



COMMON MACROALGAE OF CENTRAL TEXAS STREAMS

Print version of web document.

By Cara Muscio

City of Austin - Watershed Protection & Development Review Department

Environmental Resource Management

ABSTRACT

The following document is a printed version of a web document. The web document is available in <\\coafs01\wpdrd\EnvironmentalResourceManagement\WRE\Algae Guide\algaepg\frames.htm> and works best with Internet Explorer. There is documentation in the main folder if this link does not open the document automatically. Photo size has been reduced substantially to shorten the length of the print document. Words highlighted in **bolded brown** are defined on the glossary page. **Dark green bolded type** represents a hyperlink in the original web document. Words in *italics* represent taxa names.

INTRODUCTION

This is a key to the algae commonly encountered in Central Texas streams. In addition, there is an opportunity to review the characteristics and ecology of different groups of algae and plants commonly mistaken for algae. Please use the navigational bar above to access different areas of this web guide. Each photo of the navigation bar will load a series of links into the left window. Information on the characteristics and classification of algae is presented, as well as several references including citations and a glossary of terms. The bulk of the guide contains the key to macroscopic algal accumulations, and pages describing the prominent groups of macroalgae with descriptions and photos. This guide will concentrate on macroscopically visible accumulations of algae, especially those that can be considered a 'nuisance' or can have undesired effects for citizens and on ecosystems. Although the focus is benthic stream algae, many of these taxa are also found in lakes, wet ponds, and wetlands. Remember, this page is by no means an exhaustive account of all algal species in Central Texas streams; however, most common macroalgal forms are represented.

MACROALGAE: A PRIMER

What are algae?

The term 'algae' represents a broad diversity of organisms of many forms, and whose evolutionary relationships are still being investigated and revised. A general definition would call them mostly aquatic producers or autotrophs with at least chlorophyll a, as well as other accessory pigments, which help define the various divisions. They represent a wide variety of forms and habits, but are usually unicellular, or structured groups of unicells (filaments or colonies) with unicellular reproductive structures. The main habits of algae are planktonic (floating in the water column), metaphyton (fragments forming mats and tangles), and benthic (attached to a substrate). Benthic algae are further divided by the type of substrate they colonize, i.e. epiphytic (plant), epipellic (rock), episammic (sand).

How are algae different from other plants?

The vascular plants are so called because of the system of transport tissue they have running through their stems and branches. Plants also have many specialized parts and adaptations (leaves, bracts, buds etc.), and multicellular reproductive structures (flowers, seeds, and fruits etc.). On the other hand, Algae are usually single cells, or accumulations of single cells without specialized structures such as vascular systems, flowers, and seeds. Some macroalgae, such as *Chara* or the kelps, often look very much like plants.

Why are algae important?

Algae are the base of the food chain in most aquatic habitats, so are very important to the functioning of healthy ecosystems. In addition, they provide refuge for invertebrates and other stream fauna. Because of their growth requirements, they often respond quickly to changes in stream chemistry, particularly nutrient levels, and to climate conditions. A 'bloom' may signify a pulse of nutrients generated from a change in natural conditions (spring turnover, or fall die-back of vegetation), increased flow due to spates, or point or non-point anthropogenic sources. Many species of algae also have specific ranges of optimal growing conditions, which make them useful in bioassessment. Excessive blooms can cause water conditions that many people find unacceptable (see below).

Why care about algae?

Generally, many citizens care most about algae only when it becomes a nuisance to them. Stream and pond clogging 'blooms', taste and odor problems in water, and low DO induced fish kills cause concern among the public. Algae are important as an instrumental part of a healthy ecosystem, but when this system becomes unbalanced, the effects are often problematic for both people and the ecosystem.

Why just 'benthic macroalgae of Central Texas streams'?

Because of their position at the base of the food chain, algae are often more species-rich than other organisms like invertebrates and other consumers. With perhaps 26,000 defined algal species (and estimates going up to 100,000!) any brief guide to algae identification must narrow its scope. This guide is aimed toward helping staff and citizens learn more about the persistent accumulations of algae often visible in Austin area creeks. The majority of algae that persist in streams are benthically attached, to prevent being moved downstream. Although algae in area lakes can be of concern, most forms are phytoplanktonic and require microscopic analysis for correct identification. It is hoped that some of the tips in this guide will allow for field identification of the more common forms of stream algae, reducing the need to collect samples for further study.

