

A study that uses principals of physics to quantitatively study how forces interact within a living body.

Biomechanics

Positioned above a point of reference.

Superior

Positioned below a point of reference.

Inferior

Positioned farthest from the center of the body.

Distal

On the front of the body.

Anterior (or Ventral)

On the back of the body.

Posterior (or dorsal)

Positioned near the middle of the body.

Medial

Refers to a position relatively farther away from the midline of the body or towards the outside of the body.

Lateral

Positioned on the opposite side of the body.

Contralateral

Positioned on the same side of the body

Ipsilateral

An imaginary bisector that devides the body into left and right halves.

Sagittal Plane

The bending of a joint, causing the angle to the joint to decrease.

Flexion

The Straightening of a joint, causing the angle to the joint to increase.

Extension

An imaginary bisector that devides the body into front and back halves.

Frontal Plane



Movement of a body part away from the middle of the body.

Abduction



Movement of a body part towards the middle of the body.

Adduction



An imaginary bisector that divides the body into top and bottom halves.

Transverse Plane



Rotation of a joint toward the middle of the body.

Internal Rotation



Rotation of a joint away from the middle of the body.

External Rotation



Terms that describe location on the body.

Anatomic Locations



Examples of Sagittal Plane movements

Bicep curls, triceps pushdowns, squats, front lunges, calf raises, walking, running, vertical jump, climbing stairs, shooting a basketball.



Examples of Frontal Plane Movements

side lateral raises, side lunges and side shuffling.



Examples of Transverse Plane Movements

Trunk rotation, turning lunges, throwing a ball, throwing a Frisbee, golfing and swinging a bat.



The range of action that is known as the "muscle action spectrum"

Eccentric, Isometric and Concentric muscle action.



Eccentric Muscle Action

The lengthening of the muscle to a resting length.



Isometric Muscle Action

No visible movement with or against resistance. Dynamically stabilizes force.



Concentric Muscle Action

Moving in the opposite direction of force. Accelerates or produces force.



An influence applied by one object to another, which results in an acceleration or deceleration of the second object.

Force



The two characterizations of force.

Magnitude and Direction



Length-Tension Relationship

The length at which a muscle can produce the greatest force.



The ability of muscles to produce force with increasing velocity

Force-Velocity Curve



Muscle groups moving together (synergistically) to produce movement around a joint.

Force-Couple Relationships



Movement of the bones around the joints

Rotary Movement



A force that produces rotation

Torque



The manner in which the nervous, skeletal, and muscular system interact to produce a mechanical response to incoming sensory information.

Motor Behavior



Groups of muscles that are recruited by the central nervous system to provide movement.

Muscles Synergies



Information that the nervous system utilizes to gather information about the environment to produce movement.

Proprioception



The cooperation of the nervous and muscular system in gathering information, interpreting, and executing movement.

Sensorimotor Integration



Repeated practice of motor control processes, which lead to a change in the ability to produce complex movements.

Motor Learning



The use of sensory information and sensorimotor integration to help the kinetic chain in motor learning

Feedback



The process where by sensory information is used by the body to reactively monitor movement and the environment.

Internal Feedback



Information provided by some external source, such as a health and fitness professional, videotape, mirror, or heart rate monitor to supplement the internal environment.

External Feedback



Concentrically accelerates dorsiflexion and inversion

Anterior Tibialis



-Eccentrically decelerates plantarflexion and eversion.

-Isometrically stabilizes the arch of the foot.

Anterior Tibialis



-Concentrically accelerates plantarflexion and inversion of the foot.

-Eccentrically decelerates the dorsiflexion and eversion of the foot.

-Isometrically stabilizes the arch of the foot.

Posterior Tibialis



-Concentrically accelerates plantarflexion.

-Decelerates ankle dorsiflexion.

-Isometrically stabilizes the foot and ankle complex

Soleus



-Concentrically accelerates plantarflexion.

-Decelerates ankle dorsiflexion

-Isometrically stabilizes the foot and ankle complex

Gastrocnemius

anterior tibialis

dorsiflexion inversion



posterior tibialis

plantarflexion inversion



soleus

plantarflexion



gastroc

plantarflexion



peroneus longus

plantarflexion eversion



biceps femoris long head

knee flexion hip extension tibial external rotation



biceps femoris short head

knee flexion tibial external rotation



semimembranosus, semitendinosus

knee flexion, hip extension, tibial internal rotation



vastus

knee extension



rectus femoris

knee extension, hip flexion



adductor longus, magnus(anterior fibers), brevis

hip adduction, flexion, internal rotation



adductor magnus posterior fibers

hip adduction, extension, external rotation



gracilis

hip adduction, flexion, internal rotation
(tibial internal rotation)



pectineus

hip adduction, flexion, internal rotation



gluteus medius anterior fibers

hip abduction, internal rotation



gluteus medius posterior fibers

hip abduction and external rotation



gluteus minimus

hip abduction and internal rotation



tfl

hip flexion, abduction and internal rotation

gluteus maximum

hip extension and external rotation

psoas

hip flexion, external rotation; spine extension, rotation (lumbar)

sartorius

hip flexion, external rotation, abduction; knee flexion internal rotation

piriformis

hip external rotation, abduction and extension

obturator internus

hip external rotation, abduction

obturator externus

external rotation

gemellus

hip external rotation

quadratus femoris

hip external rotation

rectus abdominis

spinal flexion, lateral flexion, rotation

external oblique

spinal flexion, lateral flexion, contralateral rotation

internal oblique

spinal flexion (bilateral)

lateral flexion, ipsilateral rotation

transversus abdominis

increases intraabdominal pressure, supports abdominal viscera

diaphragm

pulls central tendon inferiorly, increasing volume in thoracic cavity



erector spinae
spinal extension, rotation, lateral flexion



quadratus lumborum
lateral flexion of spine



semispinalis
spinal flexion, lateral flexion; extension and contralateral rotation of the head, primarily proprioception and stabilization



rotatores
spinal extension and contralateral rotation



multifidus
spinal extension and contralateral rotation



intertransversarii
spinal lateral flexion



interspinalis
intersegmental spinal extension



latissimus dorsi
shoulder extension, adduction, internal rotation; bilaterally spinal extension



serratus anterior
scapular protraction



rhomboids
scapular retraction, downward rotation



lower trapezius
scapular depression



middle trapezius
scapular retraction



upper trapezius
cervicle extension, lateral flexion, rotation



levator scapulae

cervical extension, lateral flexion and ipsilateral rotation when scapulae is anchored;
assists in elevation and downward rotation of scapulae



pec major clavicular fibers
shoulder flexion



pec major transverse plane
adduction shoulder



pec major
internal rotation shoulder



pec minor
protraction of scapula



deltoid anterior
shoulder flexion, internal rotation



deltoid middle
shoulder abduction



posterior deltoid
shoulder extension, external rotation



t minor
shoulder external rotation



infraspinatus
shoulder external rotation



subscapularis
shoulder internal rotation



supraspinatus
abduction of arm



teres major
shoulder internal rotation, adduction, extension



scm
cervical flexion, rotation, lateral flexion



scales anterior fibers, posterior fibers
cervical flexion, rotation, lateral flexion; assists rib elevation during inhalation



scalenes middle fibers
cervical flexion, rotation, lateral flexion



longus colli
cervical flexion, lateral flexion, ips rotation



longus capitus
cervical flexion , lateral flexion



length tension relationship
length at which muscle can produce greatest force



force velocity curve
ability of muscles to produce force with increasing velocity



as velocity of a concentric muscle contraction increases its ability to produce force decreases



force couple
synergistic action of muscles to produce movement around a joint



trunk rotation
internal and external obliques



upward rotation of scapula
upper trapezius and lower serratus anterior



hip and knee extension during walking, running, stairs etc
gluteus max, quads, calf



plantarflexion foot
gastroc, posterior tibialis, peroneus longus



shoulder abduction
deltoid, rotator cuff



muscle synergies
groups of muscles that are recruited by the CNS to produce movement. simplifies movement by allowing mm and joints to operate as a functional unit

lat pulldown

lats, rotator cuff, bicep

squat

quad, hams, glut max

shoulder press

deltoid, rotator cuff , trap

proprioception

cumulative neural input to cns from all mechanoreceptors that sense position and limb movements

The Process of movement



Human movement efficiency



Biomechanics:

a study that uses principles of physics to quantitatively study how forces interact within a living body.

