

Algal Diversity and Phylogeny Part I

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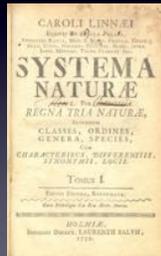
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HISTORY OF PHYCOLOGY

Prior to 1800:

- *Tsao*: with aesthetic implication in Chinese
- *Limu*: gastronomic meaning in Hawaii
- *Phykos*: seaweed for Greeks
- *Fucus*: with the Romans
- *Cochayuyo*: sushi for the Incas
- *Tecuítlatl*: spirulina for the Aztecs

•Until about 1800 algae were mostly designated with four names: *Fucus*, *Corallina*, *Ulva*, and *Conferva*



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TAXONOMY

•Algal Taxonomy is the naming, describing and classifying of algae

•Naming and Nomenclature

Principle I. Botanical nomenclature is independent of zoological and bacteriological nomenclature.

Principle II. The application of names of taxonomic groups is determined by means of nomenclatural types. Holotype, Isotype, Lectotype, & Topotype

Principle III. The nomenclature of a taxonomic group is based upon priority of publication. First come, first served; no shoes, no service!

Principle IV. Each taxonomic group with a particular circumscription, position, and rank can bear only one correct name, the earliest that is in accordance with the Rules, except in specified cases.

Principle V. Scientific names of taxonomic groups are treated as Latin regardless of their derivation.

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TAXONOMY

- Algal Taxonomy is the naming, describing and classifying of algae
- Naming and Nomenclature
- Describing and Identifying

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TAXONOMY

- Algal Taxonomy is the naming, describing and classifying of algae
- Naming and Nomenclature
- Describing and Identifying
- Classification by grouping and ranking:

Division	Chlorophyta
Class	Ulvophyceae
Order	Trentepohliales
Family	Trentepohliaceae
Genus	<i>Trentepohlia</i>
Species	<i>Trentepohlia chapmanii</i>

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TAXONOMY, SYSTEMATICS, AND PHYLOGENY

- Algal Taxonomy: the process of naming, describing and classifying algae
- Systematics: The scientific study of organismal diversity and the relationships among organisms
- Phylogeny: A hypothesis of the way in which a group of organisms is evolutionarily related

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ALGAL DIVERSITY

Number of recognized species

Cyanobacteria	2,000
Euglenoids	900
Dinoflagellates	4,000
Glaucophytes	200
Red Algae	6,000
Green algae	17,000 (mostly desmids!)
Haptophytes	300
Chrysophyceans	1,200
Yellow-greens	600
Eustigmatophyceans	12
Raphidophyceans	27
Brown Algae	1,500
Diatoms	12,000 (perhaps 10 M!!!)

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WHAT IS AN ALGAL SPECIES?

Morphological species concept

Species are the smallest groups that can be repeatedly defined by structural characteristics that are relatively easy to distinguish



Problem with algae:
Some morphological species may undergo seasonal changes (diatoms size) and others have heteromorphic life cycles

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Some species undergo astonishing morphological changes due to environmental signals such as the presence of a predator!

This is the genus *Chlorella*



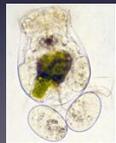
This is the genus *Micractinium*



This is *Chlorella* when *Brachionus* is present



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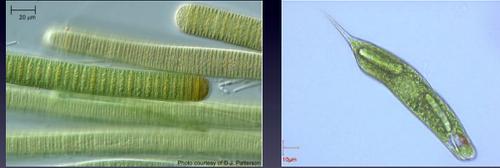


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Biological species concept

Described by E. Mayr: If two algal taxa can be demonstrated to interbreed and have viable offspring, they belong to the same species; if interbreeding does not occur, they would be regarded as separate species.



Problem with algae:
Cultures are sometimes difficult and some groups of algae do not show sexual reproduction (cyanobacteria and euglenoids) and in others is rare (dinos, diatoms and cryptomonads)

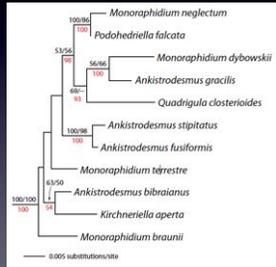
Phylogenetic species concept

A species is the smallest group of organisms that exhibits at least one distinctive and unifying structural, biochemical, or molecular characteristic. Such features are known as shared, derived characters, or **synapomorphies**

Computer software is used to compare the characters of organisms and model the patterns of relationship, depicted as branching diagrams (clades) known as **phylogenetic trees**

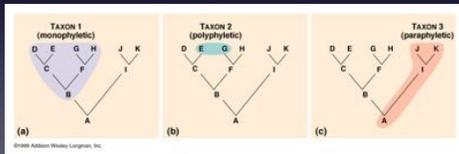
In the phylogenetic species concept, individual species occupy the tips of **branches**, with hypothetical common ancestors occurring at branch points known as **nodes**.

Figure 3.4. Phylogenetic relationships of some green algae, based on 5S rRNA sequence data. Bootstrap values shown are for distance analysis (upper left), maximum likelihood (upper right), and maximum parsimony (left). 50–80 values from Kuehn et al. 2002. Traditional generic concepts versus 10S rRNA gene phylogeny in the green algal family, Scenedesmus (Chlorophyceae, Chlorophyta), Journal of Phycology 37:402–410



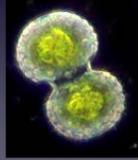
Ideally, a phylogenetic species is also **Monophyletic** group or **Clade**: is composed of an ancestor and all its descendants ("Natural" groups):

- Polyphyletic**: Taxa descended from more than one ancestral line
- Paraphyletic**: is a taxa that include a common ancestor but not all its descendants



Importance of algal Taxonomy, Classification and Systematics:

- Essential for ecological studies specially for “keystone” species
- Essential for biotechnological applications: agarophytes and drug testing
- Bioindicator species: diatoms are important in water quality
- Patents require careful definition of taxon or taxa!
- And for general scientific communication



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