Edition 4

Laboratory Manual for

Clinical Kinesiology *and* Anatomy

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To students who desire to understand so as to help others.

PREFACE

Preface to Fourth Edition

This update of the *Laboratory Manual for Clinical Kinesiology and Anatomy* permitted us to align terminology used in the manual with generally accepted terminology, make corrections, and revise some activities, particularly in the Pre-Lab worksheets. We were pleased to have the assistance of Christopher Towler, DPT who both reviewed the manual and offered suggestions especially in the cardiovascular and respiratory sections.

The goals for this Laboratory Manual remain the same: to actively engage and challenge the learner and present the material in a way that assists the student to not only learn the material but also to learn how to think about how human movement is generated.

LSL
MADM

ACKNOWLEDGMENTS

We appreciate the many individuals at F. A. Davis for their continued commitment to the Lab Manual as a companion text to *Clinical Kinesiology and Anatomy*. In particular we wish to acknowledge Melissa Duffield, Senior Acquisitions Editor, for oversight of this project, and Jennifer Pine, Senior Developmental Editor, who used her editorial skills and patience to guide us on this project.

Mary Alice D. Minor
Lynn S. Lippert

CONTENTS

Part 1

Basic Clinical Kinesiology and Anatomy

Chapter 1

Basic Information

Pre-Lab Worksheets

Student's Name _____

Date Due _____

Complete the questions that follow prior to the lab class.

1. Define (Refer to Lippert, *Clinical Kinesiology and Anatomy, 6e,* Chapter 1):

   Kinesiology:

   _____

   Biomechanics:

   _____

   Kinetics:

   _____

   Kinematics:

   _____

2. The basic information needed to determine the function of a muscle includes:

   A. _____

   B. _____

   C. _____

3. Fill in the following table by:

   A. Listing characteristics that can be observed while examining a person

   B. Identifying which sensory modality is used to perceive the characteristic

Characteristics	Sensory Modality
EXAMPLE Foot slap while walking	Auditory and visual

4. Enter the letter by the structures in Figure 1-1, next to the correct label for that structure. You can also write the names of the structures on the figure.

_____ Anterior	_____ Posterior
_____ Proximal	_____ Distal
_____ Superior	_____ Inferior
_____ Medial	_____ Lateral

5. When the right arm and leg are considered together they can be referred to as:

   (Contralateral or Ipsilateral)

   _____

6. Using Figure 1-1 and the descriptive terms listed below, describe the location of the body segments that follow. Terms may be used more than once.

Medial	Superior	Proximal	Superficial	Anterior
Lateral	Inferior	Distal	Deep	Posterior

   A. Tibia: The _____ bone of the lower leg

   B. Fibula: The _____ bone of the lower leg

   C. Ribs in relationship to the scapula: _____

   D. The elbow joint is at which end of the humerus? _____

   E. The brachialis muscle lies underneath the biceps; therefore, it is _____ to the biceps.

   F. The head is _____ to the chest.

   G. The _____ end of the tibia is at the knee joint.

   H. The great toe is on the _____ side of the foot.

   I. The eyes are _____ and _____ to the mouth.

   J. The radius is on the _____ side of the forearm.

   K. The ulna is on the _____ side of the forearm.

   L. The scapula is on the _____ side of the trunk.

   M. The shoulder girdle is _____ to the pelvic girdle.

   N. Skin is _____ to muscle.

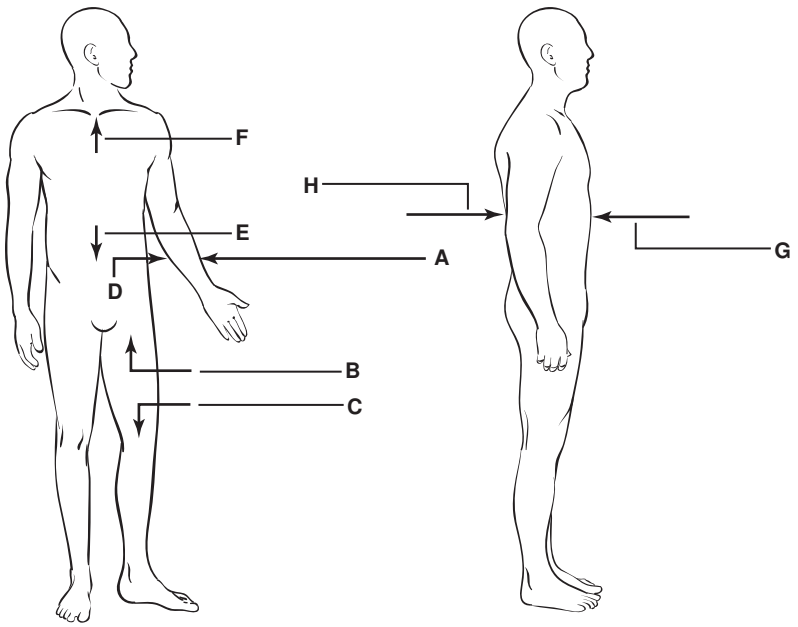

FIGURE 1-1 Descriptive terminology.

7. Match the major bone or feature of the body segment with the descriptive term for that segment.

_____ Arm	A. Cervical vertebrae
_____ Forearm	B. Chest
_____ Hand	C. Pelvis
_____ Thigh	D. Radius
_____ Leg	E. Femur
_____ Foot	F. Fingers
_____ Thorax	G. Tibia
_____ Abdomen	H. Humerus
_____ Neck	I. Toes

8. Describe and give an example of each of the types of motion listed below.

   Rectilinear motion:

   _____

   _____

   Curvilinear motion:

   _____

   _____

   Angular motion:

   _____

   _____

9. In which type of motion do all the parts move:

   A. The same distance: _____

   B. Different distances: _____

10. In Figure 1-2, identify the structure(s) that would be in linear motion and angular motion when the bicycle and rider are in motion.

    _____

FIGURE 1-2 Bicycle rider.

11. Match the joint motions that follow with the correct descriptions. The reference position is the anatomical position unless otherwise indicated. Use each answer only once.

_____ Pulling your scapulae together	A. Flexion
_____ Moving your leg toward the midline	B. Extension
_____ Rolling your arm outward	C. Hyperextension
_____ Moving your hand toward the thumb side	D. Abduction
_____ Turning your foot inward	E. Adduction
_____ Moving through a cone-shaped arc	F. Supination
_____ Moving your arm across the body at shoulder level	G. Pronation
_____ Moving your hand down the side of your leg	H. Ulnar deviation
_____ Shoulder motion during bowling backswing	I. Radial deviation
_____ Turning your palm posteriorly	J. Inversion
_____ Moving your arm out to the side	K. Eversion
_____ The position of the knee in standing	L. Lateral rotation
_____ The position of the forearm in anatomical position	M. Medial rotation
_____ Moving the thigh forward and upward	N. Lateral bending
_____ Synonymous with wrist adduction	O. Circumduction
_____ Moving your arm outward from 90 degrees of shoulder abduction	P. Horizontal abduction
_____ Moving your foot outward	Q. Horizontal adduction
_____ Moving your scapulae away from the midline	R. Protraction
_____ Turning your arm inward	S. Retraction

Lab Activities

Student's Name _____

Date Due _____

1. In a group, students perform the active motions that follow.

Shoulder:	Flexion	Extension
	Abduction	Abduction
	Horizontal abduction	Horizontal adduction
	Lateral rotation	Medial rotation
Elbow:	Flexion	Extension
Hip:	Flexion	Extension
	Abduction	Adduction
	Lateral rotation	Medial rotation
Knee:	Flexion	Extension

2. Perform the activities that follow as small groups. Make note of the speed and distance traveled by each person.
   A. Line students up shoulder to shoulder and instruct them to walk across the room keeping their line straight.
   B. Line students up shoulder to shoulder in the middle of the room and instruct them to walk in a circle with the student on the right end as the pivot or anchor.
   C. Repeat activity B with the student on the left end as the pivot or anchor.
   D. Compare the speed of movement of each student in activities A, B, and C.

   _____

   _____

   _____

   E. Compare distance traveled by each student in activities A, B, and C.

   _____

   _____

   _____

   F. What type of motion is performed in activity A?

   _____

   G. What type of motion is performed in activities B and C?

   _____

3. To practice palpation, use the finger pads of your right index and middle fingers. Place your fingertips lightly on the anterior surface of your left forearm, just proximal to the wrist, with your left wrist flexed. Extend your left wrist and note the changing sensations in your fingertips as wrist extension causes the tendons of the wrist and finger flexors to become taut. Move your fingertips medially and laterally (side to side) over the wrist and finger flexor tendons, making note of the changing sensations as you move over the tendons. Note how lightly you are touching and if you are able to palpate the changes. Describe what you feel in your right fingers as you palpate.

   _____

   _____

   _____

   _____

4. Palpate using your finger pads over the muscles on the lateral aspect of your forearm, just distal to the elbow joint. Using light pressure, move your fingers over the area. Describe what you feel (hard, soft, firm).

   _____

   _____

   _____

   _____

5. With your finger pads over the muscles on the lateral aspect of your forearm, just distal to the elbow joint, gradually increase the pressure of your palpation until it becomes slightly uncomfortable. Note how much pressure you are using. Patients, particularly those in pain or with fragile tissues, may not tolerate that amount of pressure. Repeat the muscle palpation using your fingertips. What problem may you encounter palpating with your fingertips?

6. Using your finger pads, palpate over the dorsal aspect of the elbow. This is a bony area. Describe what you feel.

7. Compare the pressure used to palpate at the wrist, forearm, and elbow. Compare and contrast the sensations you feel at each area.

8. Repeat the previous palpations on your partner. Did you feel the same characteristics as when you palpated yourself? Were you able to adjust your pressure to a comfortable level for your partner while still being able to make the observations you needed?

