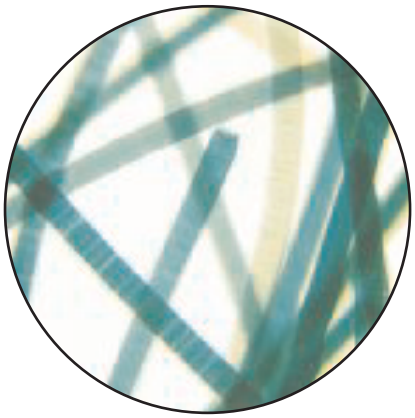
# Algae & Cyanobacteria



## Conditions for Customer Ownership

We hold permits allowing us to transport these organisms. To access permit conditions, click here.

***Never purchase living specimens without having a disposition strategy in place.***

- There are currently no USDA permits required for any algae or cyanobacteria. Do not release into the environment.

## Primary Hazard Considerations

Wash your hands before and after handling algae and cyanobacteria. It is not safe to release your algae into the environment because it could disrupt the normal ecosystem.

## Availability

- Most algae and cyanobacteria are cultured in our labs and are available year-round.
- The following algae are collected, so shortages may occur:

  Nostoc colonial: Shortages possible December– February and July–August.

  Porphyra: Shortages possible October–March.

Your algae culture will arrive in a plastic jar or sterile glass test tube filled with media. Immediately upon receipt, loosen the jar cover or test tube cap to allow gas exchange and store in a cool area (15–20˚C) with dim light. Do not store your culture in direct sunlight or at temperatures above 30 °C. In its packing container, the culture can retain its high quality for 4–7 days at room temperature. If the culture is not going to be used in this time frame, it should be subcultured to prevent death and overcrowding.

## Care

**Habitat:**

- Your cultures arrive in a habitat that is suitable for short-term use in classrooms.
- If you wish to subculture, a more specialized environment is required. Algae require specific lighting and media in order to flourish. Generally, cultures should be grown in a 16-hour light period alternating with an eight-hour dark period. Ideally, the cultures should be illuminated by 40-watt cool-white fluorescent tubes on a timer. A 40-watt fluorescent tube at a distance of about 15 cm will provide roughly 500 foot candles of illumination. Freshwater algal cultures should be grown under a light intensity of 400 to 500 foot candles. At this light intensity, cultures will reach optimum growth or density for microscopic viewing in 7–14 days, depending on the species and condition of the initial algal inoculum. After this period, reduce the light to 50–100 foot candles. Marine algae grow best in slightly lower intensities than those required by freshwater algae: 200–300 foot candles. The media that algal cultures are grown in varies based upon the requirements of each individual culture (see tables below, links at end of information section).

**Subculturing:**

Flasks, tubes, bottles, or Petri dishes can be used as culture containers. If using a 250 mL Erlenmeyer flask, fill the flask to approximately 150 mL with freshly prepared media and sterilize the media (autoclave for 20 minutes at 121°C and 15 psi). Allow the media to cool overnight before adding any algae. Add a small amount (2–5 mL) of inoculum from the culture provided, handling both containers in a sterile manner. Always prepare more than one subculture in case one of the new cultures becomes contaminated. Make new subcultures from the freshest cultures.

**Basic Types of Algae:**

***Blue-Green Algae (Cyanobacteria)***

The cyanophytes are the only prokaryotic algae. They are found in virtually every type of environment including terrestrial, freshwater, and marine habitats. Since cyanobacteria are prokaryotes, they lack membrane bound organelles. However, the external structure can range from unicellular or colonial, to branched or unbranched, and filamentous. The life-cycle is binary fission with the majority undergoing fragmentation to split. Spores/akinetes are produced as protected cells when unfavorable conditions exist. Like the rhodophytes, the cyanophytes possess no flagellated or ciliated cells at any stage of their lifecycle, although simple movements such as bending and swaying are made possible by internal pressure changes exerted on the cell wall. They are heavily pigmented with chlorophyll a, beta carotene, and several xanthophylls. The presence of several phycobiliproteins gives the cyanophyta their unique blue-green coloration. Food is stored in the form of glycogen.

