

BPK 142 – INTRODUCTION TO KINESIOLOGY

Laboratory Review Questions - Part 1

Week #1: Osteology and Torso Model Anatomy

1. a) Describe the functions of the patella.
The primary function is knee extension. It also protects the knee joint and maintains the position of the tendon during knee flexion
- b) How is the patella different from other bones of the leg?
It is a flat sesamoid bone (covers tendons and aids in motion) used for protection rather than support
2. a) Name the bones of the pectoral girdle and the bones of the pelvic girdle.
Pectoral: Clavicle, scapula, coracoid
Pelvic: Ischium, ilium pubis, coccyx
- b) Compare the pectoral and pelvic girdles with regard to strength, function, and versatility.
Pectoral muscle: Less strength, more mobile and versatile
Pelvic muscle: Built for weight bearing, more stable, less versatile
3. What functions does the clavicle serve in the skeletal system?
 - Supports the upper arm and scapula
 - Improves leverage and strength
 - Protects blood vessels and nerves travelling into the arm
 - Absorbs shock from the upper torso
 - Attachment point for muscles and tendons (6)
4. To what bones does the scapula articulate?
Clavicle and humerus
5. Describe the bony arrangements, which are involved in the elbow joint.
Humeroulnar joint: Hinge joint, allows for only flexion and extension movements
Humeroradial joint: Ball-and-socket joint
Superior radioulnar joint: Any position of flexion and extension. Radius can be rotated. Allows for pronation and supination movements
6. Describe the differences between a male pelvis and a female pelvis.
Female: Larger, broader, oval opening
Male: Taller, narrower, more compact, heart-shaped opening
7. Compare the elbow joint and the knee joint in terms of structure and function.
Elbow – hinge joint - flexion and extension
Knee – pivotal hinge joint - flexion and extension with some medial and lateral rotation

8. a) Describe the four major curvatures of the vertebral column

- Neck (cervical concave)
- Chest (thoracic convex)
- Abdomen (lumbar concave)
- Lower back (convex coccygeal)

b) Define lordosis, kyphosis, and scoliosis.

Lordosis: Exaggerated lumbar curvature (butt sticks out)

Kyphosis: Exaggerated thoracic curve (hump back)

Scoliosis: Abnormal lateral curve

9. a) What is the function of the thoracic cage?

- Protects the heart, lungs, and abdominal organs
- Protects shoulder girdle and arms
- Attachment point of respiratory muscles

b) Distinguish between true, false, and floating ribs.

True ribs: Attach directly to sternum

False ribs: Attach to the rib above it, not sternum

Floating ribs: Attach to vertebrae only

10. What are the functions of the acromion process and coracoid process of the scapula?

Acromion process:

- Projection of bone from scapula
- Articulation with clavicle
- Attachment point for trapezius and deltoid muscle

Coracoid process:

- Projection of bone from scapula
- Limits shoulder movement
- Attachment for biceps brachia and pectorals minor

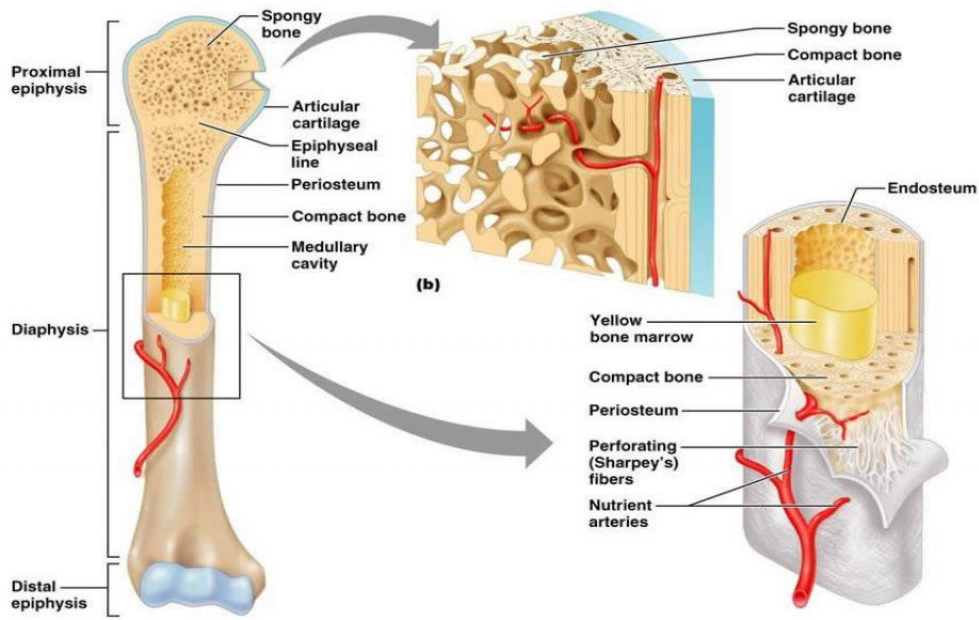
11. What is the function of the tibial tuberosity?

