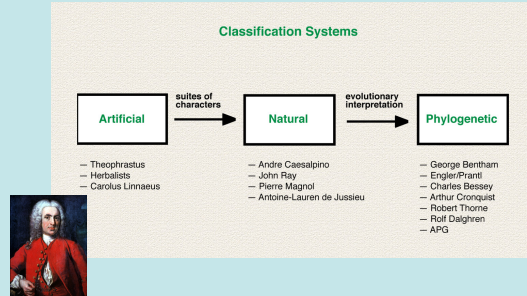


Magnoliophyta - Flowering Plant Classification

The shift from “**artificial**” systems of classification to “**natural**” systems basically involved the departure away from reliance on a single or few characters used to “pigeon-hole” a plant (e.g., habit, medicinal property, # of stamens). Instead, large numbers - or “**suites**” - of characters were later used.



Magnoliophyta - Flowering Plant Classification



This switch from artificial to natural systems of classification was aided by a fad in the 18th and 19th centuries - laying out botanical gardens to reflect the current classification scheme in vogue.

Shown here is the famous Linnaean Gardens in Uppsala, Sweden, in which the plants are arranged by stamen number as in Carolus Linnaeus’ “Sexual System of Classification”

Magnoliophyta - Flowering Plant Classification

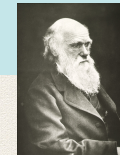
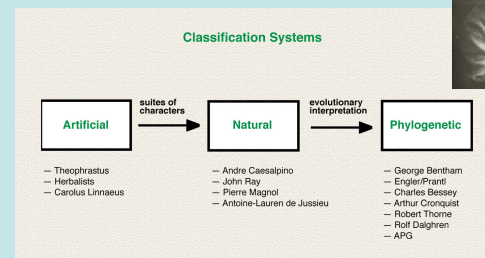


The de Jussieu family of systematists and ecologists at the Paris Herbarium experimented by replanting the species so that those most “similar” looking on the basis of many features would be in proximity.

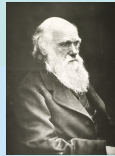
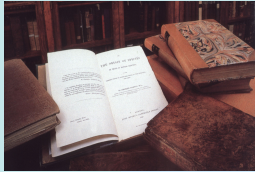
Antoine de Jussieu later developed the first “natural” system of classification of flowering plants - aspects of which are still in use today.

Magnoliophyta - Flowering Plant Classification

The shift from “**natural**” systems of classification to “**phylogenetic**” systems required the concept from Charles Darwin that organisms are tied together by genealogical descent - one of the two basic evolutionary paradigms.



Magnoliophyta - Flowering Plant Classification

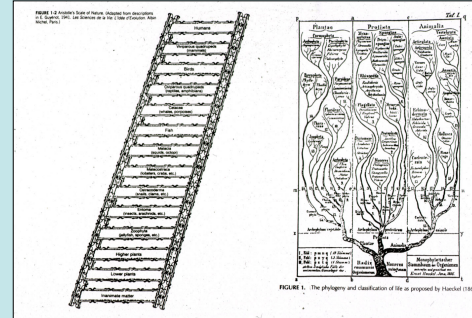


Darwin himself never uses the word "evolution" in *Origin of Species*.

He calls the process "descent with modification".

Magnoliophyta - Flowering Plant Classification

It is important to realize that evolution predicts a "tree"- like pattern to life; not the Greek "ladder of life" pattern. This confusion is the basis of a lot miscommunication in the "evolution-creationist" debate.



Magnoliophyta - Flowering Plant Classification



Adolf Engler
(1844-1930)



Karl Prantl
(1849-1893)

First truly **phylogenetic** system of classification for flowering plants was put forward at the turn of the 20th century by the German botanists Engler and Prantl.

