

# Class Aves

The Birds

# Birds share characteristics with reptiles

- Like what?
  - Lower jaw
  - Single ossicle
  - Single occipital condyle
  - Furcula





# Bird ancestors

- Are birds more closely related to dinosaurs, crocodiles or something else?
- What do you think?

# Bird ancestors

- Most likely descended from bipedal dinos
- Sinosauropteryx



# Bird ancestors

- Protarchaeopteryx



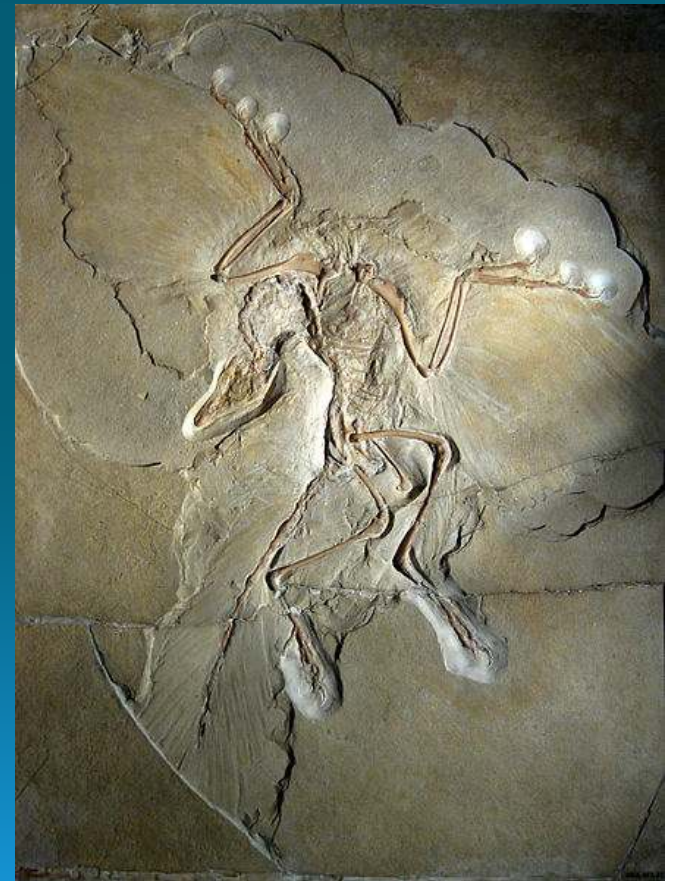
# Bird ancestors

- Caudipteryx



# The First Birds

- Archaeopteryx – Bavaria, Germany
  - Approx. 150 million years old
  - Had reptile and bird characteristics
    - Bony tail and teeth
    - Feathers and furcula (collarbone)



# The First Birds

- Other bird friends
- Sinornis
- 15 mill younger than Archaeopteryx,
- Had modified forelimbs
  - Folding wings





# The First Birds

- Other bird friends
- Eoalulavis
- Had alula
  - Used for hovering flight



# The First Birds

- Today, there are 9,100 species of birds
  - The most numerous number of species of all vertebrate animals
  - 27 orders!!!
- We have no idea whether these fossil birds are direct ancestors of any living birds





# The Evolution of Flight

- Archaeopteryx could not fly
  - Possibly a glider
  
- How can we know this if we were not there?

# The Evolution of Flight

- How did the ability to fly develop?
- Tree down:
  - Climbing → Jumping → Gliding → Gliding with flapping → Flapping
- Ground up:
  - Running → Running with flapping → Flapping for flight
- We can't tell....Maybe it was both

# Key Characteristics of Birds

1. Modified, feathered wings
2. Endothermic (warm blooded) with high metabolism
3. Flexible neck
4. Fused posterior vertebrae
5. Bones with air pockets
6. Horny bill that lacks teeth

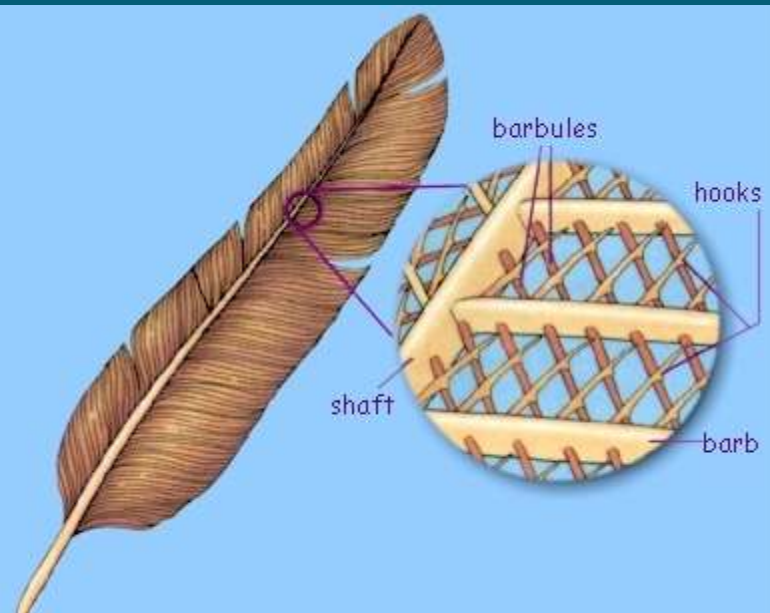
# Feathers

- Provide surface area for lift and steering
- Prevent heat loss



# Feathers

- Mature feathers are dead
  - No blood supply
  - Develop like scales in reptiles



