

ARE WE LIKE ROBOTS?

Center for Computational Neurobiology, University of Missouri

DAY 1 – 50 minutes

HOW DOES THE HUMAN BODY MOVE?

PRE-ASSESSMENT SHEET - Are we like robots?

1. What sensors or senses do we have on the human body?

Eyes, Ears, Nose, Skin, Tongue

2. What causes the muscles in your arms and legs move?

The brain sends a message through the nervous system to your muscles to move

3. Explain how your brain is involved in walking towards your mother when she calls you.

Your ears pick up the sound and sends that sound through the nervous system to the brain. Your brain recognizes that it is your mother's voice and that she is calling you. Then your brain sends a message through the nervous system to your muscles and make them move towards your mother.

We will talk about the four major parts of the human body related to movement

- **Sensors**
- **Muscles**
- **Brain**
- **Nervous System**

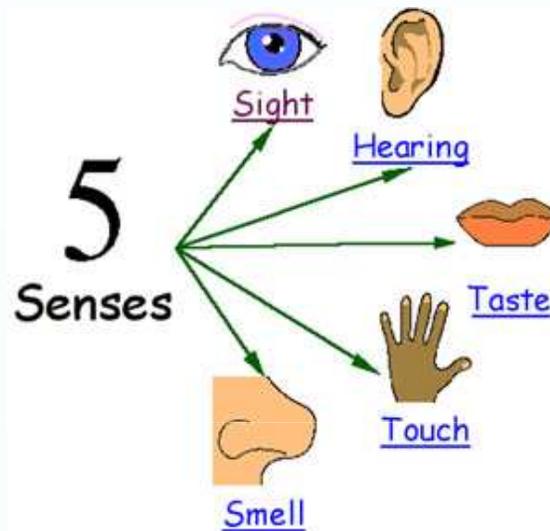
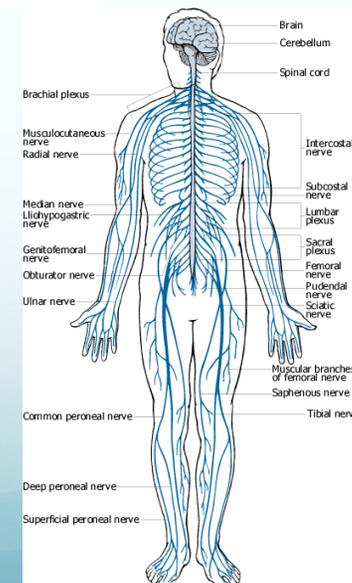
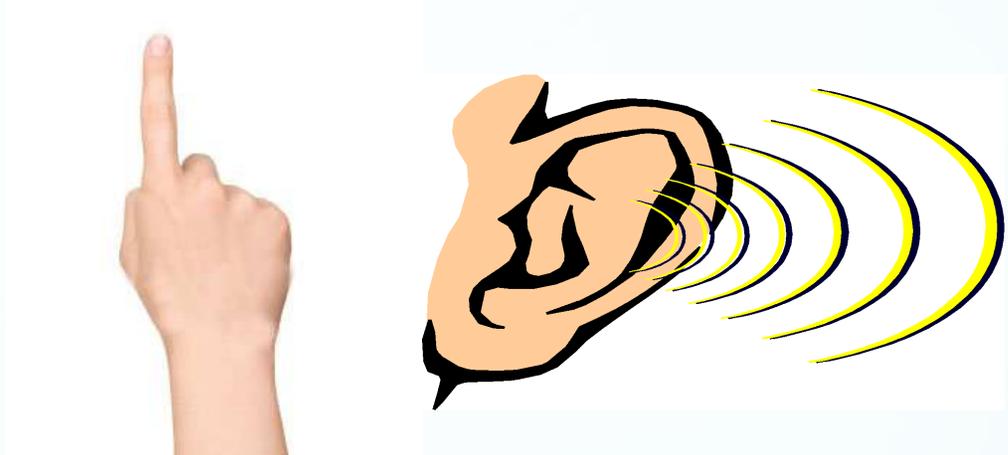


Image 1, Ref - see slide 19



What are the human senses?

