

General Botany Study Guide – Laboratory Format Chapter 24

BIO 134 Dr. Silvius PLANT ORIGINS and CLASSIFICATION

INTRODUCTION: You may not remember when you first discovered that the “green world” around you was composed of “plants” of different “kinds” which you could distinguish by their shapes or flower color. Now, at the university level you are about to see that this “green world” still challenges botanists to “divide the green matter” morphologically, or genetically into different “species” or “kinds” or whatever name you apply to the grouping.

PROCEDURE: Review your Study Guide and notes; add any new insights. Fill gaps in lecture notes from recollection or by referring to your text. Then, proceed as follows:

1. Skim over the "Study Outline" for Chapter 24, next page, and note major points.
2. Read Chapter 24 with emphasis on fleshing out your understanding of these points. Then review the “Study Outline” and make notes where appropriate.
3. Answer the discussion question below to the best of your ability and post your contribution of thoughts on the WebCT discussion area assigned for your group.
4. Please come to laboratory tomorrow prepared to share input to the class as a whole.

THEMES: Postulates and Presuppositions of Evolution, Difficulty finding a “Natural Classification”

LECTURE DISCUSSION QUESTIONS: Use the “Study Outline” as a resource along with your text to answer the following questions. See WebCT for discussion area. Bring notes to lab ready to discuss.

1. Extrapolating from Microevolution to Macroevolution:

List as many diverse groups of animals and plants that have wings or wing-like morphology as you can.

a. How does the supposed evolution of the wing as a new structure in a population pose problems for the “Theory of Descent with Modification by Natural Selection?” See link to *Darwin’s Black Box*

b. How does your list of different winged species pose an additional problem with respect to the supposed phylogenetic arrangement of species based upon postulates #1 and #6, Table 22.1?

c. How would you account for the wing in your list of organisms from a “Creation by Design” view?

I. AIMS OF TAXONOMY:

A. DESCRIBING and NAMING Species --> Essential to communication and information retrieval

1. "New world" discovery produced a host of new species, hence....
2. Need for organized system
3. LINNAEUS (1753) - *Species Plantarum*
 - a. Included Latin *phrase names*, with *binomial* name in margin
 - b. Many of these names still accepted by *Intern. Code of Bot. Nomenclature*

B. CLASSIFICATION -- GROUPING RELATED SPECIES INTO GENERA, etc.

>> Why is it helpful to group species ?

II. TYPES OF CLASSIFICATION

A. **A** _____ -- based upon easily recognized plant characteristics

1. Example: popular field guides use number of flower parts or color
2. Benefits: Convenience, ease of usage by amateurs

B. **N** _____ -- classifies species based on presuppositions about origins

1. Created "kinds" (Gen. 1:11-27) -- Linnaeus (1753) and John Ray saw species as fixed entities, with limits to biological change outside of "kinds"
2. Phylogenetic Classification -- Bessey (1915) *et.al.* -- sought to form groups (taxa) to portray lines of evolutionary descent (Fig 22.7)
3. Cladistics - arrangement of species or higher taxa in *cladograms* based upon closeness of *shared-derived character states* rather than phylogenetic trees based upon supposed primitive transitional forms

QUOTE*: Cladistics, which is, of course, an anathema to new-Darwinians, is favored by those who prefer not to transcend the observable data in their theorizing to "speculate" about genealogical relationships.
 -- D. Oldroyd (1986) *Biology and Philosophy* Vol. 1:133. Proponent of evolution who raises serious questions; taken from W.R. Bird's articles in *Creation Res. Soc. Quarterly* 25 (1988): 28-35 and 74-81.

4. TWO VIEWS OF CLADISTICS – Compare your Text (Moore, *et.al.*) with Colin Patterson (1982):

CLADOGRAM FEATURE	Cladistic Approach	Phylogenetic
Reference supporting each:	Colin Patterson (<i>New Scient.</i> 1982)	Moore, <i>et.al.</i> , <i>Botany</i>
Purpose of Cladogram:	Show Pattern of Characters	<u>plus</u> aims to show Process, Descent
Nodes	Shared Characters	Divergence. betw. 2 lines of evol.
Forks and Lines	Immaterial	Common Ancestor
Evidence for Relatedness	Shared-derived characters only	Shared-primitive, too

EXAMPLE: Anthocyanin and betalain pigment appearance in seed plants-- which is primitive and which is the derived character state? See text, pages 582-585

III. CONFUSION IN MODERN CLASSIFICATION -- Unanswered questions:

- A. What are PRIMITIVE CHARACTERS and what are ADVANCED (DERIVED)?
- > EXAMPLE: Anthocyanin pigment *versus* betalain pigment -- which is primitive?
 - > Arrangements in "phylogenetic tree" depend upon one's interpretation (subjective)
- B. Which characters are *homologous* (derived from common ancestor) and which are *convergent* (characters similar but found in groups perceived as distant from each other phylogenetically)
- > EXAMPLE: Succulent stems in cacti and in some euphorbias.