# Feathers

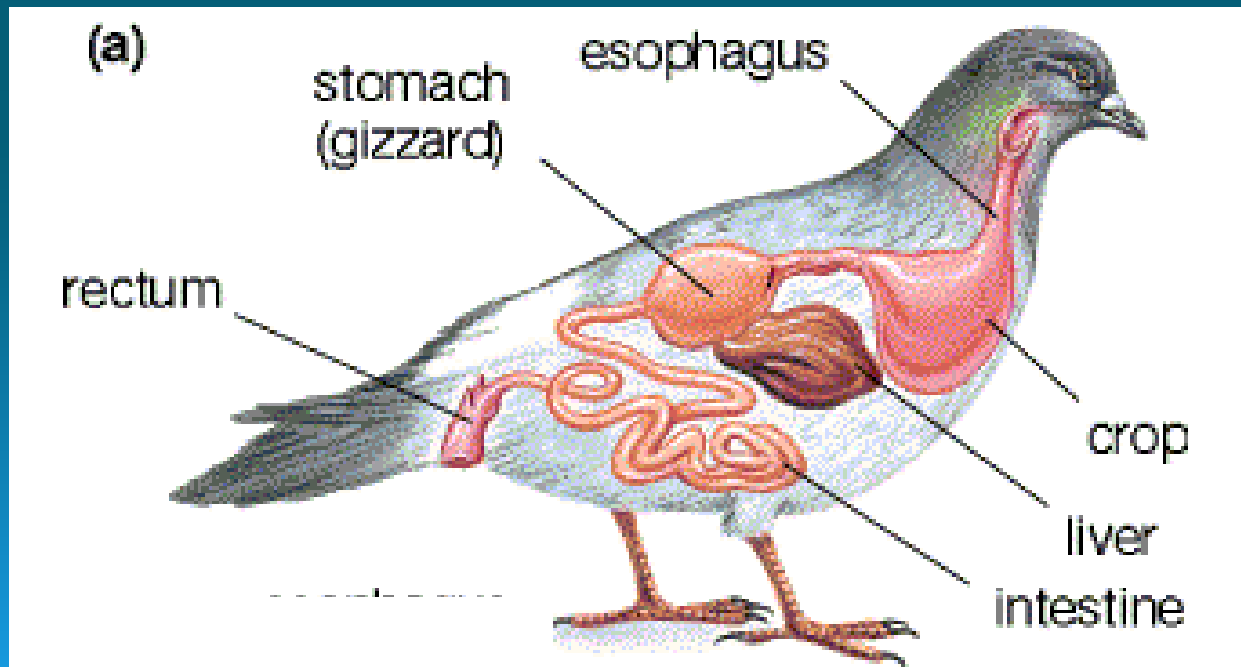
- Birds preen and molt





# Nutrition and Digestion

- Large appetites
  - Energy needed for endothermy and flight
- Crop- stores food
  - Allows them to move to safety to digest
- Gizzard- muscular for grinding



