

Jargon



<https://www.youtube.com/watch?v=Ln2Xq8fCNI8> From BBC Life of Birds

Brian O'Meara
EEB464 Fall 2019

Learning objectives

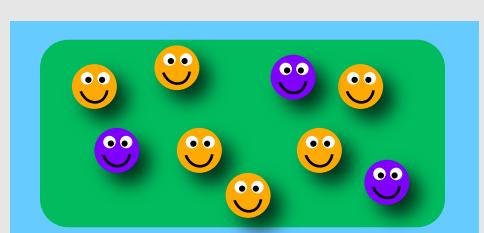
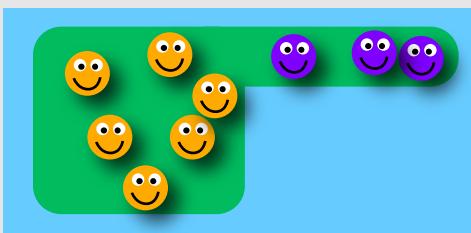
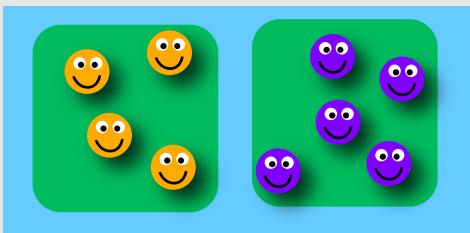
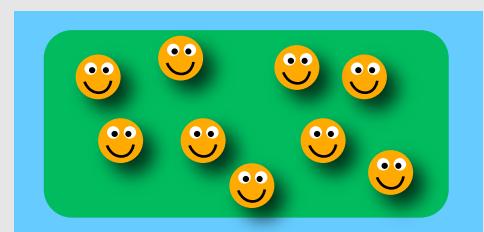
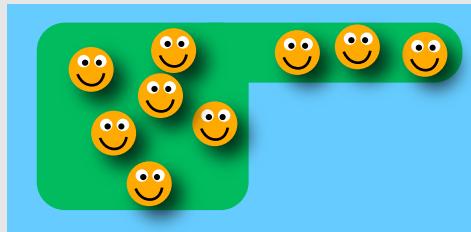
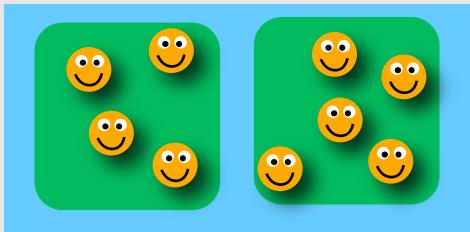
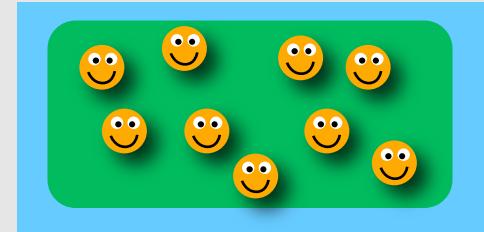
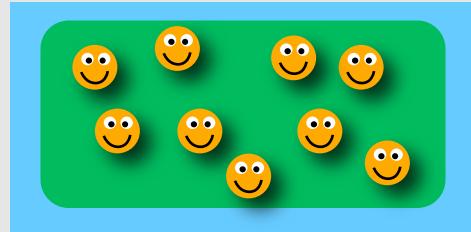
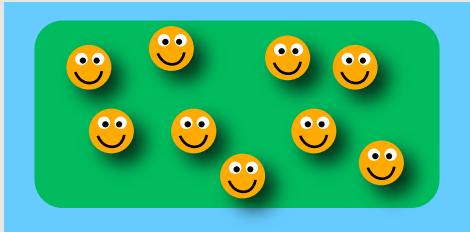
Precise language is essential to science

Learn and discuss particular vocabulary useful in rest
of semester

What is a species?

A	Biological	Species are groups of interbreeding natural populations that are reproductively isolated from other such groups (Mayr 1995)
B	Genotypic cluster	A species is a [morphologically or genetically] distinguishable group of organisms that has few or no intermediates when in contact with other such clusters (Mallet 1995)
C	Recognition	A species is that most inclusive population of individual biparental organisms which shares a common fertilization system (Patterson 1985)
D	Cohesion	A species is the most inclusive population of individuals having the potential for phenotypic cohesion through intrinsic cohesion mechanisms (Templeton 1989)
E	Ecological	A species is a lineage (or a closely related set of lineages) which occupies an adaptive zone minimally different from that of any other lineage in its range and which evolves separately from all lineages outside its range (Van Valen 1976)
F	Evolutionary	A species is a single lineage of ancestral descendant populations or organisms which maintains its identity from other such lineages and which has its own evolutionary tendencies and historical fate (Wiley 1978, modified from Simpson, 1961)
G	Phylogenetic 1	A phylogenetic species is an irreducible (basal) cluster of organisms that is diagnosably distinct from other such clusters, and within which there is a paternal pattern of ancestry and descent (Cracraft 1989)
H	Phylogenetic 2	A species is the smallest [exclusive] monophyletic group of common ancestry (de Queiroz and Donoghue 1989)
I	Genealogical	A species is a basal, exclusive group of organisms all of whose genes coalesce more recently with each other than with those of any organisms outside the group, and that contains no exclusive group within it (Baum and Donoghue 1995; Shaw 1998)

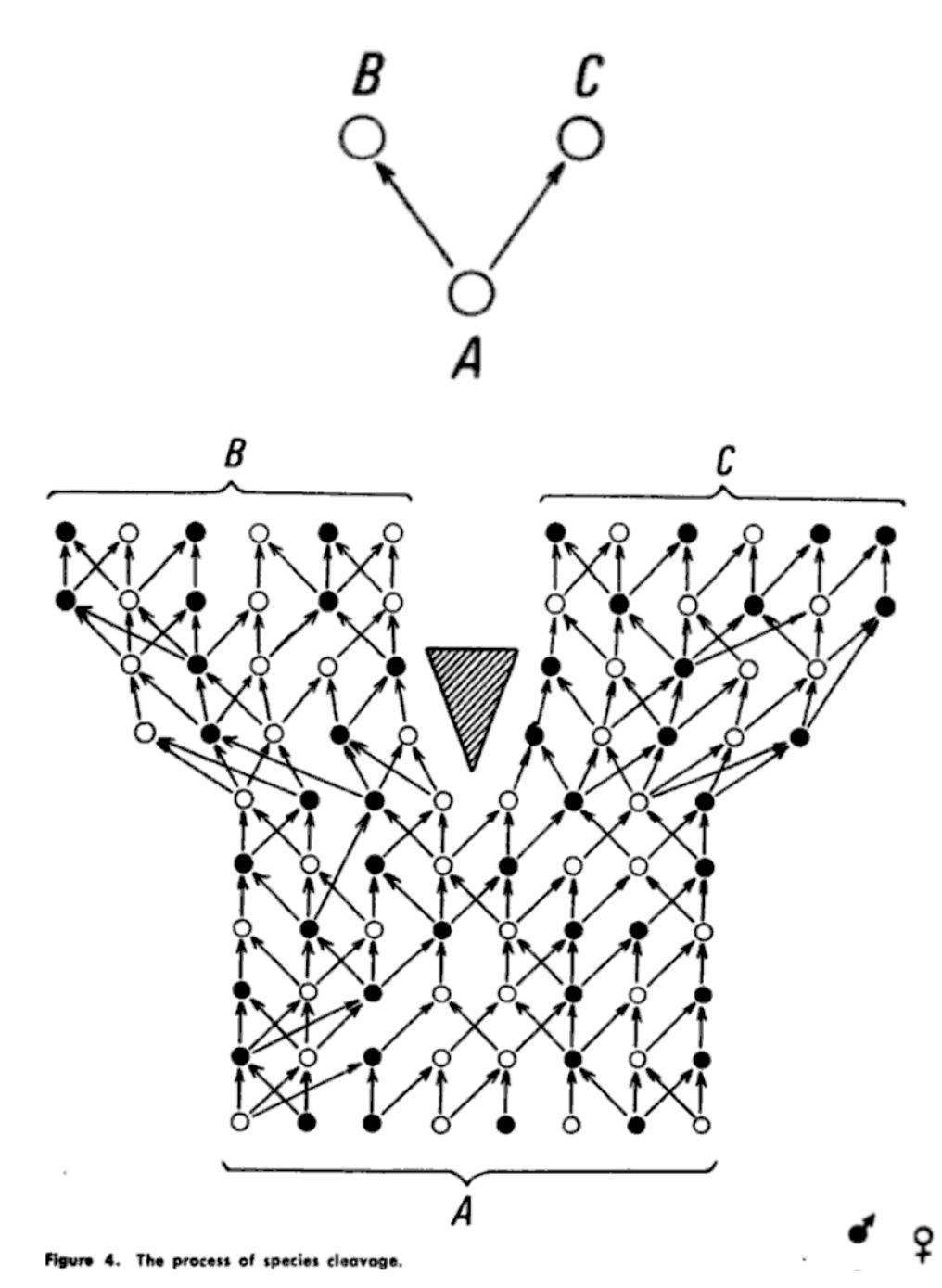
Speciation



Allopatric

Parapatric

Sympatric



Willi Hennig,
Phylogenetic
Systematics, 1966.

