Quadrant II – Transcript Related Materials

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Module Name: Vertebral Column and Vertebrae – Part I

Module No: 19

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Notes:

INTRODUCTION

Vertebral column is also known as backbone or spine is one of the important characteristic of all vertebrates. The primitive axial skeleton is a notochord which is seen in all chordate embryos is been replaced by the segmented series of bones termed as vertebral column. vertebral column houses the spinal cord and also provides mobility and extends from skull to the tip of the tail. Although the vertebrae of various animal differ also the same vertebral column has differences but the vertebrae conform a basic plan. A typical vertebra has a cylindrical body or centrum which encloses or replaces the notochord.

VERTEBRAL COLUMN IN FISHES-vertebral column is divided into 2 regions , they are trunk or abdominal region and the caudal region .Anus marks the transition between this two regions.

In fishes the tail is correlated with the direction taken by the terminal portion of the vertebral column –

1) Protocercal –when the notochord extends straight to the tip of the tail and the caudal fin is equally divided. Seen in embryonic fishes, adult cyclostome, and some amphibians.

2) Heterocercal vertebral column is bent upwards in the posterior region so the caudal fin is divided into a narrow dorsal narrow lobe and broader ventral lobe.

3) Diphycercal tail- vertebral column has lost the terminal upturn part so the vertebral column does not reach the end. Externally the tail appears symmetrical .

4) Homocercal tail- the terminal part of vertebral column is bent upwards, but the dorsal lobe of caudal fin is lost during development and the ventral lobe divides into two equal parts.This tail is very common in bony fishes.

5) Hypocercal tail has a larger lower lobe of the caudal fin into which the vertebral column is bent downwards. Found in some primitive fishes and extint reptiles called ichthyosaurs.

VERTEBRAL COLUMN IN TETRAPODS-as the tetrapods emerge on land from water they underwent lot of changes . One of these changes are differentiation of vertebral column into regions. Anterior trunk vertebrae called Cervical were developed for movement of head. Caudal vertebrae are reduced in number Thus tetrapods have cervical, trunk(dorsal),sacral and caudal vertebrae .In many reptiles , all birds and mammals the trunk vertebrae are further differentiated into thoracic and lumbar vertebrae.

Amphibians-Single cervical vertebra (atlas) articulates with the skull followed by trunk vertebrae , Single sacral vertebra connected to pelvic girdle. Caudle vertebrae are found in only tailed forms.

Reptiles –vertebral column is divided into Cervical, thoracic, Lumbar, sacral and caudal regions. Two sacral vertebrae fuse to form sacrum whose transverse processes and ribs are attached to the pelvic girdle. Caudal vertebrae have small V shaped chevron bones on the ventral side .

Aves-Cervical region is very mobile but other regions are capable of little movement.The chief characteristic of the vertebral column is its rigidity due to ankylosis . Rigidity is an advantage in flight. Vertebrae are heterocoelous or saddle –shaped.Vertebrae making up synsacrum varies from 13 to 20 in different species of birds .Synsacrum provides rigid frame work valuable in flight. Caudal vertebrae are small, first few after the synsacrum are free but the posterior ones are fused to form pygostyle which supports tail. The free caudal vertebrae are amphicoelous

Mammals- in mammals taking the example of human being the vertebral column is divided into 7 Cervical vertebrae, 12 thoracic vertebrae, 5 lumbar vertebrae 1 sacrum (5 fused) and 1 coccyx (4 fused) . Cervical , thoracic and lumbar vertebrae movable whereas Sacrum and coccyx immovable . Between adjacent vertebrae from second cervical vertebra to sacrum are intervertebral disc .

STRUCTURE- Total number of vertebrae during early development is 33 but as child grows, several vertebrae in the sacral and coccygeal regions fuse, so in adult there are 26 vertebrae. Sacrum and coccyx bones become fused.

Primary curves - the curves which develop during fetal development. Secondary curves develop after birth when the child starts lifting the head, crawling and standing . Thoracic and the Sacral are primary curves which do not change their original concavity. Cervical and Lumbar are the secondary curves.

FUNCTION-Protects spinal cord and also helps in attachment of muscles, Supports head and Permits various movement, absorbs shocks during walking, transmit body weight in walking and standing.

TYPES OF CENTRA IN VERTEBRATE GROUPS

Amphicoelous vertebra has its centrum concave at both ends Seen in most primitive type and found in nearly all fishes .

Procoelous vertebra has its centrum concave at the anterior and convex at the posterior end . Found in frogs and most reptiles

Opisthocoelous vertebra has centrum convex at the anterior end and concave posteriorly . Its not a characteristic of any group but occurs in all classes

Acoelous/Amphiplatyan vertebrae in which the ends of the centrum are flat, and the vertebrae are separated by an intervertebral disc. Type of vertebrae found in most mammals

Heterocoelous vertebrae with centra having saddle-shaped articulations.

This is the most specialised vertebra found in neck region