

CLASS AVES (Ch. 30)

1. ENDOTHERMIC TETRAPODS

endothermy - maintain constant internal temperature

- 2 classes (birds 41°C, mammals 37°C)

advantages - allows activity day or night

- not dependent on environment for heat
- more efficient for predation or escape

requirements - high metabolic rate (hence lots of food)

- efficient heart & lungs
- feathers or hair to insulate against heat loss

2. CLASS AVES

birds - 8600 species (shape most uniform)

- size 6 cm to 2 m (wingspan to 3 m)
- most observed class (but 2nd most studied)

flight - wings, feathers, reduced weight

- advantages (rapid travel, migration, more efficient predation or escape)

ecology - mostly diurnal, all habitats

evolution - from reptilian ancestor (thecodont)

- *Archaeopteryx* (feathers, teeth, scales)

3. ORDERS

1. ratites - 5 orders (incl. ostriches & penguins)

- flightless (but not related), flat sternum

2. carinates - 22 orders, majority of species

- sternum with large keel for flight muscles

4. INTEGUMENT

feathers - epidermal, evolved from scales

- functions (protection, flight, insulation)
- quill (base) & shaft (stem)
- vane (barbs & barbules interlock)

types - contour (covers body), wing, tail

- down (insulation, flexible barbules)

coloration - attracts females (but also predators)

- pigmented or structural color

preening - realigns barbules, reapplies oil

molting - most gradual & after breeding

5. SKELETON

true bone - fused for strength, light & hollow for flight

skull - single bone hinged to lower beak

- no teeth (rely on gizzard for chewing)

rib cage - furcula (clavicles fuse into wishbone)

- keeled sternum (attaches pectoral muscle)

wings - bones fused & reduced

legs - ankles bent back (knees hidden beneath feathers)

6. LOCOMOTION

flight - body compact & streamlined

- wings convex on top (flatter beneath)
- air above wings travels farther
- air less dense above wing than below
- thus air beneath wings generates lift

gliding - rise vertically on thermal air currents

- wings locked to conserve energy
- requires wings with large surface area

walking - most feet with 3 + 1 toes

swimming - webbed feet in ducks

- also flipper-like wings in penguins

7. REPRODUCTION

sexual - dioecious (testes seasonal, only left ovary)

- internal fertilization (cloacal protuberance)
- oviparous (calcium shell, lots of yolk)
- incubation (2-4 weeks, brood patch)

development - precocial (feathered & mobile)
- altricial (naked & helpless)

8. OTHER SYSTEMS

digestion - cloaca (for feces, urine, & reproduction)
- pellet (regurgitate hair & bones)

nervous - olfaction reduced (except vultures)
- syrinx (trachea produces calls-songs)

circulation - 4-chambered heart
- double pathway (for endothermy)

respiration - pair of lungs with 9 pairs of air sacs
- process fresh air even when exhaling

excretion - pair of kidneys but no bladder
- uric acid (semisolid conserves water)

9. MIGRATION

direction - most north to south
- winter in tropics (to escape cold)
- breed in temperate (new food, less competition)
- requires global conservation

ethology - zugunruhe (migratory restlessness)
- ortstreue (natal faithfulness)

navigation - environmental cues
- geography (corridors & shorelines)
- sun, polarized light, stars, magnetism