Evolution der Vertebraten

Schlüsselereignisse der Wirbeltierevolution:

1 Ostracodermi: Entstehung eines Endoskeletts aus mesodermalen Gewebe **-> Wirbelsäule** („Ersatzknochen“ ersetzen knorpelige Vorstufe) „Deckknochen“ entstehen aus mesodermaler Dermis **-> Knochenpanzer**

2 Placodermi: **Kiefer** entstehen aus Kiemenbögen, **Zähne** aus Hautknochenpanzer

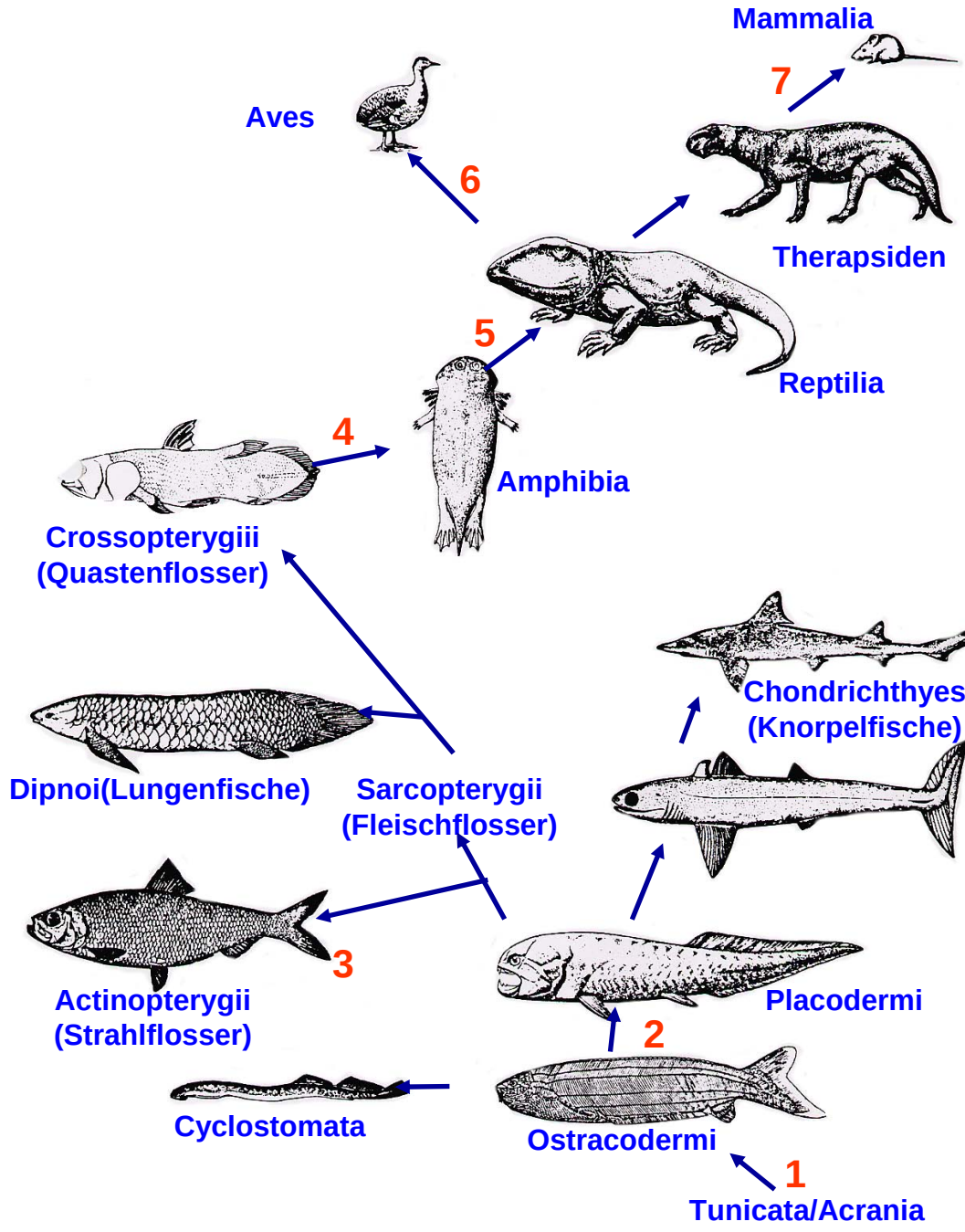
3 Actinopterygii: **Schwimmblase** bei vielen Species als Vorderdarmausstülpung, dient als hydrostatisches Organ.

