

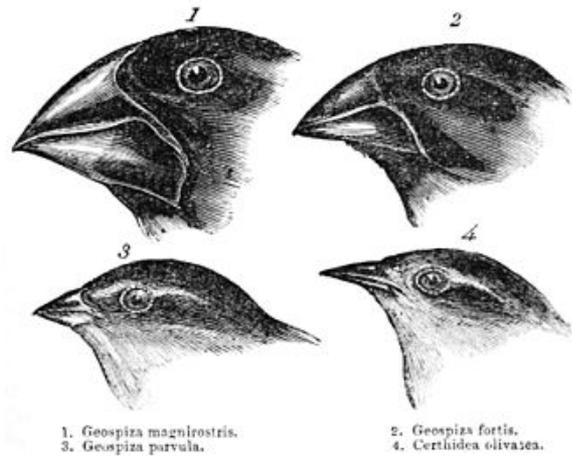
# CMSC423: Bioinformatic Algorithms, Databases and Tools

Introduction to phylogenetic  
analysis

# What is evolution?

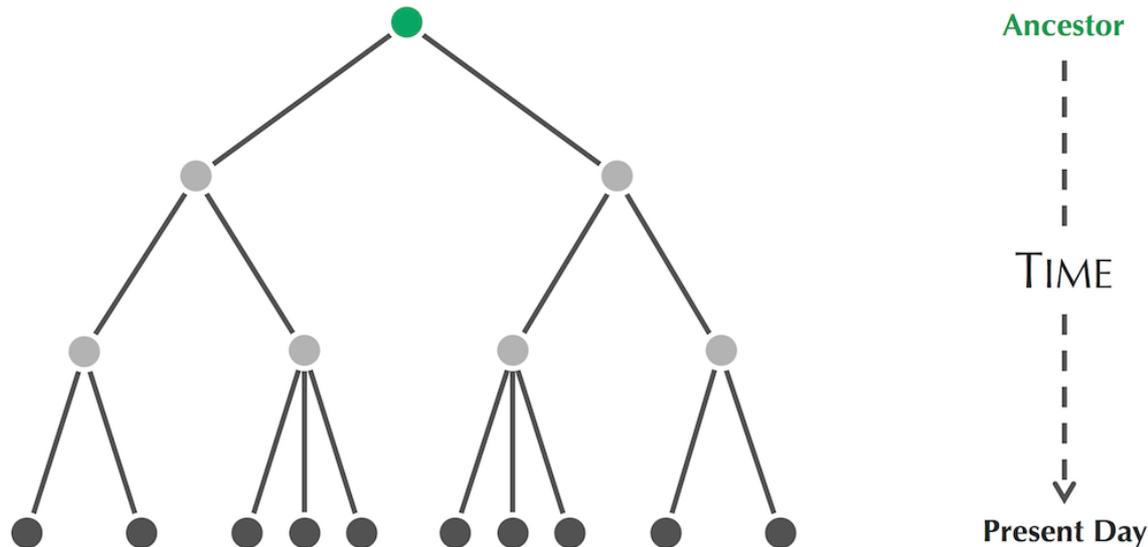
Evolution is the gradual change in the characteristics of an organism over generations.

May be random (genetic drift) or driven by environment (natural selection).

