Mechanics of Human Movement
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Lecture - 02 Part b
Bones in the Human Body

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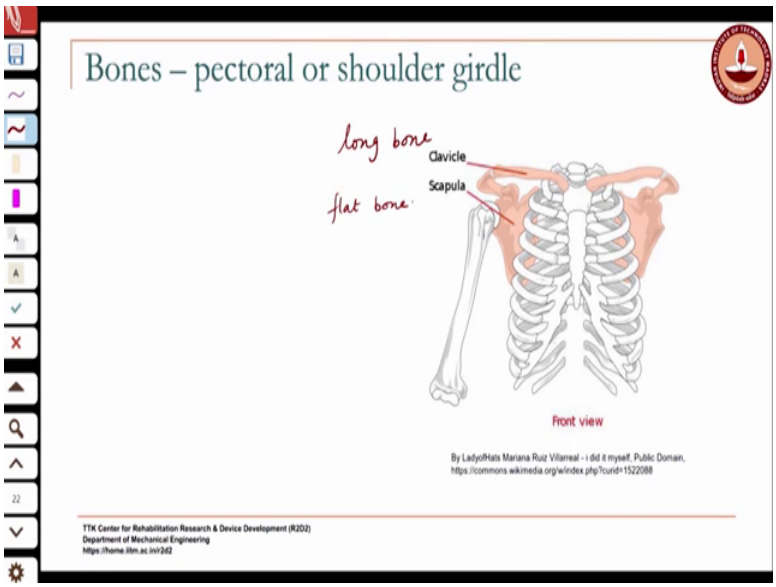

Clavicle, what kind of a bone is it. Clavicle, so if you look at this girdle, you know we looked at the skull. The skull is mainly formed of flat bones. Most of the bones in the skull are flat bones; clavicle would be a long bone. What about the scapula, scapula would be classified as a flat bone, it provides a broad surface for. So, this is the shoulder girdle that you can see with the clavicle, and the scapula.

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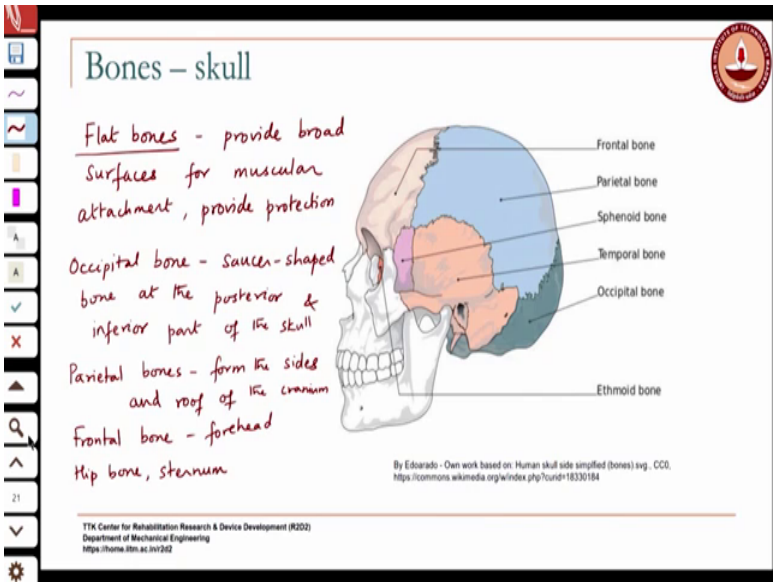

