

# Cladistics, part 2



Reading for this topic:  
Worobey et al. 2004. Contaminated polio vaccine theory refuted. *Nature* 428: 820.

[note: when requesting this, request a color copy]

## III. Uses of Cladograms



### A. Taxonomies (Classifications)

#### 1. Revision of Existing Classification Schemes

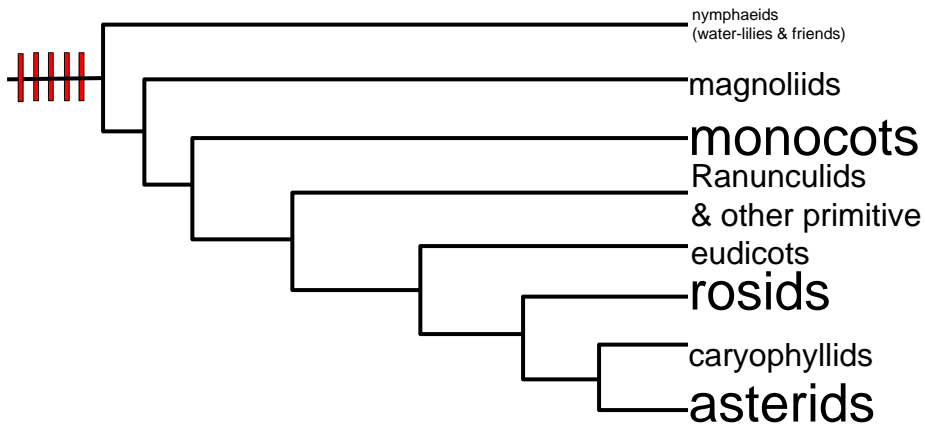
(e.g., angiosperms)

### III. Uses of Cladograms



Angiosperms are monophyletic: therefore, we could recognize as a taxon (e.g., Magnoliophyta or Magnoliopsida)

•Review synapomorphies from Taxonomic Overview lectures

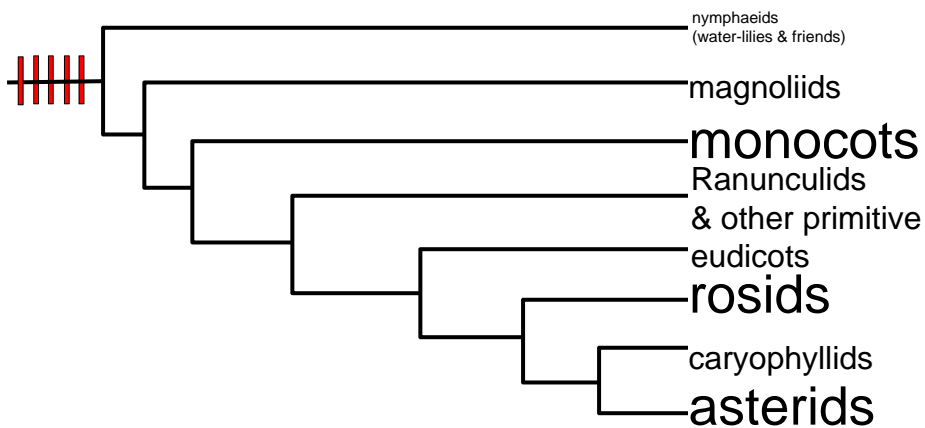


But what about classic subdivision into “monocots” & “dicots?”

e.g., Cronquist (1981)

Which of Cronquist’s classes is not monophyletic (i.e., which is paraphyletic)?