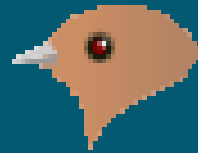
# Nutrition and Digestion

- Modified bills- cracking seeds, tearing prey, straining, shoveling





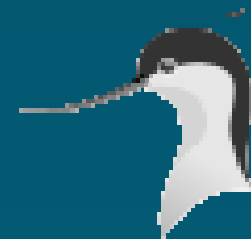
Generalist



Insect catching



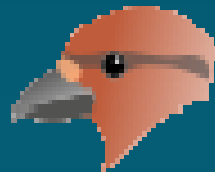
Surface skimming



Probing



Grain feeding



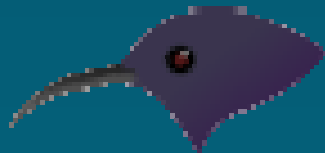
Coniferous-seed feeding



Probing



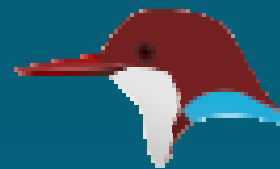
Filter feeding



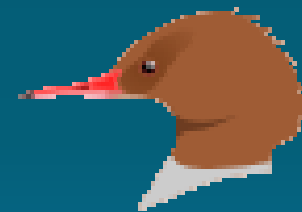
Nectar feeding



Fruit feeding



Tearing



Pursuit feeding



Chasing



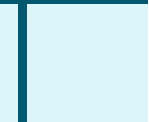
Drilling



Scavenging

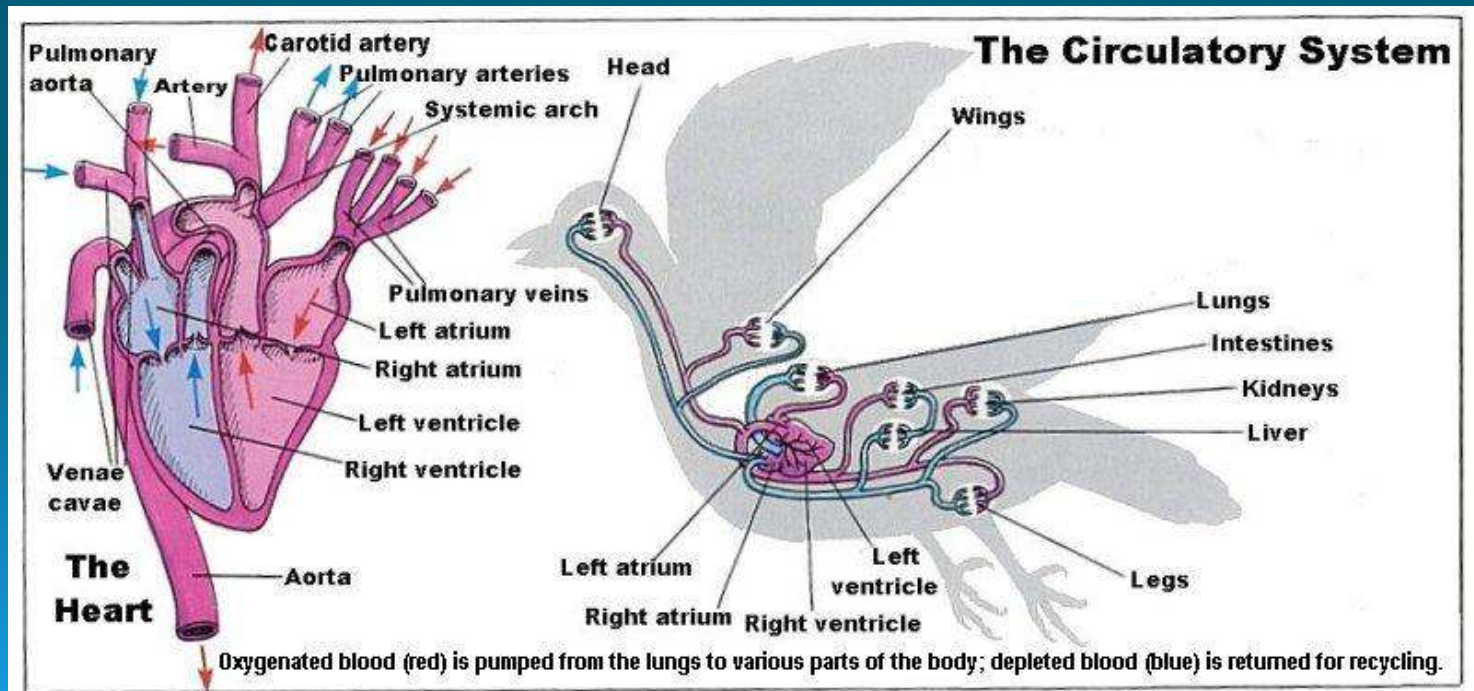


Raking



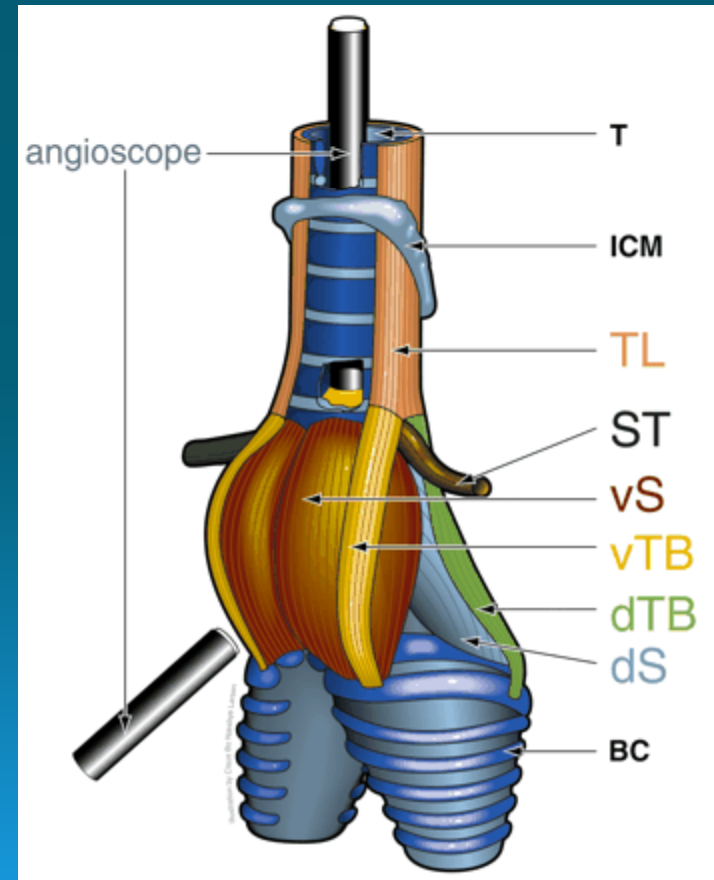
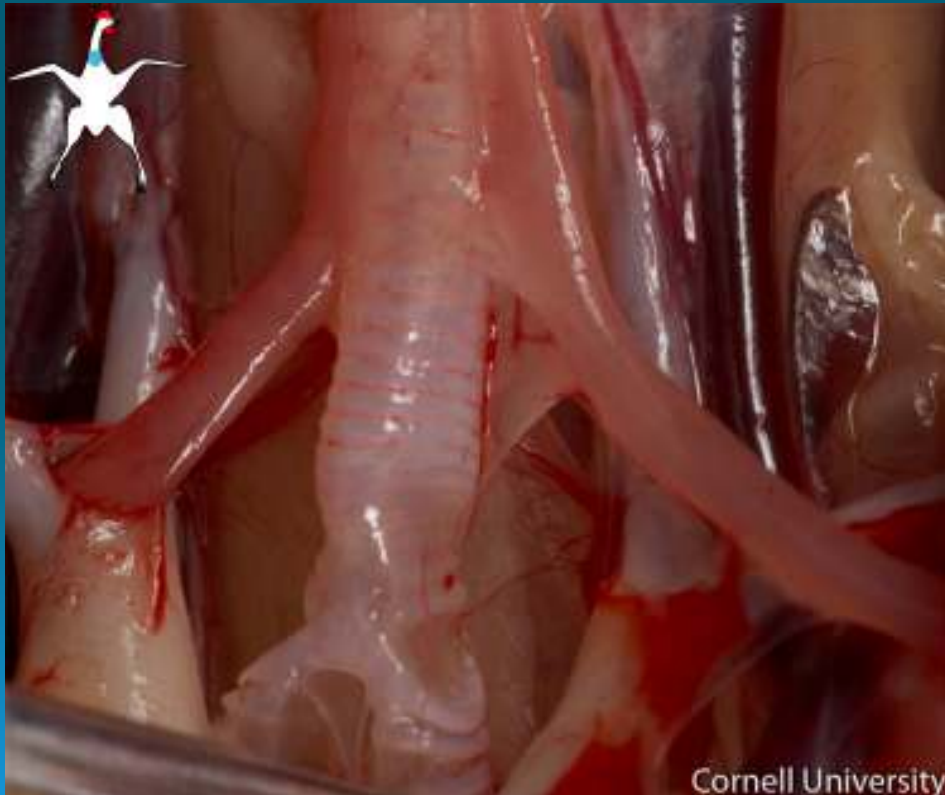
# Circulation

- Large 4 chambered heart
  - No mixing of oxygenated and non-oxygenated blood
  - Rapid beating
- High blood volume
- Why?



