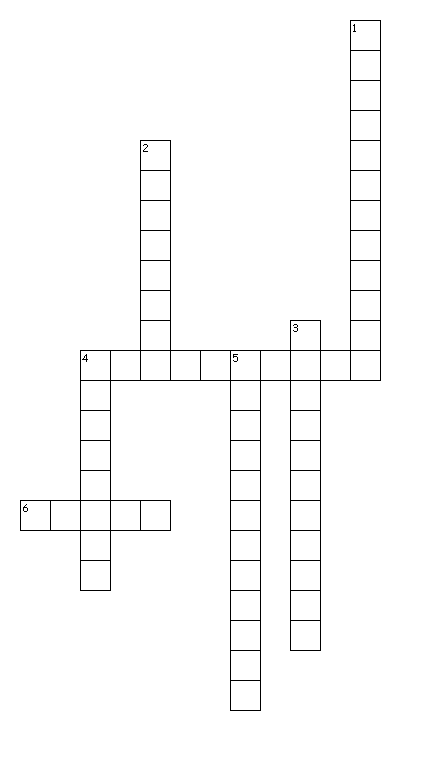
Chapter 1 - The Basics

  
Across

4. Components of movement (e.g., force, mass).

6. Skull, vertebrae, sacrum, coccyx

Down

1. The mechanical forces on the body.

2. This structure protects, supports, provides shape, assists with movement, produces blood, and stores calcium.

3. The study of movement.

4. Forces that cause movement.

5. Upper and lower extremities

|  |  |  |
| --- | --- | --- |
| Kinesiology & Biomechanics  Defined |  |  |
| Kinetics & Kinematics Defined |  |  |
| Descriptions of Positions (2) or Locations (19)  (e.g., Anatomical) |  | |

1. Positions and Location

|  |  |
| --- | --- |
| Types of Motions (2) |  |
| Joint Movements (28) (Osteokinematics) |  |

1. Joint Movements

Chapter 2 – Skeletal System

|  |  |  |
| --- | --- | --- |
| Functions of the Skeleton (6) |  | |
| Types of Skeleton (2)  Identify the bones or sections of each |  |  |
| Composition of Bone  (Types of Tissue) |  | |
| Structure of Bone  (Parts of a the bone) |  | |
| Types of Bones (5)  (Provide examples of each type) |  | |

1. Draw a Humerus and a Femur
2. Label the Parts (Diaphysis, Epiphysis, Epiphyseal Plate, Metaphysis, Endosteum, Periosteum, Medullary Canal) (p. 15)
3. Identify the “Pressure Epiphyses” and “Traction Epiphyses” of each bone (p. 16)

Chapter 3 – Articular (Joint) System

|  |  |  |  |
| --- | --- | --- | --- |
| Stability vs Mobility |  | | |
| Classification of Joints (5)  &  Structure of each |  |  |  |
|  | \* |  |
| \*Diarthroidal Joints (4) | Shape | Motion | Example |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
| Joint Structure |  | | |
| Planes (3\*),  Axes (3\*) & Motions | Plane | Axis | Joint Motion when in Anatomical Position |
|  |  |  |
|  |  |  |
|  |  |  |

1. Axes, Planes, Motions

|  |  |  |
| --- | --- | --- |
| Sprain vs Strain |  |  |

Chapter 4 – Arthrokinematics

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Osteokinematics  (Joint Motion)  (revisited) |  | | | |
| End-Feel (2)  “Quality of the feel when slight pressure is applied at the end of the PROM” | Normal (3) | | Abnormal (4) | |
|  | |  | |
| Arthrokinematic Motion  “How two joint surfaces move on each other during osteokinematic joint movement”  (Joint Surface Motion) | Roll | Glide/Slide | | Spin |
|  |  | |  |
| Convex-Concave Rule  “Shape determines motion” | Convex Shape | | Concave Shape | |
|  | |  | |
| Accessory Motion Forces | Traction/Distraction/Tension | | Approximation/Compression | |
|  | |  | |
| Shear | | Bending/Torsion | |
|  | |  | |

Chapter 5 – Muscular System

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Muscle Attachments  (p. 39) | Insertion | | | Origin | | |
|  | | |  | | |
| Reversal of Muscle Action |  | | | | | |
| Muscle Names (7) | Location | | Shape | | Action | |
|  | |  | |  | |
| Number of Heads or Divisions | | Attachments | | Direction of the Fibers | |
|  | |  | |  | |
| Size of the Muscle | | |  | | |
|  | | |  | | |
| Muscle Fiber Arrangements (2)  (p. 41) | Parallel (4) | | | Oblique (3) | | |
|  |  | |  | |  |
|  |  | |  | |  |

1. Clay Shapes, Fiber Arrangements

|  |  |  |  |
| --- | --- | --- | --- |
| Functional Characteristics of Muscle Tissue | | Normal Resting Length | Irritability |
|  |  |
| Contractility | Extensibility |
|  |  |
| Elasticity |  |
|  |  |
| Length-Tension Relationship  Hamstring Example  (2-joint muscle)  (p. 43) | Tension | | Tone |
|  | |  |
| Active & Passive Insufficiency (p. 43) | Active | | Passive |
|  | |  |
| Tenodesis  (Tendon action of a muscle)  (p. 44) |  | | |