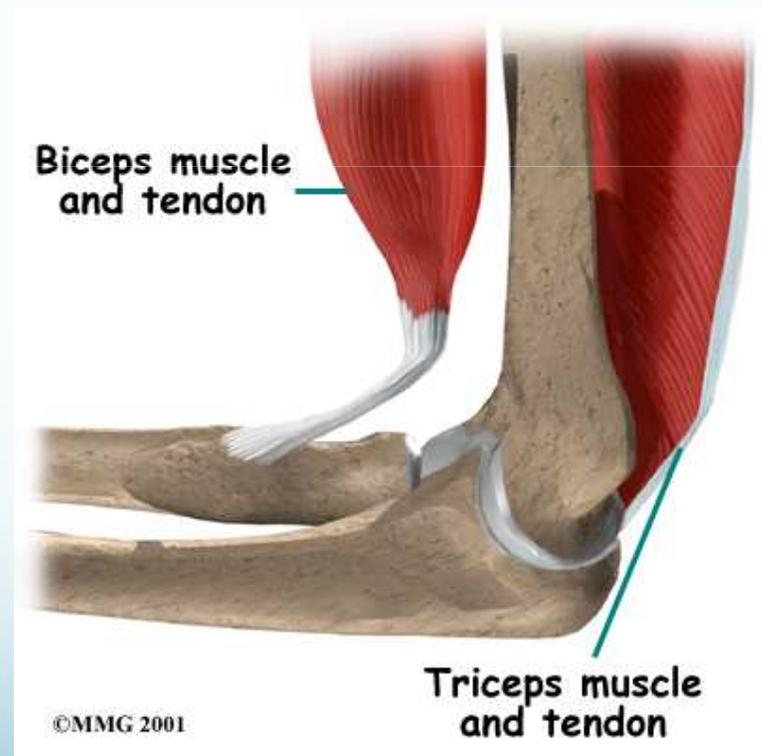
- Five Senses
 - Touch
 - Smell
 - Hearing
 - Sight
 - Taste
- Sensors take in information from the surroundings.



The Muscles

- Your muscles allow you to move around.
- How?
 - Muscles “contract”, which means they bunch up together like when you flex your biceps
 - When the muscles bunch up together, they pull on little cords in your body called ‘tendons’
 - The tendons pull on bones to make parts of your body move

- In the picture below, the biceps muscle is contracted, pulling the bone up



The Human Brain

- The brain is the decision center of the body.
- We will discuss two things that the brain does
 - It understands information from the sensors
 - When you smell a pizza, your nose doesn't know what the smell is. It tells the brain about the smell and your brain figures out that it is pizza!
 - It tells the muscles to move
- How does the brain get the information from the sensors?
How does the brain talk to the muscles?