4 Amphibien: 5-strahlige Flossenextremität bei Quastenflossern ist Präadaptation an das Landleben -> **Extremitäten** der Landwirbeltiere. Gleichzeitig: **Lungenatmung.**

5 **Autarkes Ei** der Reptilien als wichtigster Schritt zur Unabhängigkeit vom Wasser

6 Vögel: **Homoiothermie**; Lunge wird verbessert. Federn

7 Säuger: **Sekundäres Kiefergelenk** ermöglicht bessere Nutzung von Nahrungsressourcen, **Homoiothermie.**



Frühe Säugetiere

Mammalia (Klasse)

Haare, Milchdrüsen,
sek. Kiefergelenk, sek. Gaumendach

Prototheria (U.klasse):

Monotremata (Ord,) *Kloakentiere*

Kloake, Eierlegend,

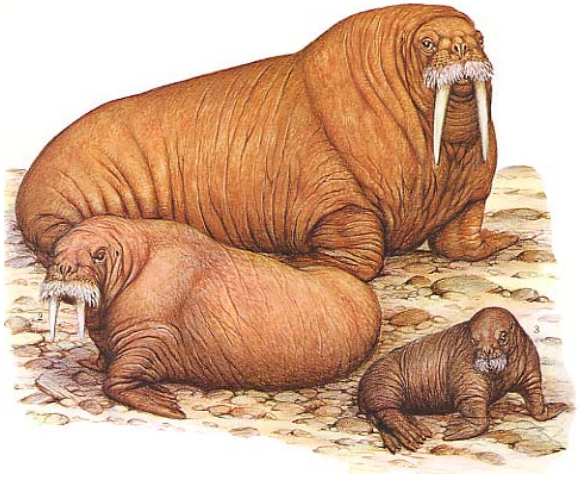
Theria (U.klasse):

Metatheria (Ü.Ord.) *Marsupialia*

Beutel, 2 Vaginae

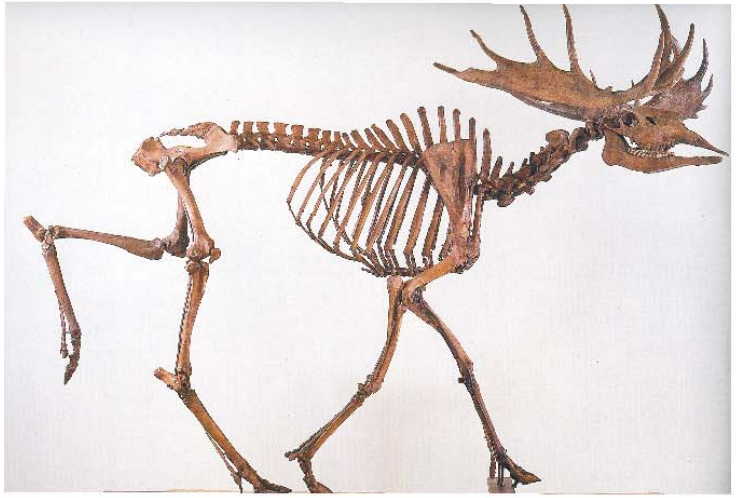
Eutheria (Ü.Ord.) *Placentalia*

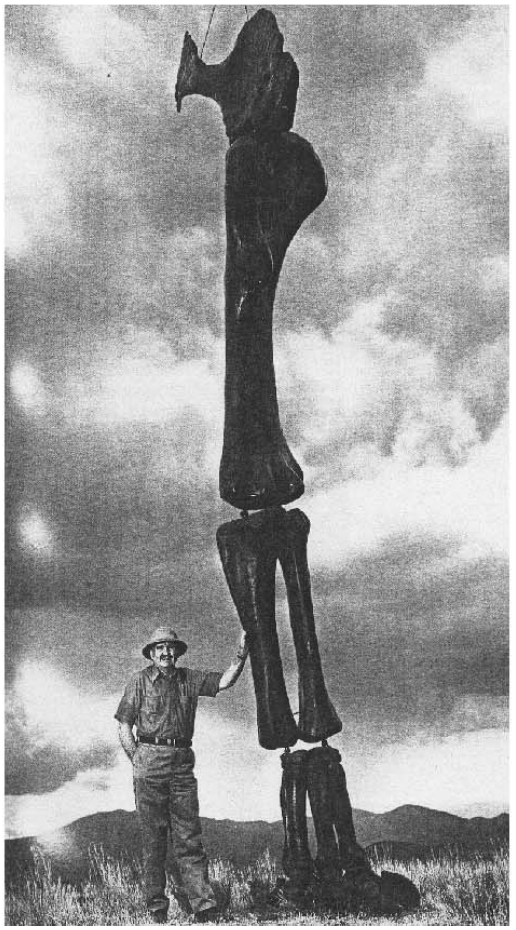
Placenta, Gehirn mit Corpus callosum
und Neocortex

