>> Deb Feickert: All right. So as we discussed in – lecture yesterday, there are different general categories of joints and the different categories of joints – I'm just going to move the chat over just a bit. Sorry. The different categories of joints are – general categories are called fibrous, of which we discussed a couple of specific types. Then there are cartilaginous, of which we discussed a couple different types. And the third general category of joints are called synovial joints. And those categories that I just explained again or mentioned again, remember, are structural categories. That is, structural categories of joints means – what is the material that you would find in between the bones of the joint? And so the joints we're going to talk about in lab are synovial and we also mentioned that, with that in mind, that all joints also have a functional category and we could give every single joint in our body a functional category, meaning how much movement is there. And when we look at functional categories, each of the joints is going to be a different functional category. That is – it's going to have no movement, a little bit of movement, or full movement. And the word for full movement of joints is diarthrotic. So we said that synovial joints, that is the structural category, we can also call diarthrotic because all of the – or for the most part – most of the synovial joints are also diarthrotic. So we might want to just write under here "synovial," so that we're remembering that those two terms are often used interchangeably. So what we are going to do to start is look at a model of a knee joint. Our discussion today is on the knee joint. As you're looking at this diagram, this is the anterior view of the knee and this is a lateral view, and its sagittal cut. This is one we actually saw in lecture as well. And just a little side note, I will have all of the bone diagrams with the correct answers and the knee joint with all of the correct answers posted in this week's module after – again, after our lab today so that you can check them. Don't always just fill them in. Do it – you do it, and then check to see if you have the correct answers. Okay. Let me just see if I can get to the chat. Sometimes in this view, I cannot – yeah, I – I can't see the chat everyone. So if you have a question, please just unmute and speak to me. No problem. Go ahead. Someone had a question, it looked like.

>> It wasn't going to be a question. I was just saying thank about posting the answers, because –

>> Oh!

>> – yeah.

>> You're very welcome. And yeah, I – I do not have a chat view with this camera, everyone, so please, please, please just – just jump in if you have a question or a comment. Happy to have you do that. I love hearing your voices, anyway. So we are going to start with a model so that I can show you all of these structures on the model. And then we'll look at an actual cow's knee joint to see – we won't be able to see all of these structures, but we'll be able to see quite a few of them. So we'll look at that next. We'll probably take a little break in between, just to give you a rest. But I'll see how the time is going. So I'm going to move this out of way now. Page 33. Bring over a knee joint

model. And give you the same view we were just looking at. This is the anterior view of the knee joint. This is what you're looking at. I'm just going to pull this – this particular first tendon and then ligament back. And this is the view that you are seeing on the left-hand side of the diagram on page 33. And what you're seeing here is what I just pulled back, which says cut patellar ligament. So that's what you're seeing right here as we're looking. So the first thing I'll point out to you and, again, this is an anterior view. I'm going to go posterior because this is how this knee joint sits in your body. And if I look at this knee joint in my body, I'm looking at how it is in standard anatomical position right now. This – we already know this bone. This bone is the femur. We already know this bone, the tibia and fibula. And now they're in the correct orientation in terms of specifically the leg where we know that the tibia is the medial bone in the leg and the fibula is the lateral bone in the leg. And as we're looking at that, just one other thing I want to point out, and that is the condyles of the femur articulating with the condyles of the tibia. And the head of the fibula, just in review from what we've already looked at, articulating with the head of the tibia. So I just want you to see all of these things that we've already talked about – kind of review on all of that. And with that in mind, with this being our – right – standard anatomical position and this is medial and this is lateral and this is posterior. So if I set it up – I won't be able to show you the whole thing – but if I set it up like this, this is how it's sitting in your body right now. Shout it out, be proud, what do I have here? A right or a left knee joint? Right or left? This is medial. This is lateral. This is posterior. This is how it's sitting in your body. What do you have here? A right or a left knee joint. Don't be afraid. Be the first one – don't be afraid!

>> Left?

>> I hear a left. I heard one answer. Anyone?

>> Right?

>> Right. Okay. One and one. One left, one right. Anyone?

>> Left.

>> Left. Anyone? Thank you for – thank you for playing, people that are playing. Right or left?

>> Left.

>> Left.