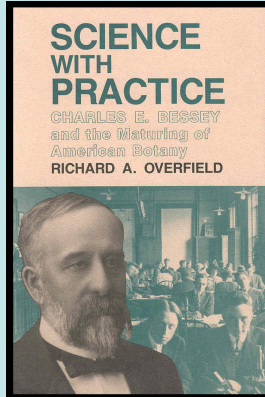
Magnoliophyta - Flowering Plant Classification



First truly **phylogenetic** system of classification for flowering plants was put forward at the turn of the 20th century by the German botanists Engler and Prantl.

They stressed that "simple" flowers - that is with few or no parts - were "primitive". Thus, their system can be called "**Salix (willows) primitive**".

Magnoliophyta - Flowering Plant Classification

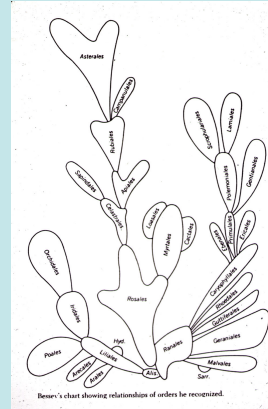


Charles Bessey, early 20th century botanist from University of Nebraska, revolutionized plant classification when he published rules - **Bessey's dicta** - to determine if plants were primitive or advanced.

His **four main rules** were:

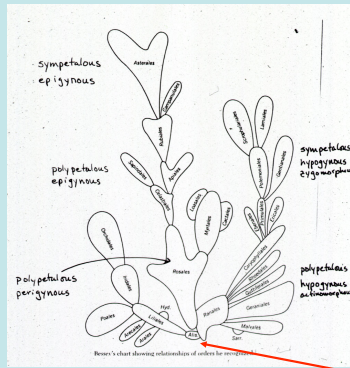
1. Many parts is primitive; reduction in parts is advanced
3. Actinomorphy is primitive; zygomorphy is advanced
5. Separate parts is primitive; fusion of parts is advanced
4. Hypogyny is primitive; epigyny is advanced

Magnoliophyta - Flowering Plant Classification



Bessey produced a classification system based on his rules. The orders of flowering plants were attached together to show how they were related and whether they were primitive or advanced. This chart has been called "**Bessey's cactus**".

Magnoliophyta - Flowering Plant Classification



Bessey produced a classification system based on his rules. The orders of flowering plants were attached together to show how they were related and whether they were primitive or advanced. This chart has been called "Bessey's cactus".

Shown here is an overlay of the some of his most important features and how they change as you move up the "cactus".

The order **Ranales** was considered by Bessey to represent the most primitive flowering plants.

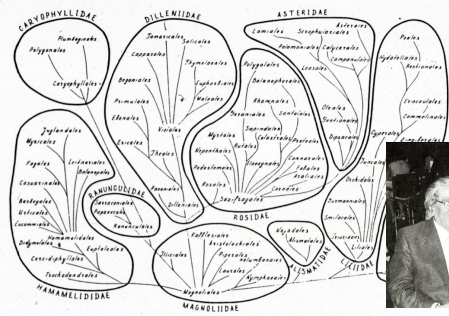
Magnoliophyta - Flowering Plant Classification

The Ranales are better known as the **Magnoliales** - the order containing the *Magnolia*. The flower has many parts in each whorl, actinomorphic, no fusion, and hypogynous. Some refer to Bessey's system as "**Magnolia primitive**".



Magnoliophyta - Flowering Plant Classification

FIGURE 11.16 "Taktajan's flower garden," which shows the putative relationships between the orders and subclasses of the flowering plants.



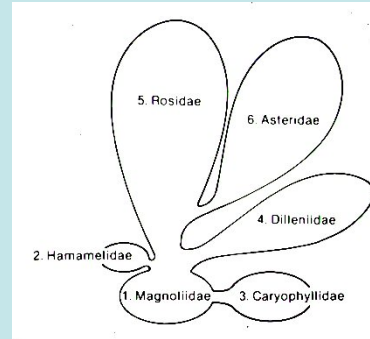
SOURCE: From Takhtajan, 1980.

