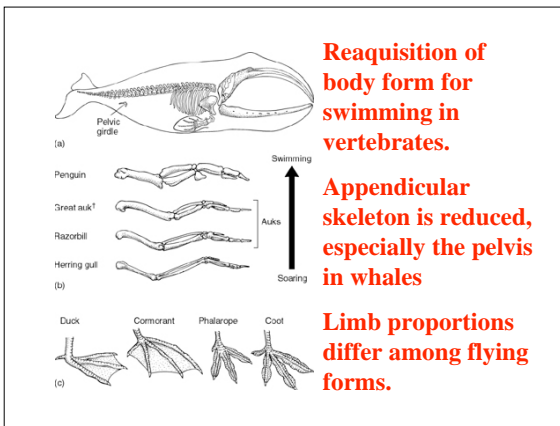
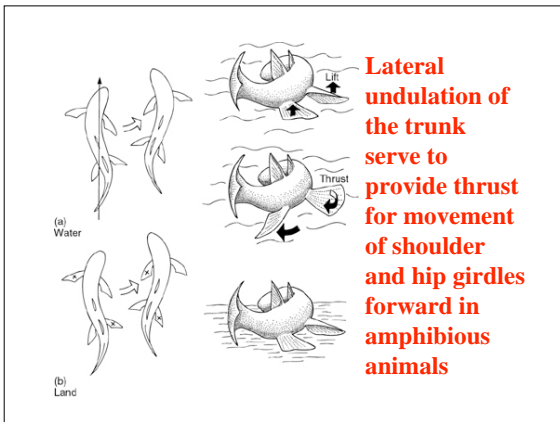
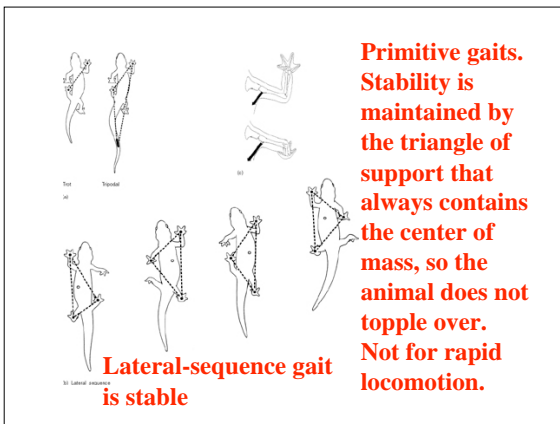


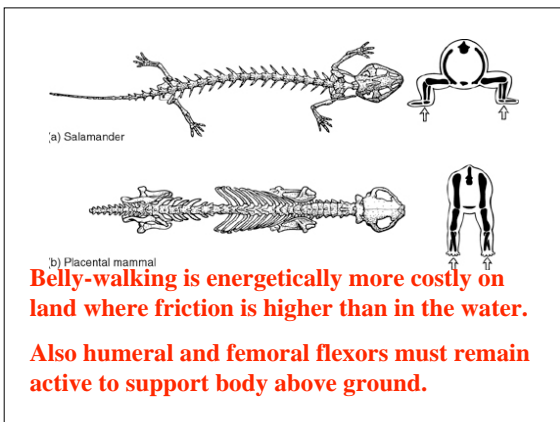
- **Pectoral girdle has little bony connection to thorax in many animals that engage in cursorial locomotion**
- **Muscular sling supports thoracic organs and is resilient to allow movement to assist with respiratory functions**
- **Pelvic girdle support is bone-bone contact (pelvis to sacral vertebrae)**
- **Direct transmission of forces, good for passive weight bearing**



