



Washington Lake Protection Association

October 5, 2016

Cyanobacteria Identification Workshop

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Huxley College of the Environment, Western Washington University, Bellingham, WA (USA)



Photo by Rachael Gravon, former IWS graduate student

What is this slime in my water?



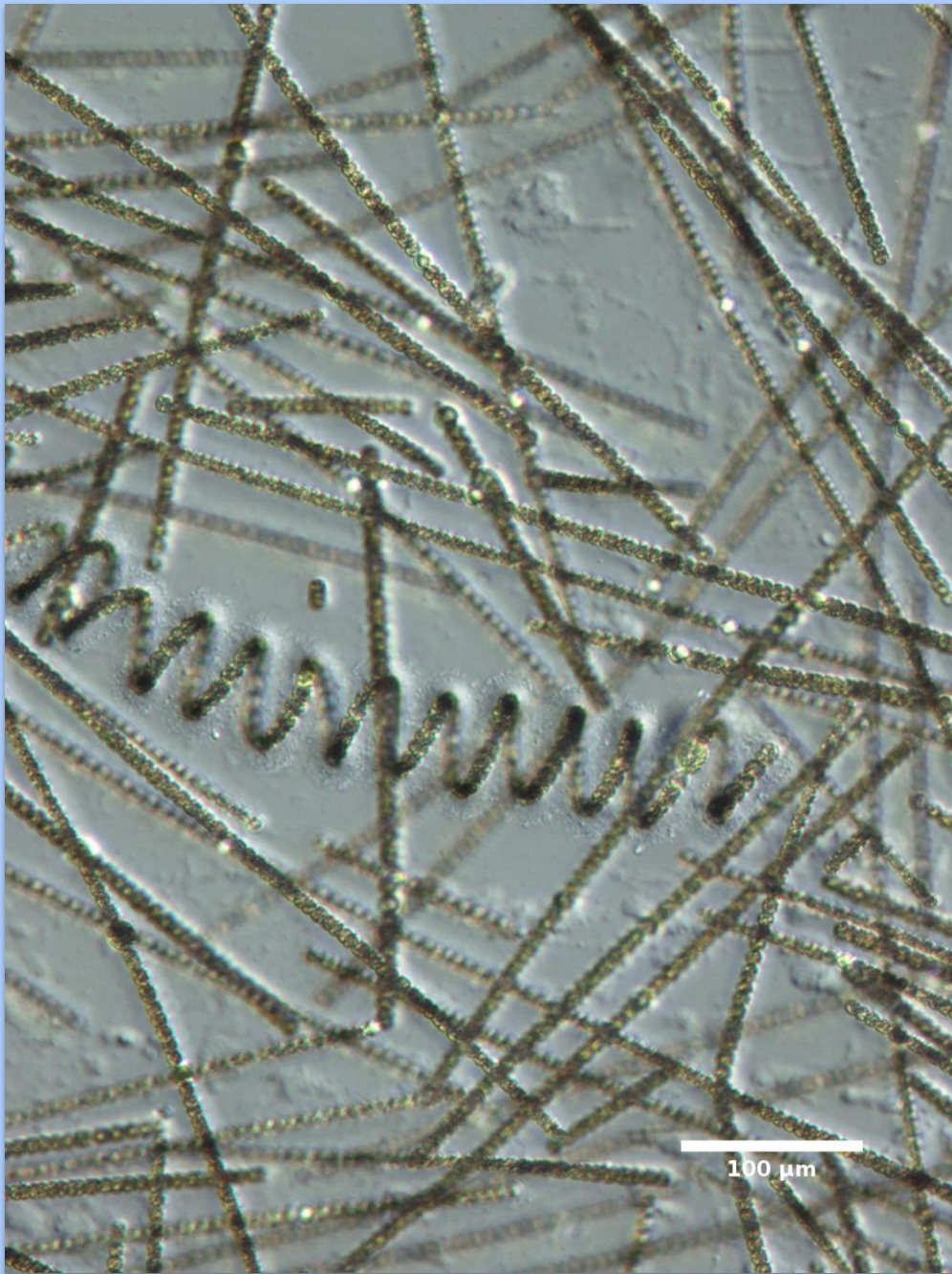
If I call this *Anabaena*, is it still toxic?

AlgaeBase Nomenclature (current)

Kingdom: Eubacteria
Phylum: Cyanobacteria
Class: Cyanophyceae
Order: Nostocales
Family: Aphanizomenonaceae
Genus: *Dolichospermum*
Species: *crassum*

ITIS Nomenclature (old)

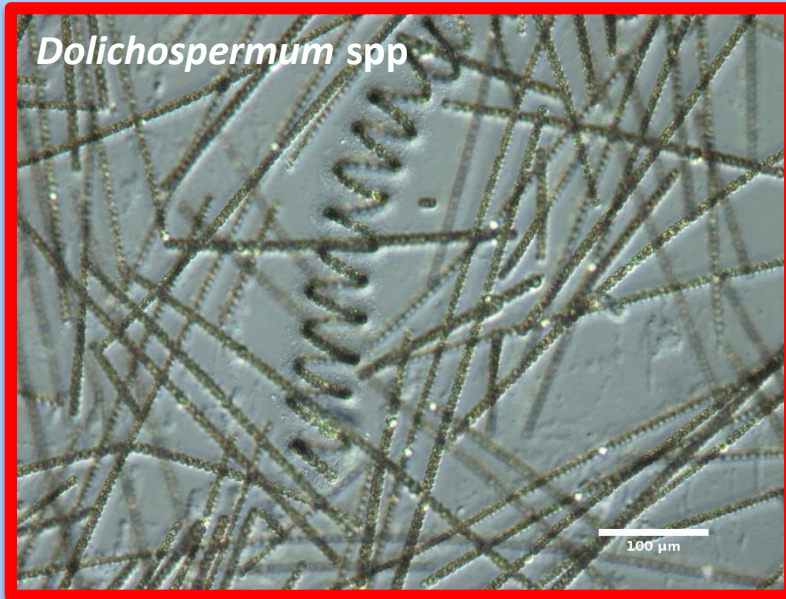
Kingdom: Bacteria
Phylum: Cyanobacteria
Class: Cyanophyceae
Order: Nostocales
Family: Nostocaceae
Genus: *Anabaena*
Species: *spiroides*
Variety: *crassa*



