

# Origins of Cetaceans

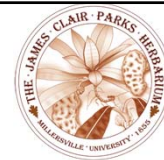


## I. Cetaceans

### A. Mammalian Heritage

- Warm-blooded
- Live young\*
- Mammary glands

nipples concealed in abdominal mammary slits



# I. Cetaceans

## A. Mammalian Heritage

- Warm-blooded
- Live young\*
- Mammary glands
- Hair (snout, chin, behind blow hole)
- Up-down spinal mobility



Fluke, humpback whale

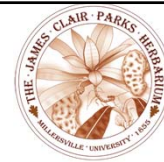


Tail fin, yellow-tail snapper

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- Lungs



Above: Sperm whales: 40 min down, 10 min up, starts to exhale just below surface.

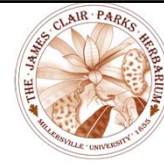
Left: mink whale

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# I. Cetaceans

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- Up-down spinal mobility
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Blowhole (nostrils) in a blue whale.

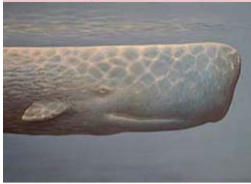




# I. Cetaceans

## A. Mammalian Heritage

## B. Types

### 1. Odontocetes (toothed whales)






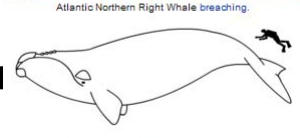
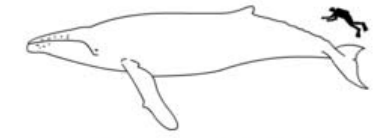
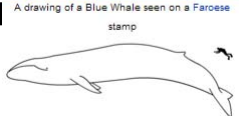
Sperm Whale	Orca	Boto
	 <p>Fossil range: Early Pliocene - Recent</p> <p>A male orca with its characteristic tall dorsal fin swims in the waters near Tyafjord, Norway</p>	
 <p>Scavd Giant — Artist: Chris Harman</p> <p>Size comparison against an average human</p>	 <p>Size comparison against an average human</p>	

# I. Cetaceans

- A. Mammalian Heritage
- B. Types



1. Odontocetes (toothed whales)
2. Mysticetes (baleen whales)

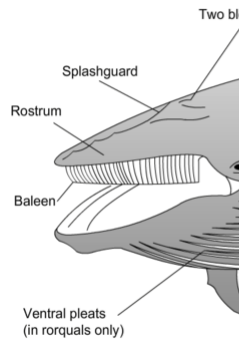
Right whales	Humpback Whale	Blue Whale
		
<small>Atlantic Northern Right Whale breaching.</small>		<small>A drawing of a Blue Whale seen on a Faroese stamp</small>
		
<small>Size comparison against an average human</small>	<small>Size comparison against an average human</small>	<small>Size comparison against an average human</small>

# I. Cetaceans

- A. Mammalian Heritage
- B. Types



1. Odontocetes (toothed whales)
2. Mysticetes (baleen whales)



From upper jaw: fine-comb-like epidermal protrusion of Keratin (stiff, elastic) & hydroxyapatite (bony)

## II. Evolutionary Origins

### A. Phylogenetic Evidence

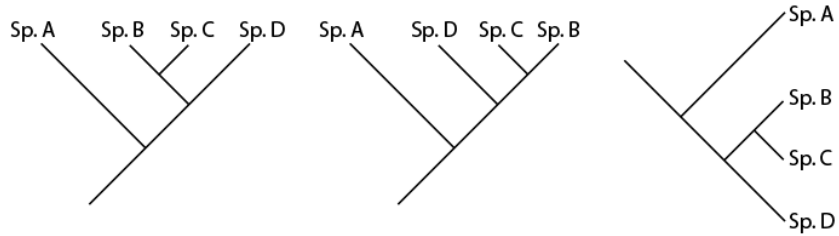


## II. Evolutionary Origins

### A. Phylogenetic Evidence

1. Phylogeny is the evolutionary history of a group
2. Cladograms used to depict phylogeny

Relative recency of common ancestry read from tips.