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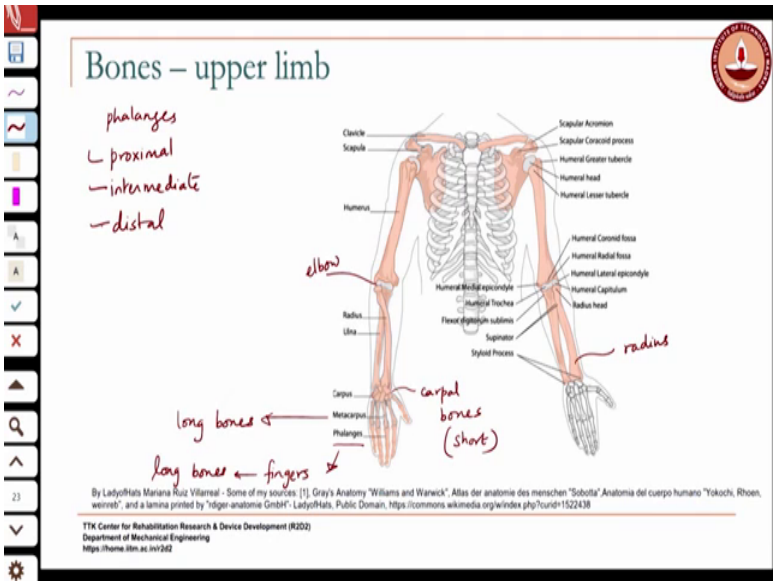

Then you have the other bones of the upper limb. I am repeating these here, so that you get very familiar with these bone names as we go along. So, you have the long bone, which is the humerus, which is the upper arm. Then you have the radius and the ulna ok. The radius is the bone that is on the side of your thumb that is the radius. So, if you see here, this is the bone, this bone here is the radius ok. And you have the ulna, the radius and ulna at forming this, so the junction, where the humerus meets the radius and ulna that is your elbow joint so where two bones meet ok. And form a joint this joint is the elbow joint in the upper limb.

You have the radius and ulna, then you have the carpal bones of the wrist, which are what kind of bones, they are short bones the carpal bones are short bones. Then you have the metacarpals, metacarpals in the palm of your hand. These bones here, they are what kind of bones would they be, they are long bones, they are long bones the metacarpals.

And then the fingers are your phalanges. These are your fingers, and these are also long bones. Of course, the last one, the most distal phalange would be more like a short bone ok. The distal phalanges would be short bones, because they are not longer than they are wide ok. But, the proximal phalanges would be the long bones. And they are actually called proximal medial and distal, median yes middle in the middle. So, this is different from the medial that we were talk intermediate I am sorry I am sorry thank you.

They are called the proximal you have the for the phalanges, you have proximal, intermediate, and distal, thank you ok. The ones in the middle are called the intermediate phalanges ok, not medial, because medial would mean its closer to the midline. So, these are you can see here.

When you look at the skeleton of the upper limb, in one case the radius and ulna are parallel to one another, and in the other case, they are kind of crossed over ok. So, these refer to the two positions of the hand your hand, you know the palms facing forward ok, this is called the supinated position. And then if you move your arm, if you rotate your forearm ok, then these two bones actually cross, and your radius crosses over the ulna to create this particular motion.

We will look at the different joints, and what kinds of motions are possible at the joint very soon. But, just to let you know if you see here, the bones you know in one hand, it shows the two bones radius and ulna parallel to one another in the other one, they are in a crossed configuration. And I cannot really show that to you, in this skeleton, because it does not have the same kind of joints joint movements, because these are mechanically fixed in the body the movement at the joints is controlled by the ligaments. Here you actually have mechanical wires tying these bones together, so they will not have the same type of motion. So I will not be able to make the same types of motion to show you with this skeleton.