9. Place the dorsum (back) of your hand on the anterior surface of your partner's foot. Gradually move your hand proximally to just proximal to the knee joint. Describe the temperature of your partner's lower extremity.

10. Practice the observation and palpation skills that follow on at least two partners.

    A. Palpate the biceps brachii muscle belly and tendons. The biceps brachii is on the anterior surface of the humerus. Palpate the relaxed muscle, and then palpate while your partner is contracting the muscle.

        1) Describe how you used your hands to palpate (e.g., fingertips, light pressure).

        2) Describe the differences you observed when you palpated the relaxed muscle compared to the contracted muscle.

        3) In which state, relaxed or contracted, was the muscle tendon easier to palpate?

        _____ Relaxed _____ Contracted

    B. Palpate the medial and lateral epicondyles of the humerus—bony projections on the medial and lateral sides at the elbow.

        1) Describe how you used your hands to palpate.

        2) Describe what you felt.

    C. Palpate the patellar tendon—first with the quadriceps muscle relaxed, and then with your partner contracting the muscle. The patellar tendon is on the anterior proximal tibia just distal to the patella (kneecap).

        1) Describe how you used your hands to palpate.

2) Describe what you felt.

3) Did the tendon feel any different when the quadriceps muscle was contracting?

4) If you felt a difference in the tendon between the relaxed state and the contracted state, describe the difference.

5) Did contracting the muscle help you to find the tendon?

D. Palpate your partner's pulse at the radial artery, which is located on the anterior surface of the forearm on the lateral side.

1) Describe how you used your hand to palpate.

2) Describe how the pulse felt (weak, strong, regular, irregular).

E. Palpate the ulnar nerve on the posterior medial aspect of the elbow as the nerve passes just lateral to the medial epicondyle. (This is the nerve that activates when one hits the "funny bone.")

1) Describe how you used your hand to palpate the nerve.

2) Describe what you felt.

3) Describe how your partner reacted when you palpated the ulnar nerve with increasing pressure.

11. Posture examination is a visual observation that compares a person's posture to the normal or ideal posture. Symmetry and deviation from normal posture are noted. Because you have not studied posture yet, compare the second of the following two postures to the first, making note of major changes. Example: In the preferred standing position, your partner shifts a major portion of body weight to the left leg.

A. Observe your partner while he or she is standing erect with weight distributed equally on both feet, which are placed approximately 4 inches apart with the toes pointed forward.

B. Observe your partner standing in his or her preferred standing posture.

C. Describe any major differences between the two postures.

12. To practice visual observation, look at your partner.

A. Describe your partner's physical characteristics such as weight, height, and hair and eye color.

B. Make faces to represent different emotional and physical states such as happy, sad, mad, and in pain. Your partner is to guess which state you are displaying.

13. To practice auditory observations, start with your back to your partner so you cannot see what he or she is doing.

    A. While your partner is facing away from you, perform some activities of daily living (ADLs) such as taking off your shoes, removing your shirt, and walking. Ask your partner to describe what they heard and to tell you what activity you performed.

    _____

    _____

    B. If you know how, take your partner's blood pressure, paying particular attention to the sounds rather than the pressure reading. What sounds did you hear? Were there periods of silence? If so, when?

    _____

    _____

    C. Using a stethoscope, listen to your partner's heart and lungs. Describe the sounds you heard.

    _____

    _____

14. Perform as many of the motions that follow as possible while standing, sitting, lying supine, and side-lying.

Shoulder girdle:	Elevation and depression
	Protraction and retraction
	Upward and downward rotation
Shoulder:	Flexion, extension, and hyperextension
	Abduction and adduction
	Horizontal abduction and adduction
	Medial and lateral rotation
	Circumduction
Elbow:	Flexion and extension
Forearm:	Supination and pronation
Wrist:	Flexion and extension
	Radial and ulnar deviation
	Circumduction
Finger:	Flexion and extension
	Abduction and adduction
Thumb:	Flexion and extension
	Abduction and adduction
	Opposition
Hip:	Flexion, extension, and hyperextension
	Abduction and adduction
	Medial and lateral rotation
	Circumduction
Knee:	Flexion and extension
Ankle:	Dorsiflexion and plantar flexion
	Inversion and eversion
Toe:	Extension and flexion

15. Perform the previously listed movements in random order and have your partner name the movement that you are performing.

Post-Lab Questions

Student's Name _____

Date Due _____

After you have completed the Worksheets and Lab Activities, answer the following questions without using your book or notes. When finished, check your answers.

1. List the senses used when observing a person.

_____

_____

2. List at least two observable body structures on the:
   A. Anterior surface:

_____

_____

   B. Lateral surface:

_____

_____

   C. Posterior surface:

_____

_____

3. Define the terms that follow.
   A. Kinesiology:

_____

_____

   B. Flexion:

_____

_____

   C. Medial rotation:

_____

   D. Osteokinematics:

_____

4. List at least two structures of the body that are:
   A. Superior to the waist:

_____

_____

   B. Lateral to the sternum:

_____

_____

   C. Inferior to the hip:

_____

_____

   D. Distal to the elbow:

_____

_____

5. What type of motion is occurring in the activities that follow?

Activity	Type of Motion
Knee flexion	
Bowling ball rolling down the gutter	
Rounding the curve when running on a track	
A somersault	
A curve ball in baseball	

Chapter 2

Skeletal System

Pre-Lab Worksheets

Student's Name _____

Date Due _____

Complete the questions that follow prior to the lab class.

1. List five functions of the skeletal system.

   _____

   _____

   _____

   _____

   _____

2. Complete the table that follows, indicating whether the listed body parts are part of the axial or appendicular skeleton.

Body Part	Axial	Appendicular
Arms		
Head		
Vertebrae		
Lower extremities		

3. The organic (living) component of bone provides bone _____.

   The inorganic (nonliving) component of bone provides bone _____.

4. Match the term to the appropriate description.

_____ Compact bone	A. Area at each end of long bones
_____ Cancellous bone	B. Flared part of bone
_____ Epiphysis	C. Center of bone
_____ Epiphyseal plate	D. Lining of medullary canal
_____ Diaphysis	E. Hard, dense outer layer of all bones
_____ Medullary canal	F. Responsible for bone resorption
_____ Endosteum	G. Outer membrane of bone
_____ Osteoclasts	H. Area of new bone growth
_____ Metaphysis	I. Main shaft of bone
_____ Periosteum	J. Porous and spongy interior of bone

5. A pressure epiphysis is located at the _____ and is where bone _____ occurs.

   A traction epiphysis is located where _____ and is subjected to _____.

6. Where are osteoclasts located?

   _____

7. Enter the letter by the structures in Figure 2-1 next to the correct label for that structure. You can also write the names of the structures on the figure.

_____ Diaphysis

_____ Epiphysis

_____ Endosteum

_____ Epiphyseal plate

_____ Medullary canal

_____ Metaphysis

_____ Periosteum

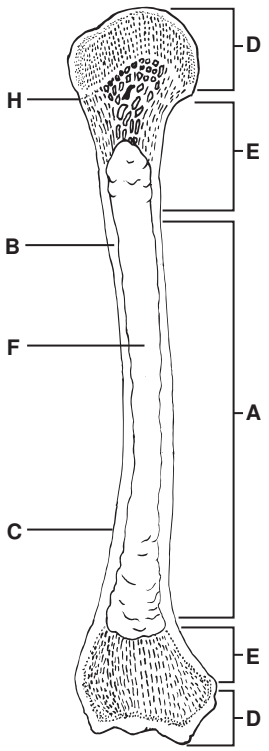

FIGURE 2-1 Longitudinal cross section of a long bone.

8. List five functions of the periosteum.

A. _____

_____

_____

B. _____

_____

_____

C. _____

_____

_____

D. _____

_____

_____

E. _____

_____

_____

9. Where does longitudinal bone growth occur?

_____

10. Complete the table that follows, indicating whether the terms are related to compact or cancellous bone.

Characteristic	Compact Bone	Cancellous Bone
Porous and spongy		
Hard and dense		
Covers outside of bone		
Inside portion of bone		

11. On Figure 2-2, label the bones, using the terms listed below.

_____ Flat bone _____ Irregular bone

_____ Long bone _____ Short bone

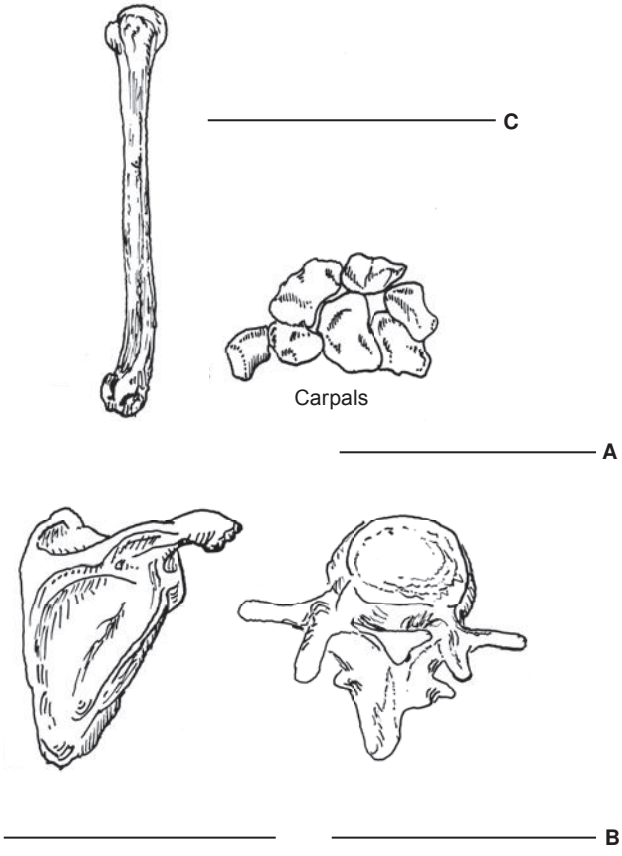

FIGURE 2-2 Types of bones.

