Mechanics of Human Movement
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Lecture - 02 Part a
Axial and Appendicular Skeleton

So, last class we looked at the three principal planes of the body that are used to reference the various parts of the body and describe relative locations of various parts of the body. And then we started looking at the first component of the skeletal system namely the bones.

So, as we know the skeleton the musculoskeletal system consists of the bones, the skeletal system which is the bones and the joints. And then you have the muscles which are the actuators of the system which provide the force for to make parts of the system move. And then we have ligaments which are the; which control the movement around the joints. And then we also have tendons which transmit the force from the muscles to the bones to which they are attached. So, of the four components of the skeletal system we are now looking at the skeletal part of the system.

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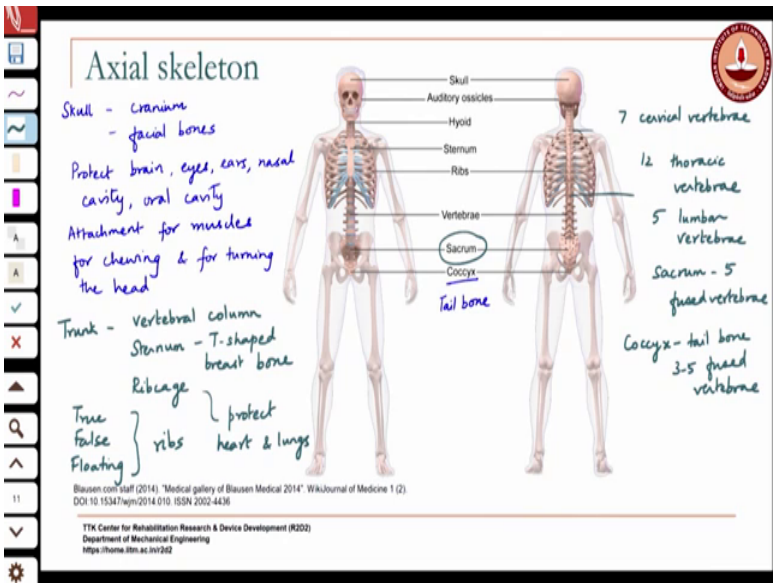

We saw that the skeleton you can classify into what is known as the axial skeleton which basically consists of the skull and the bones of the ribcage and the spinal column up to

the tail bone or the coccyx which is the end of the spinal column. So, it is the central part of the skeleton. This is known as the axial skeleton.

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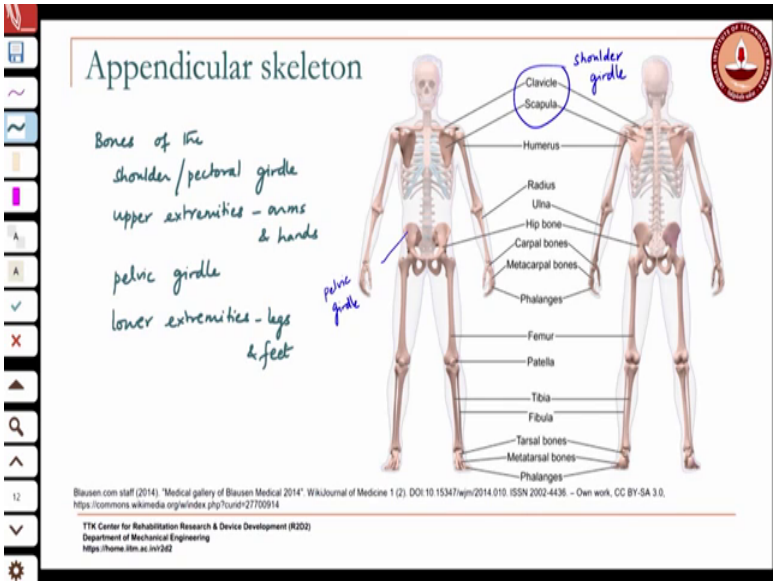

And then you have what is known as the appendicular or the skeleton that is attached to the rest of the body as an appendage. So, you have the bones of the arms and the legs as well as the connection to the rest of the body which would be your for the shoulder you have the shoulder girdle which is composed of the clavicle and the scapula shoulder or pectoral girdle. And then you also have the pelvic girdle, so you have the pelvic girdle here. So, they also form part of the appendicular skeleton.