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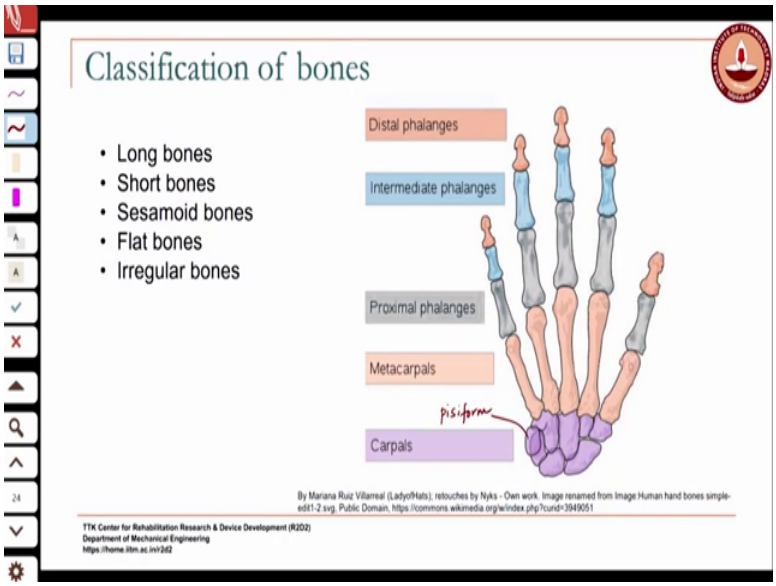

So, now let us look at again this is your long bones shot. Here you can see, this bone here is your pisiform bone that little knobbly bone that is usually embedded within a tendon, but they are part of the carpal bones. Then you have the metacarpals, proximal, intermediate, and distal phalanges in your hand. But, they are also you know, these would be the phalanges, and the metacarpals would be long bones.

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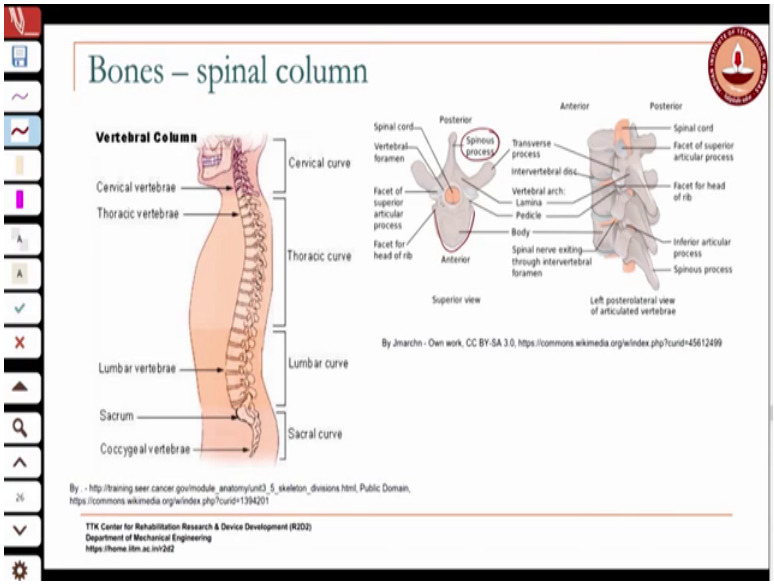

If you look at the ribs, and the spinal column then like I said these are the true ribs. Then you have five pairs of false ribs, or this. And then two pair of these the blue ones are the floating ribs. Again, these ribs are also long bones; they are considered long bones.

The vertebrae are the ones that are considered irregular bones, because if you look at the shape of each vertebra, it has all these protuberances, it has all these different things sticking out right, they have funny shapes in each of them, and if you notice, as you go down the spinal column, the size. So, if you look at the vertebra, it has this portion here, the anterior portion is like this, you have that is called the body of the vertebra.

And then you have what are known as the processes, the projections ok, they are called the processes of the vertebra, the vertebral body. So, this is called a transverse process, and these are this is the spinous. So, if you look at the anterior part of the vertebra, you see the body of the vertebra, and as you move down, you can see that the size of the body increases, as you move down the vertebral column. And part of the reason for that is that as you move down you are supporting more weight in the body, so the vertebrae have to be larger to take the larger loads as you move down the body.

And the vertebra, so there is a gap, this there is a cavity in the head of the vertebra. So, in the central portion you have an empty column through which the spinal cord passes. The spinal cord is basically the you know for your nervous system everything goes through the spinal cord, so it is a very important part of your for normal functioning, and that is protected by these vertebrae. So, you have the vertebrae protect the spinal cord in the spinal column.