Attachment of patella ligament and quadriceps tendon

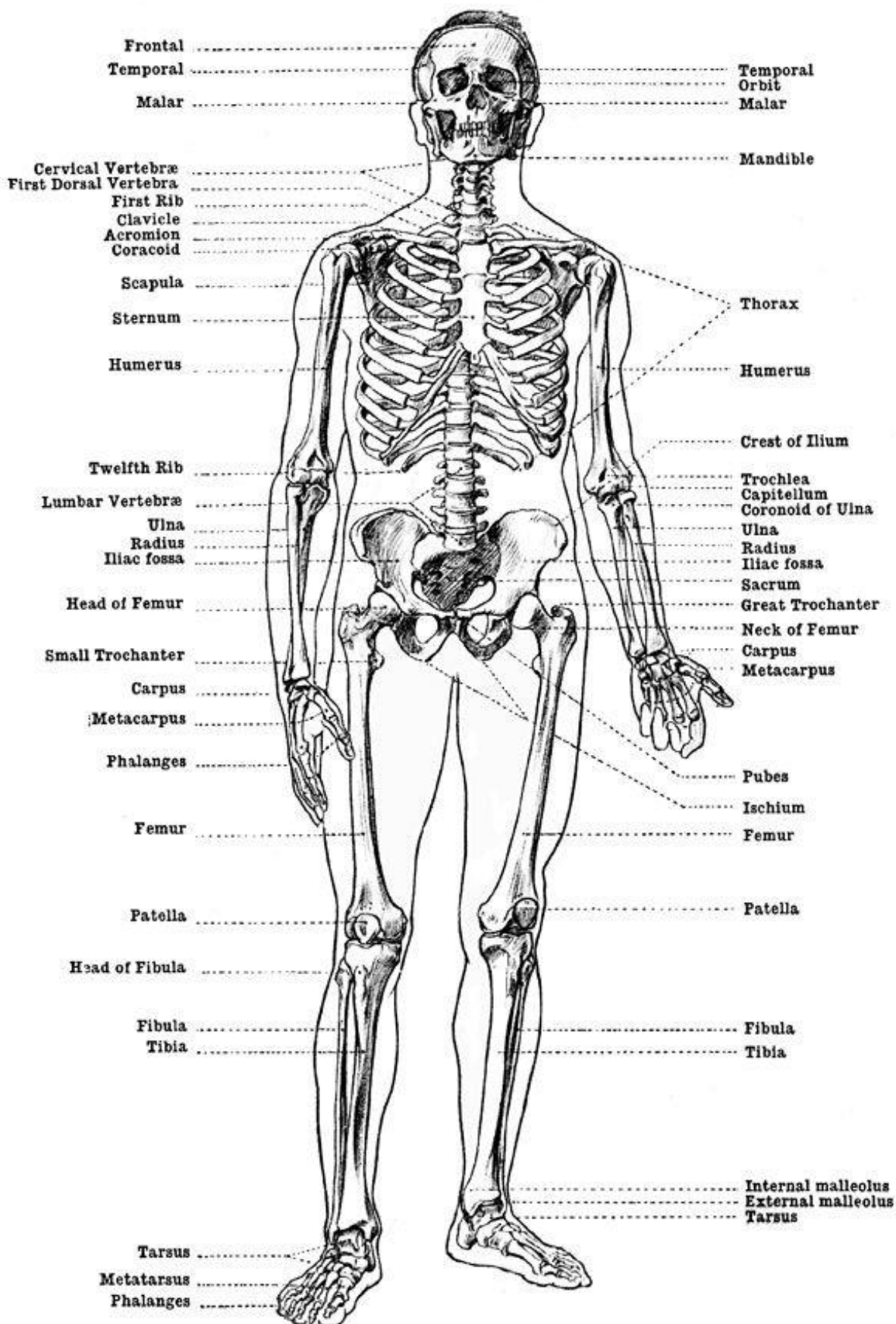
12. Describe differences between the adult skull and the baby skull.

