

Organizing the living world

Organizing the living world

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Some initial definitions

- Classification
- Taxonomy
- Systematics
- Hierarchical

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All organisms, from simple single celled protozoans to complex organisms such as insects and humans, classify their surrounding environment; often using simple dichotomous (Yes or No) outcomes to order the living world around them.

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Types of taxonomies

- Folk
- Artificial
- Mechanical
- Natural (evolutionary)
- Phylogenetic (cladistic)

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Evolutionary taxonomies

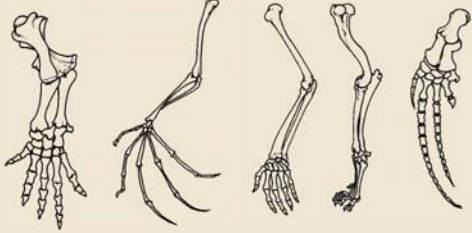
Homoplasy - homologous
Advanced - primitive characters
Weight for the different characters

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Homologies and homoplasies

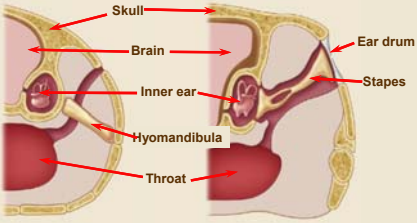


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Darwin's five theories - Common ancestry
Comparative anatomy
Homology – Divergent evolution



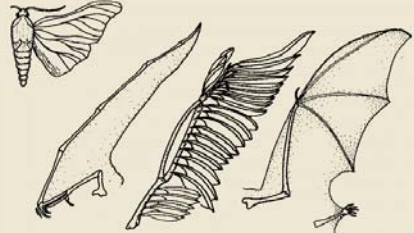
Skull
Brain
Inner ear
Hyomandibula
Throat
Ear drum
Stapes

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Homoplastic structures

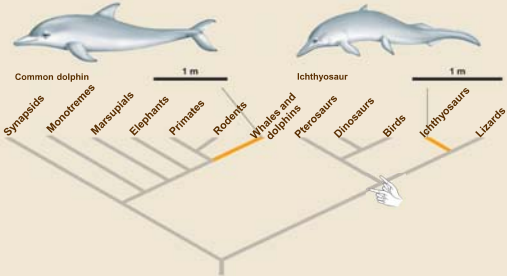


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Homoplasy – convergent evolution



Common dolphin
1 m
Ichthyosaur
1 m

Synapsids
Monotremes
Marsupials
Elephants
Primates
Rodents
Whales and dolphins
Pterosaurs
Dinosaurs
Birds
Ichthyosaurs
Lizards

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Figure 27-2a
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Three main questions

- What is the natural underlying order?
- What types of characters are available to assess that order?
- How do we handle the data from character analysis?

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Types of characters

- Morphology
- Ultra-structure
- Embryology
- Fossils
- Molecules

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Phenetic Taxonomy

Correlation coefficients

0 0.25 0.50 0.75 1.00

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Representing groups of animals

- Dendrograms
- Phylogenetic trees
- Cladograms (Phylogenetic trees)

