Next week’s lab (2/2): Joint structure and function 2. After the quiz, you will have 10-15 minutes to meet with your group. Then you will present your information to the rest of the class (instructions on what to include are listed below). If time remains, you will review muscle anatomy. The week after the presentations (i.e., week of lab 3, 2/9), you will ALL be responsible for knowing these major muscle groups (identifying the muscle on a handout or model and giving its basic action as presented on the handout they receive this week) – the first name presented is preferable; names in () are OK, names in quotes are NOT acceptable:

1. pectoralis (pectorals)
2. biceps brachii (biceps)
3. adductor longus
4. sartorius
5. quadriceps femoris (quadriceps, “quads”)
6. tibialis
7. deltoid
8. trapezius
9. triceps brachii (triceps)
10. latissimus dorsi (“lats”)
11. gluteus maximus (“glutes”)
12. gastrocnemius

Joint 1 lab preparation:
1. Downloaded articles and read about their joints and conditions

In-class assessment: participation & completion of handout

Quiz week of 2/2: none

Quiz week of 2/9: basic joint anatomy, muscle identification (see above) and actions

Homework due week of 2/2:
1. Answers to assigned questions for joint presentation.

Objectives: By the end of this lab you should be familiar with the anatomy of the joint your group has been assigned to study and the cause, nature, and treatment of the injury or condition associated with that joint. Specifically, here is the information you need to cover:

1. In all cases, you should be able to identify specific activities (sports, work-related activities, etc. – as specific as possible) that cause the conditions you’ve been assigned to research. If you include “physical therapy” as a treatment, try to be
specific about what kind of therapy is indicated. You should also be able to illustrate each joint action; I encourage you to think of exercises they can demonstrate to the class that involve your assigned joint. The specific information you need to know and teach is as follows:

A. **Shoulder**:
   1. The bones of the joint
   2. The type of joint (hinge, ball-and-socket, or pivot)
   3. Location, identity, action of superficial muscles: pectoralis, trapezius, deltoids, biceps
   4. What the rotator cuff is
   5. The nature, cause, and treatment for rotator cuff injuries.

B. **Elbow**:
   1. The bones of the joint
   2. The type of joint (hinge, ball-and-socket, or pivot)
   3. Location, identity, and action of the major muscles: biceps, triceps, hand/wrist flexors, hand/wrist extensors (i.e., the two major groups of forearm muscles, which actually move the wrist, hand, and fingers – you don’t need to know the individual ones)
   4. The locations of the tendons involved in “tennis elbow” and “golfer’s elbow” (lateral and medial tendonitis)
   5. The nature, cause, and treatment for these forms of tendonitis.

C. **Hand/wrist**
   1. The general bones of the wrist joints
   2. The type of joint (hinge, ball-and-socket, or pivot)
   3. Location, identity, and action of the wrist and finger extensors and flexors (i.e., the forearm muscles)
   4. The tendons and “tunnel” involved in carpal tunnel syndrome
   5. The nature, cause, and treatment of carpal tunnel syndrome.

D. **Hip**
   1. The bones of the joint
   2. The type of joint (hinge, ball-and-socket, or pivot)
   3. Location, identity, and action of some of the major muscles: quadriceps femoris, hamstrings, gluteus, adductor longus
   4. The cause(s) of osteoarthritis of the hip
   5. How hip replacement surgery works (what is the hip replaced with, how long does rehab take, what kind of physical therapy is involved)

E. **Knee**
   1. The bones of the joint
   2. The type of joint (hinge, ball-and-socket, or pivot)
   3. Location, identity, and action of the major muscles: quadriceps femoris, hamstrings, sartorius
   4. Important ligaments: patellar ligament, anterior and posterior cruciate
ligaments (big brownie points for the other two!)
5. The nature, cause, and treatment of ACL (anterior cruciate ligament) injuries.

F. Ankle
1. The general bones of the ankle joint
2. The type of joint (hinge, ball-and-socket, or pivot)
3. Location, identity, and action of the major muscles: tibialis anterior, gastrocnemius, soleus
4. The tendons/ligaments involved in Achilles tendonitis/rupture and plantar fasciitis (this is new)
5. The nature, cause, and treatment of Achilles tendonitis/rupture and plantar fasciitis.

Special instructions:
1. DO NOT use pens, pencils, markers, etc. as pointers on skeletal material, models, posters, or charts – use probes only.
2. Put everything back where it came from.
3. Rotate your time on the skeleton(s) and models so not everyone is trying to use them at once.

