

**Transitional Form:  
Archaeopteryx**

The evolutionary origin of birds has always been a subject of considerable debate.

- Birds and flying reptiles have delicate, lightweight skeletons which do not fossilize well - hindering studies on how the birds evolved.
- The fossil was given the name *Archaeopteryx*, which is Greek for 'ancient feather'.

**Transitional Form:  
Archaeopteryx**

•The skeleton showed several features which are **intermediate between reptiles and birds**.

•Suggesting that *Archaeopteryx* and the other birds evolved from a dinosaur similar to the *Velociraptor* featured in the film 'Jurassic Park'.

**Transitional Form:  
Archaeopteryx**

**FLIGHT**

- Evidence suggest it could fly by taking off the ground and rapidly fly for several hundred meters
- Well defined as a ground dwelling cursorial (running) predator that could leap into the air to seize flying insects and fly rapidly to escape from predators
- Could not land in trees due to its foot structure.

Describe (using a few sentences apiece) four structural adaptations which make flight possible (for most species of bird).

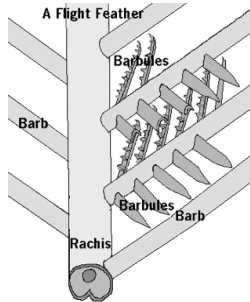
- 1)
- 2)
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**Feather structure**

- Feathers are made of **keratin**
  - Keratin is the substance found in hair, nails, claws and scales of other animals, but bird keratin is unique and differs from that of modern reptiles.

### Feather structure

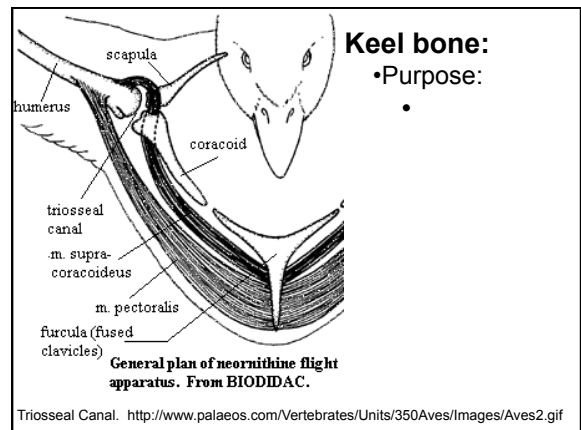
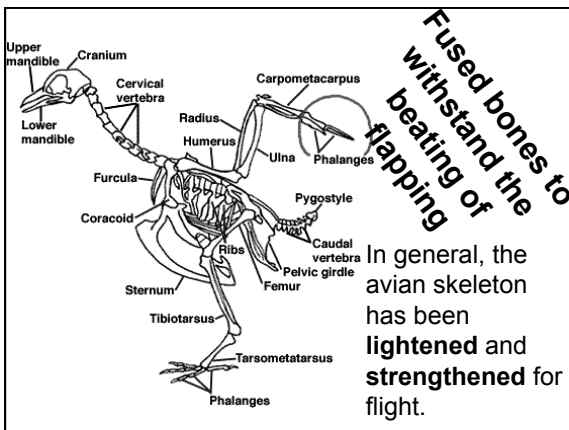
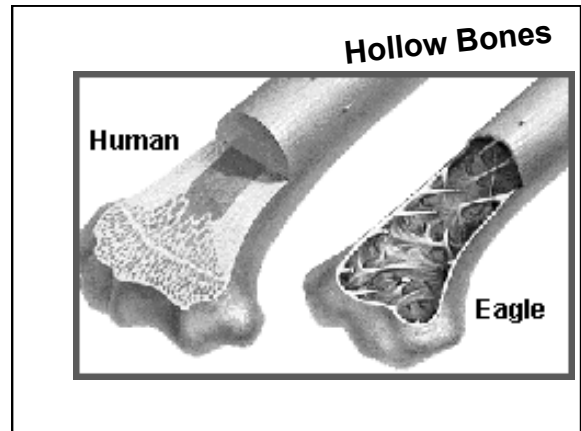
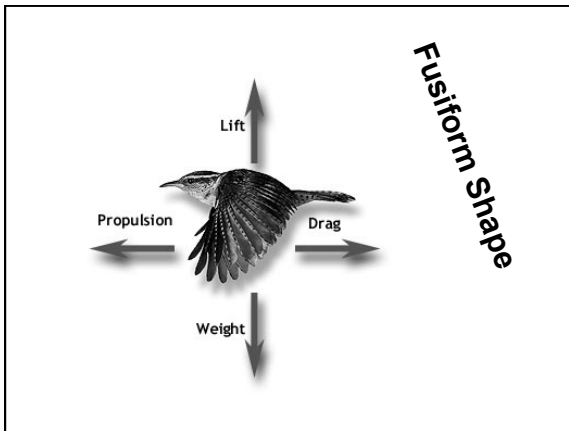
- A contour feather has a long central shaft and a broad flat **vane**. The hollow base of the shaft (**quill**) anchors the feather in a follicle under the surface of the skin.
- The rest of the shaft, the **rachis**, supports the vanes. Branching off from the rachis are **barbs**. Each barb has barbules projecting to either side that interlock with the barbules of adjacent barbs.



