• Encloses spinal cord, (dorsal aorta)
• Site of muscle attachment
• Suspendes body - tetrapods

Somites
• Somites –
  – Dermatome
  – Sclerotome
  – Myotome

Vertebral structure
• Neural (Vertebral)arch
• Hemal arch
• Neural, hemal spines

Most vertebrates have centra that unite with arches
**Amphicoelous**
- Pad of notochord bw vertebrae
  - compression and bulging
  - dislocation

**Opisthocoelous, Procoelous**
- Articulate in ball and socket fashion
  - Intervertebral pad is ossified
  - Nerve cord bending

**Acoelous**
- Centra are flattened
  - Intervertebral disks, notochord

**Heterocoelous**
- Interlocking ‘saddle’ shapes
  - Twisting prevented, yet flexible
Vertebral development

Ribs and sternum

- Dorsal ribs, ventral ribs

- Diapophysis, parapophysis

Ribs meet ventrally at sternum for many tetrapods (mostly amniotes)
- Lung ventilation

Fig. 8.3

Fig. 8.6
Ribs and sternum

- True ribs
- False ribs
- Floating rib

Fish

- Lateral forces, compression, dislocation
- Extended neural, hemal arches
- Trunk vs. tail vertebrae

Tetrapod forces

- Land not level - need dorsal-ventral flexion
- Lateral flexion for some vertebrates

Vertebrae experience torsion forces
Zygapophyses

- Tetrapods – resists torsion forces

Fish vs. tetrapods: regionalization

Amphibian regionalization

- 1: Atlas - ringlike
- 2: Axis - odontoid process extends forward into atlas

Amniote cervical region

No zygapophyses
Changes to regionalization
Amniotes have atlas, axis and other cervical

Mammal regionalization
• Cervical, thoracic, lumbar, sacral, caudal
  – Lumbar vs. thoracic

• Comparing relative lengths of lumbar area

• Comparing length and broadness of neural spines
Modifying tetrapods to be aquatic

- Cervical vertebrae
- Zygaphyses
- Hemal arch

Turtle rib modification

Bird axial modifications

Tradeoff of strength and flexibility