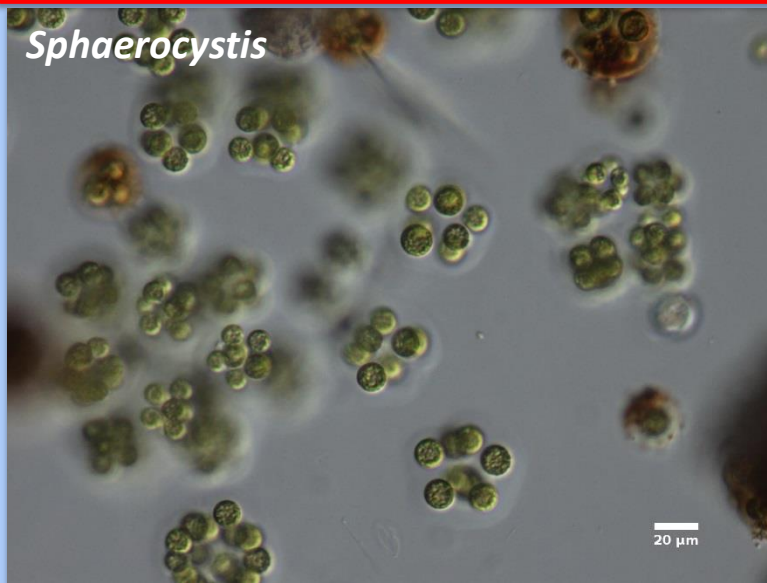
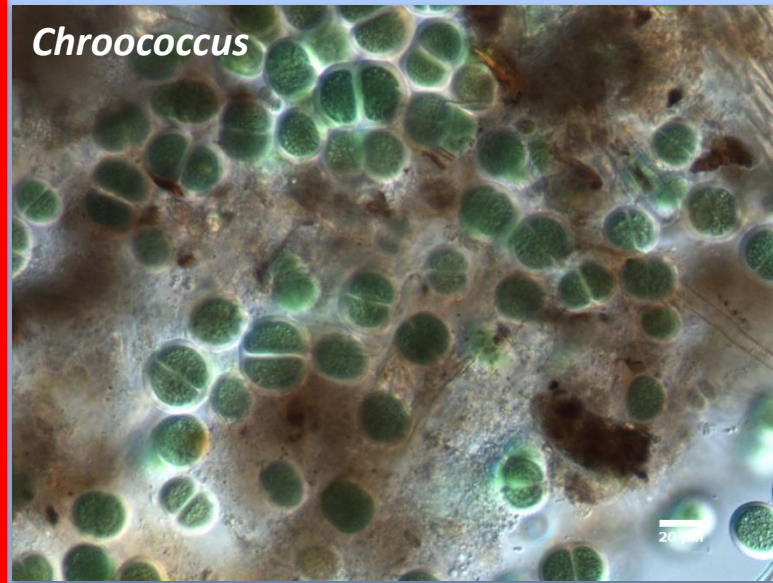
Blue-Green Algae (Cyanobacteria)

- No chloroplast, pyrenoid, nucleus, flagella
- Usually in filaments or colonies; rarely solitary
- Color might be blue-green ... or bright green, gray, blue, red, or even purple
- Movement by gliding or twitching (no flagella)
- Often very slimy!
- May form toxic or otherwise noxious blooms

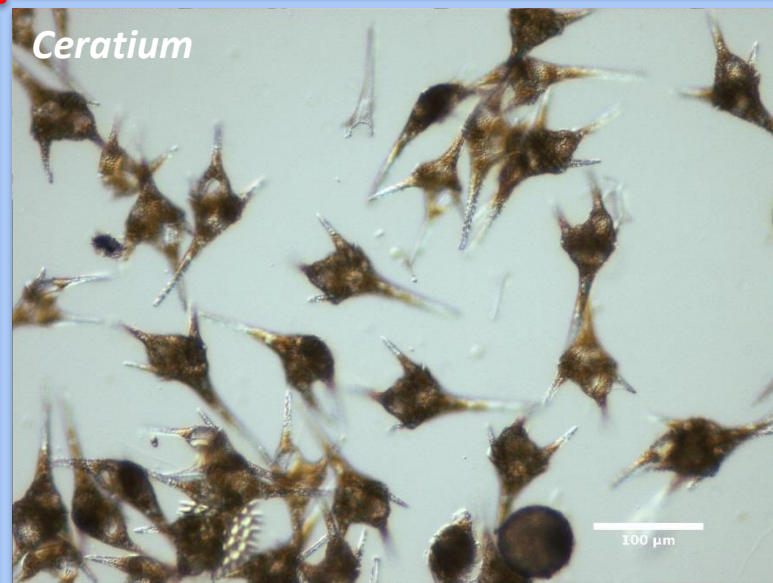
Potentially toxic cyanobacteria bloom



“Nontoxic” cyanobacteria bloom

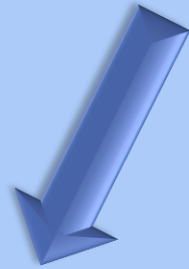


Nontoxic green algae bloom



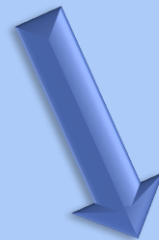
Nontoxic dinoflagellate bloom

Is it Cyanobacteria?