### The balance between survival & sexiness

#### The balance

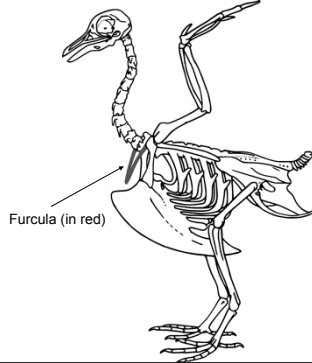
- Attract females with tail:
  - Size
  - Color
  - Fanning
  - Shaking
- Danger to male:
  - Cant escape from predators
  - Draws attention to himself



**Further skeletal modifications for flight**

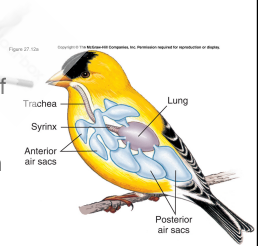
- **Furcula** The clavicles are fused to form a structure called the furcula or wishbone.

- The furcula flexs during flight and spreads and contracts during each wingbeat. The flexing may enhance gas exchange by assisting in moving air through the air sacs.



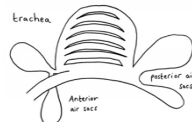
**Avian lung**

- The metabolic demands of flight are high
- Avian lung must be much more efficient.
- In birds the finest branches of the bronchi do not end in saclike alveoli.
- Air flows in only one direction
- Because the air flow is one-way, gases can be more efficiently exchanged and there is no "dead air" in the lungs



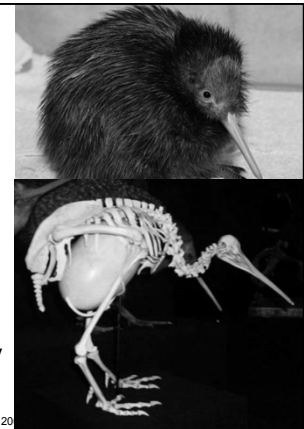
**Avian lungs**

- The one-way flow of air is achieved by using a system of air sacs and a two breath cycle.
- On inspiration a bolus of air flows down the trachea to air sacs below the lung. On expiration the air mass flows into the lung where gas exchange takes place.
- With a second inspiration the air mass in the lung flows into anterior airsacs and with a second expiration exits the body via the trachea.



**Kiwi**

- Flightless bird
- New Zealand
- Egg is 20% of the females body weight
- The equivalent of 130lb woman having a 23lb baby



Brown Kiwi hatched at the Smithsonian National Zoo 20