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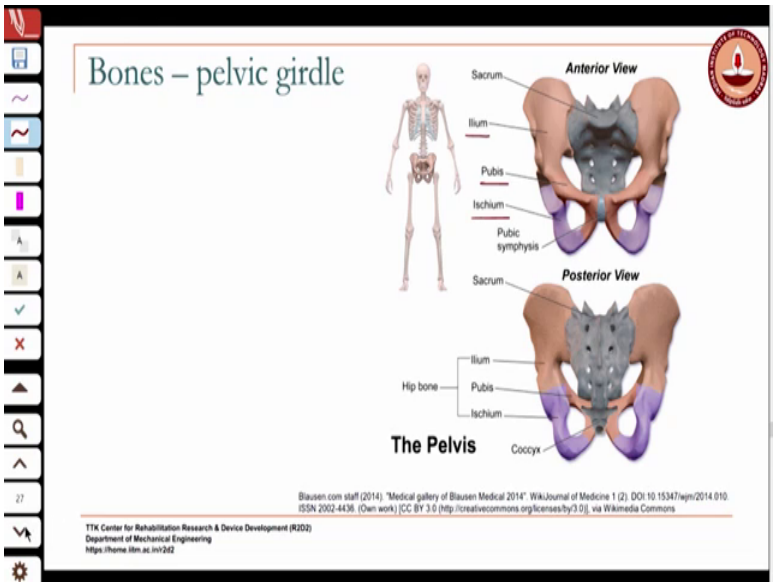

In the pelvic girdle, you have the hip bone, which is made up of the hip or pelvis the hip bone, or pelvis is made up of actually three bones, you have the Ilium, the pubis, and the ischium. And they all fuse together in an adults to form the hip bone, Ilium, pubis, and ischium.

And then you have the sacrum from the vertebral column, which articulates with the pelvis, so that is where the load from the upper body is transferred to the lower body through the sacrum to the pelvis. It is the vertebral the load from the upper part is all bone by the vertebral column, and then transferred to the lower body through the sacrum, and then the pelvis, pelvis onto the legs ok. So, these are again these are the sacrum is many of the bones of the spinal column including the sacrum, they are irregular bones. Pelvis is a flat bone, because it provides a large surface for muscles to be attached.

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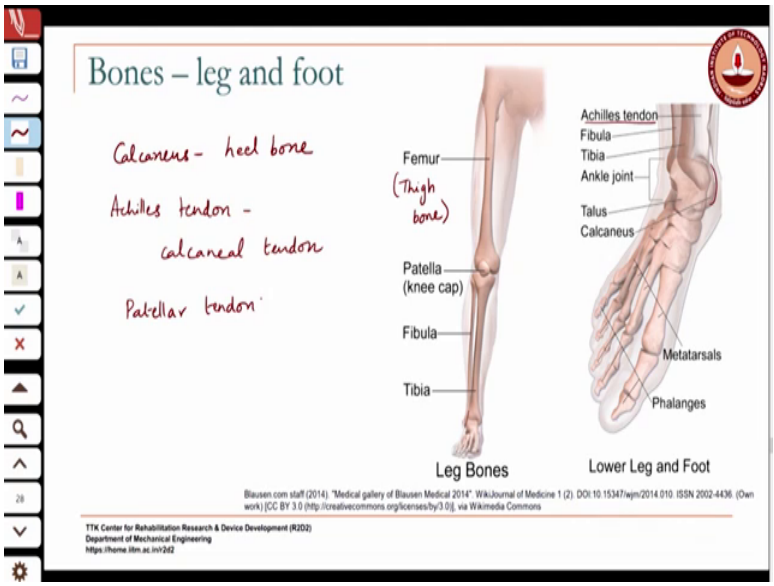

Then the important bones in the lower leg are your femur or thighbone. Then you have your kneecap or patella, then you have the tibia. So, the knee joint is only formed by articulation between the femur and the tibia.The fibula does not participate in forming the knee joint. The fibula runs parallel to the femur in the lower leg, but it does not really participate in the forming of the knee joint. However, at the bottom, it participates in forming the ankle joint with the talus bone. So, you have the fib fibula coming here, and it part is it participates in the in that joint at the ankle, so it is necessary for stability at the ankle. The fibula is necessary for stability at the ankle.