| Organism | | Media (captive care) | Reproduction | Wild habitat | Shape/Characteristic (Special Notes) |
|---|---|---|---|---|---|
| *Anabaena* | 86-1800 | Basic | Trichome fragmentation | Freshwater | filamentous; unbranched; heterocysts |
| *Cyanophora* | 86-1840 | Basic | Binary fission | Freshwater | symbiont in protozoa |
| *Cylindrospermum* | 86-1930 | Basic | Trichome fragmentation | Freshwater | filamentous; heterocysts & akinetes terminal |
| *Fischerella* | 86-1960 | Basic | Trichome fragmentation | Freshwater | true branching, dimorphic structures |
| *Glaucocystis* | 86-1980 | Basic | Binary fission | Freshwater | symbiont, lives within colorless host |
| *Gloeocapsa* | 86-2000 | Basic | Mitosis and colony fragmentation | Freshwater | colonial; concentric layers of gelatinous sheath |
| *Gloeotrichia* | 86-2010 | Basic | Trichome fragmentation | Freshwater | filamentous; trichomes radiating from basil heterocysts |
| *Lyngbya* | 86-2040 | Basic | Trichome | Freshwater | filamentous; unbranched trichome, thinly sheathed |
| *Merismopedia* | 86-2100 | Soil-water | Binary fission | Freshwater | colonial; sheet of many cells one cell thick |
| *Nostoc,* colonial | 86-2150 | Basic | Trichome fragmentation | Freshwater or Soil | macroscopic hollow balls; collected |
| *Nostoc,* filamentous | 86-2155 | Basic | Trichome fragmentation | Freshwater | filamentous; unbranched, contorted filaments |
| *Oscillatoria* | 86-2300 | Basic | Trichome fragmentation | Freshwater | filamentous; unbranched trichome, thinly sheathed |
| *Scytonema* | 86-2350 | Basic | Trichome fragmentation | Freshwater | filamentous; displays false branching |
| *Spirulina* | 86-0700 | Marine | Trichome fragmentation | Marine | brackish; helically coiled filament |

**Green Algae**

Chlorophytes are a diverse group and are common in fresh water, salt water, and soil. They are very similar to plants, and most botanists agree the ancestor of higher plants can be found somewhere within this group. Chlorophyte reproduction varies greatly, from asexual division to isogamy and heterogamy to oogamy. Cell walls are constructed of cellulose and pectin. The food storage product is true starch, the same as plants. This can be demonstrated by staining with IKI, which turns the starch in the algae blue-black. Green algae possess true chloroplasts, which contain the same pigments found in higher plants: chlorophyll a and b, alpha and beta carotene, and many xanthophylls.

| Organism | | Media (captive care) | Wild habitat | Shape/Characteristic (Special Notes) |
|---|---|---|---|---|
| *Ankistrodesmus* | 86-0010 | Proteose agar | Freshwater | needle-like cells |
| *Carteria* | 86-0080 | Basic | Freshwater | large cells, four flagella |
| *Chlamydomonas reinhardtii* (+) | 86-0102 | Basic/Proteose agar | Freshwater | small, round, biflagellated |
| *Chlamydomonas reinhardtii* (-) | 86-0103 | Basic/Proteose agar | Freshwater | small, round, biflagellated |
| *Chlamydomonas moewusii* (+) | 86-0104 | Basic/Proteose agar | Freshwater | small, round, biflagellated |
| *Chlamydomonas moewusii* (-) | 86-0105 | Basic/Proteose agar | Freshwater | small, round, biflagellated |
| *Chlorella* | 86-0126 | Basic/Proteose agar | Freshwater | small, round, non-motile |
| *Cladophora* | 86-0145 | Erdschreiber's | Marine | filamentous; freely branched |
| *Closterium ehrenbergii* | 86-0160 | Basic | Freshwater | elongated desmid |
| *Closterium littorale* | 86-0164 | Basic | Freshwater | homothallic strain |
| *Cosmarium* | 86-0165 | Basic | Freshwater | circular desmid |
| *Dunaliella* | 86-0171 | Erdschreiber's | Marine | halophilic flagellate |