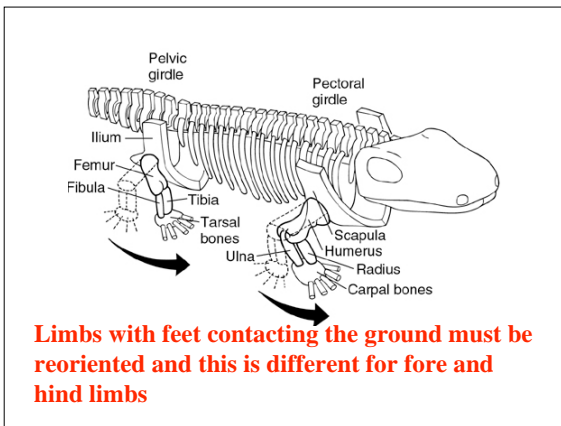


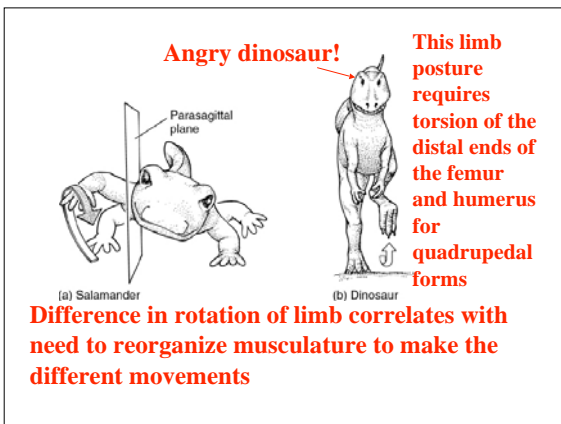
- **Gait** is the pattern of footfalls, or foot contacts with the substrate.
- **Diagonal gait** is when diagonally opposite feet contact the ground simultaneously (i. e., a trot).
- This occurs in tetrapods as well as bottom-walking fishes that use lateral body undulation to place opposite fins into contact with substrate.
- Unstable gait, but stabilized by adding a third support point onto ground as a tail.





- **Sprawled posture is primitive, as seen in most salamanders and some living forms today.**
- **More erect posture allows for limbs to support body as columns, and allows longer limbs to be a greater advantage in increasing locomotor speed.**
- **Upright stance is common among some dinosaurs and mammals.**
- **For mammals these changes occurred in therapsids and later synapsids.**

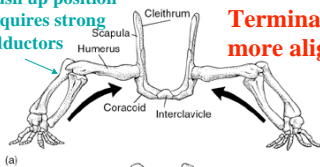




**Muscle rearrangements from fins
generating forward propulsive thrust to
sprawled posture limbs**

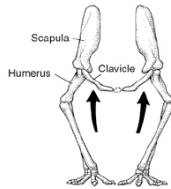
- Dorsal fin muscles become elevators
- Ventral fin muscles become depressors
- Rotators may arise from both regions or be combinations
- Limb retraction caused forward motion of body
- Return of limb to original position uses opposing muscles – antagonists, which also support the suspended body while the limb is in motion

Push up position
requires strong
adductors



**Terminal foot digits are
more aligned in direction
of travel for
increase in
efficiency**

(a)



**Limb movement more
restricted to a single
plane, i. e., parasagittal,
and allows limbs to move
as do pendulums under
the body**

(b)

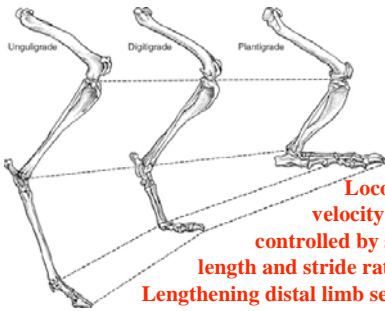
- With limb reorientation to beneath the body and sagittal locomotion, the pectoral girdle assumed more of the body weight
- However, the glenoid and acetabulum reorient to face ventrally
- Forces then shift from midline to scapula and pelvic bones.
- In forelimb girdle role of interclavicle, clavicle, coracoid and procoracoid are reduced
- Scapula becomes more important
- Pubis and ischium sizes were also reduced