Figure 4. The process of species cleavage.

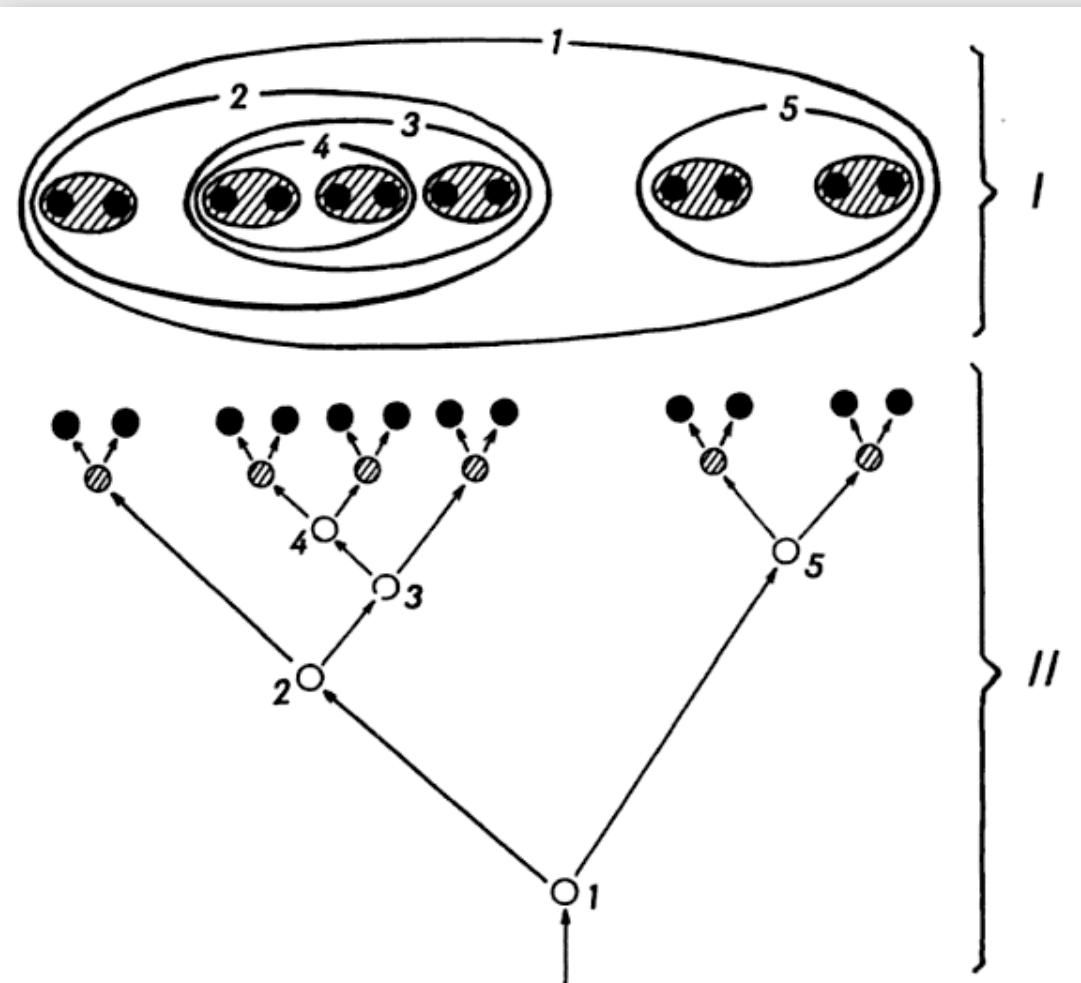
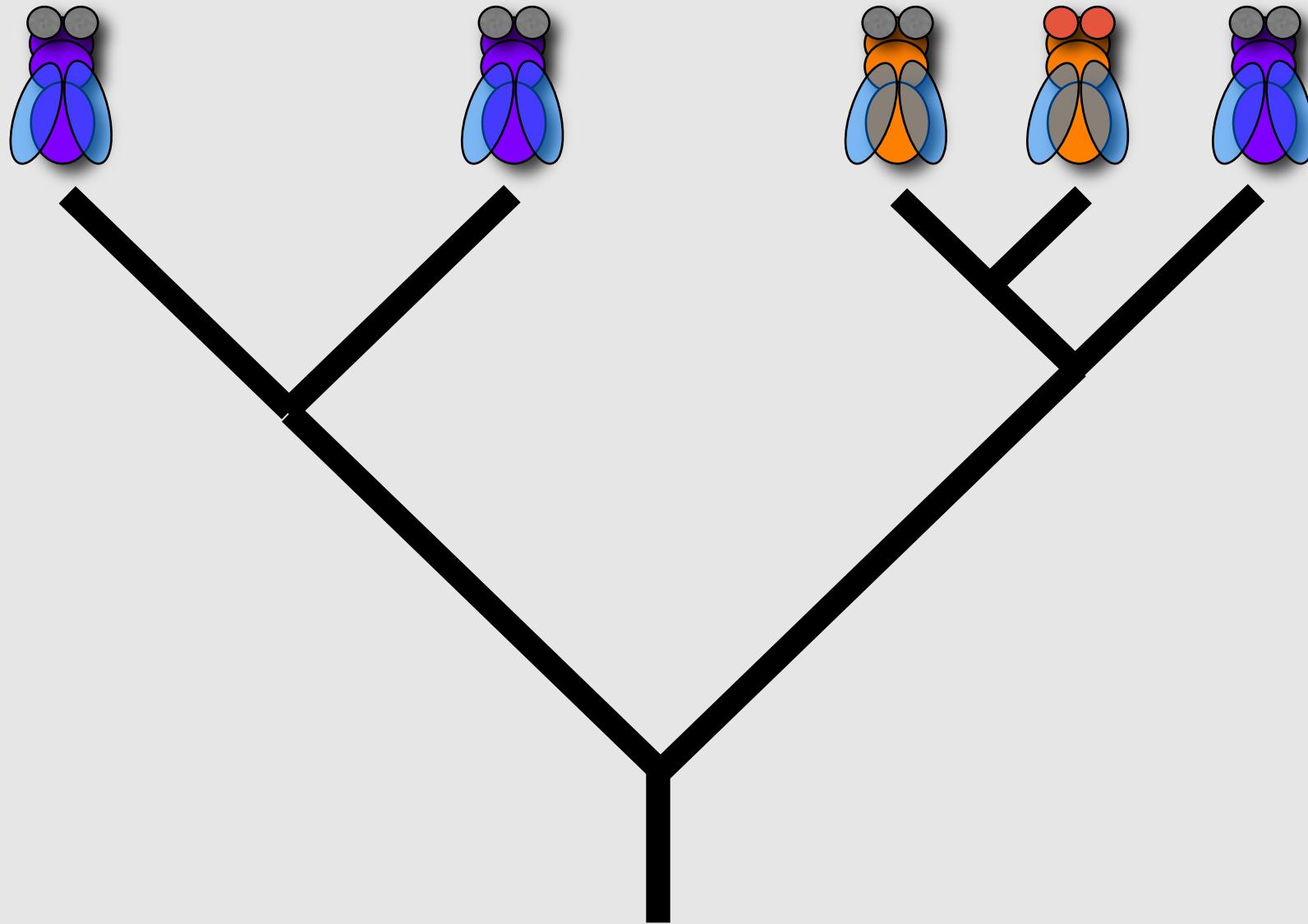


