MOLECULAR DATA

Advantages
- **strictly heritable**
- **unambiguous characters and character states**
- **change predictably**
- **amenable to quantification**
- **reasonable homology assessment**
- **ubiquitous**
- **abundant**
- **comparative**
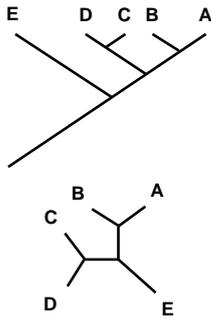
$$N_R = (2n - 3)! / (2^{n-2} (n - 2)!)$$

n	A	T
2	1	1
3	3	1
4	15	2
5	105	3
6	945	6
7	10395	11
8	135135	23
9	2027025	46
10	34459425	98
15	213458046676875	4850

$$N_U = (2n - 5)! / (2^{n-3} (n - 3)!)$$

(a)

Monophyletic group

1 2 3 4 5

(b)

Paraphyletic group

1 2 3 4 5

(c)

Prokaryotes | Dicots | Dicots
Oldest living Clades
Bacteria Archaea Eukarya Outgroup angiosperm related to Monocots
clades magnolias Eudicots

Fish
Sturgeon
Perch
trout
etc.
Lobe-finned
fish
Snake
Amphibians,
reptiles, mammals

Birds

Crocodilies

Snakes

Lizards

Turtles

Tortoises

Mammals
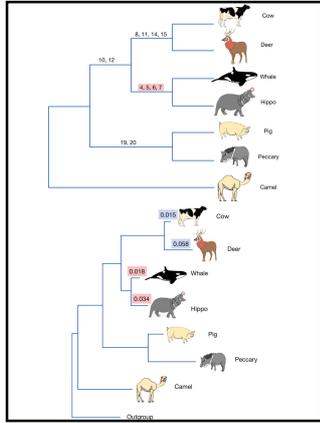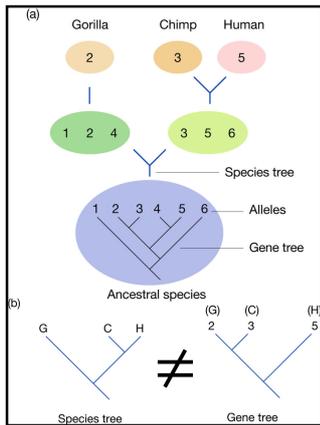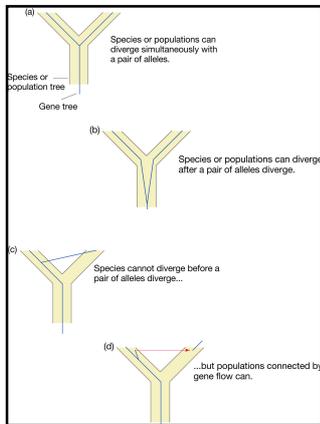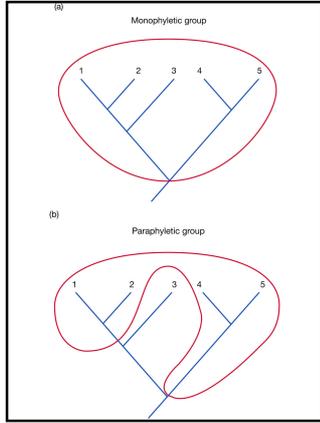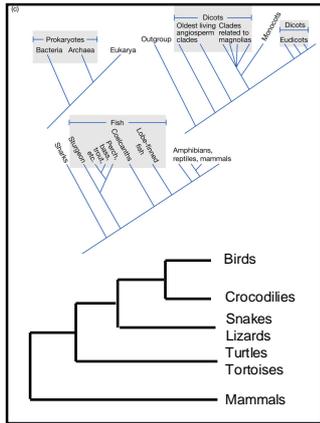
DATA

OTUs
    taxa
    genes

Characters
    morphological
    behavioural
    molecular

Character States
    quant-, qual-itative
    continuous, discrete
    binary, multistate
    un-, ordered
    distance
    'orphies'

TECHNIQUES

Distances
Parsimony
Maximum Likelihood
Bayesian Inference