Yes, but is it
potentially toxic?

No



Yes

No*

*All Cyanobacteria may be able to release compounds that can cause skin irritations and other responses



Major Cyanobacteria Toxins*

Microcystins (liver damage ++)

Anabaena/Dolichospermum, Fischerella, Gloeotrichia, Nodularia, Microcystis, Nostoc, Oscillatoria/Phormidium/Planktothrix

Cylindrospermopsin (liver/kidney damage)

*Anabaena/Dolichospermum, Aphanizomenon, Cylindrospermopsis** , Cylindrospermum, Lyngbya*

Anatoxins (nerve damage)

*Anabaena/Dolichospermum, Aphanizomenon, Cylindrospermopsis** , Cylindrospermum, Microcystis, Oscillatoria/Phormidium/Planktothrix, Tychonema, Woronichinia*

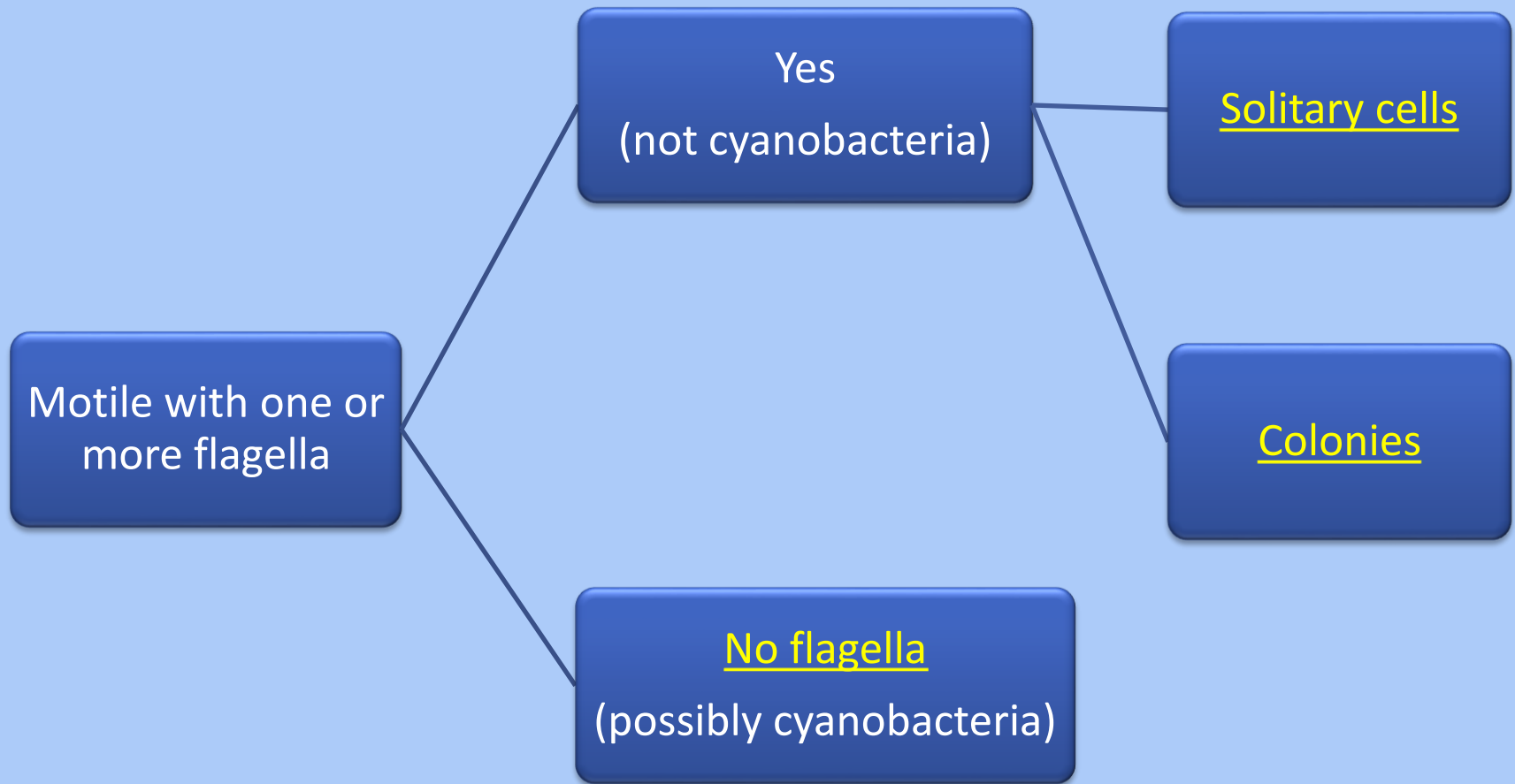
Saxitoxins (similar to PSP toxins)

*Anabaena/Dolichospermum, Aphanizomenon, Lyngbya, Cylindrospermopsis** , Oscillatoria/Phormidium/Planktothrix*

[*Cyanobacteria/Cyanotoxins | Nutrient Pollution Policy and Data | US EPA](#)

