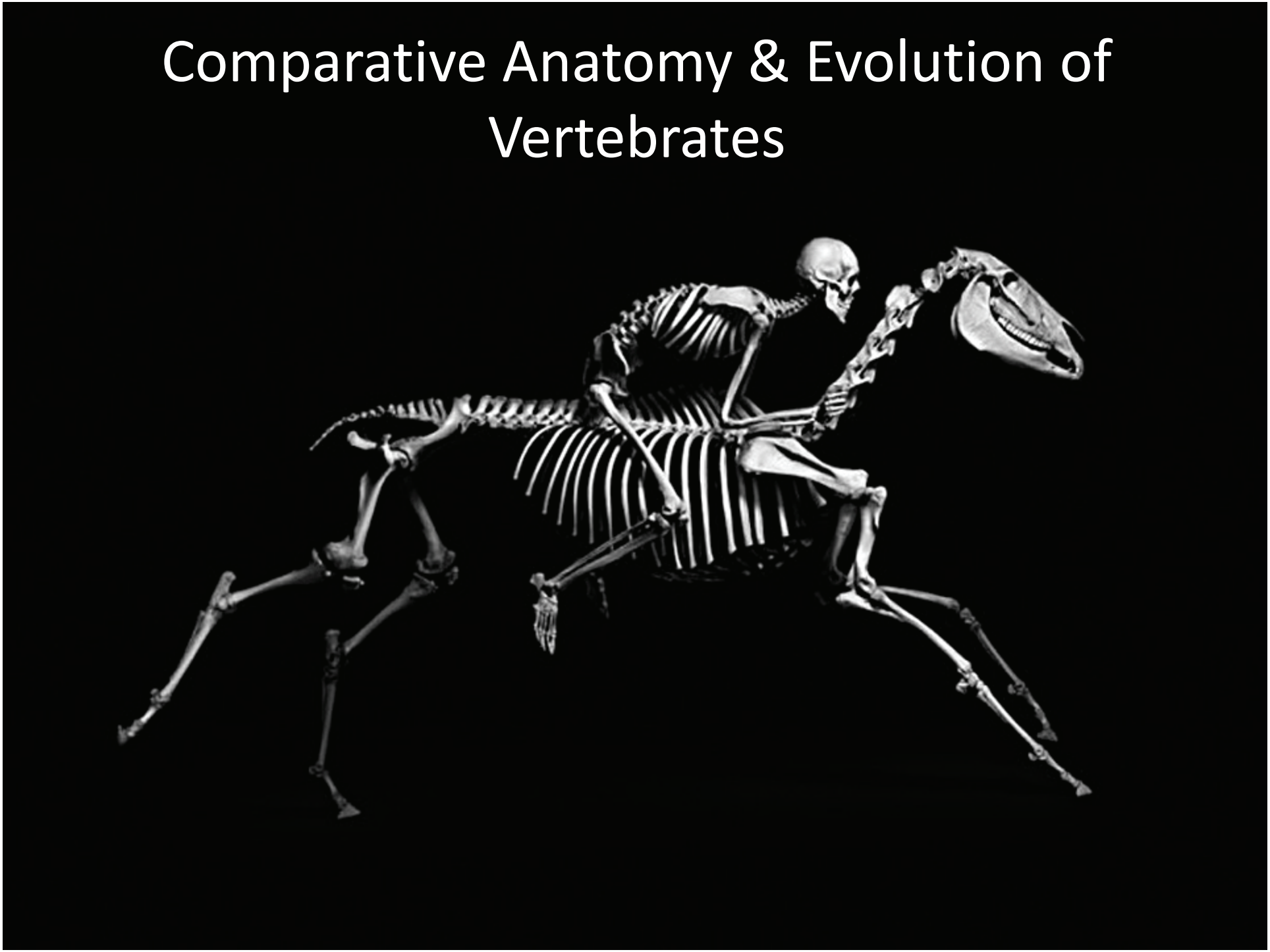
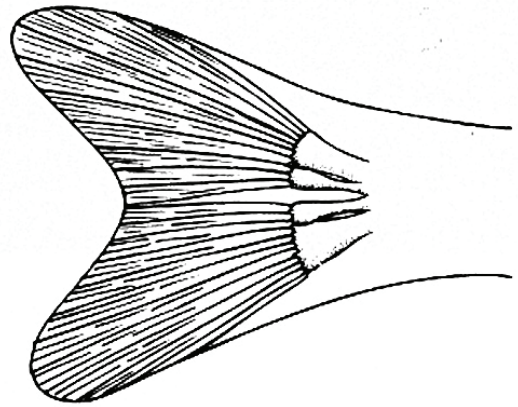
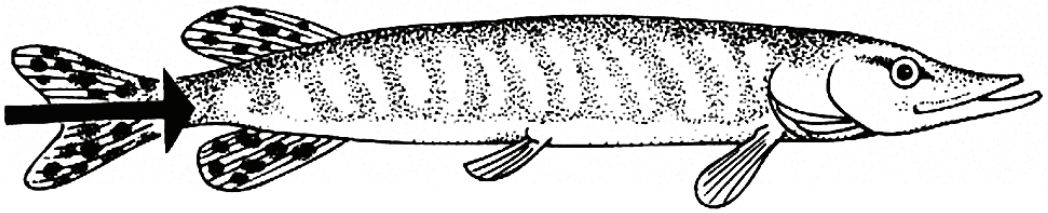
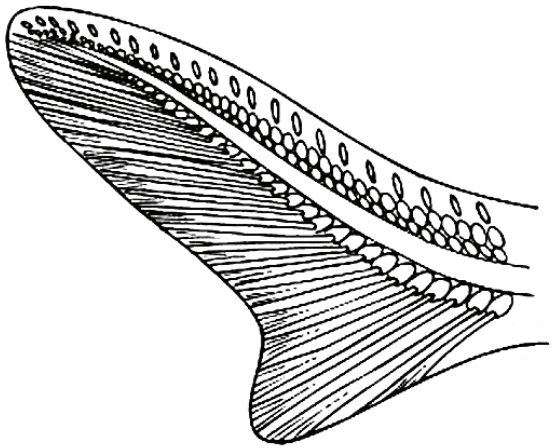
Comparative Anatomy & Evolution of Vertebrates