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Dendograms

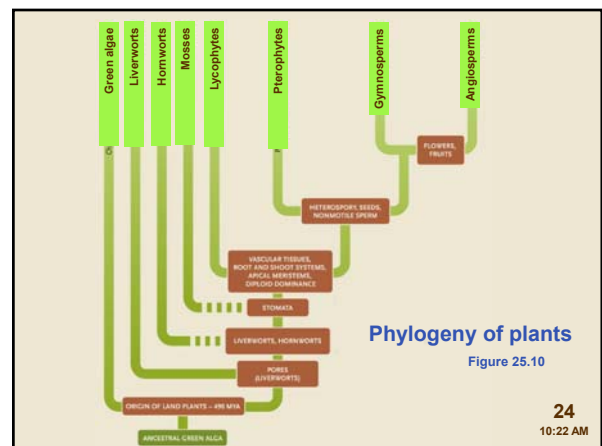
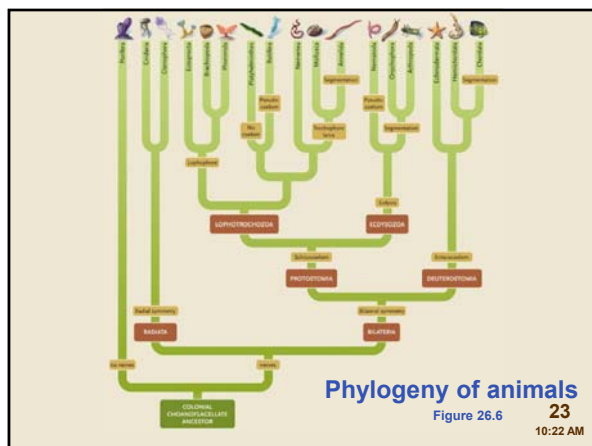
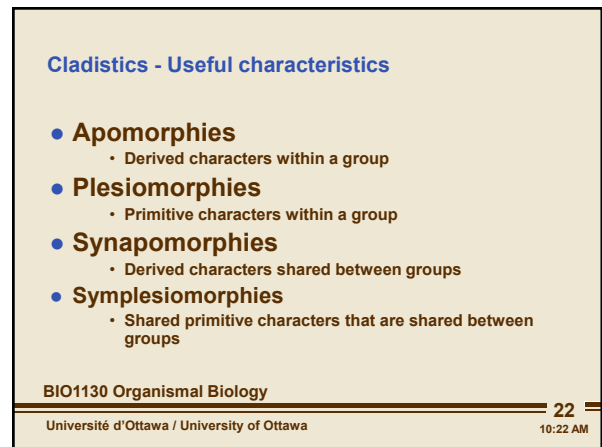
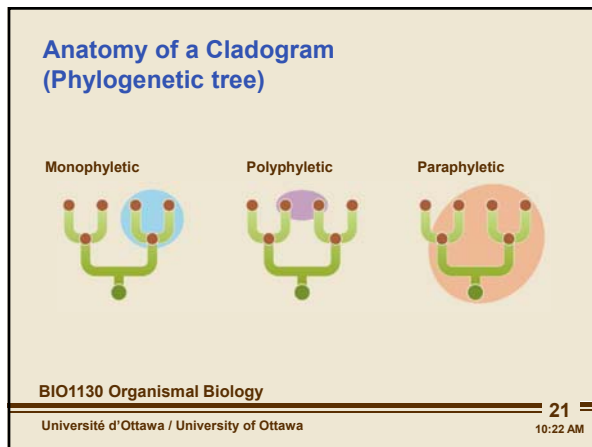
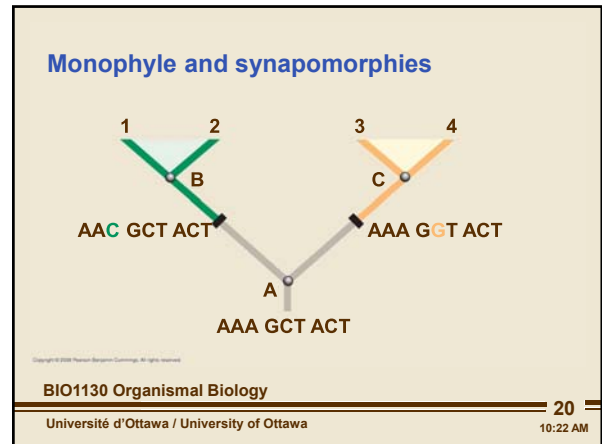
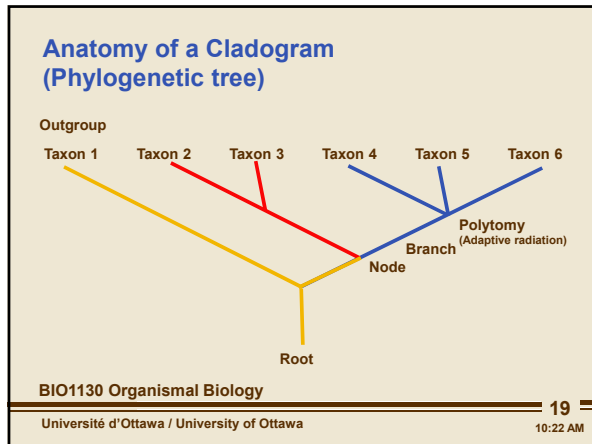
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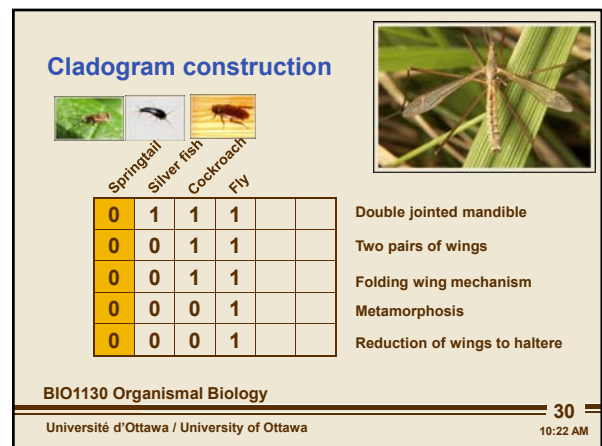
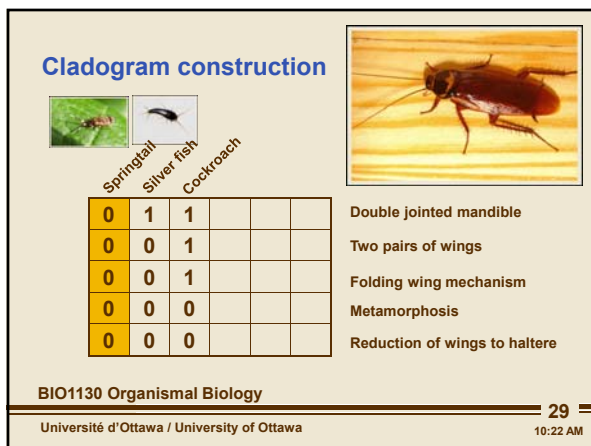
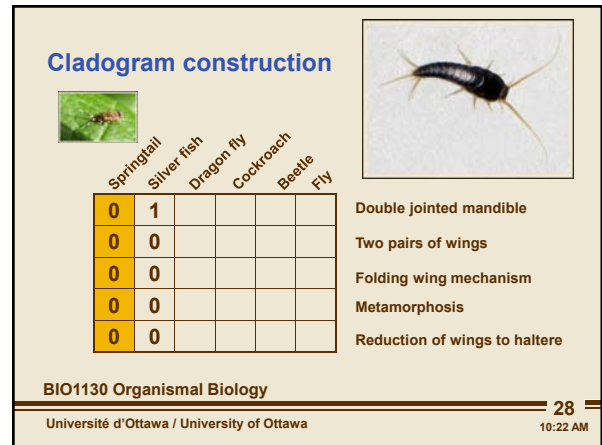
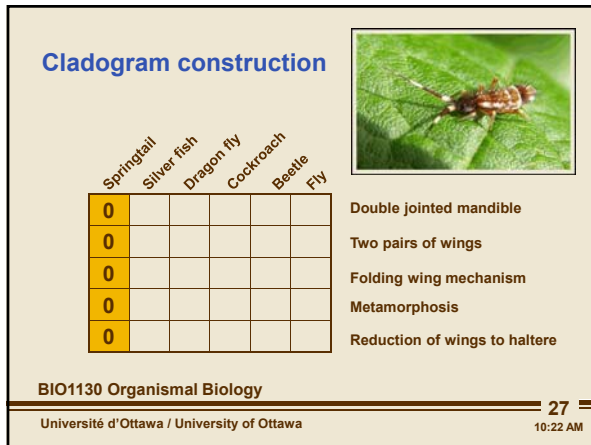
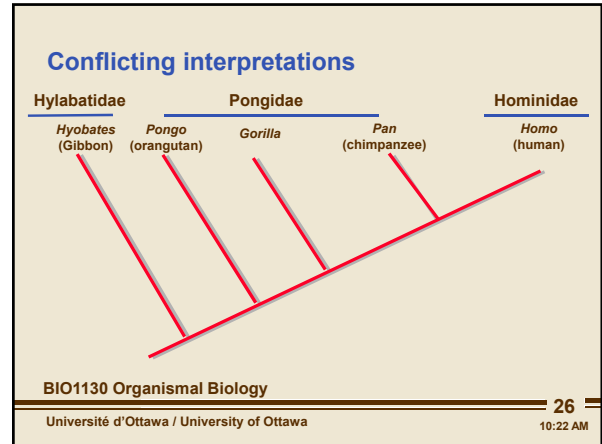
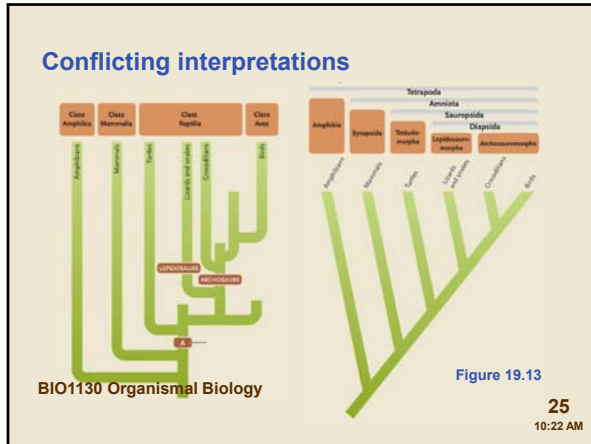
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Cladogram construction

0	1	1	1	1	
0	0	1	1	1	
0	0	1	1	0	
0	0	0	1	0	
0	0	0	1	0	

- Double jointed mandible
- Two pairs of wings
- Folding wing mechanism
- Metamorphosis
- Reduction of wings to haltere

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Cladogram construction

0	1	1	1	1	1
0	0	1	1	1	1
0	0	1	1	0	1
0	0	0	1	0	1
0	0	0	1	0	0

- Double jointed mandible
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Cladogram construction

A	0	1	1	1	1	1
B	0	0	1	1	1	1
C	0	0	0	1	1	1
D	0	0	0	0	1	1
E	0	0	0	0	0	1

- A - Double jointed mandible
- B - Two pairs of wings
- C - Folding wing mechanism
- D - Metamorphosis
- E - Reduction of wings to haltere

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Parsimony – The KISS principle

Two changes

Four changes

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Parsimony – The KISS principle

Species I Species II Species III

Three phylogenetic hypotheses:

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Parsimony – The KISS principle

	Site	1	2	3	4
Species I		C	T	A	T
Species II		C	T	T	C
Species III		A	G	A	C
Ancestral sequence		A	G	T	T

6 events 7 events 7 events

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