>> Deb Feickert: This is the last slide that we saw on– well, depending on when you saw it on Tuesday or when you watched the slideshow– number 9 slideshow that had been recorded, this is where we ended. So it's a quick review before we pick it up, remembering that this is an example of what we might see with the structures on skeletal muscle. And so we see the humerus bone, and then attaching bone to muscle is a tendon. Tendons are always dense with an R, regular connective tissue. And then that runs right into this outside covering of the entire muscle organ level, so this is the organ called the muscle. In this case, the biceps brachii muscle is surrounded by a structure called fascia, which is in a dense irregular, with an I, connective tissue called epi, meaning on top of, outside of, mysium, mysium meaning muscle. And then we go inside the muscle, we have these groups of fibers. So these are my muscle fibers, meaning cells. And so these groups of muscle fibers that we're seeing are grouped together in– oh, there we go, are grouped together in bunches called fascicles. So we're going to pull out one bunch, one fascicle with the muscle fibers that make up that fascicle. And it is surrounded, each fascicle is surrounded by some more dense irregular with an I connective tissue called perimysium. Peri means surrounding, so surrounding the fascicle, perimysium. And lastly, we would take out one individual cell, one individual muscle fiber. And each of the individual muscle fibers within the fascicle is surrounded by areolar connective tissue, and it is called endo, within, endomysium. And then from there, we pull out these organelles that we find only in muscle called myofibrils. And we talked about that then in great detail, the structures that we would see from there down to the molecular level. So that was where we were– that's what we were talking about earlier in the week. So with that in mind, now let's talk about how muscle fibers, skeletal muscle– still, starting today talking about skeletal muscle, how skeletal muscle fibers can be arranged to make different categories of skeletal muscle, and the different arrangement of those fibers and categories, they would lie in tell us something about what the action, what the job, what the primary type of contraction that particular muscle would exhibit. So it's the fascicles or fasciculi, that's a plural for fasciculus, so how the fascicles are arranged, those groupings of fibers will tell us something about how much power a particular muscle have and how much shortening a particular muscle can accomplish. So, the first group are called parallel or longitudinal. And parallel tells me how the fascicles are arranged. We have long parallel fibers within the fascicle. And when I see these long parallel fibers grouped together, then those particular types of muscles called parallel or longitudinal muscles are going to bring about the most amount of shortening. Now, let's just say this, remember, shortening, different from contraction, because contract– all skeletal muscles contract, but this means that this particular type of muscle will shorten the most, they'll bring about the most movement. So, something like, we'll give some examples of some muscles today, we haven't talked about any of these but we will encounter them, so we'll just kind of have some visuals about some of these types of muscles today. So, one very long, parallel longitudinal muscle in our body is called the rectus abdominis. This muscle is on the left side of the body. There's another rectus abdominis of course on the right side of the body, super long, super parallel, all

the way from the pubis, up to the sternum, these muscles attach. This is your six pack. Here's the three pack of the six pack, the other three are over here. And then when these muscles contract, they are the muscles that allow you to bend at your waist. I'm going to demonstrate all of these in lab, but they will allow you to bend at the waist, and if you're flexible enough, all the way down to, right, being able to touch your nose on your knees. That's a pretty large range of motion movement. Another type of arrangement are called convergent, meaning converging, coming together at. These fibers are shaped like a fan. So think of a fan. And the fibers all come together at one attachment point, they converge at one attachment point. These particular type of muscles are very versatile, meaning that the direction of the contraction of the pull on the bones can change. So you're going to get different– a lot of different movements from the same muscle. So something like the pectoralis major, so this is what we mean by a fan shape. This is where it all converges at one point. And depending on which group of fibers we activate or engage, we're going to get a different movement. This is why those of you that do some weight training and you're working on the pectoralis major and doing something like push-ups, this is why you put your hands close together, and then you put your fingertips close together and then