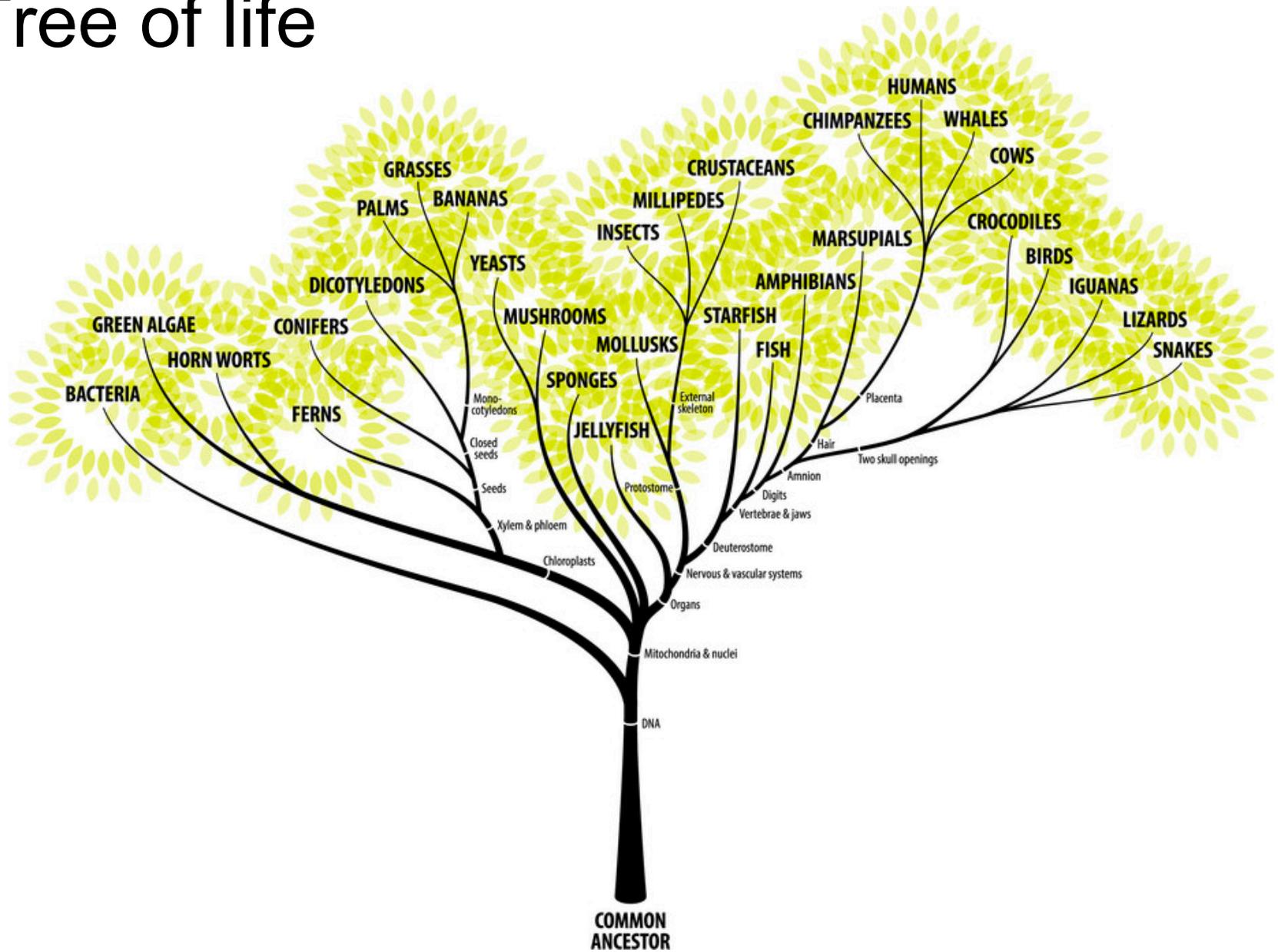


# What is a phylogenetic tree?

- A phylogenetic tree (evolutionary tree) is a branching diagram of the inferred evolutionary relationships among organisms
- The species joined together are implied to descend from a common ancestor



# Tree of life



# Large scale efforts to understand evolution of different groups of interest



## STUDY PROVIDES FRAMEWORK FOR 1 BILLION YEARS OF GREEN PLANT EVOLUTION

📅 Oct 23, 2019 👤 Alan Flurry (aflurry@uga.edu), U. Georgia; Katie Willis (kewillis@ualberta.ca), U. Alberta



Gene sequences for more than 1100 plant species have been released by an international consortium of nearly 200 plant scientists, the culmination of a nine-year research project.

The [One Thousand Plant Transcriptomes Initiative](#) (1KP) is a global collaboration to examine the diversification of plant species, genes and genomes across the more than one-billion-year history of green plants dating back to the ancestors of flowering plants and green algae.