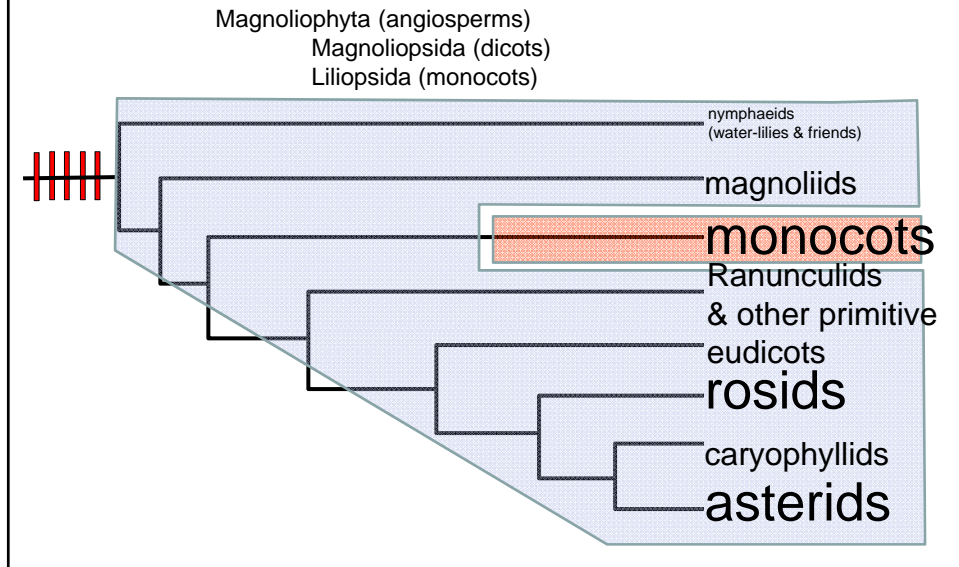
Magnoliophyta (angiosperms)  
Magnoliopsida (dicots)  
Liliopsida (monocots)



But what about classic subdivision into “monocots” & “dicots?”

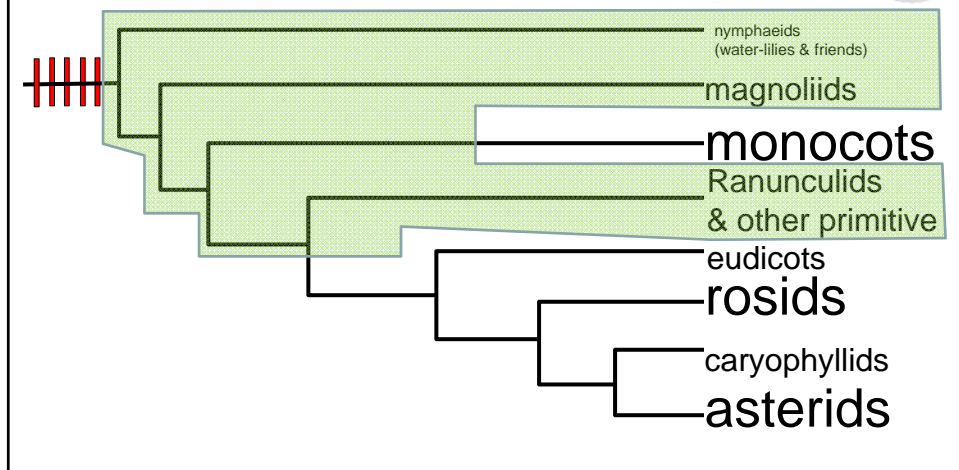
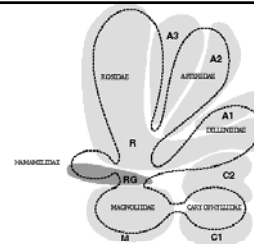
e.g., Cronquist (1981)

Which of Cronquist’s classes is not monophyletic (i.e., which is paraphyletic)?



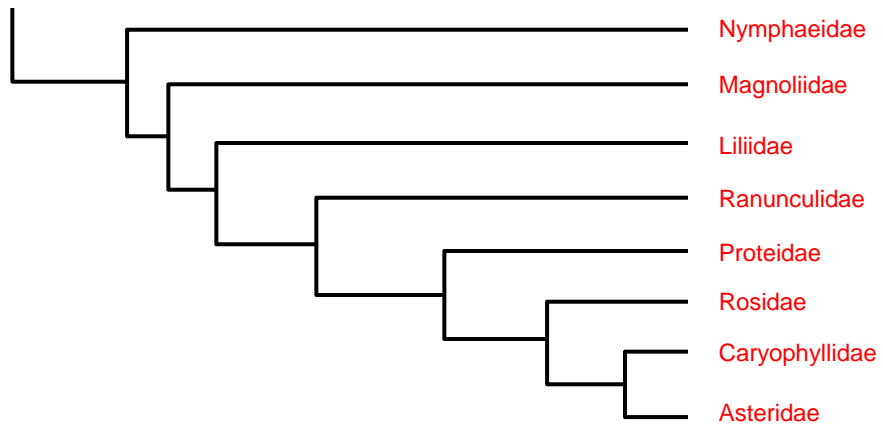
More:

Cronquist’s Magnoliidae included water-lilies,  
 Magnoliids, and some primitive eudicots.



Dr. Hardy's classifications of angiosperms:

Magnoliopsida (angiosperms)  
Various monophyletic subclasses.