CLASSIFICATION

Many schemes have been devised to classify freshwater algal species. The difficulty lies in the diversity of forms that are considered algae. Some groups of motile algae, such as dinoflagellates, were at one time classified in the animal kingdom, while others, such as chlorophytes (green algae) were classified as plants. Advances in molecular biology and electron microscopy in the mid 1900s weakened this two kingdom model of the living world. Several researchers have since used a three or five kingdom model in biological classification. Under the five kingdom scheme supported by Margulis and Schwartz (1988) among others, most algae belong to a large kingdom of **eukaryotic** microorganisms that do not develop from **embryos** (plants), **blastulas** (animals), or **spores** (fungi) and are termed the Protocista. The blue green algae are an exception (the name "*cyanobacteria*" gives away their new place in the kingdom classification scheme). The **Tree of Life** web project breaks each algal group out of the protist kingdom based on ultrastructural organization of cells, and separates the many groups of algae into different lineages, or **phylogenies** of proposed evolutionary similarity. In fact, several groups of algae known as Heterokontophyta are now thought to be evolutionarily related to many non-algal protists, in a group called the stramenopiles. Other researchers acknowledge that the diverse forms called "algae" are not the

product of a coherent phylogeny, and instead choose a definition of this ecologically important group based on shared characteristics.

Despite these recent changes in the divisions and organization of algal groups, many **phycology** texts and identification keys still use botanical nomenclature to describe the classification of algae (phyla ending -phyta, etc.). For the sake of simplicity and comparison to established taxonomic keys, the same convention will be followed here until the current research creates a coherent taxonomy for all algal species. Most classifications separate groups based primarily on the types of chlorophyll and accessory pigments they contain, which often determines their color. Other characters such as flagellar and cellular structures and mitosis patterns are also used. Depending on the classification scheme in use, from 4 to 13 divisions or phyla have been recognized by different taxonomists. These represent all algae (marine and freshwater, macro and micro) and will not all be discussed on this page. The basic scheme followed will be that of van den Hoek (1995), one of the most recently accepted revisions. For complete treatments of algal taxonomy, see the **references** page. The main divisions containing freshwater macroalgal taxa are:

Chlorophyta Green Algae. A diversity of forms with chlorophyll a and b. While possibly the largest algal phylum, only freshwater filamentous macroalgae will be described here.

Heterokontophyta This group has been revised to include several previously distinct phyla. They have chlorophylls a and c, and the accessory pigment fucoxanthin, which in most cases, masks the chlorophyll to give a yellowish or brown appearance. The diatoms, and a xanthophyte (*Vaucheria*) are the taxa treated here.

Rhodophyta Red algae. This group is uncommon in fresh waters, and is represented by a few filamentous taxa. This group has chlorophylls a and d, plus phycoerythrin and phycocyanin.

Cyanobacteria Blue-green algae. This group lacks membranous organelles, and therefore pigment material is distributed through the cells contents. These taxa are technically considered photosynthetic bacteria, and have chlorophyll a and other accessory pigments, such as phycoerythrin and phycocyanin.

How do I use a dichotomous key?

A dichotomous key is an identification guide that works by process of elimination. It can be set up in many ways, but commonly will be numbered. Sets of choices (with the same number) are given discussing certain characteristics of the organism or sample. At the end of each choice is either an answer, or a number that refers you to a different part of the key. For example (only for illustration purposes - not complete information):

1. The algae is green. (2)
- 1'. The algae is not green. (3)
2. The algae is filamentous. **Cladophora**
- 2'. The algae is not filamentous. (4)
3. The algae is bluish green. (5)
- 3'. The algae is a color other than bluish green (6).

In couplet 3 if the algae is any color but bluish green you would continue to couplet 6. However the algae cannot be green, because that was decided in question one. Each couplet should be mutually exclusive, meaning the organism fits one or the other of the two criteria in the couplet. Occasionally, the choices are not this easy, and it may be necessary to back track and re-evaluate couplets (if reaching a dead end, or obvious wrong answer). Many of the **references** used to construct this page contain keys to algal genera that are far broader in both scope and detail than this one.

