaxed state
- ✓ Postural tone
  - Upright: ↑ in postural muscle activity to counteract gravity



# FACTORS DETERMINING POSTURE

**Individual: Motor:** Reactive Balance Control

- ✓ Organization of movement strategies used to recover stability in response to brief displacement of the supporting surface
- ✓ Muscle synergies
- Postural response to perturbation (platform movement or push): Involuntary reactive or compensatory responses: Muscle synergies/ strategies
- Factors determining synergies
  - Amount & direction of motion of supporting surface
  - Width & compliance of supporting surface &
  - Location, magnitude & velocity of perturbing force; a
  - Initial posture of individual at time of the perturbation.

# FACTORS DETERMINING POSTURE

**Individual: Motor:** Reactive Balance Control

- ✓ Muscle synergies
- Types
- Fixed Support: Ankle & Hip
- Change-in support: Stepping or Reach & grasp

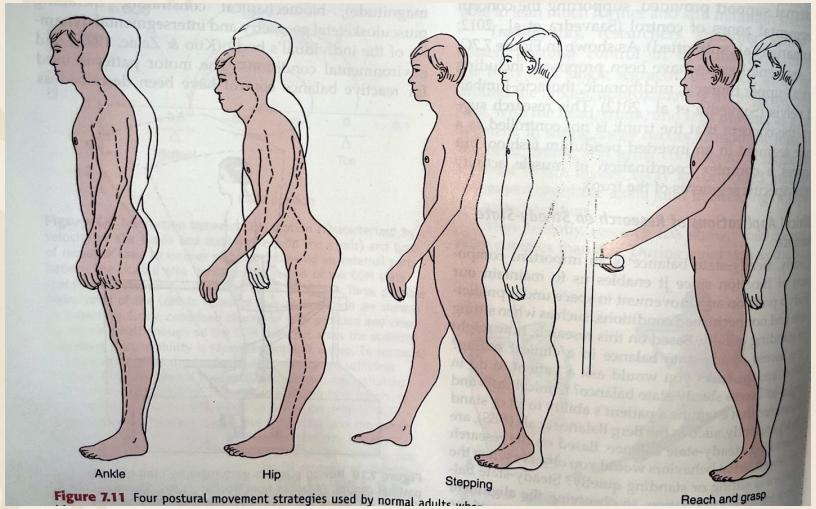


Figure 7.11 Four postural movement strategies used by normal adults

# FACTORS DETERMINING POSTURE

**Individual: Motor:** Reactive Balance Control

✓ Muscle synergies

- Types

**Fixed-support synergy**

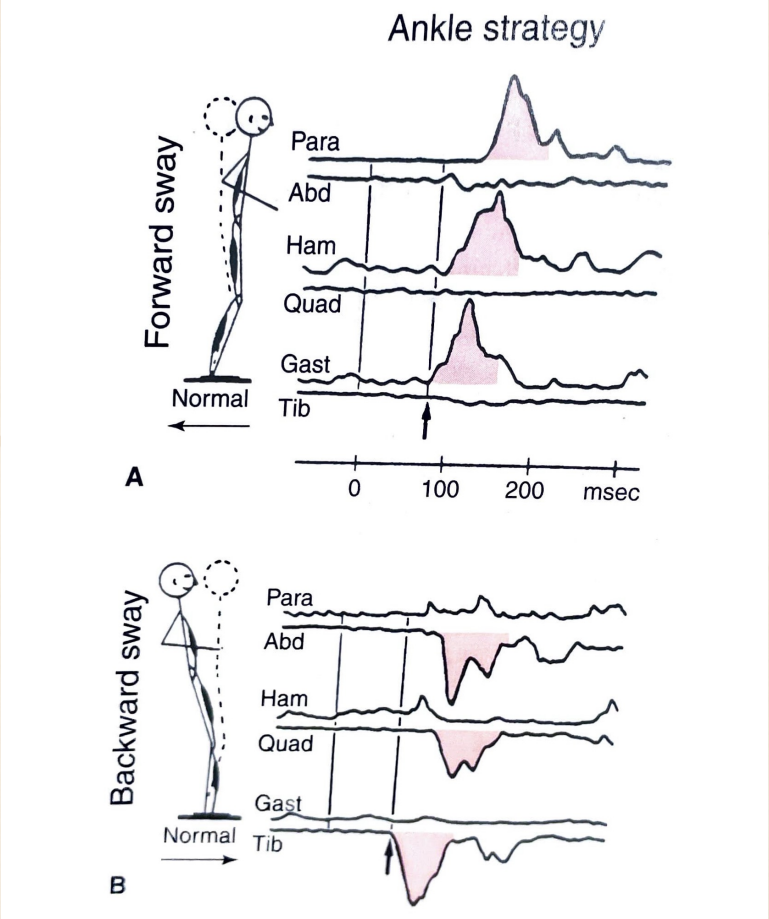
- Patterns of muscle activity in which BoS remains fixed during perturbation & recovery of equilibrium
- Stability is regained through movements of parts of body, but feet remain fixed on BoS
- Types: Ankle & Hip