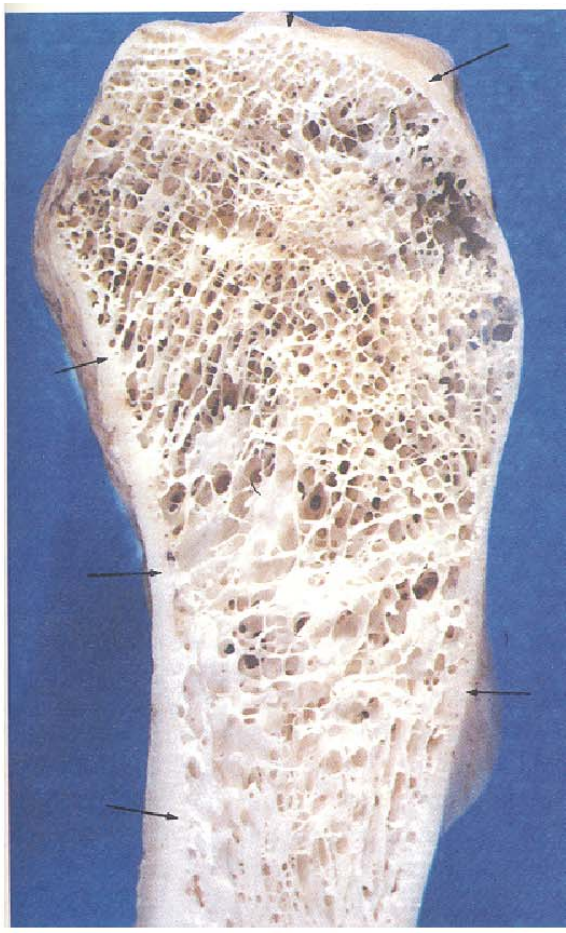


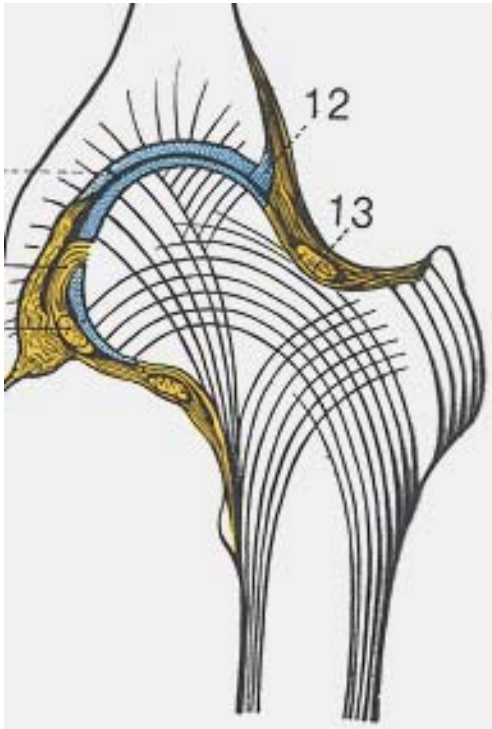
Knochen

Endoskelett der Wirbeltiere

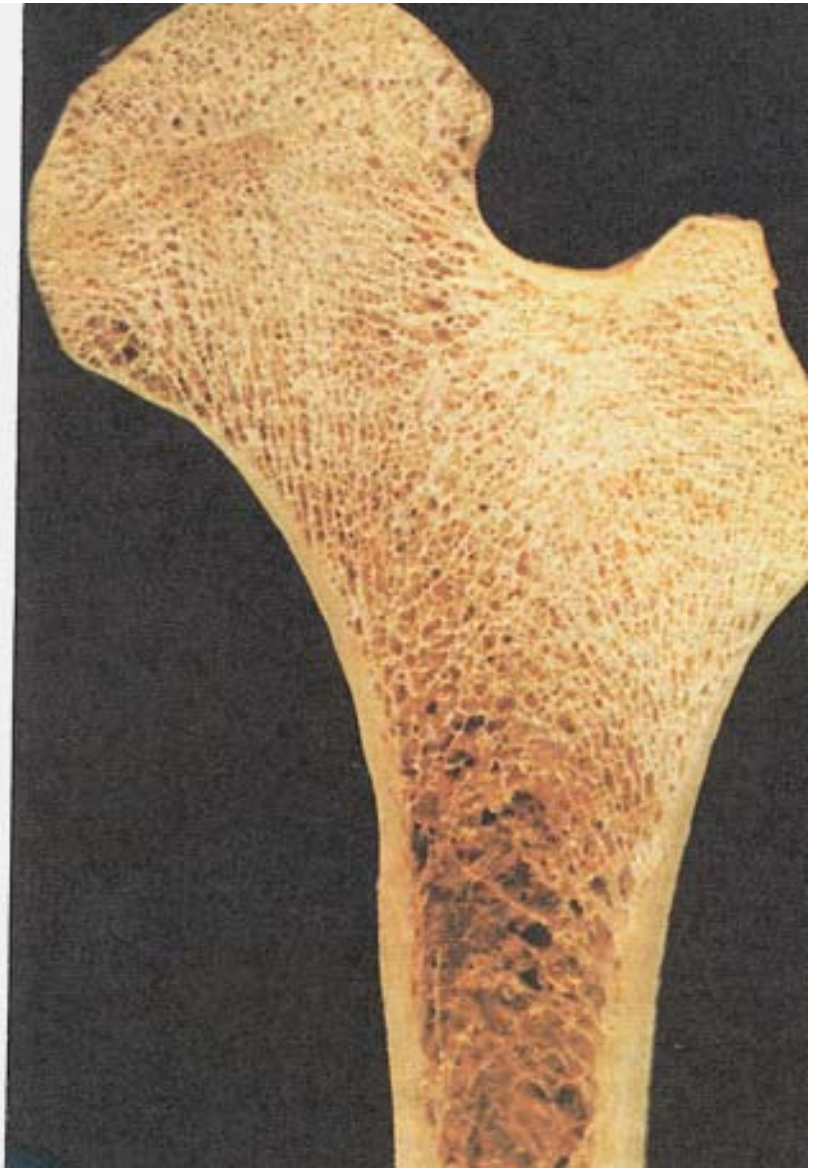


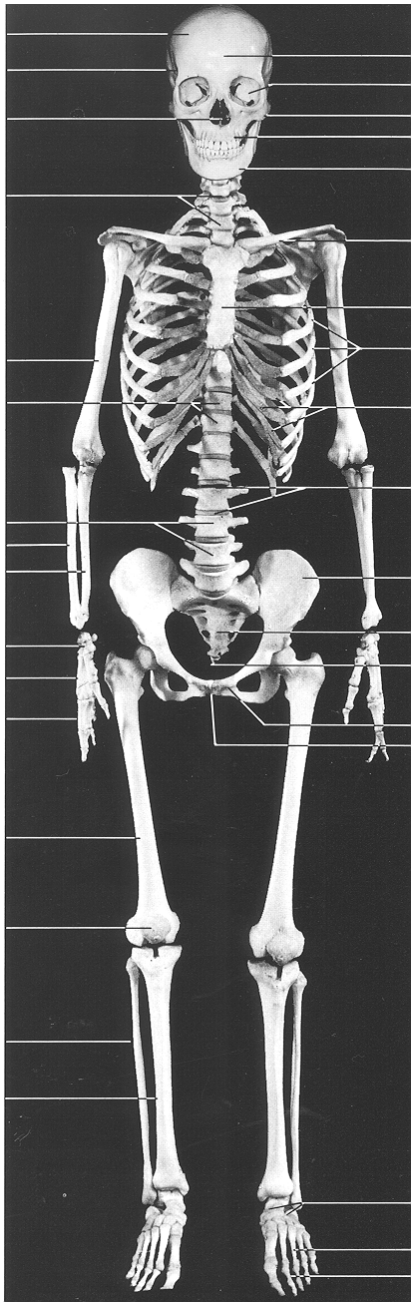






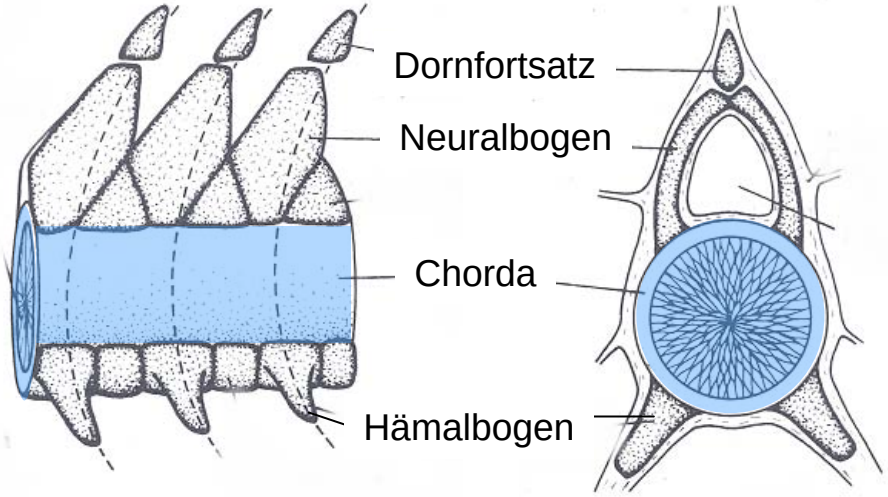
