Birds

"Reptiles by Another Name"

- By 150 million years ago
  - Feathered theropods had evolved into birds
- *Archaeopteryx*
  - Remains the oldest bird known

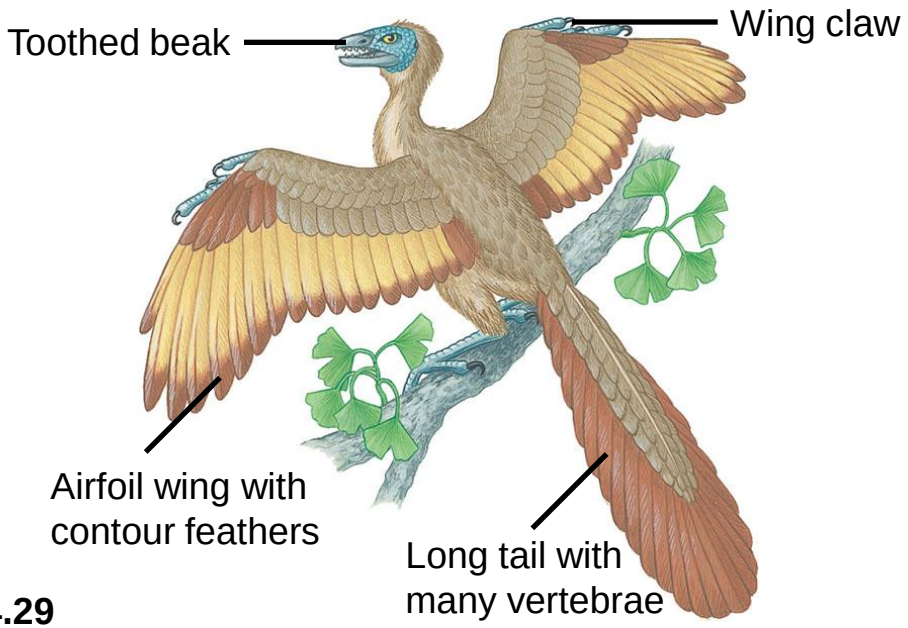


Figure 34.29

General Characteristics of Birds

- Adaptations for flight
- Appendages modified as wings
- Feathers
- Endothermy
- High metabolite rate
- A ventral column modified for flight
- Bones lightened by numerous air spaces
- Horny bill
- Lack teeth

Bird Evolution and Phylogenetic Relationships

- Bird wings adapted for different kinds of flight

*Soar, glide, rapid flapping

- Muscles adapted for flight

*contract quickly and fatigue slowly

- Very closely related to reptiles
- Question as to whether birds go back to the crocodilians or the dinosaurs (more people think dinosaurs!)
- Many fossils show similarities to the Theropod dinosaurs
- Some Zoologists say hind limb structures of earliest birds suggest that they used to run and hop along the ground

Order *Sphenisciformes*

- Heavy bodied
- Flightless
- Flipper-like wings for swimming
- Well insulated for fat
- Penguins!

Order *Anseriformes*

- Posses a wide flat bill
- An undercoat of dense down feathers
- Webbed feet
- Ducks and swans!

Order *Falconiformes*

- Strong
- hooked beak
- Large wings
- Raptorial feet
- Vultures, hawks, and eagles!

Order *Columbiformes*

- Dense feathers, loosely set in skin
- Well developed crop
- Pigeons and doves!

Order *Strigiformes*

- Large head
- Large, fixed eyes directed forward
- Raptorial foot
- Owls!

Order *Passeriformes*

- Largest avian order
- 69 families of perching birds
- Perching foot
- Variable external features
- Swallows, larks, crows!