1. Tenodesis

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Types of Muscle Contraction |  | Isometric | | Isotonic | | | Isokinetic |
| Defined |  | |  | | |  |
| AKA |  | |  | | |  |
| Subdivisions |  | |  | | |  |
|  | |  | | |  |
| Features of Concentric  &  Eccentric Contractions  (p. 46) | Concentric (3) | | | | Eccentric (3) | | |
|  | | | |  | | |
| Comparison of Concentric  &  Eccentric  Contractions  (p. 46) | Type of Contraction | | Joint Motion Occurring\* | | | Active Muscle Group\* | |
| Concentric | |  | | |  | |
|  | | |  | |
|  | | |  | |
|  | | |  | |
|  | | |  | |
|  | | |  | |
| Eccentric | |  | | |  | |
|  | | |  | |
|  | | |  | |
|  | | |  | |
|  | | |  | |
|  | | |  | |

1. Weight Room for concentric and eccentric activity

|  |  |  |
| --- | --- | --- |
| Roles of Muscles  (p. 48) | Agonist | Antagonist |
|  |  |
| Concontraction | Stabilizer |
|  |  |
| Neutralizer | Synergist |
|  |  |
| Angle of Pull |  | |
| Kinetic Chains | Closed | Open |
|  |  |

Chapter 6 – Nervous System

|  |  |  |
| --- | --- | --- |
| CENTRAL NERVOUS SYSTEM (2) | | |
| BRAIN | | |
| Cerebrum | Hemispheres (2) |  |
| Lobes (4) |  |
| Brainstem | Midbrain |  |
| Medulla Oblongata |  |
| Cerebellum  (Little Brain) |  | |
| Brain Protection | Skull | Meninges (3) |
|  |  |
| SPINAL CORD | | |
| Anatomy |  | |

**Central Nervous System**

**Terminology & Concepts from Chapter 6**

Central Nervous System

Peripheral Nervous System

Cranial Nerve (12)

Peripheral Nerve

Dermatomes

Myotomes

Plexus

1. Cervical
2. Brachial
3. Lumbosacral

Ascending & Descending Tracts

(Afferent & Efferent Tracts)

(Sensory & Motor Tracts)

Dorsal Root (Sensory Nerve)

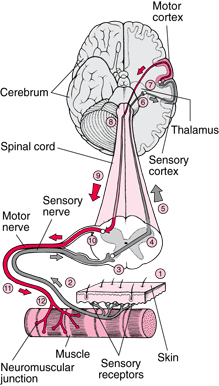
Dorsal (Posterior) Root Ganglion

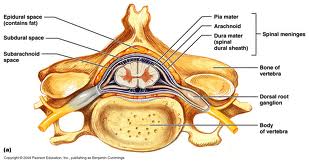
Anterior Root (Motor Nerve)