Adult skulls have plates fused by immovable fibrous joints. Baby skulls have many unfused plates with 6 openings (fontanelles) – anterior, posterior, 2 anterolateral, 2 posterolateral

13. Be able to identify the following structures:



Torso Structures and their Functions	
Structure	Function
Heart	Propel blood throughout the body
Lungs	Gas exchange processes
Liver	Detoxification, protein synthesis, production of bile (digestion)
Pancreas	Produces enzymes
Spleen	Filters blood
Kidney	Extracts wastes from blood, balance body fluids from urine
Large intestine	Reabsorption of water
Small intestine	Absorption of nutrients
Stomach	Churns food with gastric juice (HCl + pepsin) to break down proteins and kill harmful bacteria
Gall bladder	Holds bile (digests fatty foods)
Esophagus	Carries food, liquids, saliva to the stomach
Trachea	Provides air flow to and from the lungs
Diaphragm	Respiration: as the diaphragm contracts, the volume of the thoracic cavity increases and air is drawn into the lungs
Urinary bladder	Collects urine
Ureter	Carries urine to the bladder
Adrenal gland	Produces hormones (adrenaline)
Abdominal aorta	Provides oxygenated blood/nutrients to lower body
Inferior vena cavity	Carries blood from the lower body to the heart
Vertebrae	Protects spinal cord
Spinal cord	Transmission of neural signals
Brain: Cerebellum	Receives information from sensory systems (voluntary movements)
Brain: Cerebral cortex	Thought, action



Week #2: Somatotype and Body Composition Analysis

1. Describe the standardized procedure for measuring the **** skinfold, **** girth or **** bone width. Describe subject position, instrument used, and step-by-step procedure. The asterisks represent any of the measures you were asked to carry out in the lab procedures.

Skinfold: Skinfold caliper

- Subject should be relaxed
- All readings are taken on the right side of the body (except abdomen)
- Grasp skin with thumb and index finger, continue to hold while measuring, release jaw and measure after 2-4 seconds
- Record reading to 0.5mm

Girth: Anthropometric tape

- Apply tape around largest circumference being snug but not causing indentation
- Record to the nearest mm
- Measure both left and right side of the largest girth

Bone width: Bone caliper

- Locate medial and lateral epicondylar/condylar protrusions on the elbow/knee joint with fingers
- Put pen marks on the landmarks
- Apply caliper to elbow/knee joint at 90 degrees on the medial and lateral epicondylar/condylar protrusions
- Widths of both sides should be taken. The larger one should be recorded to the nearest mm

2. Bioelectrical impedance techniques are used to determine percent body fat. Describe the principle on which this technique is based. Describe sources of error in this procedure.

The bioelectrical impedance technique is based on the principle that resistance to the flow of electrical current is higher in the adipose tissue than in bone and muscle, which are 71-75% water

3. In the O-Scale System of body composition assessment, what is the rationale for using a height adjustment when calculating the Adiposity rating and the Proportional Weight rating?

