What is a bird?

**bird**  (bûrd)  n.

a. Any of the class Aves of warm-blooded, egg-laying, feathered vertebrates with forelimbs modified to form wings.
b. Such an animal hunted as game.
c. Such an animal, especially a chicken or turkey, used as food: put the bird in the oven.

- **Bird Characteristics**
  - Two-legged (bipedal) vertebrates (animals with a backbone, includes mammals, amphibians, reptiles, and bony fishes).
  - Distinguished from other vertebrates by the presence of feathers, a unique modification of the outer skin.
    - Feathers are dead structures that wear easily and must be replaced regularly, but are essential for both temperature regulation and flight.
  - All birds have bills.
    - Bird bills can vary greatly in form and function from species to species, but they are always toothless and are covered with a horny sheath.

- **Bird Evolution**
  - Birds evolved from reptiles.
  - Thomas H. Huxley: Birds are “merely glorified reptiles”.
    - Homology- Similarity in one or more body parts in different species; attributable to descent from a common ancestor
      - Birds and reptiles both have
        - Scales- Look at birds’ feet.
        - Yolked, polar eggs
        - Nucleated red blood cells. In mammals the red blood cells lack nuclei.
        - A single middle ear bone: the stapes. Mammals have three.
        - The lower jaws (mandibles) have five or six bones on each side.

  - *Archaeopteryx lithographica*- The Missing Link
    - Fossil found in Bavaria in 1861 dated at 135 to 155 mya
    - Clearly showed
      - Wing bones
      - Flight feathers
      - Pairs of feathers attached to each vertebra of the tail
    - *Archaeopteryx* was a crow-sized, bipedal “reptile” with a blunt snout and many small, reptilian teeth.
      - Feathers on both wings and tail
• A strong-running terrestrial “bird” that could leap into trees, jump among branches and make short flights.
• Capable of gliding, but not long sustained flight.
• Had strong, curved claws, like those of perching birds.
• Could not launch from the ground because it lacked the principal muscles that lift the wing rapidly in the recovery stroke.
• Vanes were asymmetrical, like that of strong fliers.
  ▪ Immensely important for the theory of evolution.
  ▪ Found only two years after Darwin published Origin of Species (1859)

  • Evolution of Avian Flight- The Debate
    ▪ Arboreal Theory vs. Cursorial Theory
      • Arboreal Theory
        o Evolution of flight started with the parachuting and gliding from elevated perches.
        o The extensions of the bones of the forelimb enhanced by elongated (flight) feathers enabled the ancestors of Archaeopteryx to parachute and glide between trees.
        o The favored theory for many years.
      • Cursorial Theory
        o Forelimbs first elongated because they heightened leaping ability in a small bipedal theropod dinosaurs that ran and jumped to catch insects in its jaws.
        Extension of forelimbs would help to control and extend its leaps.
        o Elongation of the arms and tail would enhance maneuverability and higher velocities of running and jumping.
        o Uses adaptive steps based on trajectory ballistics, rather than the aerodynamics of true flight. Flight would be a logical extension of the first small jumps by this little dinosaur.
        o Protowings, increased arboreal habits and gliding would be the next logical steps.

  • Bird Characteristics
    o Birds are feathered flying machines.
      ▪ Skeleton is strengthened and reinforced through fusion of bones of the hands, head, pelvis and feet.
      ▪ Uncinate processes overlap other ribs and so strengthen the walls of the thorax.
      ▪ The furcula (wishbone) compresses and rebounds like a spring in rhythm to the beat of the wings.
      ▪ Wings are modified forelimbs, whose sole (almost) purpose is flight.
      ▪ Fused hand bones support and maneuver the flight feathers.
      ▪ Arboreal (tree-dwelling) birds have feet that tightly grip branches.
- An enlarged, keeled sternum houses and anchors the large breast muscles that empower wings.
- The pygostyle, made of fused tail vertebrae, supports and controls the tail feathers, which are used for breaking and steering.

- Bird physiology accommodates the extreme metabolic demands of flight and temperature regulation.
  - Red fibers of avian flight muscles have an extraordinary capacity for sustained work and can also produce heat by shivering.
  - Birds maintain high body temps (40° to 44°C) over a wide range of ambient temps.
  - Circulatory and respiratory systems
    - Four-chambered heart and efficient, flow-through lungs, which deliver fuel and remove both waste and heat produced by metabolic activities.

- Reproduction
  - Large, richly provisioned external eggs, the most elaborate reproductive cells of any animal.
  - Requires dedicated parental care.
  - Most birds form monogamous pairs, though many engage in additional sexual liaisons.

- Large well, developed brains 6 to 11 times larger than that of similarly sized reptiles
  - Bird brains and primate brains exhibit functional lateralization, with left hemispheric dominance associated with learning and innovation in vocal repertoires.

- Highly developed neural systems and acute senses mediate feats of communication and navigation.
  - Birds (esp. song birds) have the greatest sound-producing capabilities of all vertebrates.
  - Birds can navigate using patterns of the Earth’s magnetism, celestial cues, and perhaps polarized light.
  - Birds can see into the near-ultraviolet and can hear infrasounds—sounds below the range of human hearing.