Key to the common freshwater macroalgae of Central Texas streams:

- 1. Macroscopically visible accumulation material present (either visible algae, or a scum). **2**
- 1'. No visible macroscopic accumulation of algae-like material. *
- 2. Material plant like or hair like, solid masses that cannot be swished away or separated into particles. **3**
- 2'. Material macroscopically visible, but composed of small particles, can be swished away, not solid accumulations. **4**
- 3. Looks plant like, whorls of 'branches' evident, green. **5**
- 3'. Other macroscopic forms, gooey masses of filaments or particles, or tangles of filaments. **6**
- 4. Particles macroscopic, green, round "leaves" or elongated "rootlets". **Lemmaceae** (Duckweed)
- 4'. Particles not seen with the unaided eye.*
- 5. Olive to gray, coarse or rough to the touch, may smell pungent or musty. **Chara**
- 5'. Lime or dark green, whorls more fragile, poofy ball-like appendages. **Nitella**
- 6. Gelatinous matrix present, material may be filaments or cells. **7**
- 6'. No gelatinous matrix, tangle of filaments. **10**
- 7. Brownish to yellow gelatinous mats, no distinguishable filaments present. **Bacillariophyceae** (Diatoms)
- 7'. Not as above, or filaments visible. **8**
- 8. Spacing evident in filaments, tufts of cells surrounded by clear matrix, often violet, black, or green. **Batrachospermum**
- 8'. Spaces in filaments indistinguishable, solidly pigmented masses, color varies. **9**
- 9. Lime green, apple green to yellowish, snotty or slimy feeling tangles of filaments. **Zygnematales**
- 9'. Blue-green to black gelatinous or slimy layers of filaments. **Oscillatoriales**
- 10. Filaments green, long and hair like, often streaming in the current. **Cladophorales**
- 10'. Filaments green, short and forming felt like masses. **Vaucheria**

*. (1')(4') Microscopic algae that are not forming a visible accumulation or scum is not covered in this key, under the assumption that microscopic examination is not possible. Often visible greenish scums of microscopic particles are species of Cyanobacteria or Chlorophyceae. These microscopic taxa may form blooms in streams occasionally, but accumulations are prevented by swift flow. Often, these taxa are more prominent in pools or stagnant areas of streams.

TAXONOMY

According to botanical nomenclature and the five kingdom model of classification, the hierarchy of taxonomic groups would progress in the following manner - using Cladophora as an example:

Kingdom:	Protoctocista
Division or Phylum:	Chlorophyta
Class:	Cladophorophyceae
Order:	Cladophorales
Family:	Cladophoraceae
Genus:	Cladophora
Species:	Glomerata

and the species would be referred to as *Cladophora glomerata*. Again, due to the difficulties of fitting these very different groups of algae in a coherent taxonomy, the level-by-level structure varies by author. In fact, the recent North American Manual (Wehr and Sheath, 2003) goes so far as to recognize algae of an ecologically related group of very different divisions of organisms. This infers that 'algae' do not represent a single taxonomic or phylogenetic group. The taxonomic groupings do become more stable further into the hierarchy, and the orders and genera are generally well defined. This section of the guide attempts to present the orders and genera of common macroalgae of central Texas streams.

The Green Algae

One of the largest and most diverse groups, green algae are present in nearly all aquatic environments and take a variety of forms. This group has chlorophyll *a* and *b* like terrestrial plants, and has been classified with the plants in some historical texts. The main groups of green algae are separated by type of reproduction, which varies through the phylum. Green algae may be single cells, colonies, or filaments. Since this guide only discusses macroalgae, only the taxa that are common in the macroalgae of central Texas streams will be represented. Three main orders of macroalgae are represented in this area:

Charales: Plant-like algae with erect 'stems' and whorls of 'branches'. Often centimeters to decimeters high, growing on channel bottom.

Cladophorales: Usually branched green filaments. No mucilage layer, often coarse and wiry. Grow attached to rocks with special basal structures, sometimes many feet in length.

Zygnematales: Unbranched filamentous green algae with no special basal structures and a special form of reproduction (conjugation). Often mucilaginous.

There are several organisms that form greenish blooms, but are not actually green algae. They will be discussed on other areas of this page.