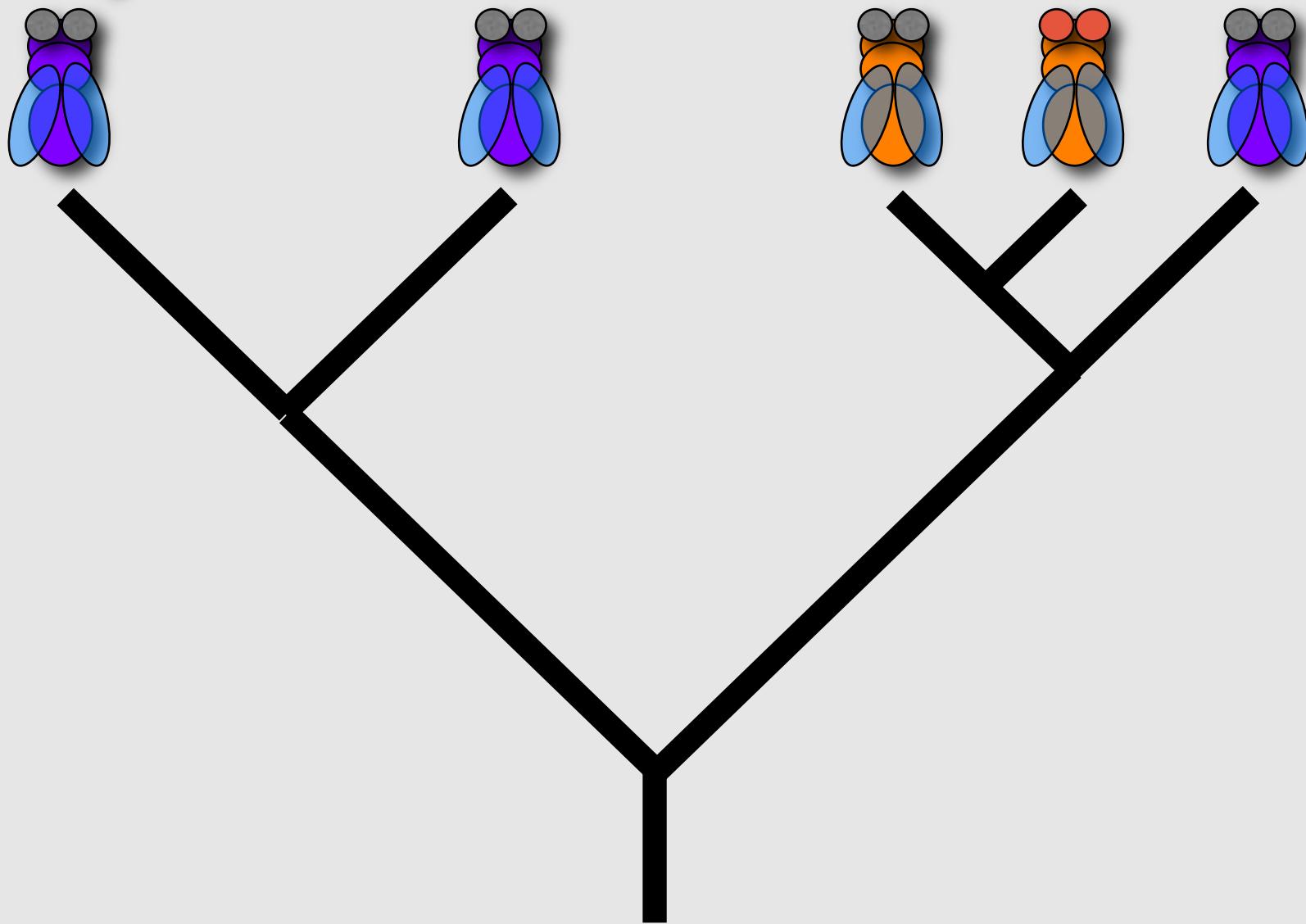
Figure 18. The phylogenetic kinship relations between the species of a monophyletic group, represented in two different ways.

Willi Hennig,
Phylogenetic
Systematics, 1966.

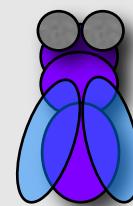
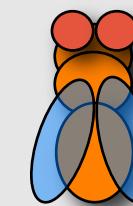
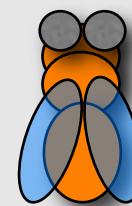
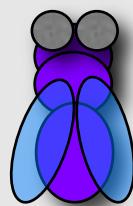
Tree = phylogeny = cladogram (if no branch lengths) = connected graph with no cycles



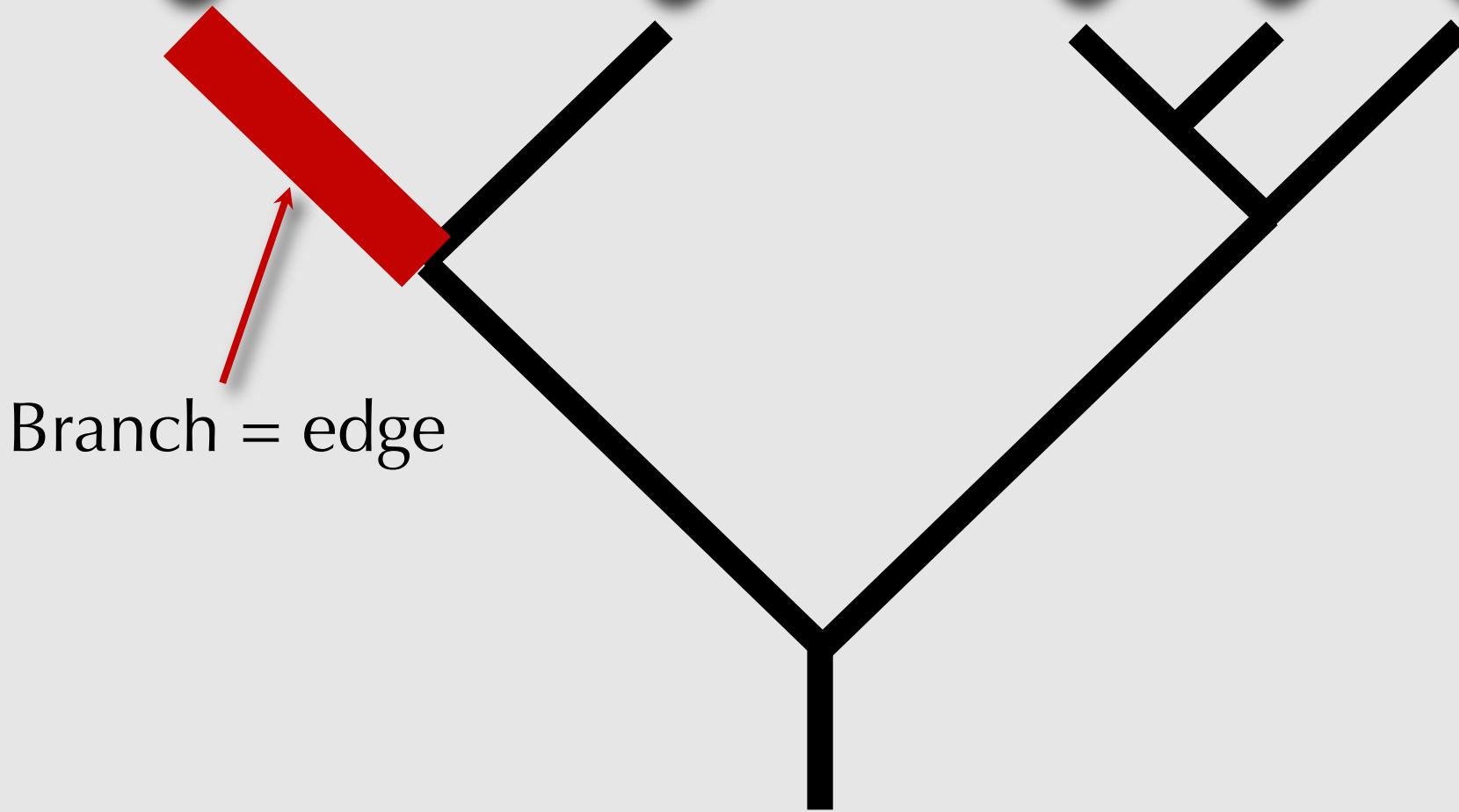
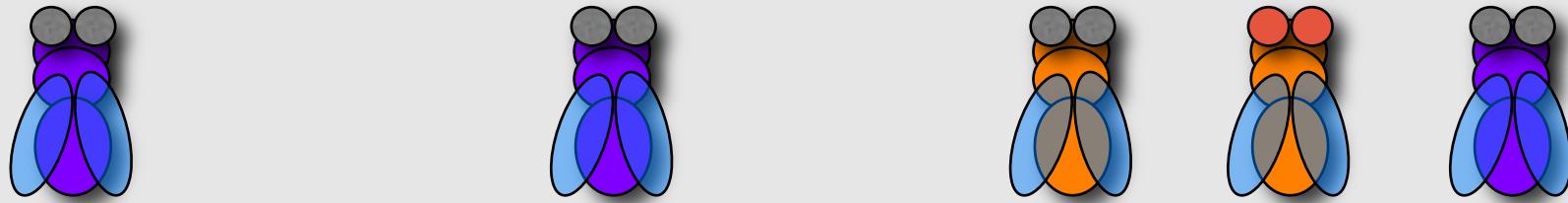
Taxon = OTU (operational taxon unit) =
Leaf = Terminal = Terminal Node



