

History
Chapter 2


January 24th, 2011

Birds ARE Reptiles

	Birds	"Reptiles"	Mammals
Occipital Condyles	1	1	2
Middle Ear	1 Bone	1 Bone	3 Bones
Mandible	Multiple Bones	Multiple Bones	1 Bone
Ankle in Tarsals?	Yes	Yes	No
Scales?	Yes	Yes	No
Eggs?	Yes	Many	Mostly No
Heterogametic Female?	Yes	Some	No
Nucleated RBCs?	Yes	Yes	No

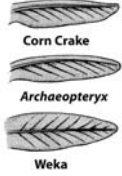

Evidence

- *Archaeopteryx lithographica*
 - Jurassic Period
 - ~150 mya
 - 7 specimens
 - Fully Articulated →
 - Real Feathers
 - "Reptilian"




Evidence

- *Archaeopteryx lithographica*
 - Furcula

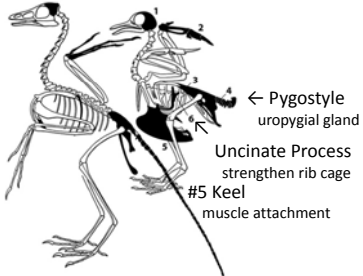
Evidence

- *Archaeopteryx lithographica*
 - Larger brain
 - Better vision
 - Better hearing
 - Compared to reptiles



Comparison

- *Archaeopteryx lithographica*

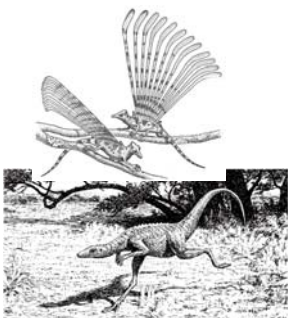


Relevance

- *Archaeopteryx lithographica*
 - Links traditional reptiles with modern birds
 - Intermediacy supported Darwin and Wallace


What Kind of Reptiles?

Triassic	Jurassic	Cretaceous
		Crocodylians
		Birds
		Sauropod dinosaurs
		Theropod dinosaurs
		Birds
		Ornithischian dinosaurs
		Flying reptiles




What Kind of Reptiles?

- Theropod Dinosaur Support
 - Some may have been warm-blooded
 - Feathers, furcula, pygostyle, bill, one-way respiration present in dinosaurs



What Kind of Reptiles?

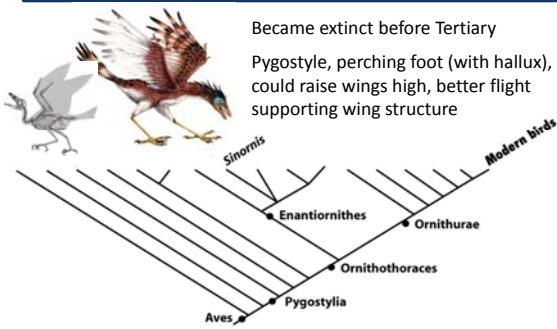
- Theropod Dinosaur Problems
 - Digit Reduction



Era	Period	Epoch	MYA
Cenozoic (age of birds and mammals)	Quaternary	Recent	0.01
		Pleistocene	1.5 - 3.5
	Tertiary	Pliocene	7
		Miocene	26
		Oligocene	36 - 38
		Eocene	53 - 54
Mesozoic (age of reptiles)	Cretaceous	Paleocene	65
		Late	100
	Jurassic	Early	135
		Late	155
	Triassic	Early	170
		Middle	180 - 190
			230

Early Avian Evolution

Became extinct before Tertiary
Pygostyle, perching foot (with hallux), could raise wings high, better flight supporting wing structure



Early Avian Evolution

Survivors included species related to modern chicken, waterfowl, and ratites

The diagram is a phylogenetic tree with a root at the bottom labeled 'Aves'. From the root, several branches lead to 'Pygostylia' and 'Ornithothoraces'. From 'Ornithothoraces', the tree splits into 'Enantiornithes' and 'Ornithurae'. 'Ornithurae' further branches into 'Yanornis', 'Patagopteryx', 'Hesperornis', 'Apsaravis', 'Ichthyornis', and 'Modern birds'. An illustration of a feathered dinosaur is shown above the tree.