Brain Lobes

Meninges

1. Dura Mater
2. Arachnoid
   1. Cerebrospinal Fluid
3. Pia Mater





Subdural Space

Vertebral Bone

Dorsal Root Ganglion

Vertebral Body

Spinal Meninges

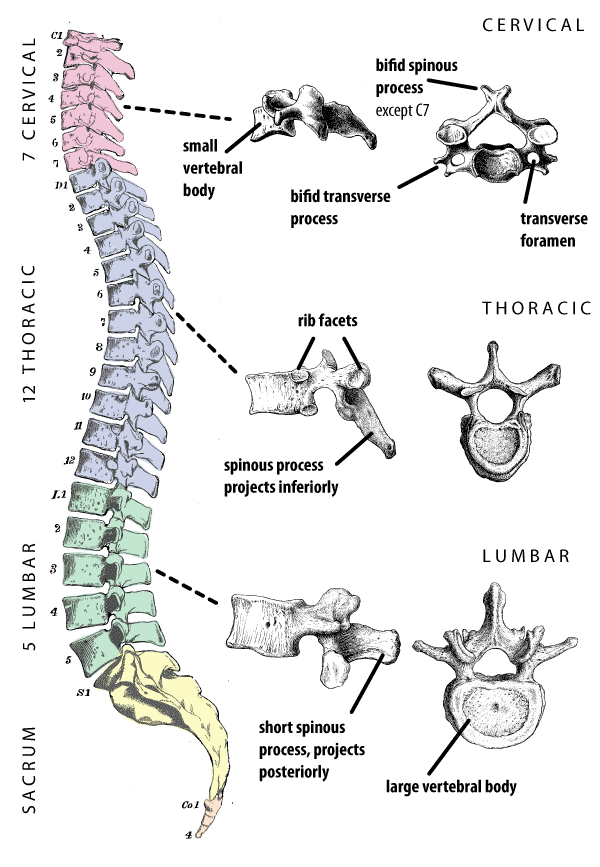
Pia Mater

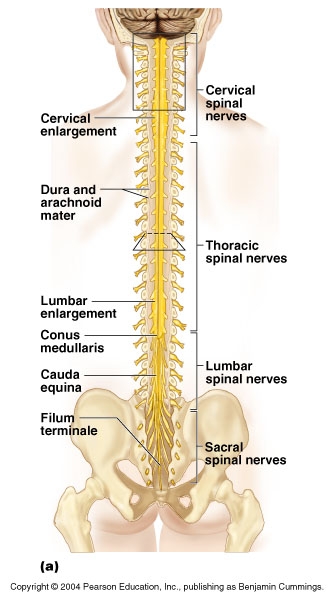
Arachnoid

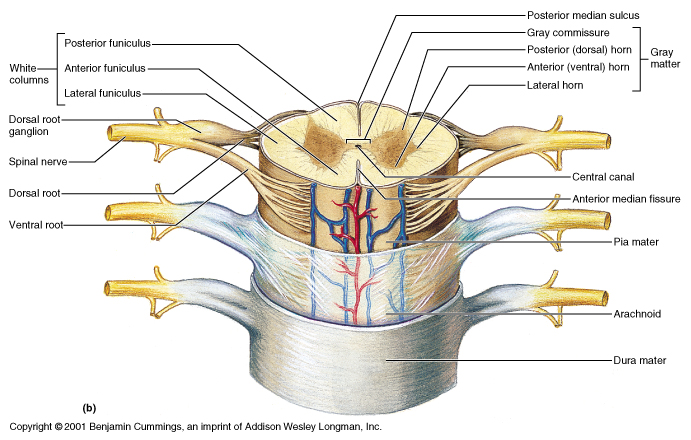
Dura Mater

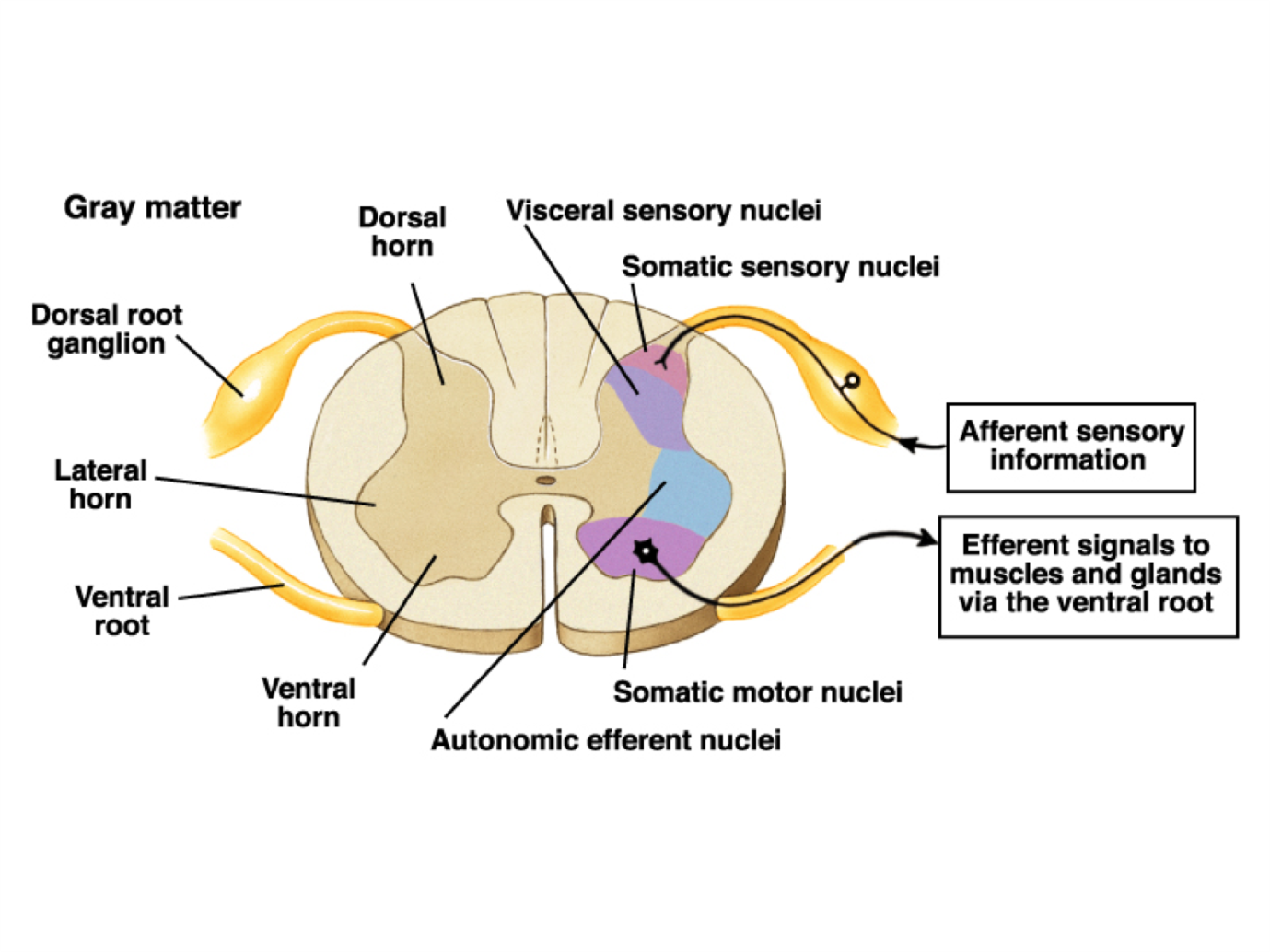
Subarachnoid Space

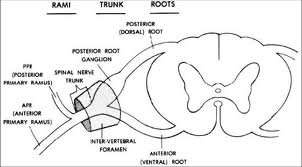
Epidural Space











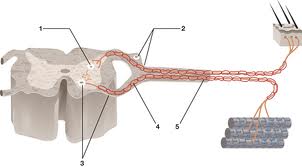
Anterior (Ventral) Root

Inter-Vertebral Foramen

Spinal Nerve Trunk

Dorsal Root Ganglion

Posterior (Dorsal) Root



Motor Response (Contraction)