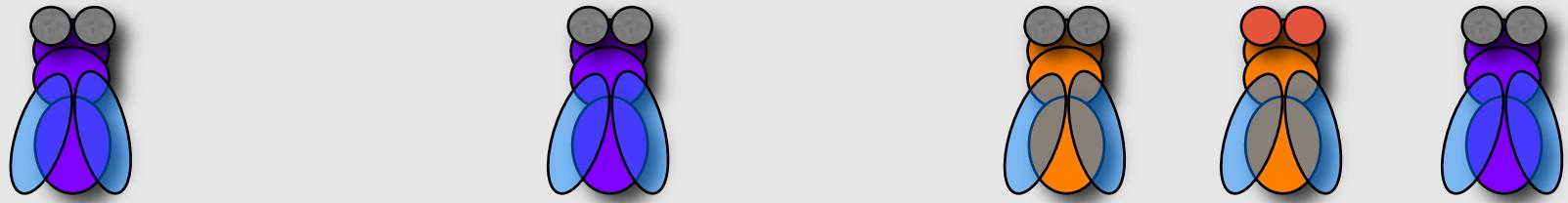
Taxon = OTU (operational taxon unit) =
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Taxa are often extant (living) organisms, but they need not be. Fossils can be taxa, viruses sampled at different times, etc. and so not all taxa need occur at the same time.