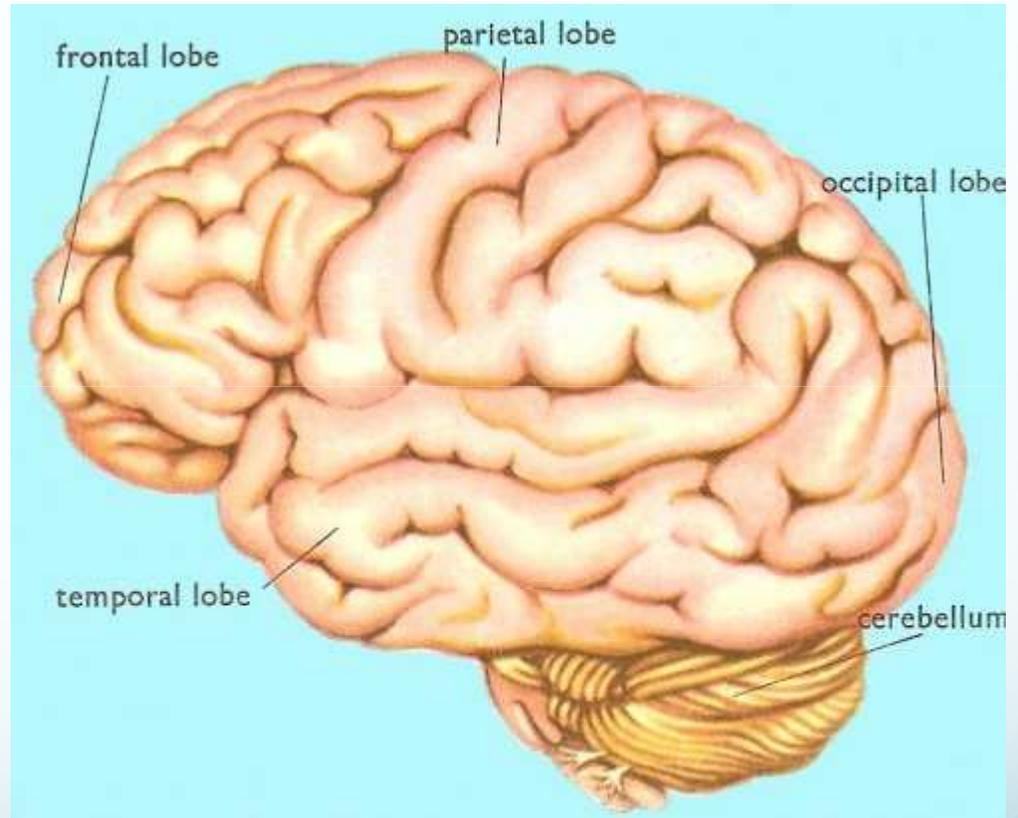


Image 3, Ref - see slide 19

The Nervous System

- The nervous system is the set of wires, called nerves, that allow the sensors to talk to the brain, and the brain to talk to the muscles.

- The nervous system is like two sets of one-way streets



- Through one set of nerves, the sensors tell the brain what they sense
- Through another set of nerves, the brain tells the muscles to contract and cause the body to move

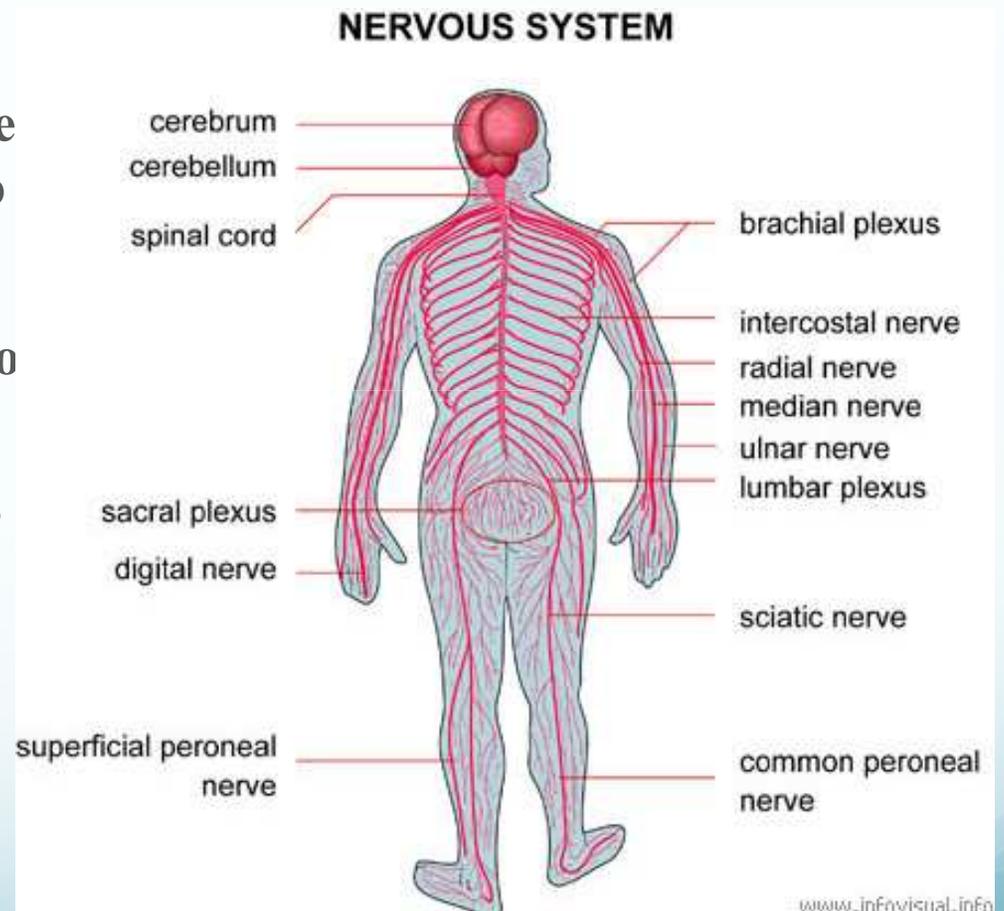
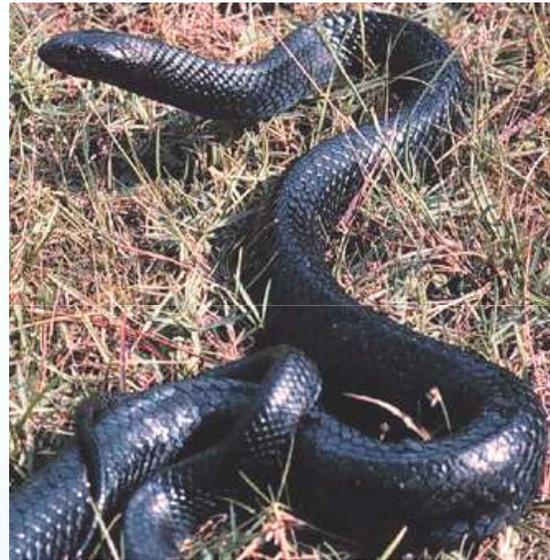