Bird External Structure & Locomotion

- Feathers have 2 functions essential for flight:

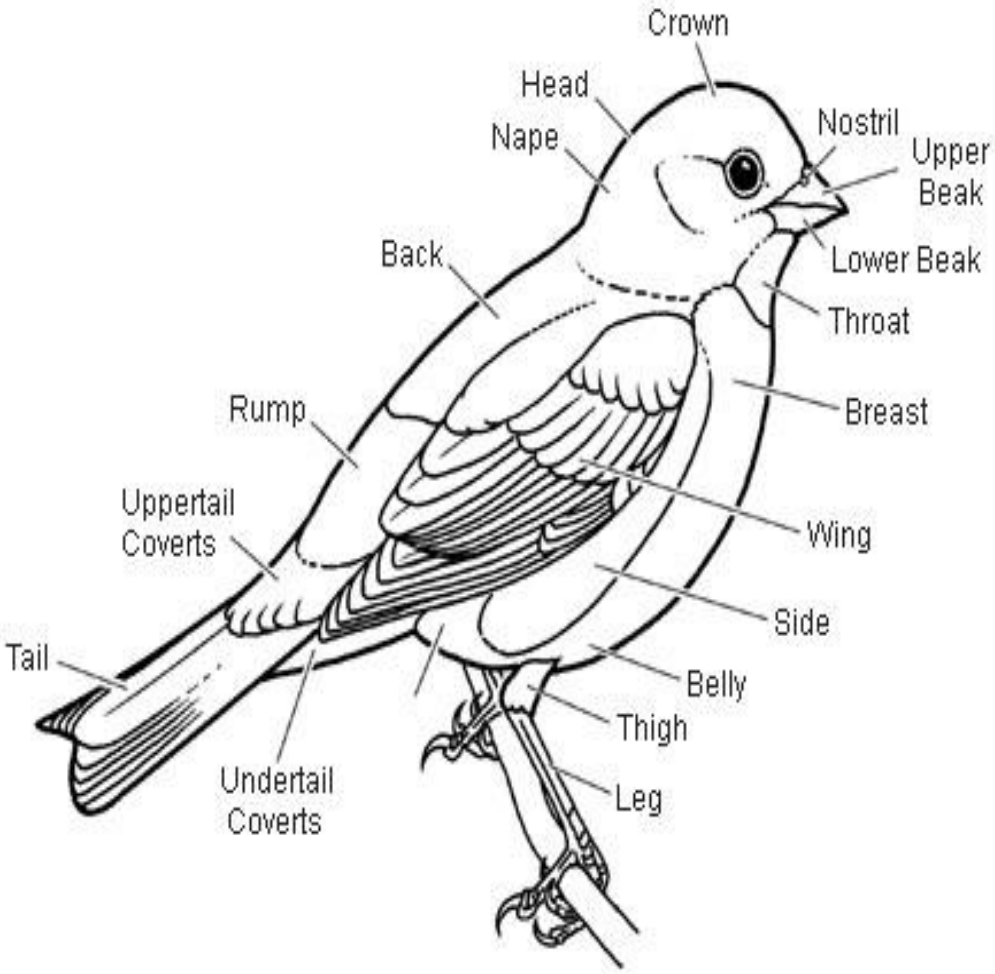
*Form the flight surfaces that provide lift and aid steering

*prevents excess heat loss

- Covered in flattened, tightly closed feathers creating an aerodynamic surf

- Feather pigments deposited during feather formation produce most colo a birds plumage
- Birds' wings for an airfoil
- Decreased air pressure on upper surface of wing helps create the lift

- When the birds' feathers get too old, it sheds and replaces, this process is called molting