you move your hands further apart, and then you spread your fingertips out. That's going to then work on all of the different fibers in all of the different directions in this muscle. What else do we have? They're called pennate. So now, as opposed to when we said parallel and longitudinal, those fibers are very long, these fibers are going to be short. These are going to be short muscle fibers. And they're arranged, this word oblique, we're going to see it many times, and in fact, some of the muscles we're going to name are going to have the word oblique in the name, oblique means at an angle. So these fibers are arranged at an angle and they are attached to a tendon or several tendons that run through the muscle. Pennate, these are the maximum power muscles. These are the high-strength muscles, as opposed to, again, they all move, so we don't want to say maximum movement when we talk about longitudinal, we say maximum shortening. When we talk about pennate, these are designed for power. And so they look like this. I can have a single tendon and then the fibers running obliquely from it. I can have a tendon and this– pennate means feather-like, so this looks kind of like a feather, right, where I have the tendon here and these fibers that are arranged at an angle, obliquely from the tendon. Or I can have multiple tendons through a single muscle and then again that pennate oblique arrangement. So, something like deltoid, let's think about this, we have heard this for deltoid already. We have a deltoid tuberosity on the humerus and it's on the proximal shaft. And remember, tuberosity is it's a rough surface. And this is where this muscle, the deltoid muscle attaches. And it's the muscle of the shoulder and it wraps around the shoulder. It goes from anterior to lateral to posterior. And again, we're going to have some great power strength in the deltoid muscles if we exercise and do some weight training. The rectus femoris, this particular muscle is that long muscle that runs right down the center of your thigh, part of the quadriceps group. So rectus femoris, also a very powerful muscle at the anterior of your thigh. What else? We have our called sphincter muscles. I had a veteran in my class several years back. And every time I said the word sphincter, he would start laughing. So it must be some sort of military thing that he never shared with me. But OK, my veterans in the room, maybe you can share with me in another time. So when we look at talking about sphincter muscles, they are– we say this before, concentric circles. So these muscle fibers are arranged in concentric circles. And they're arranged in concentric circles around body openings. So that their job, right, we've been talking about, OK, what is the job? It provides maximum shortening, it provides maximum power, it's versatile in its movement. Sphincter muscles are designed to work as a shutter of a valve, they open or close the body opening, sphincter. So around the mouth, we have a muscle called orbicularis oris, circular, right, concentric circles that open and close the mouth, body openings. The next thing we would say– We're going to use these terms all semester so let's know them now. When we talk about muscles and their position on the skeleton and what they do, then we have some terms that we need to know. And so the word origin is a point of attachment of muscle on a bone, point of attachment on the bone. It's usually– and this is important, underline it, the stationary attachment on a bone. What does that mean? That means that when I have a muscle, and again, I'll demonstrate this in lab so you can see it, when I have a muscle that attaches on one bone, it crosses a joint and attaches on another bone. And so let's use that biceps brachii as an example agai. The biceps brachii attaches on my humerus, it crosses the elbow, and then it reattaches on the radius and ulna. And so, the point of attachment, that is called the origin of the muscle is that point of attachment that does not cause or does not itself move. So, that point of attachment for the biceps brachii on the humerus is more proximal than the point of attachment on the radius and ulna. And when that muscle contracts, it flexes the forearm. So, I want you to do it right now, you're in standard anatomical position, you have a muscle that attaches on the humerus and crosses the elbow to the radius and ulna and flexes. So what does that mean? Springing the palm up toward your arm. And so, the part that's moving is the part where it's attached at the radius and ulna, not at the humerus. So it's the point of attachment that's stationary, that body part doesn't move. And it's usually proximal to the insertion, which is the attachment point of the muscle that is moving. And so, in our example, I have the origin is at the humerus, the insertion is at the radius and ulna. When that muscle contracts and causes flexion, what body part is moving? The radius and ulna, the forearm. So the insertion of muscle is where the movement occurs. Most muscles have helpers. But in any