>> I got four answers. There are 26 of us in class today. All right. This is a right knee. And so, again, my orientation is – this is the posterior. The tibia is medial. Midline to my body. The fibula is lateral. So it sits in my body just as you're seeing it here. And if I put this right up against my body and this bone is midline and this bone is lateral, it puts it on the right side of my body. So this is a right knee joint as we continue. Thank you, those of you that were joining in. I appreciate you. So now I'm going to turn it back into the anterior

view that we're seeing on page 33, and we'll start with these structures. So with all of that said, we just mention, again, this is lateral, this is medial. And because I know that the fibula is lateral and the tibia is medial, I can now name structures that on their name have the words "lateral" and "medial." So if you're looking, we're going to start on the left-hand side of the column. You can see some structures that say lateral and medial. We're also seeing some structures that say anterior and posterior. So again, anterior is where I find the patella. Look at [inaudible] again. Here's the patella. The patella, as well, remember – the condyles of the patella only articulate with the condyles of the femur. So just a little review. That when I see the patella, I know that's the anterior. So that – that's a clue to me – anterior. When I see the fibula, always lateral. Tibia, always medial. So just as we talked about with bones, if this is lateral, everything on this same side is also lateral. And if this is medial, everything on this same side is always medial. And if this is anterior, anything that we're going to look at in here is going to be anterior. So just keep those things in mind as we move through our list. First item being lateral collateral ligament, also called lateral capsular ligament. We're going to say lateral collateral because collateral means both sides. So lateral collateral ligament is going to be on the same side as the fibula. Here's the lateral collateral ligament. What does the ligament do? What is the ligament made of? Review for our exam next week. A ligament is histologically always dense regular connected tissue. It connects one bone to another bone. We can see that here. And its job, its function is to prevent dislocation. That is, prevent these two bones from moving out of alignment with each other. So if my fibula is lateral – and it is – then this – this ligament that we find lateral, the collateral, this is the lateral collateral ligament. If I have a lateral collateral ligament, here's my tibia. It's medial. I must have a medial collateral ligament and here it is, attaching now the femur to the tibia. Medial collateral ligament. I have what's called – here are those words again – lateral and medial meniscus. So let's just remind ourselves what a meniscus is. A meniscus is a pad of fibrocartilage connective tissue. And a – anytime I see fibrocartilage pad, fibrocartilage connective tissue, it is going to have a few jobs. And in the knee in particular, these are the jobs of the menisci. So menisci is plural and meniscus is singular. And the menisci, if we, again, review from our lecture yesterday, the menisci, at the meniscus, each meniscus, we're going to see sensory reception. So this is an area in the knee that, first of all, has pain receptors, but it also has kinesthetic receptors, meaning that when I'm walking down the street and I kind of a take a little stumble and maybe step off the edge of the curb, and my knee goes sideways, these kinesthetic receptors in my meniscus send signals to my brain to immediately right my knee if at all possible, if I haven't lost my balance, so that I don't injure myself. The other thing that menisci do are to cushion, right – shock absorption – because there's a pad between the bones. And they provide structural support because the – the shape of the meniscus exactly fits the condyles of the femur and tibia. So this is an anterior view. Pull back the patella. Remember – lateral, medial. So here is that fibrocartilage pad called the meniscus. If it's on this side, which meniscus am I looking at here? Which meniscus would this be? Everyone?

>> Lateral.

>> Everyone? I heard one voice.

>> Lateral.

>> Lateral meniscus. Lateral meniscus. Lateral meniscus. Excellent. The fibula is lateral so this would be the lateral meniscus. If that's the lateral meniscus, this must be the – ?

>> Medial.

>> Medial meniscus. Medial meniscus. So this is from the anterior. I want to show it to you posterior. Looking at the posterior, what – there – nothing has changed, except now I'm looking at this in standard anatomical position. What do I need to look for? The fibula versus the tibia. So in the posterior, right? Now again, which meniscus is this?

>> Lateral.