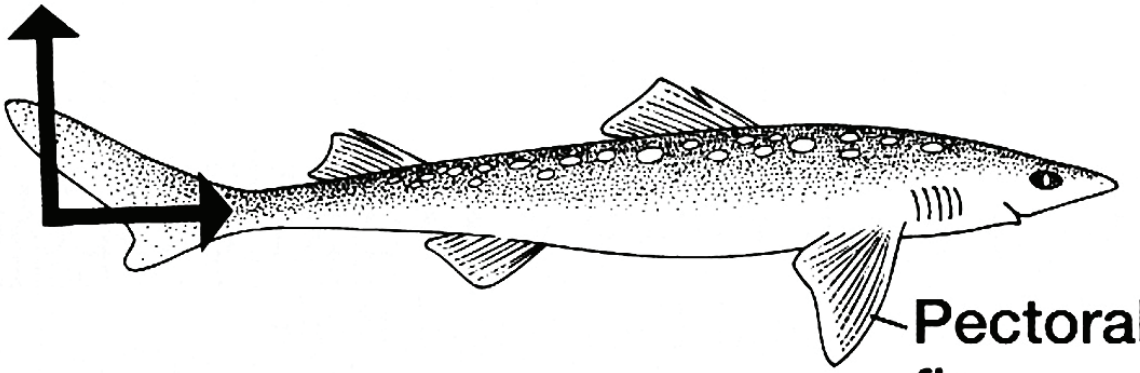




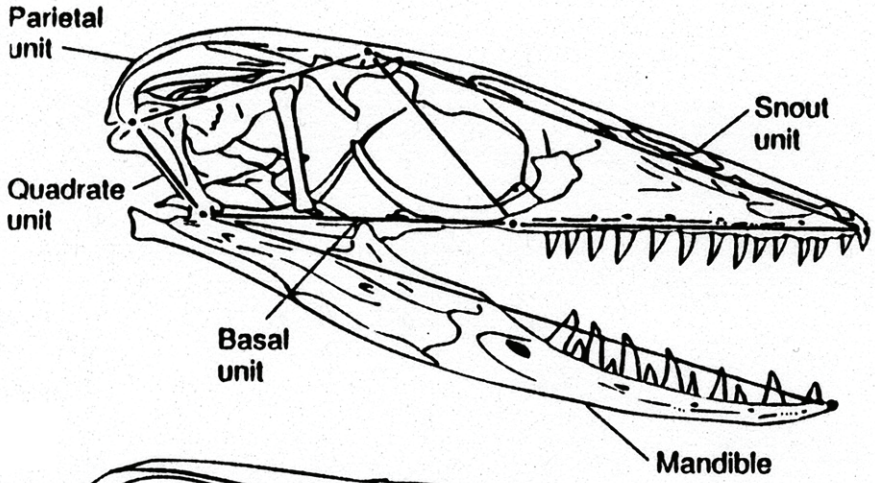


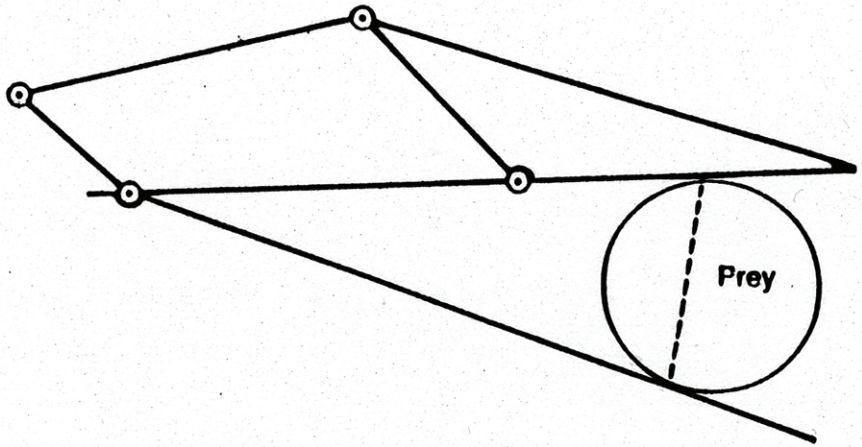
(a) Homocercal tail

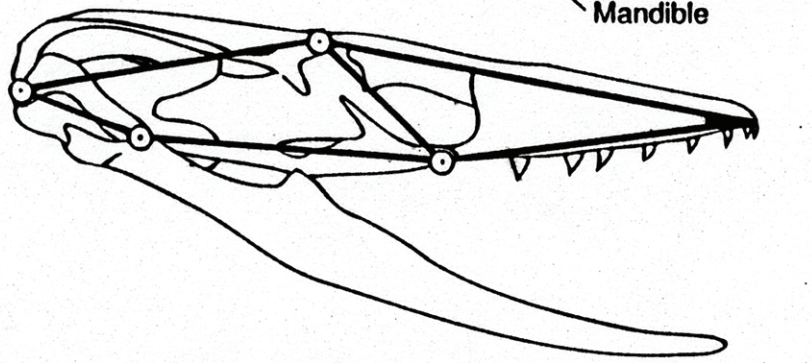


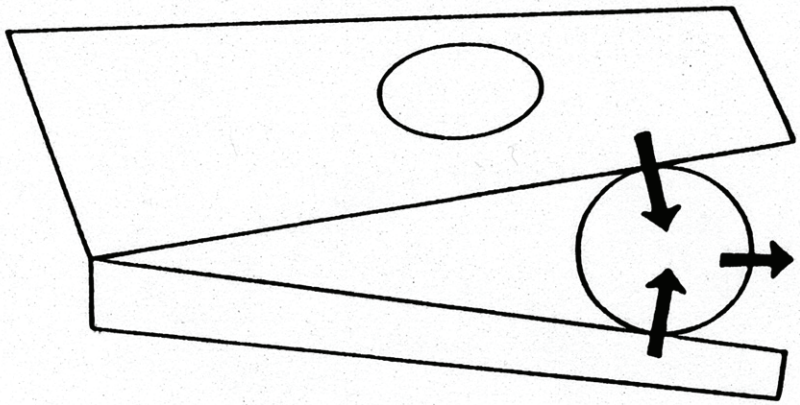


(b) Heterocercal tail

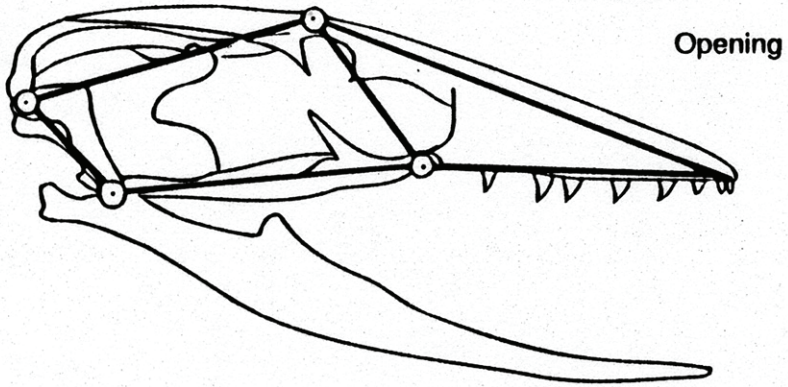


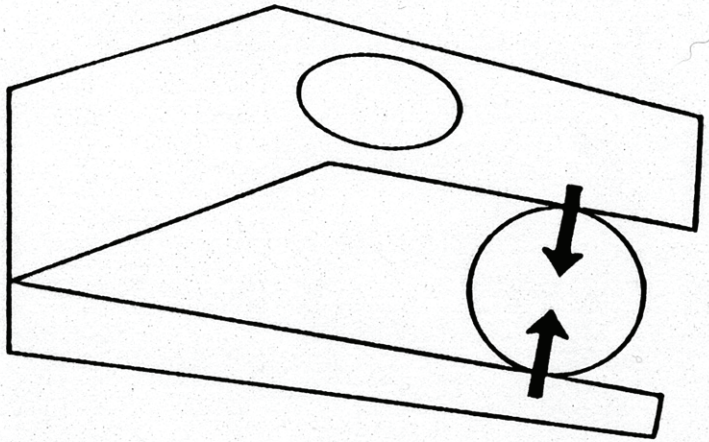




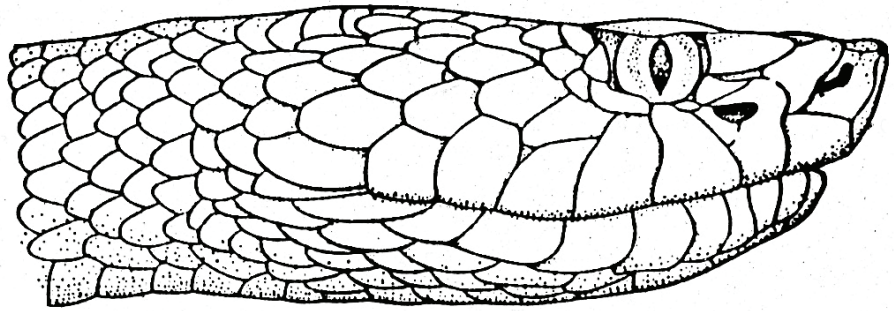


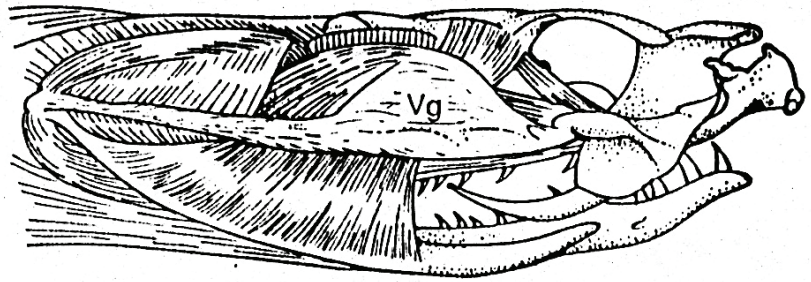
Opening

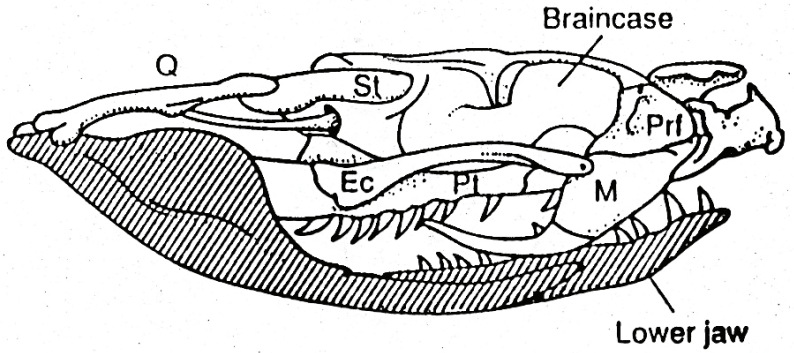