Motor Neuron

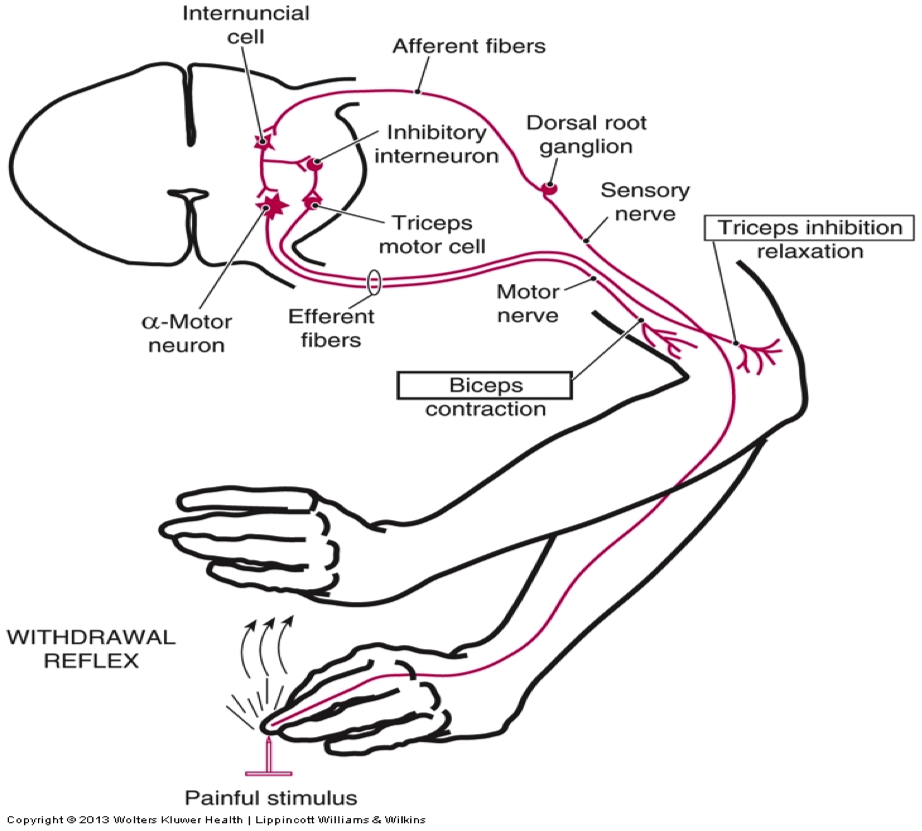
Efferent Fibers

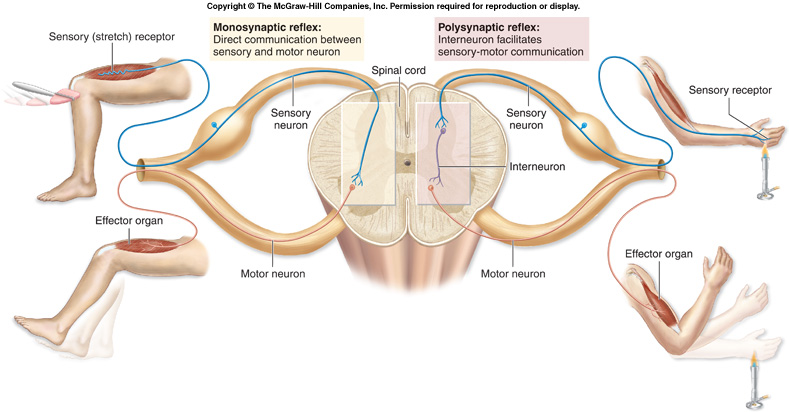
Dorsal Root Ganglion & Afferent Fibers

Motor Nerve

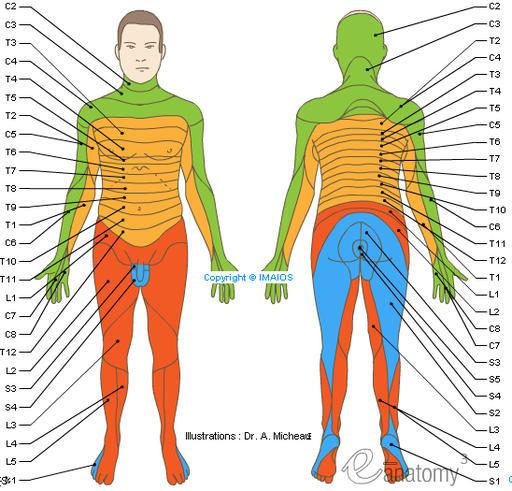
Stimulus

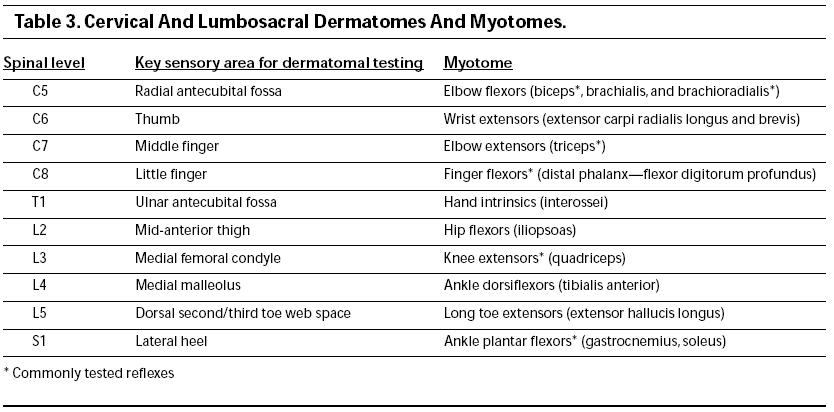
Internuncial Cell

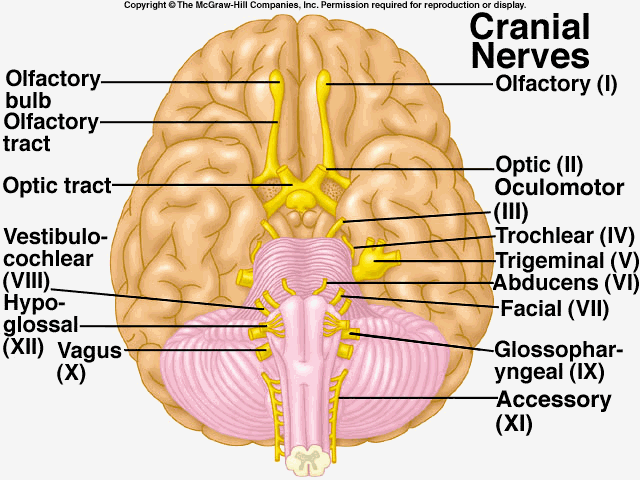


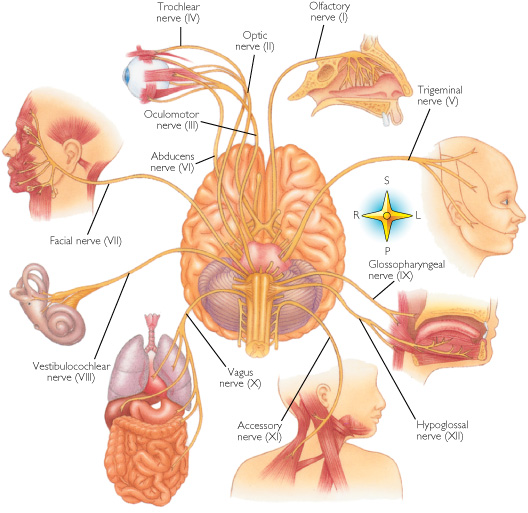


Dermatomes & Myotomes

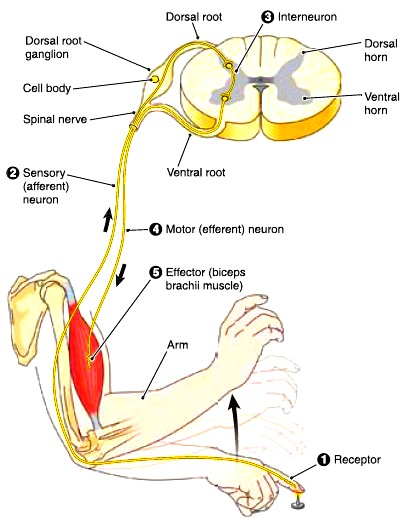








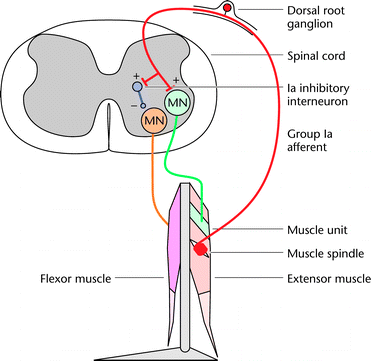




**Agonist & Antagonist Motor Nerve Unit**

Working together to allow a contraction (plantar flexion in

this case).



**Nervous System Build or Draw**

**Option 1 Option 2**

**Include: Include in drawing:**

Sensory Neuron Under surface of brain

Motor Neuron

Spinal Cord Cross Section **Build with Clay on drawing:**

Dorsal Root Ganglion 12 Cranial Nerves

Motor

**Either** Sensory

Agonist & Antagonist Unit Both

OR

Sensory & Motor Unit

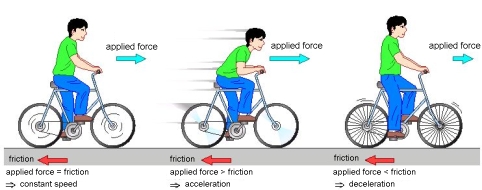
**Sensory & Motor Tracts of Nerve Fibers**

