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 devides the body into top and bottom halves.
Transverse Plane

Rotation of a joint toword 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
Bicept 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 risistance. 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 (synergisticly) 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 sensoriomotor 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, miror, or heart rate monitor to supplement the internal environment.
External Feedback

Concentrically accelerates dorsiflexion and inversion
Anterior Tibialis

-Eccentrically decelerates plantarflexiopn 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 stablizes the arch of the foot.
Posterior Tibialis

-Concentrically accelerates plantarflexion.
-Decelerates anle dorsiflexion.
-Isometrically stabilizes the foot ad ancle complex
Soleus

-Concentrically accelerates plantarflexion.
-Decelerates ankle dorsiflexion
-Isometrically stabilizes the foot and ancle comples
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

inernal 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

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

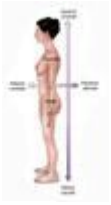
---

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

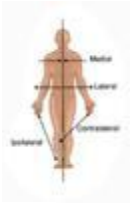
Anterior (ventral):
on the from of the body

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 food is contralateral to the left hand

ipsilateral:
positioned on the same side of the body

ex:
the right food is ipsilateral to the right hand.

Sagittal Plane

an imaginary bisctor 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 flextion 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 flextion 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 flextion:

bending of the spine (cervial, 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

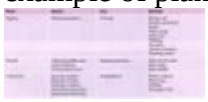
foot:
- abduction (toes pointing outward, external rotated)
- adduction (toes pointing inward, internally rotated)

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.

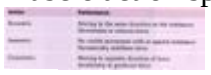
ex:
adductor and abductors of the thigh during squat will dynamically stabilize the leg from moving in the frontal and transverse planes.

Concentric contraction:
- the shortening of a muscle

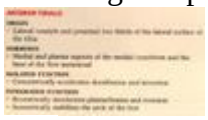
- actin and myosin crossbridges move together

- exerting more force than is being placed on it.

muscle action spectrum table:

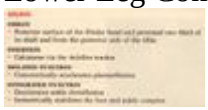


lower leg complex

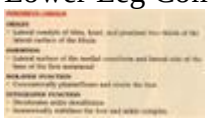


Lower Leg Complex

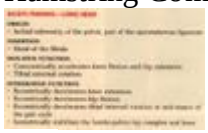
Lower Leg Complex



Lower Leg Complex

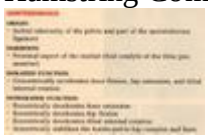


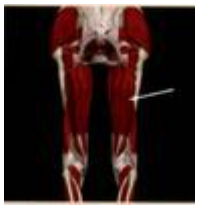
Hamstring Complex



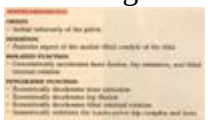
Hamstring Complex

Hamstring Complex

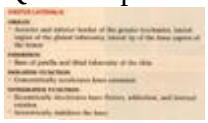




Hamstring Complex



Quadriceps Complex

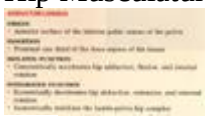


Quadriceps Complex

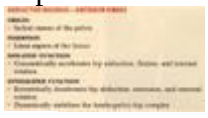
Quadriceps Complex

Quadriceps Complex

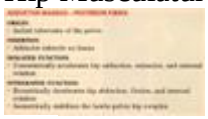
Hip Musculature



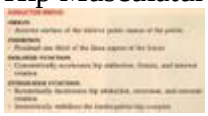
Hip Musculature



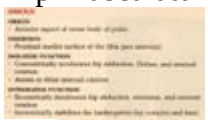
Hip Musculature



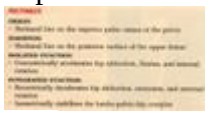
Hip Musculature



Hip Musculature

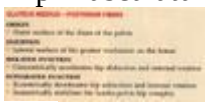


Hip Musculature

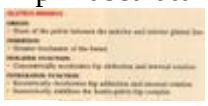


Hip Musculature

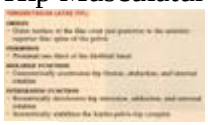
Hip Musculature



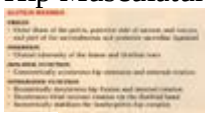
Hip Musculature



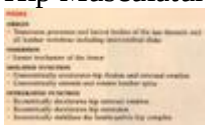
Hip Musculature



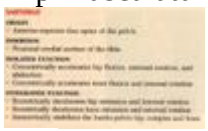
Hip Musculature



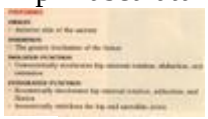
Hip Musculature



Hip Musculature

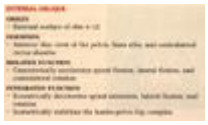


Hip Musculature

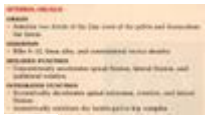


Abdominal Musculature

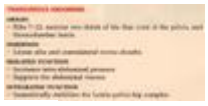
Abdominal Musculature



Abdominal Musculature

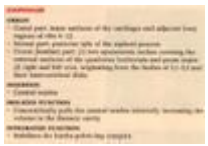


Abdominal Musculature



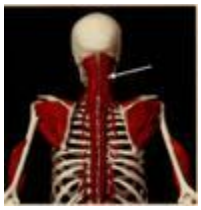
Abdominal Musculature

Abdominal Musculature



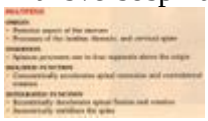
Back Musculature

Back Musculature

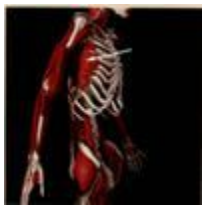


Transversospinalis complex

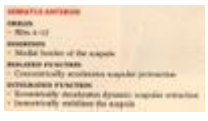
Transversospinalis complex



Shoulder Musculature



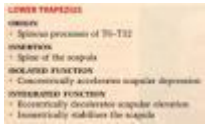
Shoulder Musculature



Shoulder Musculature

Shoulder Musculature

Shoulder Musculature



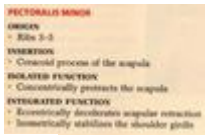
Shoulder Musculature

Shoulder Musculature

Shoulder Musculature

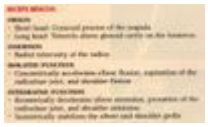
Shoulder Musculature

Shoulder Musculature

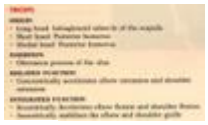


Shoulder Musculature

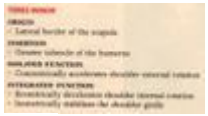
Shoulder Musculature



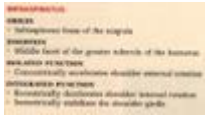
Shoulder Musculature



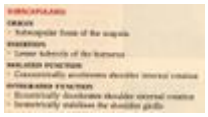
Rotator Cuff



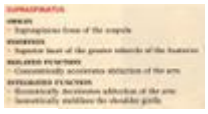
Rotator Cuff



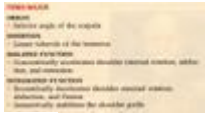
Rotator Cuff



Rotator Cuff

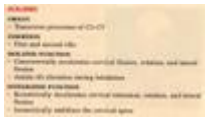


Rotator Cuff



Neck Musculature

Neck Musculature



Neck Musculature

Neck Musculature

several muscles work synergistically to?
- produce force
- stabilize the body
- reduce force

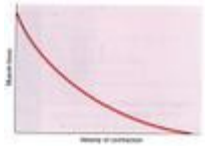
Force:
an influence applied by one object to another which results in an acceleration or deceleration of the second object