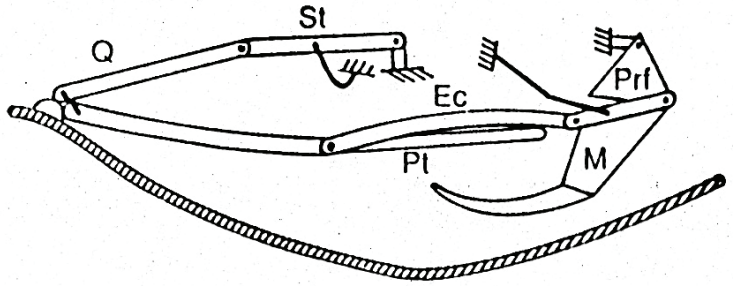


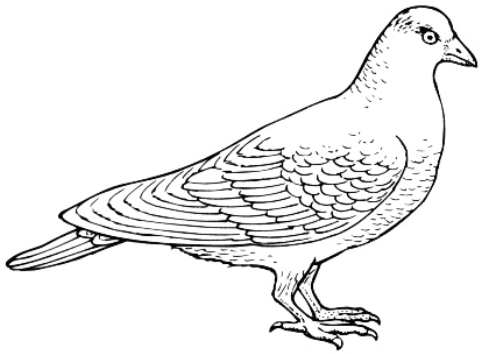
Closing



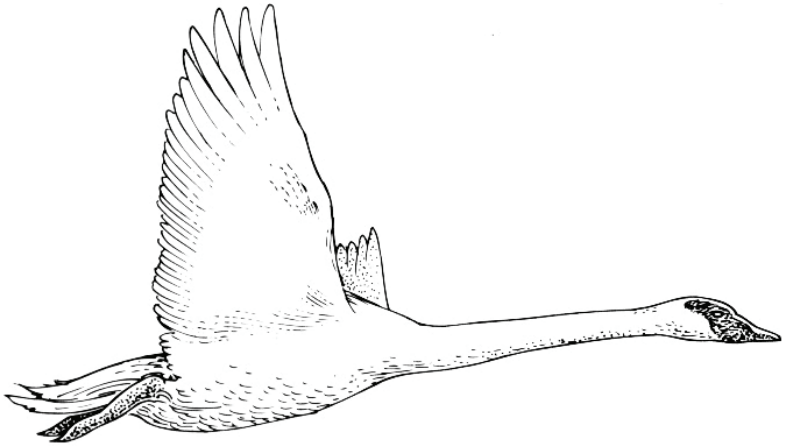

Vg


Braincase
Q
St
Prf
Ec
Pt
M
Lower jaw

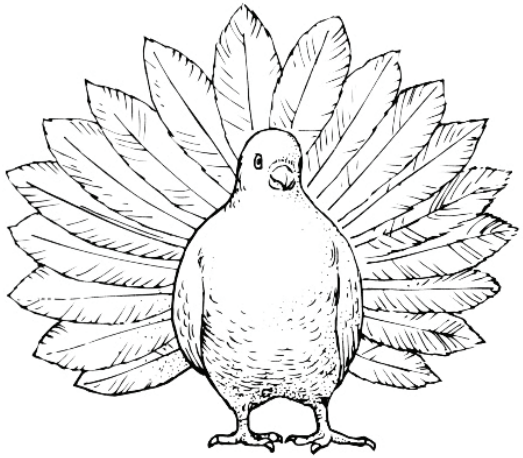

St
Q
Ec
Prf
Pt
M



Thermoregulation

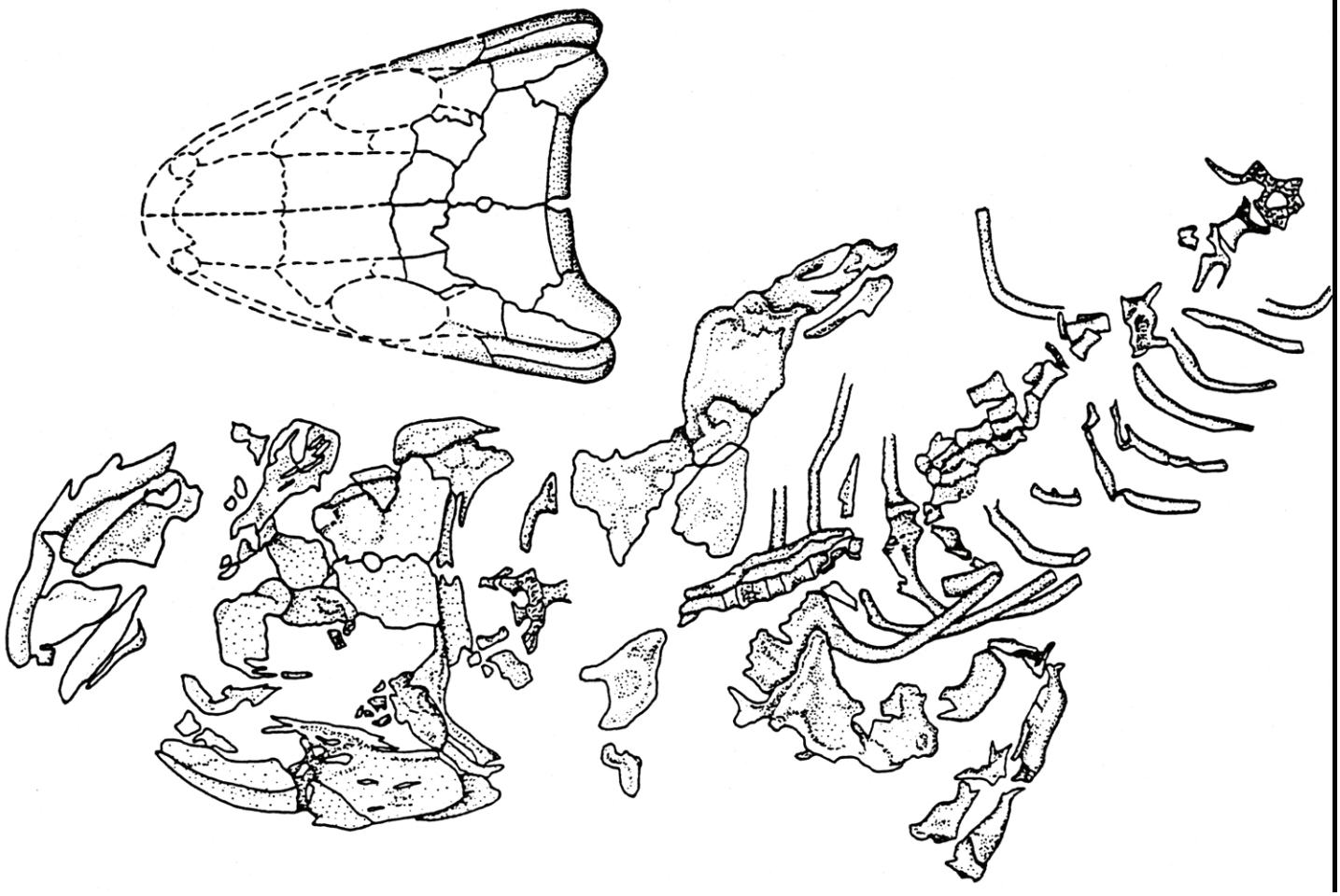


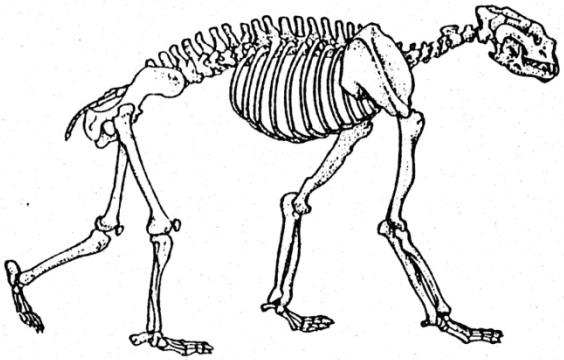
Contour

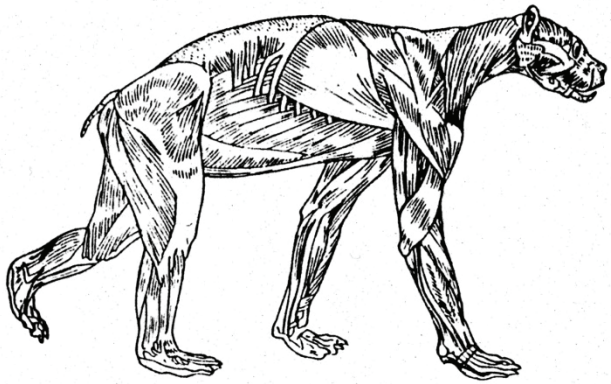


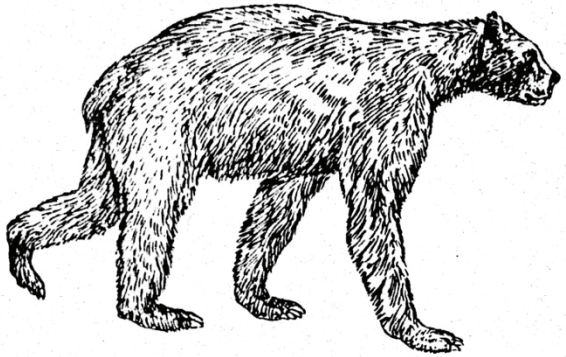
Courtship

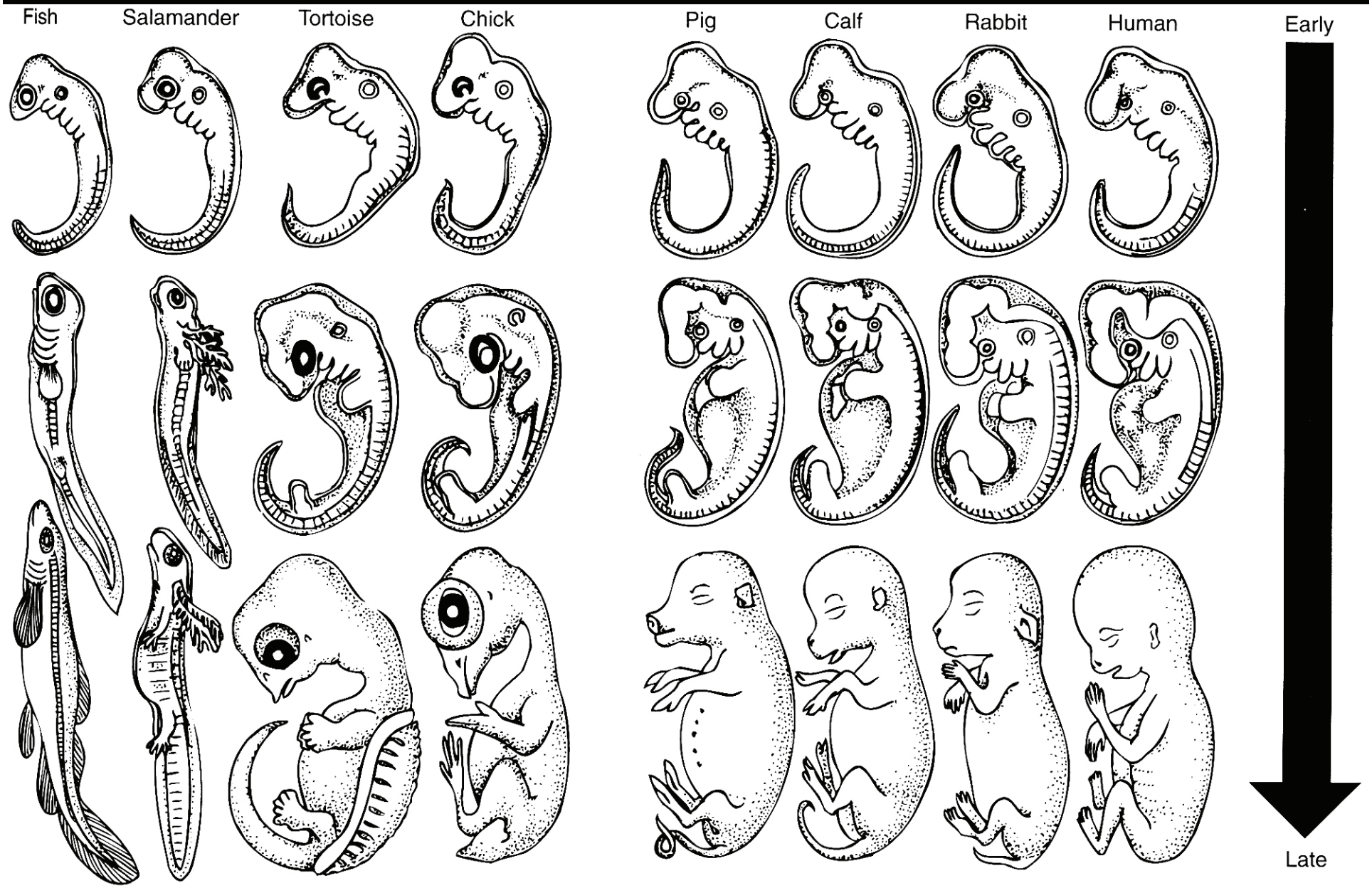

PU 16982
U. S. A.
No. R590-6
Westcott