The size adjustment scales all individuals to a standard height so that comparisons of proportions between individuals can be made

4. In the O-Scale System of body composition assessment, how is the Adiposity rating used to help interpret the Proportional Weight rating?

The Adiposity rating is the fatness rating; the difference between the Adiposity and proportional weight rating is used as an indicator of musculoskeletal system. Those with low adiposity ratings, yet high proportional weight ratings are shown to be overweight rather than over-fat, this becomes helpful with very athletic people (bodybuilders)

5. What advantages do the O-Scale System and the Canadian Physical Activity, Fitness and Lifestyle Appraisal – Health Body Composition Assessment procedure have in comparison to percentage body fat predictions from skinfold measurements, when used in individual assessments?

It is better at targeting where the additional fat is, rather than just if the subject is overweight or not

6. With reference to the O-Scale system of body composition assessment, describe the following terms – stanine scale, adiposity rating, proportional weight rating, balanced physique, dominant physique.

Stanine scale: Arbitrary scale in comparisons to the normal distribution

Adiposity rating: Fat tissue rating

Proportional weight rating: Fat to weight proportionality

Balanced physique: Having equal adiposity and proportional weight ratings

Dominant physique: Non-equal adiposity and proportional weight ratings; higher

7. In the Canadian Physical Activity, Fitness, and Lifestyle Appraisal – Healthy Body Composition Assessment procedure, what are the purposes of using the “sum of five skinfolds” value, and the waist girth measurement?

To acknowledge where any extra fat, if any, is located on the body, as it poses a greater risk if it is located in the abdominal area

Week #3: Anthology, & Flexibility

1. Be able to define the planes and axes of the body. Be able to define the various terms of direction.

Sagittal plane: Left and right halves (vertical plane)

Frontal plane: Anterior and posterior halves (lateral plane)

Transverse plane: Superior and inferior halves (horizontal plane)

Medial: Near midline of body

Lateral: Away from midline of body

Superior: Toward head

Inferior: Toward feet

Anterior: To the front

Posterior: To the back

Proximal: Toward the trunk

Distal: Away from the trunk

Internal: Away from the skin surface

External: On skin surface

2. Be able to identify and give functions for the structures learned on the knee, hip, and shoulder joint models.

Knee joint:

- Largest and complex
- Weight bearing
- Locomotion
- Location of patella and quadriceps tendon and patellar ligament provides better angle of pull and result in greater strength of quads

Hip joint:

- Very stable compared to shoulder joint
- Wide range of movements but not as mobile as the shoulder joint
- Bears our body weight
- Allows us to walk, run, etc.

Shoulder joint:

- Glenohumeral joint designed from mobility
- Stability
- The rotator muscles pull the humeral head superiorly and medially toward the glenoid fossa
- Clavicle keeps arm out/away from body

3. Be able to define movements about the major joints.

Abduction: Movement away from body

Adduction: Movement towards body

Extension: Straightening of a joint to 180 degrees

Flexion: Bending a joint to an acute angle

Rotation: A circular movement around a fixed point

4. Know the classification of joints - fibrous, cartilaginous, synovial.

Fibrous joint: Fixed or immovable

- Dense connective tissue (fibrous)

Cartilaginous joint: Slightly moveable

- Hyaline cartilage or fibrocartilage

Synovial joint: Freely moveable

- 2 bones covered by cartilage and supported by joint capsule
- Between cartilage is synovial fluid to lubricate joints

5. Compare the hip and shoulder joints with respect to structure, strength and versatility of movement.

Hip joint: Deep ball and socket, designed to mostly bear weight, sacrifices ranges of motion for strength and stability

Shoulder joint: Complex joint (glenohumeral, sternoclavicular, acromioclavicular, scapulothoracic), shallow ball and socket, designed for range of motion while still retaining control, rather than strength, common dislocation

6. Name the joint that contains the: (a) glenoid cavity and labrum, (b) cruciate ligaments and menisci, (c) annular ligament and head of radius, (d) acetabulum and iliofemoral ligament.