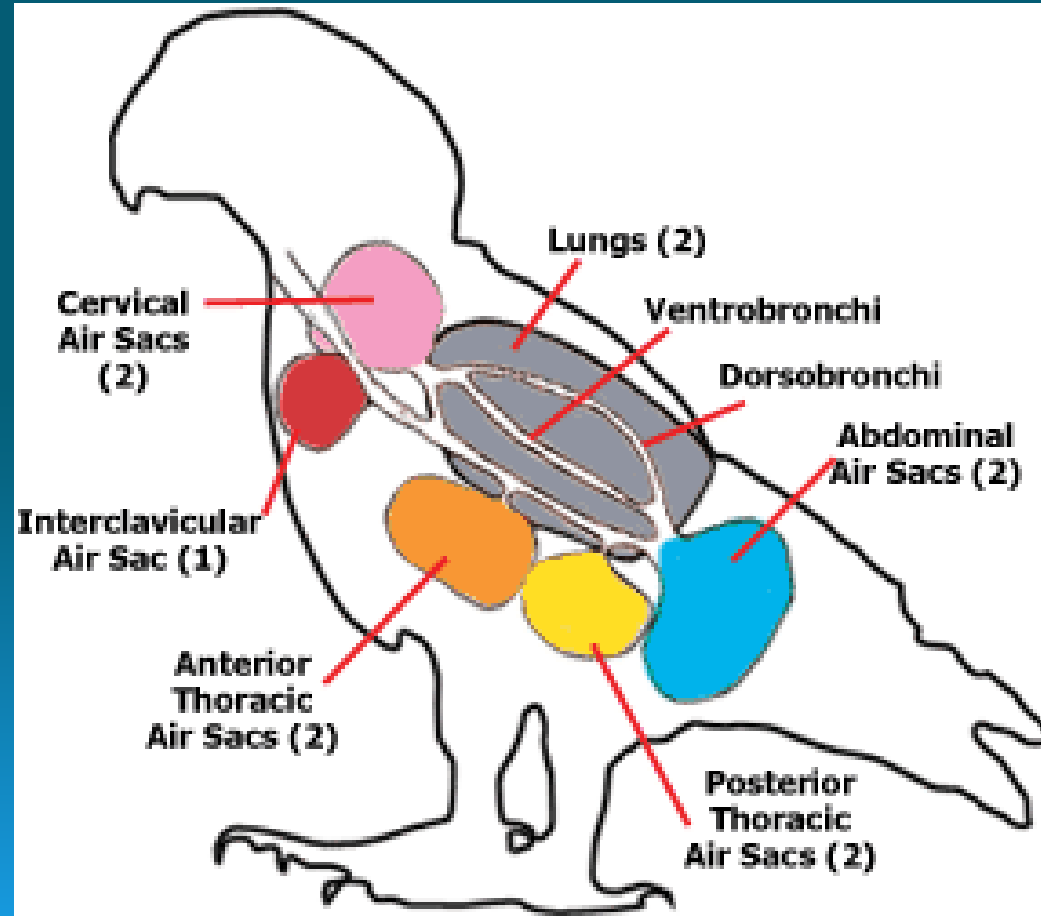
# Gas Exchange

- Syrinx- specialized voice box



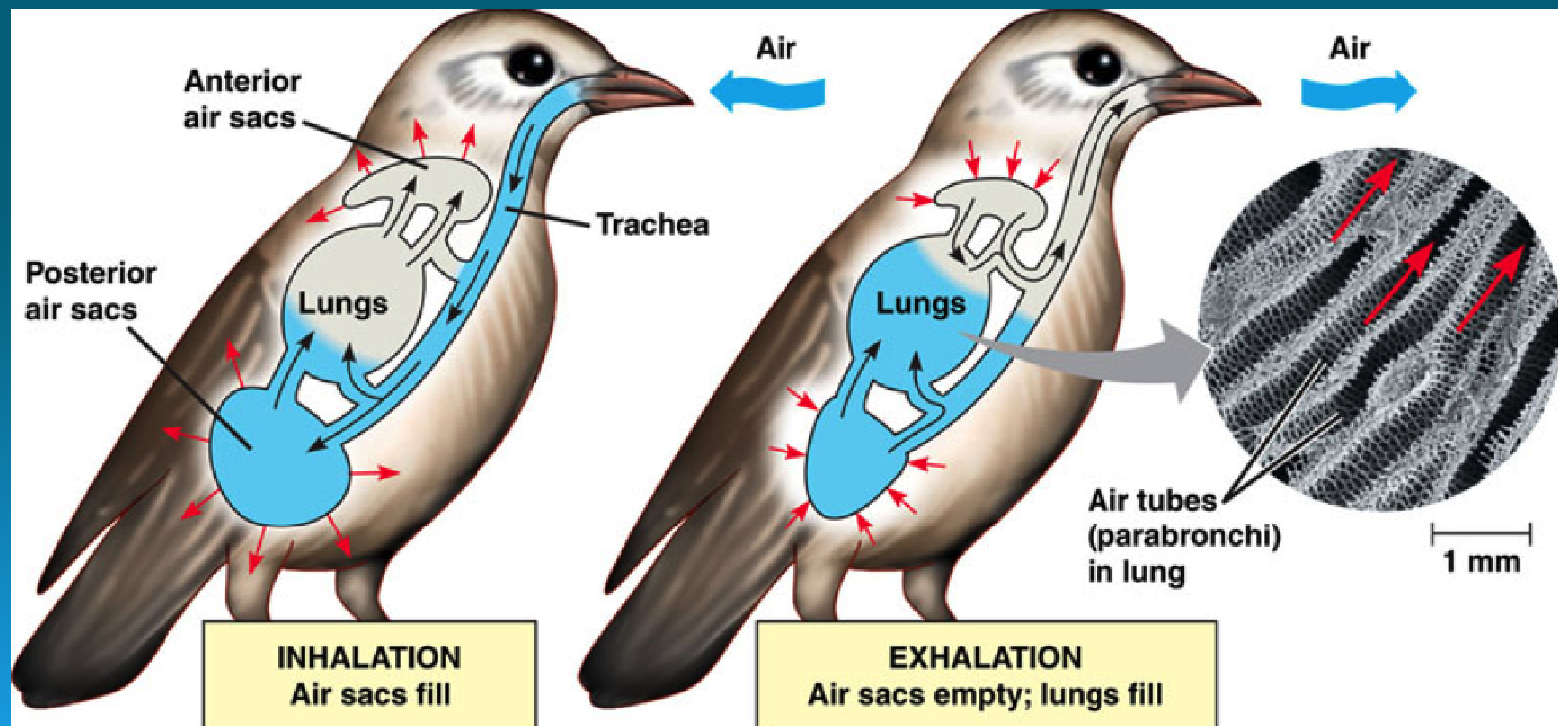
# Gas exchange

- Air sacs all over the body



# Gas exchange

- Two cycle movement of air
  - Abdominal air sacs fill, then air moves into lungs, thoracic sacs and out
- Oxygen rich air is continuously moved into the lungs
- Why is this such a great adaptation?



# Thermoregulation

- Work to maintain body heat
  - Fluff feathers
  - Tuck the bill in
  - Special countercurrent blood circulation in the feet
  - Shivering and eating more in winter
  - Torpor at night (whippoorwills)