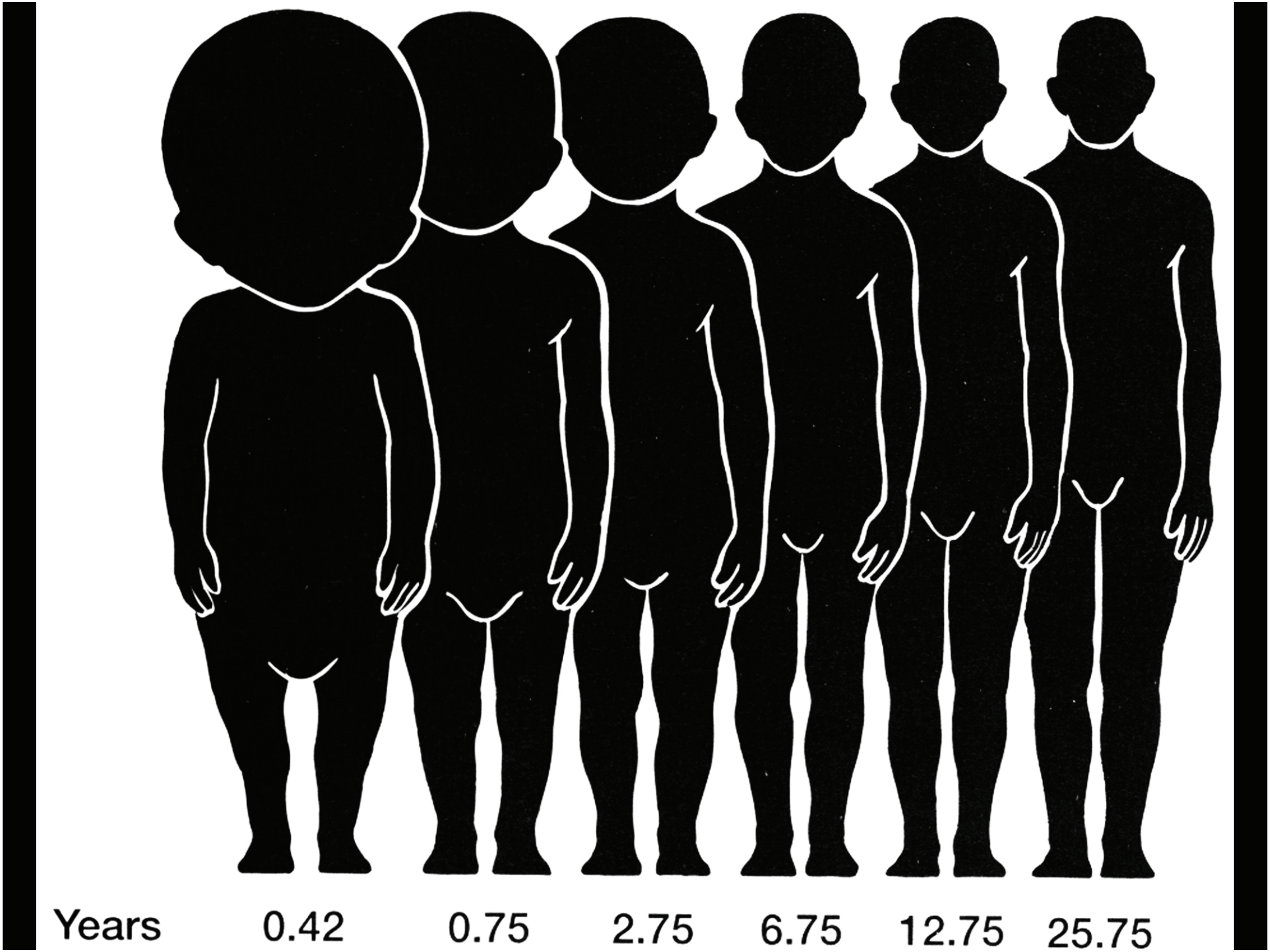


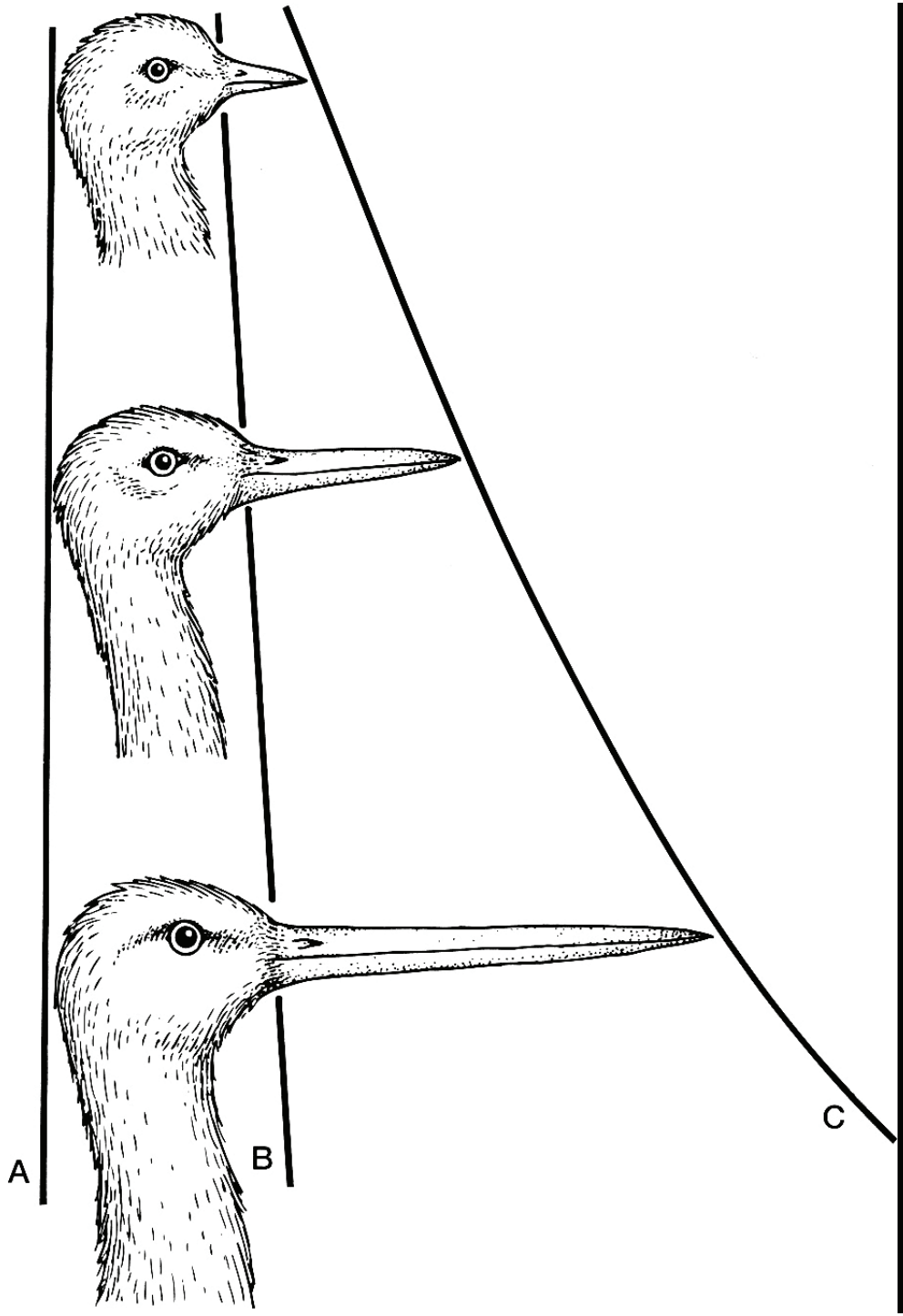


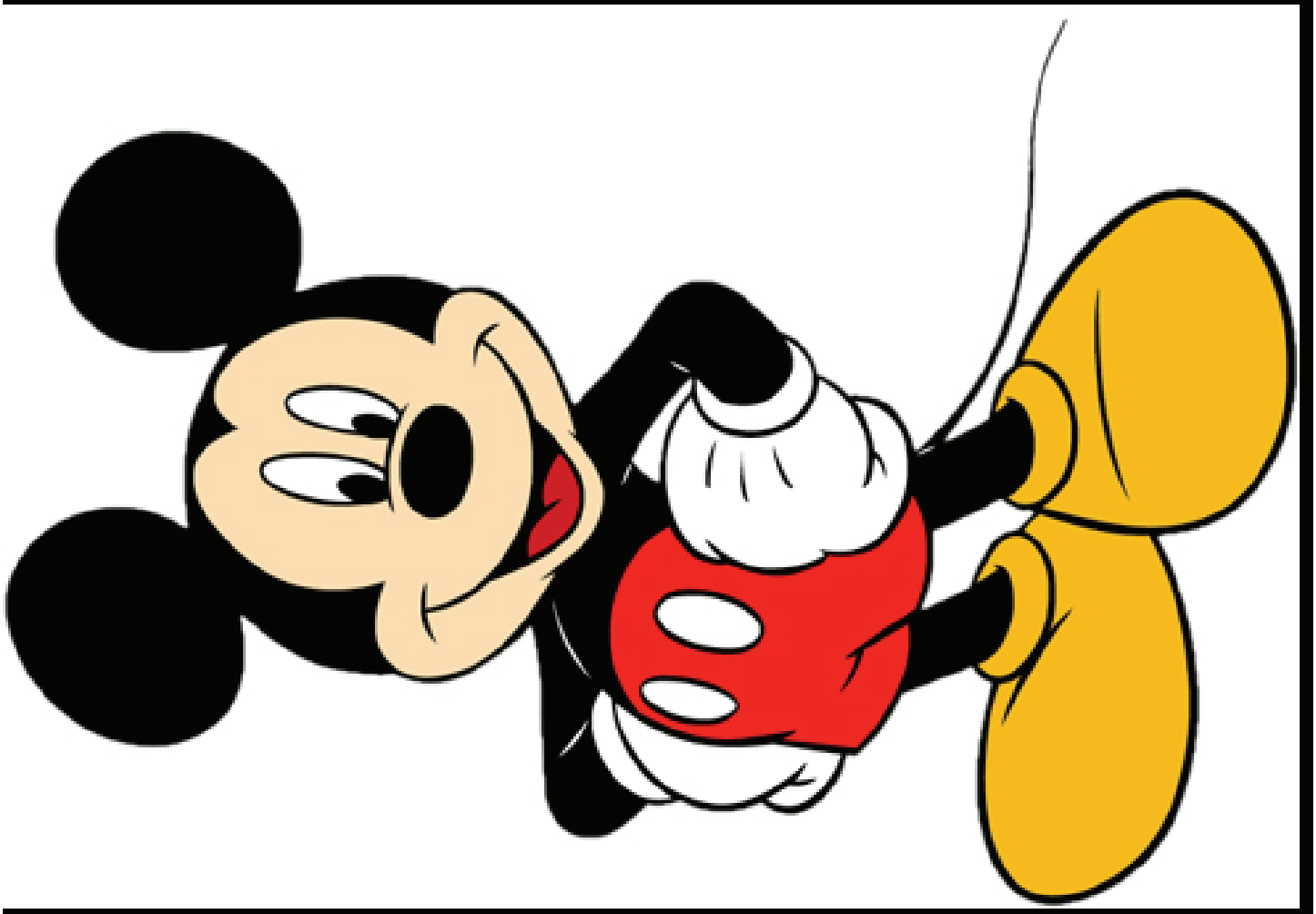


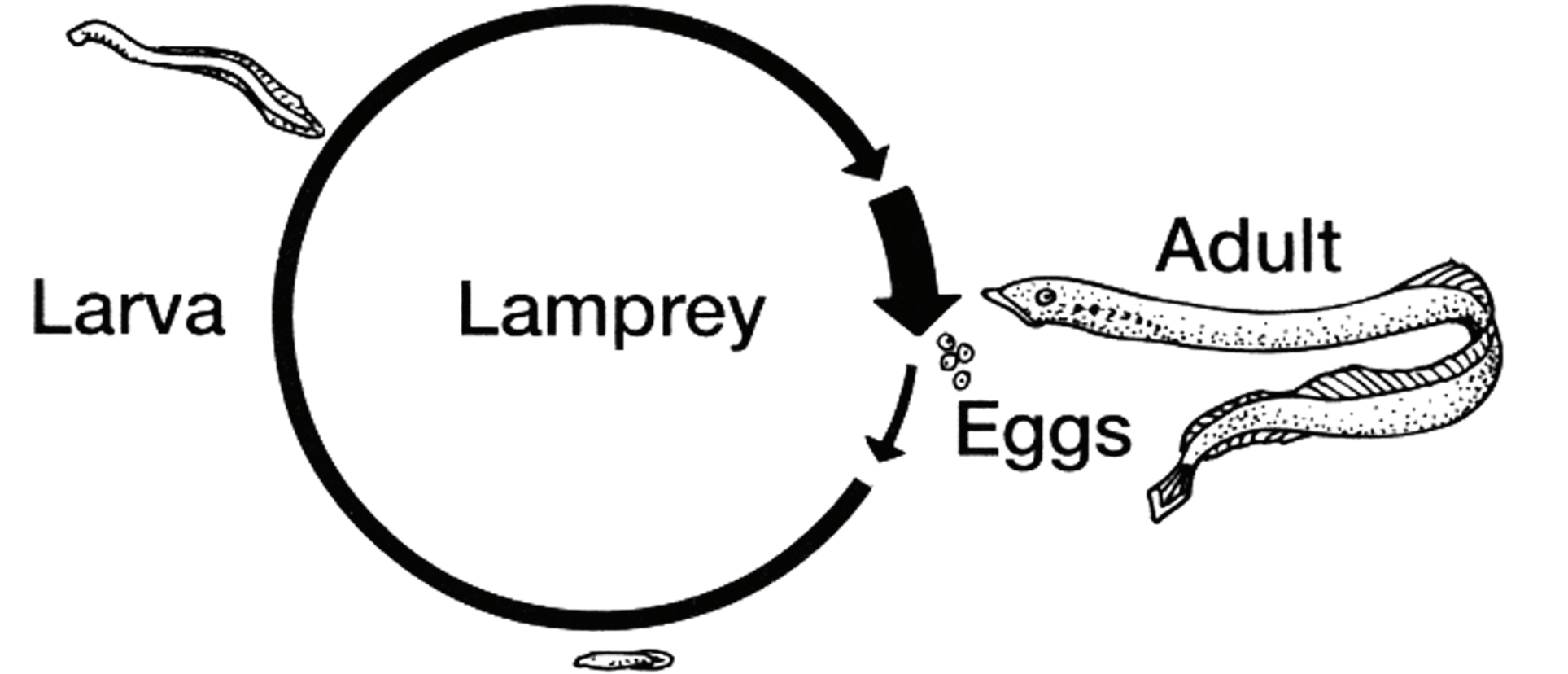


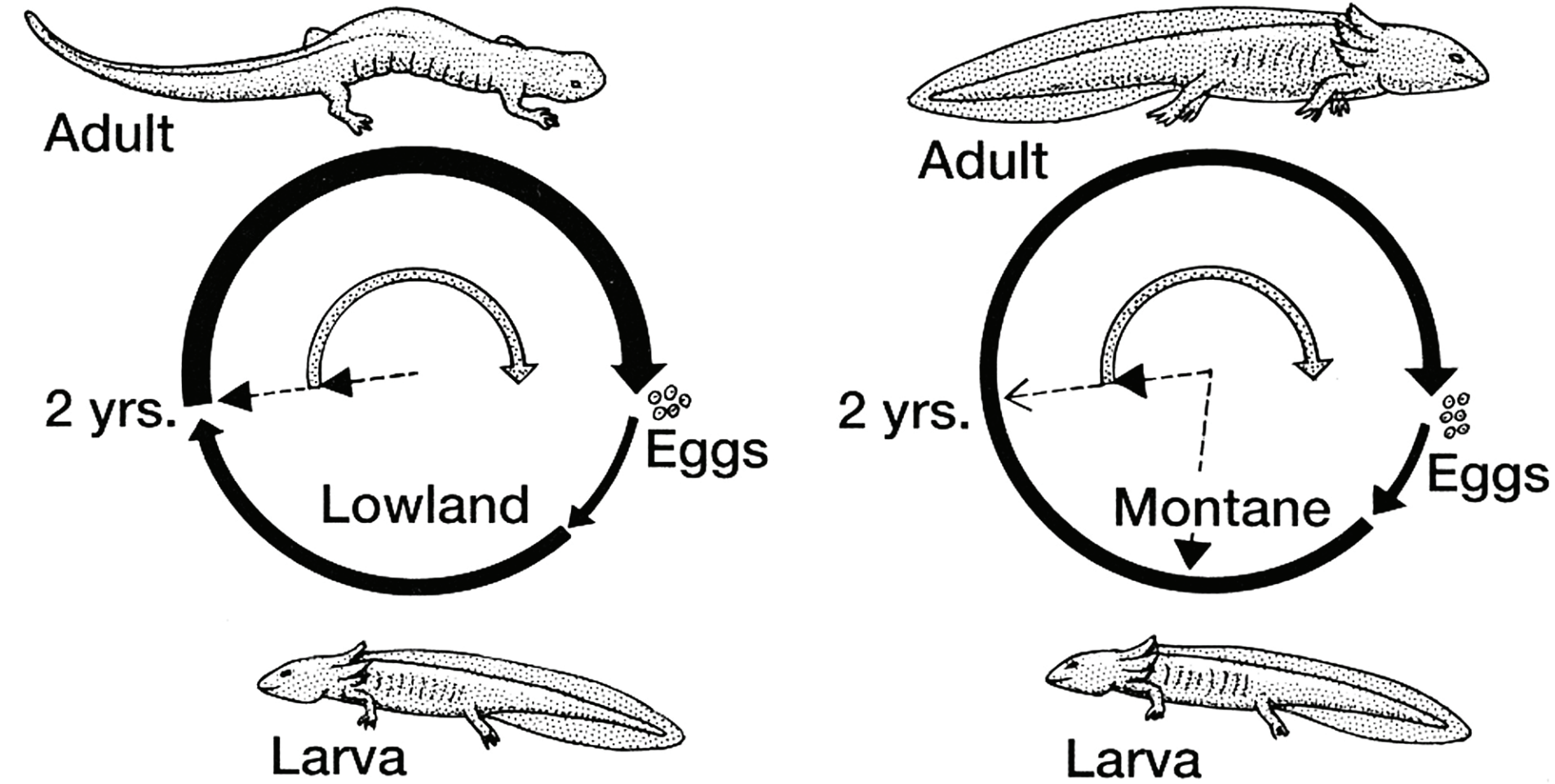

Fish
Salamander
Tortoise
Chick
Pig
Calf
Rabbit
Human
Early
Late


Years
0.42
0.75
2.75
6.75
12.75
25.75


A
B
C




Larva
Lamprey
Adult
Eggs


Adult
2 yrs.
Eggs
Lowland
Larva
Adult
2 yrs.
Eggs
Montane
Larva

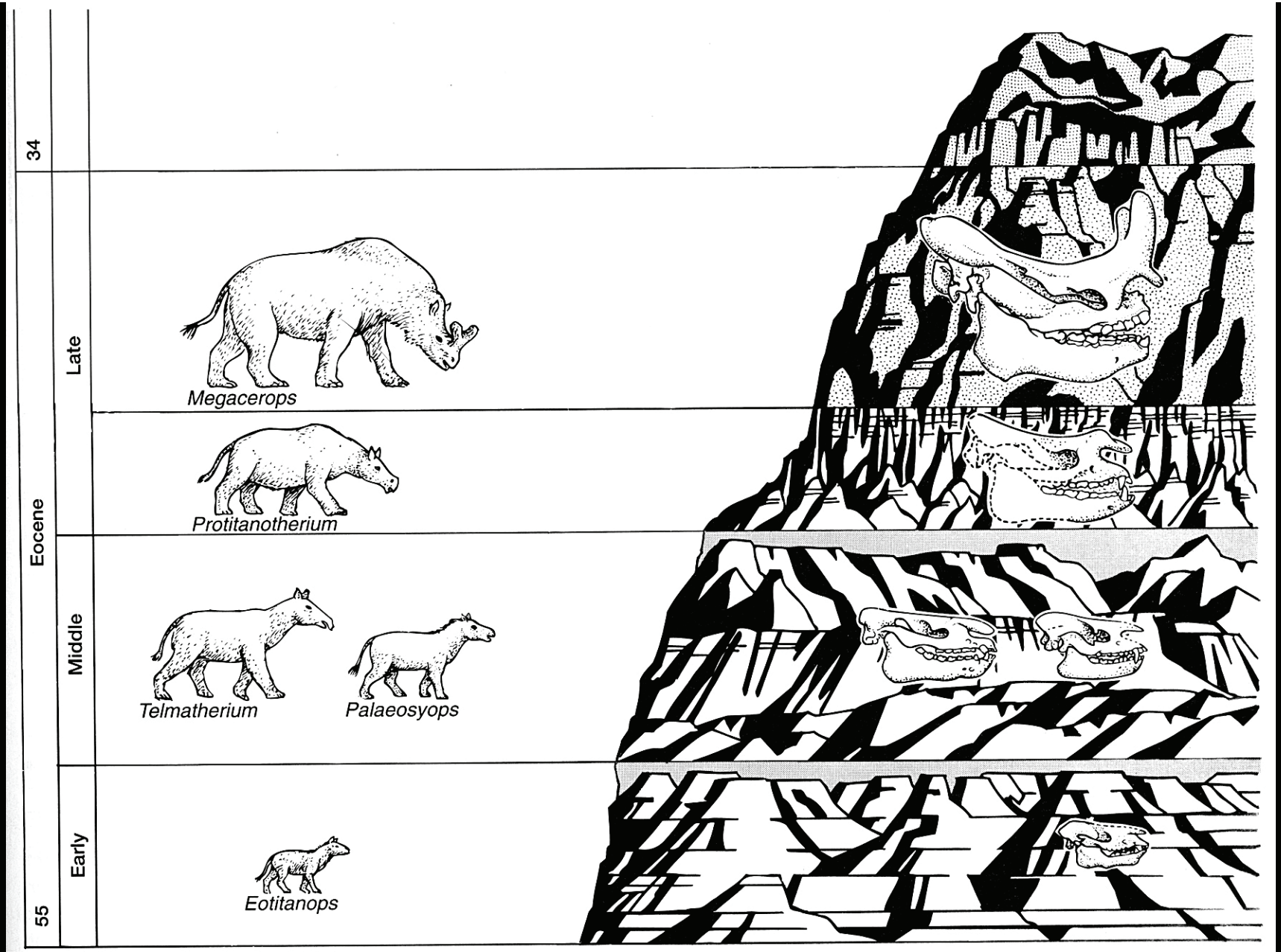
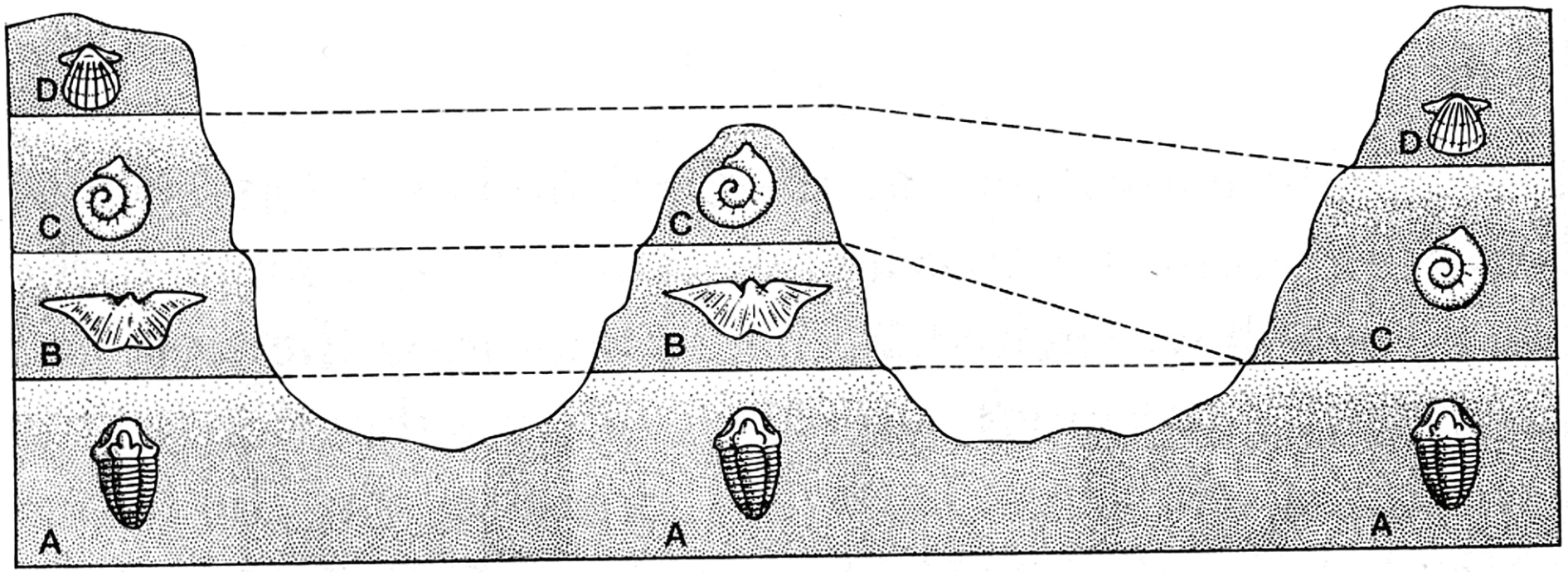


FIGURE 11. Stratigraphy. Sediment settles in layers in aquatic systems. As more sediment collects deeper layers are compacted by the ones above until they harden and become rock. Animal remains embedded in these layers form fossils. Deeper rock forms first and is older than rocl near the surface. Logically, fossils in deeper rocks are older than those above and their relative position among rock layers gives them a chronological age relative to older (deeper) and younger (surface) fossils.