*— continued —*

| Organism | | Media (captive care) | Wild habitat | Shape/Characteristic (Special Notes) |
|---|---|---|---|---|
| *Eremosphaera* | 86-0175 | Basic | Freshwater | circular, large; macroscopic |
| *Eudorina* | 86-0180 | Basic | Freshwater | colonial; with spherical, biflagellated cells |
| *Fritschiella* | 86-0181 | Basic | Freshwater | filamentous; displays differentiation |
| *Gonium* | 86-0185 | Basic | Freshwater | colonial; 4-32 cells, flattened colony |
| *Hydrodictyon* | 86-0210 | Basic | Freshwater | colonial; net-like, multinucleated cells |
| *Micrasterias* | 86-0270 | Basic | Freshwater | circular, large desmid |
| *Microspora* | 86-0275 | Basic | Freshwater | filamentous; H-shaped cell walls |
| *Mougeotia* | 86-0280 | Basic | Freshwater | filamentous; relative to *Spirogyra* |
| *Netrium* | 86-0290 | Basic | Freshwater | oblong desmid |
| *Nitella* | 86-0300 | Spring water | Freshwater | macroalga; used for cytoplasmic streaming; collected |
| *Oedogonium cardiacum* (+) | 86-0350 | Basic | Freshwater | filamentous; heterothallic strain |
| *Oedogonium cardiacum* (-) | 86-0351 | Basic | Freshwater | filamentous; heterothallic strain |
| *Oedogonium foveolatum* | 86-0355 | Basic | Freshwater | filamentous; homothallic strain |
| *Pandorina* | 86-0400 | Basic | Freshwater | colonial; elliptical; made up of 16-32 cells |
| *Pediastrum* | 86-0425 | Basic | Freshwater | colonial; polygonal cells |
| *Protococcus* | 86-0495 | None | Tree bark | colonial; on wood bark; collected |
| *Scenedesmus* | 86-0600 | Basic | Freshwater | colonial; four cells with spines |
| *Selenastrum* | 86-0620 | Proteose agar | Freshwater | lunate |
| *Spirogyra* | 86-0650 | Soil-water | Freshwater | filamentous; spiral chloroplasts |
| *Staurastrum* | 86-0660 | Basic | Freshwater | triangular desmid |
| *Stigeoclonium* | 86-0690 | Basic | Freshwater | filamentous; produces zoospores |
| *Ulothrix* | 86-0750 | Basic | Freshwater | filamentous; unbranched filaments |
| *Ulva* | 86-0770 | Sea water | Marine | macroalga, membranous thallus; collected |
| *Volvox aureus* | 86-0800 | Basic/soil | Freshwater | colonial; cytoplasmic connections about the size of flagella |
| *Volvox globator* | 86-0805 | Basic/soil | Freshwater | colonial; thickest cytoplasmic collections |
| *Zygnema* | 86-0900 | Basic | Freshwater | filamentous; 2 stellate chloroplasts per cell |

### *Diatoms*

Bacillariophytes, which occur in fresh water, salt water, and terrestrially, date back to the Cretaceous Period. They are single-celled algae with shells constructed of two overlapping valves composed of pectin and impregnated with silica; these shells can be quite ornate. Although the diatoms are single-celled organisms, they can form colonies and filaments. The group comprises two main types: centric and pennate. Centric diatoms are radially symmetrical and contain numerous plasmids, while pennate diatoms are bilaterally symmetrical and contain fewer plasmids. Many diatoms have conspicuous oil droplets within the cell, which is the photosynthetic food reserve, chrysolaminarin. The plastids of diatoms contain the pigments chlorophyll a and b, alpha and beta carotene, and several xanthophylls.

| Organism | | Media (captive care) | Wild habitat | Shape/Characteristic (Special Notes) |
|---|---|---|---|---|
| *Cyclotella* | 86-0168 | Marine | Marine | small, centric |
| *Navicula* | 86-1210 | Basic | Freshwater | pennate, with bilateral symmetry |
| *Synedra* | 86-0692 | Basic | Freshwater | pennate, with bilateral symmetry |
| *Thalassiosira* | 86-0695 | Marine | Marine | brackish, centric |

### *Dinoflagellates*

Dinoflagellates are mostly marine organisms and they compose nearly all marine plankton. They occur as free-living flagellates, sessile unicells, colonies, and filamentous forms. The fossil record of the dinoflagellates can be dated back to the Cambrian period, with some evidence suggesting they existed even earlier. The term dinoflagellate actually refers to the twirling motion exhibited by the pair of whip-like undulapodia (flagella). These flagella originate in the sulcus, or groove, of the organism. Some dinoflagellates have thecal plates embedded in their cytoplasmic membrane and are called armored, others lack these plates and are called naked. Food is stored in the form of true starch and oils. Dinoflagellates contain the pigments chlorophyll a and c, beta carotene, and several xanthophylls that often give these organisms a brownish color. Some dinoflagellates produce powerful toxins with potentially dangerous results. When "blooms" occur, the water can take on a pinkish or red hue known as a red tide. This often causes massive fish kills and can be dangerous to humans as well. Some, such as Noctiluca, are bioluminescent, and can cause ocean waves to glow at night. This is the only example of bioluminescence in the algae kingdom.