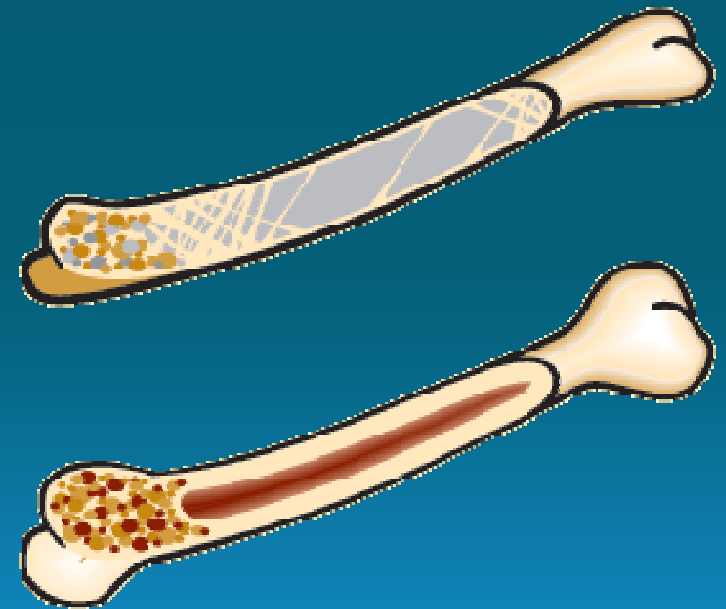
# Thermoregulation

- Heat lost by panting



# Skeleton and Movement

- Bones have air spaces, reinforced with struts



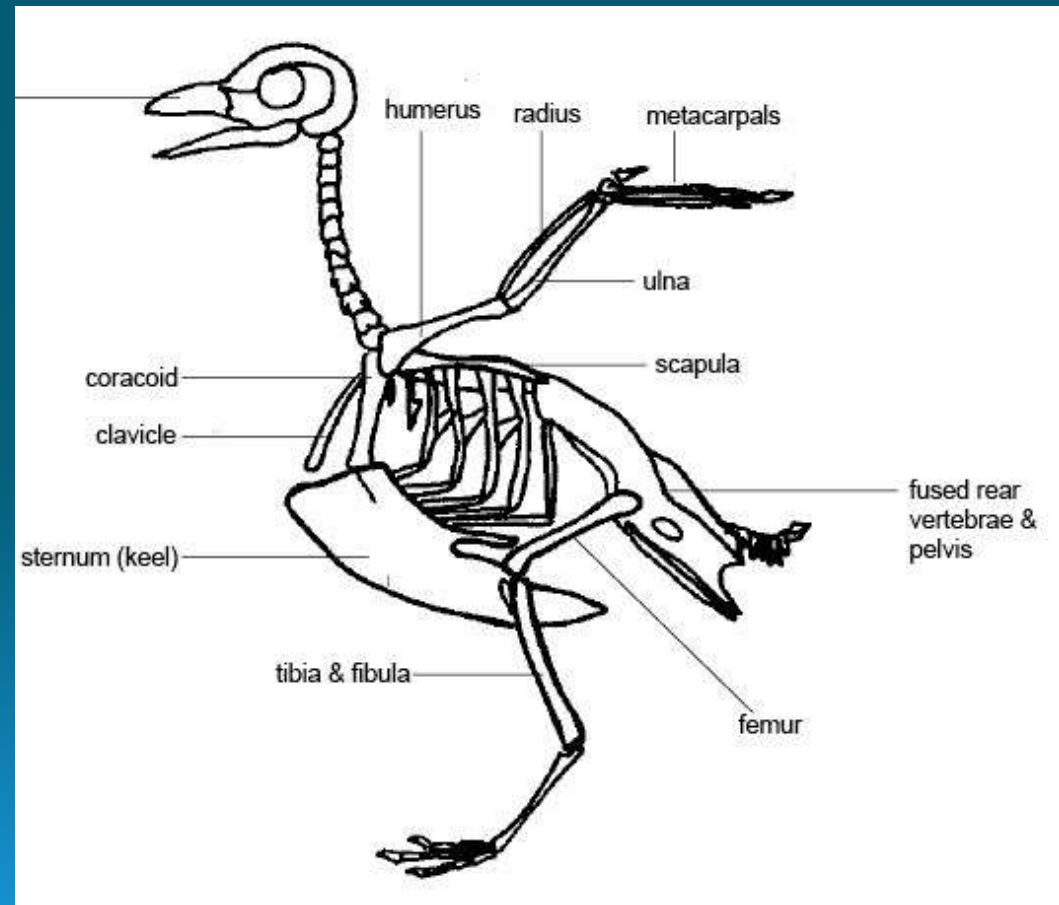
# Skeleton and Movement

- Flexible neck with bill/beak
  - Why so great?



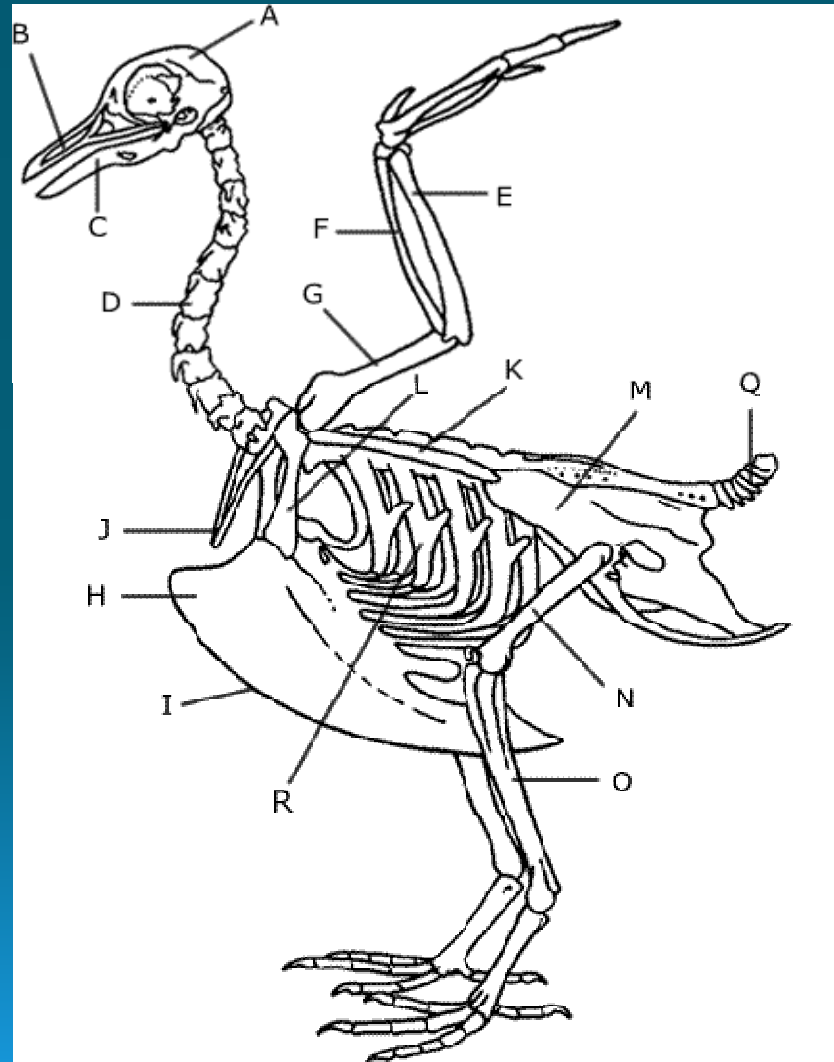
# Skeleton and Movement

- Fused posterior vertebrae
  - Reinforced for landing, hopping, walking and flight posture