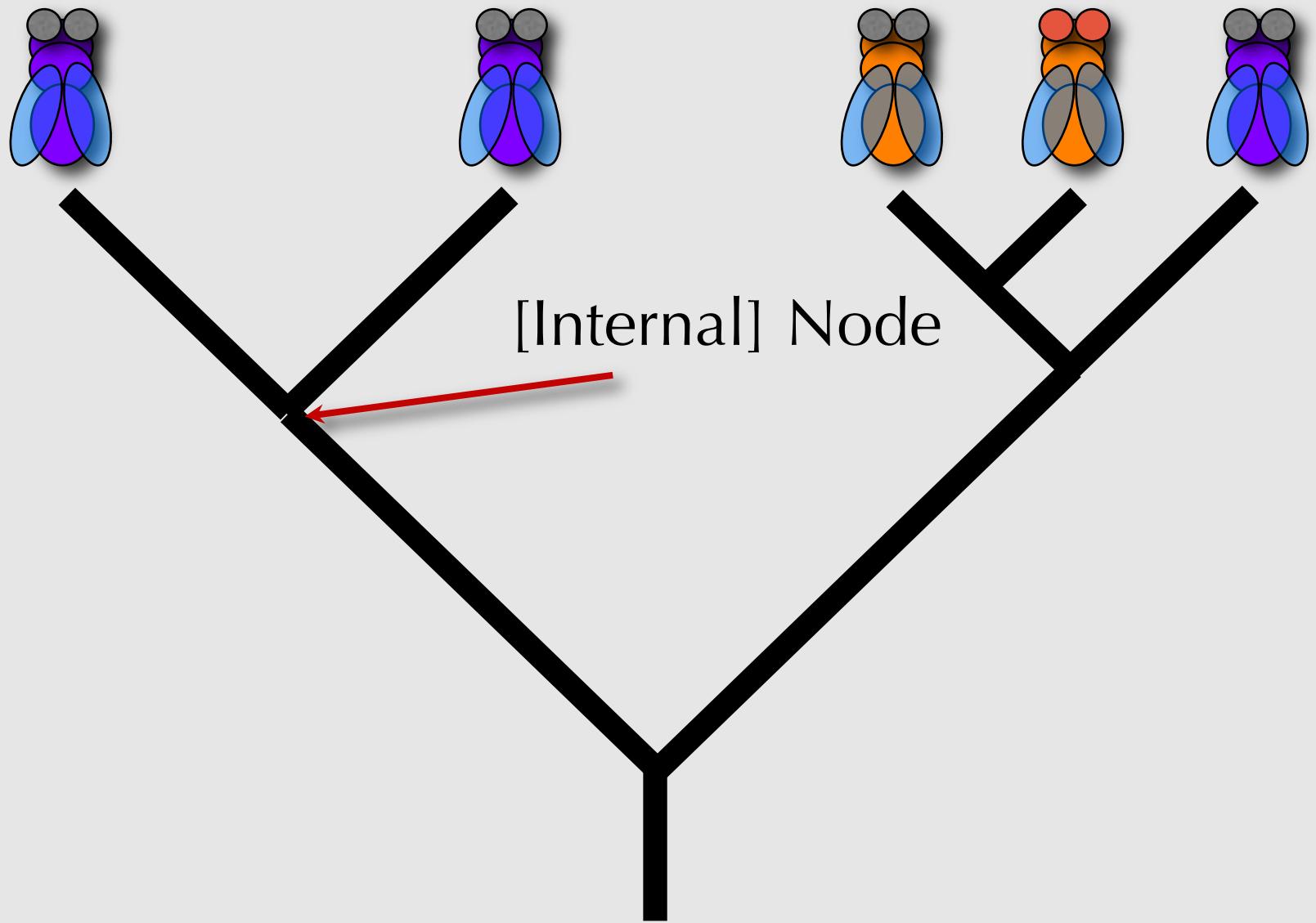


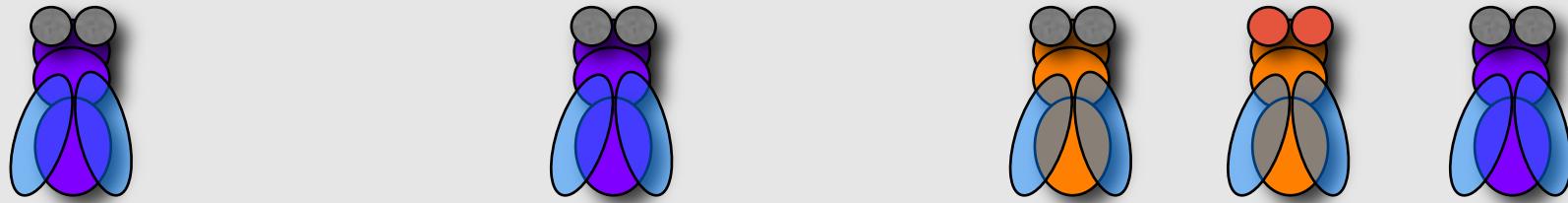
Branch = edge



Branch = edge

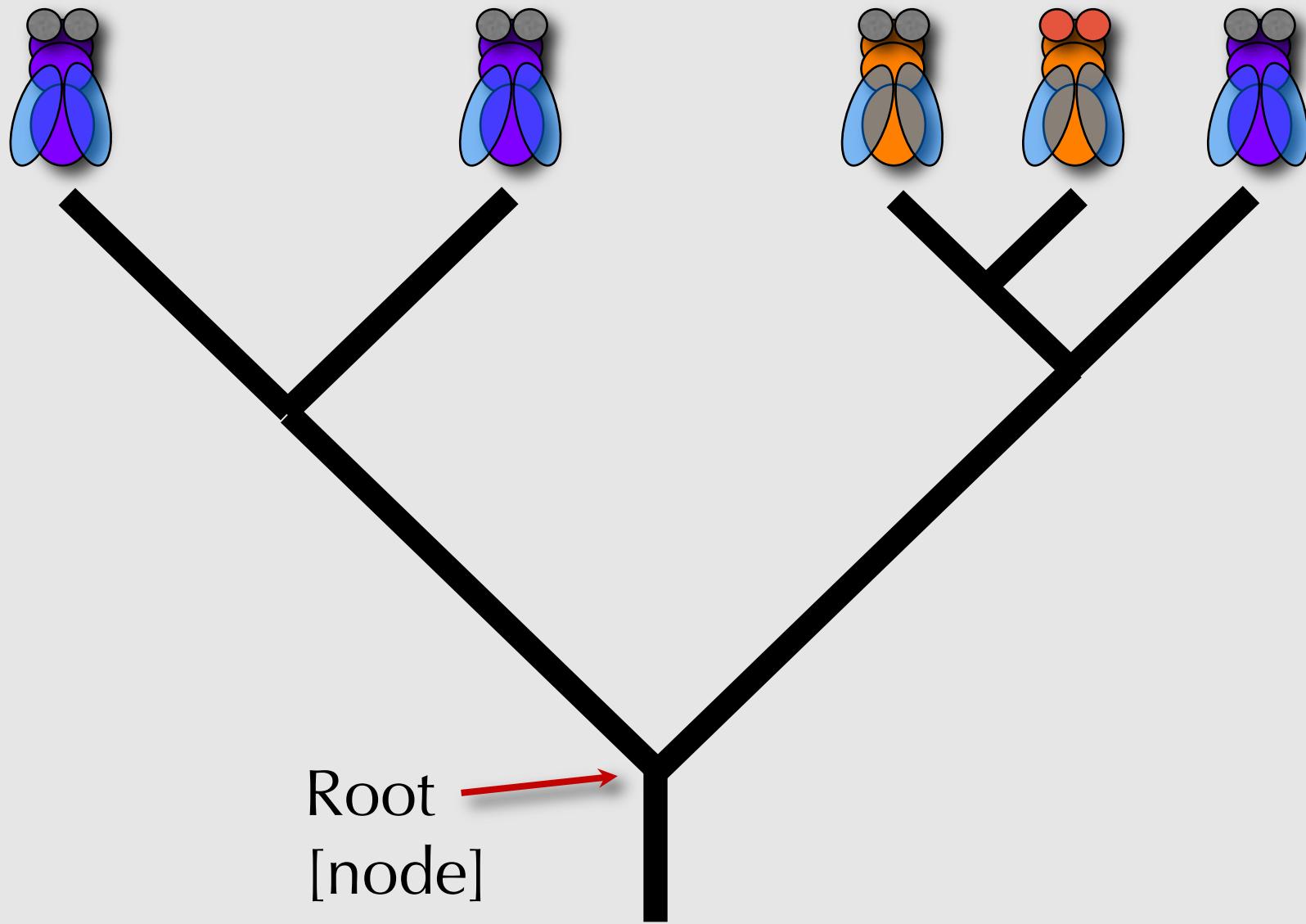
May have length, which may correspond
to time, amount of character change,
probability of character change, etc.

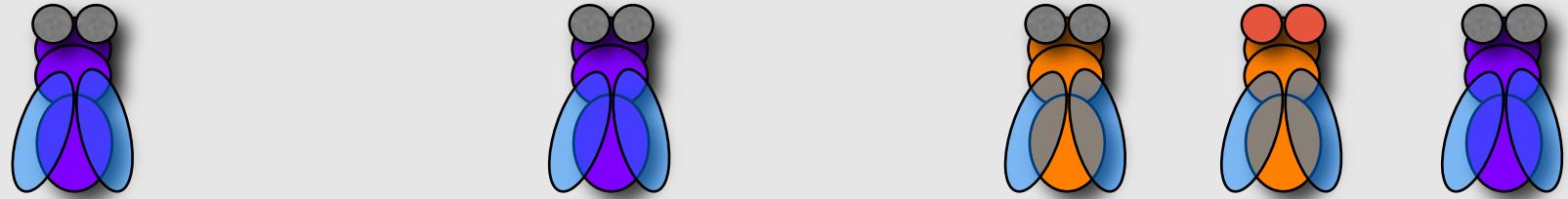




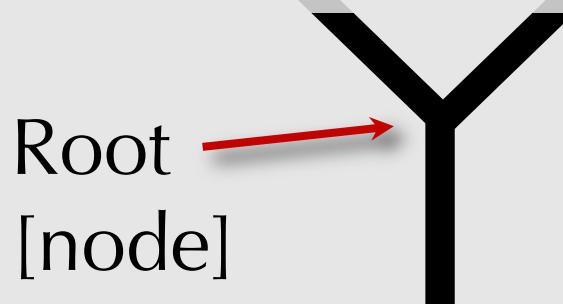
[Internal] Node

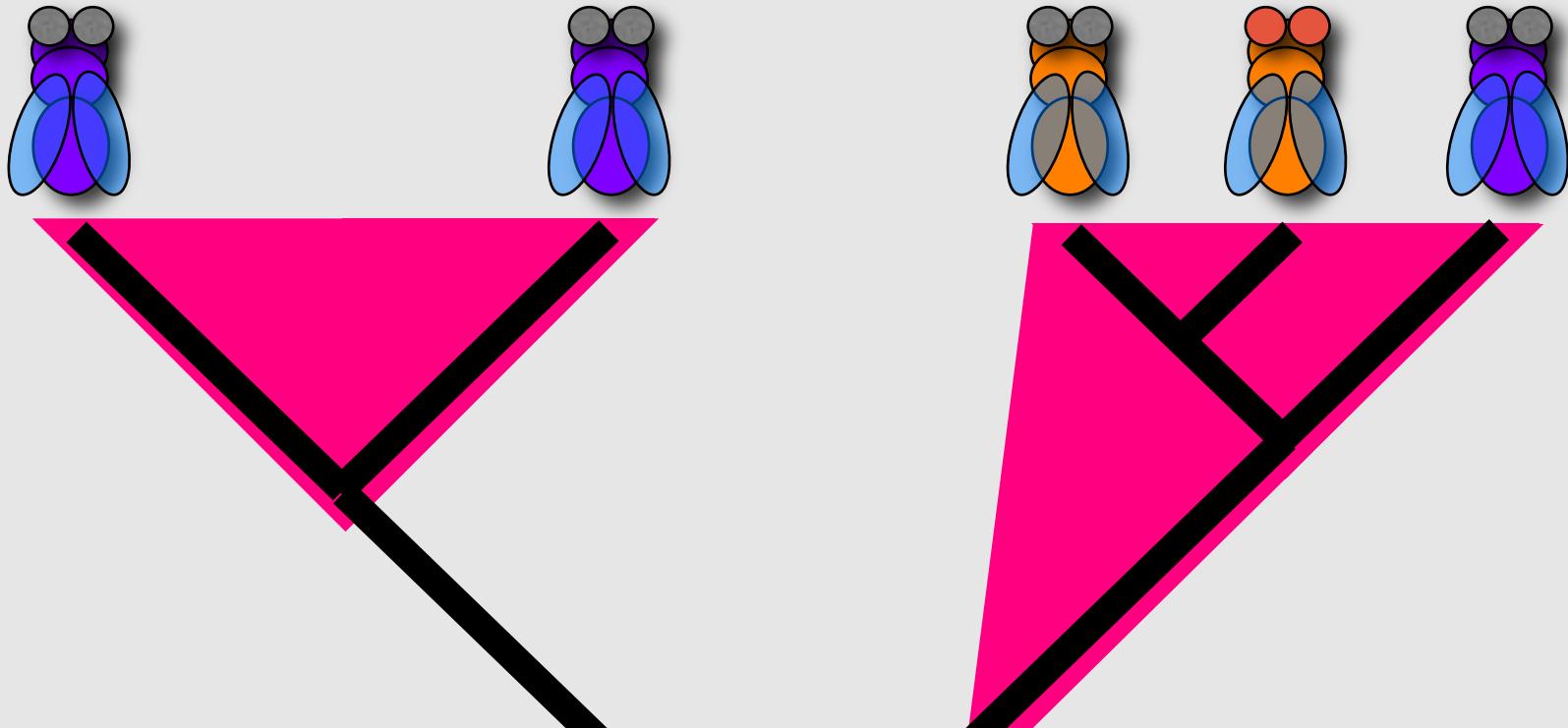
Where different edges meet. If all have just two descendant branches, tree is “bifurcating” or “fully-resolved” or “dichotomous”. Nodes with more branches are “polytomies” or “multichotomies”



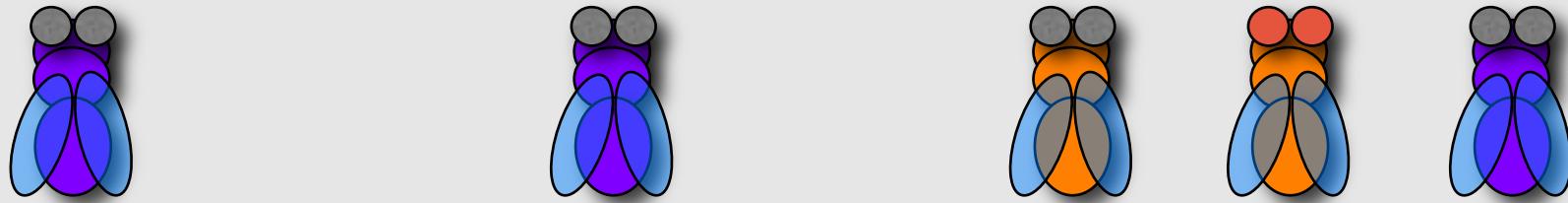


A rooted tree (most common) has a node that represents the most recent common ancestor (MRCA, or LCA (least common ancestor)) of all the taxa. A rooted tree (directed graph) shows the direction of time.

