

Phylum Chordata

Subphylum Vertebrata

CLASS MAMMALIA (4,500 spp)

1. Endothermic
2. Hair & subcutaneous fat (insulation & energy stores)
3. Synapsid skull & limbs under body
4. 3 auditory ossicles in middle ear
5. Cerebrum >, cortex enlarges (in birds it is the corpus striatum)
6. Teeth heterodont - replacement is limited
7. Muscular diaphragm
8. 4-chambered heart
9. Urea as nitrogenous wastes
10. Testes in scrotum - internal fertilization
11. Little yolk in egg (except monotremes)
12. Monotremes oviparous - others viviparous
13. Amniotes (Chorion placenta, allantois <)
14. Maternal parental care mandatory (viviparity + lactation); milk from modified sweat glands (MAMMARY GLANDS)

Class Mammalia

Subclass Prototheria

Order Triconodonta (extinct)

Order Monotremata (platypus & echidna) - cloaca, no teeth, no teates

Subclass Theria

Infraclass Metatheria

Order Marsupialia

Infraclass Eutheria

17 orders

Evolution of endothermy

Mammals from therapsid reptiles

Triassic & Jurassic mammals small, mouse-like

First mammals probably nocturnal

Big eye sockets

Large cochlear & olfactory regions in skull

Teeth for eating insects

Generate heat & hold it with fat & hairs, have a thermal neutral zone of 25-30°C
(like hedge hogs) - low O₂ consumption

Mammals move to diurnal thermoregulation

Ambient temp now 35-40°C - difficult to cool, easier to heat. Therefore, evolved to a higher body temp to remain thermally neutral, but costs 3-5X more energy than sized reptile.

Thermal mechanism: when it's too cold

Pilio erection - hair traps more air - > insulation

Blood flow < to surface - vasoconstriction to skin - protect CORE body temp.

Countercurrent arrangement of arteries with hot blood to periphery & veins returning cold blood.

Shiver (> muscle metabolism, > heat release)

Thyroxine >, general metabolism >

Behavioral - stay dry, avoid wind, seek sun, find a warm substrate

Thermal mechanism: when it's too hot

Blood flow to surface - vasodilation - > heart rate and blood flow

Increase evaporative water loss (heat of vaporization - 1 gm H₂O 1 gm vapor + 540 cal at 100°C).

At exercise we loose 80% of heat thru evaporation. [Sweat, panting (blow off CO₂), licking fur]

Shedding

Thyroxine <, general metabolism <

Behavioral - get wet, seek wind, seek shade

Hibernate - drop body temp (hypothalamus turns down thermostat)

TEETH

Homodont vs Heterodont (mammalian grade)

Tooth formula: Incisors, Canine, Premolars, Molars

Top Jaw: I₃, C₁, PM₄, M₃

Lower Jaw: I₃, C₁, PM₄, M₃ [Total = 22 x 2 = 44]

Primitive herbivores & omnivores - BUNODONT teeth

Advanced herbivores - LOPHODONT & SELENODONT teeth

Carnivores - CANINES for killing & CARNASSIAL teeth for slicing

WATER STRESS

Kangaroo rat

- Nocturnal
- Burrows (cool & humid)
- Diet of seeds (lipid-rich - metabolic water)
- Estivation (summer hibernation)
- Special kidneys (urea 4X conc. in urine as ours)

Camel

- Wide thermal neutral zone (tolerate 41°C)
- Brain cooled by countercurrent
- 27% of body wt. in water (12% for humans)
- High tolerance of osmotic conc. in blood (2X that of humans)
- Dry feces, low urine output

LOCOMOTION

- Plantigrade (primitive, us)
- Digitigrade (moving onto toes for running - e.g., dogs)
- Unguligrade (moving to toe tips for best running - e.g., deer)