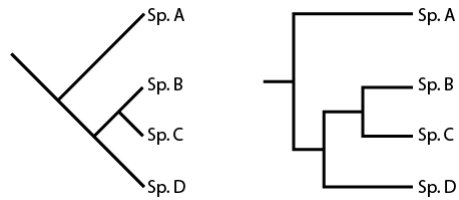


## II. Evolutionary Origins

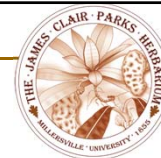


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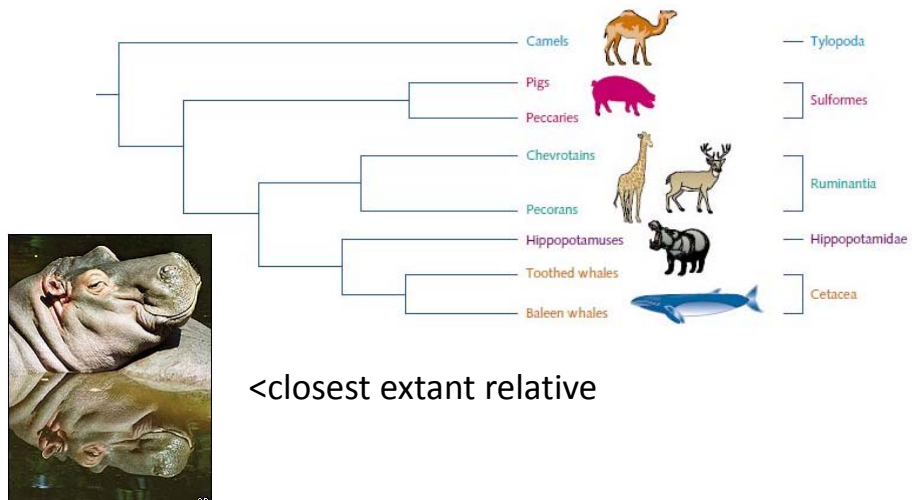


## II. Evolutionary Origins



### A. Phylogenetic Evidence

DNA-based cladograms point to terrestrial origin among ungulate mammals

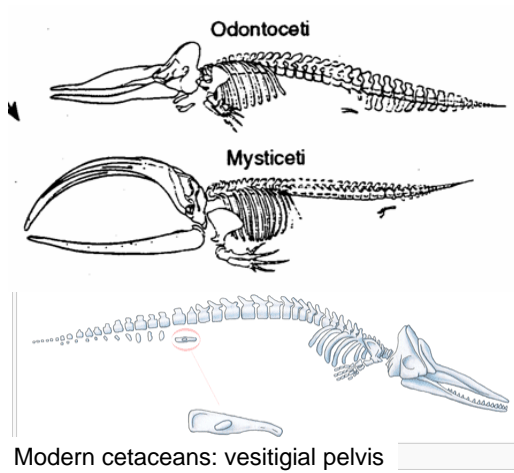


## II. Evolutionary Origins

A. Phylogenetic Evidence

B. Anatomical Evidence

1. Front legs evolved into flippers
2. Hind legs lost



## II. Evolutionary Origins

A. Phylogenetic Evidence

B. Anatomical Evidence

C. Paleontological Evidence

1. Front legs evolved into flippers
2. Hind legs lost



Valley of the Whales  
(150 km S of Cairo)