# FACTORS DETERMINING POSTURE

**Individual: Motor:** Reactive Balance Control

**Fixed-support synergy: Ankle**

| | | |
|---|---|---|
| Perturbation | Forward translation of support surface (backward motion of the body) | Backward translation of support surface*(forward motion of the body) |
| Muscle distal to proximal | Tibialis anterior<br>Quadriceps femoris<br>Abdominals | Gastrocnemius 90-100 sec Hamstrings 20-30 sec<br>Paraspinals |

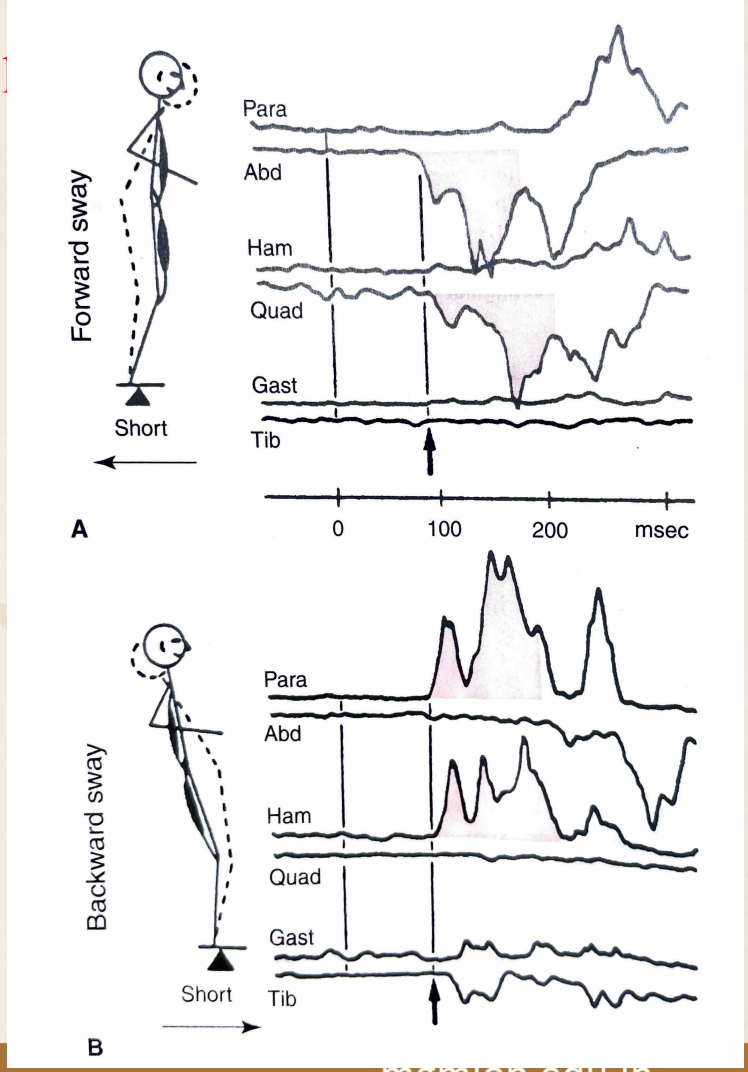


# FACTORS DETERMINING POSTURE

**Individual: Motor:** Reactive Balance Control

**Fixed-support synergy: Hip**

| | | |
|---|---|---|
| Perturbation | Forward translation of support surface (backward motion of the body) | Backward translation of support surface*(forward motion of the body) |