IV. REASONS FOR THE CONFUSION IN PLANT CLASSIFICATION:

- A. Fossil Record lacks *transitional forms* necessary to support alleged phylogenetic sequences

QUOTE: *Evolutionary relationships were hypothesized first from the remains found in the fossil record and later from the comparative data of both living and extinct organisms. The fossil record in almost all cases was very incomplete and inconclusive. Paleontologists hoped that a logical progression could be found throughout the fossil history of a group, but this was rarely the case. ...the resulting diagrams and evolutionary "trees" and "bushes" explaining the relationships between the higher taxonomic levels are therefore largely speculative and subject to variation with the biases of the individual biologist who postulates them.* Woodland, D.W. 2000. *Plant Systematics*, 3rd ed. Andrews U. Press, Barrien Springs, MI.

- B. Therefore, selection of *character traits* and evaluation of their importance is often SUBJECTIVE.

QUOTE: *Nearly all biologists must share, the species is the only taxonomic category that has at least in more favorable examples a completely objective basis. Higher categories are all more or less a matter of opinion.* -- O. Richards. 1970. *Science* 167: 1477. Note: Richards is a proponent of evolution who raises serious questions.

Question: What is your position concerning support for macroevolution by the fossil record?

V. HOW DO CREATIONISTS VIEW:

1. PRIMITIVE *versus* ADVANCED character traits:
2. APPARENT LACK OF TRANSITIONAL FORMS
3. HOMOLOGY –
4. CONVERGENCE –

General Botany Laboratory Exercise**Resource: Chapter 24 and Reading****BIO 134****Dr. Silvius****ORIGINS and CLASSIFICATION**

PROCEDURE: This page is intended as a follow-up to your study of Chapter 24 prior to the laboratory experience. No pre-lab assignment is required from this page; simply bring it with you when you come to lab.

THEME: Presuppositions and postulates of origins; benefits and challenges of plant naming and classification

DISCUSSION QUESTIONS:

The general theory of evolution proposes that all modern species are descendants of a common ancestor. From an evolution perspective, one could then attempt to arrange Botwannaland species represented in your collection into a "phylogenetic tree". Use this line of reasoning to answer the following questions:

1. What criteria did you use to classify Botwannaland species? Which of these are used by taxonomists?

2. Which Botwannaland species are most closely related, evolutionarily (phylogenetically) speaking? Most distantly related? State the postulate of *evolution* that is used to develop phylogenies.

3. What empirical evidence would be necessary to verify your "hypothesis" regarding closeness of relationship (#2)?

4. Compare two supposedly "closely related" species with respect to their relative fitness to survive and reproduce. What information is needed?

5. Refer to the section on "Cladistics" in the text assignment and sketch out a *cladogram* for three or four of the Botwannaland species--*e.g.* those I have named *Metacylindrus*, *Plasticylindrus* (all screws and nail). NOTE: You must address which species have "primitive" and which have "derived" *character states*. Explain how you would determine this. Use reverse side or separate page.

6. **SUMMARIZE:** State in your own words the most fundamental postulate (presupposition) of the general theory of evolution. Then, state inferences that are based upon this presupposition and used to position each group (taxon) on a phylogenetic "tree". What problems arise from this line of reasoning? Does your text admit to the problems?

ABBREVIATED TAXONOMIC CLASSIFICATION

KINGDOM MONERA

Subkingdom ARCHAEABACTERIA - "ancient" bacteria (or ARCHAEA)

Subkingdom/Division EUBACTERIA - "true" bacteria

Class Eubacteria

Class Cyanobacteria - "blue-green bacteria"

Class Prochlorobacteria (Chloroxybacteria)

KINGDOM PROTISTA

Subkingdom MYXOMYCOTA - plasmodial slime molds

Subkingdom MASTIGOMYCOTA - water molds and chytrids

Subkingdom PHYCOBIONTA -- autotrophic protists

Division PYRROPHYTA - "fire algae", dinoflagellates

Division CHRYSOPHYTA - golden algae, diatoms

Division EUGLENOPHYTA - euglenoids, green flagellates

Division RHODOPHYTA - red algae (*rhodo* = red)

Division PHAEOPHYTA - brown algae (*phaeo* = brown)

Division CHLOROPHYTA - green algae (*chloro* = green)

KINGDOM FUNGI

Division ZYGOMYCOTA - hyphae lack crosswalls

Division ASCOMYCOTA - sac, or cup fungi

Division BASIDIOMYCOTA - club fungi

Division DEUTEROMYCOTA - imperfect fungi

KINGDOM PLANTAE:

Division BRYOPHYTA - mosses and liverworts

Division PSILOTOPHYTA - whisk ferns

Division LYCOPODOPHYTA - clubmosses, spike mosses, quillworts

Division EQUISETOPHYTA - horsetails

Division PTERIDOPHYTA - ferns

Division CYCADOPHYTA - cycads

Division GINKGOPHYTA - ginkgoes

Division PINOPHYTA - conifers

Division ANTHOPHYTA - flowering plants

Class Magnoliopsida - dicots

Class Liliopsida - monocots