Lab Activities

Student's Name _____

Date Due _____

1. The patella can be considered a sesamoid bone. With your partner long sitting (sitting on a mat or table with knees extended) and with muscles relaxed, grasp the patella with the thumb and index finger of one hand proximally and the thumb and index finger of the other hand distally.
   - Gently move the patella medially and laterally, superiorly and inferiorly. Note the amount of motion in each direction.
   - Palpate for other sesamoid bones such as on either side of the flexor hallucis longus on the bottom of the foot, at the head of the first metatarsal, and the flexor tendons of the thumb near the metacarpophalangeal and interphalangeal joints.

2. A. Using skeletons and models, find examples of the bony landmarks that follow. Describe where the landmark is located (using terms such as *proximal/distal, medial/lateral, superior/inferior,* and *anterior/posterior*) and give the name of the bone where you found the landmark.

   B. On your partner, palpate as many of the bony landmarks as possible.

Landmark	Location
EXAMPLE Trochanter	Proximal and lateral on femur
Foramen	
Fossa	
Groove	
Meatus	
Sinus	
Condyle	
Eminence	
Facet	
Head	
Crest	
Epicondyle	
Line	
Spine	
Tubercle	
Tuberosity	
Trochanter	

3. On a skeleton, identify the bones and bone groups that make up the axial skeleton and the appendicular skeleton. List the bones that are found in each group.

Skeleton	Bones and Bone Groups (e.g., carpals, ribs)
Axial	
Appendicular	

4. Using bones in the bone box, arrange the bones of the upper extremity and the bones of the lower extremity in proper anatomical orientation to one another to create the appendicular skeleton. Arrange an entire right side or left side.

5. Compare a cross section of the diaphysis of a long bone and a cross section of the epiphysis of a long bone. Complete the table below.

	Diaphysis	Epiphysis
Type of bone		
Thickness of outer layer of bone		
In living bone, the outer layer is covered in		

6. Using disarticulated bones, identify the structures listed below on several different bones. Can all of the parts be found on each bone? _____

Epiphysis	Epiphyseal plate	Diaphysis
Endosteum	Metaphysis	Periosteum

7. Using the skeleton and models:
   A. Find examples of the types of bones that follow.
   B. Name an example of each type of bone.

Type of Bone	Example
Short	
Flat	
Long	
Irregular	
Sesamoid	

Post-Lab Questions

Student's Name _____

Date Due _____

After you have completed the Worksheets and Lab Activities, answer the questions that follow without using your book or notes. When finished, check your answers.

1. The function of the skull is to protect the brain. As the skull matures, the bones fuse together. Under what circumstances is this a disadvantage of the mature skull?

   _____

2. Describe the function of the:

   A. Axial skeleton:

   _____

   _____

   B. Appendicular skeleton:

   _____

   _____

3. What is the result of a loss of the inorganic component of bone?

   _____

   _____

4. Why is cancellous bone lighter than compact bone?

   _____

   _____

5. How does a traction epiphysis affect the shape of a bone?

   _____

   _____

6. What is the function of the parts of a bone that follow?

Bone Part	Function
Epiphysis	
Epiphyseal plate	
Diaphysis	
Medullary canal	
Endosteum	
Osteoclasts	
Metaphysis	
Periosteum	

7. Identify whether the types of bones listed below are typically part of the axial or appendicular skeleton.

Type of Bone	Axial Skeleton	Appendicular Skeleton
Long		
Short		
Flat		
Irregular		

8. Match the descriptions of bone markings that follow with the correct term. Use each term only once.

_____ Projection above a condyle	A. Sinus
_____ Rounded projection at the end of a joint	B. Tubercle
_____ Hole	C. Crest
_____ Sponge-like space filled with air	D. Spine
_____ Tube-shaped opening	E. Foramen
_____ Rounded projection beyond a narrow neck portion	F. Condyle
_____ Less prominent ridge	G. Groove
_____ Large, rounded projection	H. Fossa
_____ Flat articular surface	I. Tuberosity
_____ Very large projection	J. Head
_____ Large depression	K. Meatus
_____ Linear depression	L. Trochanter
_____ Ridge	M. Epicondyle
_____ Small, rounded projection	N. Line
_____ Sharp projection	O. Facet

9. Where does growth of long bones occur?

_____

10. Why are epiphyseal plates not found in mature bone?

_____

_____

11. What function do sesamoid bones serve?

_____

_____

Chapter 3

Articular System

Pre-Lab Worksheets

Student's Name _____

Date Due _____

Complete the questions that follow prior to the lab class.

1. What are the three basic types of joints?

   A. _____

   B. _____

   C. _____

2. Which type of joint is the most typical of the joints of the appendicular skeleton?

   _____

3. Rank the three basic types of joints from most to least amount of movement permitted.

   Most: _____

   _____

   Least: _____

4. Match the type of fibrous joint with the appropriate description.

   _____ Synarthrosis A. Bolted together

   _____ Syndesmosis B. Ligaments join the bones

   _____ Gomphosis C. Fibrous periosteum between bones

5. Give an example of each of the types of fibrous joints that follow.

   A. Synarthrosis: _____

   B. Syndesmosis: _____

   C. Gomphosis: _____

6. What is another name for a synovial joint?

   _____

7. Which of the three basic types of joints provides for:

   A. Mobility: _____

   B. Stability: _____

8. List an example of each of the synovial joints that follow.

   A. Nonaxial joint: _____

   B. Uniaxial joint: _____

   C. Biaxial joint: _____

   D. Triaxial joint: _____

9. Enter the letter by the structures in Figure 3-1 next to the correct label for that structure. You can also write the names of the structures on the figure.

_____ Articular cartilage
_____ Bone
_____ Ligament
_____ Joint capsule
_____ Joint space
_____ Synovial fluid
_____ Synovial membrane

10. Match the descriptions with the correct term that follows. Use each term only once.

_____ Enclosed cavity filled with fluid that prevents friction on moving parts	A. Joint capsule
_____ Strong cord of connective tissue that attaches a muscle to another part	B. Synovial membrane
_____ The inside lining of the joint capsule	C. Synovial fluid
_____ Strong, fibrous connective tissue band that attaches bone to bone	D. Tendon
_____ Flat, thin, fibrous sheet of connective tissue that attaches a muscle to another part	E. Articular cartilage
_____ Fibrous connective tissue that surrounds a joint	F. Bursa
_____ Sheath of connective tissue that surrounds a muscle	G. Aponeurosis
_____ Fluid secreted from inside the lining of the joint capsule that lubricates the joint	H. Ligament
_____ Smooth covering of bone ends	I. Fascia

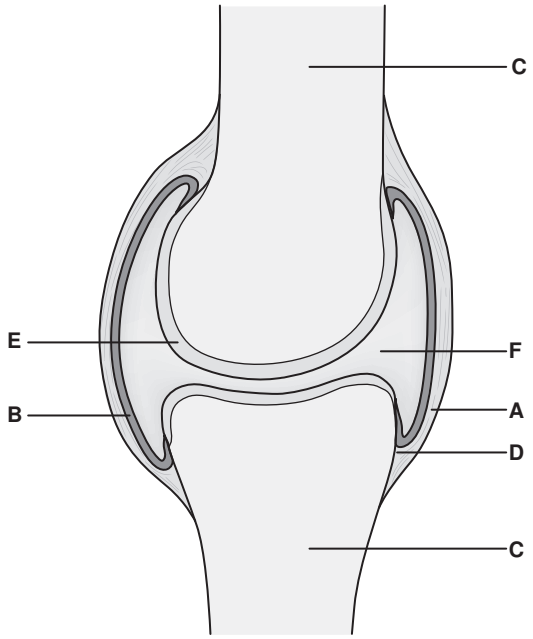

FIGURE 3-1 Synovial Joint.

11. For each drawing (Figs. 3-2 through 3-4), fill in the blanks regarding planes and axes.

A. In Figure 3-2:

This is the _____ plane. It is associated with the _____ axis.

Describe the direction of the axis.

_____

List the motions that occur in this plane around this axis.

_____

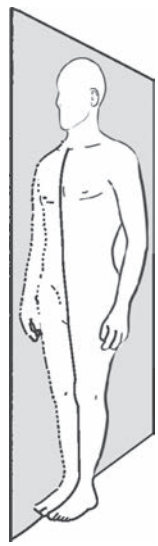

FIGURE 3-2

B. In Figure 3-3:

This is the _____ plane. It is associated with the _____ axis.

Describe the direction of the axis.

_____

List the motions that occur in this plane around this axis.

_____

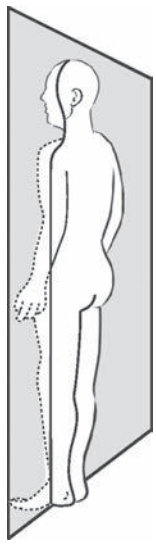

FIGURE 3-3

C. In Figure 3-4:

This is the _____ plane. It is associated with the _____ axis.

Describe the direction of the axis.

_____

List the motions that occur in this plane around this axis.