particular movement of a muscle, the muscle that does that mean movement is called the prime mover or agonist. Please know that these two terms are the same. So this is the main muscle that causes a movement to occur. Again, in our example, the biceps brachii is the prime mover when we flex our forearm. But it does have some helpers. And so, muscles that help the prime mover are called synergists. In terms of the biceps brachii, the two synergists, and we'll talk about all these in much more detail in lab, I just want to give you some examples today. The two synergists are called the brachialis and brachioradialis. And you don't have to remember that for now, I just want you to know some examples as we get to lab and we look at it again. So those two muscles that I just named also flex the forearm. So a synergist muscle does the same movement as the prime mover. And of course, if we move in one direction, we have to move in the opposite direction to return to standard anatomical position. And the muscles that do that are called antagonists, against the agonist. And so this is the muscle that is in opposition to the prime mover. In our example, the movement in opposition would be extension of the forearm, and the muscles that do that are called the triceps brachii. So the original movement is reversed by the antagonist muscle or muscles. And lastly, we've been saying movement, movement, movement, but the word for skeletal muscle movement is its action. And so in lab, what are we going to have to know, we're going to have to know the name of a muscle, we're going to have to know the actions of the muscles on our list, and we will also have to know, not a lot, but we will have to also name some synergists and antagonists. We won't have to learn insertions, we won't have to learn the origins. But knowing the origins and insertions might help in figuring out the action of a muscle. But we'll talk about that more in lab. So I'm just going to give these to you really quick, these are all in your outline. And I will demonstrate all of these actions for you in lab again, so, when we get to the muscles that do some of these actions. So for now, let's just say this. Most actions have the– have an action and then an antagonist action. So the definition of an extension is when you increase the angle between two bones. So in our example just a moment ago with the forearm, extension is when I am in standard anatomical position. Then when I decrease the angle between the bones that is between the humerus, radius, and ulna, I am flexing. So flex and extend are the two opposing muscle actions. When I talk about a muscle action, again, just like always, the action of muscle is its function. So when I talk about actions, I don't ever just say extension or flexion. I say what is being extended? What is being flexed? So an example we've been using, again, extension forearm, or extends forearm, versus flexion forearm, or flexes forearm. So I say what is the action and what body part is moving? AB, as in boy, abduction, is moving away from the midline of the body. So, if you're in standard anatomical position, and you move your arms up away from the midline of your body, that is abduction. And then when you move your arms back down towards your body, that is AD adduction. Let me show you some diagrams for each of these. Rotation, we've talked about before, is revolving around the central axis where we've talked about rotation is at atlas and axis. But also at the limbs, rotation can be medial or lateral. So we'll see that in a second. And circumduction is when the end of your appendage describes a circle. So, that doesn't mean anything until we look at a diagram. So we have some examples of flex, right, decreasing the angle between two body parts, and extend, increasing the angle between two body parts. When we go beyond standard anatomical position, it's called hyperextend. Again, this is the one we've been talking about today at the forearm. To bring the forearm up, it's flexion. To bring it back down into standard anatomical position is extension. But we don't have to do the whole arm. We could just do our hand and we can flex and extend the hand. We can flex and extend, we talked about this in lab. Most of us are already at the end knee. This is called a lateral flexion. When I just been to the side, I am flexing I'm moving body parts closer to each other, but I'm doing it to the side. So lateral flexion in this direction, or lateral flexion in that direction. This is move in life. So I was just explaining losing my arm up and away from the body is AB abduction, and bringing it back down is AD adduction. But it doesn't have to be an entire limb, I can do the same thing with my hand, put yourself in standard anatomical position right now. And if you move your hand away from the midline of your body, that is abduction. And when you bring it back toward the midline for body, it is at abduction, we could do with the lower limb and have an ad duction. We can also just do with our fingers. When we spread the fingers