- focuses on the motions that the kinetic chain produces and the forces that act on it.

Anatomic locations



Superior (cranial):

Positioned above a point of reference

ex:

femur is superior to the tibia

pectoralis major is superior to the rectus abdominis



Inferior (caudal):

positioned below a point of reference.

ex:

calcaneus is inferior to the talus

gastrocnemius is inferior to the hamstrings.



Proximal:

positioned nearest the center of the body, or point of reference.

ex:

knee is more proximal to the hip than the ankle

lumbar spine is more proximal to the sacrum than the sternum



distal:

positioned farthest from the center of the body; or point of reference.

ex:

the ankle is more distal to the hip than the knee

sternum is more distal to the sacrum than the lumbar spine



Anterior (ventral):

on the front of the body

ex:

the quadriceps are located on the anterior aspect of the thigh



posterior (dorsal):

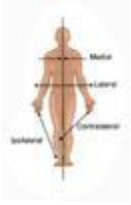
on the back of the body

ex:

the hamstrings are located on the posterior aspect of the thigh.



anatomic locations:



Medial:

positioned near the middle of the body

ex:

the sternum is more medial than the shoulder

lateral:

toward the outside of the body

ex:

the ears are on the lateral side of the head because they are farther away from the middle of the body

contralateral:

positioned on the opposite side of the body

ex:

the right foot is contralateral to the left hand

ipsilateral:

positioned on the same side of the body

ex:

the right foot is ipsilateral to the right hand.

Sagittal Plane



an imaginary bisector that divides the body into left and right halves.

In what axis does sagittal plane movement occur?

coronal axis

movements in the sagittal plane include?

flexion and extension



Flexion:



the bending of a joint, causing the angle to the joint to decrease.



Extension:



The straightening of a joint, causing the angle to the joint to increase.



when does flexion and extension occur?

in many joints in the body including:

- vertebral
- shoulder
- elbow
- wrist
- hip
- knee
- foot
- hand



Frontal Plane



an imaginary bisector that divides the body into front and back halves



what axis is frontal plane movement?

anterior-posterior axis



What are some movements in frontal plane?

In the limb

- abduction

- adduction

lateral flexion in the spine

at the foot/ankle complex:

- eversion

- inversion



Abduction:



movement of the body part away from the middle of the body.

- increase in the angle between two adjoining segments, but in the frontal plane.



Adduction:



movement of the body part toward the middle of the body.

- decrease in the angle between two adjoining segments, but in the frontal plane.



lateral flexion:



bending of the spine (cervical, thoracic, lumbar) from side to side or simply side-bending.



eversion



inversion:



Transverse plane:



an imaginary bisector that divides the body into top and bottom halves.



Axis of movement in transverse plane:
around a longitudinal / vertical axis



movement in the transverse plane include:

for the limbs:

- internal rotation
- external rotation

right/left rotation for the head & trunk

- radioulnar pronation

foot:

- abduction (toes pointing outward, external rotated)
- adduction (toes pointing inward, internally rotated)



hip internal rotation & shoulder internal rotation



spinal rotation



Pronation



example of planes, motions, and axes



What are the three different actions that muscles produce?

1. eccentric
2. Isometric
3. concentric



why do muscles produce a variety of actions?

to effectively manipulate:

- gravity
- ground reaction forces
- momentum
- external resistance.



Muscle contraction spectrum:

- eccentrically
- stabilization
- concentrically



Eccentric contraction:

- the lengthening of a muscle

- actin and myosin crossbridges are pulled apart & reattach allowing muscle to lengthen.

- exerting less force than is being placed on it.

- aka: a negative action because work is actually being done on the muscle (forces move the muscle rather than muscle doing the work)

(lengthening of the muscle usually refers to its return to a resting length and not actually increasing in its length as if it were being stretched)

ex:

resistance exercises, walking on treadmill, bench pressing.



Isometric contraction:

- a muscle maintaining a certain length.
- exerting force equal to that placed on it
- used to dynamically stabilize the body.

ex:

adductor and abductors of the thigh during squat will dynamically stabilize the leg from moving in the frontal and transverse planes.



Concentric contraction:

- the shortening of a muscle
- actin and myosin crossbridges move together
- exerting more force than is being placed on it.



muscle action spectrum table:

Mode	Performance
Isometric	Working in the same direction on the resistance
Concentric	The muscle shortens with an applied resistance
Eccentric	Working in opposite direction of force



lower leg complex

Complex	Performance
Lower Leg Complex	Supports the body of the lower leg and foot
Actions	Plantar flexion and dorsiflexion
Stabilization	Stabilizes the ankle and foot
Muscles	Gastrocnemius, soleus, peroneus, and others



Lower Leg Complex

Complex	Performance
Lower Leg Complex	Supports the body of the lower leg and foot
Actions	Plantar flexion and dorsiflexion
Stabilization	Stabilizes the ankle and foot
Muscles	Gastrocnemius, soleus, peroneus, and others





Lower Leg Complex

ORIGIN

- Posterior surface of the fibula (lateral) and posterior two-thirds of the shaft and head of the posterior part of the tibia

INSERTION

- Calcaneus via the Achilles tendon

MUSCLE ACTION

- Contractively elevates plantar flexion

FUNCTIONAL SIGNIFICANCE

- Contractively stabilizes the foot
- Contractively stabilizes the foot and pelvic complex



Lower Leg Complex

ORIGIN

- Lateral condyle of the femur, head, and proximal two-thirds of the medial surface of the tibia

INSERTION

- Lateral surface of the medial condyle and lateral side of the base of the first metatarsal

MUSCLE ACTION

- Contractively plantar flexion and rotate the foot

FUNCTIONAL SIGNIFICANCE

- Contractively stabilizes the foot and pelvic complex



Hamstring Complex

ORIGIN (Biceps Femoris - LONG HEAD)

ORIGIN

- Distal anterior of the pelvic part of the ischiofemoral ligament

INSERTION

- Head of the fibula

MUSCLE ACTION

- Contractively abducts knee flexion and hip extension
- Thigh external rotation

FUNCTIONAL SIGNIFICANCE

- Contractively flexion knee extension
- Contractively flexion hip flexion
- Contractively flexion and external rotation in mid stance of the gait cycle
- Contractively stabilizes the femorotibial complex and knee



Hamstring Complex

ORIGIN (SEMI TENDINOSUS - LONG HEAD)

ORIGIN

- Superior and distal of the posterior aspect of the ischium

INSERTION

- Head of the fibula

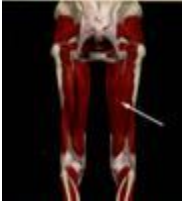
MUSCLE ACTION

- Contractively abducts knee flexion and hip extension

FUNCTIONAL SIGNIFICANCE

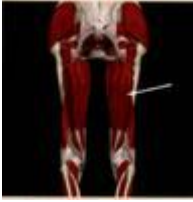
- Contractively flexion knee extension
- Contractively flexion and external rotation
- Contractively stabilizes the knee