Image 4, Ref - see slide 19

Let's put it all together...

- **Example: What happens when you see a snake on the ground?**
- **Let's break it up into what we already know**
 - **Your eyes see the snake (sensors getting information)**
 - **Your eyes send the image through the nervous system to the brain**
 - **Your brain figures out that it's a snake, and decides that it's scared**
 - **Your brain sends a signal through the nervous system to the muscles in your legs to run away**
 - **Your muscles move your legs and you start running**
- **All this takes less than a second**



Now you try one...

- **Can you give the five steps involved when you smell a cinnamon roll baking in another room?**
- **There are many right answers!**



- **One sample answer**
 - **Your nose takes in the smell of the object**
 - **Your nose sends the information of the smell through the nervous system to the brain**
 - **Your brain realizes that it's a cinnamon roll (from previous experience) and that you like cinnamon rolls**
 - **Your brain sends a signal through the nervous system to the muscles in your legs**
 - **Your muscles in your legs move you into the room**

Before we start our muscle activity, let's go over some terms...

WORD	DEFINITION
Tendon	A band of tissue (kind of like a cord or a strong string) that connects bones to muscles
Triceps	The muscle on the outside of your arm right above your elbow which contracts to make your arm straighten
Biceps	The muscle on the inside of your arm above your elbow, which contracts to make your arm bend

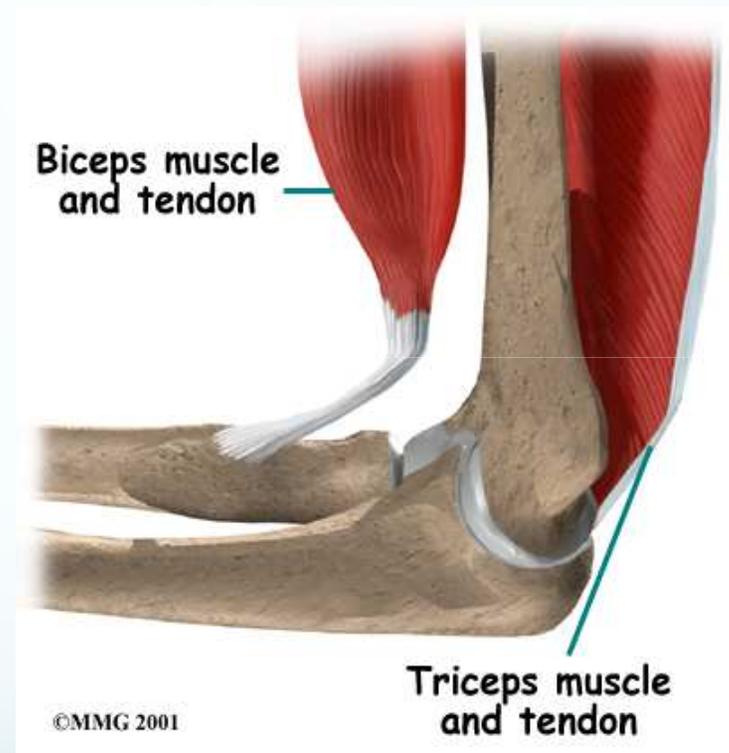


Image 2, Ref - see slide 19

How do muscles help us move? Example: bending your elbow

- Muscles help us move by contracting, which causes them to pull on our bones using connections called tendons. These contractions are caused by signals sent by the brain through the nervous system to the muscles.
- To bend your elbow, your biceps muscle contracts, which causes your triceps muscle to relax. The biceps muscle pulls on the inside of your forearm, pulling it upward and bending your elbow
- To straighten your elbow, the triceps contracts, causing your biceps to relax. The triceps pulls on the outside of your forearm, causing your arm to straighten.
- Walking requires the use of about 200 muscles, including the small ones.