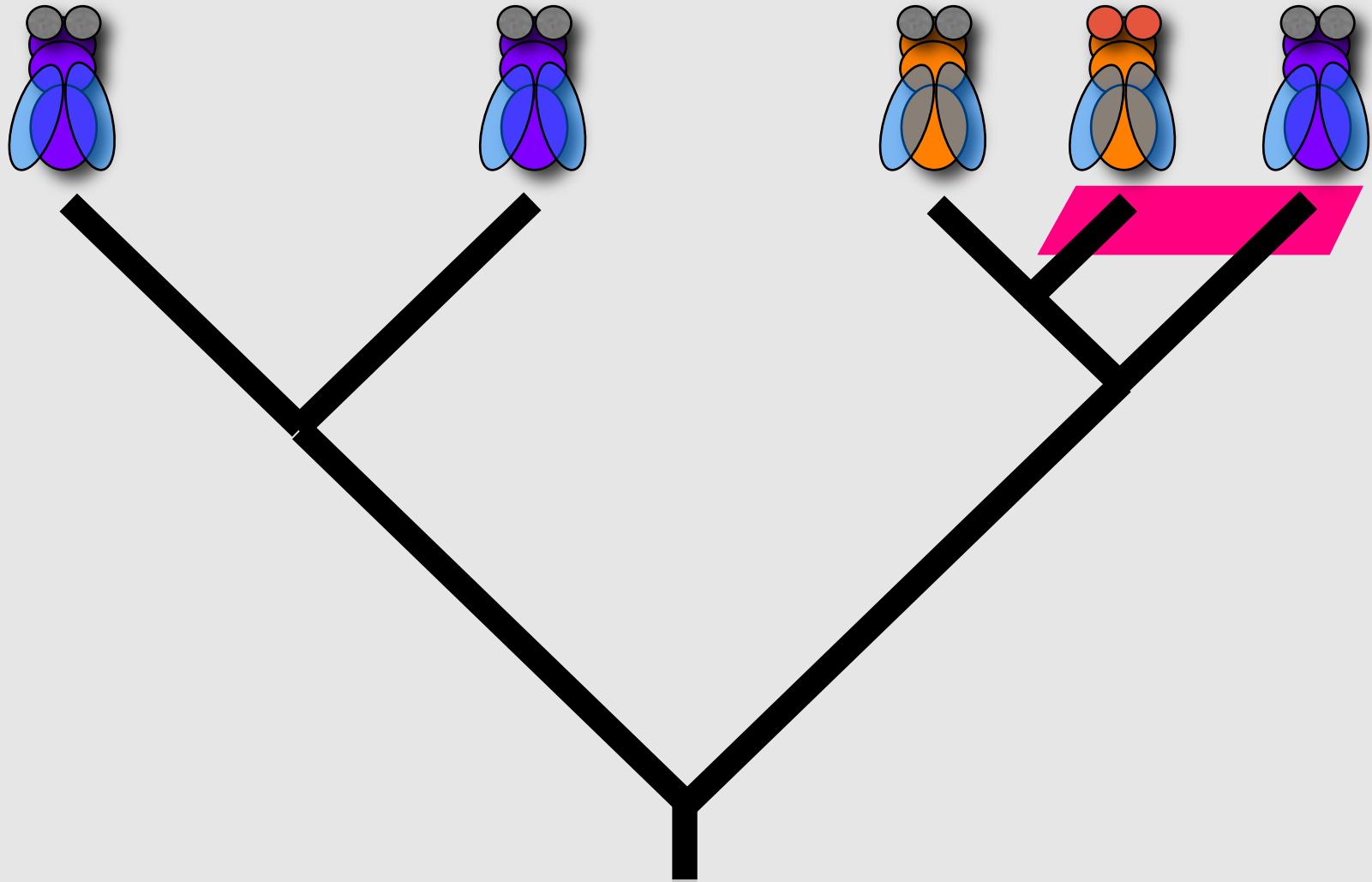




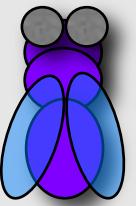
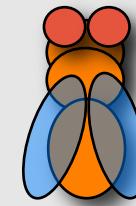
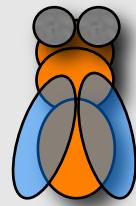
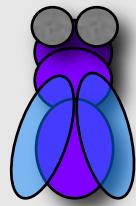
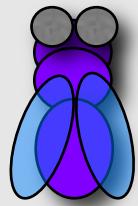
Clade: ancestor and all its descendants
(a “monophyletic” group”)



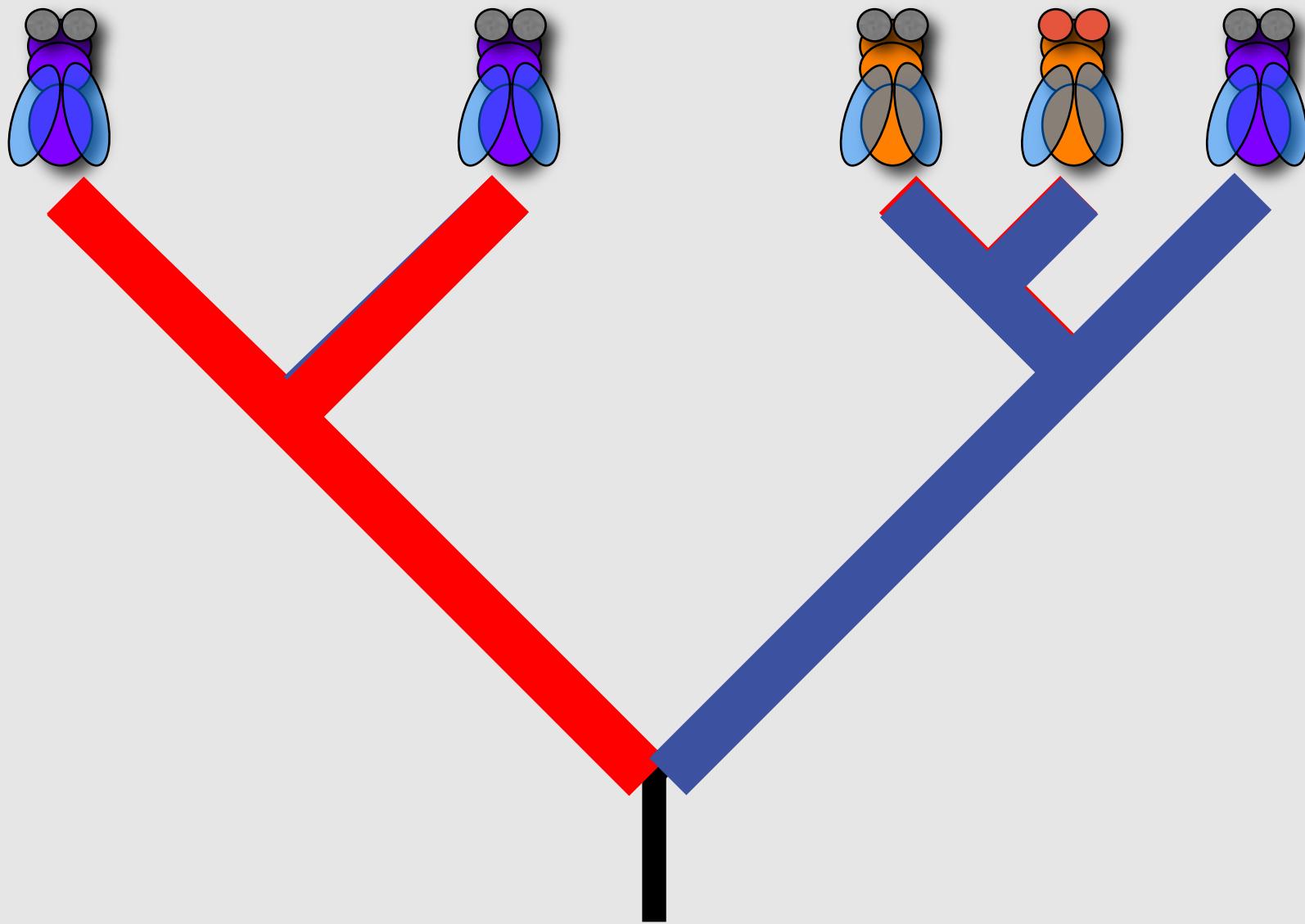
Paraphyletic group: ancestor and some but not all its descendants