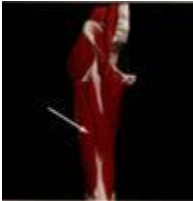
Hamstring Complex

origin
 - Medial tuberosity of the patella and part of the semitendinosus
 - Semitendinosus
insertion
 - Medial aspect of the medial malleolus of the tibia
innervation
 - Tibial nerve
actions
 - Contractively shortened knee flexion, hip extension, and lateral rotation
injury
 - Contractively shortens knee extension
 - Contractively shortens hip flexion
 - Contractively shortens plantar flexion
 - Contractively stabilizes the knee joint (leg, tibia, and foot)



Hamstring Complex

origin
 - Medial tuberosity of the patella
 - Semitendinosus
insertion
 - Medial aspect of the medial malleolus of the tibia
innervation
 - Tibial nerve
actions
 - Contractively shortened knee flexion, hip extension, and lateral rotation
injury
 - Contractively shortens knee extension
 - Contractively shortens hip flexion
 - Contractively shortens plantar flexion
 - Contractively stabilizes the knee joint (leg, tibia, and foot)



Quadriceps Complex

origin
 - Anterior and anterior border of the greater trochanter, lateral lip of the gluteal tuberosity, lateral lip of the iliac spine of the femur
insertion
 - Head of patella and distal tuberosity of the tibia
innervation
 - Femoral nerve
actions
 - Contractively shortened knee extension
injury
 - Contractively shortens knee flexion, abduction, and lateral rotation
 - Contractively stabilizes the knee



Quadriceps Complex

origin
 - Anterior and anterior border of the greater trochanter, lateral lip of the gluteal tuberosity, lateral lip of the iliac spine of the femur
insertion
 - Head of patella and distal tuberosity of the tibia
innervation
 - Femoral nerve
actions
 - Contractively shortened knee extension
injury
 - Contractively shortens knee flexion, abduction, and lateral rotation
 - Contractively stabilizes the knee





Quadriceps Complex

anterior view

origin

- Anterior surface of the upper two-thirds of the linea aspera

insertion

- Base of patella, tibial tuberosity of the tibia

innervation

- Femoral nerve

actions

- Contractively extends knee extension

synergistic muscles

- Rectus femoris, tensor fasciae latae, adductor, and lateral vastus

antagonistic muscles

- Biceps femoris



Quadriceps Complex

anterior view

origin

- Anterior surface of the upper two-thirds of the linea aspera

insertion

- Base of patella, tibial tuberosity of the tibia

innervation

- Femoral nerve

actions

- Contractively extends knee extension and hip flexion

synergistic muscles

- Rectus femoris, tensor fasciae latae, adductor, and lateral vastus

antagonistic muscles

- Biceps femoris

functional

- Contractively stabilizes the knee joint by straightening



Hip Musculature

anterior view

origin

- Anterior surface of the lesser pubic foramen of the pubis

insertion

- Proximal one-third of the lesser trochanter of the femur

innervation

- Femoral nerve

actions

- Contractively flexes hip adduction, flexion, and medial rotation

synergistic muscles

- Rectus femoris, tensor fasciae latae, adductor, and lateral vastus

antagonistic muscles

- Biceps femoris

functional

- Contractively stabilizes the knee joint by straightening



Hip Musculature

anterior view

origin

- Anterior surface of the lesser pubic foramen of the pubis

insertion

- Proximal one-third of the lesser trochanter of the femur

innervation

- Femoral nerve

actions

- Contractively flexes hip adduction, flexion, and medial rotation

synergistic muscles

- Rectus femoris, tensor fasciae latae, adductor, and lateral vastus

antagonistic muscles

- Biceps femoris

functional

- Contractively stabilizes the knee joint by straightening





Hip Musculature

gluteus maximus - posterior view

origin

- Anterior superior iliac spine

insertion

- Greater trochanter of femur

innervation

- Superior gluteal nerve
- 2. Lumbosacral plexus (L4-L5, S1-S2)

actions

- 2. Extends hip
- 2. Medially rotates hip

clinical notes

- 2. Weakness leads to hip abduction, flexion, and medial rotation
- 2. Weakness leads to Trendelenburg gait



Hip Musculature

gluteus medius

origin

- Anterior superior iliac spine of the pelvis

insertion

- Greater trochanter of the femur

innervation

- Superior gluteal nerve
- 2. Lumbosacral plexus (L4-L5, S1-S2)

actions

- 2. Medially rotates hip
- 2. Medially rotates hip

clinical notes

- 2. Weakness leads to hip abduction, flexion, and medial rotation
- 2. Weakness leads to Trendelenburg gait



Hip Musculature

gluteus minimus

origin

- Anterior superior iliac spine of the pelvis

insertion

- Greater trochanter of the femur

innervation

- Superior gluteal nerve
- 2. Lumbosacral plexus (L4-L5, S1-S2)

actions

- 2. Medially rotates hip
- 2. Medially rotates hip

clinical notes

- 2. Weakness leads to hip abduction, flexion, and medial rotation
- 2. Weakness leads to Trendelenburg gait



Hip Musculature

gluteus medius

origin

- Anterior superior iliac spine of the pelvis

insertion

- Greater trochanter of the femur

innervation

- Superior gluteal nerve
- 2. Lumbosacral plexus (L4-L5, S1-S2)

actions

- 2. Medially rotates hip
- 2. Medially rotates hip

clinical notes

- 2. Weakness leads to hip abduction, flexion, and medial rotation
- 2. Weakness leads to Trendelenburg gait





Hip Musculature

GLUTEUS MEDIUS - ANTERIOR VIEW

ORIGIN

- Greater trochanter of the femur of the same side

INSERTION

- Anterior surface of the greater trochanter of the lesser trochanter of the femur

MUSCLE ACTION

- Laterally rotate hip at flexion and neutral extension
- Medially rotate hip at flexion and neutral extension
- Stabilize pelvis



Hip Musculature

GLUTEUS MEDIUS - MEDIAL VIEW

ORIGIN

- Greater trochanter of the femur of the same side

INSERTION

- Anterior surface of the greater trochanter of the lesser trochanter of the femur

MUSCLE ACTION

- Laterally rotate hip at flexion and neutral extension
- Medially rotate hip at flexion and neutral extension
- Stabilize pelvis



Hip Musculature

GLUTEUS MINIMUS

ORIGIN

- Lesser trochanter of the femur of the same side

INSERTION

- Anterior surface of the greater trochanter of the lesser trochanter of the femur

MUSCLE ACTION

- Laterally rotate hip at flexion and neutral extension
- Medially rotate hip at flexion and neutral extension
- Stabilize pelvis



Hip Musculature

GLUTEUS MAXIMUS

ORIGIN

- Greater trochanter of the femur of the same side

INSERTION

- Anterior surface of the greater trochanter of the lesser trochanter of the femur

MUSCLE ACTION

- Laterally rotate hip at flexion and neutral extension
- Medially rotate hip at flexion and neutral extension
- Stabilize pelvis





Hip Musculature

ORIGIN
 Anterior iliac spine, anterior side of crest and lesser and part of the crest of the ilium, lesser trochanter, lesser tuberosity of the femur and ischial spine

INSERTION
 Greater trochanter of the femur

MUSCLE ACTION
 Laterally abducts the hip, extends and internally rotates

INNERVATION BY NERVE
 Superiorly, gluteus nerve (L4, L5) and inferiorly, sciatic nerve (L4, L5)

FUNCTIONAL ANALYSIS
 Laterally abducts the hip, extends and internally rotates



Hip Musculature

ORIGIN
 Superior anterior and lateral iliac crest of the hip, lesser and greater trochanters including lesser trochanter