| Muscle proximal to distal | Tibialis anterior<br><br>Paraspinals<br>Hamstrings<br>Gastrocnemius | Abdominals 90-100 sec<br>Quadriceps femoris |

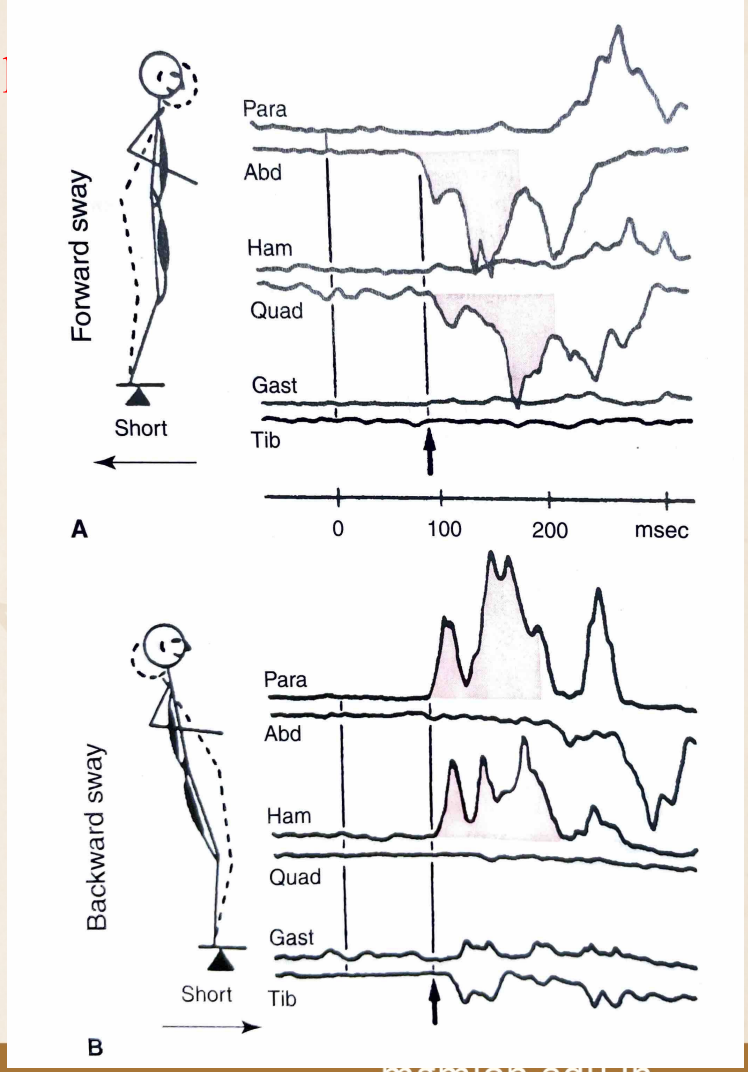


# FACTORS DETERMINING POSTURE

**Individual: Motor:** Reactive Balance Control

**Fixed-support synergy: Hip**

| | | |
|---|---|---|
| Perturbation | Forward translation of support surface (backward motion of the body) | Backward translation of support surface*(forward motion of the body) |
| Muscle proximal to distal | Tibialis anterior<br><br>Paraspinals<br>Hamstrings<br>Gastrocnemius | Abdominals 90-100 sec<br>Quadriceps femoris |