_____

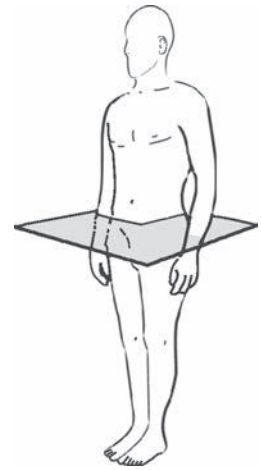

FIGURE 3-4

12. Indicate the degrees of freedom for each of the joints that follow.

Joint	One	Two	Three
Shoulder			
Elbow			
Wrist			
Hip			
Knee			
Ankle			

Lab Activities

Student's Name _____

Date Due _____

1. In a group, students perform the active motions that follow.

Shoulder girdle	Elevation	Depression
	Protraction	Retraction
Shoulder	Flexion	Extension
		Hyperextension
	Abduction	Adduction
	Horizontal adduction	Horizontal abduction
	Medial rotation	Lateral rotation
Elbow	Flexion	Extension
Forearm	Supination	Pronation
Wrist	Flexion	Extension
	Radial deviation	Ulnar deviation
Thumb	Flexion	Extension
	Abduction	Opposition
Hip	Flexion	Extension
		Hyperextension
	Abduction	Adduction
	Medial rotation	Lateral rotation
Knee	Flexion	Extension
	Medial rotation	Lateral rotation
Ankle	Dorsiflexion	Plantar flexion
Foot	Inversion	Eversion

2. Using models, locate the components of synovial joints listed below, and note the relationships of the components to one another.

Bones	Ligaments	Capsule
Hyaline cartilage	Articular cartilage	Synovial membrane
Menisci	Labrum	Disks

3. Using a skeleton or models, identify and examine examples of the types of joints that follow.

   A. Fibrous joints: _____

      Synarthrosis: _____

      Syndesmosis: _____

      Gomphosis: _____

   B. 1) Cartilaginous joints: _____

      2) What is another name for this type of joint?

      _____

   C. 1) Synovial joints: _____

      2) What is another name for this type of joint?

      _____

   D. Nonaxial joints: _____

   E. Uniaxial joints: _____

   F. 1) Biaxial joints: _____

      2) What is another name for this type of joint?

      _____

   G. 1) Triaxial joints: _____

      2) What is another name for this type of joint?

      _____

4. Standing next to a wall so that your left shoulder and hip are against the wall, individually perform flexion and extension of each of the left extremity joints that follow: shoulder, elbow, hip, and knee.

   A. In what plane were you moving?

   _____

   B. What is the axis for that plane?

   _____

5. Standing in anatomical position with your back against a wall, perform the motions that follow.

   A. Slide one arm along the wall until your hand points toward the ceiling.

   B. Return your arm to anatomical position by moving it along the wall.

   C. Move one leg to the side, sliding your heel along the wall.

   D. Return your leg to anatomical position, keeping it in contact with the wall.

      1) What motion did you perform as you moved your extremity away from your body?

      _____

      2) What motion did you perform as you moved your extremity back to the anatomical position?

      _____

3) In what plane were you moving?

_____

4) What is the axis for that plane?

_____

6. Stand facing a counter with your upper arms close to your body, your elbows at approximately 90 degrees of flexion, and your forearms pronated, placing your hands palm-down on the countertop. Keeping your hands in contact with the surface of the countertop, slide your palms on the countertop:
   - away from the midline of your body.
   - toward the midline of your body.

   A. What motion did you perform when your palms moved away from the midline of your body?

   _____

   B. What motion did you perform when your palms moved toward the midline of your body?

   _____

   C. In what plane were you moving?

   _____

   D. What is the axis for that plane?

   _____

7. Sitting on a chair, keeping your knee flexed to about 90 degrees, move your lower leg:
   - away from the midline of your body.
   - toward the midline of your body.

   A. What motion did you perform when you moved your leg away from the midline of your body (move your foot out to the side)?

   _____

   B. What motion did you perform when you moved your leg toward the midline of your body (move your foot in toward your other foot)?

   _____

   C. In what plane were you moving?

   _____

   D. What is the axis for that plane?

   _____

8. Using models of joints, a skeleton, and your own body, move the joints listed below through the motions normally permitted to determine the degrees of freedom and the specific motions. Record your findings on the chart that follows.

Joint	Degrees of Freedom	Motions
Shoulder		
Elbow		
Wrist		
Hip		
Knee		

9. What is the relationship between the degrees of freedom and the types of joint?

   _____

10. Compare models of the acetabulum and glenoid fossa with and without their labrum. How does the presence or absence of the labrum change the structure of the joint?

    _____

    _____

Post-Lab Questions

Student's Name _____

Date Due _____

After you have completed the Worksheets and Lab Activities, answer the questions that follow without using your book or notes. When finished, check your answers.

1. Compare and contrast fibrous joints, cartilaginous joints, and synovial joints.

   A. What are the structural similarities?

   _____

   _____

   _____

   B. What is the difference in the amount of motion permitted?

   _____

   _____

2. Diarthrodial joints can be classified based on their characteristics. Fill in the blanks with the appropriate information. There may be more than one example.

Number of Axes	Shape of Joint	Joint Motions Allowed	Example
Nonaxial 0	Plane	Minimal	Metatarsals
Uniaxial 1			
Biaxial 2			
Triaxial 3			

3. What structure(s) may reinforce a joint capsule?

   _____

4. List the structure(s) that lubricate and supply nutrition to joint surfaces.

   _____

5. List the five features of a synovial joint.

   _____

   _____

   _____

   _____

   _____

   _____

6. Place a check in the box that corresponds to the motions that generally occur in each plane about its axis.

Planes/ Axes	Flexion/ Extension	Adduction/ Abduction	Medial/ Lateral Rotation
Sagittal plane/ Frontal axis			
Frontal plane/ Sagittal axis			
Transverse plane/ Vertical axis			

7. For the joints listed, indicate in which plane the joint normally can actively move.

Plane	Shoulder	Wrist	Knee	Ankle
Sagittal				
Frontal				
Transverse				

8. Define degrees of freedom.

_____

9. Give examples of joints that have:

   A. One degree of freedom: _____

   _____

   B. Two degrees of freedom: _____

   _____

   C. Three degrees of freedom: _____

   _____

10. Of the joints that follow, which generally have more degrees of freedom?

_____ Axial skeleton _____ Appendicular skeleton

11. The more degrees of freedom a joint has, the more likely its function is:

_____ mobility. _____ stability.

12. Underline the correct term inside the parentheses.

    The axial skeleton functions to provide (mobility/stability) for the (mobility/stability) of the appendicular skeleton. The abilities of the axial and appendicular skeleton combine to permit the myriad of movements the human uses in daily activities.

Chapter 4

Arthrokinematics

Pre-Lab Worksheets

Student's Name _____

Date Due _____

Complete the questions that follow prior to the lab class.

1. Match the types of normal end feels and their definitions to the alternative name for that end feel.

_____ Has considerable give	A. Hard
_____ Abrupt limit to motion	B. Soft
_____ Slight give at end of motion	C. Firm

2. Match the types of abnormal end feels with their definitions.

_____ Soft, "wet sponge" feel	A. Bony
_____ Rebound movement at end of ROM	B. Boggy
_____ Sudden hard stop before end of ROM	C. Muscle spasm
_____ Reflex muscle guarding	D. Empty
_____ Pain, not mechanical constraint, limits movement	E. Springy block

3. Match the terms that follow with their definitions.

_____ Passive oscillatory motions applied by external force	A. Component movements
_____ Forceful external force applied within a short range	B. Joint play
_____ Accessory joint movements resulting from external force	C. Joint mobilization
_____ Motions that facilitate active motion	D. Manipulation

4. Underline the correct term. A convex surface is curved inward/outward. A concave surface is curved inward/outward.

5. An ovoid joint is formed by two bones forming a _____ relationship. One bone's surface is _____ and the other is _____.

6. Each of the two bones that make a sellar or saddle-shaped joint have a joint surface that is _____ and a joint surface that is _____ .

7. Match the terms for arthrokinematic motion with their definitions.

_____ Same point on each surface remains in contact with each other	A. Roll
_____ One point on a joint surface contacts new points on the other surface	B. Spin
_____ New points on each surface come into contact throughout the motion	C. Glide

8. Apply the concave-convex rule to identify the type of joint surface (concave/convex) moving in each of the statements that follow. Underline the correct term.
   A. Which joint surface (concave or convex) moves in the opposite direction as the moving body segment?
   B. Which joint surface (concave or convex) moves in the same direction as the moving body segment moves?

9. Match the joint surface position with its description.

_____ Close-packed position	A. Congruent joint surfaces
_____ Open-packed position	B. Incongruent joint surfaces

10. Match the type of force with its definition.

_____ Joint surfaces are pulled apart	A. Traction, distraction, or tension force
_____ Joint surfaces move parallel and in opposite directions of each other	B. Approximation, compression force
_____ Joint surfaces are pushed closer together	C. Shear force

11. When bending the trunk to the right:
   A. The force acting on the right side is _____ because the curve on the right side is _____.
   B. The force acting on the left side is _____ because the curve on the left side is _____.

Lab Activities

Student's Name _____

Date Due _____

1. Passively extend your partner's elbow. When you reach the end of the range, the humerus and ulna come together, locking the elbow in place. The term used to describe this end feel is _____.

2. Have your partner lie supine. Passively flex his or her hip. When you reach the end of the range, there is more "give" than at the end of elbow extension. This is because there is much more muscle bulk, and the femur and acetabulum do not lock together. The term used to describe this end feel is _____.

3. With your partner lying prone, passively hyperextend his or her hip. When you reach the end of the range, there is tension on the anterior ligaments and muscles of the hip. The term used to describe this end feel is _____.

4. Perform the motions that follow on several classmates. Describe the end feel of each motion. Was the end feel for the same joint the same on all of your classmates?

Motion	End Feel
Elbow flexion	
Elbow extension	
Wrist flexion	
Knee extension	
Hip flexion with knee flexion	
Hip flexion with knee extended	

5. Perform shoulder flexion, first while maintaining medial rotation and then with lateral rotation. Compare the amount of range of motion achieved with each movement.

   A. Which movement has greater ROM?

   _____ Medial rotation _____ Lateral rotation

   B. This is an example of what type of arthrokinematic motion? _____

6. Sitting and facing your partner, with your partner's hand supported on a table, grasp your partner's index finger middle phalange with one hand and his or her index finger distal phalange with your other hand. While holding the middle phalange stable, move the distal phalange from side to side.

