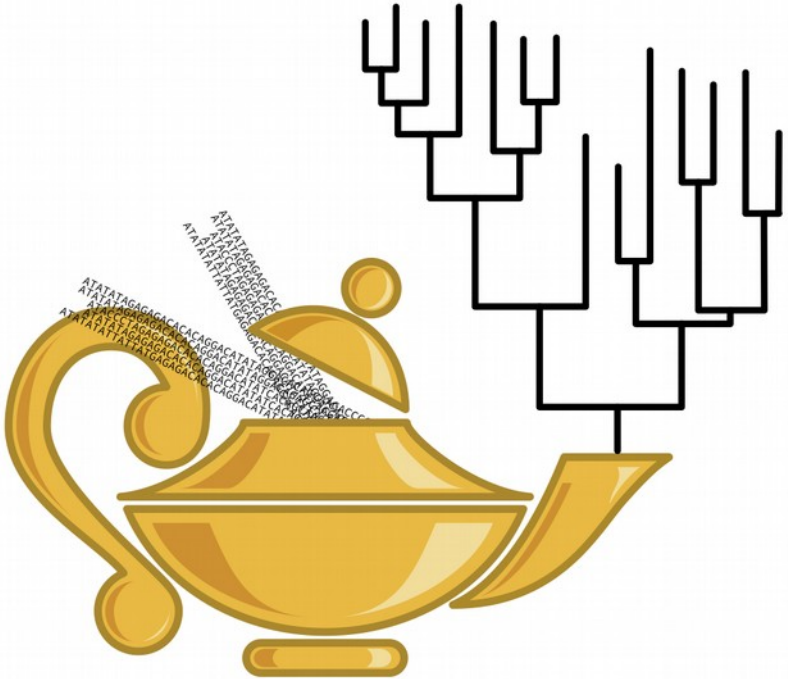
RUB

ROSCOFF Unseminars in Bio*

#0 Phylogenetics

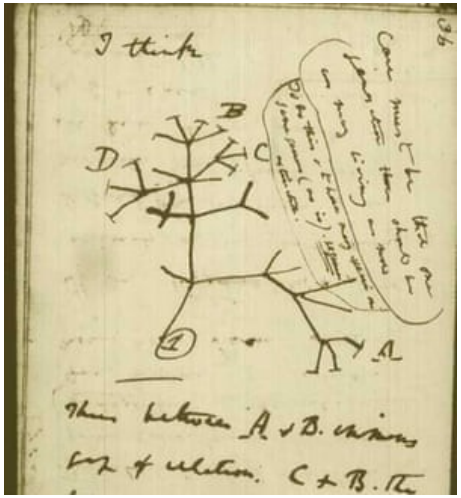


Welcome to RUB #0!

