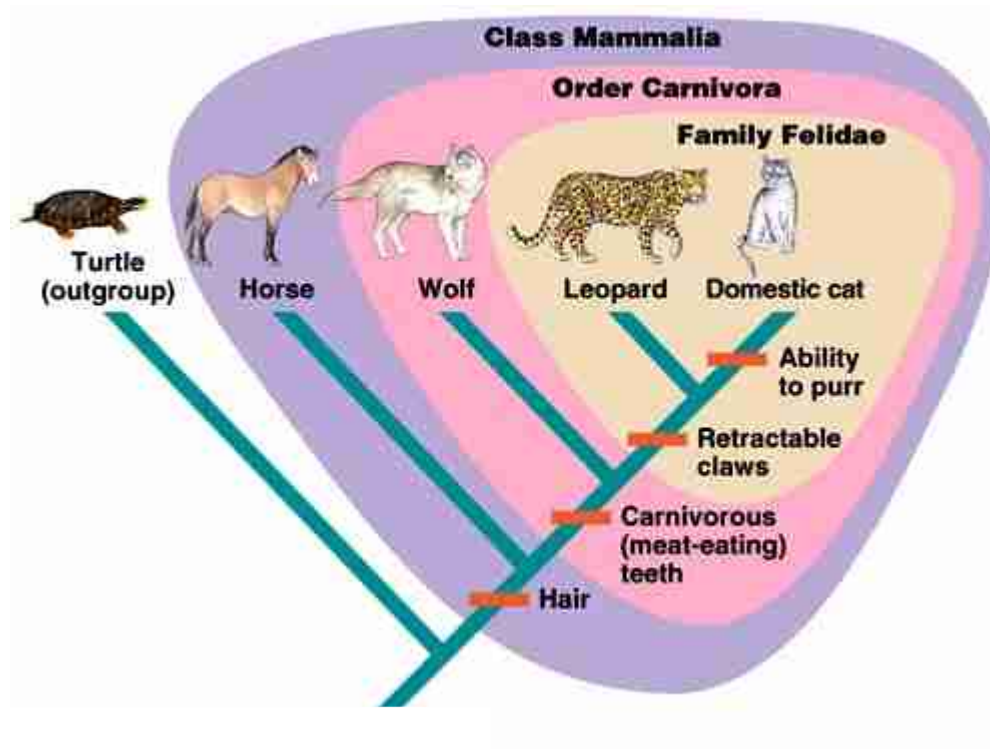# A Taxonomy

A Taxonomy

First systematic classification of living beings by Aristotele *384 -382* BC
Some terms still in use today, e.g., classification of animals into
Vertebrates versus *Invertebrates*
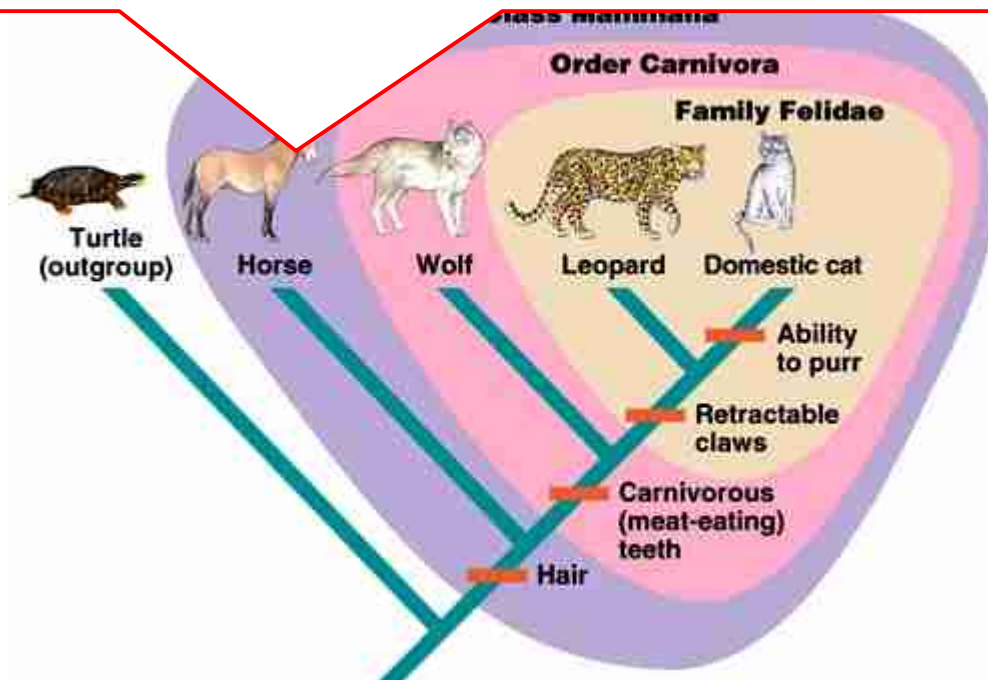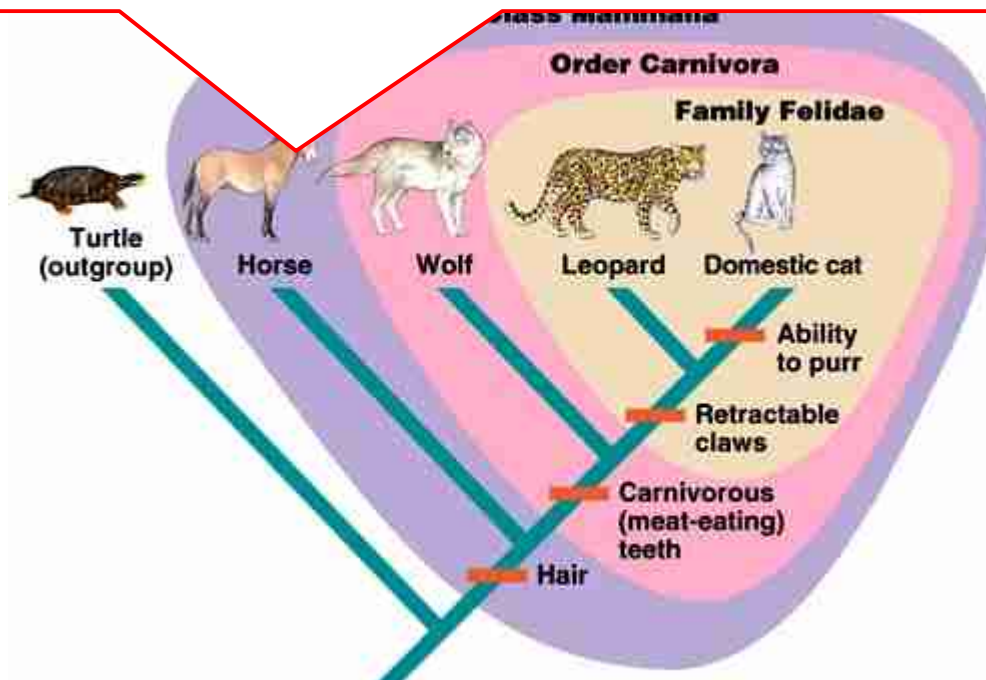
A Taxonomy

First systematic classification of living beings by Aristotele *384 -382* BC
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*Vertebrates* versus *Invertebrates*

Wirbeltiere

Taxonomy

- Group biological organisms (species) into groups with similar characteristics

- Define characteristics of groups at different hierarchy levels, e.g., animals > mammals > great apes