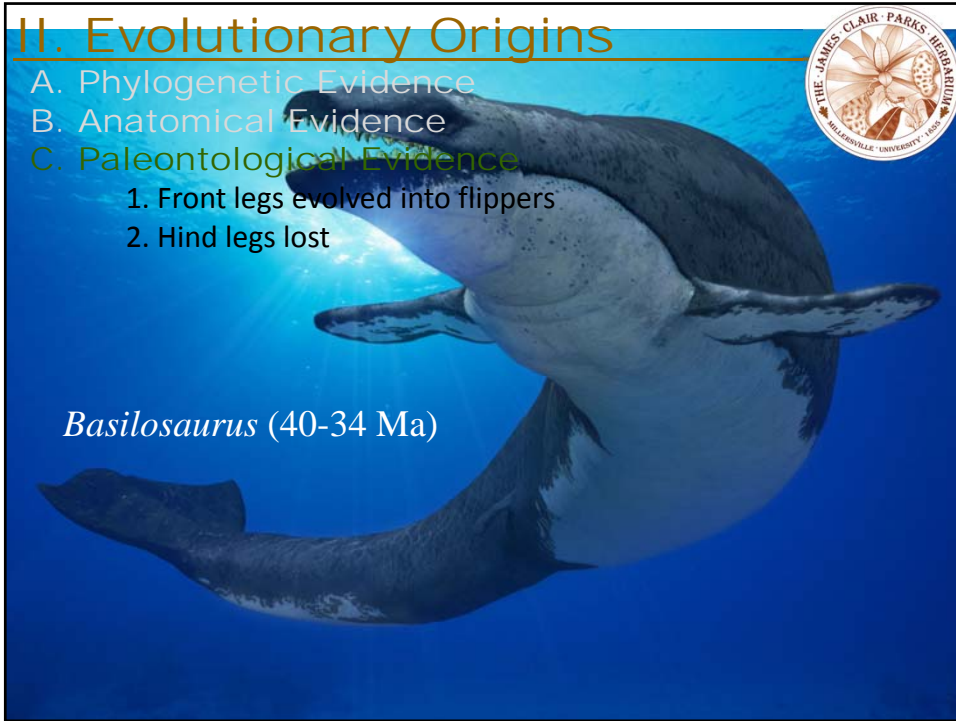


## II. Evolutionary Origins

- A. Phylogenetic Evidence
- B. Anatomical Evidence
- C. Paleontological Evidence
  1. Front legs evolved into flippers
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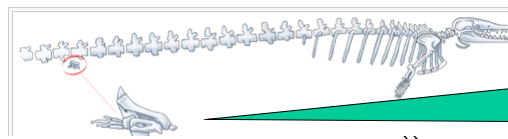


*Basilosaurus* (40-34 Ma)

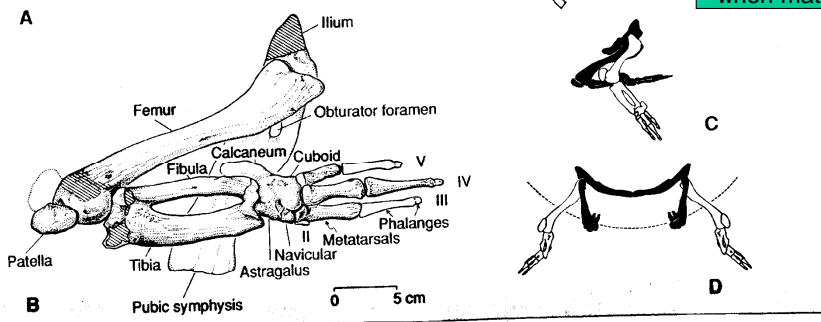


## II. Evolutionary Origins

- A. Phylogenetic Evidence
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  1. Front legs evolved into flippers
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*Basilosaurus* had 2 tiny legs, probably used as claspers when mating.





## II. Evolutionary Origins

- A. Phylogenetic Evidence
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  - 1. Front legs evolved into flippers
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## II. Evolutionary Origins

- A. Phylogenetic Evidence
- B. Anatomical Evidence
- C. Paleontological Evidence
  - 1. Front legs evolved into flippers
  - 2. Hind legs lost
  - 3. Early members of cetacean lineage were amphibious



*Ambulocetus natans* in action. A reconstruction of an early close cousin of whales. Shown here with the kind permission of artist Carl Buell.

## II. Evolutionary Origins



A. Phylogenetic Evidence

B. Anatomical Evidence

C. Paleontological Evidence

1. Front legs evolved into flippers
2. Hind legs lost
3. Early members of cetacean lineage were amphibious ambush predators, exploiting niches vacated by similar dinosaurs

4. Nostril migration