apart, that is AB abduction. And we bring the nurse back together a T adduction. This is what circumduction means that'll m if I take them in, and I move it in a circle with my limited circle to it right now. I want everyone wherever you are to see you doing this right now, when you do that, and the end of your limb draws a circle, that's called circumduction. rotation at the Atlas and axis. But we can also do rotation at our limbs. So again, it should be your set impact to what is being demonstrated right here. Put your forearm out beside you. And when you move your forearm toward your– the midline of your body, this action by the way is not at the elbow. This is happening at the shoulder. So now you are medial rotate in booth back out, you're laterally rotating. Are you understanding and feeling what I'm saying that is not your arm is moving, but that action is taking place at the shoulder. medial lateral rotation, same thing at the hip. If I move my foot away from the middle, if my body I'm doing a lateral rotation at the hip, and if I move my foot toward the midline of the body, I'm doing a medial rotation at the hip. What else see if that are specialized rotations at the palms. So when I insert anatomical position, I'm supinated if I move the palms to the posterior, then my forearm has prone a protracted retract is a horizontal movement of a body part anteriorly for protraction. Post early for retraction show you that in a second. And this is the one that is only in great apes as well as humans in opposition where thumb touches the fingertips. So if you see supination is not where it ends in anatomical position. It is only turn our palm post here. This is this is my favorite. This is protract when you jump onto it right now, when you shut your jaw forward retractors when you bring your child back and up position is being able to touch your thumb to your fingertips. I love it. And lastly elevate is a vertical motion superiorly depresses vertical motion inferiorly we'll look at some diagrams. plantar and dorsi have to do specifically with the foot plantar flex is moving the foot and the heel lifts up or C flex is moving the foot and the heel is pushed into the ground. And this also has to do with just the foot inversion e version. I mean it lifts the plantar surface right the bottom the sole of my foot toward the midline of my body. And Eve version is might take the plantar surface of my foot and move it away from the midline of my body cleverly. So good elevate to press is at the shoulders. When you shrug your shoulders you elevate it when you drop your shoulders that's depress. You can also elevate to press your jaw elevate inclosure mouth and depress. Depress and open your mouth dorsiflex they bring the toes up. plantar flex we point the toes down, invert. This is the large toe number one We bring the large torque toe toward the middle of the body midline, and Evert, we take the small toe away from the midline of the body. Love it. So then what we're going to see is, it's going to be great, we're going to have a whole bunch of names for skeletal muscle. And we're going to have to know all the names of the muscle. And so sometimes just knowing what those words mean is helpful, right. So here are the ways that skeletal muscles get their name, names, there are six ways. So the first way is that muscles are named as either by the body or each in where the muscle is found. Remember, we said day one, if you start to know the names of the body regions, you're also going to be able to name other structures throughout the rest of the semester, or the number of divisions in the muscles. So here's some examples that we're going to see in lab. So brachialis, we mentioned already today, the brachialis is a synergist to the biceps brachii, the prime mover the agonist that flexes the forearm, and so brachialis is in the brachial region. So where am I going to look for it in the upper arm because that's for the brachial region is so if I know that the brachial region is the upper arm, than I know where to look for the brachialis muscle, biceps brachii, the biceps brachii has two divisions called heads. There's a long head and a short head actually has a little division in it. So because it has the two heads, I setups brachii also has that word break Yes, in the next ways I might hit muscle or bite size or shape. Or I would name in the muscle, the origin and insertion of the muscle. So let's get some examples. We have some muscles on the back. The superficial muscles of the back are called trapezius. a trapezoid is a shape, like a diamond. And when we see these muscles, we're going to see a shape like a diamond. Sternocleidomastoids, sterno means sternum, cleido means clavicle, mastoid process. This muscle originates at the sternum and clavicle, and inserts at the mastoid process, name for its origin and insertion. Wait, here's the best one. This is a muscle name for its size. gluteus maximus. That's right. Here it is. gluteus maximus, named for its size. The last few his muscles are named our the muscle