>> Lateral meniscus. If it's over the fibula, it's lateral. If it's over the tibia, it's medial. So there are my two menisci. I'm going to pull this back just a little bit more so you get a little bit better view of the menisci. Ooh! Sorry about that. Here and here – they're described as semilunar, meaning C-shaped. So this is the shape of the menisci, this C-shape with the jobs that we just mentioned. Fibrocartilage connective tissue. Next items on the list are two more ligaments – anterior and posterior cruciate. The word "cruciate" means crossing. Crossing. And so these two ligaments do this with each other on the internal of the knee. So it sits like this, one crossing the other. I have an anterior cruciate ligament and a posterior cruciate. Please write this down. They are named according to their attachment on the tibia. I'll repeat that. The cruciate ligaments are named according to their attachment on the tibia. The cruciate ligaments attach the tibia to the femur and the naming, anterior versus posterior, has to do with where they attach on the tibia. So that cruciate ligament that attaches more on the anterior of the tibia is the anterior cruciate. And that which attaches on the posterior of the tibia is the posterior cruciate ligament. [Inaudible] knows they're on the inside of the knee, not on the outside of the knee, and they look like this. So here are those ligaments crossing each other on the inside of the knee. The cruciates. Here's the tibia. Here is one of the cruciates. I'm going posterior here. Here's the other cruciate ligament. So this cruciate ligament is, on its attachment to the tibia, is which one? Which cruciate ligament do we see there?

>> Posterior.

>> The posterior cruciate ligament. Posterior cruciate on the posterior of the tibia. And anterior cruciate ligament attaching on the anterior of the tibia. Again, ligaments are ligaments are ligaments. Still – dense regular connective tissues, still preventing dislocation. So as we look at the two sets of ligaments we just looked at, what kind of dislocation is being prevented? The collateral

ligaments prevent side-to-side dislocation. And the anterior/posteriors are preventing front-to-back dislocation. The other thing, just backing up for a second, looking at the menisci and we're talking about the jobs and we said the shape – the shape of the condyle perfectly fits into the shape of the meniscus. And so that's what brings that structural support. Just wanted to point that out. Next on our list, we have articular cartilages. And we have articular cartilage on the tibia. And we have articular cartilage on the femur. And from our definition in lecture yesterday, we said that articular cartilage was a thin layer of hyaline cartilage connective tissue on the ends of long bones. I'll lift up the menisci here. So we're seeing on this spot what's represented by this smooth, white structure that is just on the end of the femur and the tibia. We'll turn posterior. Just on the condyles here. This smooth, white surface and that same smooth, white surface on the ends of the tibia. We see articular cartilage, anterior again. Articular cartilage is telling that it's cartilage. I like that. Articular cartilage is composed of hyaline cartilage connective. Hyaline cartilage connective, when we see it macro anatomy, is always going to have this smooth, shiny surface. And it's smooth and shiny because its job is to provide a smooth, gliding surface when the – when the joint is moving. When I look right above – when I look right in here, I'm seeing, right, these little indentations and pits. And the bone is not smooth. It's rough. And that would not be the kind of surface that I would want for nice, smooth movement between bones. I don't want, kind of, herky-jerky movements every time I try to flex and extend this joint, which is, by the way, if we're talking about our specific types of joints – when we talk about synovial joints, we have six particular names of joints. And the knee joint is a hinge, like a door hinge. And the movement is flexion, extension. So this is a hinge joint. One of our six specific types of joints. Mention that again before we finish about, again, what we should be looking for on joints for our lecture exam next week. Bursae. We aren't going to see any bursae today, so I'm going to have you look at the diagram on page 33. And the right-hand diagram. There we see some bursae pointed out. Number 6 on this diagram pointing out bursae. And so remember what a bursa is. A bursa is – a bursa is extra articular, meaning outside of the fibrous capsule, joint capsule. Extra articular sac of synovial fluid. And we find these bursae outside of the joint capsule in places where I'd get a lot of movement of one structure against another. And so I have this patellar – and interesting thing about the patella. It has a muscle joining to it here. So muscle to bone is called a tendon. So this is called a patellar tendon. And then it goes from bone to bone here and then it's called the patellar ligament. And so the patellar ligament – lots of movement. Right? As I flex and extend. And so this movement between the ligament and this bone – lots of movement could cause friction. So we have a little bursa here for that. Also just the movement of the – the – the tendon and then ligament over the top, the anterior of the patella. Lots of movement. Lots of friction. So different areas that I might have this extra articular – outside the joint capsule – bursa. We won't see any in lab. Make a little note of that. Next – I actually want to – so on the right-hand side of the page, diaphysis, medullary canal, epiphysis – all the way down to where it says bone marrow, we'll come back to that but I