   A. Can a person perform this movement voluntarily?

   _____

   B. What is this movement called?

   _____

7. Using a skeleton and bones, locate bones whose articular surfaces have the characteristics that follow. Describe where on the bone the characteristic is found (proximal/distal; medial/lateral; anterior/posterior).

   A. Concave surface:

Bone	Location
Scapula	
Radius	
Tibia	
Ilium	
Sacrum	

   B. Convex surface:

Bone	Location
Humerus	
Femur	
Talus	
Sacrum	

8. Examine the carpometacarpal (CMC) joint of the thumb and fingers.

   A. How do the joint surfaces of the thumb differ from the joint surfaces of the fingers?

   _____

   _____

   B. What is the type of joint for each?

   _____

   _____

9. Observe the distal end of a femur and the proximal end of a tibia.

   A. Which has the larger articular surface?

   _____

   B. Move the tibia on the femur as if performing extension and flexion. Does the tibia move over the entire articular surface of the femur?

   _____

   C. As you move the tibia on the femur, as if performing extension, move the femur posteriorly on the tibia. Did the tibia move over more of the articular surface of the femur this time?

   _____

   D. The posterior movement of the femur is an example of what kind of arthrokinematic motion?

   _____

   E. The movement of the tibia is an example of what kind of arthrokinematic motion?

   _____

10. Using a skeleton or the articulated upper extremity bones, observe the proximal end of the radius while performing pronation and supination.

    A. Describe the movement of the radius on the humerus.

    _____

    B. This movement is an example of what type of arthrokinematic motion?

    _____

11. Using a skeleton or disarticulated upper extremity bones, observe the movement of the head of the humerus while performing shoulder joint medial and lateral rotation. Indicate which of the movements that follow occurs as the humerus moves on the glenoid fossa.

    _____ Roll _____ Spin _____ Glide

12. Place two small sticky notes with large dots on the lateral surface of your partner's arm, with one dot over the lateral epicondyle at the elbow and the other at the shoulder on the greater tubercle. Starting in the anatomical position, have your partner slowly flex the shoulder while you observe the positions of the dots. Underline the correct answers.

    A. When performing shoulder flexion, which joint surface is moving—the *concave* or the *convex* surface?

    B. In the starting position, the dot at the elbow is *superior* or *inferior* to the dot at the shoulder.

    C. At the end of shoulder flexion, the dot at the elbow is *superior* or *inferior* to the dot at the shoulder.

    D. This is an example of the concave-convex rule describing movement of the convex joint surface. According to the concave-convex rule, the convex joint surface moves in the *same* or *opposite* direction as the body segment's motion.

13. Place two small sticky notes with large dots on the lateral aspect of your partner's lower leg, with one dot over the lateral malleolus and the other over the head of the fibula. Starting in the anatomical position, have your partner slowly flex the knee moving the tibia on the femur while you observe the positions of the dots. Underline the correct answers.

    A. When performing knee flexion and extension, moving the tibia on the femur, the moving joint surface is *concave/convex*?

    B. During flexion, the proximal dot moved *superiorly/inferiorly*?

    C. During flexion, the distal dot moved *superiorly/inferiorly*?

    D. This is an example of the concave-convex rule describing movement of the concave joint surface. According to the concave-convex rule, the concave joint surface moves in the *same/opposite* direction as the body segment's motion.

14. Using a skeleton or bones, observe and describe the close-packed or open-packed positions of the joints that follow.

Joint	Close-Packed	Open-Packed
Glenohumeral		
Elbow: ulnohumeral		
Interphalangeal		
Hip		
Knee		
Ankle: talocrural		

Post-Lab Questions

Student's Name _____

Date Due _____

After you have completed the Worksheets and Lab Activities, answer the questions that follow without using your book or notes. When finished, check your answers.

1. Give an example of each of the end feels that follow. Try to use examples not described in the textbook.
   A. Bony: _____
   B. Firm: _____
   C. Soft: _____
   D. Empty end feel: _____
   E. Springy block: _____
2. What arthrokinematic motion(s) accompanies:
   A. Shoulder abduction? _____
   B. Knee extension? _____
3. A saddle joint is unique because each bone of the joint has surfaces that are:

   _____
4. Give an example of each of the descriptions that follow.
   A. Joint movement with large amount of roll:

      _____
   B. Joint movement with large amount of glide:

      _____

      _____
   C. Joint movement with large amount of spin:

      _____
5. When a person assumes sitting from standing, the knee is flexing.
   A. When performing this movement, is the concave surface moving on the convex surface or is the convex surface moving on the concave surface? Underline the correct response.
   B. During assumption of standing from sitting, according to the concave-convex rule, when the _____ surface moves on the _____ surface, the _____ joint surface moves in the _____ direction as the body segment movement.
6. Is accessory motion or joint play best observed in a *close-packed* or an *open-packed* position? Why?

   _____

   _____
7. Stand on a footstool with your right leg close to the edge of the footstool and your left leg hanging off the footstool with a cuff weight around the ankle. The force through the right lower extremity is *approximation/traction,* and the force through the left lower extremity is *approximation/traction*. Underline the correct answers.
8. In the sitting position, turn your head and upper body while keeping your lower body stationary. This movement is _____, and it occurs in the _____ plane about the _____ axis. The force producing this motion is a _____ force.
9. Describe typical exercises or activities that apply:
   A. A traction force through the upper extremities:

      _____
   B. An approximation force through the lower extremities:

      _____

10. When bending the trunk to the left:

    A. On which side are structures compressed?

    _____

    B. On which side are structures under tension?

    _____

    C. With the trunk erect, what force is applied to the structures of the trunk as the trunk is twisted to one side or the other?

    _____

11. Of the descriptions that follow, a boggy end feel occurring before complete knee flexion is likely indicative of which?

    _____ bone on bone
    _____ soft tissue approximation
    _____ swelling
    _____ pain

12. Of the causes listed, when motion is stopped by the patient prior to completing full ROM, the likely cause is which?

    _____ muscle spasm
    _____ pain
    _____ the patient does not like you
    _____ swelling

Chapter 5

Muscular System

Pre-Lab Worksheets

Student's Name _____

Date Due _____

Complete the questions that follow prior to the lab class.

1. Match the terms that follow with their definitions.

_____ Muscle contraction without joint movement	A. Reversal of muscle action
_____ Distance between maximum contracted and extended length	B. Normal resting length
_____ The origin of the contracting muscle moves toward the insertion	C. Tone
_____ Constant speed with variable resistance	D. Tenodesis
_____ Not as effective as the prime mover	E. Isometric contraction
_____ Slight tension in a muscle	F. Isokinetic contraction
_____ Position when muscle is unstimulated	G. Assisting mover
_____ Can produce hand opening and closing	H. Muscle excursion

2. Muscles have origins and insertions. Which is generally proximal?

_____

3. A. The sternocleidomastoid muscle typically flexes the head and neck. The mastoid process (on the head) is the insertion, and the sternum and clavicle are the origin. Is the origin moving toward the insertion, or is the insertion moving toward the origin during flexion of the head and neck?

_____

B. When you have worked hard and are short of breath, the sternocleidomastoid helps you to take deeper breathes by lifting the chest. In this case, is the origin moving toward the insertion, or is the insertion moving toward the origin?

_____

C. Muscles acting in this manner are said to be performing a:

_____

4. Match the muscle with the characteristic associated with its name.

	Location	Shape	Action	Number of Heads	Attachments	Direction of Fibers	Muscle Size
Rhomboids							
Abductor digiti minimi							
Biceps brachii							
Quadriceps femoris							
Pectoralis major							
Gluteus medius							
Sternocleidomastoid							

5. Enter the letter by the structures in Figure 5-1, next to the correct label for that structure. You can also write the names of the structures on the figure.

_____ Bipennate
_____ Fusiform
_____ Multipennate
_____ Unipennate
_____ Strap
_____ Triangular

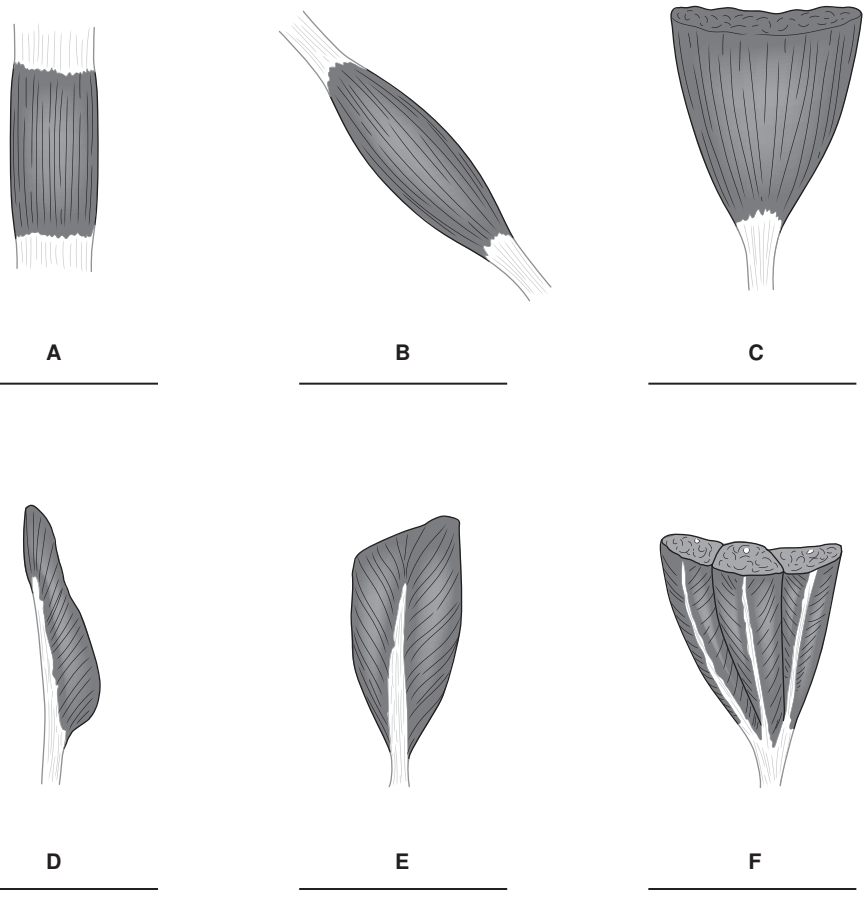

FIGURE 5-1 Muscle shapes.