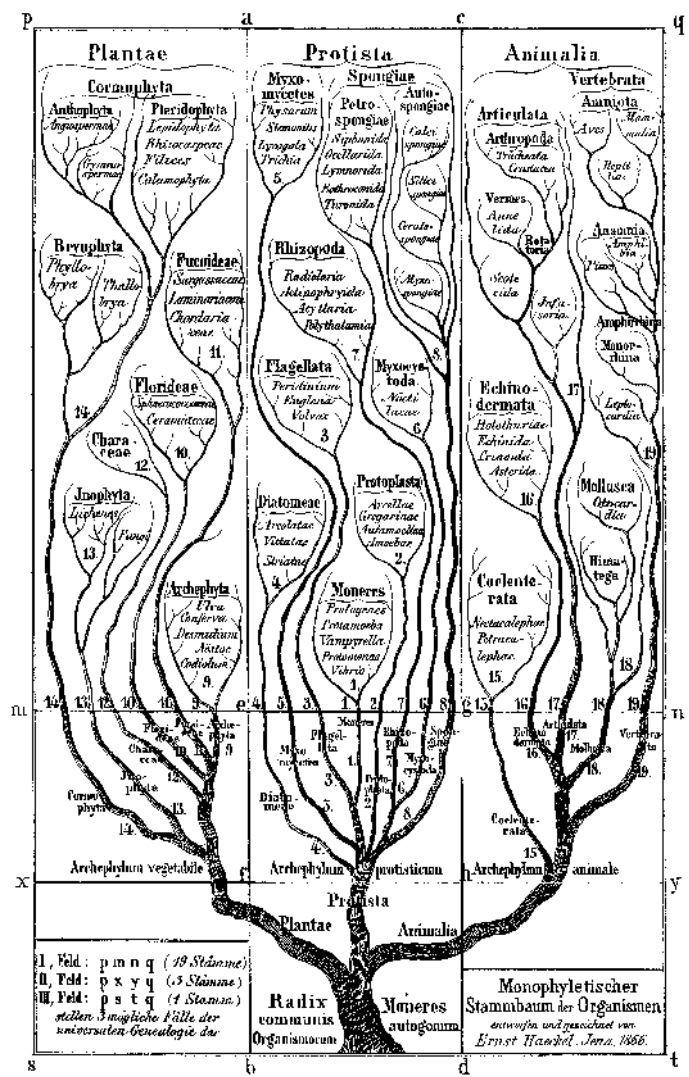
phylogenetic trees:
a representation of evolutionary relationships between taxa

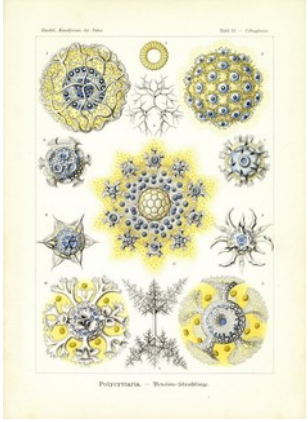
Because evolution is a unidirectional phenomenon, evolutionary relationships between living (or fossil) organisms can be represented in the form of a phylogenetic tree (dendrogram).

From a mathematical point of view, a tree is a graph used to represent relationships between objects; it is composed of links uniting points. It's not a network: a single path links any point to another.

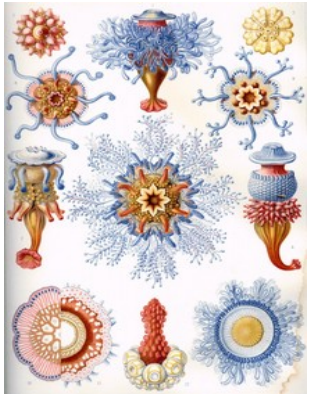


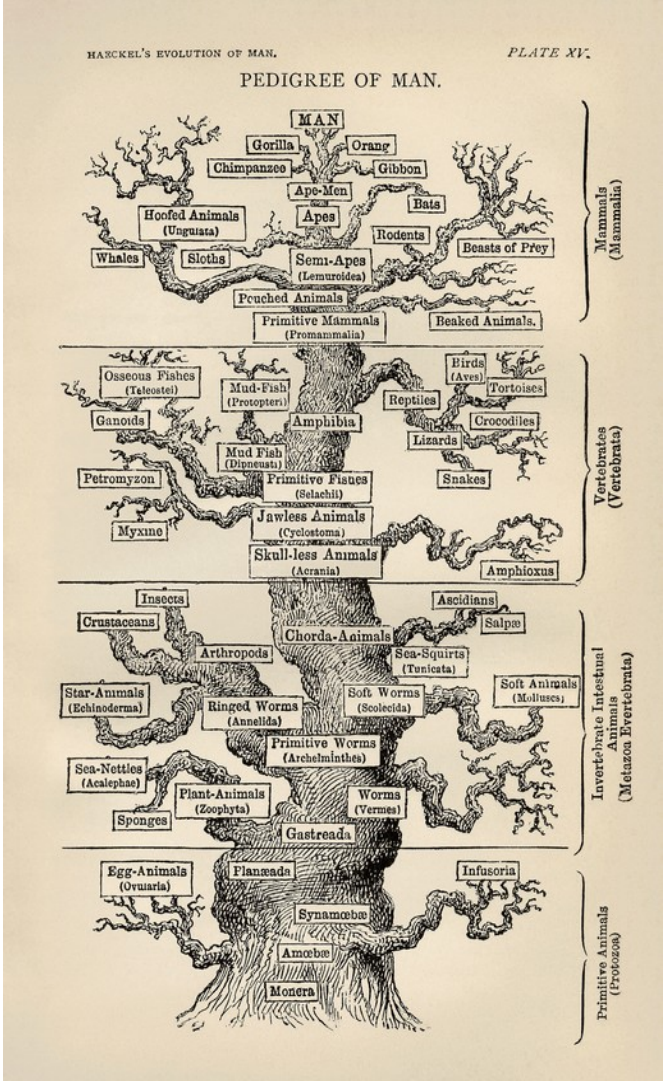
The use of trees to represent evolutionary relationships was pioneered by Darwin.