So, now, let us look at some of these one by one. So, we start at the skull. So, the skull has it is generally divided into two parts you have the cranium and then you have the facial bones of the skull. And the function of the skull is basically to protect a very important part of your body which is the brain and also your sense organs eyes, ears, the nasal cavity, the oral cavity etcetera. And it also provides like we said like we saw the skeletal system is provides the point of attachment for various muscles. So, this skull provides attachment for muscles that are responsible for chewing so for nutrition because we have to chew our food so for chewing and for turning the head. So, the skull provides the points of attachment for these muscles for moving the head.

When we move down you come to the trunk. So, if you look at the trunk, the trunk like I said is composed of the vertebral column vertebral or spinal column, then you have the

sternum which is the t shaped bone, it is also called the breastbone in the anterior part of the body. And you have the ribcage which protects some major internal organs of the body.

So, in the vertebral column, you have cervical vertebrae, you have seven cervical vertebrae; then you have thoracic vertebrae that would be 12 thoracic vertebrae; then you have 5 lumbar vertebrae. And then you have this funny shaped bone called the caustics sorry the sacrum, you have the sacrum which is made up of 5 fused vertebrae. And then you have the tailbone the coccyx is the tailbone which is again made up of 3 to 5 fused vertebrae ok. So, these are the vertebra of the spinal column; the bones of the spinal column ok.

And then you have the ribcage. If you look in the ribcage, you have these ribs that are attached you know that come from the thoracic vertebrae and they attach to the sternum in front ok. You have 12 pairs of ribs of which you know you talk about 1, 2, 3, 4, 5, 6, 7; the first seven are called true ribs, because they attach directly to the sternum. And then you have at another five pairs of ribs that are called fake ribs because they do not directly attach to the sternum. They attached by a cartilage to the other ribs and then attached which then attach to the sternum. And then you have two pairs which are not attached at all and they are called the floating ribs.

So, you have true ribs, false ribs and floating ribs depending on how they are attached to the. Sometimes the because these are also still attached you know, they are called they call them 10 pairs of true ribs, they will say the 10 pairs are true ribs and 2 are floating ribs ok. So, there is superior 10 pairs are the true ribs and the inferior 2 pairs are the floating ribs notice my use of the term in relation to the which plane transverse plane we are talking about. And the function of the ribcage is to provide support for or protect organs like the heart and lungs.

So, if you look at the appendicular skeleton, then if you notice most of our movement happens through the appendicular skeleton. So you have your arms and your legs which are responsible for most of the movements that we make and so that is the appendicular skeleton is very mobile ok, you can move the bones in the appendicular skeleton to a large extent as compared to the bones in the axial skeleton. You do not have the same range of movement in the axial skeleton as you do in the appendicular skeleton. So, the

appendicular skeleton is the bones of the shoulder girdle shoulder or pectoral girdle; girdle implies support. So, it is supporting the arms. The shoulder girdle you have the upper extremities which are the arms and the hands, then you have the pelvic girdle and then you have the lower extremities namely the legs and the feet. So, these are the bones of the appendicular skeleton.

Now, in terms the bones can also be classified in terms of their shape. So, this is in terms of their location you know whether they are part of the axial skeleton or the appendicular skeleton that is the broad classification. Then the bones in the body can also be classified in an in another manner based on their shape.