Most modern systems of classification are based on Bessey's ideas - as Takhtajan's from Russia.



Takhtajan

Magnoliophyta - Flowering Plant Classification



and the late Cronquist's from the New York Botanical Garden.

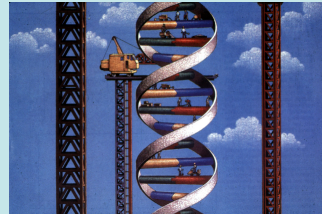


Takhtajan Cronquist

Magnoliophyta - Flowering Plant Classification

PHYLOGENETICS OF SEED PLANTS: AN ANALYSIS OF NUCLEOTIDE SEQUENCES FROM THE PLASTID GENE *trnL*

Mark W. Chase,¹ Douglas E. Soltis,² Richard G. Olmstead,³ David M. Soltis,⁴ Donald H. Les,⁵ Brent D. Mishler,⁶ Melissa R. Donnell,⁷ Robert A. Price,⁸ Harold G. Hall,⁹ Yun-Liang Qiu,¹⁰ Richard A. Bruneau,¹¹ Jeffrey A. Bragg,¹² James Smith,¹³ Jeffrey S. Burdick,¹⁴ James R. Hanken,¹⁵ Kenneth J. Syston,¹⁶ Helen J. Mickelson,¹⁷ John Raven,¹⁸ Kenneth C. Karol,¹⁹ W. Dennis Clark,²⁰ Michael Hickey,²¹ Brandon S. Geale,²² Robert E. Jensen,²³ Ki-Joung Kim,²⁴ Charles F. Rempert,²⁵ James C. Smith,²⁶ Glenn R. Kew,²⁷ Steven H. Strauss,²⁸ Qiu Yan Zhang,²⁹ Gregory M. Plunket,³⁰ Pamela S. Soltis,³¹ Susan H. Strauss,³² Stephen R. Wilton,³³ Paul A. Gleditsch,³⁴ Alexander J. Ghazanfar,³⁵ Iain E. Gibson,³⁶ Edward Gallego,³⁷ Gerald H. Sloat,³⁸ Susan W. Graham,³⁹ Spencer C. H. Barrett,⁴⁰ Scholastica Depaepe,⁴¹ and Victor A. Albert



1993 was a turning point in plant classification with the publication of the largest DNA-based phylogenetic analysis ever taken of a group of organisms.

ABSTRACT
We present the results of an exploratory preliminary analysis of DNA sequences from 175 and 499 species of seed plants representing 10 orders of flowering plants. The data are extracted from the chloroplast gene *trnL*, which has been used in previous studies to resolve relationships among angiosperms. We used two different state-independent parsimony methods to analyze the data, and the results are compared with those obtained from a state-dependent parsimony analysis. The state-independent methods generally support the same relationships, but the state-dependent method yields a different tree. The state-independent methods generally support the same relationships, but the state-dependent method yields a different tree. The state-independent methods generally support the same relationships, but the state-dependent method yields a different tree. The state-independent methods generally support the same relationships, but the state-dependent method yields a different tree.