6. Using the terms listed in Question 5, name the type of muscle fiber arrangement for each muscle:

Muscle	Fiber Arrangement
Deltoid	
Pectoralis major	
Flexor pollicis longus	
Biceps brachii	
Rectus femoris	
Sternocleidomastoid	

7. Match the muscle characteristic with the correct description. Use each term only once.

_____ Ability to be stretched beyond normal resting length	A. Irritability
_____ Ability to receive and respond to a stimulus	B. Contractility
_____ Ability to produce tension	C. Extensibility
_____ Ability to return to normal length	D. Elasticity

8. A muscle with a resting length of 4 inches can be shortened approximately 2 inches and lengthened 4 inches. Therefore, it has an excursion of _____.

9. A muscle that cannot be lengthened simultaneously over all the joints it crosses is said to be *actively/passively* insufficient. Underline the correct answer.

10. Stretching a multijoint muscle is achieved by positioning the joints to cause the muscle to be in its:

_____ shortened position.
_____ resting position.
_____ lengthened position over all joints it crosses.
_____ lengthened position at some joints and shortened at other joints.

11. The advantage of a two-joint muscle that has opposing actions at the joints it crosses is that it can maintain greater contractility through its range, because while it is _____ over one joint, it is being _____ over the other joint.

12. Identify the type of muscle contraction described below as eccentric (E) or concentric (C).

_____ Lengthening contraction
_____ Shortening contraction
_____ Insertion moves toward origin
_____ Insertion moves away from origin
_____ Isotonic contraction
_____ Muscle contraction moves the body segment against gravity
_____ Muscle contraction slows the pull of gravity on the body segment

13. Complete the statements that follow using the terms listed below.

Agonist	Antagonist	Cocontraction
Neutralizer	Stabilizers	Synergists

A. The shoulder girdle muscles act as _____ when one lifts a book off the table.

B. When a muscle acts to eliminate undesired motions during an activity, it is functioning as a(n) _____.

C. Contracting the quadriceps and hamstring muscles simultaneously is an example of _____.

D. Muscles that are primarily responsible for producing a specific movement are called the _____.

E. When the biceps are contracting, the triceps muscle is the _____.

F. The elbow has three muscles that can produce flexion. When more than one muscle is working, the muscles are acting as _____.

G. When the wrist flexors and extensors produce ulnar deviation, each muscle is also acting as a(n) _____.

14. The angle of pull of a muscle is determined, in part, by the relationship of the muscle to the _____ it crosses.

15. Indicate whether each of the activities that follow is an example of an open kinetic chain (O) or a closed kinetic chain (C).

    _____ A. The upper extremity when one is walking and carrying a book bag

    _____ B. The upper extremity when one is doing push-ups

    _____ C. The upper extremity when one is supported on crutches

    _____ D. The lower extremities when one is swinging from an overhead bar

    _____ E. The lower extremities when one is performing wall slides

    _____ F. The lower extremity being used to kick a ball

Lab Activities

Student's Name _____

Date Due _____

1. Using a skeleton, locate the attachments of the muscles listed below. Palpate on your partner the origins and insertions of the muscles listed below. Indicate which, origin or insertion, is located proximally and which is located distally. Remember that the proximal attachment is also usually the more stable attachment, and the distal attachment is the more movable attachment.

Muscle	Origin	Insertion	Proximal	Distal
Brachioradialis	Lateral supracondylar ridge on the humerus	Styloid process of radius		
Teres minor	Axillary border of scapula	Greater tubercle of humerus		
Rectus abdominis	Pubis	Costal cartilages of fifth, sixth, and seventh ribs		
Sartorius	Anterior superior iliac spine	Proximal medial aspect of tibia		
Soleus	Posterior tibia and fibula	Posterior calcaneus		

2. Using illustrations from the Lippert text, locate the muscles listed below on your partner and yourself. Use a skin pencil or a water-soluble marker to draw over your partner's muscles, showing the muscle fiber arrangement.

Deltoid Pectoralis major Flexor pollicis longus
Biceps brachii Rectus femoris Sternocleidomastoid
Rhomboids

3. Have your partner assume a supine position. Standing next to your partner's right lower extremity, place the heel of her or his lower extremity in the palm of your right hand. Place your left hand under your partner's right thigh.

   A. Slowly flex and then extend your partner's hip and knee simultaneously. Note the amount of "resistance" you feel while moving your partner's lower extremity. Some people have a difficult time letting someone else move their body parts; however, if your partner is relaxed, you will feel the normal resting tone of his or her lower extremity muscles.

4. With your partner in a supine position, stand next to her or his right lower extremity and place the heel of her or his lower extremity in the palm of your right hand. Place your left hand under your partner's right thigh.

   A. Slowly flex and then extend your partner's hip and knee simultaneously. Note the amount of hip flexion.

   B. Next, slowly flex and then extend your partner's hip while keeping the knee extended (straight). Note the amount of hip flexion your partner has when the knee remains extended. Hip flexion with the knee extended (straight) is known as a straight leg raise—SLR.

      1) Was the amount of hip flexion more, the same, or less with knee extended compared to hip flexion with the knee flexed? _____

      2) Was the result what you expected? _____

      3) Is this an example of active or passive insufficiency? _____

4) Which muscle(s) was (were) being lengthened simultaneously over all the joints they crossed when you moved your partner through the SLR?

_____

_____

5. Perform the activities that follow on your partner.

A. With your partner in a supine position, perform simultaneous hip and knee flexion. Note the amount of knee flexion obtained when the hip is flexed.

B. Have your partner assume a prone position. Align the thigh in anatomical position. Slowly flex the knee of the same lower extremity you had moved when your partner was supine. Note the amount of knee flexion motion present now that the hip is extended.

1) Was the amount of knee flexion *more, the same,* or *less* with the hip extended compared to knee flexion with the hip flexed? _____

2) Was the result what you expected? _____

3) Is this an example of *active/passive* insufficiency? Underline the correct answer.

4) Which muscle(s) was (were) being lengthened simultaneously over all the joints they cross when you moved your partner through knee flexion with the hip extended?

_____

_____

6. Perform the activities that follow on your partner.

A. With your partner sitting over the side of a treatment table with her or his knee at about 90 degrees of flexion, resist your partner's isometric knee flexion. Note how strong the knee flexors are in this position.

B. Have your partner assume a prone position with hip extended and the same knee flexed to 90 degrees. Repeat the resisted isometric contraction of the knee flexors, noting the strength of the knee flexors.

C. Have your partner assume a prone position with hip extended and flex her or his knee through as much of its range of motion as possible (more than 90 degrees). Repeat the resisted isometric contraction at the end of the motion, noting the strength of the knee flexors. Be cautious with the resistance offered because your partner may develop a muscle cramp.

1) Describe the hip and knee position in these three scenarios:

Hip and Knee Position	Hip	Knee
Sitting on side of table		
Prone with knee at 90 degrees		
Prone with maximum knee flexion		

2) Was the strength of the knee flexors the same in all three positions? _____

3) If not, in which position were the knee flexors strongest? _____ weakest? _____

4) Is the weakest position an example of *active/passive* insufficiency? Underline the correct answer.

7. When your partner performs the maximum knee flexion possible in the prone position, how do you determine if she or he is experiencing active insufficiency of the knee flexors or passive insufficiency of the knee extensors?

_____

_____

_____

_____

8. As a general rule, the statements that follow describe muscle contractions in relation to gravity.

   A. When joint movement occurs against gravity, the agonist performs which type of contraction?

   _____ Isometric _____ Concentric
   _____ Eccentric _____ None

   B. When joint movement occurs against gravity, the antagonist performs which type of contraction?

   _____ Isometric _____ Concentric
   _____ Eccentric _____ None

   C. When a muscle contracts to prevent an undesired motion of another muscle, the contraction is usually?

   _____ Isometric _____ Concentric
   _____ Eccentric _____ None

   D. When joint movement occurs in the same direction that gravity would produce movement, the agonist performs which type of contraction?

   _____ Isometric _____ Concentric
   _____ Eccentric _____ None

   E. When performing an eccentric contraction, the agonist is acting to

   _____ overcome gravity.
   _____ slow down gravity.

   F. When performing a concentric contraction, the agonist is acting to

   _____ overcome gravity.
   _____ slow down gravity.

9. Throughout this lab manual, you will be asked to analyze activities to determine the type of muscle contractions required to perform the activity. The general rule is that when a muscle is acting to **overcome** gravity or body weight, the muscle is performing a concentric (shortening) contraction and when a muscle is acting to **slow down** gravity, the muscle is performing an eccentric (lengthening) contraction. In the supine position, perform a straight leg raise.