Background: most of this material is NOT in the book, so pay attention to your TA’s lecture!

I. Types of joints:
A. A joint is a place where two or more bones come together. Joints can vary in the degree of movement they permit.
B. Some joints, such as the sutures of the skull, are immovable – the bones are actually fused together; they firmly connect bones together (why have multiple bones, then?)
C. Some joints, such as the ones between vertebrae of the backbone are only slightly moveable because the bones involved are connected by stiff cartilage. They provide a great deal of stability and a little flexibility.
D. The joints we’re focusing on are the synovial joints, which are the most freely moveable. They provide a combination of strength, protection to the bones, and flexibility.

II. Basic joint structure: To provide strength, protection, and flexibility, synovial joints have a variety of different components working together. We’ll look at them one at a time.
A. Synovial joints are surrounded by a fluid-filled joint capsule that helps separate and cushion the ends of the bones (more on this later), by creating a fluid-filled space between the bones.
B. To keep the ends of the bones from grinding against one another, they are
covered by slick, smooth cartilage (articular cartilage).

1. Osteoarthritis results when the articular cartilage wears out, causing the bone ends to thicken and develop bone spurs, restricting joint movement.

2. Even though they're covered in cartilage, bone ends don't normally contact one another because the joint is lined with a special synovial membrane that secretes lubricating synovial fluid. The fluid has a consistency like honey; it's primary functions are to
   a. lubricate the cartilage at the ends of the bones to reduce friction
   b. circulate nutrients and remove waste from the living tissues of the joint
   c. absorb "shock" in joints subject to compression (knees, e.g.)

3. Additional cushioning and support may be provided by
   a. pads of cartilage called menisci (sing. meniscus) or articular disks; these lie between the bones; and
   b. fat pads, which are usually small, localized fat deposits laid down between the joint capsule and overlying material. These protect the articular cartilages and act as packing material that can change its shape as the joint moves.

4. Ligaments are very strong connective tissue "straps" that connect bones together.
   a. Ligaments stabilize, strengthen, and support the joints.
   b. A sprain is the result of stretching a ligament to the point where some of its fibers are torn; torn ligaments are usually harder to heal than broken bones!

5. Tendons are not technically considered part of joints, but still help stabilize them. They are the connective tissue straps that connect muscles to bones; when tension is placed on a muscle whose tendons span a joint, that tension will help stabilize the joint.
   a. The suffix "-itis" means inflammation. Tendonitis means inflammation of the tendons; it can be caused by tears, shock to the joint, or sometimes infection.
   b. "Tennis elbow" and "golfer's elbow" are both common forms of tendonitis; Achilles tendonitis is another.

6. Bursae (sing. bursa, "purse") are small fluid-filled pouches that lie between tendons or ligaments and the tissues they would otherwise rub against. They reduce friction and act as shock absorbers.
   a. Bursitis is an inflammation of the bursae
   b. Several common forms of bursitis include
      (1) bursitis of the shoulder in tennis players, golfers, baseball pitchers, and others whose activities involved repetitive motion at the shoulder.
      (2) "housemaid's knee" is inflammation of the bursae between the kneecap and the skin
“student’s elbow” can result from frequently propping your head up on your hand while your elbow rests on a table

C. Synovial joints can be classified based on the range of movement they permit. Note that all joints represent a tradeoff between flexibility and stability – the greater the range of motion a joint permits, the less stable (strong) it will be:
1. **Hinge joints** permit movement in one plane and are stable in the others – e.g., the knee, the elbow
2. **Pivot joints** allow rotation in one plane (e.g., rotating your forearm at the elbow)
3. **Ball-and-socket joints** permit the greatest range of motion – e.g., hips and shoulders.
   a. To keep hips strong, they are heavily stabilized with lots of accessory structures (including lots of ligaments, a heavy joint capsule, and a strong articulation between the bones).
   b. In contrast, the shoulder joint is stabilized primarily by muscles and some ligaments; it’s fairly weak compared to the hip.
   c. Does this all make sense evolutionarily? (think about it)

D. To describe the movement of limbs at the joints, we use special terms – if you do any personal training, you’ve probably heard these. Study the diagrams and be sure to learn these:
1. **adduction and abduction** (moving limbs toward, away from the middline of the body)
2. **rotation** (moving a limb around its own long axis)
3. **flexion and extension** (decreasing/increasing the angle of a joint)
4. **supination and pronation** (rotating the forearm palm up/palm down)