

ORGANIZATION OF BIOLOGICAL SYSTEMS I

Subparticles – protons, neutrons, electrons

Atoms – carbon, hydrogen, oxygen

Simple molecules – amino acid, nucleotide

Complex molecules – protein, nucleic acid

Organelles – nucleus, mitochondria

Cells – neuron, vessel element

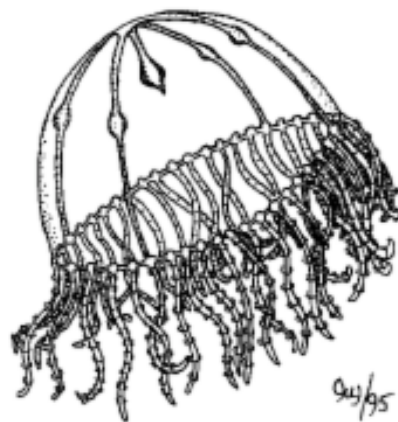
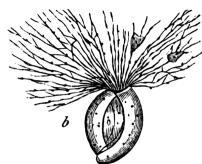
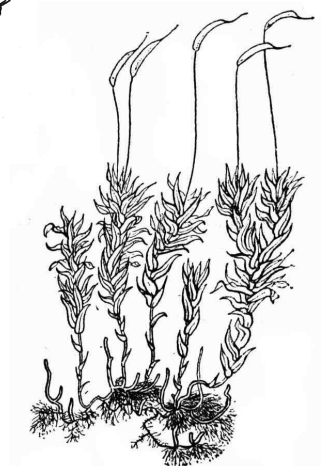
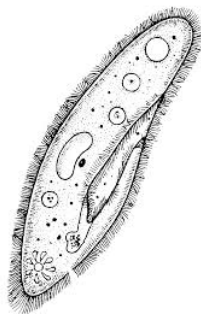
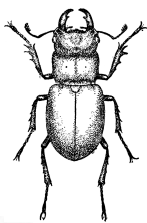
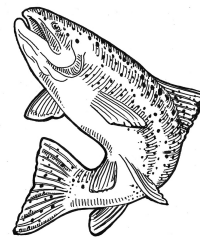
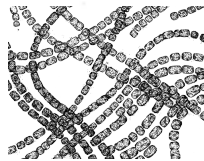
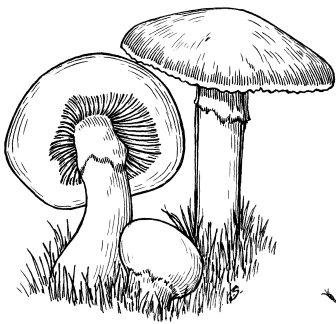
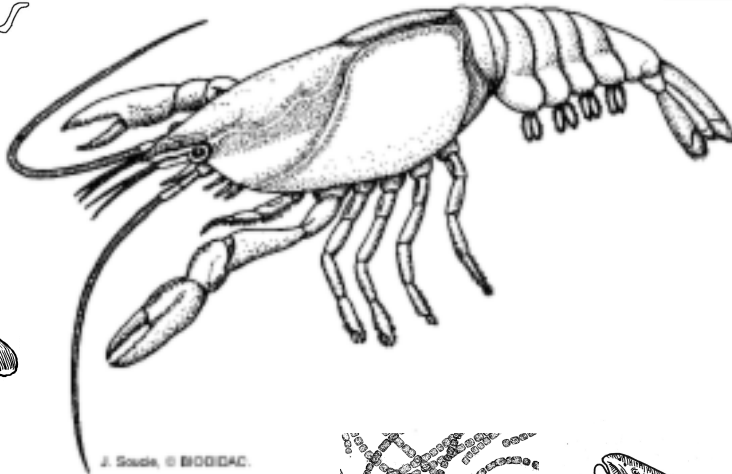
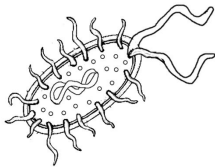
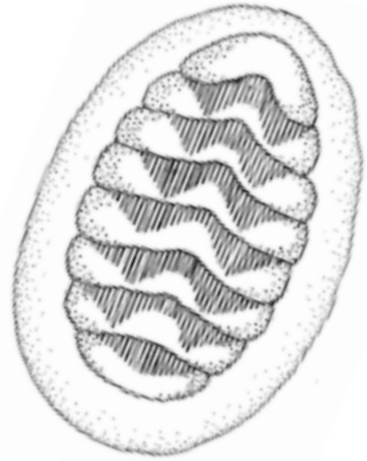
Tissues – nervous, muscular, xylem

Organs – stomach, skin, leaf

Organ systems – digestive, reproductive

Individuals – person, dandelion

BIOLOGICAL DIVERSITY!