do want to talk about the fibrous capsule synovial membrane just really quickly on the model. Those items at the top of the page there, we can see on this model, but before we get there I want to say something about the fibrous capsule. So remember the fibrous capsule is – the fibrous capsule is the structure that completely encloses the joint. And as it completely encloses the joint, it provides joint stability, structural support. And we said the fibrous capsule is also extra articular – or excuse me, we said that the collateral ligaments are extra articular to the fibrous capsule. So this is what we'd be seeing. My hands are the fibrous capsule. And I'm going to put my hands around the joint so it would be underneath this ligament. And underneath this ligament – it's very tight. I hope I don't break it. So let me do this [inaudible]. The fibrous capsule is underneath these collateral ligaments which are extra articular and it forms a set. It completely encloses the joint all the way around to the front. Right? It could completely enclose the joint like this. And my collateral ligament are on the outside of my fibrous capsule. So my fibrous capsule. – get this out of the way – is, right, deep to the collateral ligaments and it forms this complete kind of encircling structure. And the fibrous capsule is dense regular – with an 'r' – connective tissue. I'm going to show you a little bit of that on the knee in just a second. And if I were to cut my fibrous capsule and look on the inside, the inside lining attached directly to the inside of the fibrous capsule is the synovial membrane. So fibrous capsule forms the outside encompassing structure of the joint. And when I cut open the fibrous capsule and look on the inside lining, that would be my synovial membrane. So the fibrous capsule – dense regular connective tissue. Synovial membrane – ooh – we'll see some in just a second – is a specialized, loose connective tissue that – it's job is to secrete a fluid called synovial fluid. And it secretes that synovial fluid which reduces friction into the space between the femur and the tibia. So there's a space right here and we have little thin layer of this fluid called synovial fluid which reduces friction. Again, right – lots of movement, lots of movement, lots of movement, lots of movement. We – when we have any structures where there's a lot of movement, we need something to reduce the friction, to reduce the heat buildup. And in a synovial joint – this is the name of the joint – it is what's called synovial fluid. So now let's finish with these other structures on the right-hand side of the list with the different view. Here's a femur that has a mid saggital cut. Here's the head of the femur. Here's the diaphysis, the shaft. Here's the – here's the distal end of the femur, so let's point out some items on this. This is an actual human bone. And so – let me just zoom in a bit on some of these structures. So as we're looking at our list starting with diaphysis, remembering that the diaphysis is the shaft. So it's this entire, long portion of the bone. The diaphysis of a long bone – just a reminder for lecture material – is compact bone. So it's very hard. Oops, sorry. Very hard bone along the diaphysis. Compact bone. And we said that every bone has both compact and spongy. And we'll see that on this in just a second. But what does the bone primarily have? And on a long bone it's primarily compact bone. There is a space in the center of the shaft, the diaphysis. This space is called the medullary canal. The medullary canal. See the space all along the diaphysis. And the medullary canal is filled with a

substance that we'll look at as we move through our list – what we're seeing here represented in yellow. If this is the diaphysis and the medullary canal, then if I look at the ends of a long bone, the ends of the long bone are the epiphyses. So epiphyses is plural. Epiphysis is singular. This is the proximal epiphysis. That is the head. And again, this is the distal epiphysis. And as compared to this hard, compact bone, the epiphyses – and we said we would see this – is composed of our type of bone – cancellous or spongy. I can use either of those words. And we can see what that means. As we look at this bone, it has holes all through it like a sponge. And these projections, these sharp projections we can see down deep in here, these kind of sharp, needle-like projections of spongy bone are called trabeculae. And so we can see the difference of the spongy versus the compact at the epiphysis versus the diaphysis. Within the medullary canal is bone marrow. And we can see on our list, we have two types of bone marrow. Red bone marrow and yellow bone marrow. Let's guess which one is in the medullary canal. Yellow. Yellow bone marrow fills the space called medullary canal. And yellow bone marrow is composed of adipose connective tissue. So now let me give you two different test questions with the same material. So I have an arrow pointing to this material on the lab practical. Here are my questions that might be asked. This is my reminder. Read carefully. So the first thing that I might ask is for you to name the material. And if I ask you to name the material, you're going to write what? Speak into your mics please. Name the material. It is called – ?

>> Yellow bone marrow.

>> Everyone? I'm hearing Vanessa, Vanessa, Vanessa. Thank you, Vanessa. But I need to hear everyone's voice.

>> Yellow bone marrow.

>> Yes, yes, yes. Everyone? Are we in agreement that that's yellow bone marrow?

>> Yellow bone marrow, yeah.