### III. Uses of Cladograms



#### A. Taxonomies (Classifications)

##### 2. Construction of new classification schemes

(e.g., cycads)

The Cycad Pages - Windows Internet Explorer

http://plantnet.rbg.gov.au/PlantNet/cycad/ident.html

The Cycad Pages


## The Cycad Pages

### Cycad Identification

The cycads are members of an ancient and very distinct natural group botanically known as the *Cycadophyta* or *Cycadales*. This group has been divided into three families and 11 genera. A key distinguishing families and genera is at the foot of this page, and each family and genus has its separate home page. Each genus page has links for all accepted species in that genus and keys to identify them. [Evolution](#) and [distribution](#) are discussed on other separate pages. You can also search the [World List of Cycads](#) for any cycad name.

#### Cycad classification

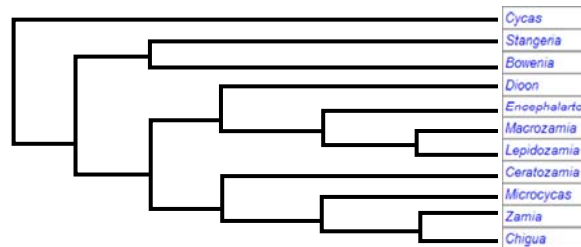
The following detailed classification (from [Stevenson 1992](#)) aims to accurately reflect inferred evolutionary relationships among the living cycads.



*Cycas californiana* Photo Ken Hill

Order	Suborder	Family	Subfamily	Tribe	Subtribe	Genus	
Cycadales	Cycadineae	Cycadaceae					<i>Cycas</i>
			Stangeriaceae	Stangerioideae			<i>Stangeria</i>
				Bowenioidaeae			<i>Bowenia</i>
	Zamiineae	Zamiaceae	Encephalartoideae	Diooeae			<i>Dioon</i>
					Encephalartinae		
				Encephalarteae			<i>Macrozamia</i>
					Macrozamiinae		
			Zamioideae	Ceratozamiiae			<i>Ceratozamia</i>
					Microcycadinae		
				Zamieae			<i>Zamia</i>
					Zamiinae		

1. Most parsimonious cladogram from Stevenson (1992).



2. Classification based on cladogram.

Order	Suborder	Family	Subfamily	Tribe	Subtribe	Genus	
Cycadales	Cycadineae	Cycadaceae					<i>Cycas</i>
			Stangeriaceae	Stangerioideae			<i>Stangeria</i>
				Bowenioidaeae			<i>Bowenia</i>
	Zamiineae	Zamiaceae	Encephalartoideae	Diooeae			<i>Dioon</i>
					Encephalartinae		
				Encephalarteae			<i>Macrozamia</i>
					Macrozamiinae		
			Zamioideae	Ceratozamiiae			<i>Ceratozamia</i>
					Microcycadinae		
				Zamieae			<i>Zamia</i>
					Zamiinae		

### III. Uses of Cladograms



#### A. Taxonomies (Classifications)

#### 3. How to recognize new taxa within existing shemes

(e.g., spiderworts)

e.g., recognition of new genus, *Plowmanianthus*, in Commelinaceae (2004).

#### Timeline:

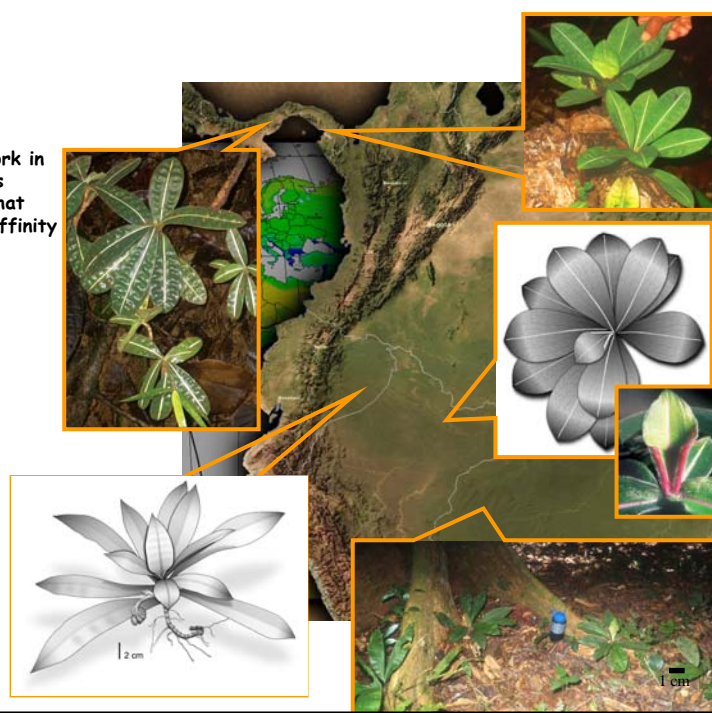
1. 1976 - Strange Commelinaceae discovered at Field Museum Herbarium- were misplaced in Gesneriaceae indet folders
2. Herbarium search turns up several more
3. Ca. 1980 - Tim Plowman returns from S America w/ living plant
4. C-some counts, flower point to relationship with *Cochlostema* ...