| Organism | | Media (captive care) | Wild habitat | Shape/Characteristic (Special Notes) |
|---|---|---|---|---|
| *Amphidinium* | 86-1560 | Erdschreiber's | Marine | Lower cell half is longer and broader than upper |
| *Peridinium* | 86-2900 | Soil-water | Freshwater | Thick, armored plates |
| *Prorocentrum* | 86-2905 | Marine | Marine | Prominent anterior spine |

### *Euglenoids*

Typically green and unicellular, euglenoid flagellates live in fresh water. They have characteristics of both plants and animals yet are distinct in many ways. Most are photosynthetic, but many, lacking chloroplasts, are heterotrophs. Most do not reproduce sexually. Euglenoids lack a cellulose cell wall; instead, they have a proteinaceous pellicle just inside the plasmalemma. The plastids contain chlorophyll a and b, beta carotene, and xanthophylls. If placed in the dark over the course of several divisions, the chloroplasts of *Euglena gracilis* will become colorless. When returned to the light, the plastid structure is reformed and the green color returns.

| Organism | | Media (captive care) | Wild habitat | Shape/Characteristic (Special Notes) |
|---|---|---|---|---|
| *Euglena acus* | 86-2600 | Euglena or soil– water | Freshwater | large; slow swimmer |
| *Euglena gracilis* | 86-2650 | Euglena agar | Freshwater | Z strain; used in vitamin $B_{12}$ assay |
| *Euglena* sp. | 87-0100 | Euglena | Freshwater | good for general flagellates study |
| *Phacus* | 86-2750 | Soil-water | Freshwater | heart-shaped |
| *Trachelomonas* | 86-2800 | Soil-water | Freshwater | loricated flagellate |

### *Brown Algae*

Multicellular and structurally complex, with no colonies or simple, unbranched filaments, the Phaeophytes, or brown seaweed, are primarily marine algae; less than one percent occur in fresh water. They are most abundant and reach their maximum development in the colder water of the oceans. While some species of Sargassum are found floating in enormous numbers in the Atlantic, the algae are usually firmly attached to a substrate by means of elaborate holdfast structures. Food is stored as soluble carbohydrates such as lamarin, fats and the alcohol mannitol. The plastids of the brown algae contain pigments chlorophyll a and c, c-carotene, and xanthins; an accessory pigment, fucoxanthin, gives the algae their characteristic dark brown or olive green color. The Phaeophytes are an economically important resource, used for alginic acid, fertilizer, and food. The brown algae are all collected from marine sources.

| Organism | | Media (captive care) | Wild habitat | Shape/Characteristic (Special Notes) |
|---|---|---|---|---|
| *Dictyota* | 86-1940 | Seawater | Marine | thin, flat forking branches; macroalgae; collected |
| *Ectocarpus* | 86-1950 | Seawater | Marine | filamentous; branched thallus, zoospores |
| *Fucus* | 86-3921 | Seawater | Marine | bladderlike floats, disk-shaped holdfasts for clinging to rocks; macroalgae; collected |
| *Laminaria* | 86-3920 | Seawater | Marine | long, leathery laminae and large in size; kelp; collected |

### *Golden Algae*

Chrysophytes are a large and complex group characterized by plastids containing distinctive golden yellow pigments. The group is diverse in form, yet all feature this yellow color, permitting easy identification. Chrysophytes are usually found in cold freshwater lakes and ponds, although some marine forms are common. *Synura*, existing in colonies in fresh water, can cause a fishy odor in reservoirs even in low concentrations, but is not harmful.

| Organism | | Media (captive care) | Wild habitat | Shape/Characteristic (Special Notes) |
|---|---|---|---|---|
| *Coccolithophora* | 86-2915 | Marine | Marine | coccoid, from coccoliths |
| *Ochromonas* | 86-1250 | *Ochromonas* | Freshwater | two unequal flagella |
| *Synura* | 86-1350 | Soil-water | Freshwater | colonial; radically arranged colonies |

