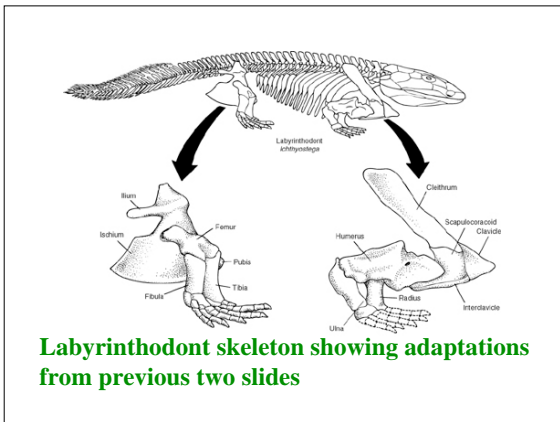
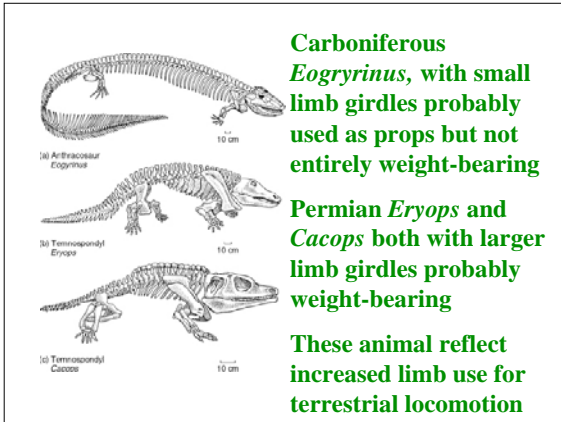


Terrestrial vertebrate body support
Each end of trunk supported to keep appendages in contact with the ground
Standing waves of muscle contraction provide propulsion
Axial support in amphibians increases for weight bearing, but still provide flexibility
Zygapophyses develop on neural arches for closer vertebral articulation
Intervertebral disks increase thickness and fiber content for shock absorption

Ribs ossify or enlarge and increase in rigidity
Muscles and tendons between axial skeletal elements enlarge, diversified in orientation and lever angles and become better braces
Epaxial musculature volume is reduced in terrestrial vertebrates, while appendicular musculature volume increases
Epaxial musculature remains important in swimming forms
Hypaxial musculature becomes specialized regionally





Tetrapod limbs

- Appendages are elongated and specialized for locomotion on hard surfaces
- Support the body trunk off the ground
- Bone pattern retained from crossopterygians although elements are elongated
- More mobility is possible at joints
- Joint mobility specialized to provide mechanical advantage for specific movement patterns that differ for fore and hind limbs

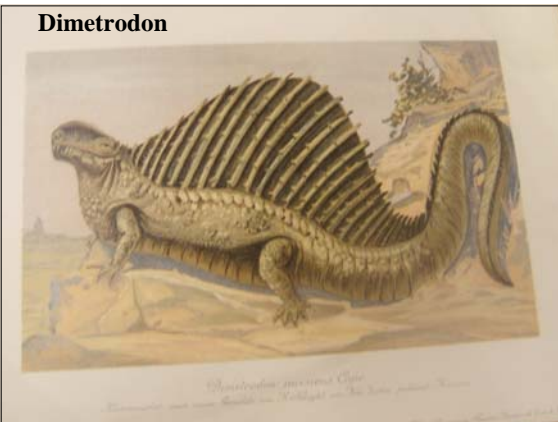
- Allows greater freedom of limb movement but increased positional control
- Allows limbs to be placed under body for support
- Joint between wrist and arm allows the forefoot to be rotated toward ventral midline (=pronated)
- Pronated position allows limb plan to touch ground
- Requires humeral rotation
- Olecranon provides mechanical advantage to triceps muscle

Disagreement among fossil critters



- Pectoral girdle elements arise from both endochondral and dermal bones
- Scapulocoracoid is endochondral and arose from fusion from several basal fin elements
- Articulation of fin or limb to pectoral girdle
- Anchors appendicular musculature
- Dermal elements moved inward and attached axial musculature to branchial chamber region
- Brace the pectoral girdle
- Interclavicle in crocodyliforms and later forms