D
C
B
A
C
B
A
D
C
A

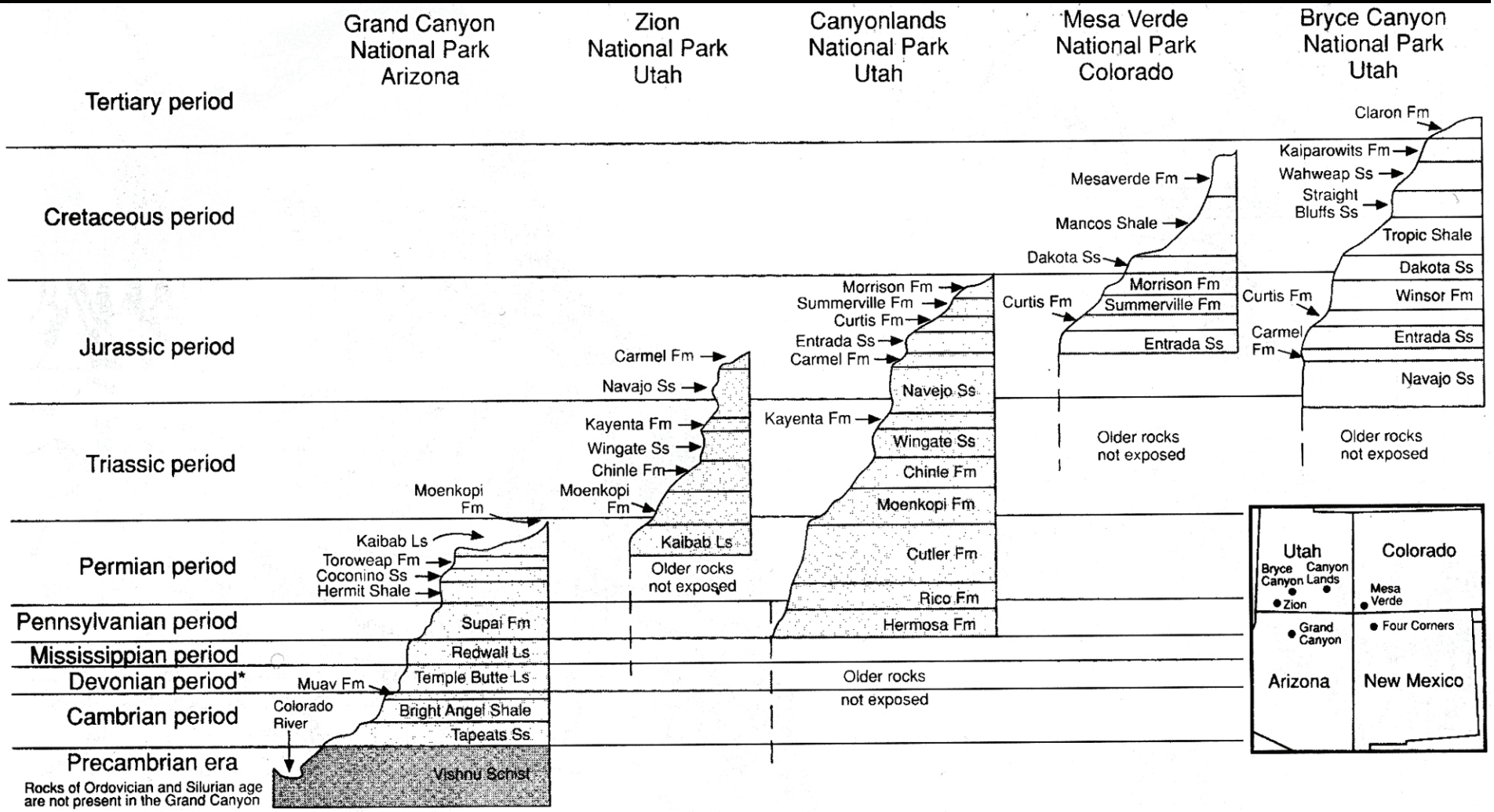


FIGURE 13. **Building a chronology of fossils.** Each exposure of rocks can be of a different age from other exposures. To build up an overall sequence of fossils, various exposures can be matched where they share similar sedimentary layers (same ages). From five sites in the southwest United States, overlapping time intervals allow paleontologists to build a chronology of fossils greater than that at any single site.

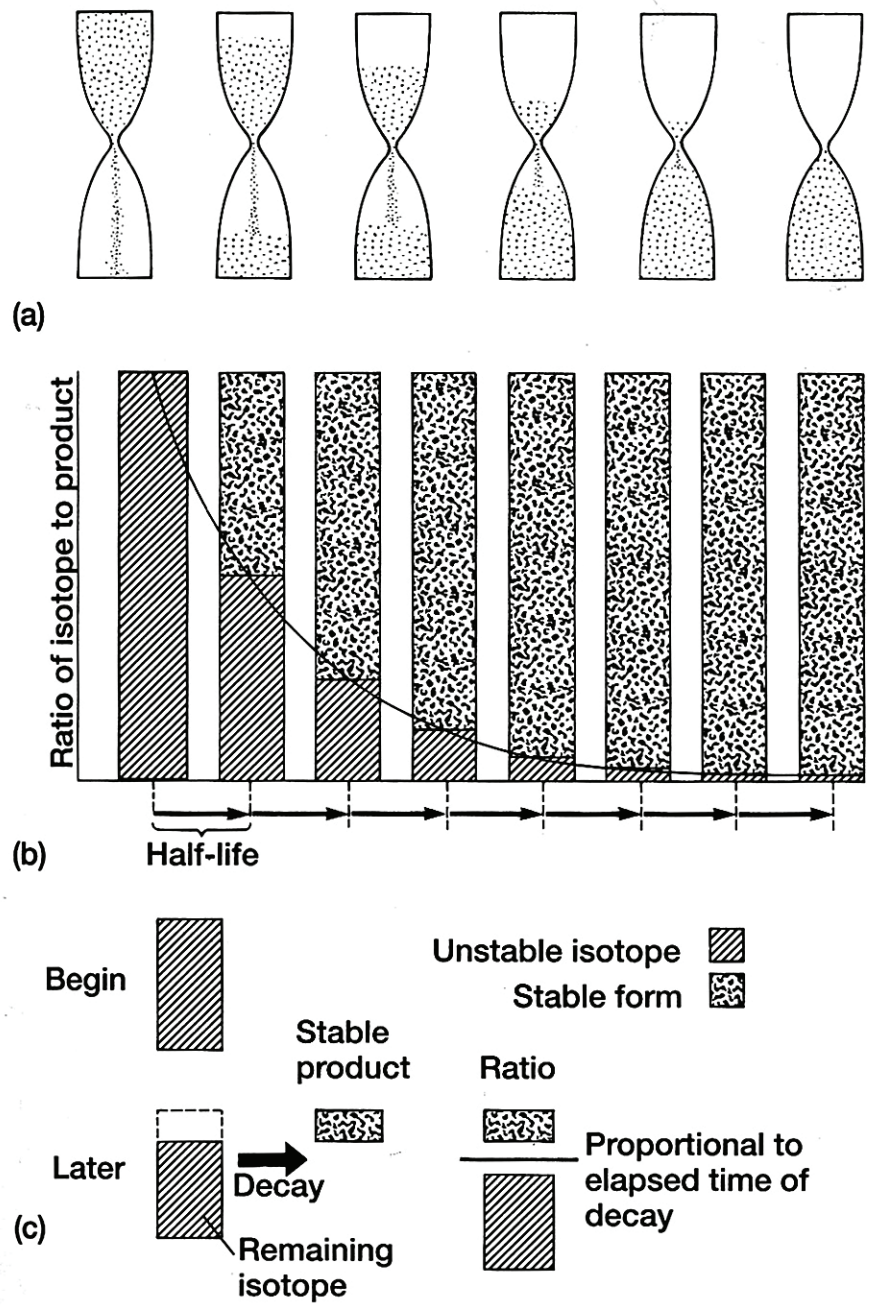


FIGURE 14. **Radiometric dating.**

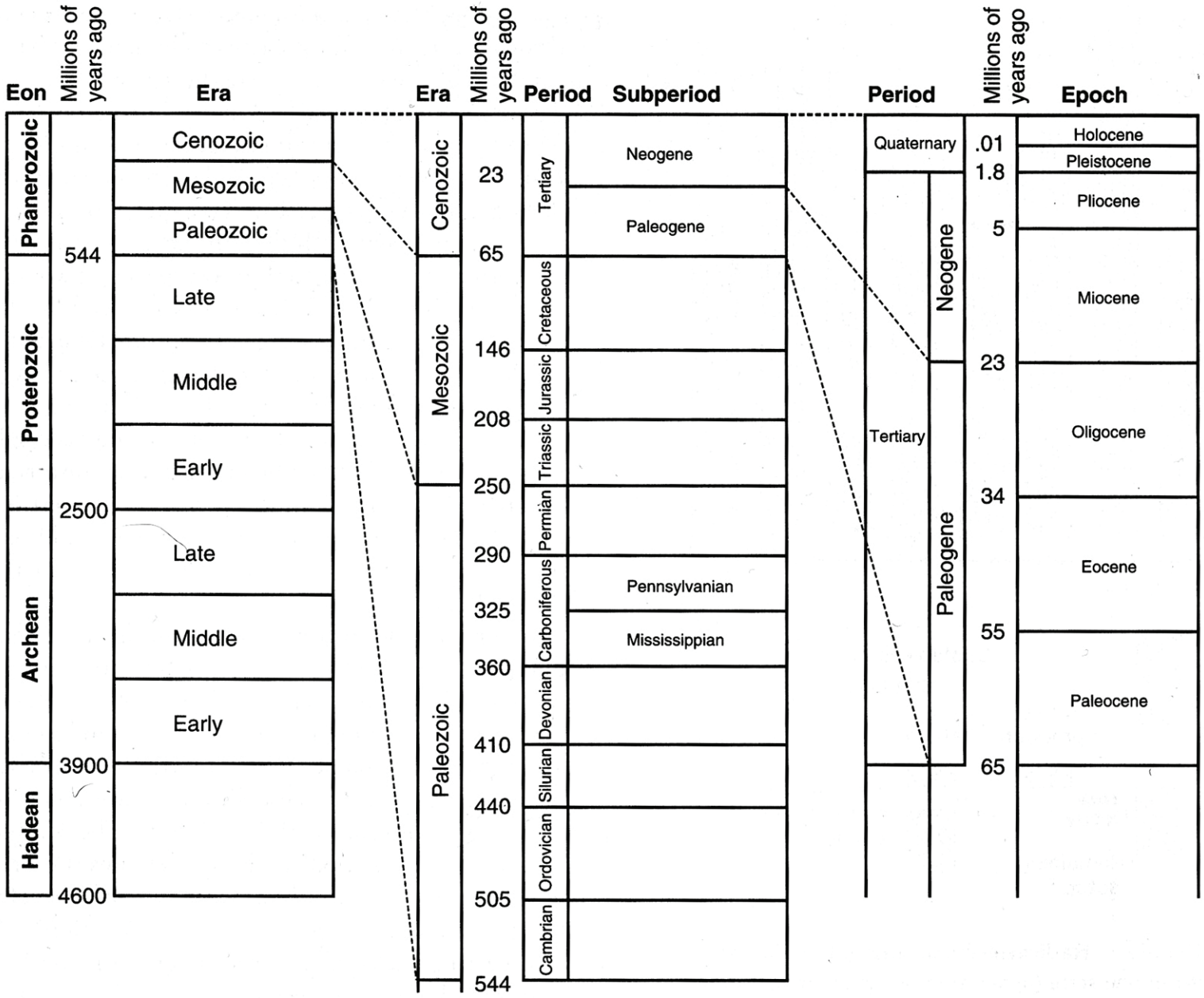


FIGURE 15. **Geological time intervals.** The Earth's history, from its beginnings 4.6 billion years ago, is divided into major eons, the Cryptozoic and the Phanerozoic. These eons are divided into four eras of unequal length—Precambrian, Paleozoic, Mesozoic, and Cenozoic. Each era is divided into periods, and periods into epochs. Only epochs of the Cenozoic are listed in this figure.