Cladophorales



A. Macroscopic mass of *Cladophora*. B. Microscopic view of branching *Cladophora* filament.

Characteristics:

Green dichotomously branched filaments with multinucleate cells.

Filaments forming long, **pseudoparenchymous** nets of hair-like tangles.

Does not feel slimy, has rough texture.

Basal cells (usually attached) different from cells of filament.

Ecology:

Often found in nutrient-enriched flowing waters with low heavy metal concentrations.

Usually anchored to rocks or other substrate, can grow quite long.

Very common, can become a 'nuisance'.

Can withstand great stress, and is often associated with high flow situations.
Often a large component of spring growth due to the seasonal recirculation of nutrients.

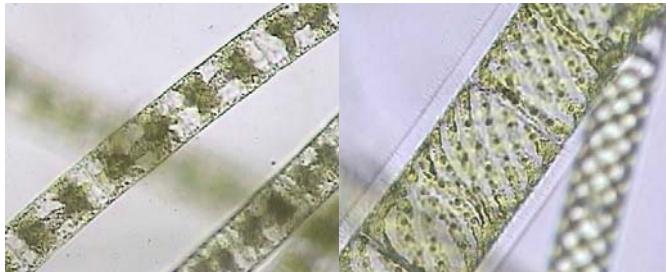
Taxa:

Cladophora by far the most common in this group.
Occasionally, *Rhizoclonium* is also found - this genus rarely branches.

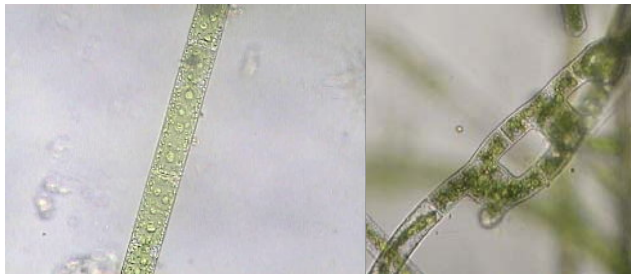
Zygnematales



A. Pond with a severe *Spyrogyra* and *Zygnema* bloom. B. Surface of a floating *Zygnema* bloom.



Zygnema (A.), *Spyrogyra* of different sizes (B.).



Mougotia (A.) undergoing conjugation (B.).

Characteristics:

Unbranched filaments, green in color.
Mucilage sheath around filament gives a slimy feel.
Can be identified to genus by chloroplast patterns.
Reproduces via **conjugation**.

Ecology:

The species of concern are mostly filaments that may form blooms.
Blooms often electric or lime green, but color may vary.
Usually floating at the surface, slimy/snotty appearance.
Often found in small, stagnant water bodies, or attached in flowing waters.

Most common in spring and early summer, with the addition of nutrients, and before grazing becomes heavy.

Taxa:

About a dozen genera exist, with near 700 species.

Species identification requires material in reproductive state, however genera are relatively easy to distinguish.

Spyrogyra is the most common, and identified by spiral chloroplasts.

Zygnema is also common and is identified by star shaped chloroplasts.

Mougotia is less common, its chloroplast contains a linear row of **pyrenoids**.

Charales

The Charales are a group of freshwater green algae that are most similar to plants. Their highly specialized structures are described by morphological terms unique to the algal realm. These algae appear to have branches and 'whorls' of leaves like other aquatic plants. The most common genera in this order are Chara and Nitella.

Chara



A. Macroscopic underwater view of Chara. B. 'Stem' and 'whorls' of branches on *Chara* filament (L). C. Reproductive structures under magnification (R).

Characteristics:

Lime-green or greyish-green in color.

Growing erect - appears as a plant with 'stem' and 'whorls' of branches.

Often feels rough or spiny because of lime (CaCO₃) deposits on surface, sometimes called Stonewort.

May have a musty odor, also called Muskwort.

Ecology:

Abundant in high pH, calcium rich waters.