- Taxonomic ranks

  - Domain → three domains of life

  - Kingdom

  - Phylum

  - Class

  - Order

  - Family

  - Genus

  - Species

A Phylogeny or Phylogenetic Tree

A taxonomic subclass

The ingroup

This tree is unrooted

The outgroup

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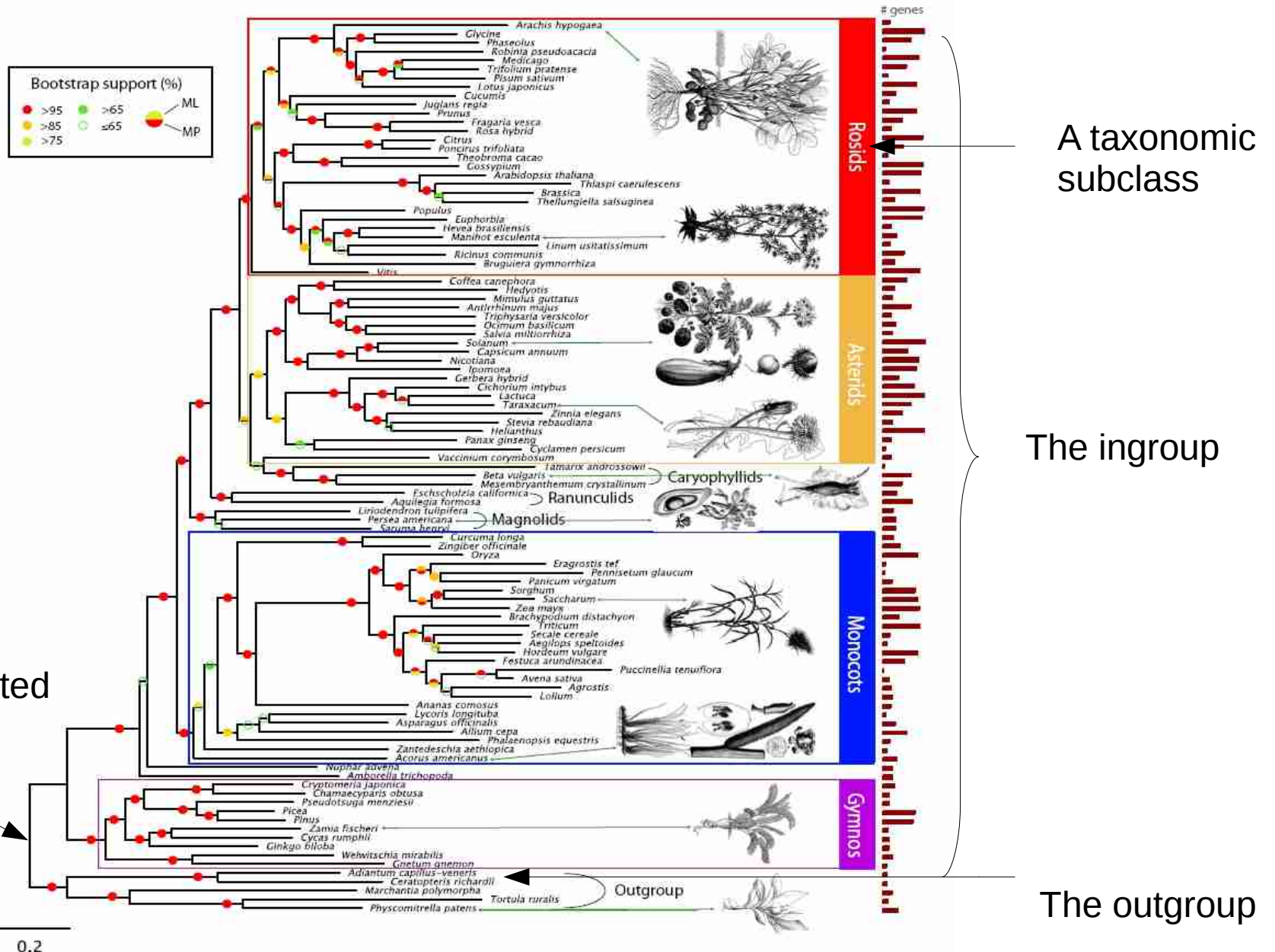
A Phylogeny or Phylogenetic Tree
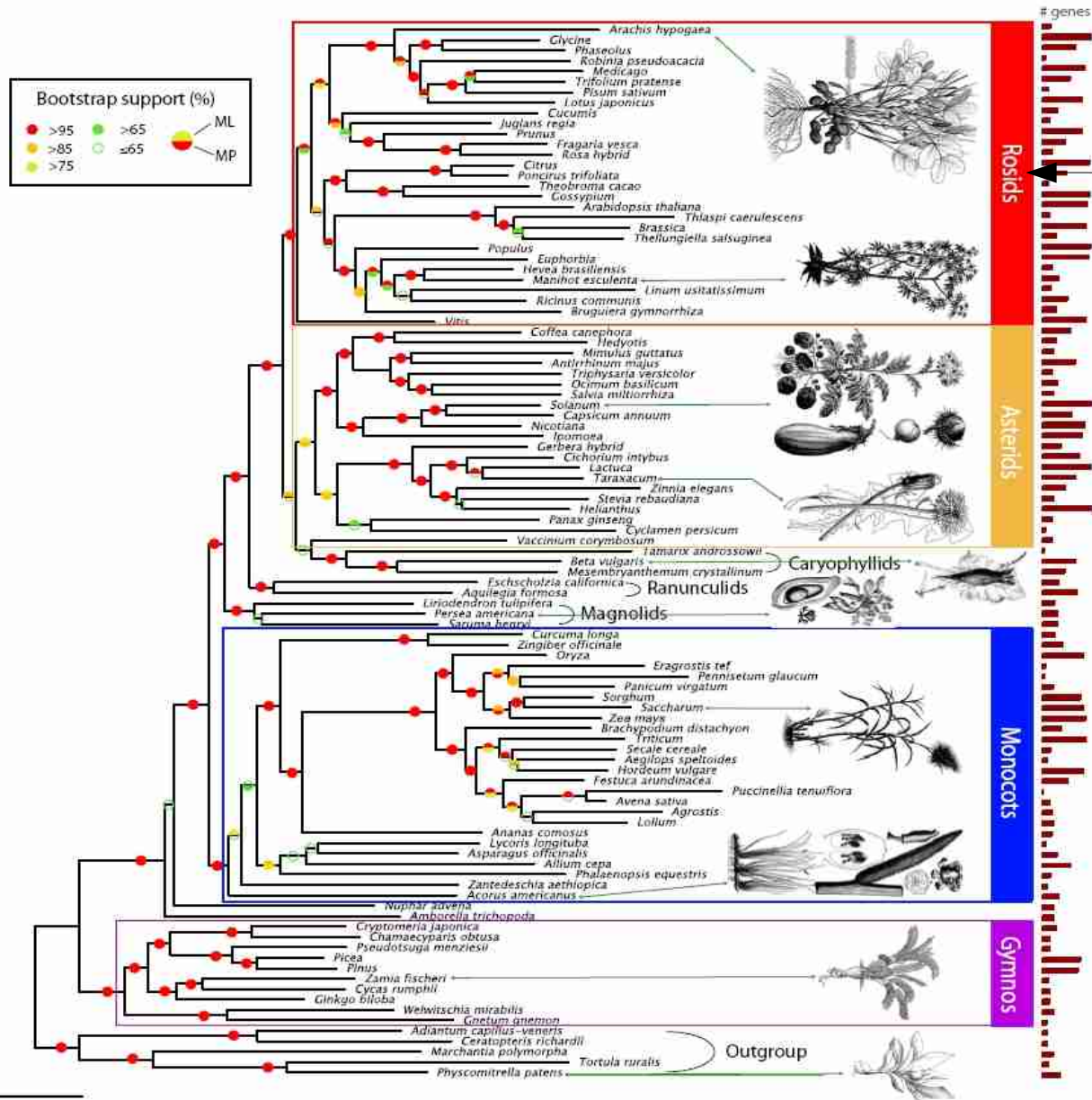
In Phylogenetics such a subtree is often also called *Lineage*!