"In the tree of life, everything is interrelated," said [Gane Ka-Shu Wong](#), lead investigator and professor in the University of



## VERTEBRATE GENOME PROJECT IS BUILDING 66,000 GENOMES...WITH BIONANO

OCTOBER 15, 2018



### CAPTION

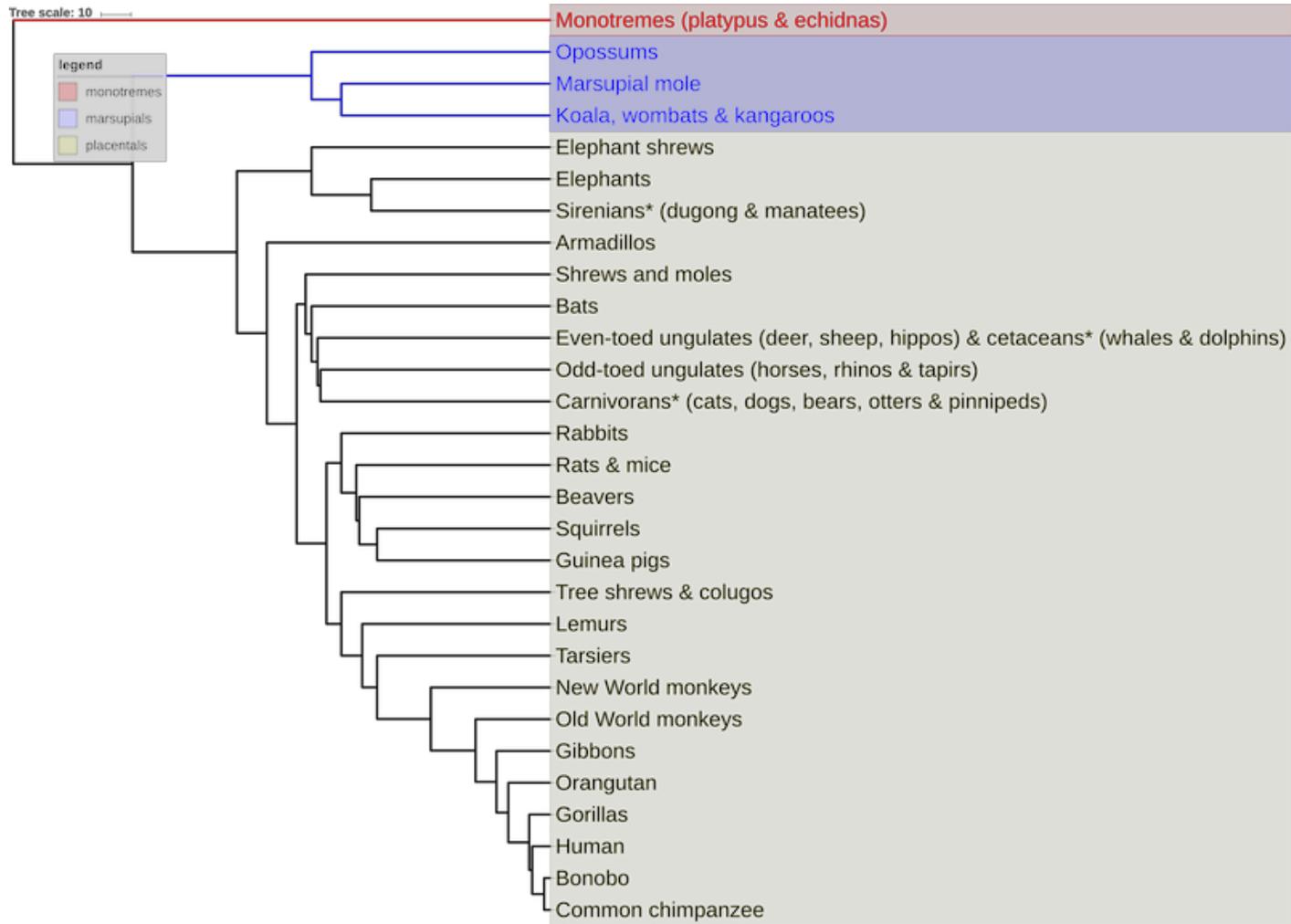
Researchers have worked out the evolutionary relationships of dozens of bird species. The findings add to the evidence that some traits -- such as vocal learning or foot-propelled underwater diving - evolved independently among different groups of birds.

# Applications

- Understanding human origin
- Understanding biodiversity
- Understanding origin of particular traits
- Understanding the process of molecular evolution
- Origin of disease
- Forensics
- Other use cases – evolution of languages, cancer tumor evolution, etc.

Who's more related? A whale and a manatee or a whale and a cow?