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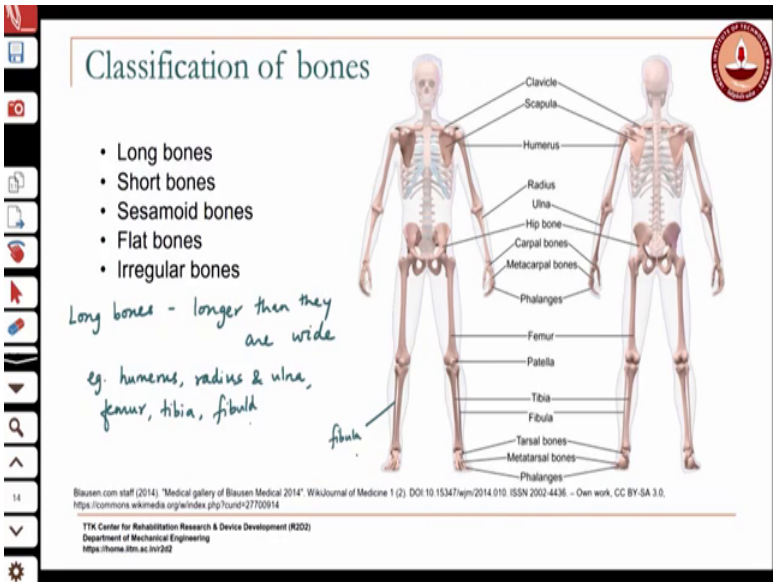

And based on their shape they are classified as long bones, short bones, sesamoid bones, flat bones and irregular bones. So, let us look at each of these in a little more detail. Long bones, these are bones that are longer than they are wide ok, typical bones. So, if you look at this bone of the upper arm which is called the Humerus. Then this is a bone that is much longer than it is wide. Similarly, if you look at the bones of the forearm you have the radius and the ulna; and they are also bones that are longer than they are wide.

Similarly, if you look at the lower limb if you look at this bone this is the thigh bone or the femur. So, if you look at this femur or thighbone, then you can again see that this is considered a long bone. So, examples of these long bones are many of the bones in the appendicular skeleton. So, you have the humerus, radius and ulna, then you have the

femur tibia fibula is I do not have it here, but it is the bone that is next two this is the fibula the tibia ok. So, you have the tibia, fibula these are all. So, this is the tibia that you can see here.

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So, this is this way. So, this is that is your hip and you have the knee here and that goes down to the ankle there. So, the tibia, femur and the tibia are also considered long bones of the body.

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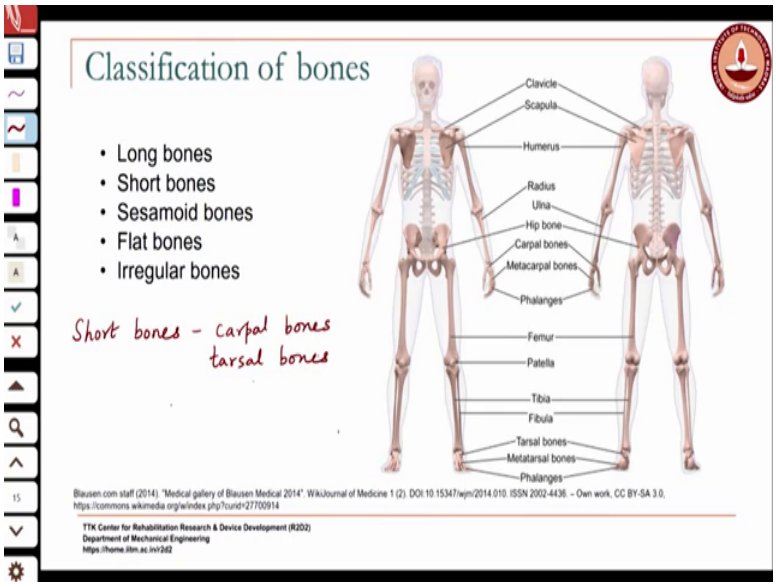

Then you have short bones short bones are typically.

Student: Ok.