>> Thank you. Thank you.

>> Yeah.

>> Thank you. Thank you. So that is the first question. The other – the exact same arrow. Right? What is the histology of the material at the end of the probe. And instead of saying yellow bone marrow, you are now going to say?

>> Adipose connective tissue.

>> Adipose connective tissue.

>> Oh, good, good, good, good. So the question – read the question carefully because those – those are not the same answer. And you – and they would not get credit if you answered the question incorrectly. So make sure you're answering what's being asked of you. Very important. That's in the medullary

canal. We aren't seeing it here. We'll see it on the actual knee in just a moment. In the spongy bone, in the epiphyses, I'm going to find not yellow marrow, but red bone marrow. Red bone marrow is the name of the material. And red bone marrow is composed of, histologically, myeloid connective tissue. So I wouldn't ask this on a – I don't ask functions on lab practicals. We do that in lecture. But we do have this lecture test coming up next week. So another thing I could ask on the lecture exam, if I'm asking something about red bone marrow, I could ask what is the histology. But I could also ask the function. So myeloid connective tissue is producing red and white blood cells. It's not the bone. The bone doesn't produce bone. Or – excuse me – the bone doesn't produce blood. The red bone marrow in the spongy bone produces blood cells. And then the function of the yellow bone marrow is to lighten the bone. Right? We don't – this solid bone would be very heavy. But any place I see adipose, it's an energy store. So I could say energy storage or I could say lightens the bone if I'm talking about yellow bone marrow in the medullary canal. Last [inaudible] – or one last thing here. Periosteum. So peri- means surrounding, -osteum means bone. We don't have it here. It's gone. But the entire outside of the bone would be covered in a double layer of dense, irregular connective tissue. We'll see it on the actual knee in just a second. And that's called a periosteum. And the periosteum is, again, dense, with an i – irregular connective tissue. Why is that important? Remember what irregular means. It means that the collagen fibers are not – if I'm talking about regular, my fingers are the collagen fibers. The collagen fibers are parallel to each other. In irregular, they are just kind of scattered and interconnected in all kinds of ways – my collagen fibers. And that's important because my periosteum, my dense irregular connective tissue, amongst its jobs is connecting. It connects other structures that need to attach to the bone that can't attach to the bone itself because it's too smooth and slick and hard. There's no place to attach. So the periosteum surrounds it and allows tendons and ligaments to attach. It allows blood vessels and nerves to attach. And also, if we peeled it back, my hand is now – it used to be a fibrous capsule, now it's the periosteum. If we peel back the periosteum from outside the bone, it's within this area that I'm going to find osteoprogenitor cells that produce osteoblasts. And as the bone needs to grow or repair or restructure itself, that's where those cells are coming from. Here and along the inside edge of the bone, along the medullary canal. We'll see the periosteum in a second. Something is missing here. I'm not sure why. I want you to add – sorry – I want you to add at the bottom of the list – one side or the other – the – the two words "nutrient foramen." Nutrient foramen. I'll do that as well so you can see what I'm talking about. And the nutrient foramen are the holes, as always, that are on the outside of the bone that allow, right – nutrient foramen – that allow blood vessels and nerves to get into the interior of the bone. Because the bone is alive, it has living cells, and needs blood and a nervous supply. And so I need a way for blood vessels and nerves to get into the bone from the outside. And so these holes we're seeing would be nutrient foramen. Nutrient foramen. There they are. Okay. That's our list. First time through looking at the models and the bone. I'm going to ask you if you have any questions. I'll answer those,

then we will take a ten-minute break. I'm going to actually stop – [inaudible] stop. I'm either going to stop this recording and start a new one or maybe just pause it. I'll decide while you're on the break. But before we do that – ask any questions that you might have before we go. Anything I can answer about anything we just covered. And we're not finished, we're not finished. We'll look at an actual knee joint just after – just after the break. Anything?

>> Professor? I have a question.

>> Yes.

>> Are we going to need to know right or left of the [inaudible]?

>> Oh, that's such a good – here. I'm actually, everyone, I'm actually going to – I'm going to actually stop the share and pause the recording for a second, so I can see who I'm speaking to. So hold on one sec. Because I cannot see that one and I have [inaudible]. All right, Julia. Thank you. Um – yeah. I'm deciding. I'm not sure yet. I'm not sure what – what I want to do about that. Just going to pause the re –