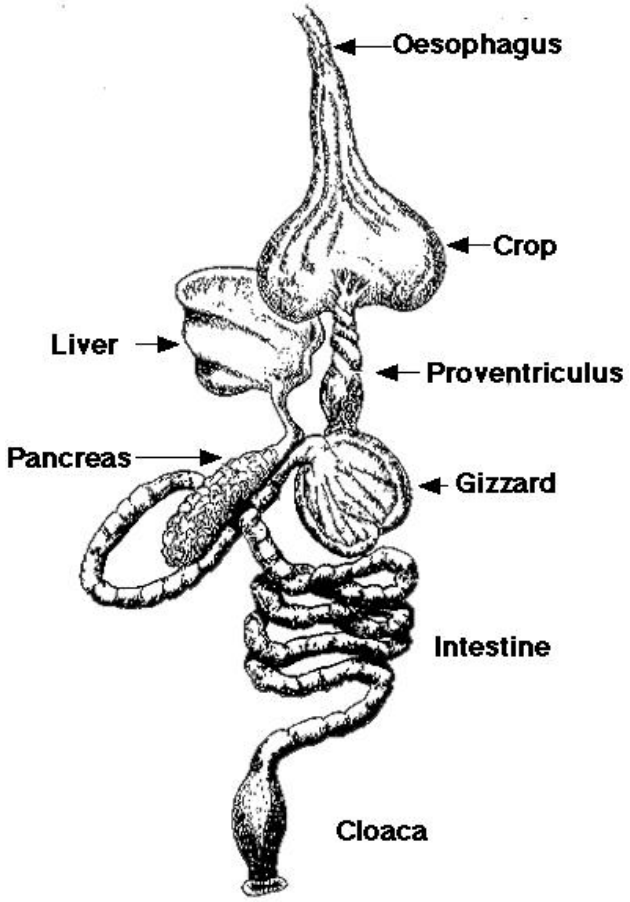


https://www.google.com/search?q=external+structure+of+birds&sxsrf=ALeKk025wp3-zquq4wsFmAEdLH

Bird Nutrition and Digestion

- Most birds have ravenous appetites.
- High Metabolism to make endothermy and flight possible.
- Birds bill and tongues are modified for a variety of feeding habits and food sources.
- The **neck, head, and bill** combination function as a fifth appendage.
- A diverticulum of the esophagus, called the crop, is a storage structure that allows birds to quickly ingest large quantities of food.
- The **stomach is modified into two regions**.
- The Ventriculus (gizzard) has muscular walls to abrade and crush hard materials.
- Enzymatic digestion and aborption occurs in the small intestine, aided by secretion from the pancreas and liver.
- Paired ceca are sacs that contain bacteria that aid in cellulose digestion.
- Birds usually eliminate undigested food through the **cloaca.**
- Birds are often grouped by their food habits.

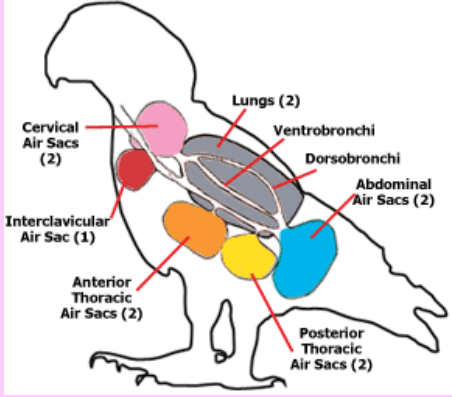
Generalized digestive system of a bird



Bird Circulation

- The heart has a completely separated atria and ventricles which result in separate pulmonary and systematic circuits.
- The sinus venosus is used as a patch of pacemaker tissue in the right atrium
- Very large heart which beats rapidly, except larger birds have smaller hearts at a slower pace
- A large heart, rapid heart rate, and complete separation of high to low oxygenated blood are adaptations for delivering the large quantities of blood required for endothermy and flight.

Bird Gas Exchange



- Very complex
- External nares lead to nasal passage ways which lead to the pharynx
- A special voice box called the syrinx is located where the trachea divides into the bronchi
- Muscles of the syrinx, bronchi, and the characteristics of trachea produce voice vocalizations
- The bronchi leads to a complex system of air sacs that occupy much of the body and extend into some of the bones of the skeletal system
- The lungs of birds are made of air tubes called parabronchi
- The avian system of gas exchange is more efficient than any other tetrapod