fibers arranged those words that we used earlier, or it's named for its action. So some more examples, abdominal oblique arrangement of the fibers at an angle. We said earlier this afternoon, we're going to see this word oblique when we talk about the names of some muscles. So they're obviously in the abdominal region and their muscles that the fibers are arranged in angle. And then this one is named protection, it's telling me it's an AD, adductor meaning bringing whatever body part this is attached to the midline of my body. The adductor longus is in the thigh. So adductor longus brings the thigh back to the midline of the body. Here are some disorders of skeletal muscle. This will be the end of our discussion on skeletal muscle and then we'll finish our day with a little bit info on cardiac and sleep muscle. So, there is a condition called Fibromyalgia which is an inflammation of that fascia. Remember the dense irregular connective tissue that surrounds the entire muscle and the fascicles inside the muscle. So if I have inflammation of those binding structures, I am going to get pain, tenderness, stiffness fatigue in my muscle. Lots of research on fibromyalgia, no one known cause. It is probably linked to many causes. But the latest research seems to show that it's linked to a decrease in serotonin levels, which is a brain neurotransmitter. And that's going to increase your sensitivity to pain. Because serotonin helps with feelings of happiness, euphoria, and reduces pain levels. muscular dystrophy, muscular dystrophy is a genetic disease of the muscle fibers and it causes an atrophy, right be making smaller of degeneration of the muscle fibers. If my muscle fibers are smaller, they're going to be weak. And this especially affects skeletal muscles of the upper limbs head and chest. My as seen in Gravis, myasthenia gravis is an autoimmune disease at the neuromuscular junction. So neuromuscular junction means where just the motor neuron innervate, the muscle to bring about movement. So what happens here is that we get again, weakness. And eventually what happens with my senior Gravis is that it affects the skeletal muscles of the respiratory system, so that eventually respiratory failure is what causes death and some with my senior graph that's so again, this mice incorrect This is the immune system response, the auto immune system response is that our immune system produces antibodies that will block or destroy the receptor sites on the muscle for the neurotransmitter that would allow for the movement we can get a strain of difference. This is not the same thing as SP sprain. A sprain is a joint a strain is a muscle. And that's a tear in the muscle. And lastly, we're going to add atrophy back here, a condition where we don't use an occlusive element of trainer muscles, and they get smaller and weaker. Alright, so what we're going to say about credit and smooth muscle, and these last few slides are going to be information for our next test. But again, we are certainly not going to spend the time we spent on skeletal muscle, because we are going to see these last two muscle types when we get to be systems where they are found and we're going to spend a lot more time in. But for now, what we'll do is just do kind of a general comparison of cardiac muscle, to the skeletal muscle and to each other. So where do we find cardiac muscle, the walls of the heart. That's the only place we find cardiac muscle, the walls of the heart. As opposed to skeletal muscle, which we said was voluntary. We have conscious control cardiac muscle for the most part is involuntary. Now we can some a change maybe our breathing rate or excuse me our heart rate, but doing some deep breathing and some relaxation. But we can't just stop our heart by thinking about it. We can't just start our heart if it does stop by thinking about it. It is involuntary outside of our conscious control. The job of cardiac muscle we mentioned before is to pump blood and it pumps blood away from the heart and into the circulatory system. And then eventually through the circulatory system and smooth muscle their blood makes its way back to the heart. The structure of cardiac muscle at the remember we do this with skeletal muscle we start the organ level and we move through getting smaller and smaller. So organ level of cardiac muscle. It's fancy around even for chambers in the heart at the fiber that is cell level. These are words we know about cardiac muscle is mono nucleated different from skeletal muscle which is multi nucleated. It has the unique structures called intercalated discs between the adjacent fibers like skeletal muscle it is straight. Unlike skeletal muscle, which is parallel on parallel fibers, cardiac muscle fibers are multi directional often described as that branching organelle we said that that unique organelle and muscle, my fibro we do have, of course myofibrils in cardiac muscle and just like skeletal muscle, a lot of mitochondria. Does this make sense? Yes, mitochondria producing energy for the muscle contraction. Your