Hauptspannungs-Linien (Trajektorien) im Oberschenkel-knochen



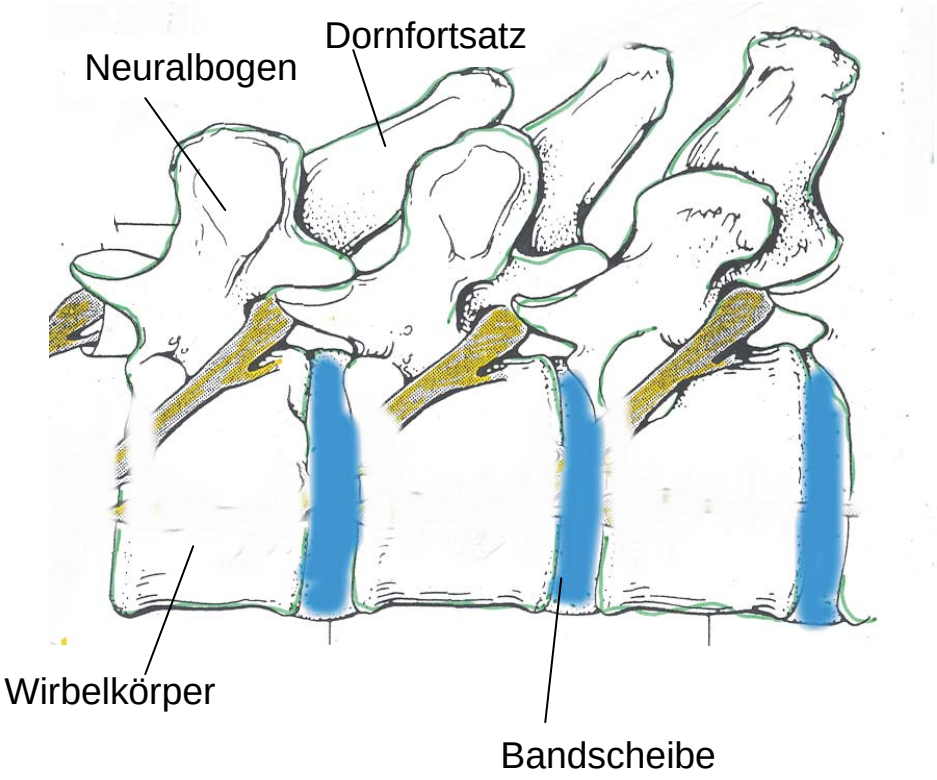


Evolution der Wirbelsäule

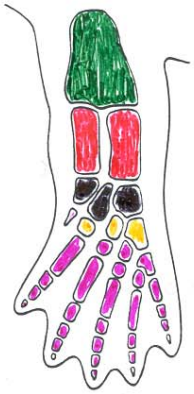
Bogenstadium der Wirbelsäule (Stör)