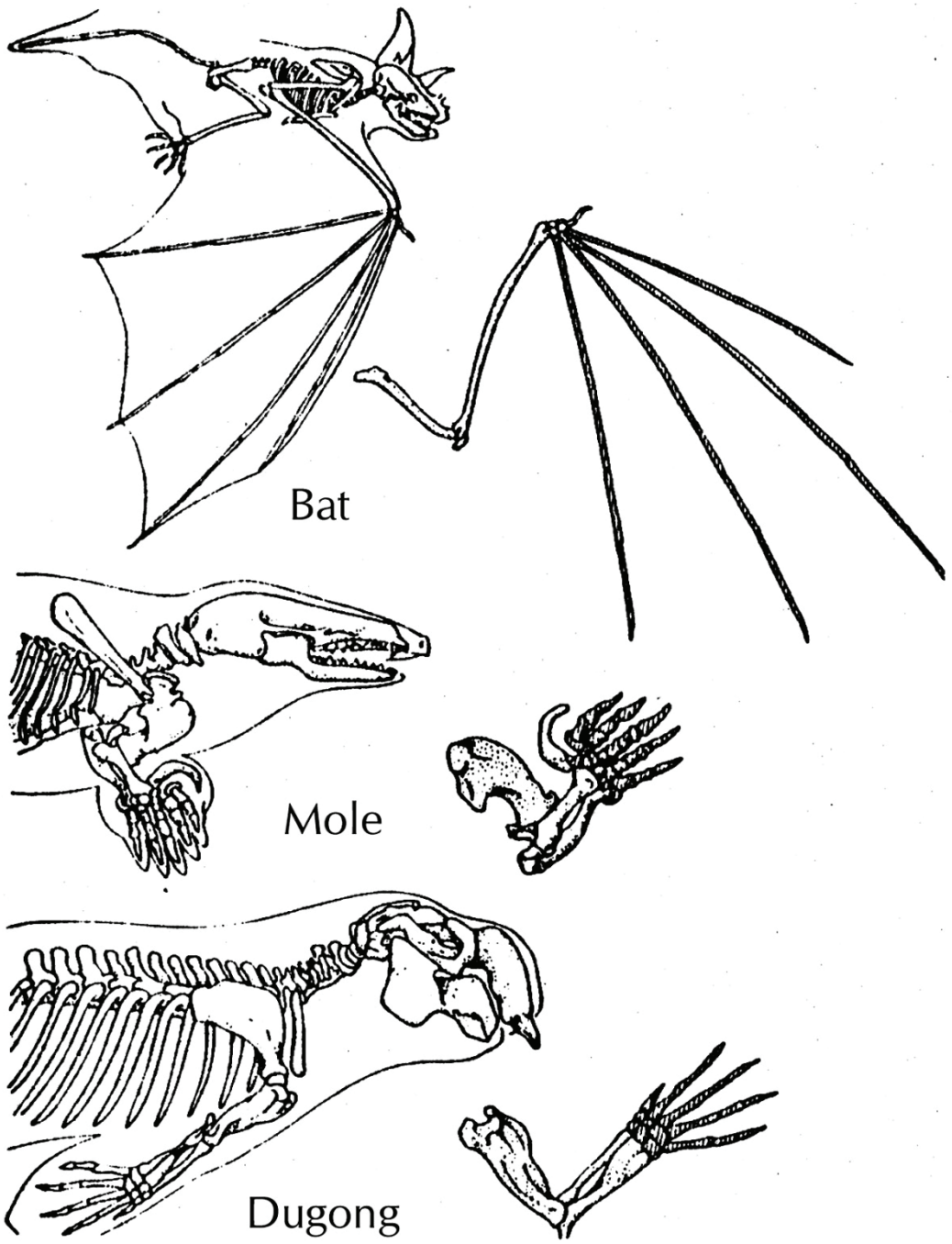


FIGURE 16. Examples of forelimb homology.

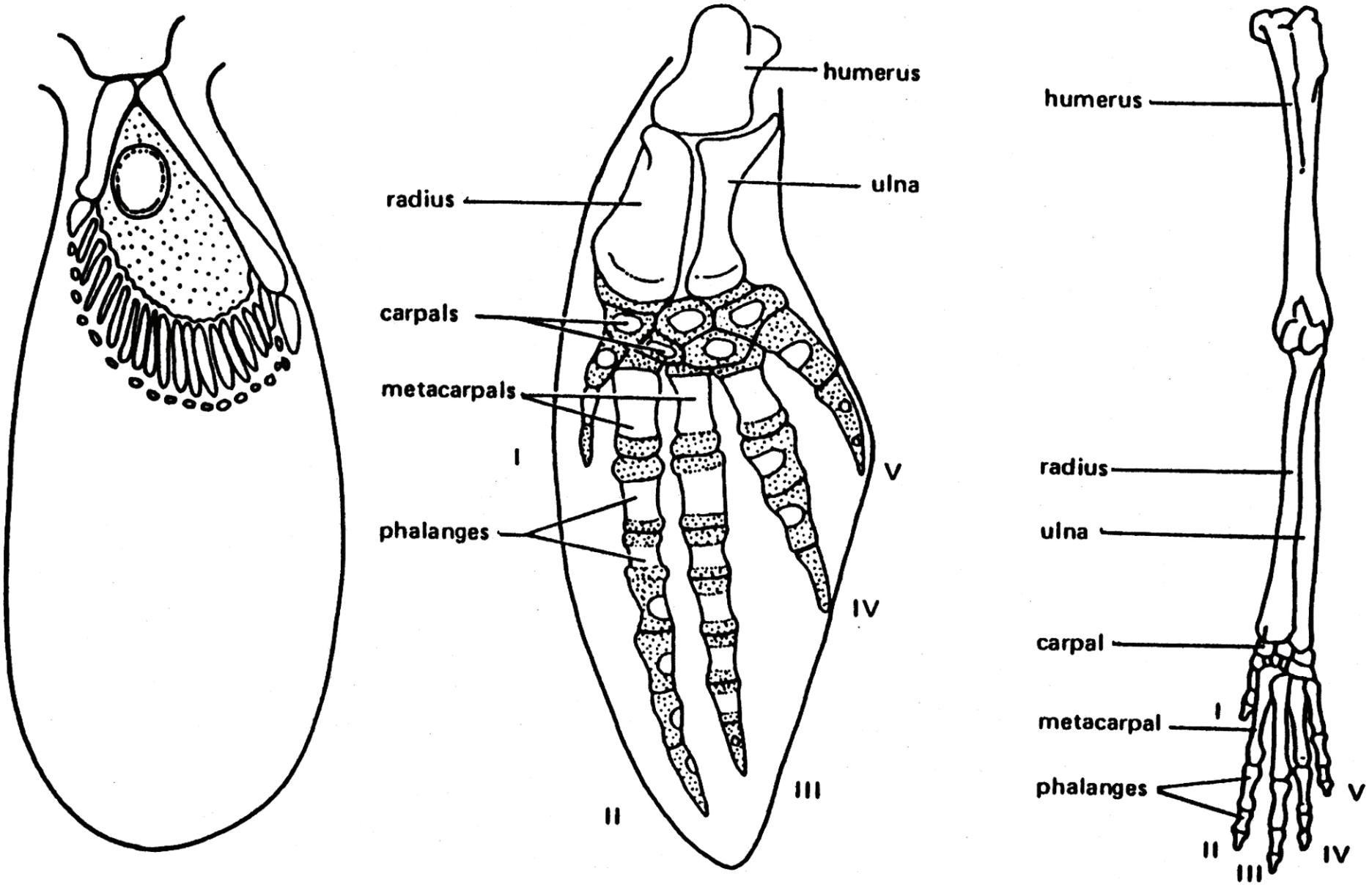


FIGURE 17. Left pectoral appendages skeletons **(A)** a primitive living fish (*Polypterus)*, **(B)** a porpoise (*Phocaena*), and **(C)** a rabbit (*Sylvilagus*). The dermal fin rays have been omitted from *Polypterus.* The pattern of bones of *Phocaena* is more "mammalian" (cf. *Sylvilagus*) than it is "fish-like" (cf. *Polypterus*).

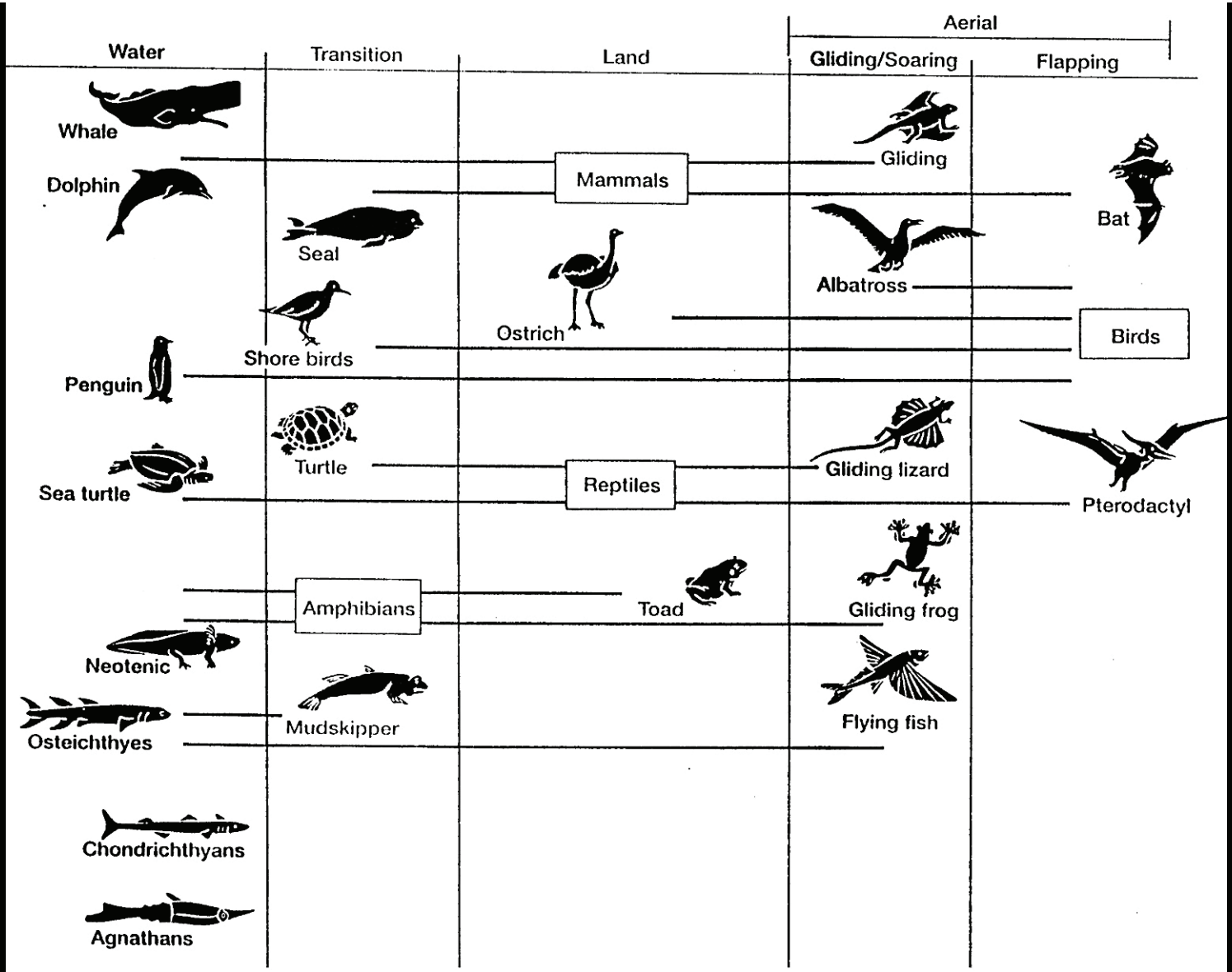


FIGURE 18. **Convergence of design.** Groups of animals often evolve in habitats that differ from those of most other members of their group. Most birds fly, but some cannot, living exclusively on land or largely in water (ostrich, penguin). Most mammals are terrestrial but some are aerial (bats) and others are almost wholly aquatic (whales, poroises). "Flying fishes" leave the water to glide through the air. Species from different groups entering similar habitats experience similar selective pressures and thus convergence of design. Fins and flippers are analogs that serve a similar function for fish, porpoises, and penguins. Common function does not explain all aspects of design: each species carries historical contraints than persist despite convergence.