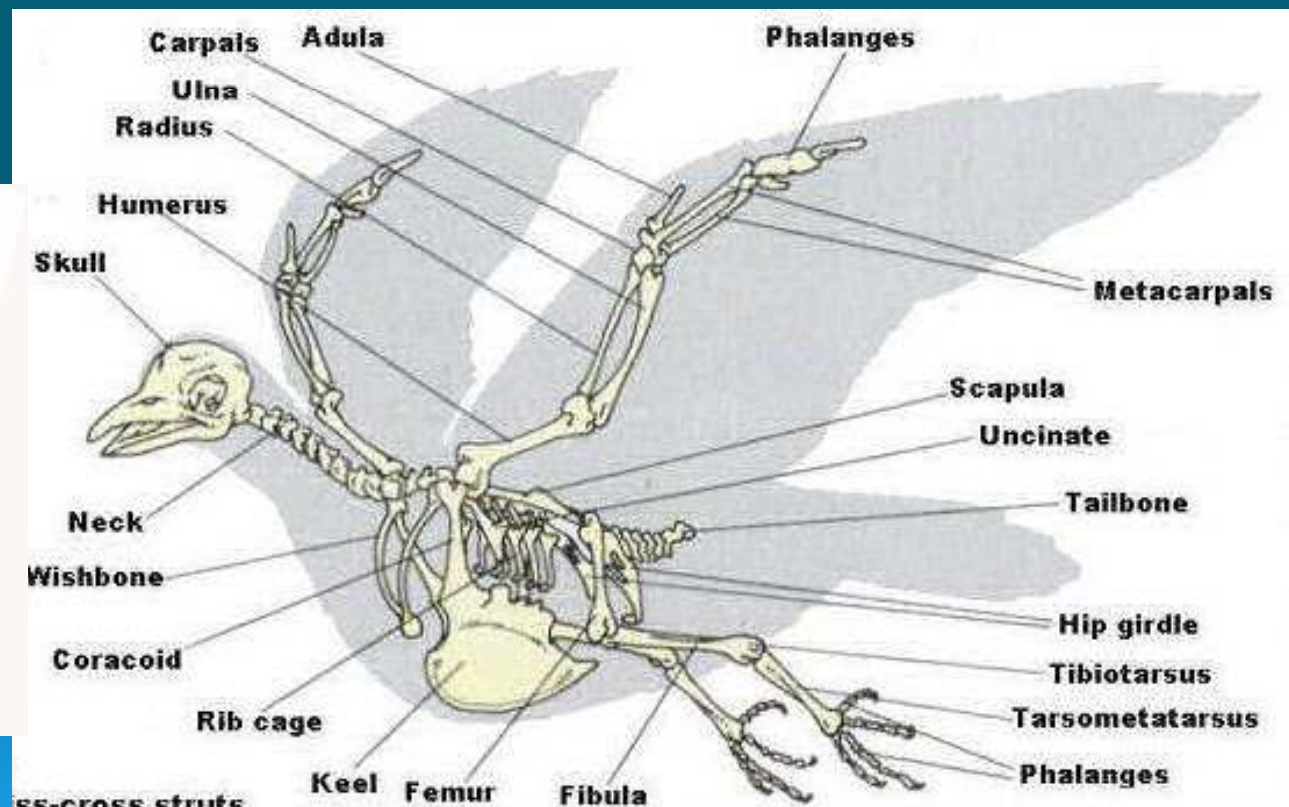
# Skeleton and Movement

- Sternum (keel)
  - Flight muscle attachment
  - Strong flight muscles
  - Quick contraction and slow fatigue