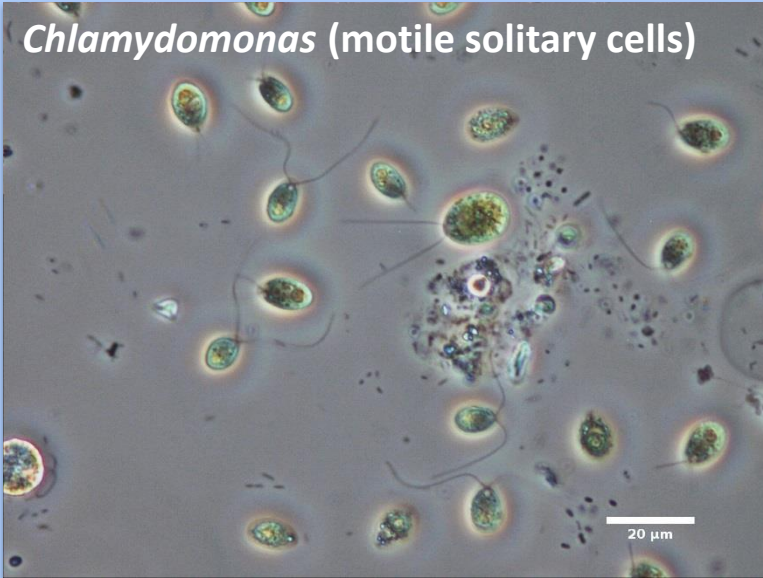
** Warm water genus – not present in WA lakes?

Key to Common Freshwater Algae



Motility is a tricky taxonomic feature. Flagella can be hard to see; cells may temporarily lose flagella or remain motionless; and some cells have nonmotile “pseudocilia”

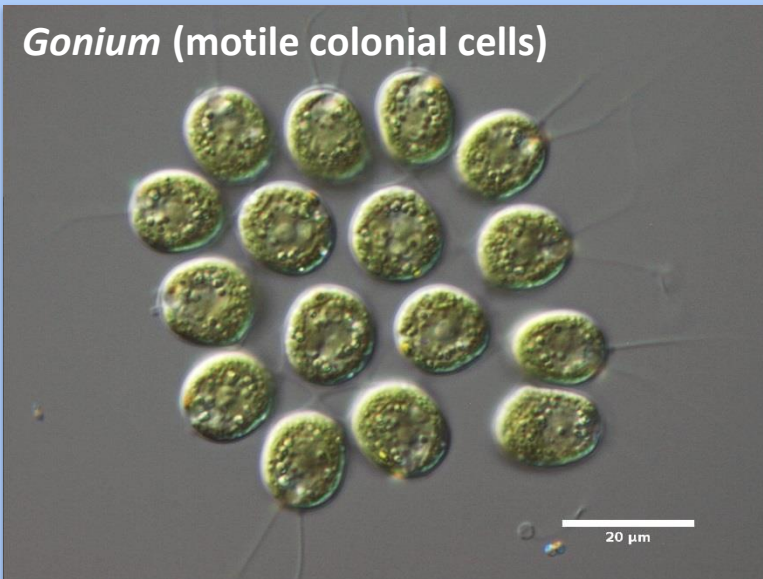
Chlamydomonas (motile solitary cells)



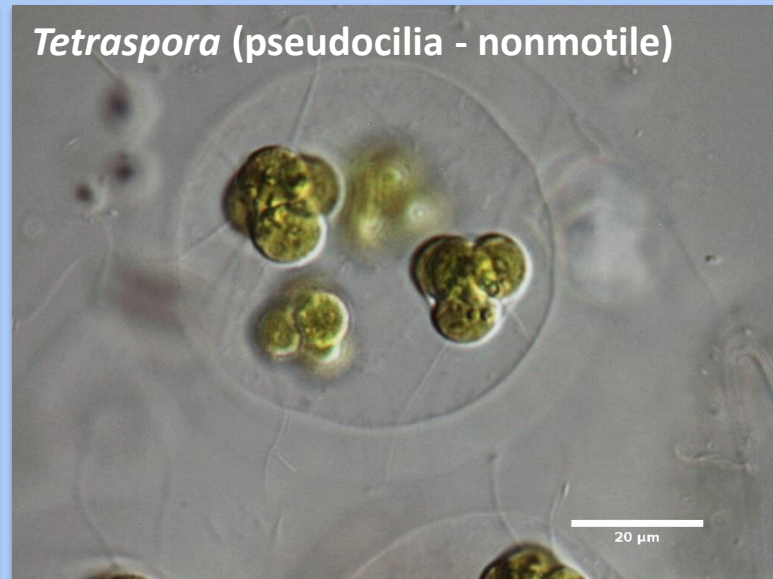
Chlamydomonas (nonmotile cells)



Gonium (motile colonial cells)

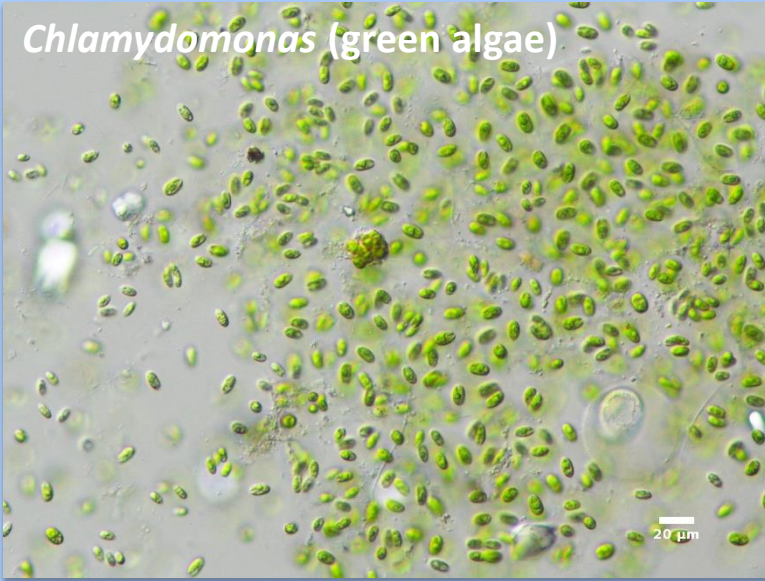


Tetraspora (pseudocilia - nonmotile)

