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## Bird Facts

### Classification

Bird Characteristics:

Possess **feathers**; forelimbs modified into **wings**; hind limbs adapted for walking, swimming or perching; **scales** present on feet; mandibles with **no teeth** (in living species); **light skeleton** with much fusion; **four chambered heart**; extensive **air sacs** throughout the body; **warm blooded**; no urinary bladder; **oviparous**.

**Kingdom:** Animalia

**Phylum:** Chordata

**Class:** Aves

**Subclass:** Archaeornithes = Fossil birds (e.g. archaeopteryx)

**Subclass:** Neornithes = All modern birds

**Orders:** 27

**Families:** 166

**Genera:**

**Species:** 8700

Birds are (numerically speaking) **the most successful terrestrial vertebrates** on earth. There are about 8700 living species of birds compared with **3000 amphibians, 6000 reptiles, and 4100 mammals**. **Fishes**, which live in a much less demanding aqueous environment, number around **20,000 living species**. Among the invertebrates, the **insects** are overwhelmingly the most successful and dominant class, numbering over **800,000 species**. They too owe much of their **dominance to their ability to fly**.

### Evolution

-In **1861** the **fossilized** remains of what was thought to be the skeleton of a **thecodont reptile** were discovered in a limestone quarry in **southern Germany**. The fossil was dated at approximately **150-160 million years old** (Jurassic period, 136-195 mya). However along with the fossilized skeleton were the **unmistakable impressions of feathers** along the forearm. The existence of **feathers** was enough to designate this fossil as the **first known bird: Archaeopteryx lithographica** (18 inches long). It had reptilian **eyes, toothed jaw** and from the structure of the **breastbone**, it probably had very limited powers of flight.

-It is thought that birds evolved from thecodont **reptiles** during the **Jurassic Period** some **150 to 160 million** years ago. **Thecodont reptiles** were one of the dominant groups during the **Triassic Period (195-230 mya)**. They were **bipedal and lizard-like** and were **related to the dinosaurs and pterosaurs** (the **pteranodon** was the largest-ever flying creature with a wingspan of better than 27 feet). *The pterosaurs died out at the end of the Cretaceous Period (65-136 mya) along with the other dinosaurs.*

-Unfortunately, the **fragile** structure of bird **bones**, and the speed with which they **decompose** is not conducive to fossilization, so knowledge of early avian **evolution is scant**. Little detail is available of the

**transitional stages** in the **evolution of the feather from the reptilian scale** or of the stages by which the **forelimb was modified into the avian wing**.

-The **next known birds** in the fossil record occur **30 million years** later (dated 120 mya) and show much more advanced avian characteristics. In the **Cretaceous (65-136mya) shale** of Texas, Kansas and Montana, **six species of Gull-like birds** were uncovered. In almost every detail they looked like modern birds: deeply **keeled sternum** and **modern bird wings**, indicating **strong powers of flight**. The vertebrae were still **biconcave** as in reptiles but the **long tail** found in archaeopteryx had disappeared. The size of the **brain** was **intermediate** between modern birds and reptiles, and the **optic lobes** were enlarged.

**The Tertiary Period (10-60 mya) was a period of radiation for birds. About three-quarters of the present day families emerged over this time period.**

-Birds show many **reptile affinities** such as their habit of **laying eggs**, the possession of **scales** on beaks and legs, and the arrangement of many **internal structures**.

**For perceptive:**

Another group of reptiles from the Triassic Period (195-230 mya) were the **thrinazodons**. These were mammal-like reptiles: **quadrupeds, sharp canines**, the beginning of a **bony palate** separating the nasal cavity from the mouth (a condition which enables mammals to breath continuous even while eating - reptiles lack this palate). These reptiles are thought to have given rise to the first mammals at the end of the Cretaceous Period (65 mya).

## **Flight**

Over the 600 million year history of **life on Earth**, four life forms have forsaken their earthbound ancestors and evolved the power of flight.

- The **insects** were the first to exploit the aerial habitat, about 220 million years ago (mya) during the Triassic Period (195-230 mya). The **flying reptiles** (pterosaurs) were next, about 160 mya during the Jurassic Period (136-195mya), followed by the **Birds** (150-160 mya) and lastly the mammals (**bats**) during the Eocene about 40 mya.