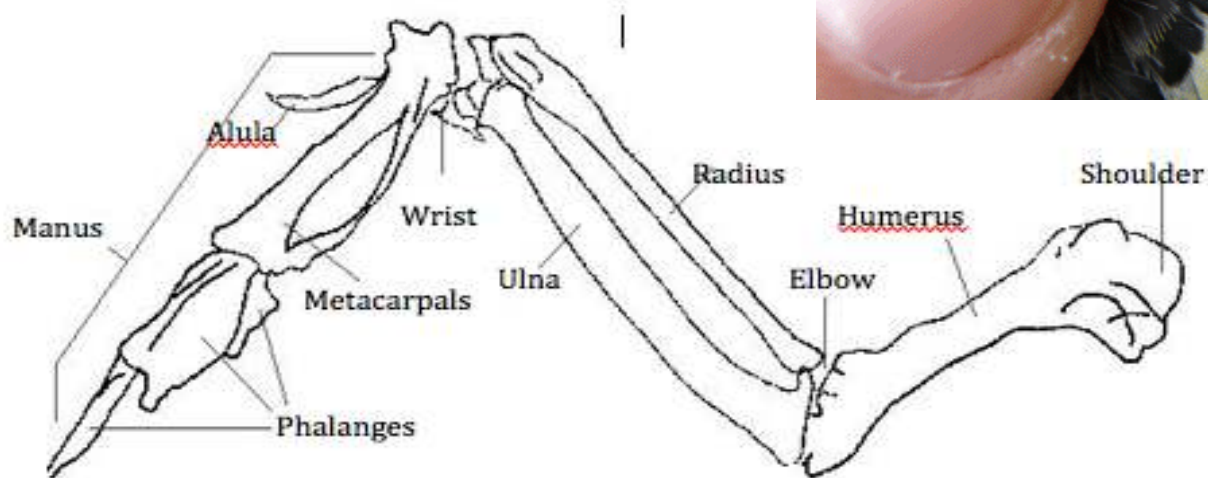
# Skeleton and Movement

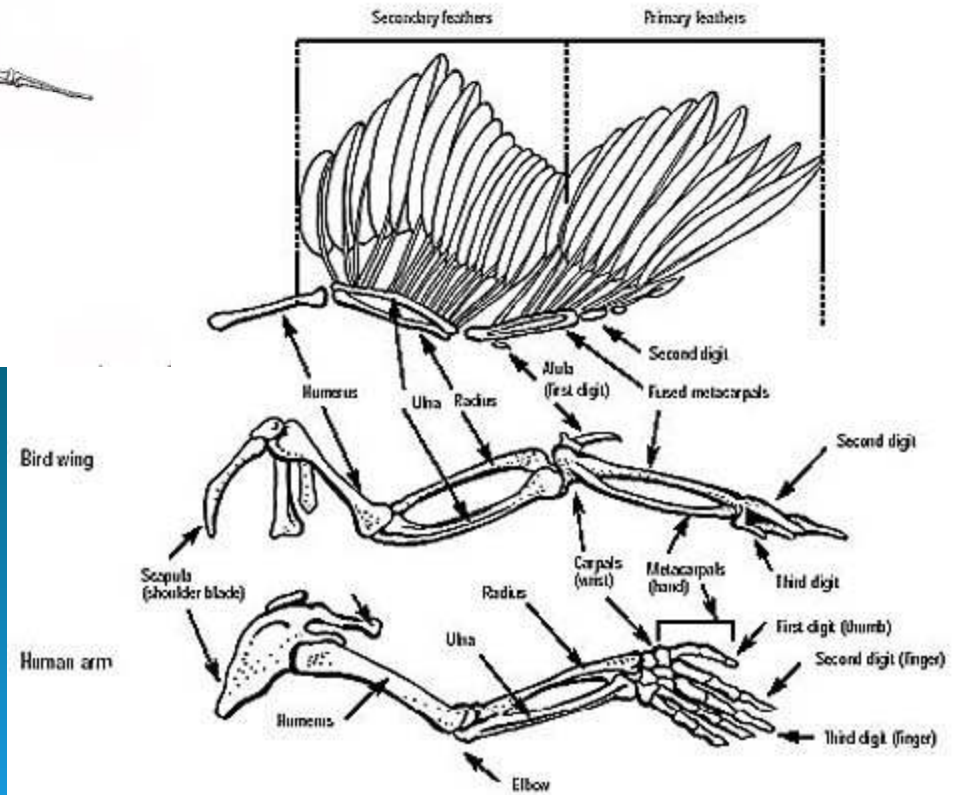
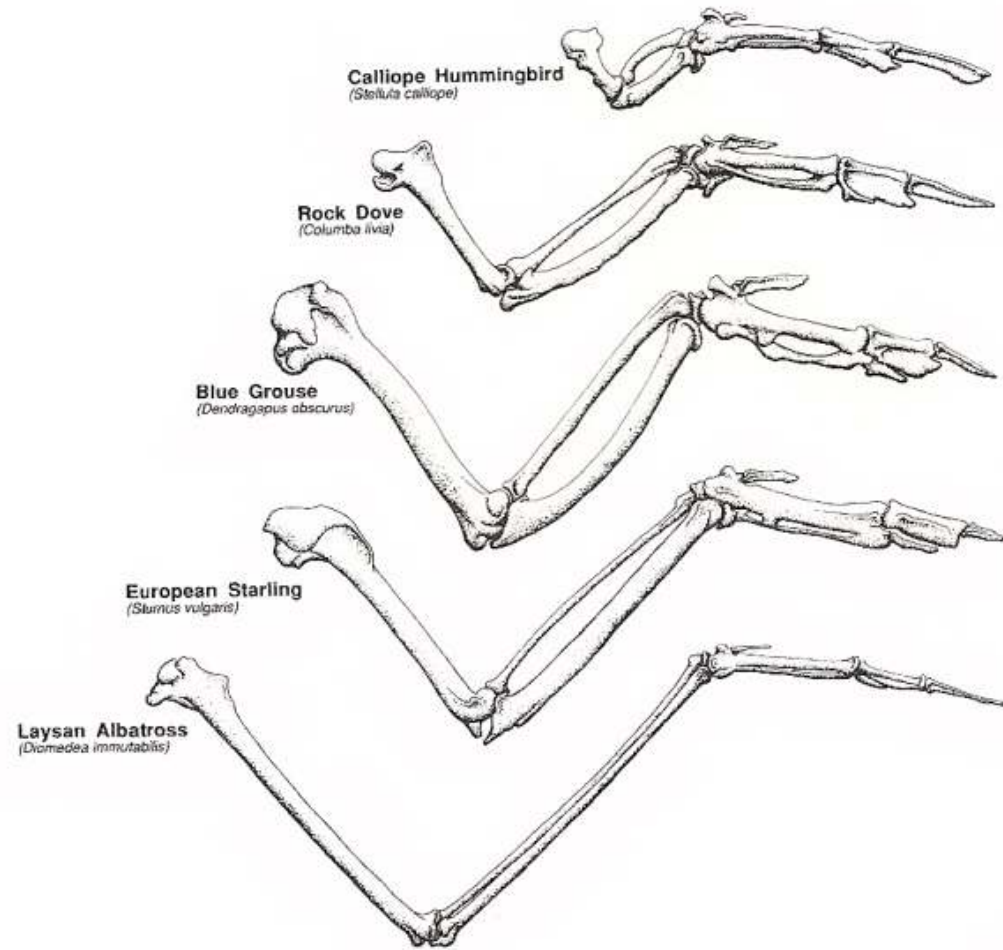
- Paired clavicles form the furcula (wishbone)
  - Flight muscle attachment and bracing



# External Structure and Movement

- Digits fuse to form alula





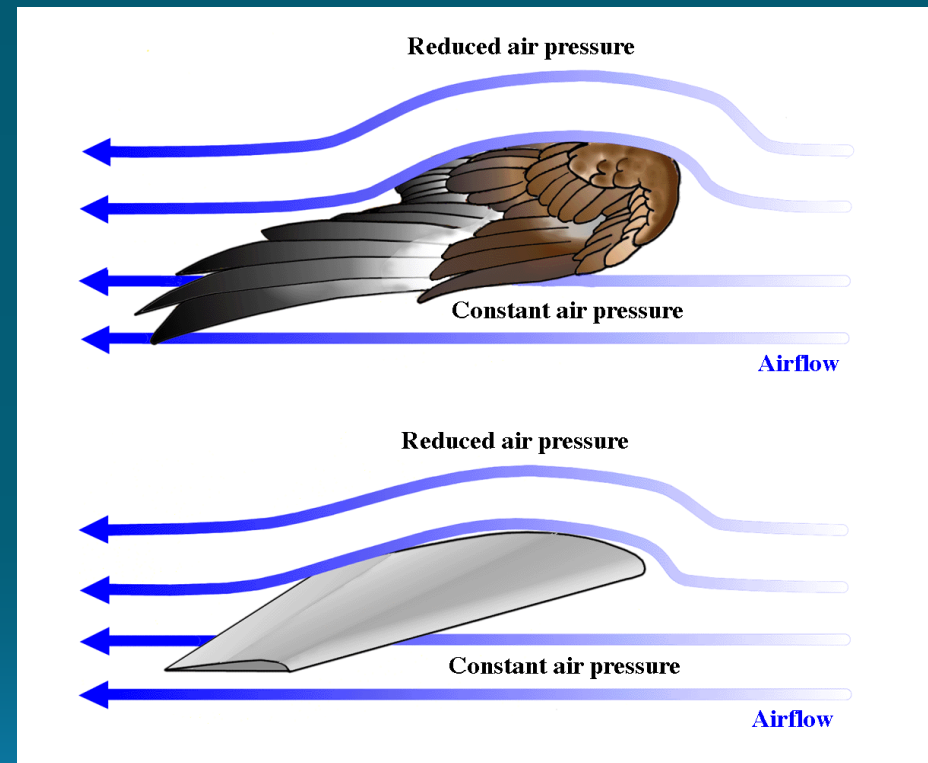


# Flight

- Soaring, gliding, rapid flapping and hovering flight
- Examples?