Bird Temperature Regulation

- On a cold day, a resting bird fluffs its feathers to increase their insulation properties and increase dead air space around them
- Tucks its bill into its feathers to reduce heat loss from the respiratory tract
- Feet and tarsi are the most exposed part, and have neither fleshy muscles nor rich blood supply, so temperatures in these extremities are allowed to drop near freezing to prevent heat loss
- Countercurrent heat exchange between warm blood to legs/feet and cold blood throughout body core from legs/feet prevents excessive heat loss at feet.
- Shivering regenerates heat in extreme cold weather
- Some birds become torpid to allow their body temperature to drop on cool nights
- Muscular activities from flight produces large quantities of heat which birds dissipate by panting

Bird Nervous and Sensory Structures

- **Forebrain is larger than reptiles**, however, hindbrain is same as reptiles- it coordinates motor activities, and regulates heart and respiratory rates
- Vision is very important- structure of the eyes are relatively larger than their body size
- Eyes have a unique double-focusing mechanism which allows them to focus on prey while they descend
- **Nictitating membrane** over surface of eye to cleanse and protect the eye
- Well developed hearing
- Middle and inner ear similar to reptiles
- Olfactory plays a minor role, and the olfactory epithelium is poorly developed

Bird Excretion and Osmoregulation

- The anatomy of birds and reptiles are almost identical
- Excrete **uric acid** which is temporarily stored in the cloaca
- Excretion of uric acid conserves water and promotes embryo development in terrestrial environments
- Some birds have **supraorbital salt glands** that drain excess sodium chloride through the nasal opening through the outside of the body

Bird Reproduction and Development

- All birds are **oviparous**
- The males testis enlarge during the breeding season
- In females, two ovaries form during development but usually the left ovar develops
- A large, funnel shaped opening (the ostium) of the oviduct envelops the o receives eggs after ovulation
- A shell gland in the lower region of the oviduct adds a shell
- Oviduct opens into the cloaca

- Many birds establish **territories** prior to mating
- They provide nest locations and sometimes food resources for adults and
- Most birds are monogamous, which means they stay will one partner duri mating season
- Some birds are **polygynous** which means the males mate with more than
- A few bird species are **polyandrous** which means the female mates with m one male
- Some birds make nests after pair formation, while others, such as penguir

Bird Migration and Navigation

- Over 20 centuries, Aristotle described birds migrating to escape he winter cold and the summer heat. **Migration** refers to periodic round trips between breeding an nonbreeding areas.
- Birds migrate more north because about 70% of e earths land is in the Northern Hemisphere.
- Migration allows birds to **avoid climate extremes and secure adequate food, shelter**, an space through the year.
- What influences their preparation for migration **is innate(genetic) clocks and environmental factors.**
- The changing photoperiod imitates seasonal changes in gonadal development that often serve as migratory stimuli.
- **Changing in photoperiod** also appears to promote fat deposition, which acts as an energy reserve for migration.
- The mechanics for migration are species specific, as well as migration routes.

Bird Migration and Navigation cont.

- In ancient Egyptian times and as a recent as World War II, pigeons returned messages from he battlefield.
- Birds use two forms of navigation.
- Route-based navigation, Involves keeping track of landmarks on outward journey so hat those landmarks can be used in a reverse sequence on the return trip.
- Location-based navigation, based on establishing the direction of the destination from information available a the journeys site of origin.
- Birds' lenses are transparent o ultraviolet light, allowing them to orient using the sun even on cloudy days.
- Some zoologist believe that birds have magnetic compasses to detect the earth's magnetic field.

Some basic Terminology

- **Contour feathers-** usually symmetrical and line the body and cover the base of the flight feathers-provides water proofing, insulation, and streamlining
- **Down feathers-** included in plumulaceous feathers, insulating. It lies below contour feathers
- Flight feathers- line tip and trailing edge of the wing and they are asymmetrical with larger barbs on one side of the shaft. Strongest muscle of the bird
- **Clutch**- the group of eggs laid and chicks produced by a female
- **Atricial**- an animal that is helpless at hatching or birth
- **Precocial-** having developed to a high degree of independence at the time of hatching or birth
- **Migration**- refers to periodic round trips between breeding an nonbreeding areas

References

- www.smackslide.com