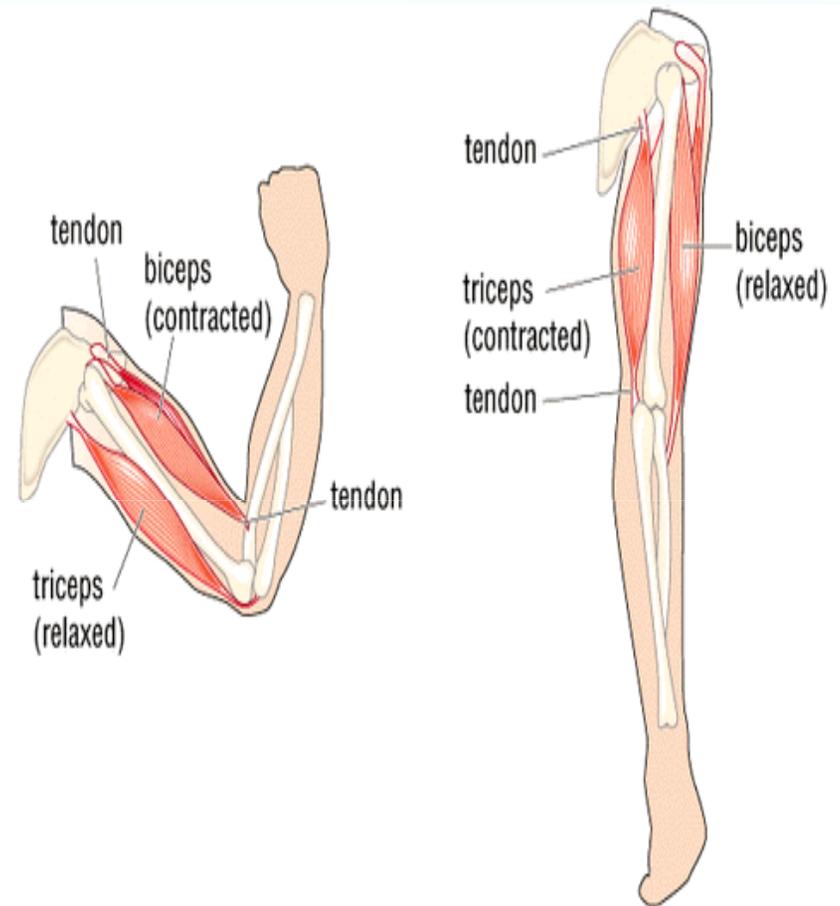


Image 5, Ref - see slide 19

Let us learn more about movement

- You are provided with a worksheet with three pages (copies of slides #14-16).
- You have 15 min to complete the task.
- You are encouraged to work in groups.

Worksheet 1 (Page 1 of 3) – understanding human movement (fill in after discussing each in groups of two or three)

Practical Example:

- Let us use the information about muscle structure you learnt (in slide #12) to figure out how the muscles are used to move your arm
- Feel the inside of your elbow as you bend it repeatedly, you can feel the tendons that connect your biceps muscle to your bones in your forearm. You can actually feel these muscles contract in your own arm! Then feel your biceps muscle as you bend your elbow.
- What happens to your biceps muscle when you straighten your elbow? It's harder to feel your triceps muscle, so if you can't feel it, what do you think is happening to your triceps muscle as you bend and straighten your elbow?

Worksheet 1 (Page 2 of 3) – understanding human movement (fill in after discussing each in groups of two or three)

Fill in the blanks marked by the lines with words from the Word Bank (there are two tendons on each picture):