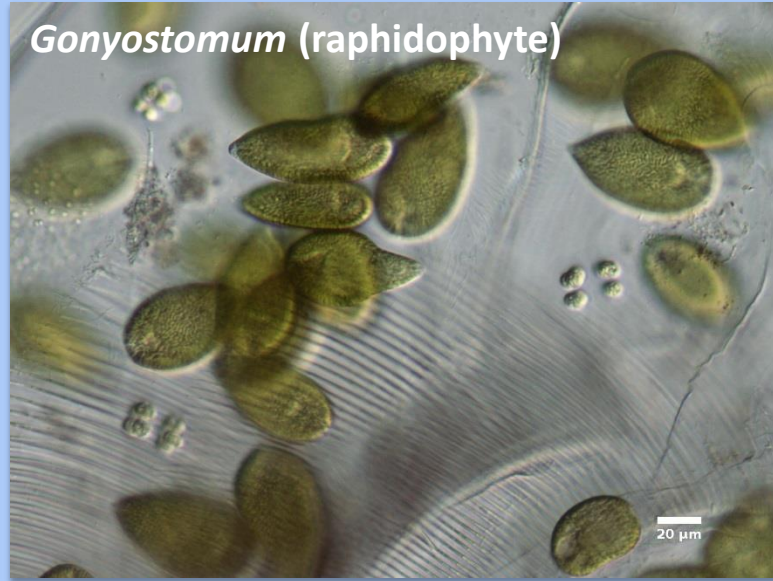


Common Freshwater Algae – Motile Solitary Cells (Not Cyanobacteria)

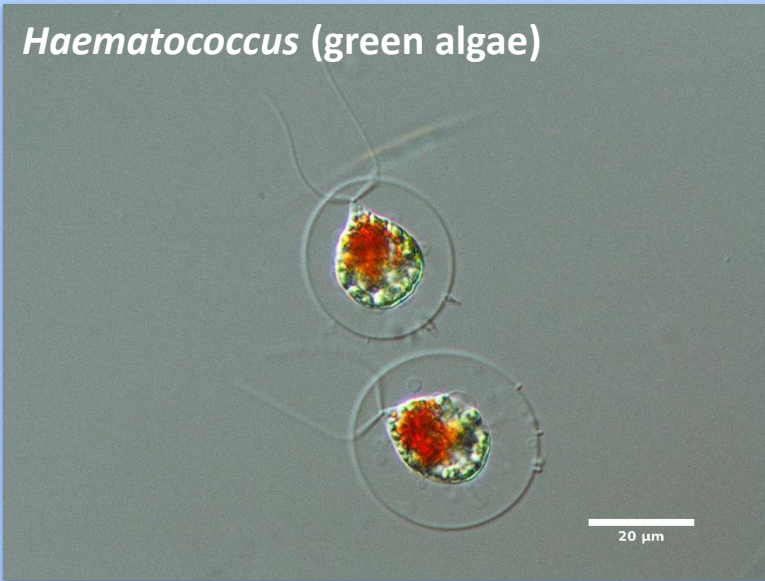
Chlamydomonas (green algae)



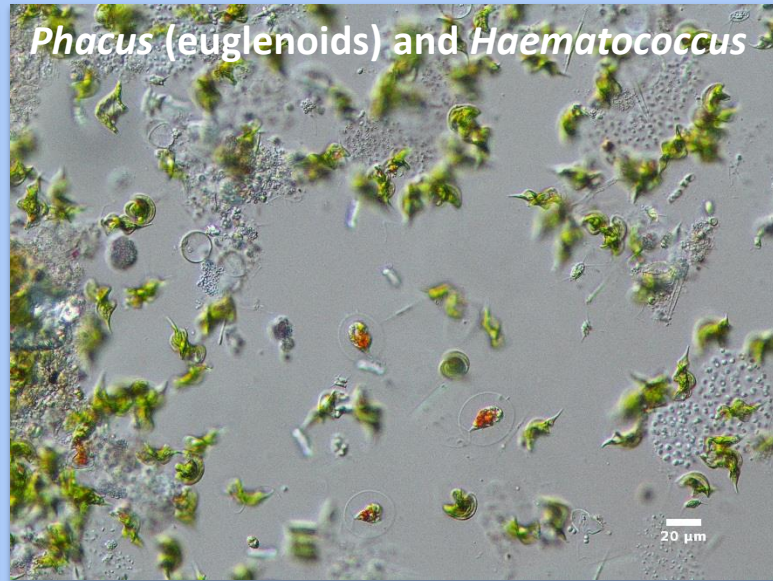
Gonyostomum (raphidophyte)