- a. Shoulder
- b. Knee joint
- c. Elbow joint
- d. Hip joint

7. How do ligaments contribute to joint stability and mobility?

- Attaches bone to bone for stability
- Acts as mechanical reinforcements in a synovial joint
- Gradually stretches when pressure is applied
- Limits the mobility of articulations or prevents them all together

8. a) Name a bone that is distal to the humerus.

Radius, ulna, carpals, metacarpals

b) Name a bone that is proximal to the patella.

Femur, ilium, ischium, pubis

c) Name a bone that is lateral to the sternum.

Rib cage, humerus, radius, ulna

9. In the knee joint, what is the function of:

- a) **Articular cartilage**
Cushion between bones
- b) **Synovial fluid**
Reduces friction and lubricates joints
- c) **Cruciate ligaments**
Maintains stability in the anterior-posterior direction
- d) **Collateral ligaments**

14. Why is the anatomical position so important in explaining the movements that are possible at joints?

Precise terminology is required to describe joint movement and muscle actions

15. Name two of the joints that are considered to be part of the “shoulder joint” complex.

Glenohumeral, sternoclavicular, acrioclavicular, scapulothoracic

16. Why is dislocation of the humerus at the glenohumeral joint most likely to occur inferiorly?

The muscular and ligamentous support anterior to the humeral head is much less robust than the substantial muscular and bony support afforded posteriorly by the rotator cuff and scapula

17. Describe five different types of joint injuries.

Sprain: Twisting or overstretching a joint causes a ligament to be stretched beyond normal limits or separated from its bony attachment

Dislocation: The articular surfaces of bones are forcibly displaced. Ligament are sprained (or torn)

Subluxation: Partial dislocation of a joint

Bursitis: Inflamed bursa resulting from injury, exercise, or infection

Arthritis: Joint inflammation caused by trauma, bacterial infection, metabolic disorders, or other unknown causes

18. At the ankle joint, compare inversion sprains versus eversion sprains. Which ligaments are most likely damaged in an inversion sprain?

19. Criticize the Sit & Reach test.

The sit and reach test does not measure the flexibility of the lower back and the hamstring correctly because there is no way to put the arms into proportion. The test is unfair if the subject has longer than average legs/shorter arms and will produce a lower than average reading. If the subject has short than average legs/long arms, then the test will provide a higher than average rating

20. Distinguish between active range of motion and passive range of motion.

Active range of motion is the arc during unassisted voluntary joint motion

Passive range of motion is the arc attained when the examiner moves the patient’s body

21. Define the term “goniometry”.

Measurement of angles created at joints by bones

22. Why is precise measurement of joint range of motion important?

23. Does normal range of motion at one joint indicate that the subject will likely have normal range of motion at all joints? Explain.

Flexibility of one joint does not indicate good ROM in other joints (no flexibility test to represent the total body)

24. Describe three types of devices that are often used when a precise measure of flexibility is desired.

- 1) Universal goniometer
- 2) Gravity-dependent goniometer (inclinometers)
- 3) Electrogoniometer

25. Which joint movements are needed at the shoulder joint in order to successfully tuck the tail of your shirt into the back of your pants?

The shoulder is a very mobile joint, and so such an action actually entails multiple movements. Starting from a standing position with the palms at the side, bend the elbow so that the arm is at a 90-degree angle. Rotate the palm to your belly, and then slide the palm down to the waist line. From there, slide the palm along the belt line to the back of the body. The shirt has been tucked in. This series of movements involved humeral rotation as the palm moved to the body and then slid around it. Additionally, as the palm slid around the body, the humerus moved backwards in an action known as arm extension. And so: the major movements that occur in the action you asked about are humeral rotation and arm extension. In addition, as the scapula moves, it undergoes extension

Week #4: Muscle Anatomy and Movement Analysis

1. For each of the muscles studied in this lab, you should know the location of the muscle and the joint movements that it performs.