Short bones are bones which are you know about the same in terms of their length and width. So, some examples of short bones are the bones in your wrist, the carpal bones, the bones in the hand carpal bones and the tarsal bones in the foot are examples of short bones.

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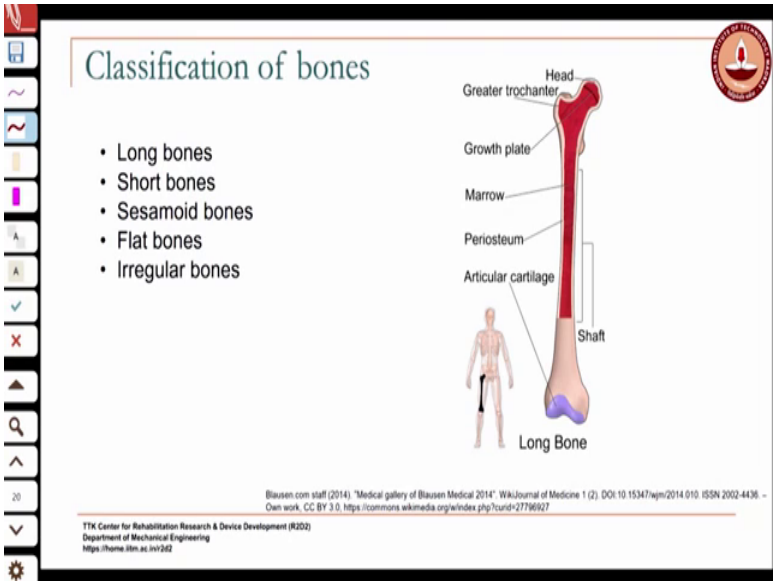

So, here is your long bone like we saw the femur, you can see there that is the head of the femur which is like a ball which is what kind of forms the joint with the pelvis or the hip bone. So, this is a long bone example of a long bone.

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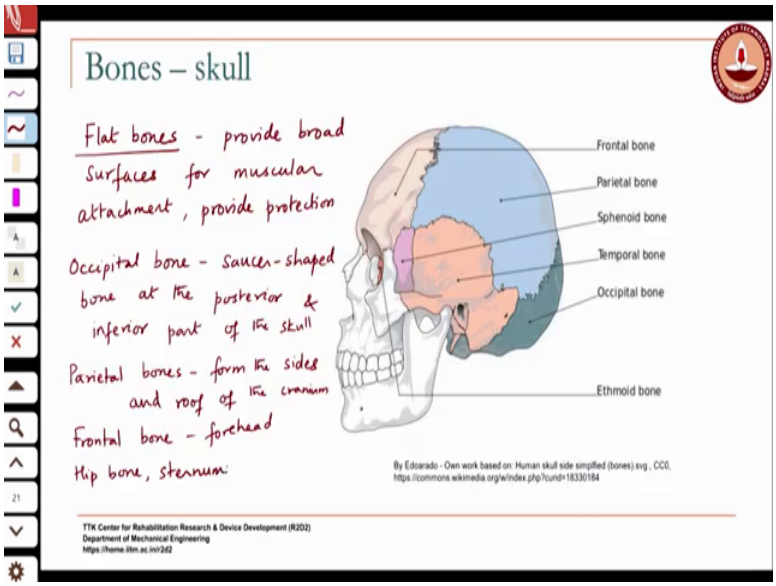

Then you have flat bones. So, flat bones the bones in the skull are examples of flat bones. Flat bones provide large areas of attachment for the muscles. So, they provide broad surfaces for muscular attachment. And they are also protective bones. So, provide protection. So, the bones of the skull are good examples like you have the occipital bone, then you have the parietal or the parietal stands for roof, roof bone, you have your forehead frontal bone. So, these are all examples of flat bones.