Timeline (Continued):

5. 1995-2001: Fieldwork in S America reveals new discoveries that further support affinity w/ *Cochliostema*.

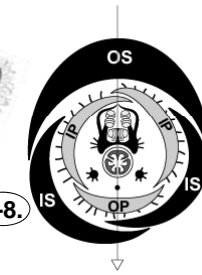
...



**Summary of Biogeography & character states uniting & differentiating *Cochliostema* and these new undescribed species.**

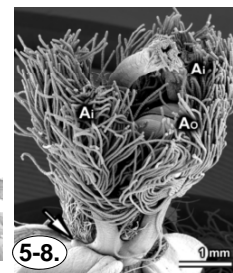
***Cochliostema***

1. NW South America.
2. n = 19.
3. Epiphytic in trees.
4. Fringed petals.
5. Reduction to 3 stamens.
6. Filaments basally fused.
7. Anthers concealed by fused filament hairs.
8. Anthers spirally coiled.



**Undescribed spp.**

1. NW South America.
2. n=19.
3. Semi-terrestrial: rooting only in leaf litter.
4. Fringed petals.
5. Reduction to 3 stamens.
6. Filaments basally fused.
7. Anthers concealed by unfused filament hairs.
8. Anthers strongly curved, but not spirally coiled.

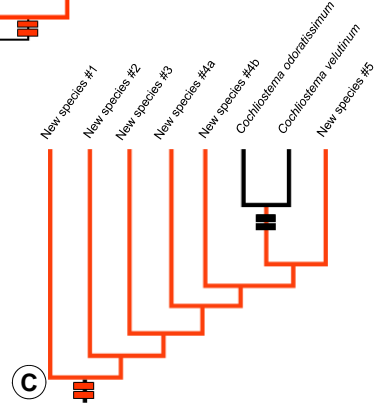
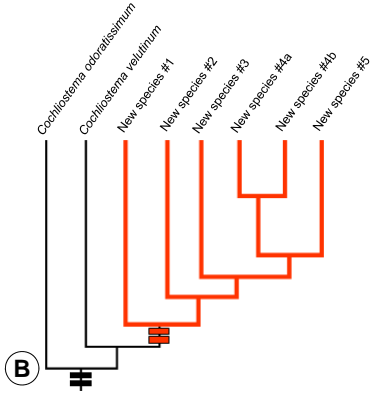
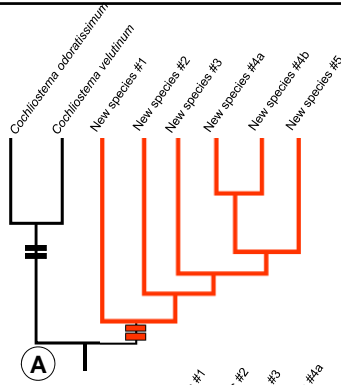


Cladistic analysis of Hardy (2001) provided support for the recognition of two genera, with the undescribed species comprising the second genus, *Plowmanianthus*.

Which of the following three cladograms match the one obtained by Hardy?

Hint: remember Hennig's principle that only monophyletic groups should be named.

Hint 2: Hennig said that clades (and taxa) are recognized based on synapomorphies, not symplesiomorphies.



### III. Uses of Cladograms



#### B. Disease Origins & Disease Forensics



## HIV origins

Table 1. A comparison of species (strains) of Human Immunodeficiency Virus (HIV).