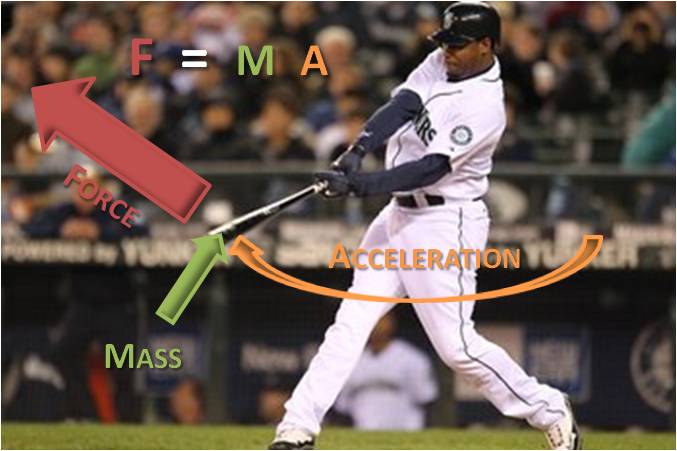
Afferent (Sensory) impulse to CNS

Efferent (Motor) impulse to muscle to cause action

CHAPTER 8 - BIOMECHANICS

1. Newton’s 3 Laws of Motion
   1. Law of Inertia
      1. An object at rest tends to stay at rest and an object in motion tends to stay in motion
      2. Force overcomes the inertia; object moves, stops or changes direction
      3. [Comic](http://www.phdcomics.com/comics/archive.php?comicid=221)
      4. <https://www.facebook.com/messages/karen.hostetter.39>
   2. Law of Acceleration
      1. The amount of acceleration depends on the strength of the force applied to an object
      2. Change in direction depends on force applied to it
      3. Acceleration is inversely proportional to Mass (*F = MA); therefore, A = F/M*



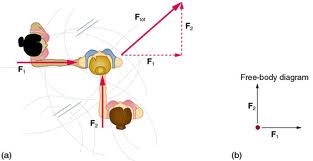


* 1. Law of Action-Reaction
     1. For every action, there is an equal and opposite reaction <http://www.youtube.com/watch?v=jid7Nlzfet8> (Newton’s Cradle)
     2. Strength of the reaction is always equal to the strength of the action, and it occurs in the opposite direction
     3. [Comic](http://www.phdcomics.com/comics/archive.php?comicid=223)

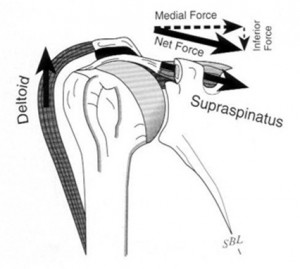
1. Force
   1. Either a push or pull (compression or tension)
   2. Vector = magnitude and direction



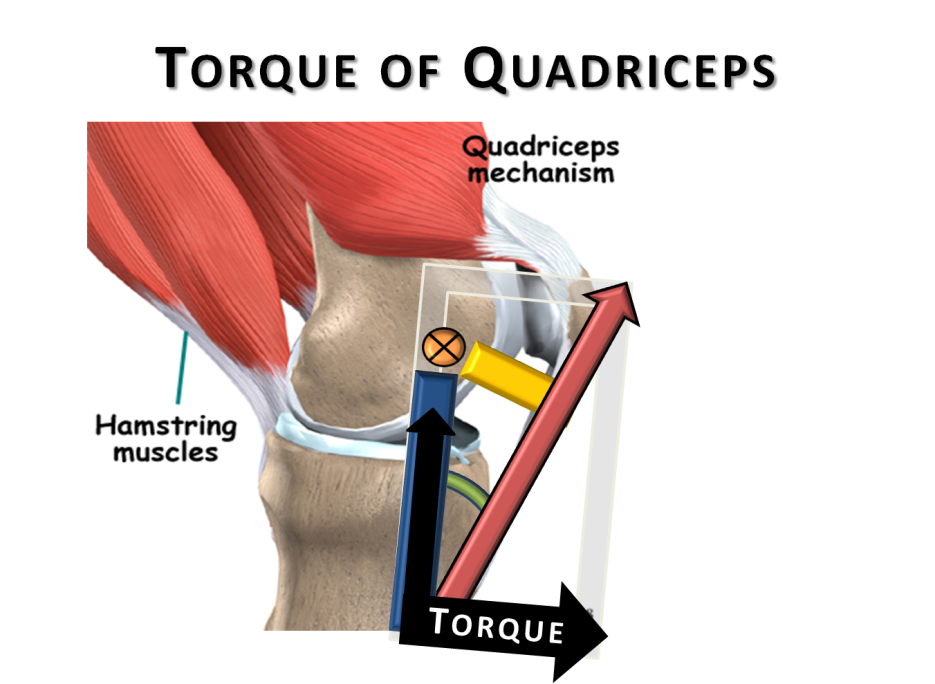
* 1. Linear Force – same or opposite direction in a line
  2. Parallel Force – back brace example (p 96) – same plane, but different levels (opposite must be in middle of other forces, otherwise torque)
  3. Concurrent Force – different directions = resultant Force (parallelogram method)



* 1. Force Couple – two or more forces act in different directions for a “turning effect”
     1. Deltoid and supraspinatus (**without** the force couple the convex/concave rule is in effect and the head of the head of the humerus rolls upward, but the glide pulls it [downward] out of the glenoid fossa)

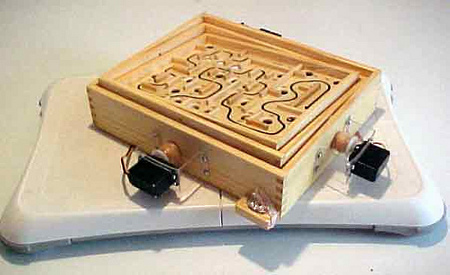


1. Torque – “Moment of Force” (“moment arm”)
   1. Ability of a force (muscle) to produce rotation around an axis (joint)

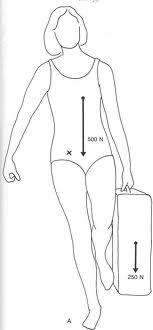


* 1. Amount of force needed by a muscle contraction to cause rotary joint motion
     1. Depends on
        1. Strength of the force (Magnitude)
        2. Perpendicular distance from force’s line of pull to the axis of rotation (Moment Arm) (p 97+)
        3. The longer the moment arm, the less effort necessary for movement