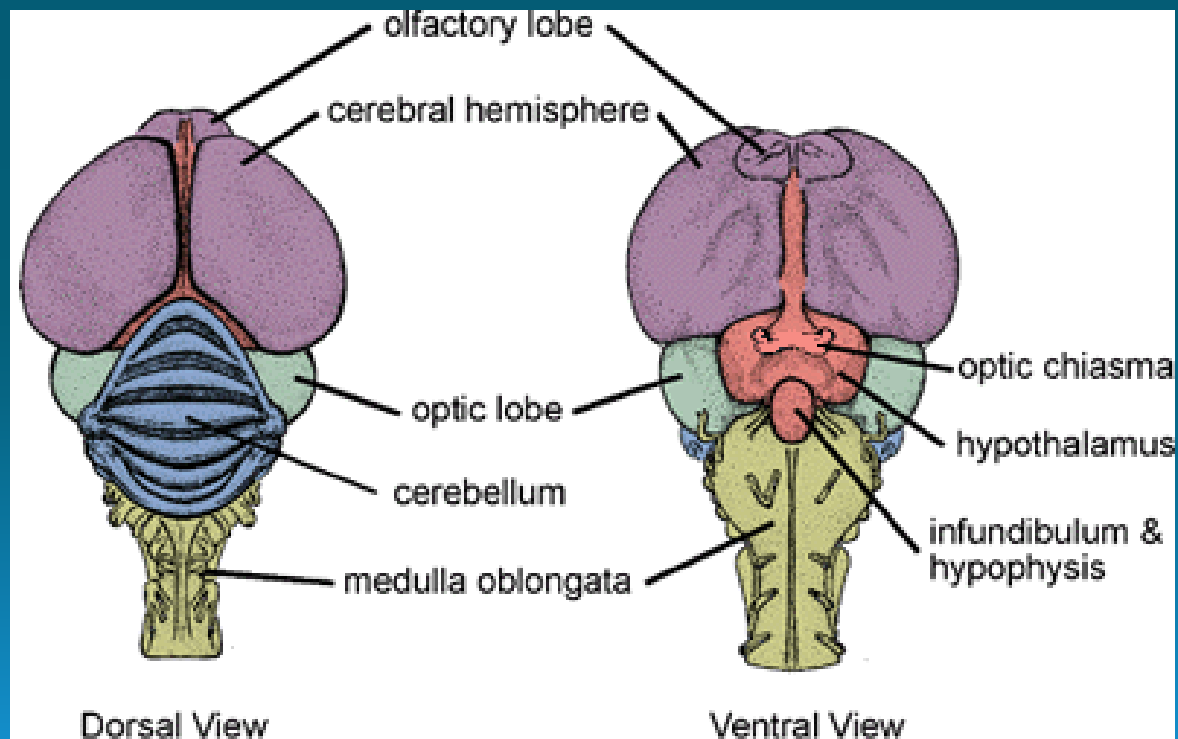
# Flight

- Wing is airfoil shape
  - Creates lift
- Alula – reduce turbulence
- Tail- balance, steering and braking



# Nervous and Sensory

- Larger brain
  - Visual learning, feeding, courtship, nesting



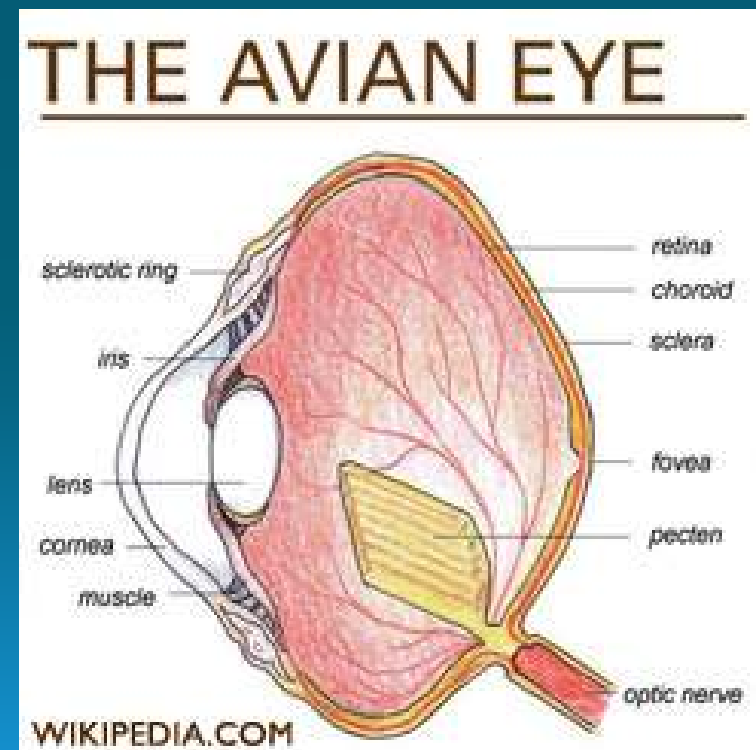
# Nervous and Sensory

- Large eyes (relatively), positioned to back and side
  - Wide monocular vision but narrow binocular vision



# Nervous and Sensory

- Double focus mechanism
  - Search- wide angle monocular vision
  - Pursuit- focus, binocular vision
- Can see color and UV



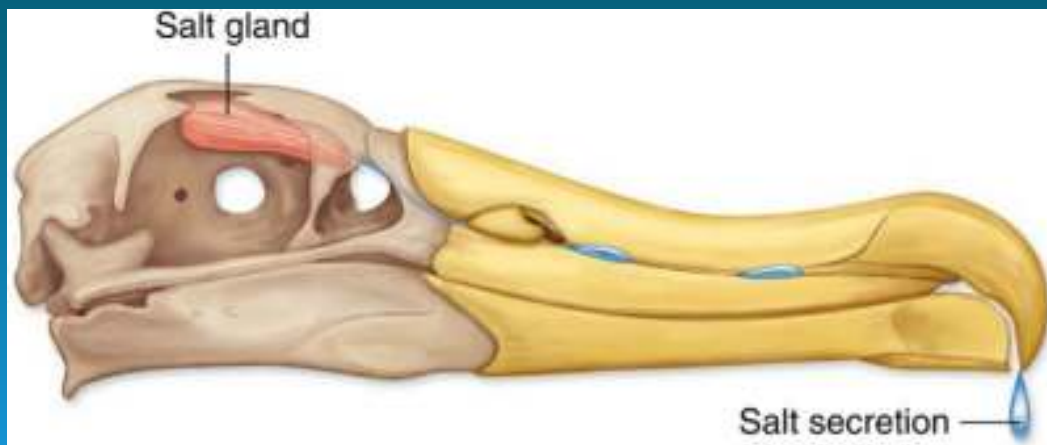
# Nervous and Sensory

- Nictitating membrane
- Poor smell
- Good hearing



# Excretion and osmoregulation

- Birds excrete uric acid
  - Like reptiles- paste
- Cloaca reabsorbs water
- Some sea birds release salt from special glands



# Reproduction and Development

- Territories are established for breeding
  - Nesting site and food resources
  - Males attract females to their territory





# Reproduction and Development

- Breeding typically involves some type of courtship display
  - Body language signals readiness to mate



# Reproduction and Development

- All birds lay eggs
  - Female has gland that secretes shell



# Reproduction and Development

- Most birds are monogamous- (at least for the season)
  - Some for life -swans, eagles, geese
- Both parents build nest and care for young
  - One incubates while the other protects or searches for food
- What are the advantages of this?



# Nesting

- Building a nest is instinctive behavior
  - Clutch size varies on the species
  - Eggs are turned,
  - 10-80 days for incubation



# Nesting

- Parents instinctively feed open mouths
  - Bring food or regurgitate
  - Color patterns or calls stimulate babies to open mouths
  - Altricial young- naked and helpless
  - Precocial young- can walk and move, parent leads them to safety



# Interesting Bird Life facts

- 50% of eggs laid hatch and survive to leave the nest
- Birds can live 10-20 years in captivity but not as long on average in the wild
- A robin will live 1-3 years on average
- A chickadee will live less than one year on average
- Why?