INSERTION
 Greater trochanter of the femur

MUSCLE ACTION
 Laterally abducts the hip, extends and internally rotates

INNERVATION BY NERVE
 Superiorly, gluteus nerve (L4, L5) and inferiorly, sciatic nerve (L4, L5)

FUNCTIONAL ANALYSIS
 Laterally abducts the hip, extends and internally rotates



Hip Musculature

ORIGIN
 Anterior iliac spine of the pelvis

INSERTION
 Greater trochanter of the femur

MUSCLE ACTION
 Laterally abducts the hip, extends and internally rotates

INNERVATION BY NERVE
 Superiorly, gluteus nerve (L4, L5) and inferiorly, sciatic nerve (L4, L5)

FUNCTIONAL ANALYSIS
 Laterally abducts the hip, extends and internally rotates



Hip Musculature

ORIGIN
 Anterior iliac spine

INSERTION
 Greater trochanter of the femur

MUSCLE ACTION
 Laterally abducts the hip, extends and internally rotates

INNERVATION BY NERVE
 Superiorly, gluteus nerve (L4, L5) and inferiorly, sciatic nerve (L4, L5)

FUNCTIONAL ANALYSIS
 Laterally abducts the hip, extends and internally rotates





Abdominal Musculature

External oblique

Location

- Flank, antero-lateral of the spine

Origin

- T10-L1
- Iliac crest of the ilium

Insertion

- Anteriorly: anterior superior iliac spine, lateral femoral epicondyle, and costal cartilage of the 10th rib
- Posteriorly: iliopectineal space, anterior femoral epicondyle, and ilium
- Inferiorly: anterior ilio-inguinal lig complex



Abdominal Musculature

Internal oblique

Location

- Medial aspect of the 4-12

Origin

- Anterior ilio-crest of the ilium, lumbar 4th and costal cartilage of the 10th rib

Insertion

- Anteriorly: anterior superior iliac spine, lateral femoral epicondyle, and costal cartilage of the 10th rib
- Posteriorly: iliopectineal space, anterior femoral epicondyle, and ilium
- Inferiorly: anterior ilio-inguinal lig complex



Abdominal Musculature

Transversus abdominis

Location

- Anterior two-thirds of the 10th level of the pelvis and throughout the torso

Origin

- T10-L1, ilio-crest, and anterior superior iliac spine

Insertion

- Anteriorly: anterior superior iliac spine, lateral femoral epicondyle, and costal cartilage of the 10th rib
- Posteriorly: iliopectineal space, anterior femoral epicondyle, and ilium
- Inferiorly: anterior ilio-inguinal lig complex



Abdominal Musculature

Rectus abdominis

Location

- T10-L1, anterior two-thirds of the 10th level of the pelvis, and throughout the torso

Origin

- Anterior ilio-crest and anterior superior iliac spine

Insertion

- Anteriorly: anterior superior iliac spine, lateral femoral epicondyle, and costal cartilage of the 10th rib
- Posteriorly: iliopectineal space, anterior femoral epicondyle, and ilium
- Inferiorly: anterior ilio-inguinal lig complex





Abdominal Musculature

ORIGIN

- T12-L1 anterior superior iliac spine (ASIS) and thoracolumbar fascia

INSERTION

- Xiphoid process and sternum

FUNCTIONS

- Compresses abdominal contents
- Supports the abdominal viscera

INNERVATION

- T12-L1 anterior rami of spinal nerves



Abdominal Musculature

ORIGIN

- T12-L1 anterior superior iliac spine (ASIS) and thoracolumbar fascia

INSERTION

- Xiphoid process and sternum

FUNCTIONS

- Compresses abdominal contents
- Supports the abdominal viscera

INNERVATION

- T12-L1 anterior rami of spinal nerves



Back Musculature

ORIGIN

- T12-L1 anterior superior iliac spine (ASIS) and thoracolumbar fascia

INSERTION

- Xiphoid process and sternum

FUNCTIONS

- Compresses abdominal contents
- Supports the abdominal viscera

INNERVATION

- T12-L1 anterior rami of spinal nerves



Back Musculature

ORIGIN

- T12-L1 anterior superior iliac spine (ASIS) and thoracolumbar fascia

INSERTION

- Xiphoid process and sternum

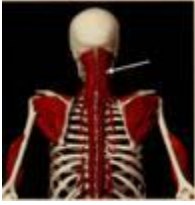
FUNCTIONS

- Compresses abdominal contents
- Supports the abdominal viscera

INNERVATION

- T12-L1 anterior rami of spinal nerves





Transversospinalis complex

TRANSVERSOSPINALIS COMPLEX

ORIGIN

- Cervicis: Transversus processus T1-L1
- Cervicis: Transversus processus Th1-12
- Capitis: Transversus processus C1-C7
- Cervicis: Processus T1-L1

INSERTIO

- Cervicis: Spinatus processus C1-C6
- Cervicis: Spinatus processus Th1-12
- Capitis: Nuchal line (if original basis of the skull)

MUSCULUS ET FUNCTIO

- Concomitantly profundus spinalis, aditus and lateral flexus
- Concomitantly profundus dorsalis and transversalis dorsalis of the hand

MUSCULUS ET FUNCTIO

- Concomitantly decussatus lateral flexus of the spine
- Concomitantly decussatus dorsalis and transversalis dorsalis of the hand
- Concomitantly sustinetur the spine



Transversospinalis complex

TRANSVERSOSPINALIS COMPLEX

ORIGIN

- Cervicis: Processus of the vertebrae
- Processus of the vertebrae dorsalis and cervical spine

INSERTIO

- Spinatus processus in line superior above the origin

MUSCULUS ET FUNCTIO

- Concomitantly profundus spinalis dorsalis and transversalis dorsalis

MUSCULUS ET FUNCTIO

- Concomitantly decussatus spinalis dorsalis and transversalis dorsalis
- Concomitantly sustinetur the spine



Shoulder Musculature

SCAPULOHUMERAL MUSCLES

ORIGIN

- Scapula: Processus coracoideus
- Coracoclavicular ligament
- Clavicula: Processus coracoideus
- Clavicula: Processus coracoideus

INSERTIO

- Humerus: Caput of the humerus
- Humerus: Caput of the humerus

MUSCULUS ET FUNCTIO

- Concomitantly profundus dorsalis dorsalis, aditus and lateral flexus

MUSCULUS ET FUNCTIO

- Concomitantly decussatus dorsalis dorsalis, aditus, and transversalis dorsalis
- Concomitantly sustinetur the humerus by complex and constant



Shoulder Musculature

SCAPULOHUMERAL MUSCLES

ORIGIN

- Clavicula: Processus coracoideus
- Clavicula: Processus coracoideus

INSERTIO

- Humerus: Caput of the humerus

MUSCULUS ET FUNCTIO

- Concomitantly profundus dorsalis dorsalis, aditus and lateral flexus

MUSCULUS ET FUNCTIO

- Concomitantly decussatus dorsalis dorsalis, aditus, and transversalis dorsalis
- Concomitantly sustinetur the humerus by complex and constant



Shoulder Musculature



Shoulder Musculature

UPPER TRAPEZIUS

ORIGIN

- Spinous processes C7-D1

INSERTION

- Lateral border of the scapula

ISOLATED FUNCTION

- Concentrically produces scapular rotation and elevation

INTEGRATED FUNCTION

- Eccentrically decelerates scapular protraction and upward rotation
- Isometrically stabilizes the scapula



Shoulder Musculature

MIDDLE TRAPEZIUS

ORIGIN

- Spinous processes T6-T12

INSERTION

- Spine of the scapula

ISOLATED FUNCTION

- Concentrically accelerates scapular depression

INTEGRATED FUNCTION

- Eccentrically decelerates scapular elevation
- Isometrically stabilizes the scapula