   A. Name the muscle group acting at the hip to perform the SLR. _____

   B. Name the antagonist muscle group at the hip. _____

   C. As the leg is raised, select the type of contraction the hip agonist is performing.

   _____ Isometric _____ Concentric
   _____ Eccentric _____ None

   D. As the leg is lowered, select the type of contraction the hip agonist is performing.

   _____ Isometric _____ Concentric
   _____ Eccentric _____ None

   E. Name the muscle group acting at the knee to maintain it extended. _____

   F. Name the antagonist muscle group at the knee. _____

   G. As the leg is raised, select the type of contraction the knee agonist is performing.

   _____ Isometric _____ Concentric
   _____ Eccentric _____ None

   H. As the leg is lowered, select the type of contraction the knee agonist is performing.

   _____ Isometric _____ Concentric
   _____ Eccentric _____ None

10. Move from a sitting to a standing position:

   A. The lower extremities are moving in

   _____ an open kinetic chain.
   _____ a closed kinetic chain.

   B. Which hip and knee muscle groups are the agonists?

   _____ Extensors _____ Flexors

   C. The agonists are performing what type of contractions?

   _____ Isometric _____ Concentric
   _____ Eccentric _____ None

11. From a standing position, sit down.

    A. The lower extremities are moving in

    _____ an open kinetic chain.
    _____ a closed kinetic chain.

    B. Which muscle groups are the agonists?

    _____ Extensors _____ Flexors

    C. The agonists are performing what type of contractions?

    _____ Isometric _____ Concentric
    _____ Eccentric _____ None

12. Examine the location of the biceps brachii on the anterior surface of the arm. The insertion of its tendon on the radius indicates that the biceps will flex the elbow and supinate the forearm.

    A. When the elbow is in extension with the forearm supinated and the biceps performing an isometric contraction, in terms of angle of pull, what force does the biceps exert on the elbow?

    _____ Approximation _____ Traction

    B. When the elbow is in full flexion with the forearm supinated and the biceps performing an isometric contraction, in terms of angle of pull, what force does the biceps exert on the elbow?

    _____ Approximation _____ Traction

Post-Lab Questions

Student's Name _____

Date Due _____

After you have completed the Worksheets and Lab Activities, answer the questions that follow without using your book or notes. When finished, check your answers.

1. A. When the agonist is contracting to overcome the resistance of gravity, the body part is moving in the *same/opposite* direction as the force of gravity. Underline the correct answer.

   B. In the example described in A, the agonist is contracting:

   _____ concentrically. _____ eccentrically. _____ isometrically.

2. A. When the agonist is contracting to slow down the force of gravity, the body part is moving in the *same/opposite* direction as the force of gravity. Underline the correct answer.

   B. In the example described in A the agonist is contracting

   _____ concentrically. _____ eccentrically. _____ isometrically.

3. When the agonist is contracting isotonically, generally the antagonist is: _____.

4. What is the relationship between muscle fiber arrangement and the force that a muscle can produce?

   _____

   _____

   _____

5. When a muscle lacks irritability, it will lack the ability to: _____.

6. When the lower extremity is held at the end of the range of SLR, the hamstrings muscles have been _____. When the lower extremity is then lowered to anatomical position, the hamstrings are able to return to _____ because of the property of _____.

7. A person who has less hip flexion ROM when performing a SLR than when flexing the hip and knee simultaneously would experience _____ insufficiency of the _____.

8. Sit with your upper extremity in the anatomical position. Curl (flex) just your fingers as much as possible and then flex your wrist. Which of the descriptions that follow may explain the difference in the ROM of wrist flexion?

   _____ A. Passive insufficiency of the finger flexors

   _____ B. Passive insufficiency of the finger extensors

   _____ C. Passive insufficiency of the wrist flexors

   _____ D. Passive insufficiency of the wrist extensors

   _____ E. Active insufficiency of the finger flexors

   _____ F. Active insufficiency of the finger extensors

   _____ G. Active insufficiency of the wrist flexors

   _____ H. Active insufficiency of the wrist extensors

9. Muscle names often refer to size, shape, function, or location of the muscle on the body. Fill in the table below with muscle names that are reflective of the description given.

Size	Shape	Function	Location

10. What is the relationship between types of kinetic chain and whether the origin moves toward the insertion or the insertion moves toward the origin during a muscle contraction?

11. What effect does muscle fiber arrangement have on function of a muscle?

Chapter 6

Nervous System

Pre-Lab Worksheets

Student's Name _____

Date Due _____

Complete the questions that follow prior to the lab class.

1. Match the terms and descriptors that follow.

_____ Transmits impulses toward cell body	A. Neurons
_____ Nerve cell	B. Cell body
_____ Integrates signals from sensory neurons	C. Myelin
_____ Conductor of impulses from the cell body	D. Node of Ranvier
_____ Has cell body in dorsal root ganglion	E. Axon
_____ Group of myelinated nerve fibers within central nervous system (CNS)	F. Dendrite
_____ Distal end of axon	G. Anterior root (ventral)
_____ Includes major tracts in the CNS	H. Posterior root (dorsal)
_____ Large cell body with a long axon	I. Interneuron
_____ Contains mostly unmyelinated fibers	J. Nerve fiber
_____ Has both dendrites and an axon extending from it	K. Synapse
_____ Fatty sheath	L. Tract
_____ Conducts nerve impulses from the neuron	M. White matter
_____ Collection of axons located near the intervertebral foramen	N. Gray matter
_____ Break in myelin sheath	O. Motor neuron
_____ Gap between neurons	P. Motor endplate
_____ Collection of dendrites located near the intervertebral foramen	Q. Sensory neuron

2. What structure connects the right and left cerebral hemispheres? _____

3. Complete the table that follows about the lobes of the brain:

Lobe	Location in Brain	Main Function
Frontal		
Occipital		
Parietal		
Temporal		

4. Match the spinal cord coverings with their location.

_____ Outer layer	A. Arachnoid mater
_____ Middle layer	B. Dura mater
_____ Inner layer	C. Pia mater

5. Match each of the structures that follow with its major function.

_____ Thalamus	A. Hormone function and behavior
_____ Hypothalamus	B. Body sensations—where pain is perceived
_____ Basal ganglia	C. Automatic control of respiration
_____ Midbrain	D. Coordination of motor movement
_____ Medulla oblongata	E. Control of muscle coordination, tone, posture
_____ Cerebellum	F. Center for visual reflexes

6. A. The subarachnoid space is located between which spinal cord coverings?

_____ and _____

B. What circulates through the subarachnoid space?

_____

C. What is its function?

_____

_____

7. Match the spinal cord elements that follow with their descriptions.

_____ Contains neuronal cell bodies and synapses	A. Conus medullaris
_____ End of spinal cord	B. Cauda equina
_____ Collection of nerve roots	C. Filum terminale
_____ Non-neural portion of spinal cord	D. Gray matter

8. Label the drawing of a vertebra using the terms that follow (Fig. 6-1).

_____ Vertebral foramen _____ Body
_____ Neural arch

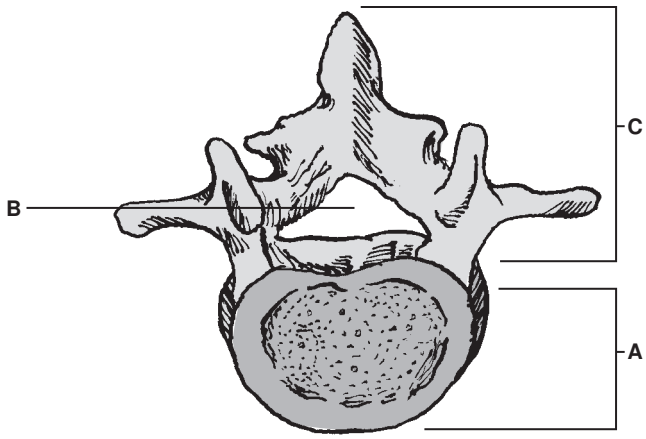

FIGURE 6-1 Vertebra, superior view.

9. Label the cross-sectional drawing of the spinal cord using the terms that follow (Fig. 6-2).

_____ Anterior horn	_____ Gray matter
_____ Peripheral nerve	_____ Posterior column
_____ Posterior horn	_____ Posterior root
_____ White matter	_____ Anterior root

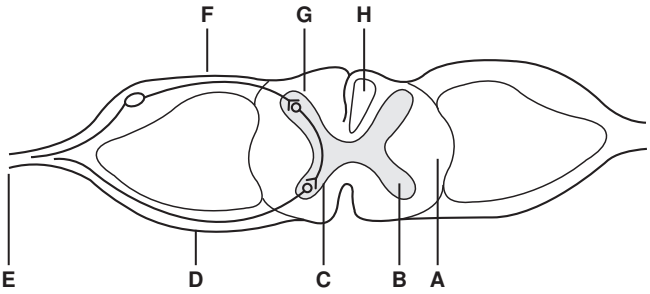

FIGURE 6-2 Spinal cord.

10. The conus medullaris is located at approximately the level of the _____ lumbar vertebra.

11. The cauda equina is made up of the nerve roots for what spinal levels? _____.

12. The filum terminale is at which end of the spinal cord?

_____ Proximal _____ Distal

13. The corticospinal tract is the main pathway for _____.

    The tract crosses from one side of the brain to end in the opposite side of the spinal cord at the level of the _____.

    The corticospinal pathways synapse in the _____ horn.

14. An upper motor neuron synapses in the anterior horn cell and is considered part of a peripheral nerve.

    _____ True _____ False

15. Match the cranial nerve name with the cranial nerve number.

    _____ Facial A. XI

    _____ Spinal accessory B. V

    _____ Trigeminal C. VII

16. Indicate whether the spinal nerves that follow exit above or below the vertebra of the same number. If there is not a matching vertebra, indicate which vertebra it exits below.

Nerve	Above	Below	Vertebra
C1			
C7			
C8			
T1			

17. The spinal nerve divides into the posterior (dorsal) ramus and the anterior (ventral) ramus. What is the function of each ramus?