So, you can see here, at the ankle joint you have the talus, which is part of the tarsal, the tarsals of the foot. Then you have what is known as the calcaneus, or the heel bone. So, if you look at the lower leg, you can see the patella now clearly on the femur, although it is not showing it articulating like it normally should. So, if you look at the bones in the foot, you have the calcaneus, or the heel bone ok. This is again probably would class be classified as an irregular bone ok. You have the calcaneus the heel bone. Then you have the talus that is part of that.

And you can see here that this tibia, the tibia and the talus form the ankle joint, the ankle joint that is responsible for motion in the sagittal plane. The fibula does not it sort of just stabilizes it, by forming like a in carpentry, we call that a mortise and tenon joint right. You have this on either side, and you so that is what the fibula does.

They actually the joint between the tibia and the fibula is fairly, there is no there is very little more there is no movement between the tibia and the fibula at the distal end. So, they kind of are joined together there to form the ankle joint. So, you can see the fibula in this case, and also see the other tarsal bones, and then the metatarsals of the foot, and the phalanges of the foot. So, the calcaneus is your heel bone.

And what is known as the many of you may be familiar with the achilles tendon, so that is the tendon that connects the calf muscles to the calcaneus or heel bone. So, the achilles tendon, the technical name for that is the calcaneal tendon, because that is the bone to which it attaches. Just as the tendon that attach to attaches to the patella is called the patellar tendon. So, you have the patellar tendon, which is the tendon that attaches from the muscles of the thigh to the patella.

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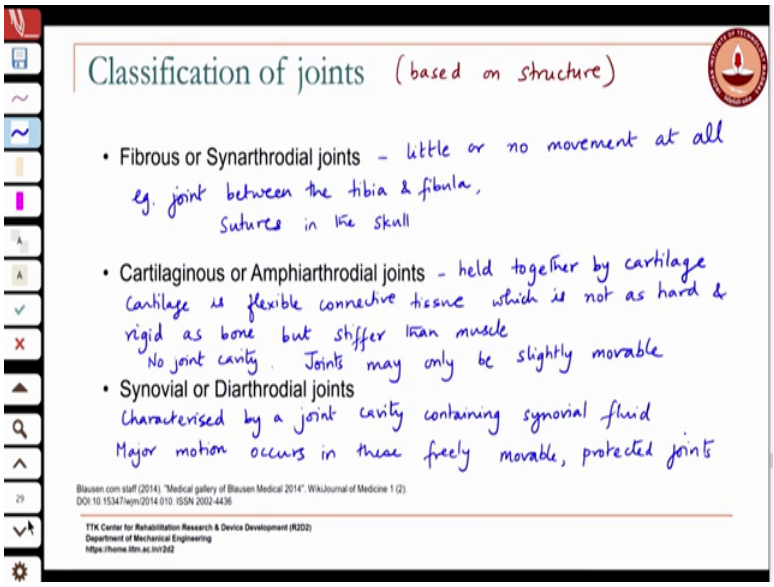

So, the next thing we will look at now that we have looked at how the bones are classified. And you have a good idea of the major bones in the body that we will be looking at in terms of movement. We will look at how these joints are classified ok. There are various types of classification possible. So, one is we look at the structure of the joint ok, there is one classification that is based on the structure of the joint. And there are other classifications that are based on you know what kinds of movements are allowed at the joint, you know then what we call the degrees of freedom at the joint. So, you can have our classifications based on those as well.