CONCEPTS OF CLASSIFICATION

I. General Concepts:

A. What is classification?

B. Why do we classify things?

II. Organismal classification:

A. In biology, we are confronted by a huge array of organisms.

B. When we classify organisms, we want to produce taxa based on characters.

1. Taxa:

2. Characters:

C. The strategy is to maximize predictivity.

1. Definition

2. Example

3. High predictivity is attained by looking for correlated characters.

D. In classification, one must distinguish between characters and character states.

1. Characters
2. Character states

E. Diagnostic characters:

1. Definition
2. Diagnostic characters are based on two criteria:
 - a. Constancy-
 - b. Facility-

F. Two categories of characters

1. Qualitative -
2. Quantitative -

III. Five Historical Approaches to Organismal Classification

A. Practicality -

B. Relationship to deity -

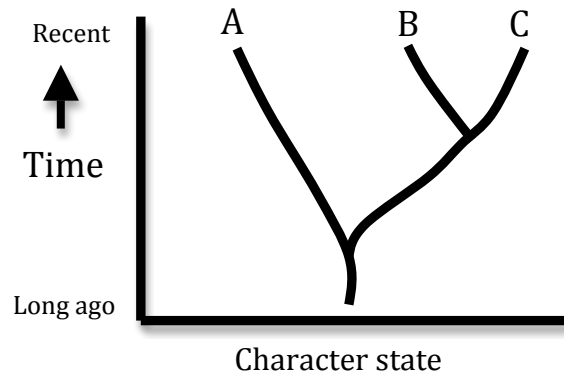
C. Artificial system -

D. Natural system -

E. Phylogenetic classification -

CONCEPTS OF PHYLOGENETIC CLASSIFICATION

Basic idea - Classification should reflect patterns of evolutionary divergence. Taxa that diverged recently should be grouped together. Those that diverged a long time ago should be placed in separate categories.



An important tenet of phylogenetic classification is that all taxa are monophyletic.

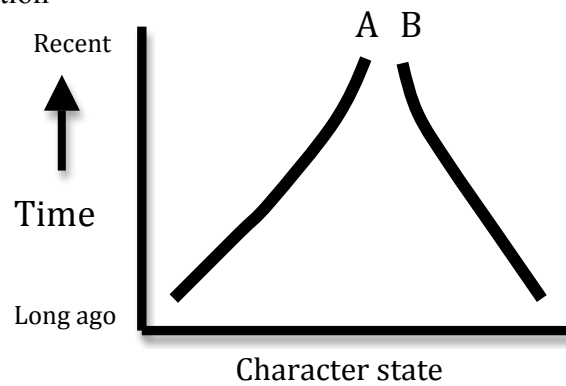
Taxa comprised of members that can be traced back to different ancestors are called polyphyletic.

What evidence do we need to best construct a phylogenetic classification?

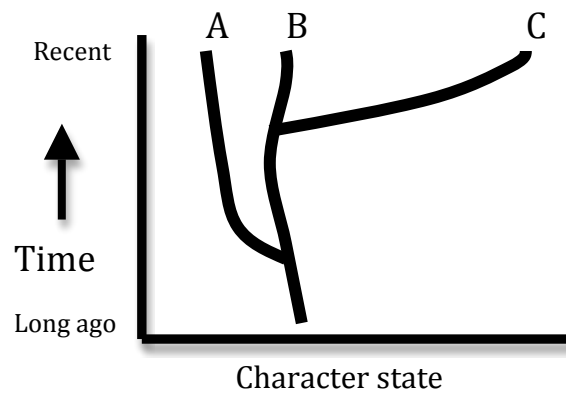
If that evidence is lacking, we let phenetics infer phylogenetics.

The assumption that phenetics can infer phylogenetics can be invalid if we have convergent evolution, or differing rates of evolution.

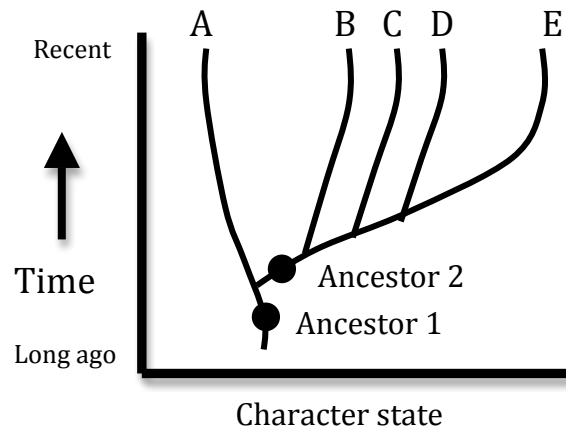
Convergent evolution



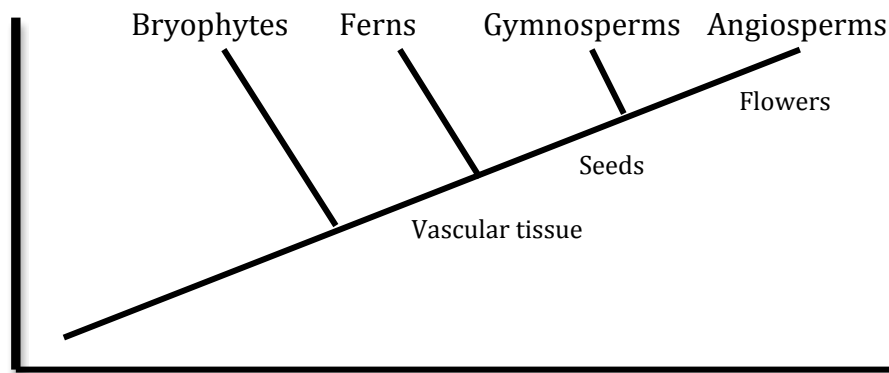
Differing rates of evolution



Want to avoid paraphyletic classification



An important approach to phylogenetic classification is the use of cladistics. Look at a wide range of characters and determine which are primitive, and which are advanced (derived). Get a cladogram.



Important concepts of cladistics

Outgroup – Closely related taxon that is not in a group being examined. Use as a basis to determine ancestral features. All taxa in a group are aligned relative to the outgroup.

Clade – Group of organisms that share a derived character.

Apomorphy – Derived character found in a taxon

Synapomorphy – Derived character shared by all members of a clade.