Species	Virulence	Transmittability	Prevalence	Purported origin
HIV-1	High	High	Global	Common Chimp
HIV-2	Lower	Low	West Africa	Sooty Mangabey

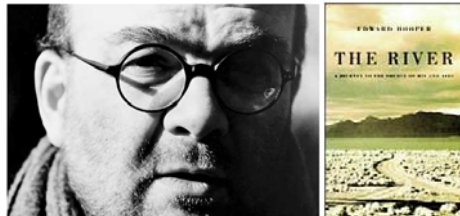
## e.g., HIV origins

1992: *Rolling Stone*, Tom Curtis:  
HIV-1 (human immunodeficiency virus type 1) may have jumped into humans via OPV

- Chimps have related Simian IV (SIVcpz)
- Human HIV is clearly derived from SIVcpz
- Certain population of chimps in DR Congo were allegedly used to prepare OPV by Hilary Koprowski in the 1950's.
- Rolling stone retracts story.

1999: "*The River: A Journey to the Source of HIV and AIDS*" by Edward Hooper.

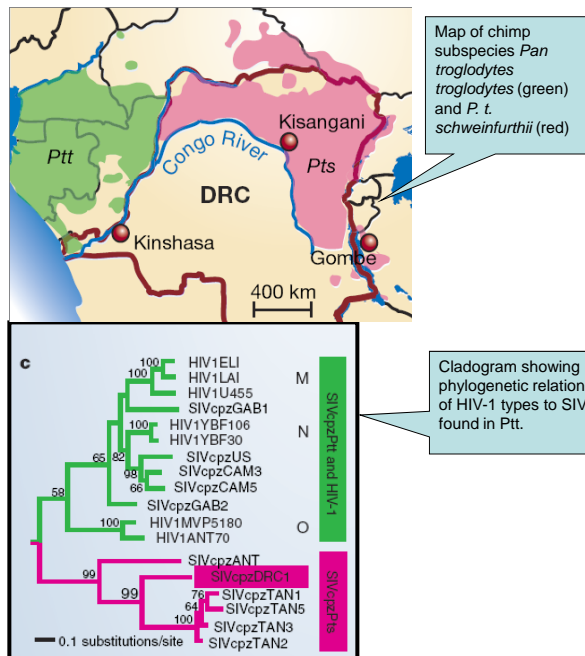
- 7 yrs journalistic research.
- His conclusion: "Good" evidence for OPV-origin.
- <http://www.aidsorigins.com/>



Map of the Democratic Republic of the Congo



Worobey et al. 2004. Contaminated polio vaccine theory refuted. *Nature* 428: 820.



HIV transmission (disease forensics)