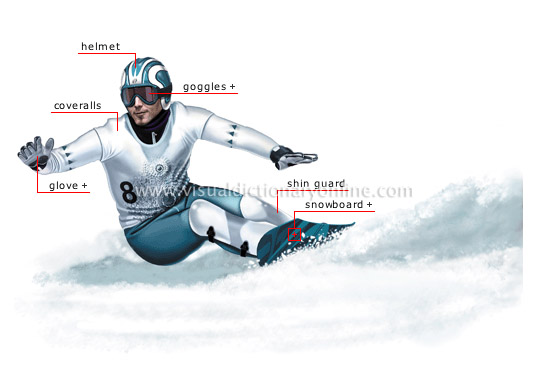
1. Stability
   1. Equilibrium = Balanced



* 1. Gravity = Mutual Attraction between earth and an Object
  2. Center of Gravity (COG) = balance point of an object at which torque on all sides is equal
     1. May be within body or may be outside of body
     2. Point at which all three planes intersect

X

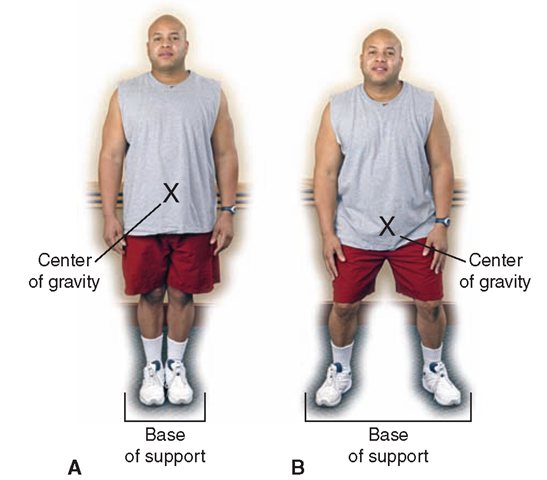
 







* 1. Base of Support (BOS) = part of a body that is in contact with the supporting surface



* 1. **Line of Gravity (LOG)** = imaginary vertical line passing through the COG towards the center of the earth
  2. **Stable** Equilibrium – to disturb = “uncentering” COG

1. **Unstable** Equilibrium – minimal force required to disturb object
   1. **Neutral** Equilibrium – COG doesn’t change (e.g., a ball rolling)
   2. Six Principles
      1. Lower COG = more stability
      2. COG & LOG must remain within BOS to be stable (wider BOS = more stability)
      3. Stability increases as BOS widens in direction of force (e.g., windy day)
      4. Large mass = greater stability
      5. Greater friction = greater stability
      6. Better balance when focus on stationary object
2. Simple Machines (4 of ‘em)
   1. Classes of **Levers** (leverage)

Terms: **Force (Muscle Action)**

**Axis (Joint to which action occurs)**

**Resistance (Weight or pressure against the force or muscle action)**

Mnemonics: “FAR FRAm AFaR” (far from afar)

“ARF” – if A is middle = 1st Class; R = 2nd Class; F = 3rd Class

* + 1. **First Class (F A R)**

**Force Axis Resistance**

* + - 1. Ruler Pencil Book
      2. Neck Muscles Base of Skull Wt of Hd
    1. **Second Class (F R A)**

**Force Resistance Axis**

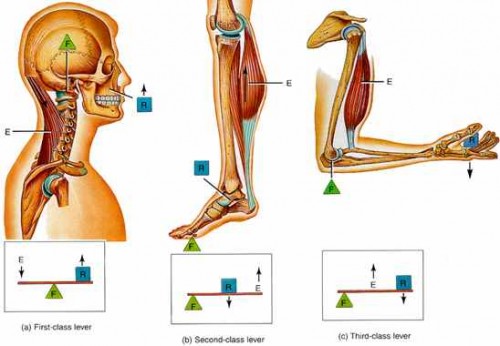
* + - 1. Lift Whbarrow Load Wheel
      2. Gastrocnemius Body Weight MTP jt
      3. (eccentric)

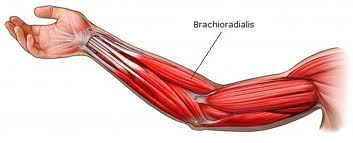
Elbow Ext Against Gravity Elbow jt

* + 1. **Third Class (A F R)**

**Axis Force Resistance**

* + - 1. Boat Tie Push Wt of Boat
      2. Elbow Biceps Forearm Wt

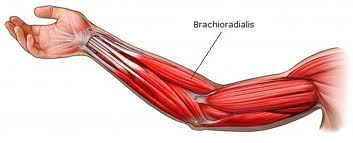




ARF = 2nd Class Lever

Balance point

Balance point



AFR = 3rd Class Lever

Examples: Force Axis Resistance

First Class:

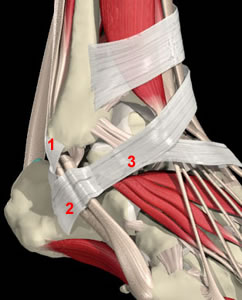
Force Resistance Axis

Second Class:

Axis Force Resistance

Third Class:

* 1. **Pulleys** (tendons / retinaculae / grooves)
     1. Fixed Pulley – attached on “resistance” side
     2. Axis – joint axis/pulley action
     3. Force – Muscle Contraction
     4. Always act as 1st Class Lever with the axis between the resistance and the force
     5. Examples
        1. Peroneus Longus – Superior & Inferior Retinaculum
        2. Peroneus Brevis – Superior & Inferior Retinaculum
        3. Peroneus Tertius – Inferior Extensor Retinaculum
        4. Long Head of Biceps Tendon – Transverse Ligament

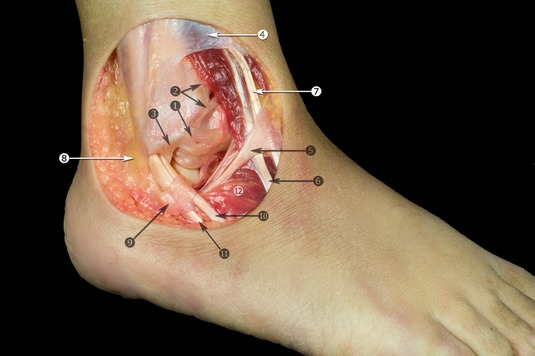


1. Superior Peroneal Retinaculum
2. Inferior Peroneal Retinaculum
3. Inferior Extensor Retinaculum

No number = Superior Extensor Retinaculum

\*\*Create on the Skeletons

\*\*Show flexor video clip [Video](http://www.youtube.com/watch?v=HnLBAlSs1ck&oref=http%3A%2F%2Fwww.youtube.com%2Fresults%3Fsearch_query%3Dflexor%2Btendon%2Bsurgery%26oq%3Dflexor%2Btendon%2Bsurgery%26gs_l%3Dyoutube.3...1928.8788.0.8968.31.30.1.0.0.0.136.2254.26j4.30.0...0.0...1ac.1.MRY_r6CZ)



1 Anterior talofibular ligament

2 anterior tibiofibular ligament

3 fibular insertion of the

calcaneofibular ligament

4 superior extensor retinaculum

5 inferior extensor retinaculum

6 peroneus tertius tendon

7 extensor digitorum longus

tendons

8 superior peroneal retinaculum

9 inferior peroneal retinaculum

10 peroneus brevis tendon

11 peroneus longus tendon

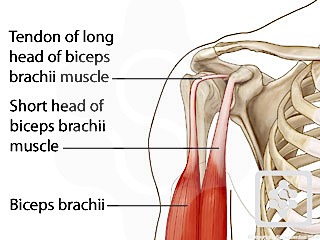
12 extensor digitorum brevis

muscle



Long Head of Biceps Tendon running through the Intertubercular (Bicipital) Groove

Held in place by the Transverse Ligament



* 1. **Wheel and Axle**
     1. Shoulder ER with elbow extended

vs

* + 1. Shoulder ER with elbow flexed to 90degrees
  1. **Inclined Plane** – for ease of access in therapeutic Settings (rise vs run)
     1. None in the human body

TBBT Example of physics: <http://www.youtube.com/watch?v=MVywNxUjPWQ>

**8 Principles of Human Movement (abbreviated)**

1. The greater the size of the base of support, lower center of gravity, line of gravity within the base of support, greater mass = greater stability
2. Use of all joints = greater force
3. Use of all joints in sequential order = greater velocity
4. Force produced over greater distance or time is increased; Absorb force over longer time or distance - “give” to absorb force
5. Longer levers produce more force (Longer the implement, faster end is moving – may give up control)
6. Direction of force is governed by “equal and opposite reactions”
7. Rotations are created by off-center forces
8. Pulling limbs closer to axis of rotation = greater speed of rotation. Important in recovery and striking movements; Moving limbs away from axis = slower speed of rotation

Biomechanics

1. List these athletes in order of most stability to least stability



A B C D E

1. Consider two athletes are equal in strength: One athlete will throw a baseball from home plate while on the knees. The other will do the same from a standing position.

Which athlete will be able to throw the ball farther? Why?

1. Why is coordination in a throwing motion important?
2. Force = Mass x Acceleration F = MA

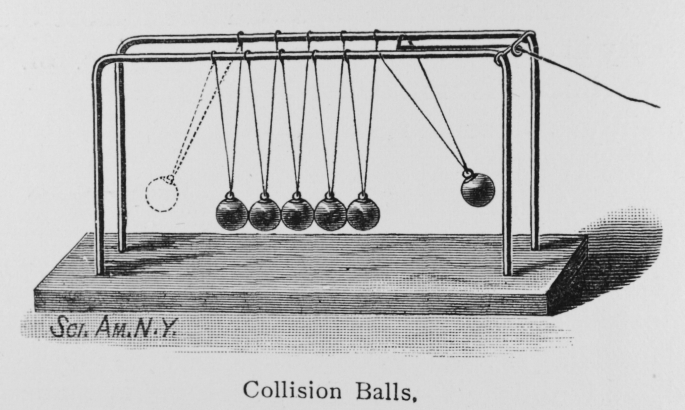
Acceleration = Force / Mass A = F/M

Or a = (final velocity-initial velocity) / (elapsed time)

Velocity = Distance / Time V = D/T

1. 

Why do baseball coaches use a fungo bat for fielding practice?

1. 

Which of the three Laws of Motion is represented by Newton’s Cradle?

2. Which athlete will spin faster? Why?