Evolution of Feathers

- Feathers originated with theropod dinosaurs
 - Similar to modern feathers
- Form and function diversified in birds
- Feathers originated for thermoregulation
- Not from scales
- Allowed flight to develop

Evolution of Flight

- **Two Theories**
 - **Arboreal**
 - Trees down
 - **Cursorial**
 - Ground up

The diagram shows a staircase-like progression of flight evolution. From bottom to top: 'Quadrupedal locomotion—ground-dwelling ancestral thecodont', 'Bipedal locomotion—thecodonts or later theropod dinosaurs', 'Cursorial life—preproavis', 'Arboreal life—proavis', 'Leaping between trees', 'Parachuting', 'Gliding', 'Archaeopteryx', and 'Active flight'. An arrow points from 'Active flight' to 'To modern birds' with an illustration of a modern bird.

Evolution of Flight

- **Two Theories**
 - **Arboreal**
 - Trees down
 - **Cursorial**
 - Ground up

Theropod Dinosaurs that hunted by leaping and jumping would be aided by extra maneuverability and increased gliding distance

Evolution of Flight

- **Two Theories**
 - False dichotomy
 - Lift and thrust most important

Evolution of Flight

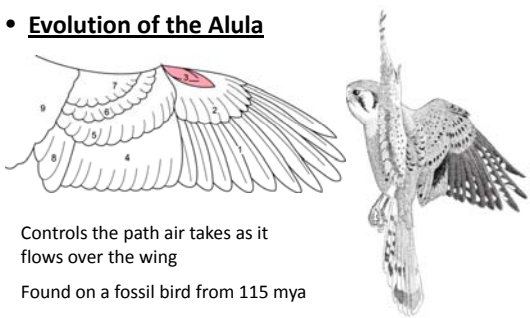
- **Wing-assisted Incline Running**

The diagram shows six stages of flight evolution with illustrations of birds in different postures:

- Horizontal (Walk and run only, no flapping)
- Incline (Walk and run only, no flapping)
- Incline > 45° (Run-flapping)
- Vertical flight (Run-flapping)
- Vertical flight (flapping only)
- Horizontal flight (flapping only)

Evolution of Flight

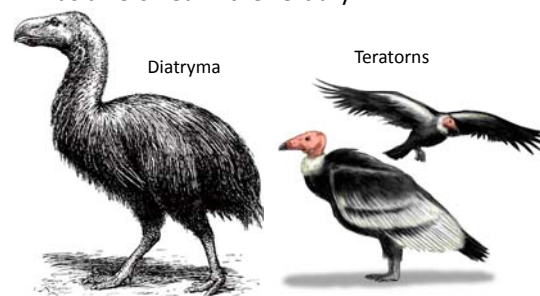
- Evolution of the Alula**



Controls the path air takes as it flows over the wing
 Found on a fossil bird from 115 mya

Modern Birds

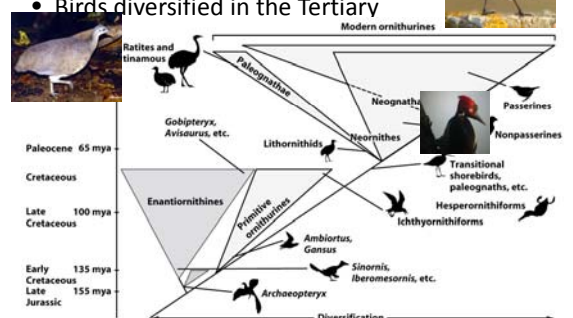
- Birds diversified in the Tertiary



Diatryma Teratorns

Modern Birds

- Birds diversified in the Tertiary



Timeline on the left:
 Paleocene 65 mya
 Cretaceous
 Late 100 mya
 Early 135 mya
 Cretaceous Late 155 mya
 Jurassic

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Rapid Evolution of flowering plants and insects

Modern Birds

- Birds diversified in the Tertiary
- Continental locations and climate much different for much of the Tertiary
 - Warm world-wide
 - Break-up of Pangaea