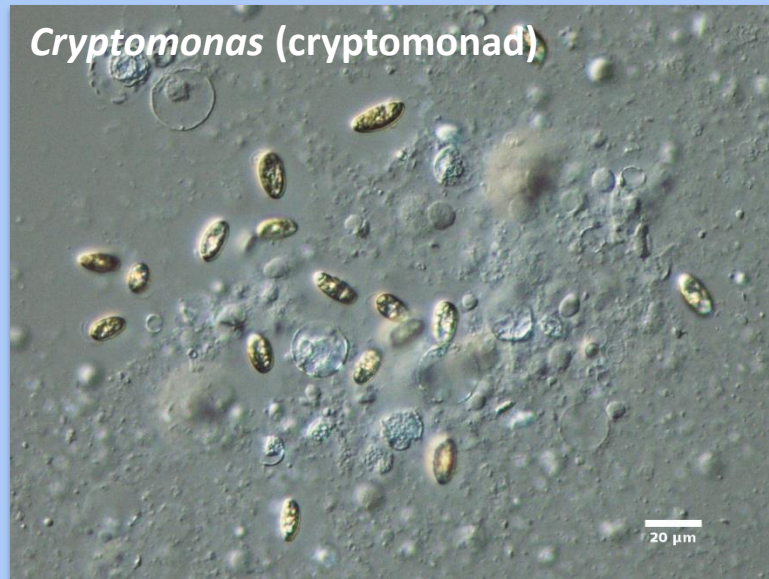
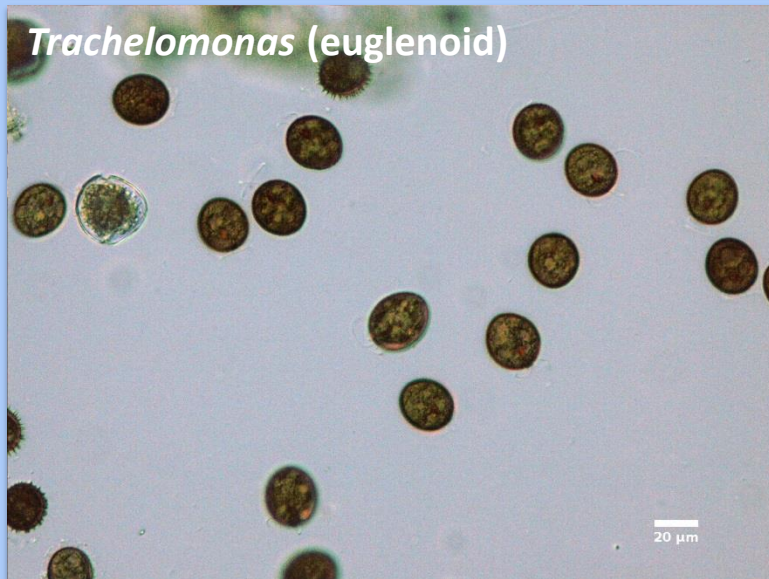
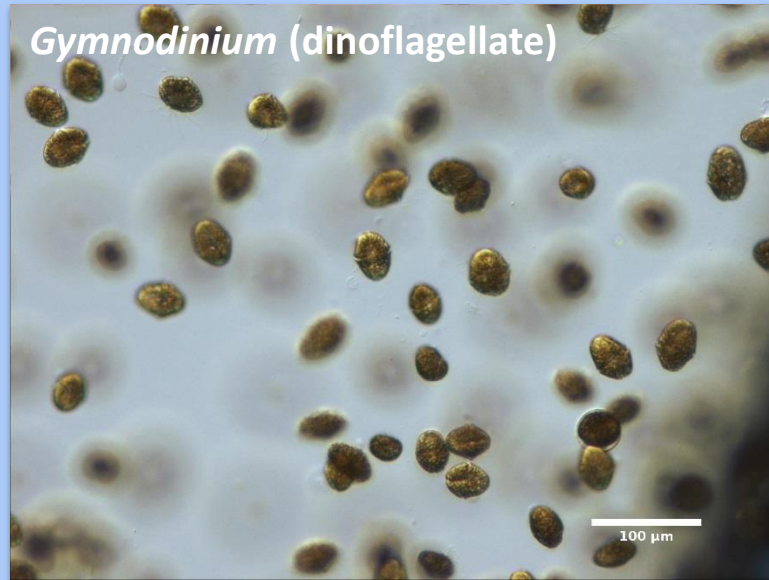
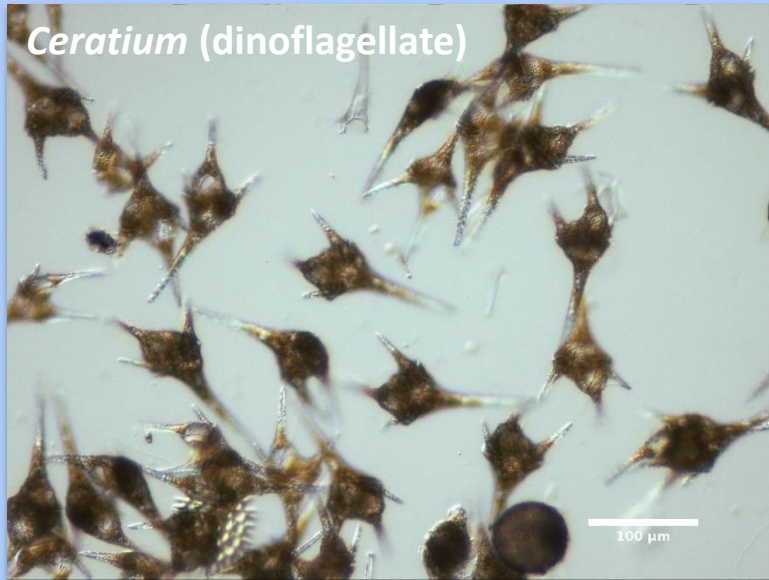
Haematococcus (green algae)



