BIRDS NOTES

- EVOLUTION AND CLASSIFICATION
- Birds are Vertebrates of the Class Aves
- The evolution of warm-blooded, has enabled birds to survive in virtually every known environment

ORIGIN AND EARLY EVOLUTION

- Evidence from fossils and from studies of comparative anatomy indicates that birds evolved from reptiles
- Their features and their fragile hollow bones do not preserve well

ARCHAEOPTERYX





SKELETON OF Archæopteryx

- The fossil genus Archaeopteryx link between reptiles and birds, these mammals possessed characters of both reptiles and birds
- Like reptiles it had a large skull with teeth, bones that weren't hollow, claws on its forelimbs, and a long tail
- Its strong legs and rounded wings indicated that it glided rather than flew
- In contrast, the presence of feathers and of a furculum, the fused collarbones commonly called the wishbone, suggest that Archaeopteryx was birdlike
- After Archaeopteryx the next bird fossil dates from about 90 million years ago, in the Cretaceous period

HESPERORNIS

- Hesperornis, a large, flightless, diving bird, probably resembled the modern loon but had reptilian teeth
- A smaller tern like bird called Ichthyornis had large wings, indicating that it may have been a strong flier
- The development of sustained flight may have enabled birds to colonize new areas during the Cretaceous

CLASSIFICATION

- Most taxonomists classify the nearly 9,00 species of Class Aves into 27 orders
- To classify birds into orders and families, taxonomists most often use morphological evidence from beaks, feet, plumage, bone structure, and musculature

CHARACTERISTICS OF BIRDS

- The following characteristics distinguish birds from other Vertebrates
- Body covered with feathers
- Bones are thin and hollow
- The forelimb function on wings are used for flight not grasping
- The two hind limbs, with clawed toes, support the body
- A toothless, horny beak is present
- Body temperature is generated and regulated internally
- The 4-chambered heart has a single right aortic arch
- Internal fertilization
- Amniotes eggs are encased in hard, calcium containing shells
- Most species eggs are incubated in a nest
- ALL birds are oviparous





EXTERNAL CHARACTERISTICS

- Soft, fluffy down feathers cover the body of nestling birds and provide an insulating undercoat for adults
- Contour feathers give adult birds their streamlined shaped and provide coloration and additional insulation
- Flight feathers are specialized contour feathers on the wings and tail
- Hair like Filo plumes, or Pinfeathers, and dust filtering bristles near the nostrils
- Feathers develop from thin pits in the skin called follicles
- At maturity each vane has many branches called barbules that are equipped with microscopic hooks
- In the process of preening, the preen gland, located at the base of the tail secretes oils to lubricate feathers
- The major molt, during which the birds replace their flight feathers, occurs in the late summer between breeding and migration

ENDOTHERMY

- Generate and regulate body heat internally
- Enables birds to inhabit both cold and hot climates
- Body temperature ranges from 40 46 degrees Celsius
- To help conserve body heat, birds fluff out their feathers for insulation



BEAKS AND FEET

- Hawks and eagles have powerful beaks and clawed talons that help them capture and then rip their prey
- Swifts have a tiny beak that opens wide like a catcher's mitt to snare insects in midair
- The feet of flightless birds, on the other hand, are modified for walking and running

SKELETONS AND MUSCLES

- Combine lightness and strength
- Bones are thin and hollow
- The fused bones of the trunk and hip vertebrae form the pectoral and pelvic girdles
- Fused bones form a sturdy frame that anchors the powerful breast muscles during flight and support the muscles when a bird is walking or at rest
- The sternum supports the large breast muscles
- The humorous, ulna, and radius, along with the pectoral girdle and sternum support the wing
- The Pygostyle and the terminal vertebra of the spine support the tail feathers which also play an important role



Bird skeleton

Internal bone structure

DIGESTIVE AND EXCRETORY SYSTEMS

- Food passes from the mouth cavity straight to the esophagus
- Enlargement of the esophagus called the crop stores and moistens food
- In the first chamber, the Proventriculus, gastric fluids begin breaking down the food
- Food then passes through the gizzard, a muscular organ, that kneads and crushes the food

EXCRETORY

- The avion excretory system is also efficient and light weight
- The two kidneys filter a nitrogenous waste called uric acid from the blood
- The highly concentrated uric acid travels by ducts called ureters to the cloaca, where along with undigested matter from the intestines, it is excreted in a semisolid, usually white mass



RESPIRATORY SYSTEM

- Air enters through paired nostrils at the base of the beak flows down the trachea, past the syrinx (or song box) then enters two primary bronchi to the lungs 75% bypasses the lungs and flows directly to posterior sacs these sacs connect with air spaces in bones, filling the hollow bones with air
- When the bird exhales, the carbon dioxide rich air from the lungs, oxygen rich air is forced out of the posterior air sacs into lungs via small air tubes