Shoulder Musculature

LOWER TRAPEZIUS

ORIGIN

- Spinous processes T1-T5

INSERTION

- Acromion process of the scapula
- Superior aspect of the spine of the scapula

ISOLATED FUNCTION

- Concentrically accelerates scapular rotation

INTEGRATED FUNCTION

- Eccentrically decelerates scapular elevation
- Isometrically stabilizes the scapula



Shoulder Musculature

LEVATOR SCAPULAE

ORIGIN

- Cervical vertebrae (transverse) on the skull
- Spinous process of C7

INSERTION

- Lateral border of the scapula
- Superior process of the scapula

ISOLATED FUNCTION

- Concentrically elevates medial clavicle, medial border, and vertebra
- Concentrically accelerates scapular elevation

INTEGRATED FUNCTION

- Eccentrically decelerates medial border, medial border, and rotation
- Eccentrically decelerates scapular depression
- Isometrically stabilizes the cervical spine and scapula





Shoulder Musculature

TRAPEZIUS

ORIGIN

- Theroid process of C1-C4

INSERTION

- Superior nuchal line of the occipital

ISOLATED FUNCTION

- Concentrically decelerates cervical extension, lateral flexion, and rotational rotation when the scapula is motionless
- Passive in elevation and downward rotation of the scapula

INTEGRATED FUNCTION

- Eccentrically decelerates cervical flexion and mediolateral rotation and lateral flexion
- Eccentrically decelerates scapular depression and upward rotation when the neck is motionless
- Stabilizes the cervical spine and posture



Shoulder Musculature

PECTORALIS MAJOR

ORIGIN

- Clavicular: anterior surface of the clavicle
- Sternal: anterior surface of the sternum, cartilage of ribs 1-6

INSERTION

- Greater tuberosity of the humerus

ISOLATED FUNCTION

- Concentrically accelerates shoulder flexion, shoulder extension, horizontal adduction, and lateral rotation

INTEGRATED FUNCTION

- Eccentrically decelerates shoulder extension, horizontal adduction, and lateral rotation
- Eccentrically stabilizes the shoulder girdle



Shoulder Musculature

PECTORALIS MINOR

ORIGIN

- Ribs 3-5

INSERTION

- Coracoid process of the scapula

ISOLATED FUNCTION

- Concentrically protects the axilla

INTEGRATED FUNCTION

- Eccentrically decelerates scapular retraction
- Isometrically stabilizes the shoulder girdle



Shoulder Musculature

LEVATOR SCAPULAE

ORIGIN

- Transverse process of the cervical vertebrae

INSERTION

- Superior angle of the scapula

ISOLATED FUNCTION

- Concentrically accelerates shoulder flexion and medial rotation

INTEGRATED FUNCTION

- Eccentrically decelerates shoulder flexion and medial rotation
- Eccentrically decelerates scapular depression and upward rotation when the neck is motionless
- Eccentrically decelerates scapular depression and upward rotation when the neck is motionless
- Stabilizes the cervical spine and posture





Shoulder Musculature

ORIGIN

- Short head: Lateral border of the acromion
- Long head: Fibrous sheath around coracoclavicular ligament

INSERTION

- Lateral tuberosity of the humerus

MAINLYNED FUNCTION

- Contraction: abduction of the humerus, extension of the scapulothoracic joint, and elevation of the humerus

ANTAGONIST MUSCLES

- Horizontally: latissimus dorsi, pectoralis major of the anterior chest, and anterior deltoid
- Vertically: posterior deltoid, latissimus dorsi



Shoulder Musculature

ORIGIN

- Long head: Anterior border of the acromion
- Short head: Pectoralis major
- Short head: Pectoralis major

INSERTION

- Lateral tuberosity of the humerus

MAINLYNED FUNCTION

- Contraction: abduction of the humerus and elevation of the humerus

ANTAGONIST MUSCLES

- Horizontally: latissimus dorsi, pectoralis major of the anterior chest, and anterior deltoid
- Vertically: posterior deltoid, latissimus dorsi



Rotator Cuff

ORIGIN

- Lateral border of the acromion

INSERTION

- Greater tuberosity of the humerus

MAINLYNED FUNCTION

- Contraction: abduction of the humerus, extension of the scapulothoracic joint, and elevation of the humerus

ANTAGONIST MUSCLES

- Horizontally: latissimus dorsi, pectoralis major of the anterior chest, and anterior deltoid
- Vertically: posterior deltoid, latissimus dorsi



Rotator Cuff

ORIGIN

- Anterior border of the acromion

INSERTION

- Greater tuberosity of the humerus

MAINLYNED FUNCTION

- Contraction: abduction of the humerus, extension of the scapulothoracic joint, and elevation of the humerus

ANTAGONIST MUSCLES

- Horizontally: latissimus dorsi, pectoralis major of the anterior chest, and anterior deltoid
- Vertically: posterior deltoid, latissimus dorsi





Rotator Cuff

ORIGIN
 Superior ends of the muscles

INSERTION
 Lesser tuberosity of the humerus

MUSCLES INVOLVED
 Concentrically adducts shoulder internal rotation
 concentrically extends
 concentrically adducts shoulder external rotation
 concentrically adducts the shoulder girdle



Rotator Cuff

ORIGIN
 Superior ends of the muscles

INSERTION
 Greater head of the greater tuberosity of the humerus

MUSCLES INVOLVED
 Concentrically adducts shoulder of the arm

FUNCTIONS OF MUSCLES
 concentrically adducts shoulder of the arm
 concentrically adducts the shoulder girdle



Rotator Cuff

ORIGIN
 Superior ends of the muscles

INSERTION
 Lesser tuberosity of the humerus

MUSCLES INVOLVED
 concentrically adducts shoulder internal rotation, adducts
 arm, and extension

FUNCTIONS OF MUSCLES
 concentrically adducts shoulder external rotation,
 adduction, and flexion
 concentrically adducts the shoulder girdle



Neck Musculature

ORIGIN
 Cervical level: Top of hyoidbone of the larynx
 Cervical level: Middle ear level of the thyroid

INSERTION
 Hyoid bone, larynx, epiglottis, thyroid gland, base of the tongue of the
 pharynx

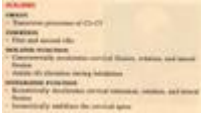
MUSCLES INVOLVED
 Concentrically adducts cervical flexion, rotation, and lateral
 flexion

FUNCTIONS OF MUSCLES
 concentrically adducts cervical extension, rotation, and lateral
 flexion
 concentrically adducts the cervical spine and larynx/pharynx
 area

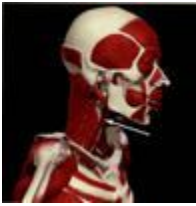




Neck Musculature



Neck Musculature



Neck Musculature



several muscles work synergistically to?

- produce force
- stabilize the body
- reduce force



Force:

an influence applied by one object to another which results in an acceleration or deceleration of the second object



forces are characterized by:

- magnitude (how much)
- direction (which way they are moving)



Length-tension relationship:

the length at which a muscle can produce the greatest force.



Force-Velocity curve



refers to the ability of muscles to produce force with increasing velocity



Force-Couple



muscle groups moving together to produce movement around a joint.