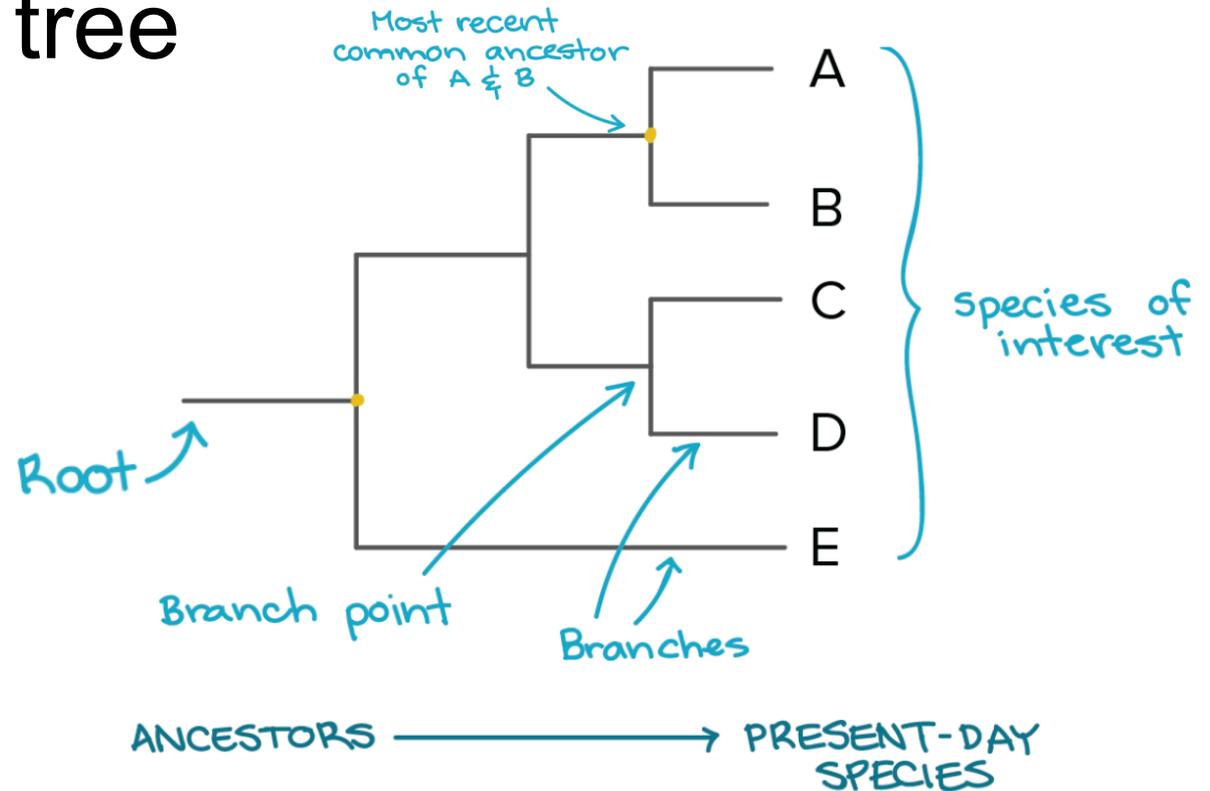




elephant  
manatee

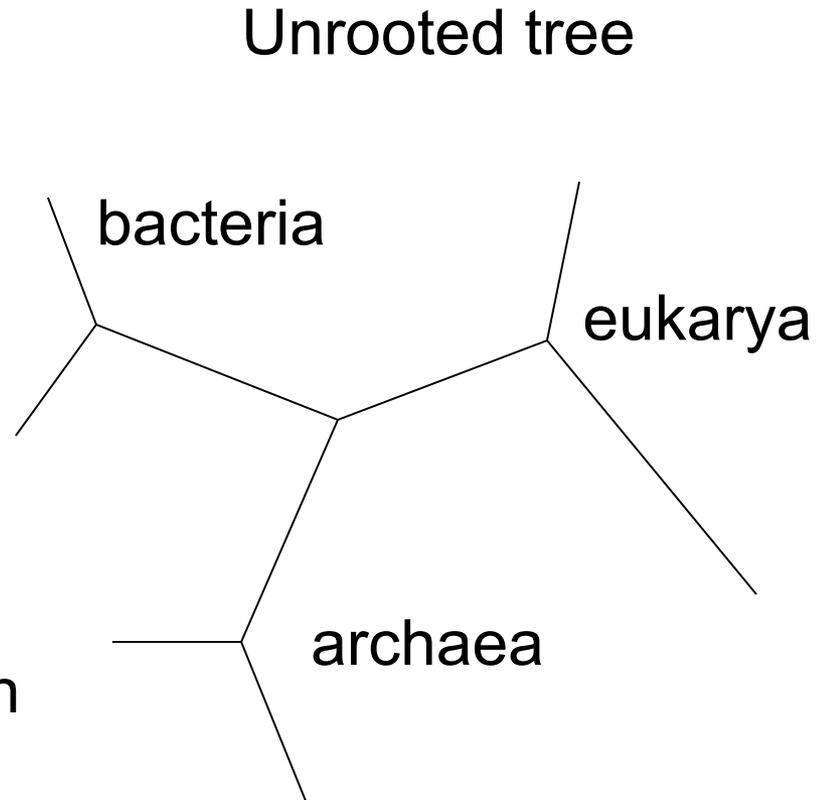
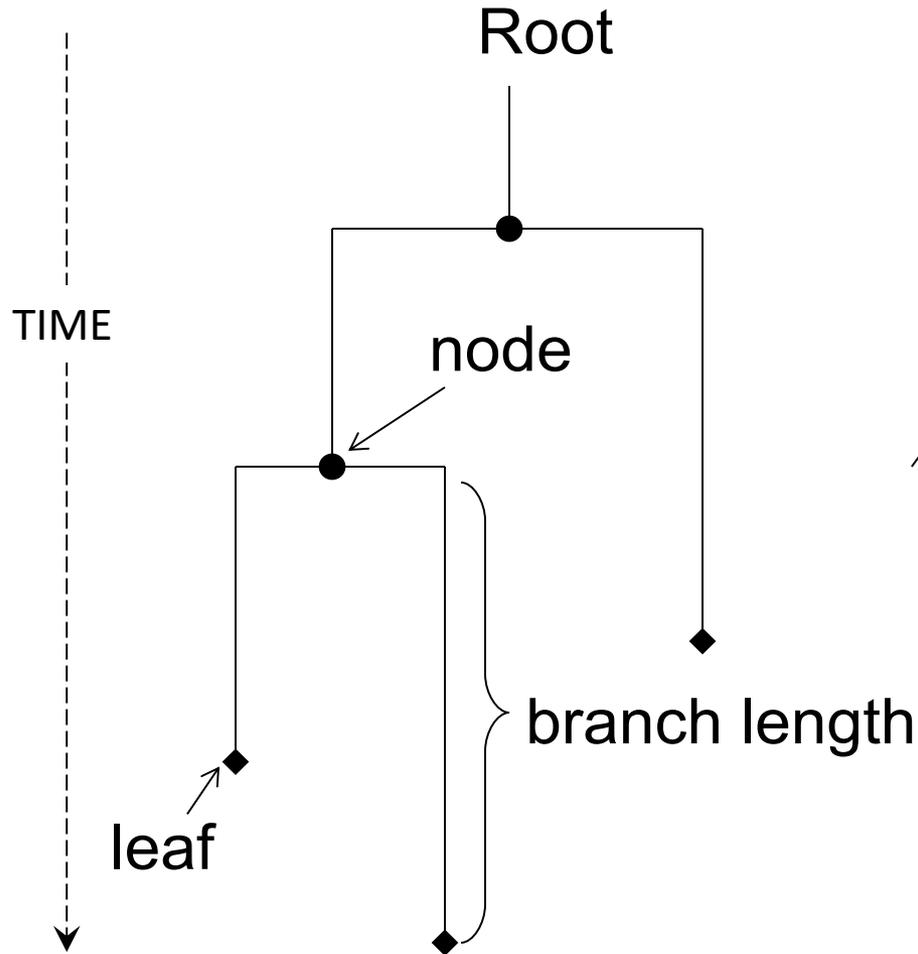
whales and cows

# Anatomy of tree



- Phylogenetic trees are usually binary (though they don't have to)
- Can be rooted or unrooted
- In trees, two species are **more related** if they have a more recent common ancestor and **less related** if they have a less recent common ancestor.

# Anatomy of a tree



Connected and Acyclic