INTRODUCTION
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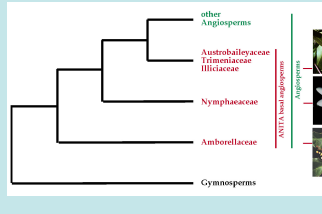
The authors acknowledge the following support: U.S. National Science Foundation (NSF) grant IBN-8906666 to M.W.C.; NSF grant IBN-9306666 to D.E.S.; NSF grant IBN-9306666 to R.G.O.; NSF grant IBN-9306666 to D.M.S.; NSF grant IBN-9306666 to D.H.L.; NSF grant IBN-9306666 to B.D.M.; NSF grant IBN-9306666 to M.R.D.; NSF grant IBN-9306666 to R.A.P.; NSF grant IBN-9306666 to H.G.H.; NSF grant IBN-9306666 to Y.-L.Q.; NSF grant IBN-9306666 to R.A.B.; NSF grant IBN-9306666 to J.A.B.; NSF grant IBN-9306666 to J.S.B.; NSF grant IBN-9306666 to J.R.H.; NSF grant IBN-9306666 to K.J.S.; NSF grant IBN-9306666 to W.D.C.; NSF grant IBN-9306666 to M.H.; NSF grant IBN-9306666 to B.S.G.; NSF grant IBN-9306666 to R.E.J.; NSF grant IBN-9306666 to C.F.R.; NSF grant IBN-9306666 to J.C.S.; NSF grant IBN-9306666 to G.R.K.; NSF grant IBN-9306666 to S.H.S.; NSF grant IBN-9306666 to Q.Y.Z.; NSF grant IBN-9306666 to G.M.P.; NSF grant IBN-9306666 to P.S.S.; NSF grant IBN-9306666 to S.H.S.; NSF grant IBN-9306666 to S.R.W.; NSF grant IBN-9306666 to P.A.G.; NSF grant IBN-9306666 to A.J.G.; NSF grant IBN-9306666 to I.E.G.; NSF grant IBN-9306666 to E.G.; NSF grant IBN-9306666 to G.H.S.; NSF grant IBN-9306666 to S.W.G.; NSF grant IBN-9306666 to S.C.H.B.; NSF grant IBN-9306666 to S.D.; NSF grant IBN-9306666 to V.A.A.

ANN. MOENT. BOT. GARD. NY 528: 580-593, 1993.

Magnoliophyta - Flowering Plant Classification

PHYLOGENETICS OF SEED PLANTS: AN ANALYSIS OF NUCLEOTIDE SEQUENCES FROM THE PLASTID GENE *trnL*

Mark W. Chase,¹ Douglas E. Soltis,² Richard G. Olmstead,³ David M. Soltis,⁴ Donald H. Les,⁵ Brent D. Mishler,⁶ Melissa R. Donnell,⁷ Robert A. Price,⁸ Harold G. Hall,⁹ Yun-Liang Qiu,¹⁰ Richard A. Bruneau,¹¹ Jeffrey A. Bragg,¹² James Smith,¹³ Jeffrey S. Burdick,¹⁴ James R. Hanken,¹⁵ Kenneth J. Syston,¹⁶ Helen J. Mickelson,¹⁷ John Raven,¹⁸ Kenneth C. Karol,¹⁹ W. Dennis Clark,²⁰ Michael Hickey,²¹ Brandon S. Geale,²² Robert E. Jensen,²³ Ki-Joung Kim,²⁴ Charles F. Rempert,²⁵ James C. Smith,²⁶ Glenn R. Kew,²⁷ Steven H. Strauss,²⁸ Qiu Yan Zhang,²⁹ Gregory M. Plunket,³⁰ Pamela S. Soltis,³¹ Susan H. Strauss,³² Stephen R. Wilton,³³ Paul A. Gleditsch,³⁴ Alexander J. Ghazanfar,³⁵ Iain E. Gibson,³⁶ Edward Gallego,³⁷ Gerald H. Sloat,³⁸ Susan W. Graham,³⁹ Spencer C. H. Barrett,⁴⁰ Scholastica Depaepe,⁴¹ and Victor A. Albert



Major surprises were uncovered including the recognition of the first diverging flowering plants - which include the water lilies.

ABSTRACT
We present the results of an exploratory preliminary analysis of DNA sequences from 175 and 499 species of seed plants representing 10 orders of flowering plants. The data are extracted from the chloroplast gene *trnL*, which has been used in previous studies to resolve relationships among angiosperms. We used two different state-independent parsimony methods to analyze the data, and the results are compared with those obtained from a state-dependent parsimony analysis. The state-independent methods generally support the same relationships, but the state-dependent method yields a different tree. The state-independent methods generally support the same relationships, but the state-dependent method yields a different tree. The state-independent methods generally support the same relationships, but the state-dependent method yields a different tree.

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