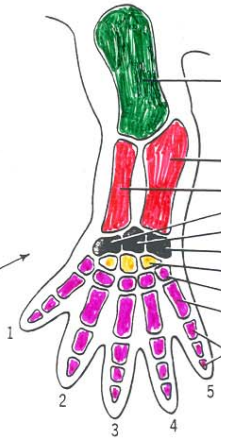
Wirbelsäule der Säugetiere



Extremitäten: Evolution

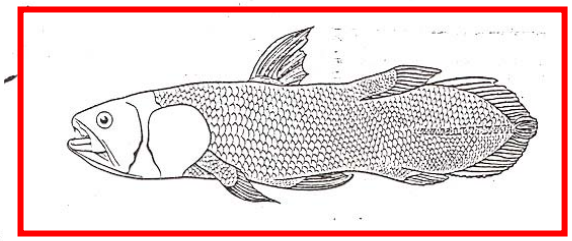


Hypothetische Zwischenstufe

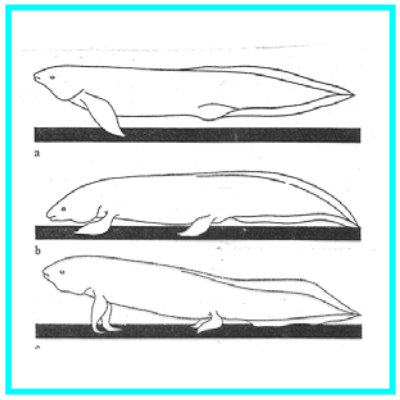


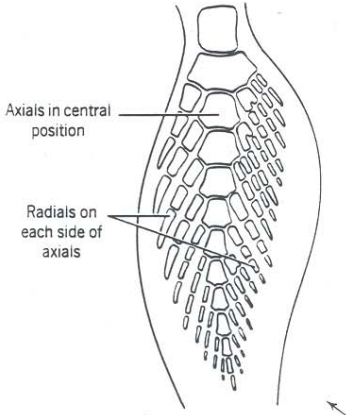
Oberarm (Humerus)
Unterarm mit Elle(Ulna)
und Speiche(Radius)
Handwurzel (Carpus)
Mittelhand (Metacarpus)
Finger (Phalangen)