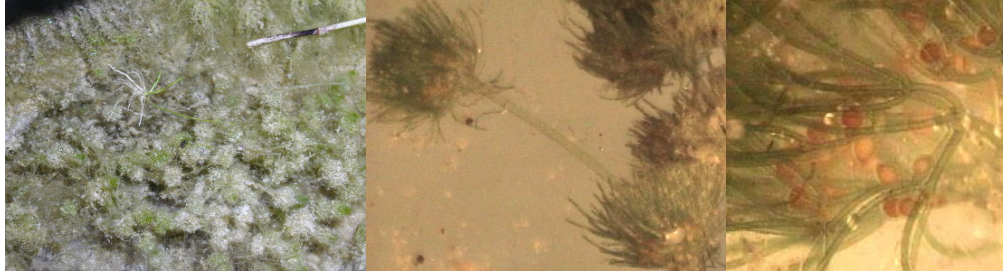
Grow benthically, may be found slow moving or still water several feet deep.

Occasionally found in spring seeps.

Cannot tolerate elevated nutrient concentrations.

Chara 'hummocks' often help to stabilize sediment.

Nitella



A. Macroscopic view of *Nitella* catching sediment. B. 'Stem' and 'whorls' of *Nitella* filament. C. Close-up of 'whorls' with reproductive structures.

Characteristics:

Light to dark green filaments, look like 'branches' and 'stems'.

More fragile than *Chara* filaments

Not rough or spiny, no lime deposits.

Whorls of branches look 'poofy' under water (poodle-tails).

Ecology:

Mainly found submerged in still or slow waters.

Often present at lower pH levels, common in peaty bogs.

Also intolerant of high nutrient conditions.

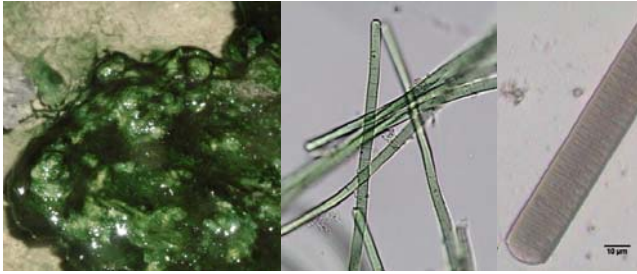
Helps to stabilize sediment.

Blue-Green Algae

This group of 'algae' is actually more closely related to bacteria, which is reflected in current taxonomic schemes. Cyanobacteria can be separated from other algal groups based on their lack of membrane-bound organelles (such as chloroplasts) within the algal cell. The distinct nucleus and chloroplasts of other algal groups are lacking within cyanobacteria, and cellular material is distributed within the cell. These algae contain chlorophyll a and several accessory pigments (phycobillins, phycocyanin etc.) which often color cells bluish-green, violet, or black. These taxa occur as unicells, colonies, and as filaments, and have a great diversity of forms, even within the same species!

Cyanobacteria are the freshwater algae with the worst reputation. They are most often to blame for large scale blooms and toxic events in slow-moving or still freshwaters. In general they prefer warm temperatures, and many thrive in calcareous environments, making them fairly common in Central Texas. Several groups also atmospherically fix nitrogen, and may be less dependent on continual nutrient flows, though they are often found in nutrient rich environments. Several species have been found to release toxins under certain environmental conditions, particularly *Microcystis* and *Anabaena*. General information on potentially toxic freshwater algal species can be found at the Bigelow laboratory **Freshwater blooms** web page. More often, some people may develop a completely non-toxic, itchy, allergic reaction after contact with the sheaths of these organisms. In streams, the most common persistent forms of blue-green algae are the non-nitrogen fixing, unbranched filaments known as the Oscillatoriales.

Oscillatoriales



A. Mass of *Oscillatoria* filaments on rock surface. B and C. *Oscillatoria* filaments of different sizes under the microscope.

Characteristics:

Macroscopic masses often bluish-green to black and appearing gelatinous.

Composed of thin "hairs" or filaments of individual cells.

Typically unbranched filaments, without specialized cells (**akinetes** or **heterocytes**).

Filaments may be tapered, or have a sheath present. Many of these taxa exhibit a wave-like or oscillating movement. Some taxa contain gas vesicles in aerotopes.

Ecology:

May form as benthic masses, or fill with air and float to the water surface.

Large scale accumulations are usually linked to excess nutrients present in the water body.

Some forms are known to produce toxins, and some produce allergenic reactions in humans.