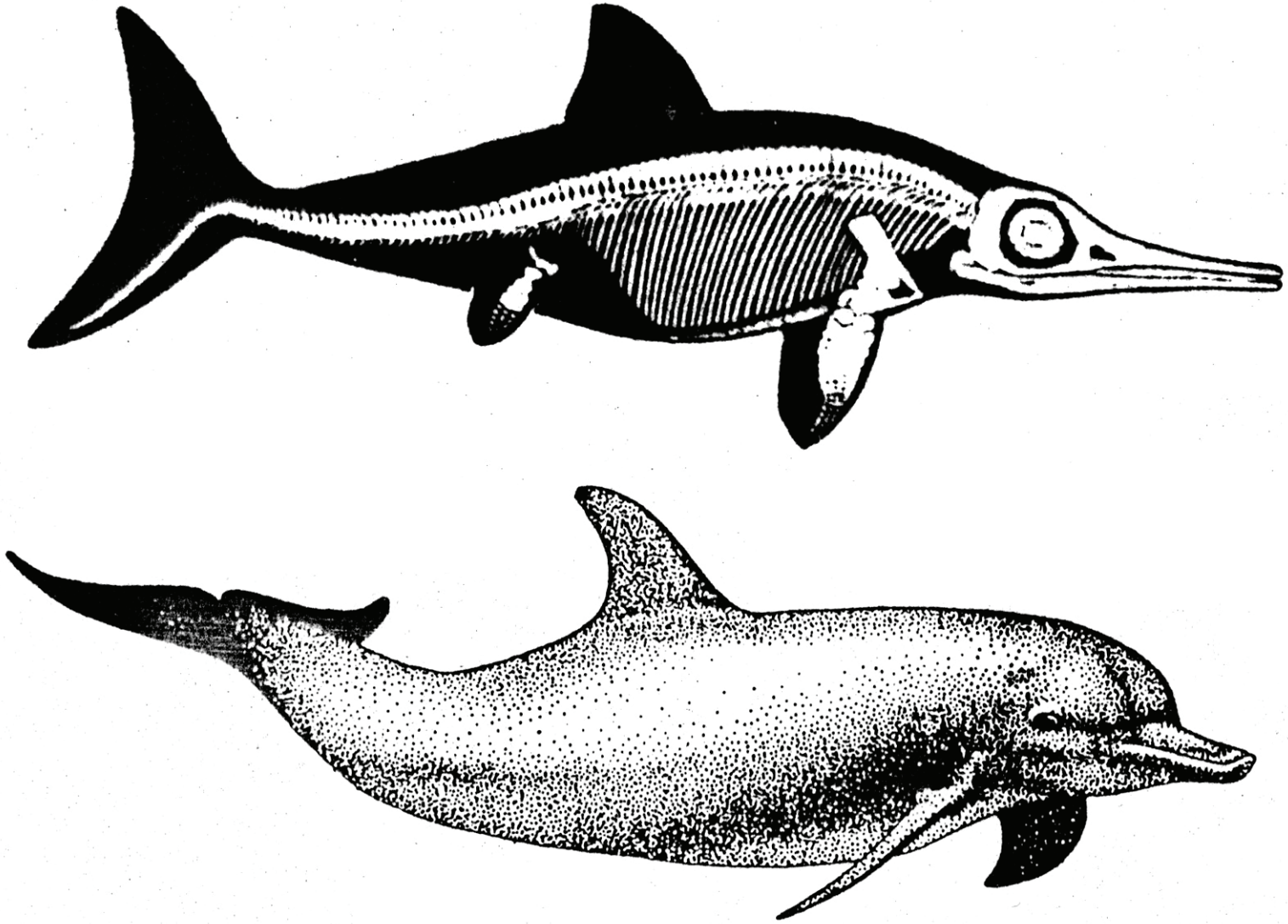


FIGURE 19. **Convergence of design across time.** Ichtyosaurs (top) and porpoises (bottom) share strong general similarity and specific adaptations for life as a fish-eating marine predator such as flippers, dorsal fins, bilobate tails, and a stream-lined body form. Nonetheless they remain distinctly repilte and mammal, respectively.

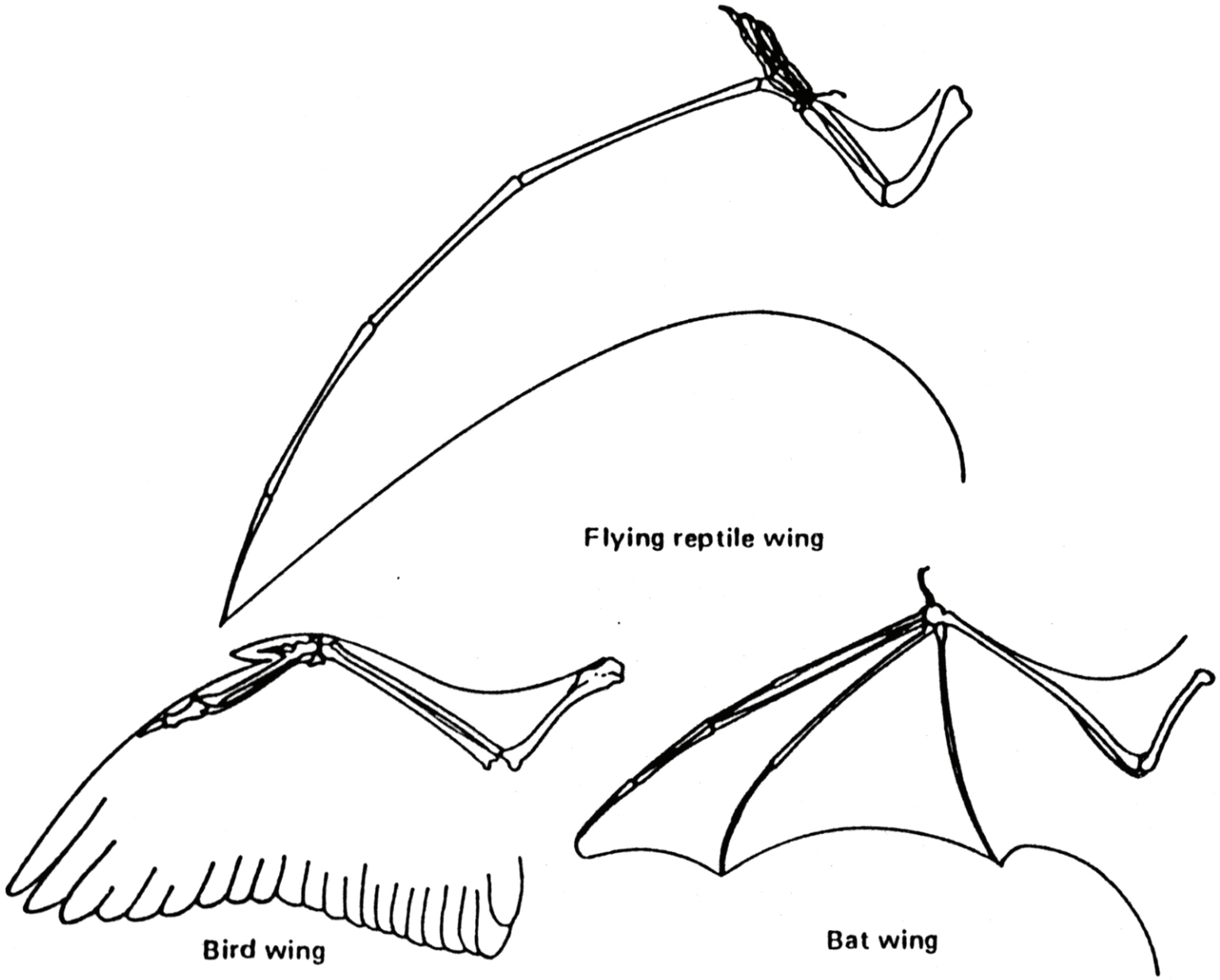
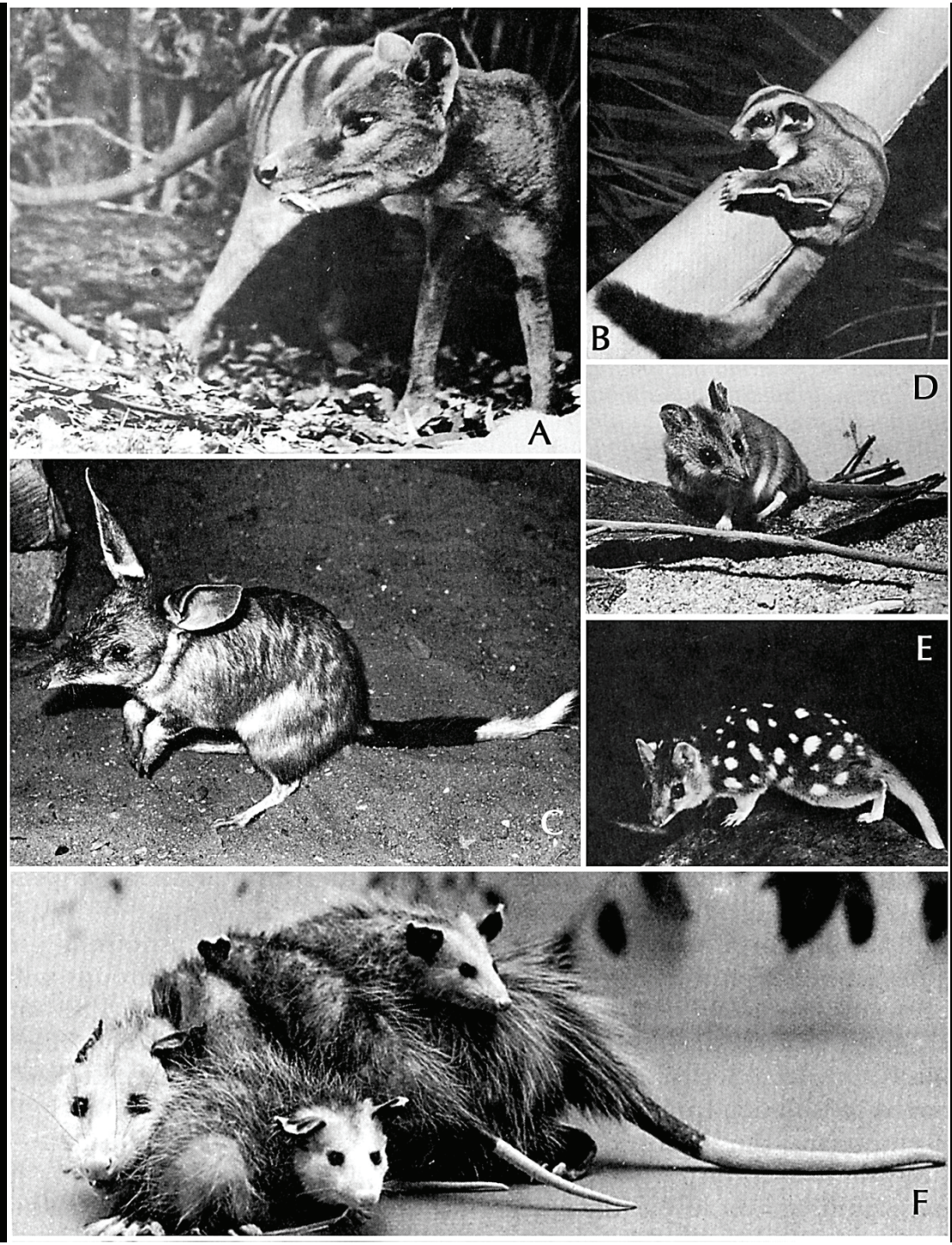


FIGURE 20. **Convergence in wing design among pterosaurs, birds and bats.** Although the metacarpals and phalanges have been modified in a similar way to form a support structure for the flight surface the modifications are not identical.

Ecological Replacements


A
B
C
D
E
F