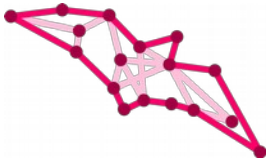




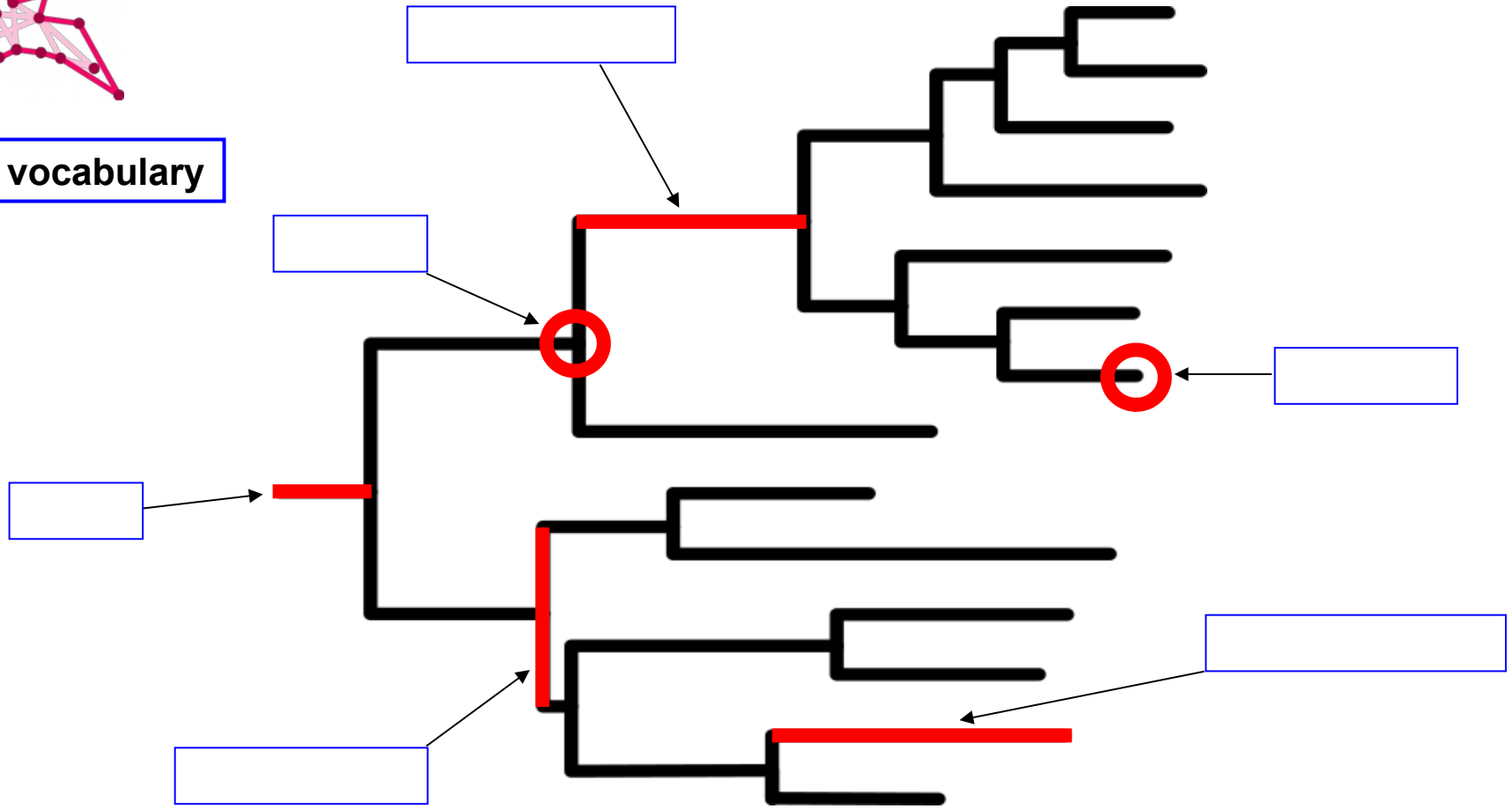
Ernst Haeckel largely popularized the use of trees to represent evolutionary relationships thanks to his beautiful artwork.