Phacus (euglenoids) and *Haematococcus*

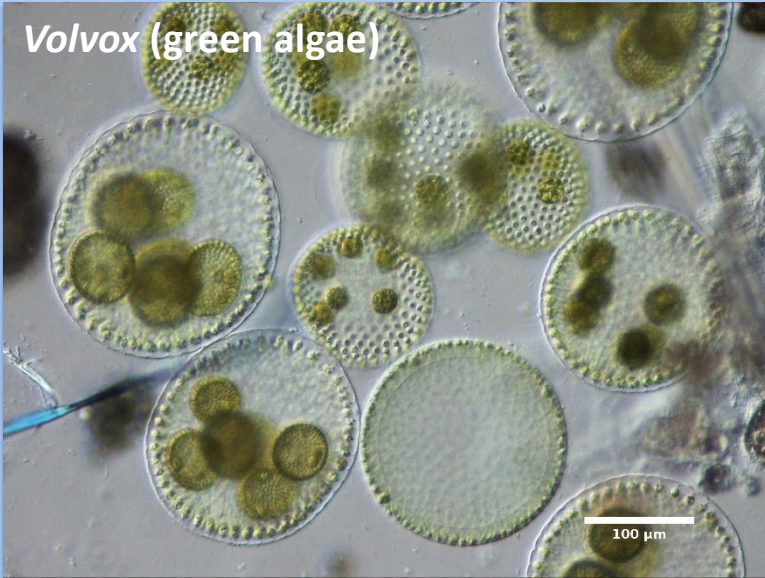


Common Freshwater Algae – Motile Solitary Cells (Not Cyanobacteria)

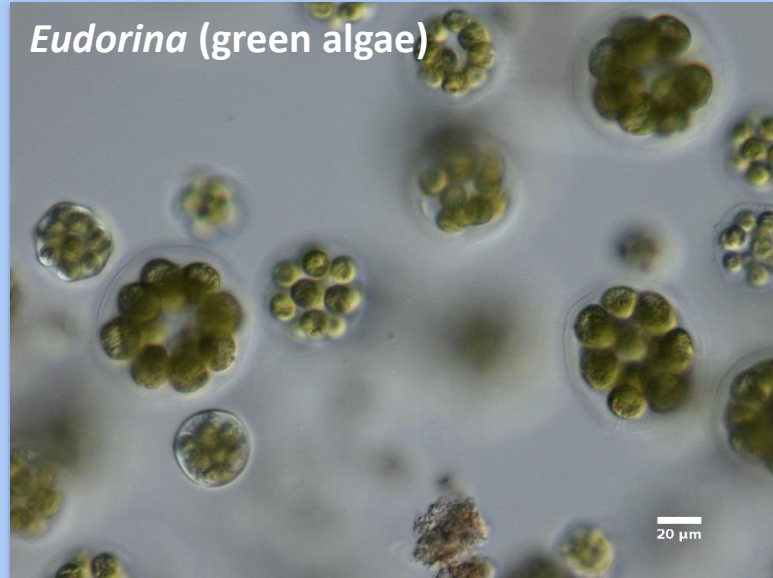


Common Freshwater Algae – Motile Colonial Cells (Not Cyanobacteria)

Volvox (green algae)



Eudorina (green algae)



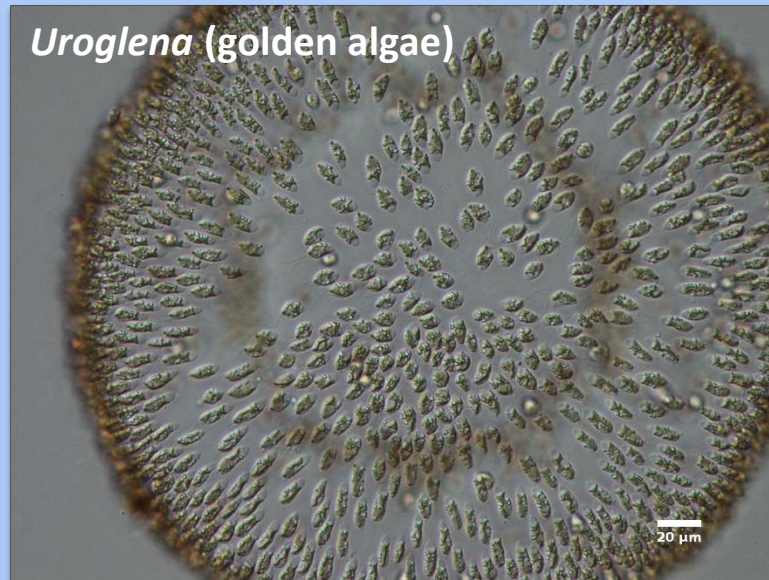
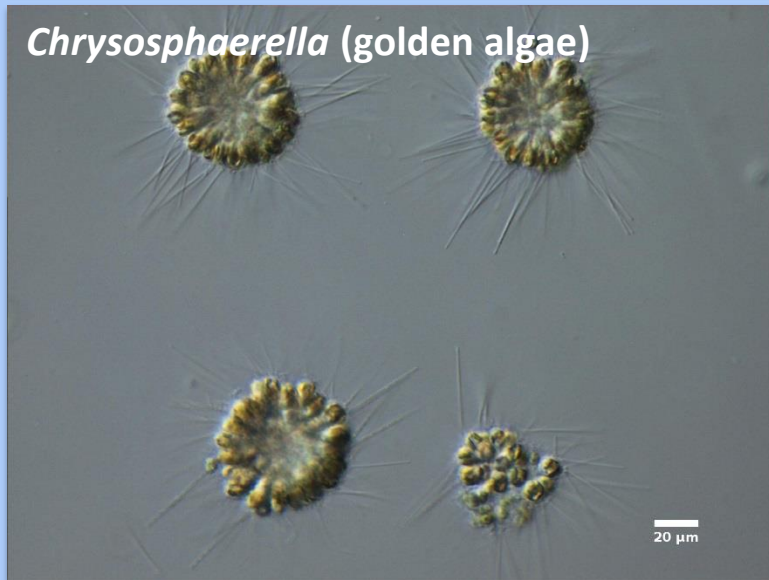
Pandorina (green algae)