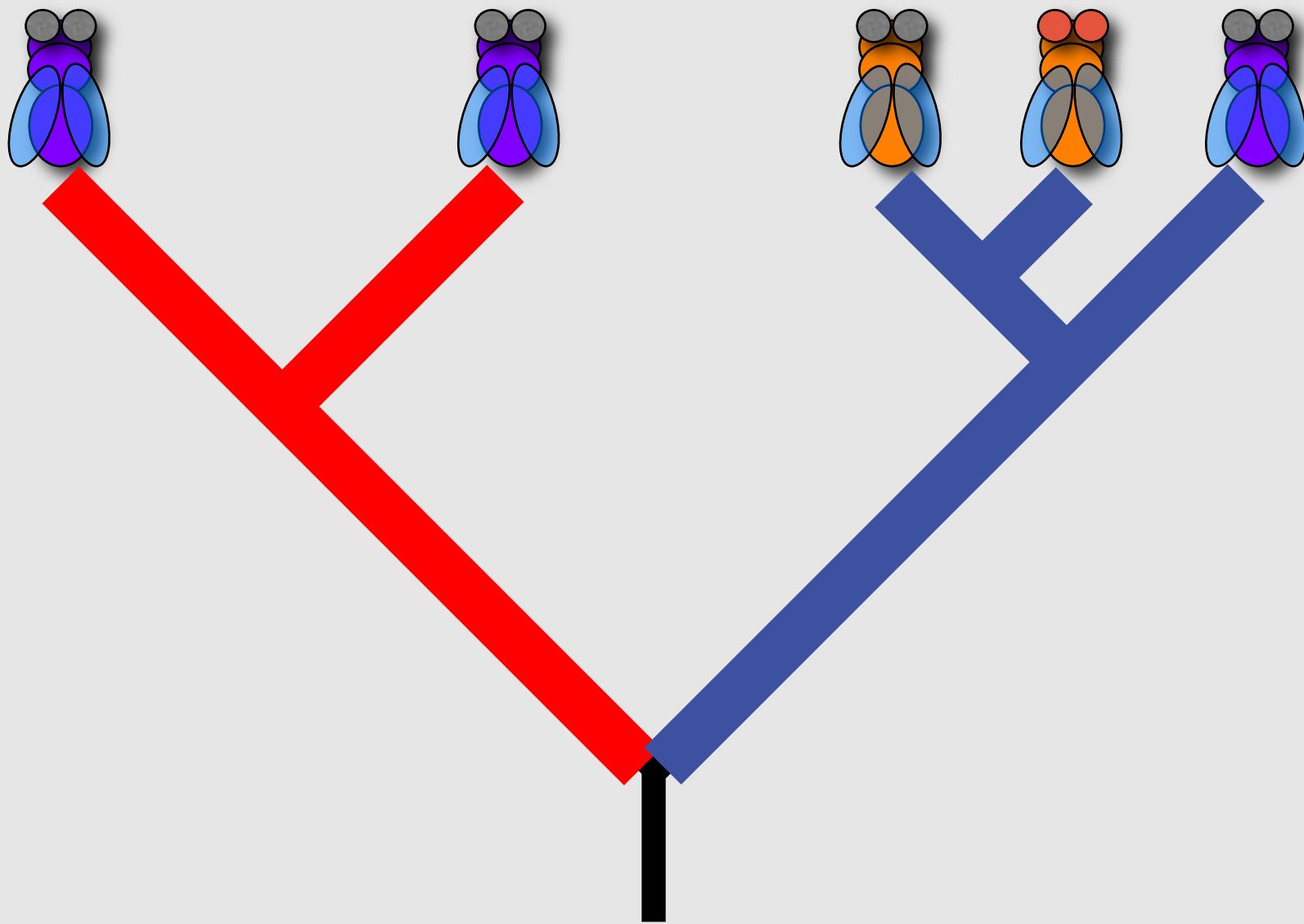


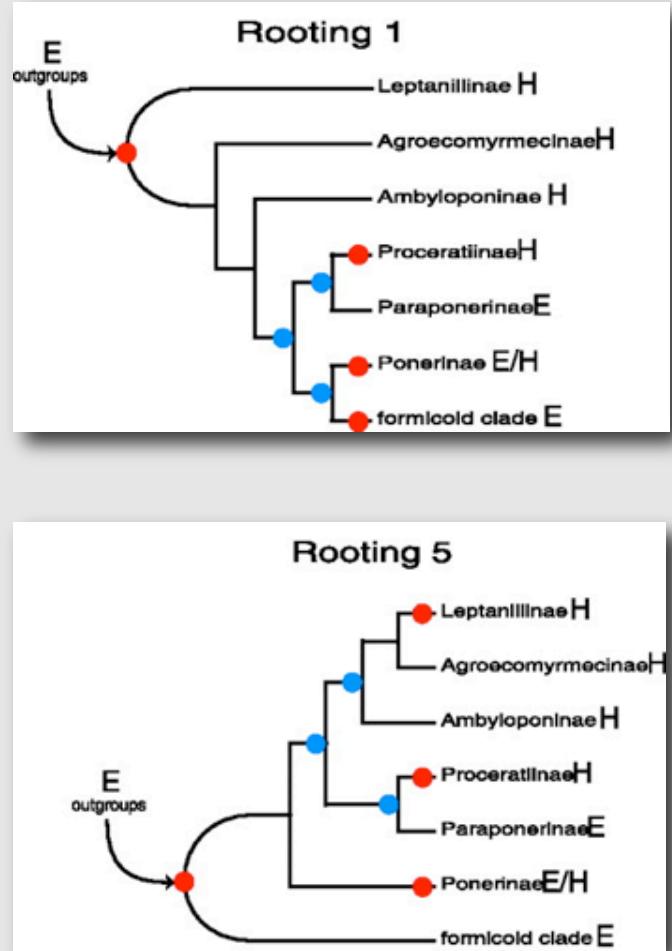
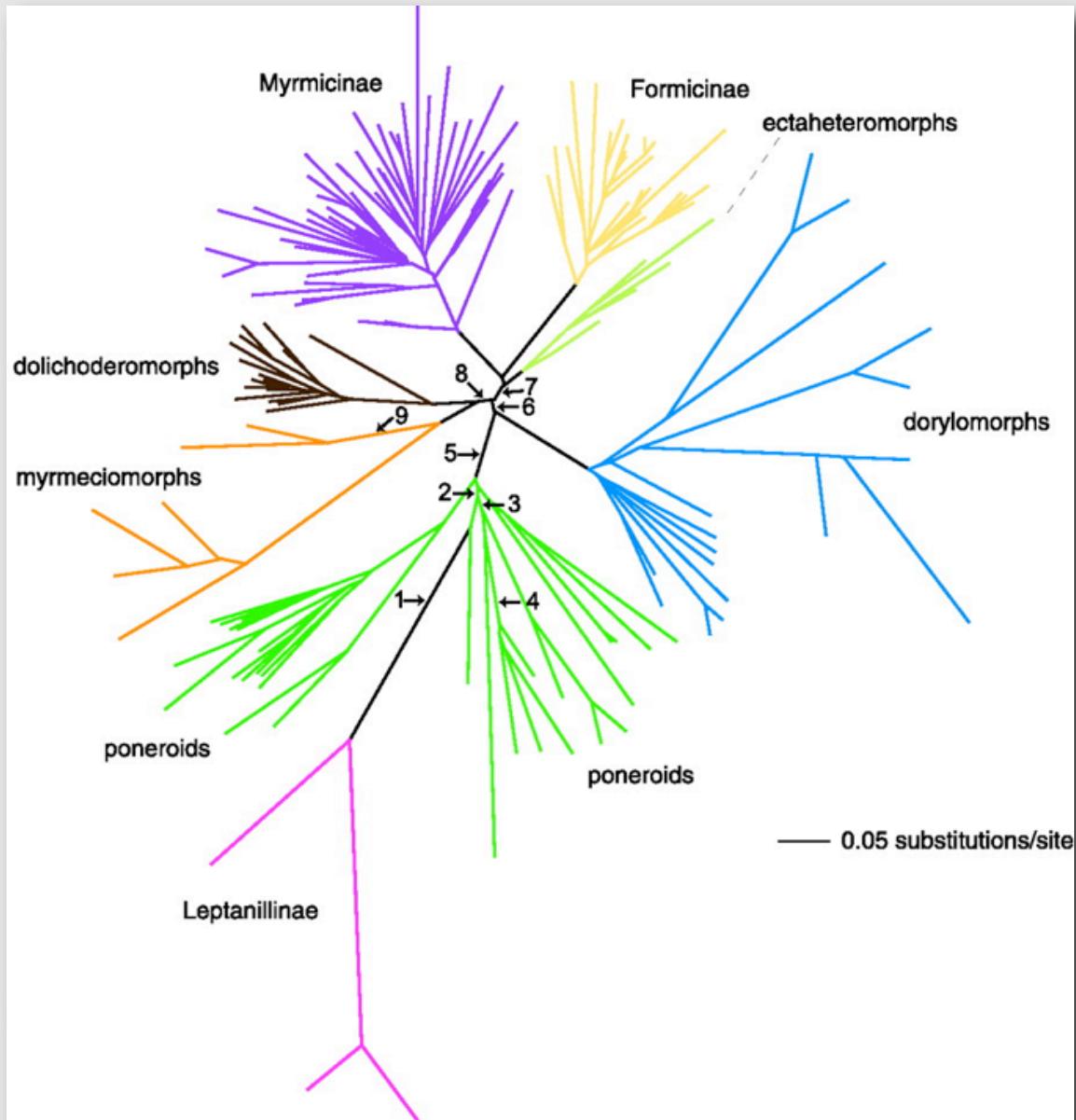
Polyphyletic group: even worse