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

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 moiton?
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 on 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 of 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 gather information, interpreting, and executing movement

motor learing
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

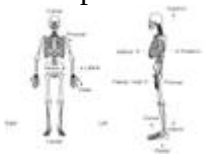
When a muscle exerts less force than is being placed upon it, which results in the lengthening of a muscle
Eccentric

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

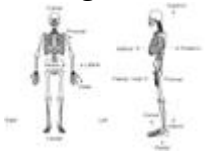
Study that uses principles of physics to quantitatively study how forces interact within a living body is called ...
BIOMECHANICS
p. 58 (NASM)

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



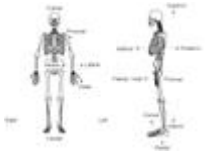
POSITIONED ABOVE IT
(Superior = positioned ABOVE a reference point)
p. 59 (NASM)

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



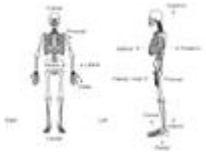
POSITIONED BELOW IT
(Inferior = positioned BELOW a reference point)
p. 59 (NASM)

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



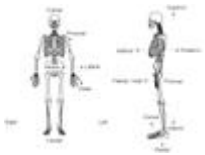
NEARER TO THE CENTER OF THE BODY (OR POINT OF REFERENCE)
(in this case, the hip is the point of reference)
p. 59 (NASM)

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)

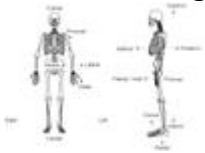
If the quadriceps are located on the "anterior" aspect of the thigh, they are ...



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)

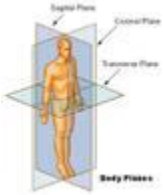
If the adductors are on the "medial" side of the thigh, they are ...
ON THE SIDE CLOSEST TO THE MIDLINE OF THE BODY
p. 59 (NASM)

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)

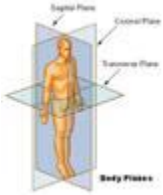
Which plane bisects the body into right/left halves?



SAGITTAL PLANE
Allows both flexion and extension movements

p. 60 (NASM)

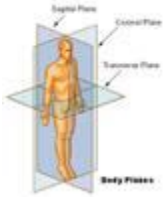
Which plane bisects the body into front/back halves?



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)

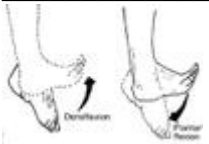
Give 3 examples of movements in the frontal plane.
- SIDE LATERAL RAISES
- SIDE LUNGES
- SIDE SHUFFLING

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 ankle 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.

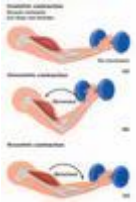
pp. 62-63 (NASM)

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)

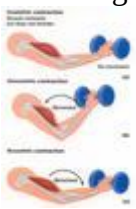
When a muscle lengthens, it is contracting ...



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)

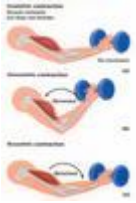
Eccentric motion moves in the _____ (same/opposite) direction as the resistance is moving.



SAME DIRECTION
p. 65 (NASM)

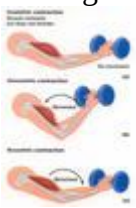
Eccentric motion acts to _____the forces acting on the body.
DECELERATE (or reduce)
p. 65 (NASM)

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)

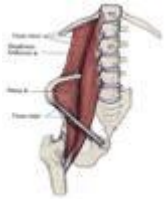
Name the muscles of the quadriceps complex.
- VASTUS LATERALIS
- VASTUS MEDIALIS
- VASTUS INTERMEDIUS
- RECTUS FEMORIS
pp. 71-72 (NASM)

Name the 3 parts of the triceps brachii.

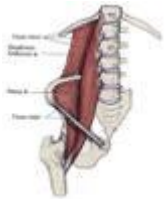
- LONG HEAD
- SHORT HEAD (posterior humerus)
- MEDIAL HEAD (posterior humerus)
p. 83 (NASM)

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)