Some characteristics such as tapering trichomes, have been linked to environmental conditions, and are no longer diagnostic of species delineations.

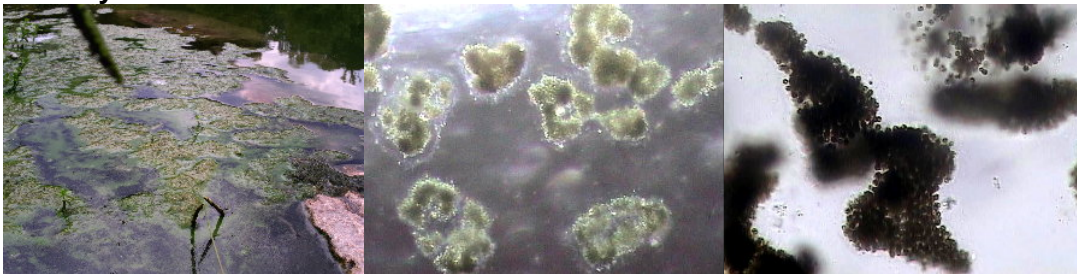
Taxa:

Oscillatoria and *Phormidium* are the most common taxa, but many others are found.

Identification is difficult, even under light microscopy.

This group is currently undergoing taxonomic revision - many of the taxa are being revised based on cellular chemical and structural characters, including potential toxicity.

Microcystis



A. *Microcystis* bloom in a wet pond. It is the bright aqua scum between the green macroalgae. B and C. *Microcystis* colonies from this bloom in both dark and bright fields.

Characteristics:

Unicellular, microscopic blue-green spheres.

Form large irregularly shaped colonies.

Some species are known to have toxic strains.

Ecology:

Can be seen as a bright aqua green surface scum in bloom conditions. Accumulation should scatter when disturbed, not a solid mass of algae. Usually indicates eutrophic conditions. Most often found in lakes or non-circulating water, blooms uncommon in streams.

Red Algae

Rhodophytes, or red algae are seldom found in freshwaters (approximately 3% of over 5000 species). Most freshwater taxa are present benthically attached in flowing waters. *Batrachospermum* is the most common of the 25 North American genera. Other taxa do occur, either as filaments or crusted **thalli** on rock or soil surfaces. Despite the name red algae, many species are actually violet, blue or olive-green in color, rather than red. Red algae have similar accessory pigments to the blue green algae (phycobillins etc.) and the proportion and number of these pigments determine the actual coloration of the algal cells.

Batrachospermum

A. *Batrachospermum* under dissecting microscope. Spaces between whorls evident. B. *Batrachospermum* under higher magnification, showing whorls of beaded filaments and hairs coming off of filament ends.

Characteristics:

Rarely appear red, often violet to grayish green, sometimes black.
Spaces evident between clusters of whorls on a central axis.
Gelatinous feeling whorls and filaments.
Filaments 'beaded', with setae or hairs at tips.

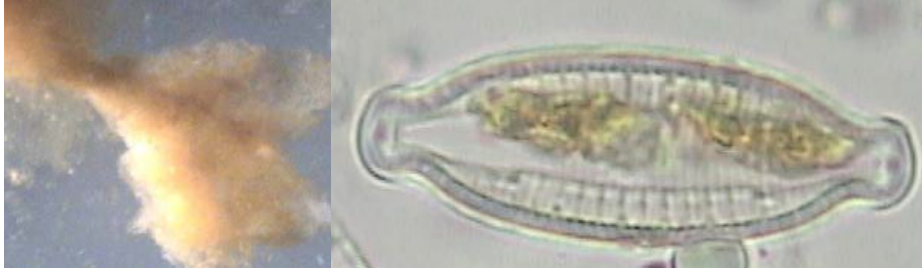
Ecology:

Often present in streams with low to moderate nutrient levels and moderate flow. Light is a key factor in its distribution.
Often found in spring-fed creeks.