Genus?



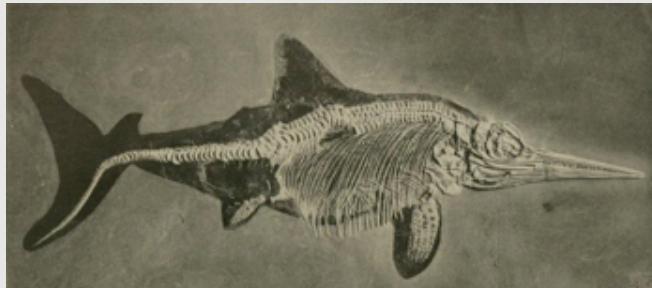




Brady S.G., T. R. Schultz, B.L. Fisher, and P.S. Ward. 2006.
“Evaluating alternative hypotheses for the early evolution and
diversification of ants.” *PNAS* 103:18172–18177

Characters

Homology: Similarity due to shared ancestry (i.e., humans, birds, and turtles all having four limbs)



Homoplasy: Similarity, but not due to shared ancestry (i.e., convergence of dolphins and ichthyosaurs on similar shape)

Characters

Plesiomorphy: An ancestral (“primitive”) character state (with reference to another, derived, state)

Ex: Sharks living in water (compared to tetrapods living on land)

Symplesiomorphy: Plesiomorphy shared by ≥ 2 taxa

Apomorphy: A derived (“advanced”) character state (with reference to another, ancestral, state)

Ex: Whales living in water (compared to other tetrapods living on land)

Synapomorphy: Apomorphy shared by ≥ 2 taxa

Autapomorphy: Apomorphy possessed by one taxon

Characters

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Note correct plural!

TABLE 1. A taxonomy of fitness.

Process	Character	Usage
Natural selection shapes the character for a current use—adaptation	adaptation	function
A character, previously shaped by natural selection for a particular function (an adaptation), is coopted for a new use—cooptation		
A character whose origin cannot be ascribed to the direct action of natural selection (a nonaptation), is coopted for a current use—cooptation	exaptation	effect

Wings have been
exapted for
shading

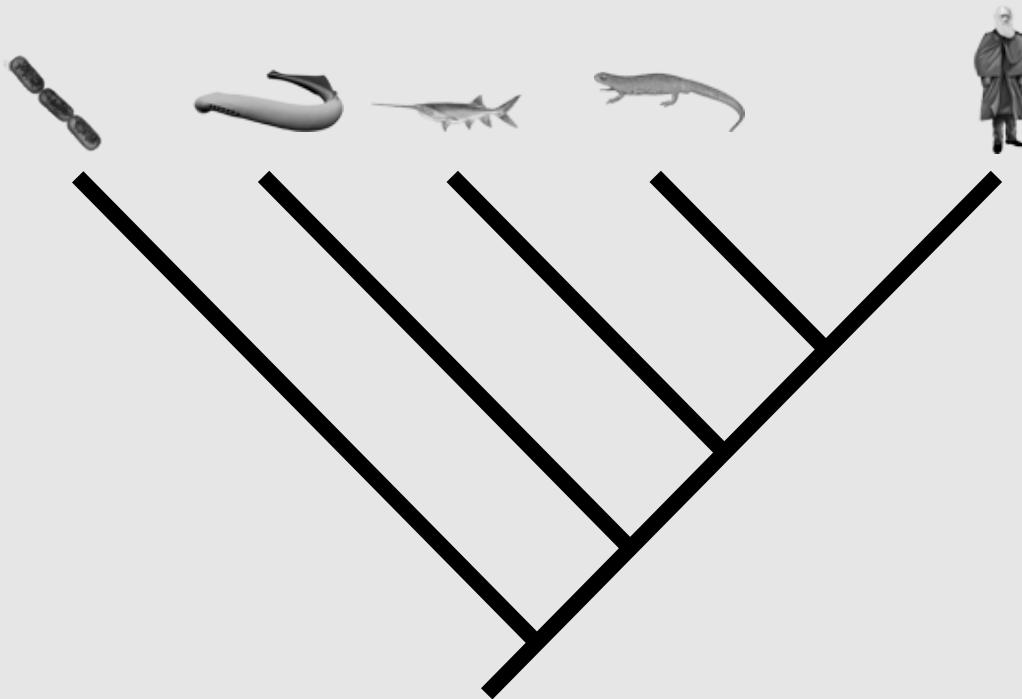


Advanced and primitive

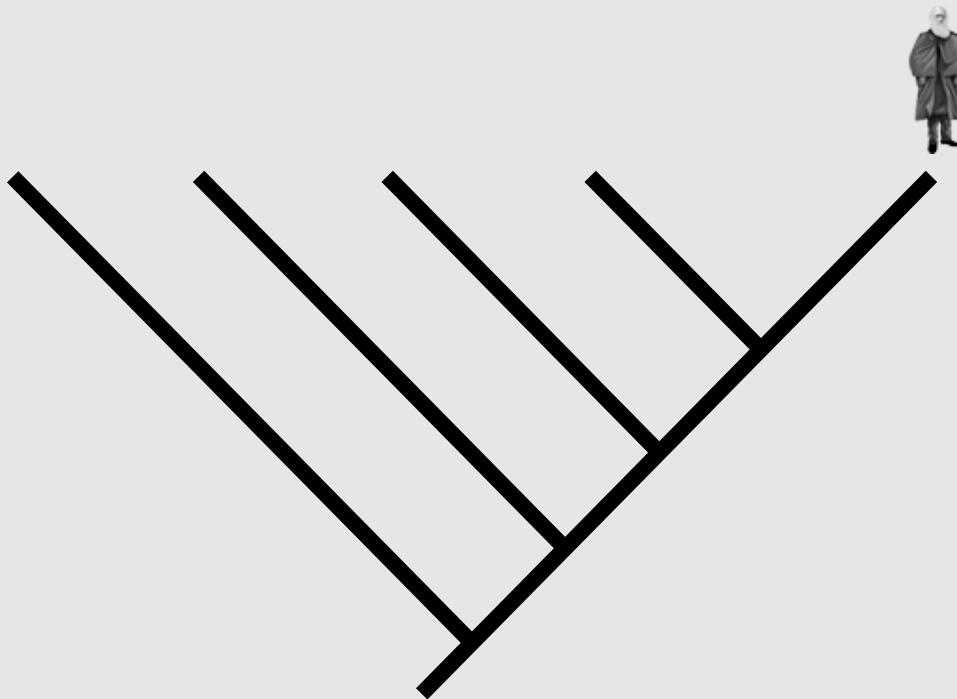


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Advanced and primitive



Advanced and primitive



Advanced and primitive