Trapezius muscle:

- Tilt and turn the head and neck
- Steady shoulders and twist arms
- Stabilize and move scapula

Serratus anterior muscle:

- Responsible for protraction of scapula
- Upward rotation of the scapula

Rhomboid muscle:

- Under trapezius
- Keeps the scapula to the rib cage
- Retraction and downward rotation of the scapula

Deltoid muscle:

- Anterior portion: Flexion and horizontal flexion
- Middle portion: Abduction and horizontal flexion
- Posterior portion: Horizontal extension, assists with extension

Pectoralis Major muscle:

- Flexion of the humerus
- Adducts the humerus
- Rotates humerus medially
- Responsible for keeping arm attached to trunk of body

Latissimus Dorsi muscle:

- Extension
- Adduction
- Assists in inward rotation and horizontal extension

Biceps Brachii Muscle:

- Supination of the forearm
- Assists in flexion of the shoulder joint

Triceps Brachia muscle:

- Flexion

Flexor muscle:

- Flexion of wrist and fingers

Extensor muscle:

- Extension of wrist and fingers

Abdominal muscle groups (recuts abdominus, internal oblique, external oblique, and transverse abdominus):

- Trunk flexion
- Lateral flexion

Erector spinae muscle group:

- Eight muscles
- Acts as one great extensor muscle of the vertebral column (trunk extension) and head
- Some of these muscles act on later flexion and rotation of trunk

Iliac and psoas muscle:

- Flexion at hip joint
- Psoas muscle-trunk flexion

Gluteus medius muscle:

- Abduction at hip joint

Adductor magnus muscle:

- Adduction at hip joint

Quadriceps muscle group:

- Extension at knee
- The great extensor of the leg
- Rectus femoris – flexion at hip joint

Hamstring muscle:

- Flexion at knee joint
- Extension at the hip joint

Gastrocnemius muscle:

- Plantar flexion of the foot
- Assists flexion at the knee

Soleus muscle:

- Plantar flexion of the foot

Tibialis anterior muscle:

- Dorsiflexion of the foot (prevents stubbing the toes as limbs swing forward)

2. You should be able to analyze the joint actions and muscles involved (prime movers only) in any movement.

Dumbbell fly exercise

Joints:

- Shoulder joint horizontal adduction

Muscles:

- Pectoralis major muscle
- Anterior deltoid

3. Describe the role played by the gluteus maximus muscle in walking, running, and climbing stairs.

The gluteus maximus muscle helps maintain your balance as you walk or run. As your leg comes forward and your heel hits the ground, this muscle tightens to slow down the forward movement of your leg and keep you balanced. When you run, this muscle tightens on the leg you are standing on to control the forward momentum of your trunk. Although the quadriceps muscles on the front of your thighs primarily move your legs forward as you walk or run, the gluteus maximus muscle tightens to help propel your body forward on hills or uneven surfaces. This muscle also lifts you from a squatted position and helps you climb stairs.

4. **If your deltoid muscles were paralyzed, how would this affect the activities which you are able to perform?**
Abduction, flexion, horizontal flexion and extension
5. **In a duel in 1547, Jarnac defeated Chastaigneraie by slicing through the tissue behind the left knee. This is known in history as the "coup de Jarnac". Which muscles would be affected by such a cut. Would the victim be able to walk and/or run properly?**
6. **Describe four possible movements of the humerus that can occur at the shoulder joint, and name the prime mover(s) of each movement.**
Flexion: Anterior deltoid, clavicular pectoralis major
Abduction: Middle deltoid
Horizontal flexion: Anterior deltoid, clavicular pectoralis major
Inward rotation: Anterior deltoid