### *Red Algae*

Although Rhodophytes, the most abundant type of seaweed, are widely distributed in the oceans, most occur in tropical and subtropical littoral zones. Of the 4,000 species, the vast majority are marine. Rhodophytes are not mobile –they possess no flagellated or ciliated cells at any stage of their life cycle — yet all reproduce sexually. Many red algae, such as *Corallina*, are calcified and encrusted appearing much like coral. This calcification has made it possible to trace the Rhodophytes to the Paleozoic Period. Single-celled forms such as *Porphyridium* are a rarity. Rhodophytes are characterized by reddish plastids, called rhodoplasts, which contain the pigments chlorophyll a and d, alpha and beta carotene, some xanthophylls and phycobiliproteins.

| Organism | | Media (captive care) | Wild habitat | Shape/Characteristic (Special Notes) |
|---|---|---|---|---|
| *Bangia* | 86-2510 | Erdschreiber's | Marine | filamentous; unbranched thallus |
| *Batrachospermum* | 86-2825 | Basic | Freshwater | filamentous |
| *Callithamnion* | 86-1568 | Erdschreiber's | Marine | filamentous |
| *Corallina* | 86-3933 | Seawater | Marine | macroalga; pink, coral like appearance; collected |
| *Gigartina* | 86-3926 | Seawater | Marine | macroalga, common high-intertidal alga; collected |
| *Polysiphonia* | 86-2910 | Seawater | Marine | filamentous; polysiphonious construction; collected |
| *Porphyra* | 86-3929 | Seawater | Marine | macroalga, long, irregular lobed; collected |
| *Porphyridium* | 86-2850 | Erdschreiber's | Marine | thin, gelatinous, blood red layer |

### *Yellow-Green Algae*

Xanthophytes are highly successful in fresh water and terrestrial environments, although some marine forms also exist. The yellow-green algae have pectin-rich cellulose walls. Starch is absent and food is stored in the form of oils. Xanthophytes are characterized by yellow-green plastids (xanthoplasts) which contain pigments chlorophyll a and c, several xanthins, and beta carotene. *Vaucheria* is a large, macroscopic, filamentous form that was classified a chlorophyte until pigment analysis showed the absence of chlorophyll b and true starch. *Tribonema* is a typical freshwater, unbranched, filamentous form which clearly demonstrates overlapping walls.

| Organism | | Media (captive care) | Wild habitat | Shape/Characteristic (Special Notes) |
|---|---|---|---|---|
| *Tribonema* | 86-1400 | Basic | Freshwater | filamentous; H-shaped overlapping cell wall |
| *Vaucheria* | 86-1500 | Soil-water | Freshwater | filamentous; oogamous |

## *Media for Algae and Cyanobacteria*

See the label or tables above for the appropriate media for each specimen.

**Basic Culture Solution Concentrate**

For culture of freshwater algae. Sterile. Makes one liter.

88 W 3250—100 mL bottle

**Basic Culture Solution, Working Solution**

For culture of freshwater algae. Sterile.

88 W 3251—1 L bottle

***Euglena* Medium**

Sterile.

88 W 5200—1 L bottle

**Erdschreiber's Medium**

For culture of marine algae. Sterile.

88 W 4351—1 L bottle

**Marine Algae Culture Medium**

For culture of macroscopic and microscopic marine algae. Sterile. Makes 1 liter.

88 W 4155—125 mL bottle

**Soil-Water Medium**

For culture of freshwater forms. Sterile.

88 W 4150—1 L bottle

**Spring Water**

To maintain *Hydra, Planaria*, protists, and algae.

88 W 7000—1 gal. jug

**Water, distilled**

For defined media.

88 W 7005—1 gal.

**Pond Water**

Non-sterile; may contain organisms.

88 W 7010—1 gal. jug

**Seawater**

From our marine tanks. Used in culturing saltwater invertebrates or in media recipes. Non-sterile.

88 W 7011—1 gal. jug

## *Disposition*

- Please dispose of excess living material in a manner to prevent spread into the environment. Consult with your school to identify their preferred method of disposal.
- You can safely use one of the following methods:
  - Treat culture with a 10% bleach solution for 24 hours (1 part bleach to 9 parts culture medium or water culture medium removed). Then rinse bleach solution down the drain with water until you can no longer smell bleach. Rinse remaining materials and containers with water and dispose of them in a general garbage container.
  - Carefully wrap specimens and their containers in a biohazard bag (without containing anything sharp that might puncture the bag) and tie closed (a twist tie works well). Autoclave the bag for 30 minutes at 121 degrees C and at a pressure of 15 lbs. per square inch. Dispose of autoclaved bag as your school recommends.



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