The first, first we will look at based on the anatomical structure of the joint. We look at what are the various types of joints. So, this is classification based on structure, and let me change color. So, you have fibrous or senatorial joints, these are joints, which allow little or no movement at all. Joints, which do not allow any movement or very, very little movement, are called fibrous or senatorial joints. And examples of those are the join between the tibia and the fibula. So, you have joined between they especially the distal joint, the distal tibia fibular joint ok. Then you also have the sutures in the skull.

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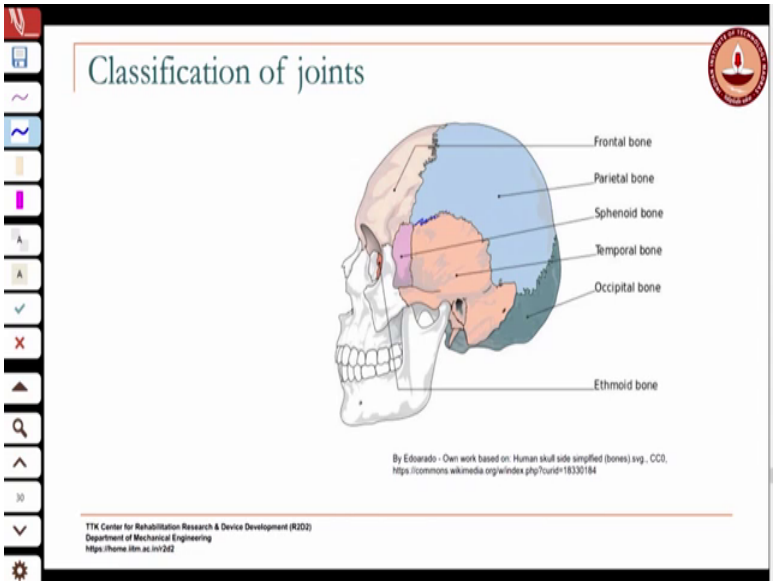

So, we saw that the skull was actually made up of multiple bones ok. You have various bones in the skull. And initially as a child, these are fairly moveable. You know that is why with a baby you have to be careful about how you hold. You know the babies, because they have to come out of the birth canal, they have they do not have a rigid head, but as you grow older these joints fuse.

So, you can see that it is almost like it is been welded together ok. These are called the sutures in the skull, and because they are formed by different bones coming together distal, it is still a joint. But, it is a joint not in the sense of it is it is actually a joint, which does not allow any movement ok. So, this is an example of the fibrous joint, the sutures in the skull and the tibia fibular joint.

The next types of joint are the cartilaginous or amphiarthrodial joints. So, these are joints that are held together by cartilage, which is basically cartilage is flexible connective

tissue, which is not as hard and rigid as born, but it is stiffer than muscle. So, it is less flexible than muscle, but it is not as hard as bone. So, it is somewhere in between. So, these are joints that are basically held together by cartilage. And you do not have any joint cavity ok, there is nothing there is you know what I mean, when we talk about the nest next kind of joint, but in this case, there is no joint cavity. And the joints may only be slightly movable

A, good example of these are the joints between the vertebrae ok. This you have this cartilage between the vertebrae. It is, so it allows one vertebra to move against another ok, but only to a limited extent ok. There is some flexibility, it is like a cushion between the two vertebrae, it allows some movement there is some flexibility. So, it allows some movement, but you really do not have a whole lot of movement. The reason we are able to make such large movements with the trunk, is because these are all stuck together. So, they all add up like you know, you have the vertebrae stuck together like this, and so the movements kind of add up. And that is the reason you are you have this flexibility of the spinal column as a whole.