heart never stops contracting, you need a lot of mitochondria in your heart muscle cells, molecular level, those myofilaments called actin and myosin are present in cardiac muscle as well. And they are also arranged in circle mirrors. That's what causes the look of striation, illustrated muscle type. We've seen it before. Here those intercalated discs here are straight Asians mononucleated kind of a branch look like tree branches as we're looking at it in a diagram. On contraction, just like skeletal muscle acts, cardiac muscle fibers going to contract along its entire length, Britt's not going to contract at all. Unlike skeletal muscle, cardiac muscle is what we call auto rhythmic. It is self-explanatory. Now, it is innervated by neurons that do control and regulate the muscle contraction. But cardiac muscle can contract although not regulated, without a neural interface in innervation. And so it is what we call auto rhythmic. It is also unlike skeletal muscle, which is very subjective fatigue, resistant to fatigue, that's a good thing. We don't want our cardiac muscle to get tired and wear out lose muscle. Where do we find smooth muscle, we're going to talk about smooth muscle a whole lot when we get to the internal viscera, the systems in the in particular abdominal pelvic cavity, it's, again, it's voluntary, I do not have conscious control over the contraction of my smooth muscle. It's functions three, three main functions we're going to mention here kind of general. And then of course, we'll be more specific when we get to the systems. But one of the primary jobs of smooth muscle is movement at the GI tract. Because we want the food that we have chewed and swallowed to move through our GI tract without our having to think about it. That movement, the contraction as soon as muscle is called the peristalsis. Because the contraction is in a wave like contraction, it contracts and squeezes, and then it relaxes and that moves the material down the tract. And that particular area of the track contracts and squeezes it loose material a bit further down the track. Another important function is muscle is smooth muscle is found on the middle lining of the uterus to bring about childbirth. We'll talk about that later. And middle air of our vessels is muscle. So that remember this word face on each vessel, so that our vessels can constrict that is the loom and the center opening can get smaller. And these the dilate that central lumen can get larger, so that this helps to move blood through the circulatory system once the blood has reached the vessels. Structurally, we have where we find in it at the organelle level in the walls of hollow organs. And it's going to be a middle layer. When we get to the organs, hollow organs in the again not only but most mostly in the abdominal pelvic cavity is what we will see is that the structures the organs are made up of layers of tissue, and the middle layer of hollow organs is always going to be smooth muscle. We're going to find that smooth muscle in many layers and arranged in different directions and we'll talk about why that's important when we get there. These fibers words we know, are spindle shaped, they're fat in the middle, spindle point at both ends, they're mononucleated like cardiac muscle, they are nonstriated unlike either the other two muscles.

They do have myofibrils because myofibrils are the organelles, that bring back contraction. But the myofilaments are not arranged in sarcomeres, not arranged in sarcomeres. And so we have actin and myosin, but they're not in that very specific geometric arrangement that bring out the work of striation when we see it under the microscope. So again, my filaments of actin and myosin, but no sarcomeres. So we've seen this spindle shape before pointed put in the middle mononucleated sheets, right squeeze muscles always very closely attached to each other. Up think properties. We said earlier, we have the slow squeezing wave like contractions, as opposed to the pumping kind of an action of a cardiac muscle that are strong, fast contraction of skeletal muscle. Well, I cardiac muscle, they are auto rhythmic. They don't let me just say they don't need they don't need neural innervation but they have neural innervation that smooth muscles can contract without neural innervation they can be stretched without being damage, which makes sense as we think about the materials moving through to think that something like materials moving through our digestive tract and the materials just right after a heavy meal, that's a push against the sides of the whatever organ they have, the food happens to be in as it's moving through the tract. And then once that begins to be broken down and digested, we have the tract expanding and getting smaller and getting smaller and so smooth muscle can be stretched like that without being damaged. sleeve. So very definitely just like cardiac muscle resists fatigue, very slow, prolonged contraction. Oh, that was abrupt. And that is the end of our muscle discussion. Let me stop our recording.