- because muscles are recruited as groups, many muscles will transmit force onto their respective bones, creating movement at the joints.



common force-couples

Muscle	Stabilization
Latissimus dorsi	Stabilizes the shoulder joint
Trapezius	Stabilizes the scapula
Rotator cuff	Stabilizes the shoulder joint
Posterior deltoid	Stabilizes the shoulder joint
Anterior deltoid	Stabilizes the shoulder joint
Coracoclavicular ligament	Stabilizes the acromioclavicular joint
Acromioclavicular ligament	Stabilizes the acromioclavicular joint
Coracoacromial ligament	Stabilizes the acromioclavicular joint
Coracohumeral ligament	Stabilizes the acromioclavicular joint
Transverse ligament of the scapula	Stabilizes the scapula
Transverse ligament of the knee	Stabilizes the knee joint



Rotary motion:

movement of the bones around the joints.



In resistance training:

bones provide the means by which we can attach forces (torque) to our joints.



Torque



a force that produces rotation



What's the easiest way to alter the amount of torque generated at a joint?

move the resistance

the closer the weight is to the joint, the less torque it creates.

the farther away the weight is from the joint, the more torque it creates.

what are the three ways muscles move:

- eccentrically (to decelerate force)

- isometrically (to stabilize)

- concentrically (to accelerate force)

motor behavior:

the process of the body responding to internal and external stimuli

motor control:

the study of posture and movements and the involved structures and mechanisms that the central nervous system used to assimilate and integrate sensory info. with previous experience

looks at the involved structures and mechanisms that the nervous system used to gather all sensory info. and integrates it all with previous experiences to produce a motor response.

synergies:

groups of muscles that are recruited by the central nervous system to provide movement

Proprioceptive:

the cumulative sensory input to the central nervous system from all mechanoreceptors that sense position and limb movements.

why is proprioception a vital source of info?

because the nervous system uses it to gather info. about the environment to produce the most efficient movement.

many of today's health club members may have altered proprioception as a result of past injuries. What does this provide?

a rationale for core and balance training to enhance one's proprioceptive capabilities, increasing postural control and decreasing tissue overload.

sensorimotor intergration:

the cooperation of the nervous and muscular system in gathering info. interpreting and executing movement.

what happens when individuals train with improper form?

improper sensory info. will be delivered to the central nervous system, leading to movement compensations and potential injury.

motor learning:

repeated practice of motor control processes, which lead to a change in the ability to produce complex movements.

looks at how movements are learned and retained for future use.

proper practice and experience will lead to a permanent change in one's ability to perform the movement efficiently

feedback:

the use of sensory info. and sensorimotor integration to help the kinetic chain in motor learning.

what are the two forms of feedback?

- internal (sensory)

- external (augmented)

internal feedback:

the process whereby sensory info. is used by the body to reactively monitor movement and the environment

- acts as a guide, steering the kinetic chain to the proper force, speed, and amplitude of movement patterns.

why is it important to have proper form when exercising?

to ensure that the incoming sensory feedback is correct info., allowing for optimal sensorimotor integration and ideal structural and functional efficiency.

external feedback:

info. provided by some external source, such as a health and fitness pro. , video tape, mirror, or heart rate monitor to supplement the internal environment.

provides the client with another source of info. that allows him/her to associate whether the achieved movement patterns was "good" or "bad" with what he or she is feeling internally.

what are two major forms of external feedback?

- knowledge of results

- knowledge of performance.

knowledge of performance provides:

info. about the quality of the movement during an exercise



knowledge of results are used:

after the completion of a movement to help inform the client about the outcome of their performance.

should come from a health/fitness pro.



abduction and adduction occur in which plane of motion?

frontal plane



lowering a barbell down toward the chest during a bench press is an example of what kind of muscle contraction?

eccentric



a heart rate monitor is an example of what kind of feedback?

external feedback



sensorimotor integration requires proprioception? true or false?

true

Biomechanics

The study that used principles of physics to quantitatively study how forces interact within a living body



contralateral

positioned on the opposite side of the body



ipsilateral

positioned on the same side of the body



Dorsiflexion

toe pointing up



plantarflexion

toe pointing down



inversion

bottom of foot pointing inwards, frontal plane



Eversion

bottom of foot pointing outwards, frontal plane



Force

An influence applied by one object to another which result in acceleration or deceleration of the second object



Length tension relationship

The length at which muscle can produce the greatest force



Force couple

muscle groups moving together to produce movement around a joint



rotary motion

movement of the bones around the joint



torque

A force that produces rotation



motor behavior

The process of the body responding to internal and external stimuli



motor control

the study of posture and movements and the involved structure and mechanisms that the central nervous system uses to assimilate and integrate sensory information with previous experience.



proprioception

the cumulative sensory input to the central nervous system from all mechanoreceptors that sense position and limb movements



sensorimotor integration

the cooperation of the nervous system and muscular system in gathering information, interpreting, and executing movement



motor learning

repeated practice of motor control processes which lead to a change in the ability to produce complex movements



feedback

the use of sensory information and sensory motor integration to help the kinetic chain in motor learning



internal feedback

the process whereby sensory information is used by the body to reactively monitor movement and the environment



Anterior Tibialis

Concentric: dorsiflexion, inversion

Eccentric: plantar flexion, eversion

Isometric: arch of foot

Refers to the length at which a muscle can produce the greatest force
Length-tension relationship



Muscle action where there is no appreciable change in muscle length

Isometric



Information that the nervous system utilizes to gather information about the environment to produce movement

Proprioception



Synergistic action of muscles to product movement around a joint

Force-couple



When a muscle exerts more force than is being placed on it, which leads to the shortening of the muscle

Concentric



Ability of nervous system to gather and interpret information and select and execute the proper motor response

Sensorimotor integration



The study of how the kinetic chain creates movements

Motor control



When a muscle exerts less force than is being placed upon it, which results in the lengthening of a muscle

Eccentric



Provides information about the quality of a movement during an exercise

Knowledge of performance



The study of how internal and external forces affect the way the body moves

Biomechanics

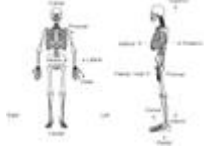
Study that uses principles of physics to quantitatively study how forces interact within a living body is called ...

BIOMECHANICS

p. 58 (NASM)



If the pectoralis major is "superior" to the rectus abdominis, it is ...



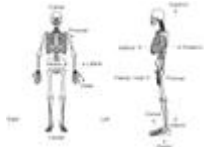
POSITIONED ABOVE IT

(Superior = positioned ABOVE a reference point)

p. 59 (NASM)



If the gastrocnemius is "inferior" to the hamstrings, it is ...



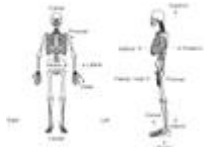
POSITIONED BELOW IT

(Inferior = positioned BELOW a reference point)

p. 59 (NASM)



If the knee is more "proximal" to the hip than the ankle, it is ...



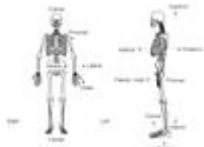
NEARER TO THE CENTER OF THE BODY (OR POINT OF REFERENCE)

(in this case, the hip is the point of reference)

p. 59 (NASM)



If the ankle is more "distal" to the hip than the knee, it is ...



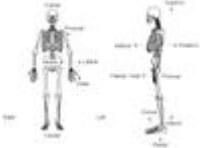
FARTHER FROM THE CENTER OF THE BODY (OR POINT OF REFERENCE)

(in this case, the hip is the point of reference)

p. 59 (NASM)



If the quadriceps are located on the "anterior" aspect of the thigh, they are ...



ON THE FRONT

(or toward the front of the body)

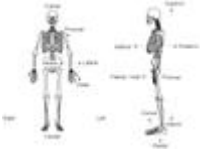
Anterior

Also referred to as "ventral"

p. 59 (NASM)



If the hamstrings are located on the "posterior" aspect of the thigh, they are ...