-All other so-called flying creatures - flying fish, squirrels, tropical frogs, lizards and snakes - are capable of only controlled glides.

-Why did animals evolve the ability to fly?

1. Open niches full of insects
2. Escape from terrestrial predators
3. Increased mobility = easy migration to follow favorable climate

### **Adaptations for flight**

**Weight-Reducing Adaptations:**

1. Thin, **hollow bones**
2. Super light insulating **body covering** (i.e., feathers)
3. Elimination of **skin glands**
4. Elimination of **teeth and heavy jaws**
5. Elimination of **tail vertebrae** and some digits
6. Extensive **bone fusion**
7. Extensive branching **air sacs**
8. **Oviparous** rather than viviparous reproduction
9. Atrophy of **gonads** between breeding seasons
10. Selection of **high-energy foods** that are not bulky to maximize energy input while minimizing weight. They eat seeds, fruit, worms, insects, rodents, and fish.
11. Rapid and efficient digestion

12. Excretion of uric acid (low solubility: 1g with 2ml of H<sub>2</sub>O) instead of urea (1g needs 60ml of H<sub>2</sub>O) found in mammals.

### Power-Increasing Adaptations:

1. Warm bloodedness (40-42°C) (Mammals =36-39°C)
2. Heat conserving plumage
3. Energy rich diet
4. Rapid and efficient digestion
5. High glucose content of the blood
6. Four chambered heart provides double circulation (respiratory and systemic) same as mammals
7. Rapid, high-pressure circulation (500-1000 beats per minute for a chickadee)
8. Highly efficient respiratory system
9. High rate of metabolism

### Other Adaptation of birds

1. Excellent eyesight (navigational demands) (courtship)
2. Foot morphology
3. Beak morphology
4. Feather morphology

### Feathers:

**-No bird is without feathers, nor is there any other kind of animal that possesses feathers.**

-Probably evolved from reptilian scales into a primitive heat conserving, fluffy insulation and later into highly complex epidermal structures.

-4 basic **types** of feathers:

1. **Vane or contour:** Strong flight feathers with a central shaft and radiating filaments that are connected together with a multitude of tiny interlocking barbules. Primaries = propulsion; Secondaries = lift (airfoil)
2. **Down:** Insulation
3. **Filoplume:** fine hair-like fuzz around the bases of flight feathers appears to play a sensory role that aids in controlling feather position during flight.
4. **Bristle:** Modified vaneless contour feathers consisting of a small stiff rachis. These bristles are found around the eyes (eyelashes), nose (to filter dust), and mouth.

-Once formed, the feather is a **dead** horny structure without living cells, only receiving support from the body. These feathers are molted twice a year, once in the fall and once in the spring.

### Migration

**def:** regular, extensive seasonal movements that animals make between their summer breeding regions and their wintering regions.

#### -Chief advantages

1. Live at optimal **climate**
2. Provides optimal conditions for rearing **broods**
  - a. **Broods are largest in the far north** where the long summer days and abundance of insects combined to provide parents with ample food-gathering opportunity.
  - b. **Predation** pressure is less in the north and the brief, once a year appearance of vulnerable young does not encourage a build-up of predator populations.
  - c. Migration vastly increases the amount of **space** available for breeding.

#### Migration facts:

-4000 migratory species

-”Instinctive” migrants migrate about on the same date each year (Catbirds)

- "Weather" migrants migrate based on local climatic changes (Robins)
- Most (90%) fly below 1500m. Some passerines fly as high as 6400 m (4 miles)
- The Arctic Tern is the greatest globe spanner of all: it breeds north of the arctic Circle and winters in Antarctica.

**Stimulus for Migration:**

-Photoperiod: Increasing day length stimulates the anterior lobe of the pituitary which produces gonadotrophic hormone. Gonadotrophic hormone promotes gonad growth, fat deposition, migration, courtship behavior, and care of the young.

**Orientation and navigation:**

1. Gravity
2. Magnetic field
3. Stars
4. Sun