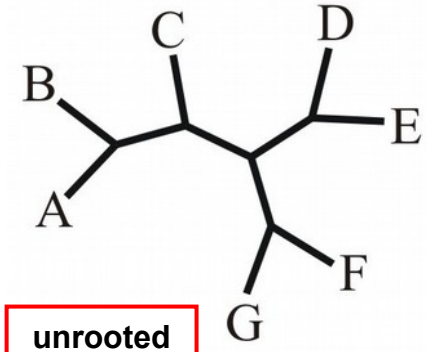






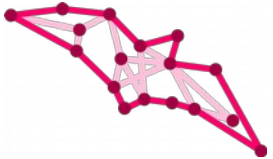
tree vocabulary

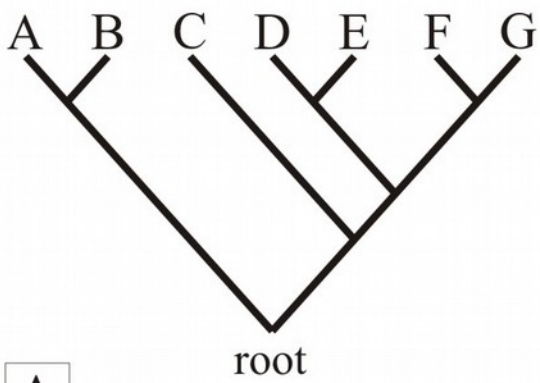




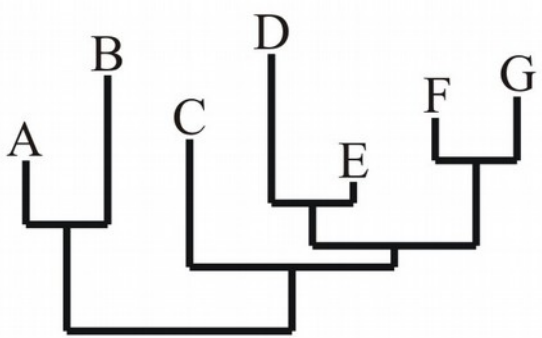
unrooted tree

rooted tree

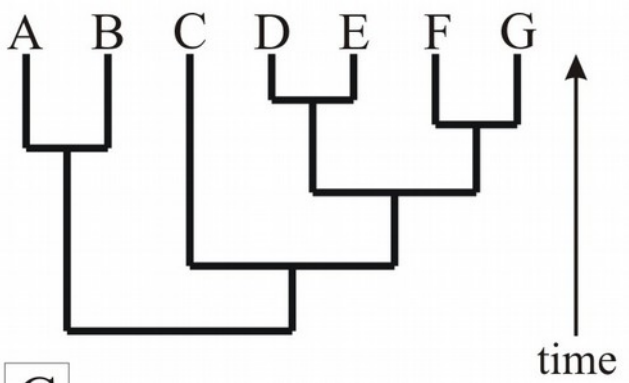




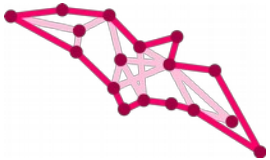
A cladogram

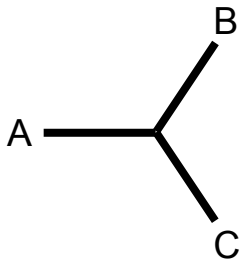


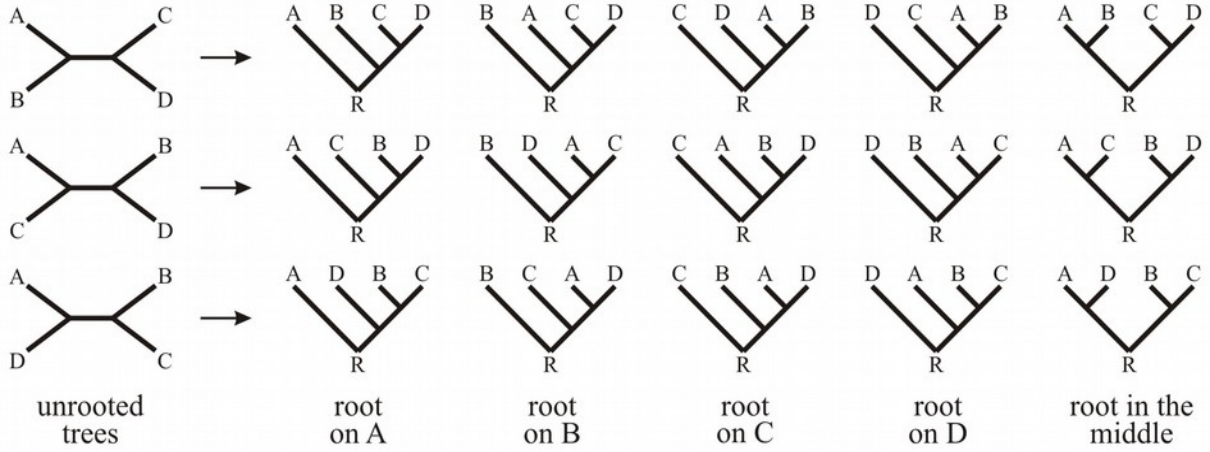
B phylogram



C ultrametric tree

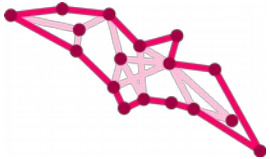