    Posterior (dorsal) ramus: _____

    Anterior (ventral) ramus: _____

18. List the major muscle groups innervated by each of the spinal segments that follow.

    A. C1–C3: _____

    B. C5–C6: _____

    _____

    C. C6–T1: _____

    _____

    D. T2–T12: _____

    E. L2–L4: _____

    _____

    F. L4–S3: _____

    _____

19. For each of the three major nerve plexuses, provide the spinal levels that combine to make the plexus.

    A. Cervical plexus: _____

    B. Brachial plexus: _____

    C. Lumbar plexus: _____

    Lumbar portion: _____

    Sacral portion: _____

20. Enter the letter by the structures in Figure 6-3 next to the correct label for that structure. You can also write the names of the structures on the figure.

_____ Cords _____ Divisions _____ Nerve roots _____ Peripheral nerves _____ Trunks

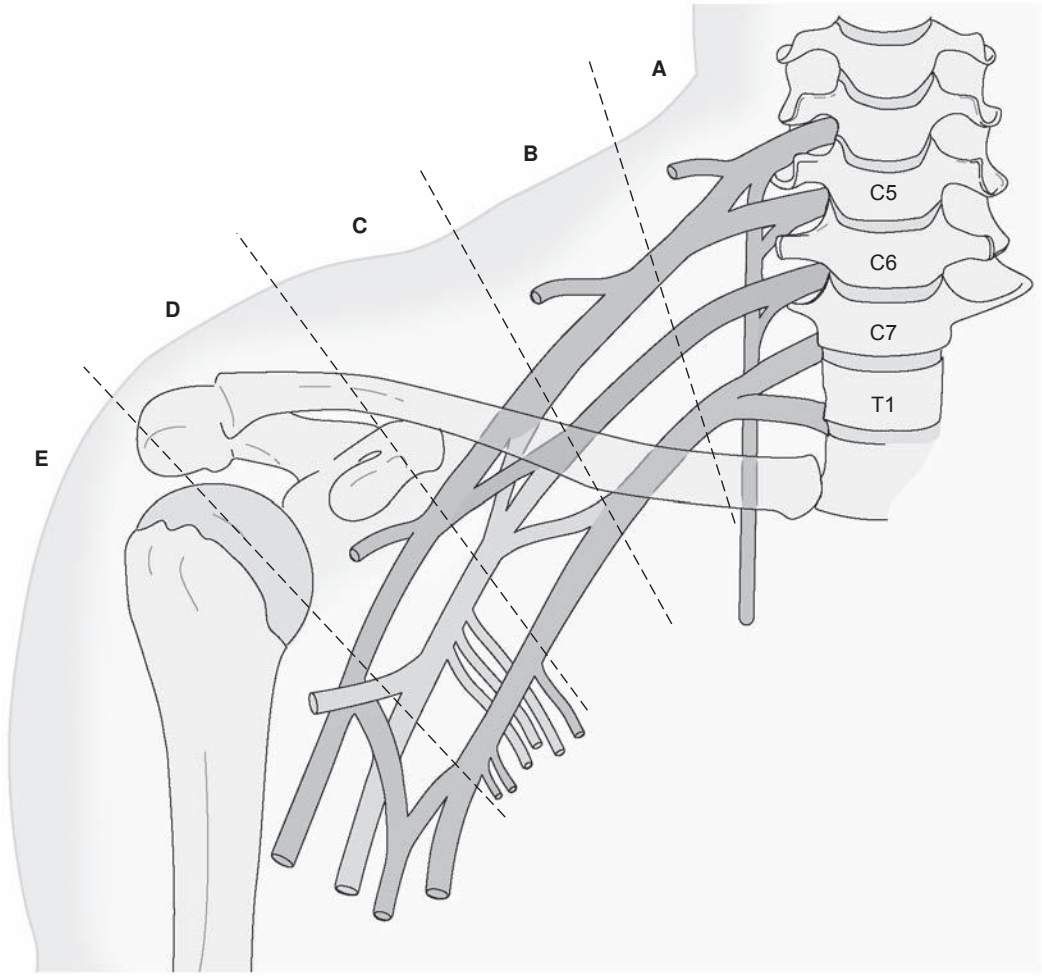

FIGURE 6-3 Brachial plexus.

21. Enter the letter by the structures in Figure 6-4, *A* and *B* next to the correct label for that structure. You can also write the names of the structures on the figure.

_____ Afferent neuron _____ Axon _____ Axon terminals _____ Cell body _____ Motor endplate
_____ Dendrites _____ Efferent neuron _____ Myelin sheath _____ Node of Ranvier

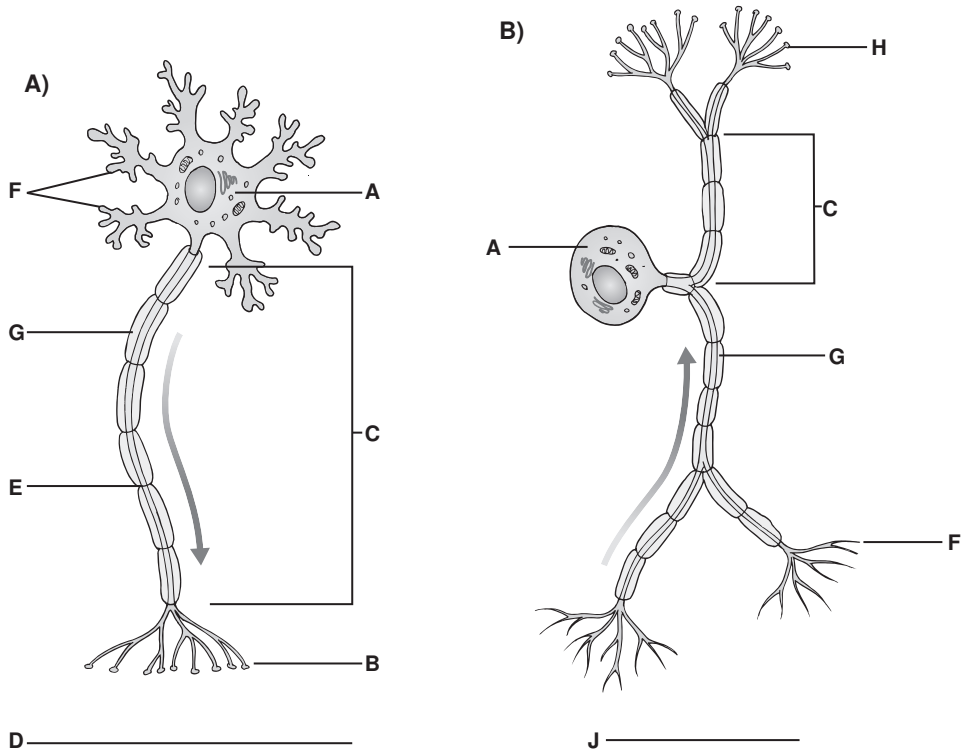

FIGURE 6-4 Neuron structure.

22. Identify which peripheral nerve(s) arise(s) from the nerve roots that follow.

C5–C6: _____ L2–L4: _____

C6–T1: _____ L4–S3: _____

C8–T1: _____ L4–S2: _____

Lab Activities

Student's Name _____

Date Due _____

1. Using models of the brain and skull, locate the lobes of the brain. Note the relationship of the lobes within the skull.

2. Using a model of the spinal column, locate:

   A. The divisions of the vertebral column—cervical, thoracic, lumbar, sacral, and coccyx

   B. The intervertebral foramen

3. Place stockinets on your arm and leg, then draw on the stockinet the path of the peripheral nerves and the sensory distribution of the peripheral nerves. Use the stockinets as study guides for reviewing peripheral nerves and their sensory distribution. Alternatively, use a washable marker or skin pencil to draw on your arm and leg. For the peripheral nerve pathways, refer to Figures 6-23 through 6-33 in the Lippert textbook, 6th edition.

   A. Upper extremity: Because the peripheral nerves emerge from the brachial plexus as the five individual nerves at approximately the head of the humerus, begin drawing at that level. Describe the path and sensory distribution of each.

      1) Axillary nerve:

         a. Path: _____

         _____

         b. Sensory distribution: _____

         _____

      2) Musculocutaneous nerve:

         a. Path: _____

         _____

         b. Sensory distribution: _____

         _____

      3) Radial nerve:

         a. Path: _____

         _____

         b. Sensory distribution: _____

         _____

      4) Median nerve:

         a. Path: _____

         _____

         b. Sensory distribution: _____

         _____

      5) Ulnar nerve:

         a. Path: _____

         _____

         b. Sensory distribution: _____

         _____

   B. Lower extremity: Because the peripheral nerves emerge from the lumbosacral plexus and enter the thigh at the proximal end of the lower extremity as individual nerves, begin drawing at the inguinal ligament anteriorly and below the buttock posteriorly.

      1) Obturator nerve:

         a. Path: _____

         _____

         b. Sensory distribution: _____

         _____

      2) Femoral nerve:

         a. Path: _____

         _____

         b. Sensory distribution: _____

         _____

      3) Sciatic nerve:

         a. Path: _____

         _____

         b. Sensory distribution: _____

         _____

4) Tibial nerve:

a. Path: _____

_____

b. Sensory distribution: _____

_____

5) Common fibular nerve:

a. Path: _____

_____

b. Sensory distribution: _____

_____

4. Identify the dermatome area for C5–C6.

5. Using string or yarn of different colors, construct models of the brachial and lumbar plexuses. Alternatively, draw them on a white board.

6. Using the skeleton, arrange string or yarn to illustrate the pathways of the peripheral nerves.

7. Palpate the ulnar nerve in the groove between the medial epicondyle and the olecranon process. When you rolled or tapped on the nerve, did you feel a "pins and needles" sensation in your little finger?

8. Describe and assume the postures resulting from the nerve injuries that follow. Identify the nerve involved.

Posture	Description	Nerve
Erb's palsy		
Scapular winging		
Wrist drop		
Ape hand		
Pope's blessing		
Claw hand		
Drop foot		