Other flat bones in the body this hip bone the pelvis right that is a flat bone. Again this scapula or your shoulder blade also provides broad surface area for attachment. So, these are good examples of flat bone. So, as the sternum, the sternum is also a flat bone. So, the occipital bone is your, its shape like a saucer; it is the saucer shaped bone at the back. So, I should say instead of back and lower part, I should say posterior and inferior part of the skull ok.

Back is posterior; lower is inferior. The parietal bone bones they form the sides and the roof of the cranium parietal means wall. And then you have the frontal bone which is the forehead then you have the hip bone the sternum these are all examples of flat bones. Now, you have sesamoid bones which are a special type of their short bones essentially.

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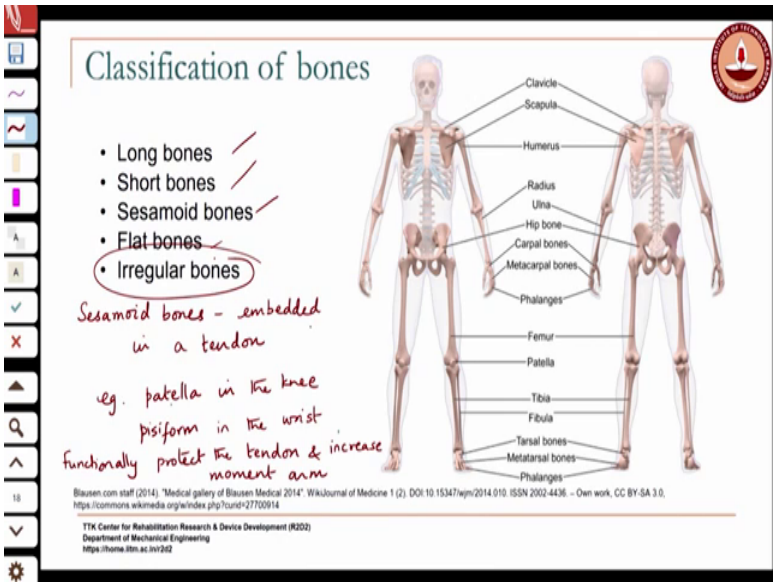

They are small bones actually, but they are given a special name because they are bones that are embedded in a tendon. And the classic example of the sesamoid bone is your kneecap I am not able to. So, you have add the connection between the femur and the tibia you have your kneecap. It is called the patella or the kneecap and that is a bone that is embedded within that tendon that goes from the quadriceps muscle to the tibia ok. So, there is a bone in here that is that is embedded into the tendon and that is considered a classic example of a sesamoid bone.

The other sesamoid bone is your pisiform in your wrist. So, you have that small bone and that is also embedded inside a tendon. So, it is also a short bone, but it is embedded in a tendon it is like a pea shaped bone in your wrist, where the ulna joins the wrist. So, examples are the patella and the pisiform patella in the knee and the pisiform in the wrist. And the function of these sesamoid bones is to protect if it acts like.

So, you have the patella here you will have the patella here and the muscle and the tendon goes over it. And essentially what that does is so when it pulls, it is actually increases the moment arm for the force that is acting about the knee joint. So, it protects that it also protects the tendon. So, if you have a joint and you have you know especially a joint with a large range of motion like the knee joint, then when the knee moves and comes back, there is a chance for the tendon to kind of get pinched between the two bones. So, what the patella does is it keeps there tendon a little bit away from that joint

and helps to protect the tendon from getting stuck between the two bones of the joint so that is what this sesamoid bones do.

They functionally protect the tendon and increase the momentum by holding the tendon slightly away from the center of the joint. So, anything that does not come under long bones, short bones, sesamoid bones or flat bones becomes an irregular bone ok. So, if you cannot classify is it so it is none of the above becomes an irregular bone; so any bone that is. So, you have various you know the vertebra for instance, the vertebrae are examples of irregular bones you know they have a funny shape and each vertebra as you go down; you know from the cervical to the lumbar vertebra, and then the sacrum, and coccyx you will find that they are irregularly shaped bones.