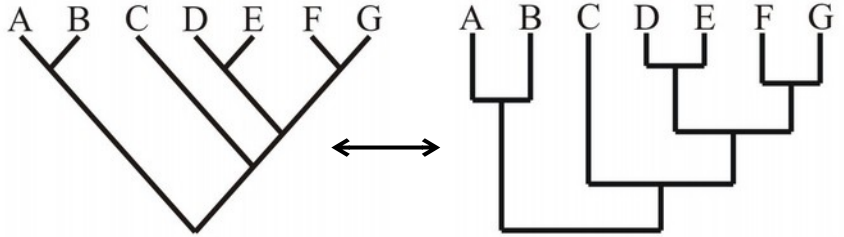


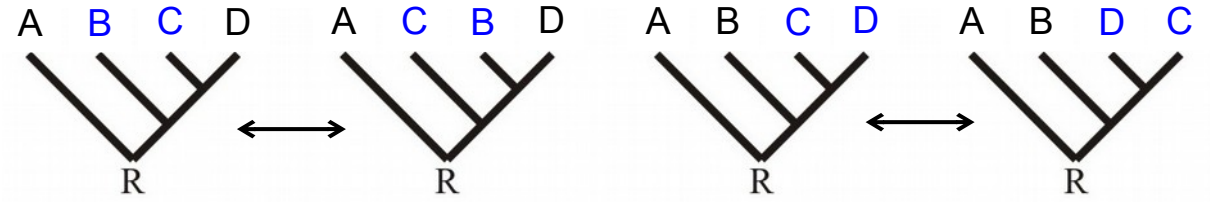
number of taxa	# of unrooted trees	# of rooted trees
n	$\frac{(2n-5)!}{2^{(n-3)}(n-3)!}$	$\frac{(2n-3)!}{2^{(n-2)}(n-2)!}$
3	1	3
4	3	15
5	15	105
6	105	945
7	945	10'395
8	10'395	135'135
9	135'135	2'027'025
10	2'027'025	34'459'425

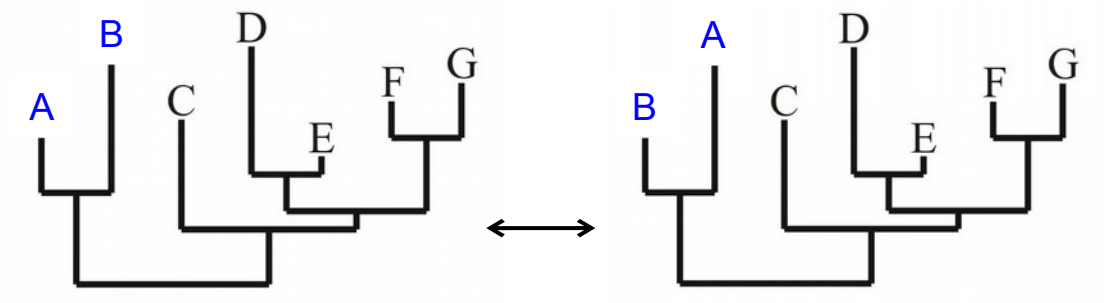
20 taxa: 8'200'794'532'637'891'559'000 (8 sextillions) possible rooted trees!



Are these pairs of trees different? If yes, how?



