hello students welcome to the e-content. Title of the unit is skeletal system the name of the module is the vertebral column and vertebrae part one module number is nineteen .Myself seraph natasha gomes working in government college of arts science and commerce Quepem goa the outline will be the introduction, vertebral column in fishes, vertebral column in tetrapods ,structures function different types of centra and references so the learning objectives will be differences in regions of vertebral column from fishes to mammals define the normal vertebral curvatures, different types of centra, different types of shape of the tail which is correlated with the direction taken by the terminal portion of the vertebral column. Coming to the introduction vertebral column is also known as the backbone or spine is an important characteristics of all vertebrate groups, as we know the vertebral column is made up of series of bones called as vertebra now in the early primitive the actual vertebral skeleton was a notochord which was seen in all embryos which has been replaced by the series of bones called as vertebral column. The major function of the vertebral column is that they protect the spinal cord and provides the mobility as well as the flexibility, the vertebral column extends from the skull to the tip of the tail. Although the vertebrae of various animals are different but all the vertebrae conform to a basic plan although there are differences in the same vertebral column itself so a typical vertebra has a cylindrical body or centrum which encloses or replaces the notochord . Coming to the vertebral column in fishes , It is divided into two regions , the region differentiated is the trunk vertebrae which is also called as abdominal vertebrae and the other one is the caudal vertebrae, the anus marks the transition between these two types of vertebrae. In fishes the shape of the tail is correlated with the direction taken by the terminal portion of the vertebral column the first type of tail is the protocercal tail, in this type of tail you will see that the vertebral column extend to the tip of the tail thereby the caudal fin is divided equally, and externally it remains symmetrical from outside now this type of tail is generally seen in embryonic fishes adult cyclostomes and amphibians the protocercal tail gives rise to the next type of tail that is the heterocercal now what happens is in this particular tail the vertical column is bent upwards in the posterior region thereby forming a smaller dorsal cordal fin and a larger ventral cordal fin the heterocercal tail give rise to the next two types of tail that is the diphy cercal tail and homocercal tail.In diphycercal tail the vertebral column is lost at the tip of the tail but externally the caudal fin appears symmetrical, this type of tail is seen in dipnoid, polypturus and latimera. Homocircle tail this type of tail the vertebral column has lost its dorsal part and the ventral part itself divides equally into two symmetrical halves thereby it appears symmetrical from outsides now this type of tail is very common in bony fishes . Hypocircle tail has a larger lower lobe of the caudal fin into which the vertebral column is bent downwards this type of tail is found in some primitive fishes and extreme reptiles. As we know that the tetrapods emerge on land from water they underwent lot of changes so one of the change is that they started showing the differentiation of region in the vertebral column so the anterior trunk vertebrae was developed as a cervical vertebrae which was meant for the movement of head the posterior caudal vertebrae were reduced in number thus the tetrapod have cervical trunk or dorsal, sacral and caudal vertebrae. In some reptiles many birds and mammals the trunk vertebrae is further divided into thoracic and lumbar vertebrae , thoracic for the articulation with ribs and lumbar. There are reduction in the ribs in amphibians you will see there is a single cervical vertebra called as atlas which articulates with the skull followed by the trunk, single sacral vertebrae connects to the pelvic girdle . caudal vertebrae are found only in the tail forms in reptiles you will see the vertebral column is differentiated into cervical thoracic lumbar sacral and caudal region. the cervical region is very mobile and it is one of the chief characteristics of birds whereas the other part is capable of little movement the chief characteristics of the vertebral column is its rigidity due to ankylosis now this rigidity is a great advantage in birds in their flight the vertebrae are heterozygous or shallow shape vertebrae making of the synsacrum varies in birds from 13 to 20. Synsacrum provides a rigid framework which is very much valuable in flight the caudal

vertebrae are very small first few after the synsacrum are free but the posterior ones are fused to form pygostyle that is a bone which supports the tail the free caudal vertebrae are amphicoelous ,coming to the mammals taking the example of human beings there are seven cervical vertebrae 12 thoracic vertebrae five lumbar vertebrae one sacrum wherein there are fusion of five bones which forms one sacrum and four bones fuse to form a single bone called as coccyx now cervical thoracic and lumbar vertebrae are movable because there is a space found in them called as intervertebral disc whereas sacrum and coccyx are immovable because they do not have any space they are joined, between the vertebrae from second cervical vertebra to the sacrum you will see that there are intervertebral discs, if you see the structure the total number of vertebrae during early development is 33 but what happens is that as the child starts growing as she starts walking several vertebrae in the sacral and coccyx region starts fusing you will generally see that adult vertebrae just have 26 vertebrae sacrum coccyx bones become fused . In the fetus you will see a single curve which is known as the primary curve and the primary curves are the ones which retains its posture same in the adult the thoracic and the sacral are called as the primary curvatures whereas the cervical and the lumbar are known as the secondary curvatures because they tend to change when a child starts lifting his head or walking . primary are the thoracic and sacral and secondary are the cervical and lumbar coming to the function the major function of the vertebral column is that they will protect the spinal cord helps in the attachment of different muscles, supports head it will help to permit the different movements it will also absorbs the shock during walking, it will transmit the body weight in walking and standing .The different types of centra in vertebrate groups . first type of centra is the amphiocelous which has its centrum concave at both ends now this type of centre you will generally see most primitive types found in nearly all fishes . proscelous centra wherein the vertebra has its centrum concave at the anterior and convex at the posterior end now this type of center is generally found in most reptiles and frogs the apistocelous vertebra has centrum convex at the anterior end and concave at the posterior end it is not a characteristic of any group but occurs in all classes oscillus or amphiplatin vertebrae in which the ends of the centrum are flat and the vertebrae are separated by an intervertebral disc they are found in most mammals the heterocyllus vertebrae with centrum having saddle shape for articulation this is the most specialized vertebra which is found in the neck region. here are the references thank you