A Long Story

- From a stiff internal support (notochord)...
- ..."uniform" vertebral column of fishes...
- ...specialisations for terrestrial life
- ...to the erect human column.
- Did it all begin with locomotor needs?
- Locomotion in fishes and humans –
  little similarity if at all!
- How evolution uses available resources!

The Human Vertebral Column

- Cervical (convex = neck)
- Thoracic
- Lumbar
- Sacrum
- Coccyx

Curvatures

A

Primary and Secondary

“Head holding”

Sitting
Standing
Walking

A Generalised Vertebra

- Neural Arch
- Spine
- Lamina
- Transverse Process
- Pedicle
- Body

Developmental terminology slightly different!
A Generalised Vertebra

- Articular processes and facets
- Notches

A Generalised Vertebra

- Canal
- Spinal cord and nerves
- Meninges

Regional Features

- Canal
- Transverse process
  - Foramen
  - Costal and transverse elements
- Spine

Do not memorise now! Lab exercise!

Atypical Vertebrae

- Transitional areas
- C 1 and 2, C 7
- Upper and lower thoracic
- L 5

Joints

- Zygaphysial (facet joints – synovial)
- Intervertebral discs (sympathes)
- Ligaments
  - Locations and names
- Also note intervertebral foramen

The Intervertebral Disc

- Annulus fibrosus
- Nucleus pulposus
- White fibrocartilage
  - Deformable tissue
Movements
- Limitations and summation
- The "motion segment" (Unit of movement)
- Flexion and extension
- Lateral flexion
- Rotational movement
  - Torsion of the disc
  - Orientation of facets

Muscles
- "Extrinsic" : Belong to the limbs
- Intrinsic
  - Long and short
  - Superficial and deep
  - Many segments / few segments / one segment
  - Spine to spine / spine to transverse process / transverse pr. to transverse process
- Unilateral (one-sided) / Bilateral actions
- Once more... concept vs detail

Muscles

Development
- Paraxial mesoderm
- Segmentation – somites
- More somites than 'visible' segments
- Occipital region → caudal end
- (...pre-occipital region...)
- Somite
  - Sclerotome
  - Dermomyotome

Segmental Sclerotomes
- Each vertebra : Two segments
- Nerves are segmental
- Arteries are intersegmental

Comparative Features
- Beware of generalisations!
  - Vertebrae : Complex structures
  - Invertebrate locomotion
  - Muscle contraction → shortening of body
  - Notochord
    - Stiffness : flexion of body
  - Vertebrae
    - Greater strength
    - Levers for muscles
Fishes
- Buoyancy
- Uniform vertebral structure – well, almost!
- No “neck”

Amphibia
- Gravity and limbs
- Single cervical vertebra
- “Trunk” vertebrae
- Single sacral vertebra

Reptiles
- Terrestrial
- Distinct neck
- Stronger limbs
- Tremendous variation

Birds
- Rigid back
  - Number of fused trunk vertebrae
- Long neck
  - 15 – 20 vertebrae

Mammals
- Regional specialisation
- Epiphyses (?Embryonic source)
- 7 Cervical vertebrae as a rule
- Approx 20 trunk vertebrae
  - Thoracic
  - Lumbar
- Swingers and jumpers
  - Thoracic and lumbar proportions
- Human vertebral column and other primates