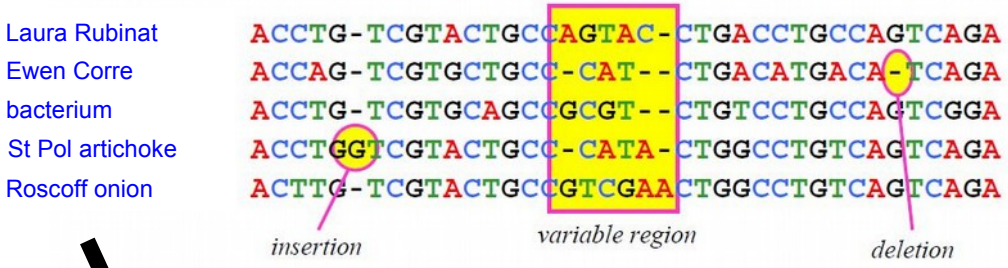




molecular data as a source of phylogenetic information

Because all living organisms share a common origin, analysis of the divergence between strictly homologous gene sequences should reflect the phylogenetic relationships between the organisms from which they were obtained.

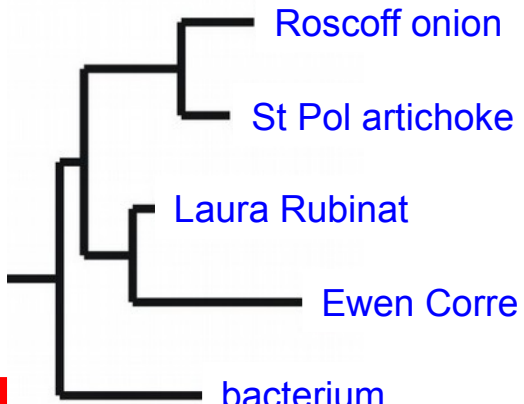
1



2

wingardium leviOsa (not wingardium leviosA)

3



methods of tree construction