## Molecular Epidemiology of HIV Transmission in a Dental Practice

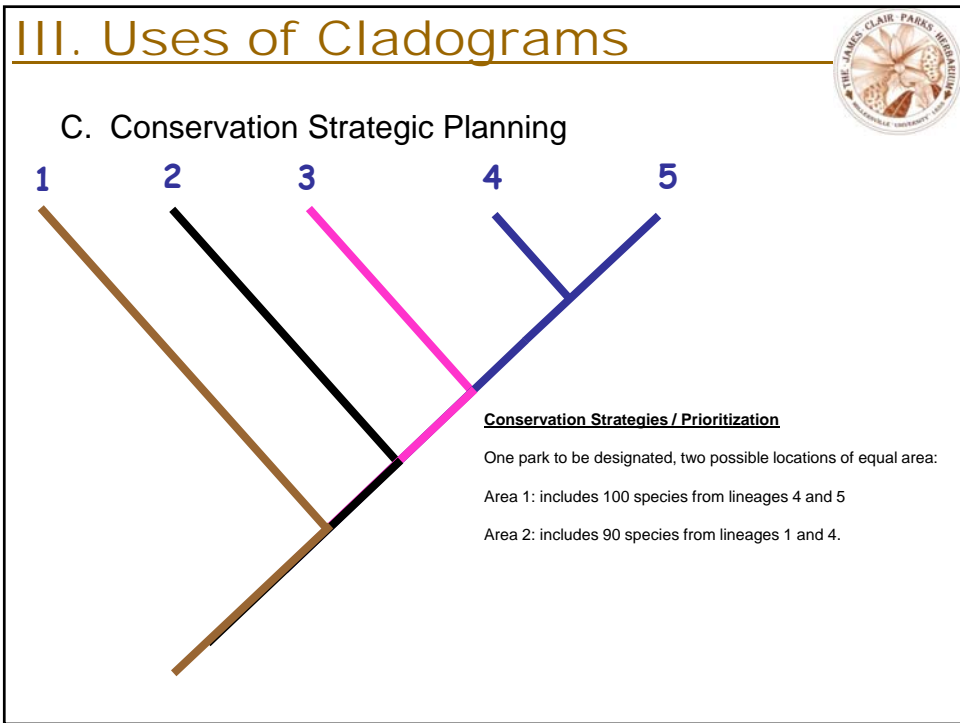
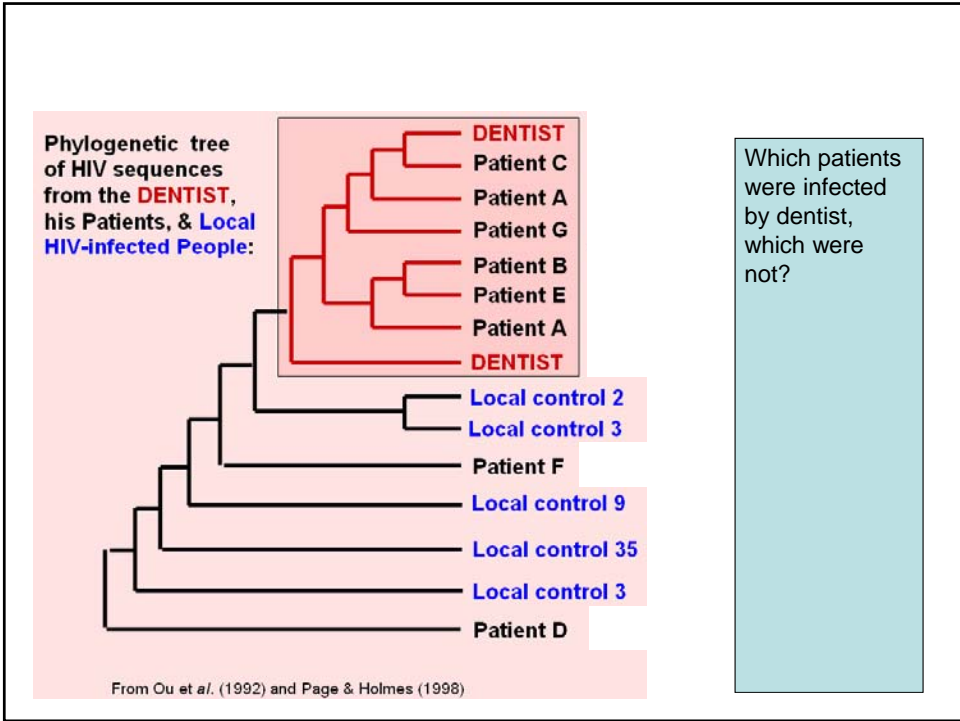
Chin-Yih Ou, Carol A. Ciesielski, Gerald Myers, Claudiu I. Bandea, Chi-Cheng Luo, Bette T. M. Korber, James I. Mullins, Gerald Schochetman, Ruth L. Berkelman, A. Nikki Economou, John J. Witte, Lawrence J. Furman, Glen A. Satten, Kersti A. MacInnes, James W. Curran, Harold W. Jaffe, Laboratory Investigation Group,\* Epidemiologic Investigation Group†

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### CDC Teams Up with Systematists:

- 1990's: Florida dentist was suspected of transmitting HIV to several of his patients.
- Several of his patients were indeed infected, but some had other risk factors as well.
- Conclusions?

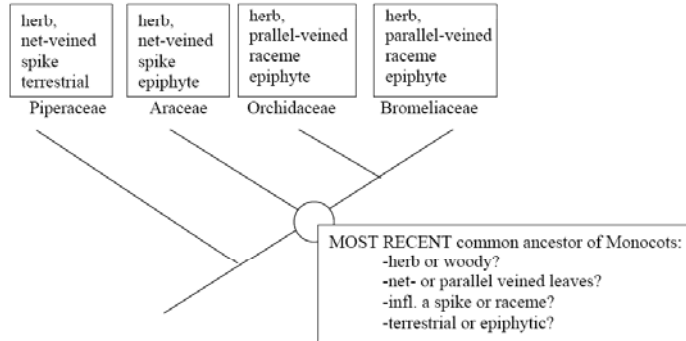


### III. Uses of Cladograms



#### D. Ancestor Reconstruction

34. Based on the following cladogram and the principle of parsimony, infer the morphology of the MOST RECENT common ancestor of monocots.



- a. an epiphytic shrub with net-veined leaves and a raceme for an inflorescence.
- b. an epiphytic herb with net-veined leaves and spike inflorescences.
- c. a terrestrial herb with net-veined leaves and raceme inflorescences.

### III. Uses of Cladograms



#### E. Testing Adaptational Hypotheses



*Euphorbia* (Euphorbiaceae)



*Cereus* (Cactaceae)