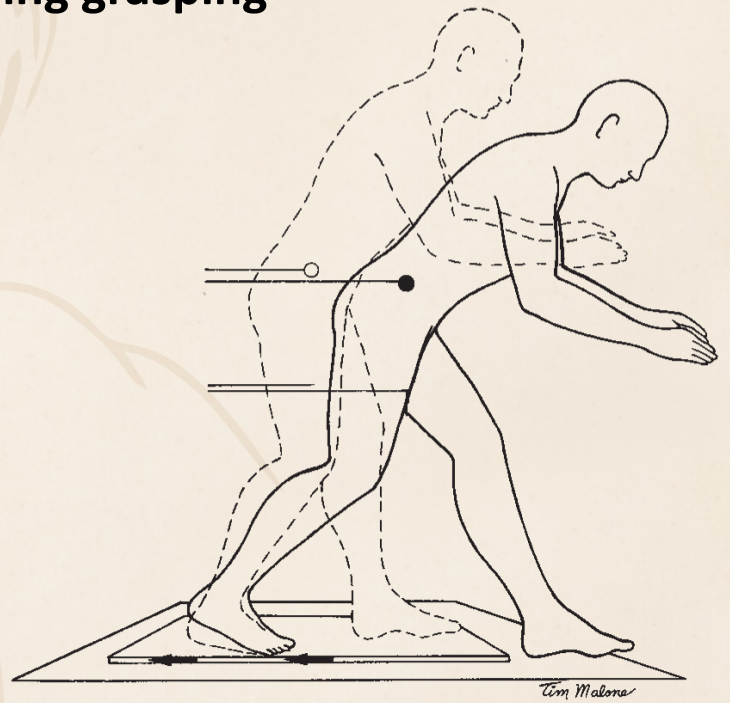


# FACTORS DETERMINING POSTURE

**Individual: Motor:** Reactive Balance Control

**Change in support strategy: Stepping or reaching grasping**

- ✓ Moves or enlarges the body's BoS so that it remains under the body's CoM



# FACTORS DETERMINING POSTURE

**Individual: Motor:** Proactive (Anticipatory) Balance Control

- Based on previous experience CNS forms a representation of what perception/action subsystems are needed to accomplish task
- Pretunes

# FACTORS DETERMINING POSTURE

**Individual: Sensory :** Steady State Balance/Reactive/Proactive

- Visual Contribution: Position & motion of head w.r.t surrounding objects & reference for verticality
- Somatosensory contribution: Position & motion of body w.r.t supporting surface
- Vestibular contribution: Position & movement of head w.r.t gravity & inertial forces providing gravitational frame of reference