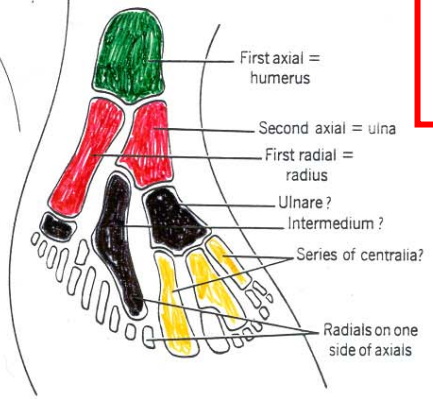
Primitiver Tetrapode



Crossopterygium



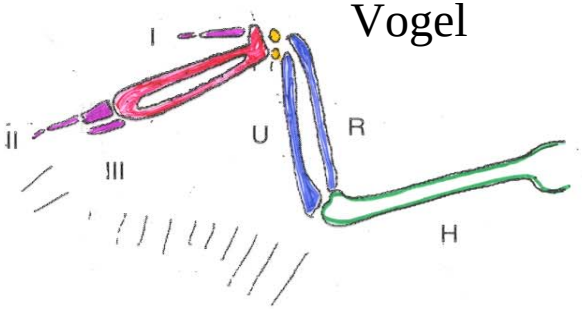




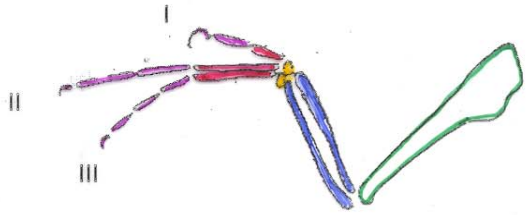
Archipterygium

Extremitäten: Flügel

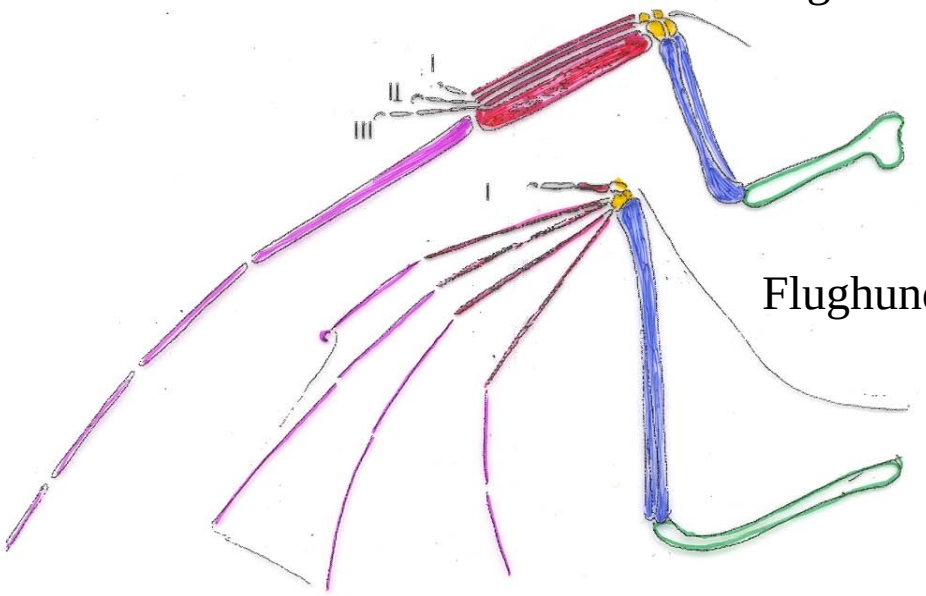
Vogel



Archaeopterix



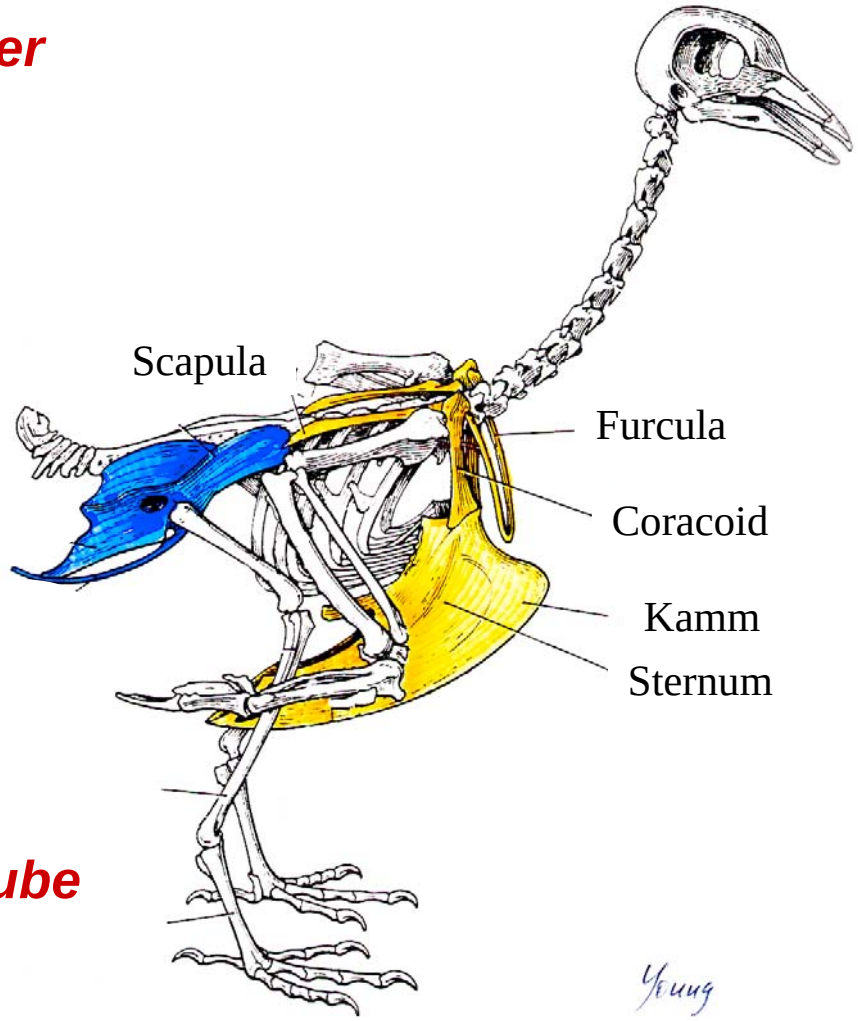
Flugsaurier



Flughund

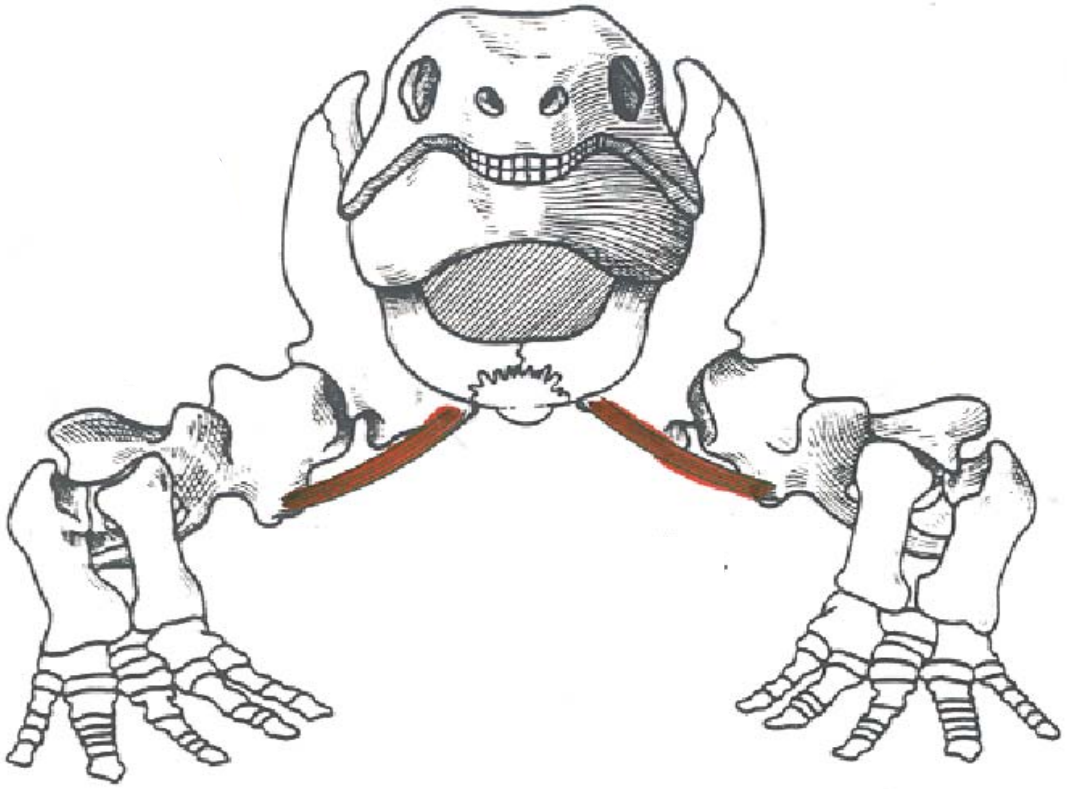
Schulter/Beckengürtel

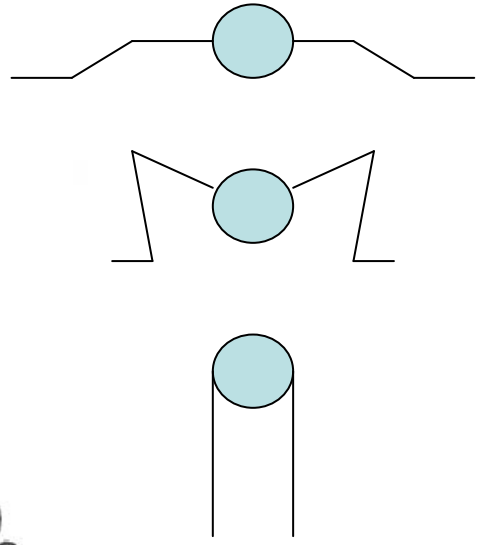
Adler



Taube

Schulter/Beckengürtel



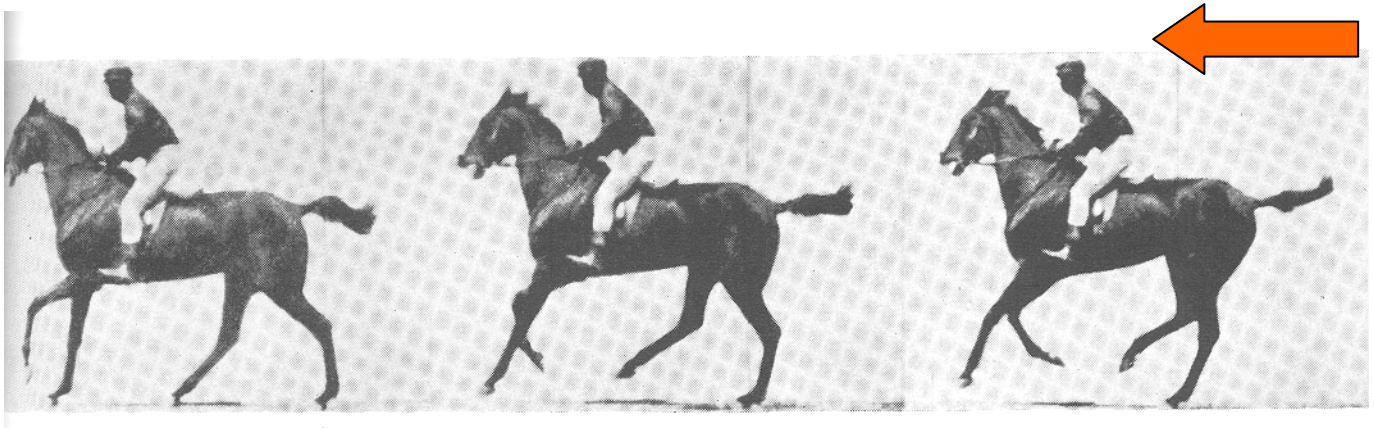


Amphib

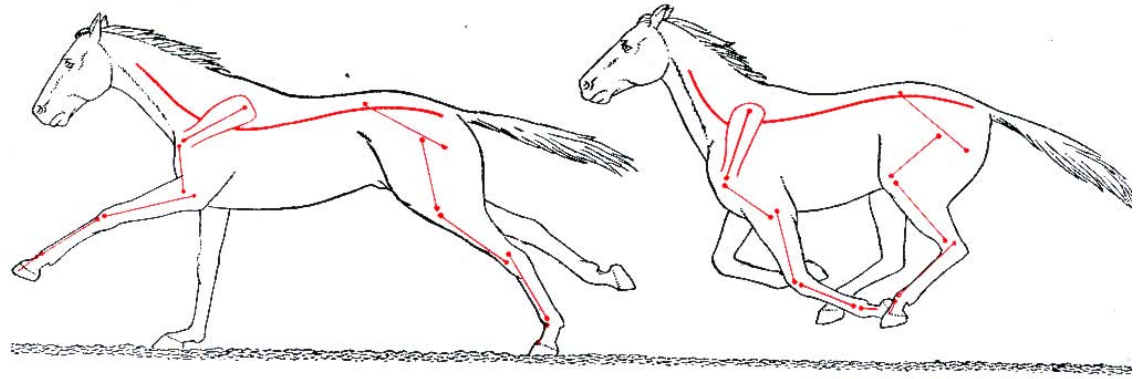
Reptil

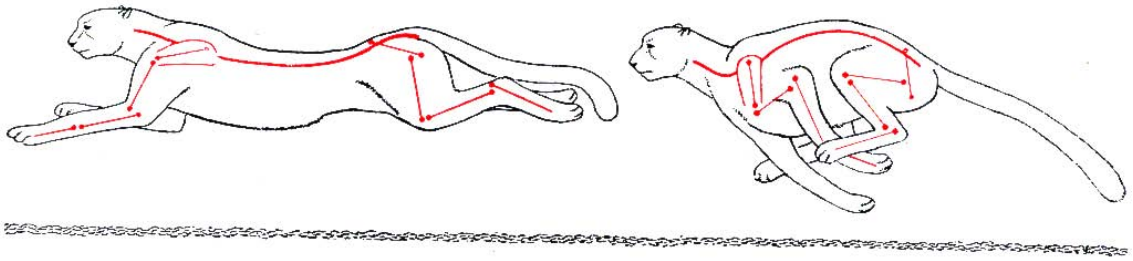