Word Bank

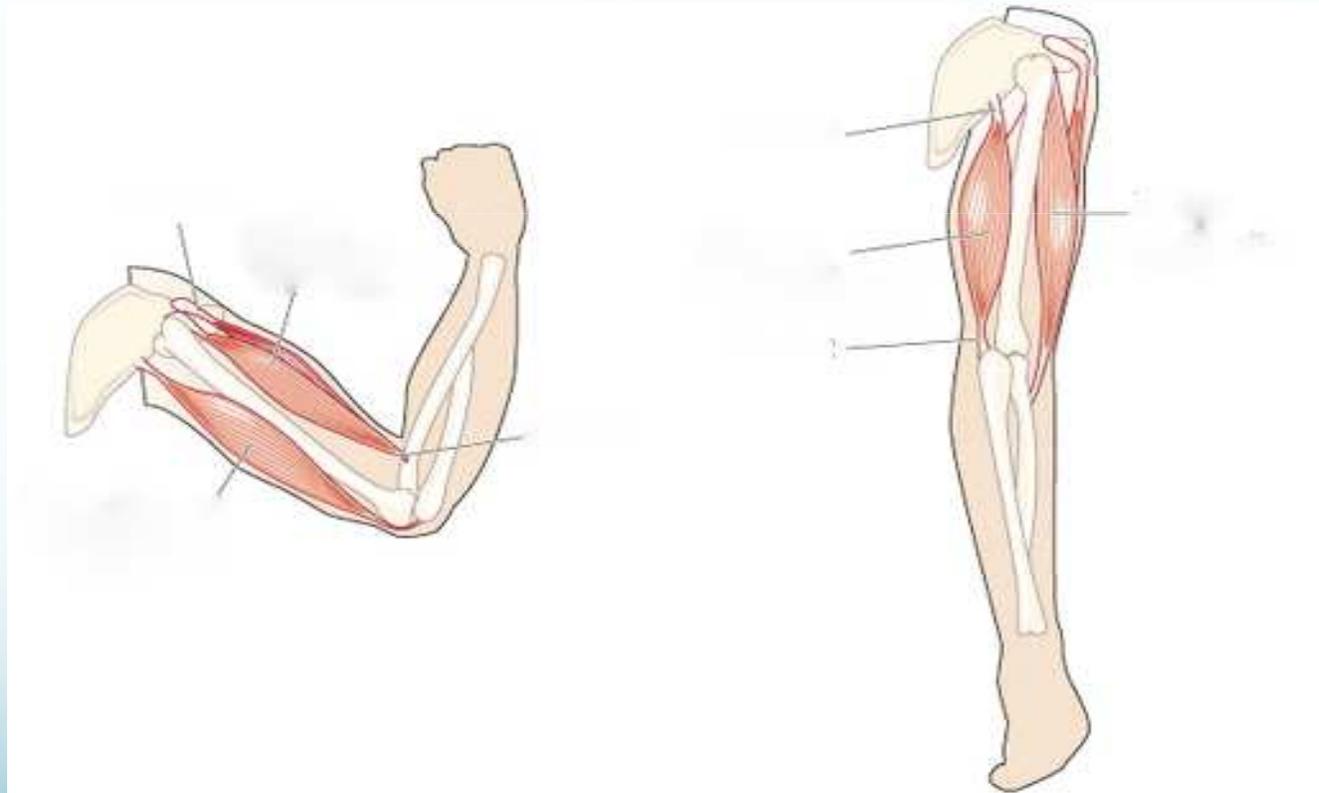
Tendon

Triceps (relaxed)

Triceps (contracted)

Biceps (contracted)

Biceps (relaxed)