Dimetrodon

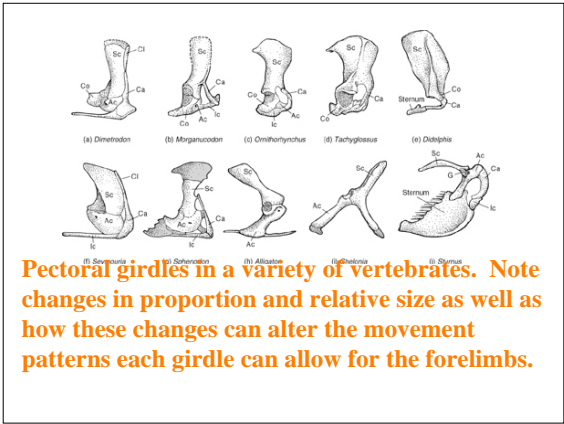


- Tetrapod limbs evolved from lobe fins of rhipidistian crossopterygians
- NOT anticipation of moving to land
- Served better to prop animals to move through shallow water or across mud to find better water areas
- These animals and their descendant dipnoans are freshwater forms
- They “walk” along the bottoms of slow-moving streams and use lobed fins as pivots

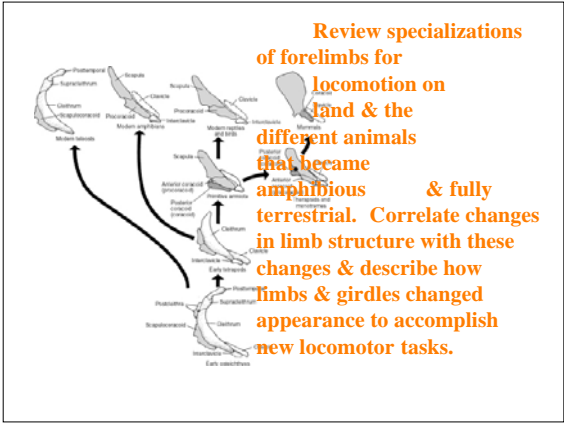
- When conditions become too dry present day lungfishes estivate
- Build a cocoon of mud and remain asleep until the water level rises in their ponds
- Metabolic rate, breathing and all other activity slows
- See p. 100 in text for more information on estivation in lungfishes
- Review question: How does estivation differ from hibernation?



Pectoral girdle evolution, starting with fish pectoral girdles attached to the head and a fin to amphibians and to modern forms with greater limb specialization



Pectoral girdles in a variety of vertebrates. Note changes in proportion and relative size as well as how these changes can alter the movement patterns each girdle can allow for the forelimbs.



Review specializations of forelimbs for locomotion on land & the different animals that became amphibious & fully terrestrial. Correlate changes in limb structure with these changes & describe how limbs & girdles changed appearance to accomplish new locomotor tasks.

Evolution of hips and shoulder factors in common

- 1. Girdles required to support body weight on land**
- 2. Serve as anchor points for muscles**
- 3. Provide stable base against which limb can move differentially**
- 4. Pelvic girdle loss of attachment to head allows independent head movement**

What does a neck do for you? Or, can having a neck turn your head?

Less dependence on mobility of entire body to respond to special sensory stimulus (primarily visual and auditory)

Can extend feeding range of animal without moving whole body if head can move to gather food

Loss of posttemporal bones cushions ear region from shock of walking movements

Pectoral girdle simplifies during evolution

In later forms only clavicle is retained

Clavicle lost in cursorial forms

Review question: What is the function of a clavicle and why is it lost or kept in different animals?

Coracoid reduced and fused to scapula (= coracoid process of scapula in mammals)

Interclavicle and sometimes two coracoids may be present



This photograph of the National Zoological Park's new panda cub was taken during a recent veterinary exam. The male cub is healthy, thriving and growing daily. (Photo by Jessie Cohen)