Yellow - Brown Algae

Many classes in this group of algae were formerly considered separate phyla. Van den Hoek (1995) cites at least nine very diverse classes of algae within Heterokontophyta, all of which are united by ultrastructural characteristics. This includes groups such as the Chrysophytes, Bacillariophytes (diatoms), and Xanthophytes. This group was united because of the ultrastructural characteristics they share, as well as similar pigments, including chlorophylls *a* and *c* and sometimes fucoxanthin. Here, in Central Texas streams, the most common taxa in this group are benthically attached diatoms. A great diversity and abundance of these forms are found in streams and lakes, and are instrumental in the science of **paleolimnology**. There is also however, a fairly common filamentous Xanthophyte that many mistake for a green alga, called *Vaucheria*.

Diatoms



A. Photo of diatom 'bloom' (80x). Clumps of yellow-brown slimy material were found on rocks and floating in a small stream. B. An ornately decorated pennate diatom at 1000x.



A. *Fragillaria* colony (left). B. The taxa that made up the 'bloom' above (right).

Characteristics:

Yellowish-brown cell surrounded by two-halved, ornately decorated silica (glass) shell.

Classification is based on features of the silica shell, such as **striae** and **punctae** as well as chloroplast structure.

Common as solitary cells and colonies or chains of cells. Some grow attached to surfaces or on stalks. Some cells use secretions through a **raphe** to slide along surfaces.

Ecology:

Usually not visible to the unaided eye, cell features begin to be distinguishable at 1000x.

Occasionally form 'blooms' (see photo). Informally referred to as "deer snot"

Very important food source in aquatic environments.

Both planktonic and benthic species are very abundant.

Taxa:

Main divisions are: centric, or round diatoms, and pennates, or oblong, bilaterally symmetrical forms.

Pennates are more common in benthic stream ecosystems.

Many taxa are useful indicators in bioassessment, due to their very narrow ecological optima and tolerances.

Vaucheria



A. Macroscopic view of *Vaucheria* mat. B. Macroscopic View showing short filaments. C. Microscopic view of *Vaucheria* filaments.

Characteristics:

Actually a golden-yellow algae, though it appears green.

Short hair-like filaments, with no cross walls, rarely branched.

Mats do not feel slippery or slimy; sometimes called 'water felt' because of texture.

Filaments branched and **multinucleate**.

Ecology:

Usually on damp soil, streamside, or submerged in shallow water.

Taxonomy is based on reproductive features, which may not be present in a sample.

Other aquatic blooms

There are many other types of aquatic plants found in stream environments, and some of them are often confused with filamentous algae. Some of these species are invasive and cause problems in central Texas waterways. These taxa will not be described at this time, because most can be identified as plants after careful inspection. Information on *Hydrilla*, one invasive plant of concern in this region, can be found on the COA Watershed Protection **Hydrilla** page. However, there is one particular kind of plant that is often mistaken for a microscopic algal bloom that is important to mention here. It is composed of tiny leaves or globules, rather than traditional stems and whorls of leaves and branches. It is very aggressive and can often cover entire water bodies with a green layer of material. This group of taxa is called "duckweed" or "Water meal".

In addition, microscopic algae can often form thick green water blooms, where no discernable masses are present. Often green or blue-green algae are responsible for these blooms. There are far too many of these organisms to list in a key of this scope, and water coloring blooms are seldom found in swift flowing creeks. However, in low flow, or stagnant conditions, or on larger water bodies, such as Town Lake, these taxa can occasionally become a problem.

Lemnaceae or Duckweeds



A. Bloom of duckweed in a small pond, these conditions induced a fish kill. B. *Lemna* (big), *Wolfia* (small) under dissecting microscope.

Characteristics:

Not actually algae, but the smallest known flowering plants.
 Actually small round or globular leaves, millimeters in diameter.
 May or may not have tiny "rootlets" dangling beneath the water.

Ecology:

Often prevalent in hard water habitats.
 Reproduce rapidly, may become a nuisance under certain conditions.

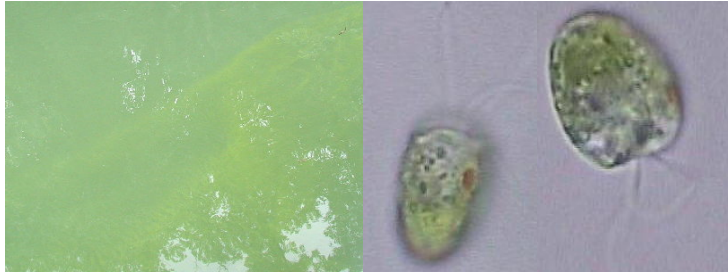
Taxa:

Spirodella is the largest in this group, and can be recognized by the purple underside to the leaves and numerous rootlets.