ON THE BACK

(or toward the back of the body)

Posterior

Also referred to as "dorsal"

p. 59 (NASM)



If the adductors are on the "medial" side of the thigh, they are ...

ON THE SIDE CLOSEST TO THE MIDLINE OF THE BODY

p. 59 (NASM)



If the arms are on the "lateral" side of the torso, they are ...

FARTHEST AWAY FROM THE MIDLINE OF THE BODY

p. 59 (NASM)



"Contralateral" means to be...

ON THE OPPOSITE SIDE OF THE BODY

Think of opposing views in a controversy.

p. 59 (NASM)



"Ipsilateral" means to be ...

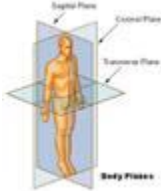
ON THE SAME SIDE OF THE BODY

p. 59 (NASM)





Which plane bisects the body into right/left halves?



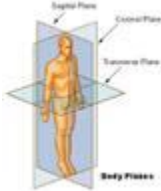
SAGITTAL PLANE

Allows both flexion and extension movements

p. 60 (NASM)



Which plane bisects the body into front/back halves?



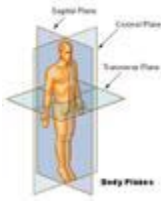
FRONTAL (or coronal) PLANE

Allows abduction/adduction (in the limbs relative to the trunk), lateral flexion (of the spine), and eversion/inversion (at the foot/ankle complex) movements

p. 61 (NASM)



Which plane bisects the body into upper/lower halves?



TRANSVERSE (or horizontal) PLANE

Allows both internal and external rotation (for the limbs), right/left rotation (for the head and trunk), and pronation/supination (for the radioulnar joint) movements

p. 61 (NASM)



Give 3 examples of movements in the sagittal plane.

- BICEP CURLS
- SQUATS
- TRICEPS PUSH-DOWNS
- FRONT LUNGES
- WALKING
- RUNNING

p. 61 (NASM)



Give 3 examples of movements in the frontal plane.

- SIDE LATERAL RAISES
- SIDE LUNGES
- SIDE SHUFFLING

p. 61 (NASM)



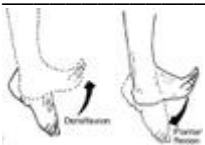
Give 3 examples of movements in the transverse plane.

- TRUNK ROTATION
- THROWING A BALL/FRISBEE
- GOLFING
- SWINGING A BAT

p. 61 (NASM)



At the ankle, flexion is referred to as _____ and extension is referred to as _____.



- DORSIFLEXION
- PLANTARFLEXION

pp. 60-61 (NASM)



Flexion is ...



A BENDING MOVEMENT IN WHICH THE RELATIVE ANGLE OF A JOINT DECREASES

p. 60 (NASM)



Extension is ...



A STRAIGHTENING MOVEMENT IN WHICH THE RELATIVE ANGLE OF THE JOINT INCREASES

p. 60 (NASM)



Abduction is ...



A MOVEMENT AWAY FROM THE MIDLINE OF THE BODY

(similar to extension - increase in the angle of a joint, but in the frontal plane)

p. 61 (NASM)



Adduction is ...



A MOVEMENT TOWARD THE MIDLINE OF THE BODY

(similar to flexion - decrease in the angle of a joint, but in the frontal plane)

p. 61 (NASM)



Internal rotation is ...

ROTATION OF A JOINT TOWARDS THE MIDDLE OF THE BODY

p. 61 (NASM)



External rotation is ...

ROTATION OF A JOINT AWAY FROM THE MIDDLE OF THE BODY

p. 61 (NASM)





This is an example of what type of movement?

EXTENSION

A straightening movement where the relative joint angle increases.

p. 63 (NASM)



This is an example of what type of movement?

FLEXION

A bending movement where the joint angle decreases.

p. 63 (NASM)



This is an example of what types of movements?

ABDUCTION/ADDUCTION

(of the shoulders)

Movement away/toward the midline.

pp. 64-65 (NASM)



This is an example of what type of movement?

EXTERNAL ROTATION

(of the trunk)

p. 61 (NASM)





This is an example of what type of movement?

EXTERNAL SHOULDER ROTATION

Rotating the joint **AWAY** from the middle of the body.

p. 67 (NASM)



This is an example of what type of movement?



SUPINATION

(the foot/ankle - another example)

Supination is a position of either the forearm or foot; in the forearm when the palm faces anteriorly, or faces up (when the arms are unbent and at the sides). Supination in the foot occurs when a person appears "bow-legged" with their weight supported primarily on the anterior of their feet.

(from <http://en.wikipedia.org/wiki/Supination>)

Supination is the opposite of pronation and refers to the outward roll of the foot during normal motion.

(from <http://www.thestretchinghandbook.com/archives/pronation-supination.php>)

Rolling movement outward of either the forearm or foot.

p. 67 (NASM)



What is pronation and what is its opposite?



1. Movement of the forearm so that the palm faces downwards. Pronation is the natural position of the forearm when a person is standing in a relaxed position.

INWARD ROLLING MOTION:

During running or walking, an inward rolling motion just after the heel strikes the ground and when the weight is shifted to the middle of the foot. It is a natural action which serves as a shock-absorbing and an energy-return mechanism.

OPPOSITE = SUPINATION

from <http://www.answers.com/topic/pronation>

pp. 66-67 (NASM)



What forces do muscles produce a variety of actions to manipulate?

- GRAVITY
- GROUND REACTION FORCES
- MOMENTUM
- EXTERNAL RESISTANCE

HINT: The muscle action spectrum is used to produce efficient movement.

pp. 62-63 (NASM)



What is the "muscle action spectrum" (what does it consist of) and what is its purpose?

A RANGE OF MUSCLE ACTIONS CONSISTING OF 3 TYPES OF MUSCLE ACTIONS:

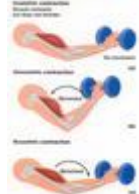
- ECCENTRIC CONTRACTION
- ISOMETRIC CONTRACTION
- CONCENTRIC CONTRACTION

PURPOSE: TO PRODUCE EFFICIENT MOVEMENT

pp. 62-63 (NASM)



When a muscle lengthens, it is contracting ...



ECCENTRICALLY

Actin and myosin crossbridges are pulled apart (sliding filament theory) and reattach and the muscle returns to its resting length.

pp. 63-64 (NASM)

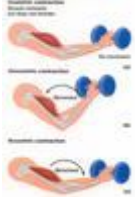


Eccentric contraction is also known as a "negative" because ...

WORK IS DONE ON THE MUSCLE vs. THE MUSCLE DOING THE WORK

pp. 64-65 (NASM)

Eccentric motion moves in the _____ (same/opposite) direction as the resistance is moving.



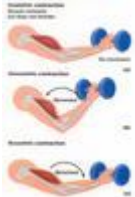
SAME DIRECTION

p. 65 (NASM)

Eccentric motion acts to _____ the forces acting on the body.
DECELERATE (or reduce)

p. 65 (NASM)

When a muscle shortens, it is contracting ...

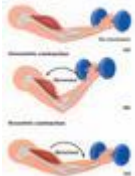


CONCENTRICALLY

Actin and myosin crossbridges move together (sliding filament theory), allowing the muscle to shorten.

p. 68 (NASM)

Concentric motion moves in the _____ (same/opposite) direction as the resistance is moving.



OPPOSITE DIRECTION

p. 68 (NASM)

Concentric motion acts to _____ the forces acting on the body.
ACCELERATE (or produce)

p. 68 (NASM)

When a muscle contracts isometrically, the force it exerts is _____ (equal to, less than, greater than) the force exerted on it.