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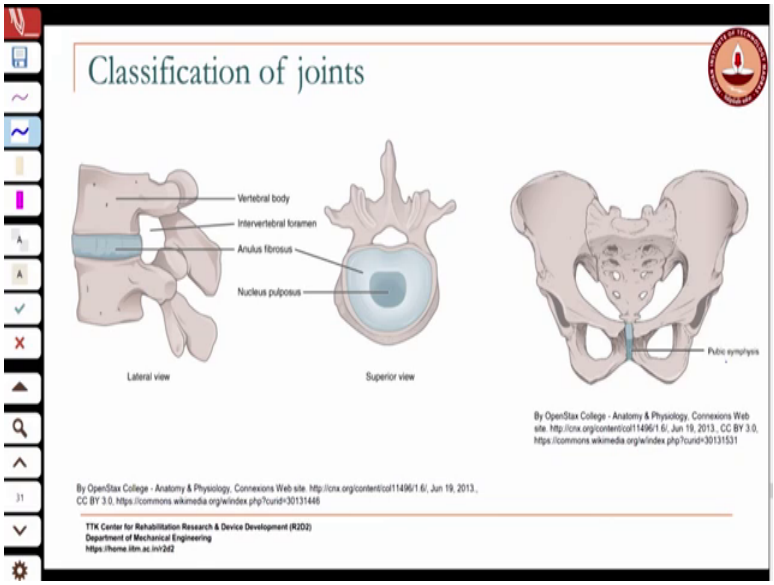

So, this cartilaginous joints are the joints between the vertebrae. There is also the pubic symphysis, which is the joint between the, if you saw the pelvis, these two come together in the front. And then you have this cartilage, this pad of fibrous cartilage between the

two bones that allows some movement, but not a whole lot ok, so that is another the pubic symphysis is also another joint, which is an example of a cartilaginous joint.

The third type of joint in terms of structure is your synovial or the diarthrodial joints. And these are joints that are characterized by a joint cavity. So, you have a joint cavity, and this cavity contains a lubricant called synovial fluid. So, all the major movable joints in the body are typically synovial joints, they are lubricated joints, which contain this lubricant in a joint cavity. And these the major motion in the body occurs in these joints, they are freely movable protected joints.

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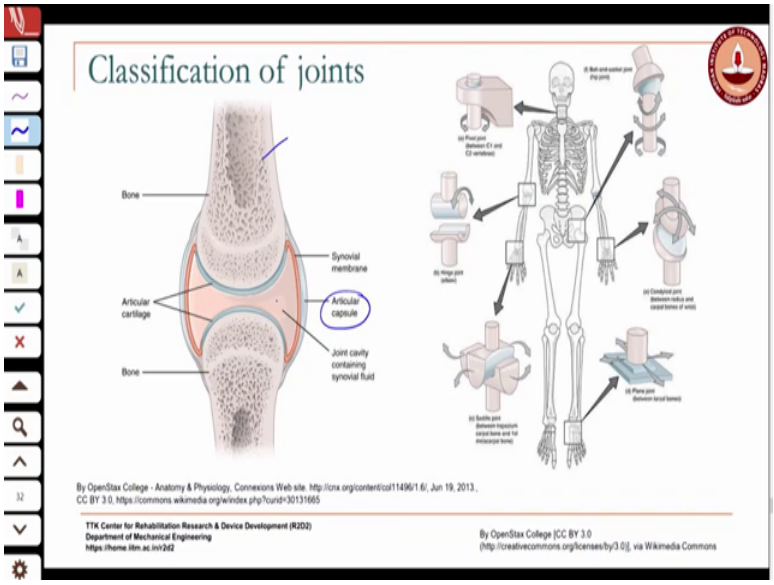

The classic example for the synovial joint is your knee joint. So, if you look at the knee, you have the femur, this is true of most synovial joints, but in the case of the knee, this would be the femur, this would be the tibia, and you would have this joint cavity here. So, you have what is known as the articular capsule, which is the ligaments, and other connective tissue surrounding the joint. And then within that you have a joint cavity, which contains the synovial fluid.

And in addition to that you also have the joint surfaces covered by a thin layer of articular cartilage. So, these are all mechanisms to reduce the friction ok, and to make the joint freely movable in the human body ok. So, they have synovial fluid that that acts as a lubricant for this joint. So, these are the movable joints, and different types of joints will have different types of movement.

So, we will look at the types of synovial joints in the next class.