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CIRCULATORY SYSTEM

- 4 chambered heart •
- Right and left sides completely separated •
- Right side receives deoxygenated blood from the body and pumps it to the lungs
- Left side receives oxygenated blood from the lungs and pumps it to the rest of the body •
- Has a single aortic arch
- Most birds have a rapid heartbeat compared to other vertebrates – the Hummingbird heart beats 600





NERVOUS SYSTEM

- Birds have a large brain, relative to their size •
- Cerebellum coordinates movement •
- Cerebrum controls complex behavior patterns such as navigation, mating, and nest building •
- Optic lobe receives and interprets visual stimuli ٠
- Keen vision is necessary for taking off, landing, spotting landmarks, hunting and feeding •
- Have good color vision •
- Birds have large eyes that are located near the sides of the head, giving a bird a wide field of vision •
- Birds with eyes near the front of the head have better binocular vision •
- Hearing is important to nocturnal species that rely on sounds to help them locate prey •
- Birds lack internal ear canals that lead to a tympanic membrane or eardrum •
- Sense of smell is poorly developed except in ducks and flightless birds •
- Sense of taste helps birds avoid bitter tasting or toxic foods

Brain structure of the bird (goose)



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REPRODUCTIVE SYSTEM

- Male bird sperm is produced in two testes that lie beneath the kidneys
- Sperm passes through small tubes called Vasa Defrentia into the males cloaca
- During mating the male presses his cloaca to the females and releases sperm
- Females single ovary releases eggs into a long, funnel shaped oviduct, where they are fertilized by sperm
- Fertilized eggs move down the oviduct, where they receive the protective covering and a shell
- Unfertilized eggs consist of a nucleus, cytoplasm, and a yoke
- When fertilized, the embryo is suspended in albumen, the egg white
- The liquid medium is supported by ropelike strands of material called chalaza that are attached to the shell membrane
- Females have a shell gland that secretes a protective calcium carbonate which forms the shell around the egg

INCUBATION AND DEVELOPMENT



- A female bird usually lays eggs in the nest. One or both parents will incubate or warm the eggs by sitting on them
- They cover them with a thick, featherless patch of skin on their abdomen called a brood patch
- In penguins, the male emperor heats the egg by placing it on his webbed feet and enfolding it with his warm abdomen
- Embryo development begins when the zygote forms a plate of cells on the surface of the yolk
- This plate begins to form the tissues and organs
- The membrane produces digestive enzymes that dissolve proteins and lipids in the yolk
- Blood vessels in the yolk sac membrane carry the nutrients to the embryo
- When hatching begins the embryo makes a star shaped crack in the shell with a scale like egg tooth

- The chick presses and scrapes the shell until the crack widens enough for the chick to emerge
- The egg tooth, falls off soon after the chick hatches
- Birds have two contrasting methods for rearing young
- Those that lay many eggs and incubate them for long periods hatch precocial young
- These birds are active as soon as they hatch, they can swim, and feed themselves. Examples are ducks and quail
- Birds that only lay a few eggs and hatch quickly produce altrical young
- They depend on both parents for several weeks. Examples are woodpeckers, eagles, robins, hawks, pigeons, and parrots.

BEHAVIOUR

- The long periods of parental care may enable birds to learn such complex behaviors as courtship, nesting, and migration
- Young birds need protection until they develop the strength to fly and obtain food

TERRITORALITY AND COURTSHIP

- Many male birds establish an area that they defend against other males of their species, a behavior called territoriality
- The male then attempts to attract a female to share this territory
- Once a territory is established most birds engage in a period of courtship, behavior that is designed to attract a mate
- Many males attract females by means of their brightly colored feathers
- Some males combine song with flight displays

NEST BUILDING

- Nests hold eggs, conceal young birds from predators, provide shelter from the elements, and sometimes even serve to attract a male
- Most birds build nests in sheltered, well-hidden spots from holes in the ground to treetops
- As a further adaptation to the environment, birds construct their nests of almost any material available
- Twigs, grasses, feathers, and mud are the most common materials used

MIGRATION

- When temperatures drop and the food supply dwindles, these birds migrate to warmer climates
- Birds rely on a variety of cues to help them navigate
- Some species monitor the position of the stars or the sun
- Others rely on topographical landmarks, such as mountains
- Magnetic cues, changes in air pressure, and low frequency sounds may also provide information to migrating birds
- The ability of birds to read these cues, along with their many adaptations for flight, enables them to migrate to and inhibit virtually any environment