Week #5: Measurement of Strength, Power & Muscular Endurance

1. **Distinguish between hip flexion and trunk flexion.**
Hip flexion: Involves the muscle of the thigh
Trunk flexion: Involves muscles of the abdomen
2. **a) Why would individuals accustomed to wearing high-heeled shoes experience discomfort when wearing low-heeled shoes?**
Individual would be accustomed to constant plantar flexion

b) Where might the discomfort be found and what are some possible anatomic and mechanical reasons?
Discomfort will be found in the tibialis anterior muscle as dorsiflexion is not common for the individual and wearing low-heeled shoes would require toes to be flexed
3. **How is walking different from running with regard to the use of hip joint muscle actions and range of motion?**
The gluteus maximus is strongly activated when running and easily activated during walking
4. **Why are there different protocols for the so-called "male" & "female" push-ups? Do you think that this is appropriate? Why or why not?**
Males have more upper body strength compared to females. Although men have more upper body strength, they also have a higher body weight, so technically the strength ration should even out
5. **Critique the grip strength test. Do you think that the correlation between grip strength and overall body strength would be very high? Explain.**
It is not a good indicator of overall strength unless the subject is a well-rounded athlete. We increase our grip strength everyday without even knowing it. A well-rounded athlete has equal muscular strength everywhere on the body
6. **What is the vertical jump a test of? What factors can affect the distance jumped?**
 - Test to measure power
 - Factors: Muscle strength in legs as well as mass

7. Differentiate between strength, power, and muscular endurance. Give an example of a test that was used in Kinesiology 142 for measuring each of these factors.

Strength: Grip strength, knee and hip extension upright rowing

Power: Vertical jump

Muscular endurance: Push-ups, partial curl ups, back extension

8. Explain the shape of your velocity versus force graph and your power versus force graph. What general information is given by these graphs regarding the optimal combination of force and velocity needed to obtain maximal power output?

Velocity vs. force: Inversely proportional, which indicates that as force, increases, velocity decreases

Power vs. force: Shaped like an inverse parabola. Indicates that power is peaked when force is around the halfway point

Week #6: Biomechanics

1. Which lever classes do a golf club, a swinging door, and a shovel belong to? Explain your answers using a diagram, if necessary.

Golf club: Third class (resistance, force, fulcrum)

Swinging door: Second class (force, resistance, fulcrum)

Shovel: First class (force, fulcrum, resistance)

2. How much force must be produced by the biceps brachia, attached at 90 degrees to the radius at 4.0 centimeters from the centre of rotation of the elbow joint, to support a weight of 95 newtons held in the hand at a distance of 32 cm from the elbow joint? Assume that the forearm and hand have a combined weight of 35 newtons and that their center of gravity is located 17 cm from the elbow joint.

$$F \times FA = RA \times R$$

$$F = R \times RA/FA$$

$$F = 95N \times 32cm/4cm$$

$$F = 760N$$

3. Is the mechanical advantage of a first class lever greater than, less than, or equal to one? Maybe be all three. It depends on the lengths of the RA and FA, therefore it can be a speed or force lever
4. Describe the various stance phase events and swing phase events during a gait cycle.
- Heel strike:** Heel hits floor
- Foot-flat:** When the whole foot is in contact with the floor
- Mid-stance:** Weight is being transferred from heel to toe, swing foot passes stance foot
- Heel-off:** Heel loses contact with ground, push off initiated by gastrocnemius and soleus
- Toe-off:** Toe leaves ground, stance phase ends
5. As any runner changes from a slow running speed to a faster and faster running speed he/she lands less flat-footed and more on the toes. Why? Flat footed event of the stance phase is eliminated during running and the runner is essentially "falling" forward, and the accelerating phase becomes more pronounced
6. Why is video useful for studying what is happening to the foot and leg during the support phase of running? Tells if you are over pronating or over supinating and potentially prevent injury

7. In running a 400 meter race, an athlete toes out on each stride so that her foot length measured in the direction of progression is 2.0 centimeters shorter than if she toed straight ahead. If her stride length averaged 2.00 meters per stride, how much more distance could she cover in the same length of time (50 seconds) if she toed straight ahead?

8. Based on your muscle activity analysis in the Gait Analysis Lab, describe the role played by the hamstring muscle group during the gait cycle.
Hamstring is active during: heel-strike, foot-flat, acceleration, mid-swing and deceleration