Säuger/
Vögel

Schulter/Beckengürtel



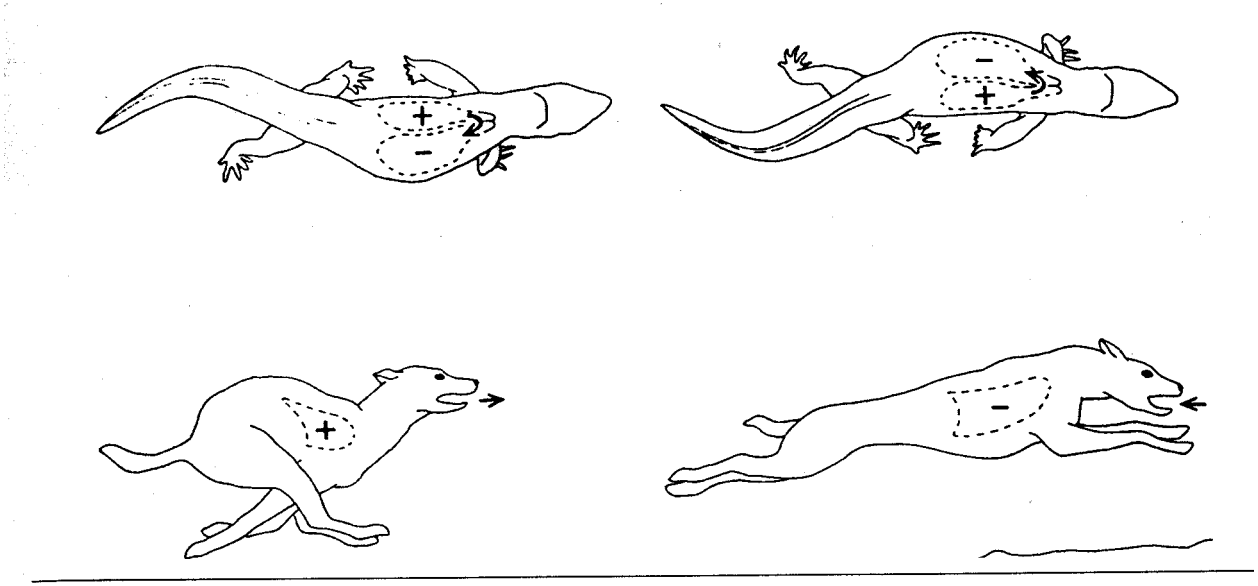
Bewegungsstudie
Mybridge 1878





Kein Schlüsselbein,
Freischwingende
Schulterblätter er-
höhen Schrittlänge

Lokomotionsgekoppelte Atmung



Reptil

Säugetier

Figure 19–12 The effect of axial bending on lung volume of a running lizard and a galloping dog. The bending axis of the thorax of the lizard is between the right and left lungs. As the lizard bends laterally, the lung on the concave side is compressed and air pressure in that lung increases (shown by +) while air pressure in the lung on the convex side is reduced (shown by –). Air may be pumped between the lungs (arrow), but little or no air will move in or out of the animal. In contrast, the bending axis of the thorax of a galloping mammal is dorsal to the lungs. As the vertebral column bends, the volume of the thoracic cavity decreases, and pressure in the lungs rises (shown by +), pushing air out of the lungs (arrow). When the vertebral column straightens, the volume of the thoracic cavity increases, pressure in the lungs falls (shown by –), and air is pulled into the lungs (arrow). (From D. R. Carrier, 1987, *Paleobiology* 13:326–341.)