Sensory integration & sensory reweighing

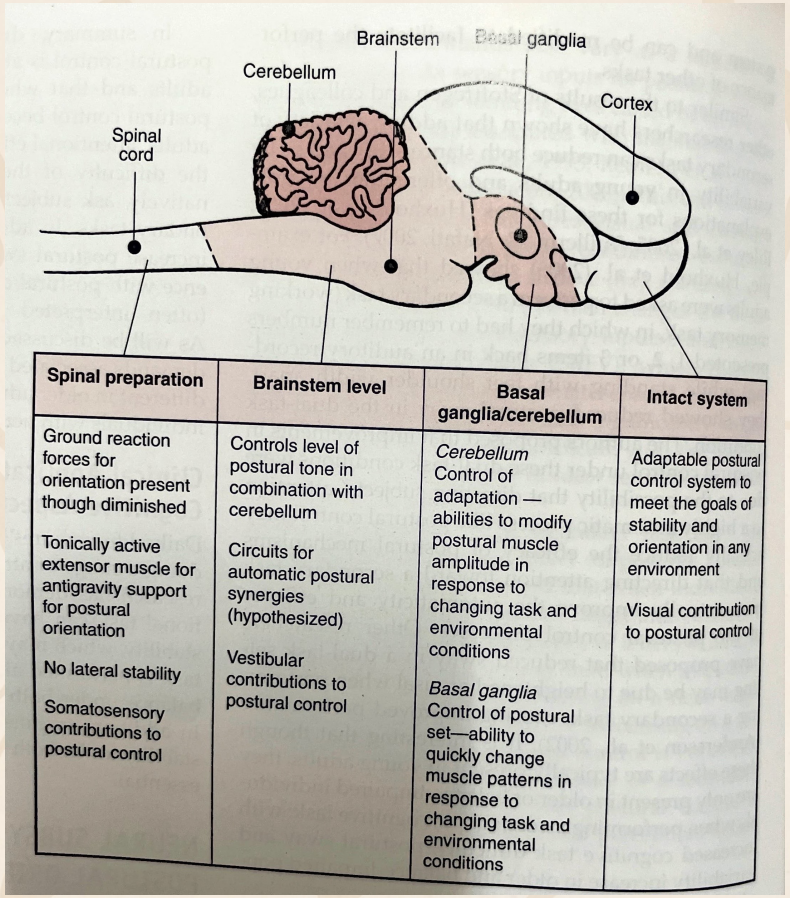
# FACTORS DETERMINING POSTURE

**Individual: Cognitive :** Steady State Balance/Reactive/Proactive

- Attentional resources: Information processing resources

# FACTORS DETERMINING POSTURE

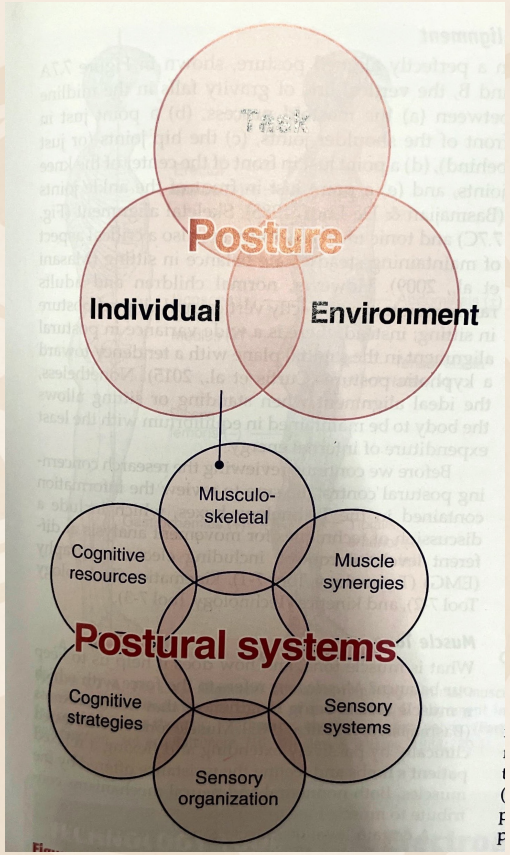
## Individual: Neural Subsystems




| Spinal preparation | Brainstem level | Basal ganglia/cerebellum | Intact system |
|---|---|---|---|
| Ground reaction forces for orientation present though diminished<br><br>Tonically active extensor muscle for antigravity support for postural orientation<br><br>No lateral stability<br><br>Somatosensory contributions to postural control | Controls level of postural tone in combination with cerebellum<br><br>Circuits for automatic postural synergies (hypothesized)<br><br>Vestibular contributions to postural control | *Cerebellum*<br>Control of adaptation — abilities to modify postural muscle amplitude in response to changing task and environmental conditions<br><br>*Basal ganglia*<br>Control of postural set—ability to quickly change muscle patterns in response to changing task and environmental conditions | Adaptable postural control system to meet the goals of stability and orientation in any environment<br><br>Visual contribution to postural control |

# FACTORS DETERMINING POSTURE

## Individual: Neural Subsystems



# Reference


- Pamela Levangie, Cynthia Norkin - Joint Structure And Function. A Comprehensive Analysis

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