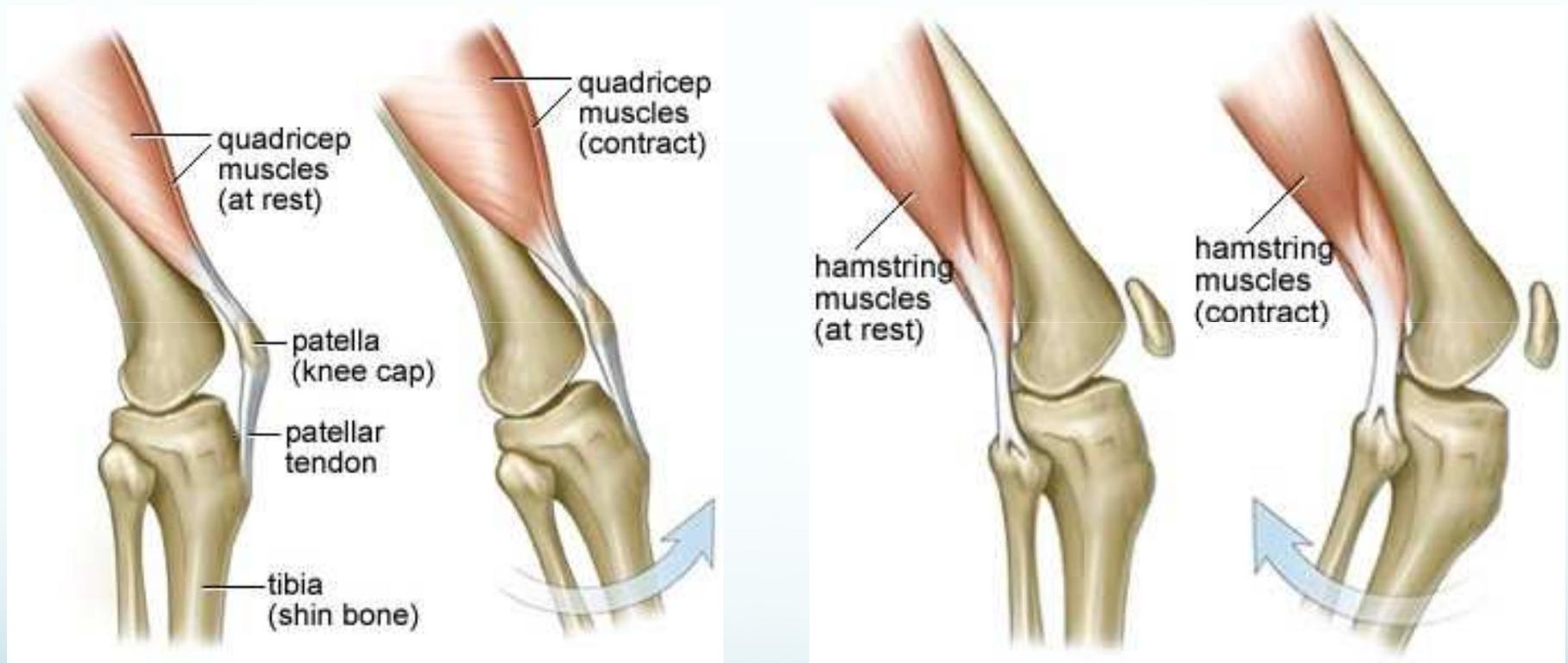
Worksheet 1 (Page 3 of 3) – understanding human movement
(fill in after discussing each in groups of two or three)

Application of knowledge

1. In the front of your thigh there is a muscle called the quadriceps muscle. The back portion of your thigh has a muscle called the hamstring muscle. Using what we learned in this worksheet, can you explain how those two muscles are involved in the bending and straightening of your knee?

2. Discuss how humans walk. Note that we typically use about 200 muscles when we just talk and it is a very complex activity. In comparison, robot motion on wheels is much simpler.

Muscles in the leg (answer to question #1 on slide #16)



Images 6-7, Ref - see slide 19

The answer to question #2 on slide #16 is much more difficult – you may learn about that in College!

End of Day 1

Image Source/Rights

Image 1:ADA Description: 5 senses

Image file name: 5senses.jpg

Source/Rights: fiercelystrategic.blogspot.com

Image 2: ADA Description: Tricep muscle and tendon

Image file name: tricep.jpg

Source/Rights: "The Torn Triceps - Conquest Chronicles." *Conquest Chronicles - For USC Trojans Fans*. Web. 05 July 2010. <http://www.conquestchronicles.com/pages/The_Torn_Triceps>

Image 3:ADA Description: Human brain

Image file name: banner_electricity.jif

Source/Rights: www.daviddarling.info/encyclopedia/B/brain.html

Image 4:ADA Description: The nervous system

Image file name: nervoussystem.jpg

Source/Rights: infovisual.info

Image 5: ADA Description: Arm muscles

Image file name: armmuscles.jpg

Source/Rights:"Right To Bare Arms - Great Exercises For Women Who Want Amazing Arms." *Get Into Shape Stay Fit - Meal Plans & Workout Routines To Burn Fat & Build Muscle*. Web. 04 July 2010. <<http://www.shapefit.com/right-to-bare-arms-women.htm>>

Images 6 and 7: ADA Description: Leg muscles

Image file name: legmuscles.jpg

Source/Rights: "ACL Solutions - ACL Knee Anatomy and Diagram Images." *ACLSolutions- ACL Injury, Knee Pain and ACL Knee Surgery Explained*. Web. 04 July 2010. <http://www.aclsolutions.com/anatomy.php>