EQUAL TO

p. 65 (NASM)



_____ contraction results in no appreciable change in muscle length.

ISOMETRIC

p. 65 (NASM)



Isometric contractions are used functionally by the body to ...

DYNAMICALLY STABILIZE THE BODY

This can be seen in stabilizers that are isometrically stabilizing a limb from moving in an unwanted direction.

p. 65 (NASM)



Which muscle isometrically stabilizes the foot/ankle complex?



GASTROCNEMIUS (calf)

p. 69 (NASM)



Which abdominal muscles isometrically stabilize the lumbar-pelvic-hip complex?

- **TRANSVERSUS ABDOMINIS**

- **RECTUS ABDOMINIS**

p. 77 (NASM)



Name the muscles of the hamstring complex.

- **BICEPS FEMORIS**

- **SEMIMEMBRANOSUS**

- **SEMITENDINOSUS**

pp. 70-71 (NASM)



Name the muscles of the quadriceps complex.

- **VASTUS LATERALIS**

- **VASTUS MEDIALIS**

- **VASTUS INTERMEDIUS**

- **RECTUS FEMORIS**

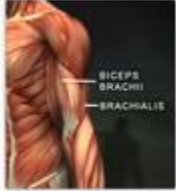
pp. 71-72 (NASM)



Name the 3 parts of the triceps brachii.

- LONG HEAD
- SHORT HEAD (posterior humerus)
- MEDIAL HEAD (posterior humerus)

p. 83 (NASM)

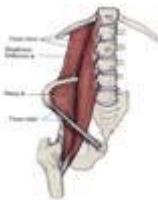


What is the integrated function of the biceps brachii?

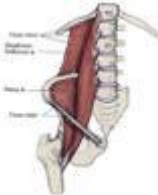
- ECCENTRICALLY DECELERATES:
 - * ELBOW EXTENSION
 - * PRONATION OF RADIOULNAR JOINT
 - * SHOULDER EXTENSION

- ISOMETRICALLY STABILIZES THE ELBOW AND SHOULDER GIRDLE

p. 83 (NASM)



What is the integrated function and insertion point (generally) of the psoas muscle?



- FUNCTION: ECCENTRICALLY DECELERATES HIP INTERNAL ROTATION AND HIP EXTENSION; ISOMETRICALLY STABILIZES THE LUMBO-PELVIC-HIP COMPLEX

- INSERTION: LESSER TROCHANTER OF THE FEMUR

p. 75 (NASM)



What is the integrated function of the multifidus?



STABILIZES VERTEBRAE IN LOCAL MOVEMENTS OF THE VERTEBRAL COLUMN

The multifidus muscle consists of a number of fleshy and tendinous fasciculi, which fill up the groove on either side of the spinous processes of the vertebrae, from the sacrum to the axis. The multifidus is a very thin muscle.

Deep in the spine, it spans three joint segments, and works to stabilize the joints at each segmental level.

The stiffness and stability makes each vertebra work more effectively, and reduces the degeneration of the joint structures.

from http://en.wikipedia.org/wiki/Multifidus_muscle

p. 79 (NASM)



Which muscles decelerate ankle dorsiflexion?



- GASTROCNEMIUS
- SOLEUS
- PERONEUS LONGUS

pp. 69-70



Name the 3 gluteus muscles and their general insertion and origin.



- GLUTEUS MINIMUS
- GLUTEUS MEDIUS
- GLUTEUS MAXIMUS

ORIGIN: ILLIUM OF THE PELVIS

INSERTION: GREATER TROCHANTER OF THE FEMUR

p. 74 (NASM)



Forces are characterized by _____ and _____.

MAGNITUDE, DIRECTION

p. 87 (NASM)

The kinetic chain is designed to manipulate _____ from a multitude of directions to effectively produce _____.

VARIABLE FORCES, MOVEMENT

p. 87 (NASM)

What refers to the length at which a muscle can produce the greatest force?

LENGTH-TENSION RELATIONSHIP

There is an optimal muscle length at which the actin and myosin filaments in the sarcomere have the most amount of overlap. This results in the ability of myosin to make a maximal amount of connections with actin and so results in the potential for maximal force production of that muscle.

p. 87 (NASM)

Lengthening a muscle beyond its optimal length and then stimulating it _____ (increases/decreases) the amount of actin/myosin overlap, _____ (increasing/decreasing) force production.

DECREASES, DECREASING

p. 87 (NASM)

What can cause muscle lengths to become altered, resulting in their not being able to generate proper force to allow for efficient movement?

MISALIGNED JOINTS (I. E., POOR POSTURE)

p. 87 (NASM)

What is the force-velocity curve?

THE ABILITY OF MUSCLES TO PRODUCE FORCE WITH INCREASING VELOCITY

p. 87 (NASM)

As the velocity of a concentric muscle contraction increases, its ability to produce force

_____.

DECREASES

p. 87 (NASM)

As the velocity of an eccentric muscle contraction increases, its ability to produce force

_____.

INCREASES

p. 87 (NASM)

Synergistic action of muscles to produce movement around a joint is also known as ...

FORCE-COUPLE

p. 88 (NASM)

All muscles working together for the production of proper movement are said to be working in a ...

FORCE-COUPLE

p. 89 (NASM)

The amount of force that the kinetic chain can produce is dependent on ...

- MOTOR UNIT RECRUITMENT

- MUSCLE SIZE

- LEVERAGE OF BONES & MUSCLES

p. 89 (NASM)

The _____ system is ultimately responsible for manipulating force.

NEUROMUSCULAR

p. 89 (NASM)

The amount of leverage the kinetic chain will have for any given movement depends on the leverage of the muscles in relation to _____.

THE RESISTANCE

p. 90 (NASM)

The easiest way to alter the amount of torque generated at a joint is to ...

MOVE THE RESISTANCE

p. 90 (NASM)

Motor control looks at the involved structures and mechanisms that the nervous system uses to gather all sensory information and integrates it with

PREVIOUS EXPERIENCE

p. 91 (NASM)

Groups of muscles that are recruited by the CNS to provide movement is known as ...

SYNERGIES

p. 91 (NASM)

Proprioception uses information from _____ to provide information about

....

- MECHANORECEPTORS

- BODY POSITION, MOVEMENT, AND SENSATION

p. 91 (NASM)

TRUE or FALSE?

Proprioception is altered after injury.

TRUE

p. 91 (NASM)



Proprioception helps the nervous system learn about the environment to produce

EFFICIENT MOVEMENT

p. 91 (NASM)



The ability of the nervous system to gather and interpret sensory information and to select and execute the proper motor response is known as ...

SENSORIMOTOR INTEGRATION

p. 91 (NASM)



If individuals train with improper form, improper sensory information will be delivered to the CNS, leading to ...

- MOVEMENT COMPENSATIONS

- POTENTIAL INJURY

p. 93 (NASM)



The integration and practice of motor control processes leading to a relatively permanent change in the capacity to produce skilled movements is known as ...

MOTOR LEARNING

p. 93 (NASM)



What can lead to a permanent change in one's ability to perform movements efficiently?

PROPER PRACTICE AND EXPERIENCE

p. 93 (NASM)



Using posture and joint motion as sensory information is an example of _____ feedback.

INTERNAL

p. 93 (NASM)



Using a heart rate monitor to supplement the internal environment is ...

EXTERNAL FEEDBACK

p. 93 (NASM)



Knowledge of results are used _____ to help inform a client about _____.

- AFTER COMPLETING A MOVEMENT

- THE OUTCOME OF THEIR PERFORMANCE

p. 93 (NASM)



Knowledge of performance provides information about _____.

THE QUALITY OF MOVEMENT DURING AN EXERCISE

p. 94 (NASM)