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Phylogeny

- An unrooted strictly binary tree

- Leafs are labeled by extant "übrig geblieben" (currently living) organisms represented by their DNA/Protein sequences

- Inner nodes represent hypothetical common ancestors

- Outgroup: one or more closely related, but different species → allows to root the tree

Taxon

- Used to denote clades/subtrees in phylogenies or taxonomies

- A group of one or more species that form a biological unit

- As defined by taxonomists

  - → subject of controversial debates

  - → part of the culture/fuzziness of Biology

- In phylogenetics we often refer to a single leaf as taxon

  - → the plural of taxon is *taxa*

A final quote

"Nothing in Biology makes sense except in the light of evolution" – Russian evolutionary biologist Theodosius Dobzhansky

Terminology introduced today

- Shotgun sequencing
  - Coverage
  - Paired-end reads
  - De novo versus by reference assembly
- Gene
  - Protein coding
  - RNA
  - Direction
  - Introns versus Exons
  - Splicing & alternative splicing
  - Function prediction
- RNA
  - tRNA
  - mRNA
  - rRNA
    - present in all organisms
    - important for inferring/calculating evolutionary relationships
    - 16S gene
  - Secondary RNA structure

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Terminology introduced today

- Three domains of life
  - Eukaryota (with cell nucleus → splicing mechanisms)
  - Prokaryota (no cell nucleus)
  - Tree of life
- Codons
  - Redundancy
  - Start/stop Codons
  - Synonymous versus non-synonymous substitutions
- DNA
  - 3' versus 5' end
  - Default convention 5' → 3'
- Protein synthesis
- Transcription & translation
- The central dogma of molecular biology
- Transcriptome
- Meta-Genome
- Chromosome
  - Allele
- Species
- Taxonomy
- Phylogeny

Your questions from last time

- Q: How closely related does a reference genome need to be for conducting by-reference assmebly?

- A: No clue, even the expert I asked didn't have an answer to this!

- Q: What happnes to mRNA after transcription?

- A: Might be transcribed several times, then (after seconds in *Bacteria* up to several days in *Mammals*) it degrades into its constituent nucleotides.

- Q: How is RNA splicing steered/controlled?

- A: Mainly by the spliceosome (combination of RNA and proteins).

Next Lecture

- Benoit Morel
  - Comparing sequences computationally
  - Algorithms on strings of DNA