

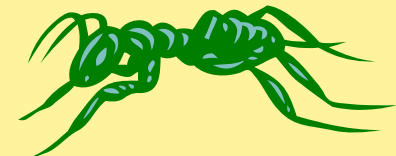
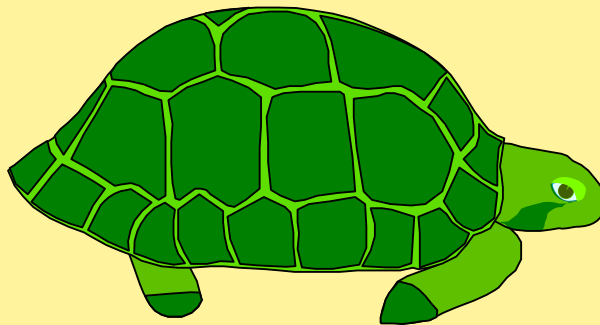
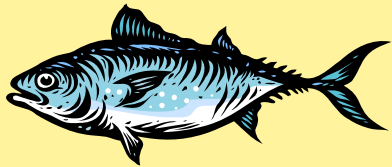
Bioinformatics CSM17

Week 4: Evolutionary systems

- Evolution and phylogeny
- Historical systems
- Modern methods
- Tools and software

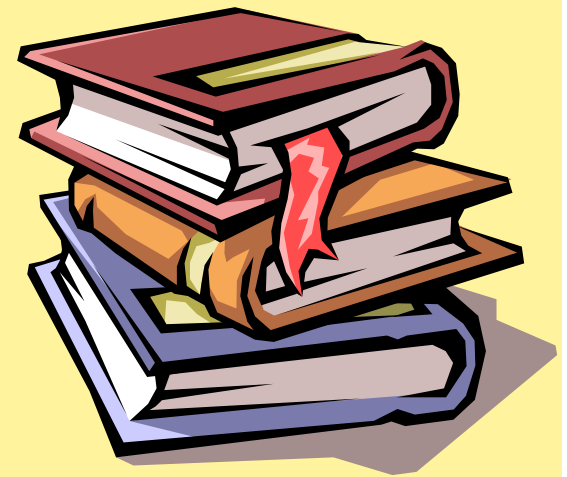
Evolution and phylogeny

- definition of terms
- what is phylogeny?
- what is evolution?



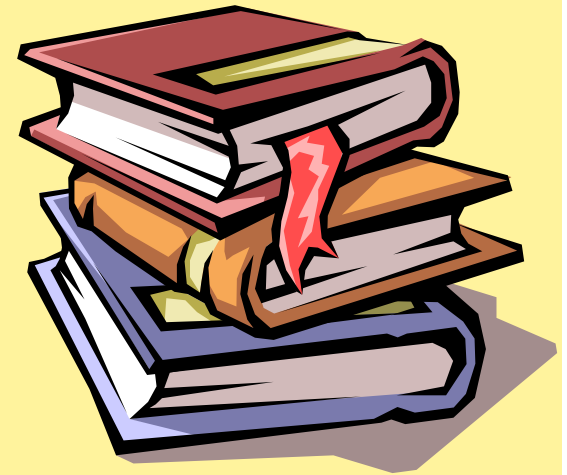
Historical systems

- Charles Darwin
- Cronquist (plants)
- Mostly phenotypic characters



Historical systems

- Charles Darwin
- The voyage of the Beagle
- The Galapagos Islands
- *The Origin of Species* (1859)



Modern methods

- Cladistics
- Willi Hennig (1950, 1966)
- Phylogenetic systematics

Cladistics principles

- clades
- convergence (homoplasy)
- parallelism
- apomorphy and synapomorphy
- plesiomorphy and symplesiomorphy

- has 4 main Axioms (assumptions, premises)

Cladistics axiom #1

- Nature's hierarchy can be represented by a branching diagram
- Cladograms
- Monophyly

Cladistics axiom #2

- Characters change status at different hierarchical levels. Those present in all members of the group, or have a wider distribution than the group cannot indicate relationships within the group
- Outgroup(s)

Cladistics axiom #3

- Character congruence is the decisive criterion for distinguishing homology from non-homology

Cladistics axiom #4

- The principle of parsimony maximises character congruence
- Occam's Razor - the simplest is best

Cladistics terms

- apomorphy (advanced, derived)
- synapomorphy (shared and advanced)
- plesiomorphy (primitive, ancestral)
- symplesiomorphy (shared and ancestral)

Tools and software

- HENNIG86 (Farris, 1988)
- PAUP (Swofford, 1983)
- PHYLIP (Felsenstein, 1985)
- MacClade (Maddison & Maddison, 1987)

HENNIG86

- The first!
- Willi Hennig
- Characters polarised before cladogram construction



PAUP

(Phylogenetic Analysis Using Parsimony)

- Swofford (1983)
- widely used on Mac
- also available for PC (Beta test version)
- costs money...

PHYLIP

- by Joe Felsenstein (Univ. Washington)
- produced in 1985
- for a number of platforms (incl. PC)
- FREE! (by download)

PARS

- A *Parsimony* method
- Wagner parsimony

Useful Websites

- PHYLIP

<http://evolution.genetics.washington.edu/phylip.html>

- PAUP

<http://paup.csit.fsu.edu/>

- HENNIG Society:

<http://www.cladistics.org/education.html>

- TREE OF LIFE

<http://tolweb.org/tree/phylogeny.html>

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