Lemna is the most common, with flat, round leaflets with a single trailing rootlet.

Wolffia plants are usually smaller drops or globules.

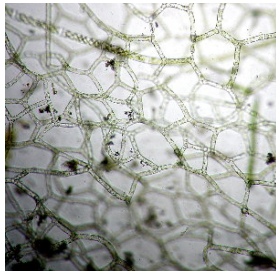
Wolffiella plants actually look like a thin cross in the water, may appear as rootlets.

Planktonic Blooms

A. Green flagellate bloom in backwater area on Town Lake. B and C. The culprit at 1000x, multiple views. Careful observation will show four flagella.

Although not covered in this key, microscopic algae occasionally bloom in slow moving waters in the Austin area. Most often, these blooms are phytoplanktonic green or blue-green cells. They occasionally occur on Town Lake after rainstorms, or during low flow events.

The particular bloom shown here was composed of a green phytoplanktonic algae with four flagella. This cell was most likely a species of *Carteria* or a freshwater *Pyramimonas*. Unfortunately, as algal taxonomy is constantly revised, dividing characteristics are not always visible by light microscopy. In this case, *Pyramimonas* is part of a group (Prasinophytes) that have been elevated to phylum status separate of the rest of the green algae, based on characteristics not readily observed with light microscopy. Some texts put this group in the same key as other green flagellates in an attempt to aid identification.

Hydrodictyon

A. Microscopic view of *Hydrodictyon* mat.

Characteristics:

A green macroalgae, one of the few chlorococcales that are filamentous bloom formers. Macroscopic growth of cylindrical cells, forming a hexagonal network.

Ecology:

Floating masses, primarily in ponds and lakes.
May become a nuisance algae.

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* Denotes references that contain a taxonomic key for one or more groups.

Glossary of terms:

This is by no means an exhaustive glossary. However, there are certain multi-syllabic words used within these pages that may require further explanation. If words are missing which your standard dictionary of biology does not list, please contact **COA staff**.

Akinete -Specialized cell in blue-green algae resulting from a normal vegetative cell developing into a resting spore.

Blastula -Animal embryo, hollow sphere of cells, outer layer of which is a single wall.

Conjugation - Division process in Zygnemataceae, in which tubes are formed between filaments, and non-flagellated gametes are passed through.

Embryo - Early stage of multi-cellular organism, produced from a fertilized egg.

Eukaryote -Cells with membrane-bound nuclei and organelles; includes all organisms not in kingdom Prokaryota.

Heterocyst - Specialized cell that fixes nitrogen in blue-green algae. Recognized by glassy appearance and thick wall.

Lotic - Pertaining to streams, creeks, or unidirectionally flowing waters.

Lacustrine - Pertaining to lakes.

Multinucleate -Cell possessing several nuclei.

Paleolimnology -The study of past lacustrine environments by using sediment cores and analyzing microfossils (particularly diatoms and pollen).

Phycology - The study of algae.

Phylogeny (ies) - A representation of the evolution of a genetically related group of organisms. Used increasingly as a basis for taxonomy, highlighting evolutionary relatedness rather than shared morphology.

Prokaryote - Cells lacking a nucleus or other membrane-bound organelles, principally blue-green algae and other simple bacteria. These organisms are classified in kingdom Prokaryota in the five kingdom model.

Pseudoparenchymous - Tissue of compactly arranged filaments of cells, appears to be plant (parenchymous) tissue.

Punctae - Pores in the walls of a diatom frustule, seen with light microscopy.

Pyrenoid - A distinct, usually spherical spot of high reflectivity inside a chloroplast.

Raphe - Longitudinal slit in diatom valve. Structure through which mucilage is secreted, aid in locomotion. The presence of a raphe is a major taxonomic characteristic of diatoms.

Spores - Small reproductive unit, not resultant from sexual reproduction. Often heat and desiccation resistant.

Striae - Rows of pores in the walls of a diatom frustule. Number of striae per 10um is a characteristic used to identify diatom species.

Thallus (thalli) -General form of an alga.