In a sprawled stance, the forces are more vertical; in an upright stance forces are more forwardly oriented and improve locomotor speed



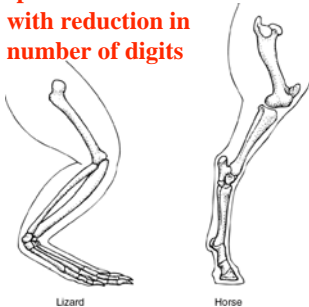
(a) Primitive reptile

(b) Placental mammal



Locomotor velocity is controlled by stride length and stride rate. Lengthening distal limb segments increases stride length & also speed

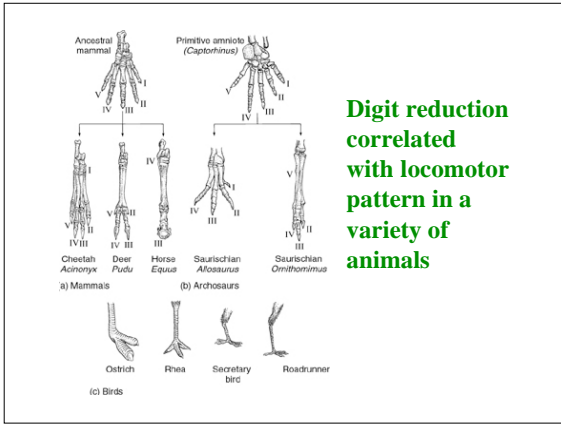
Increased locomotor speed also correlates with reduction in number of digits



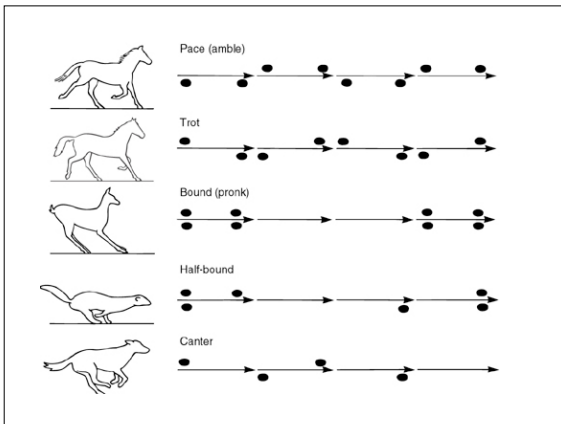
Lizard

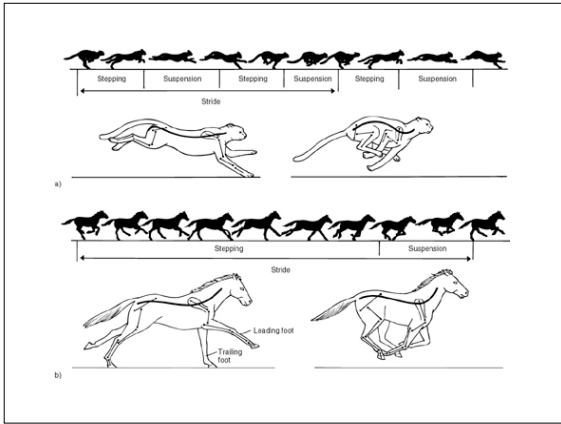
Horse

Moving muscle bellies proximally reduces the distal weight to the limbs and therefore requires less energy to overcome inertia resulting from mass



- **Footfall order and spacing in a variety of animals show gait patterns**
- **Rate of movement**
- **Amount of time body is unsupported**
- **Ability to calculate speed of travel**
- **Relative stability of each gait**





- **Comparison of fast running cursors.**
- **Cheetahs run with great back flexibility to add length to each stride**
- **Horses have little back flexibility and travel forward more horizontally**
- **Cheetahs use more effort to move vertically during running and so expend more effort**
- **Cheetahs sprint while horses run long distances over a longer time**



What is wrong with these pictures?