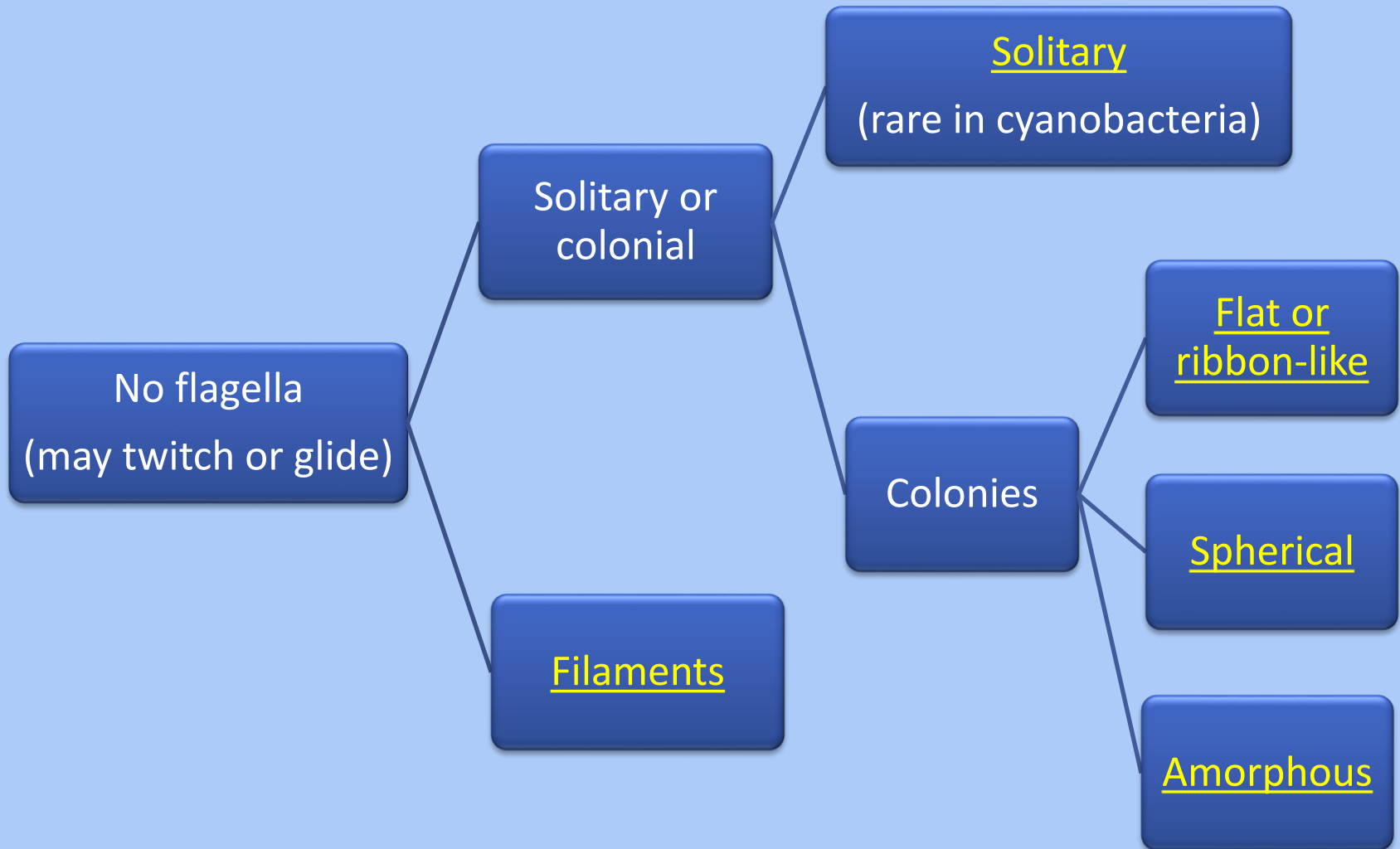
Pediastrum (green algae)



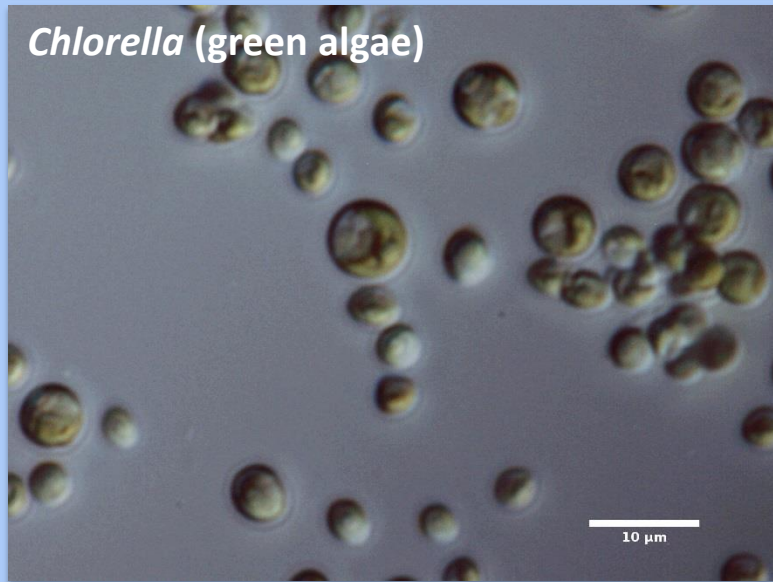
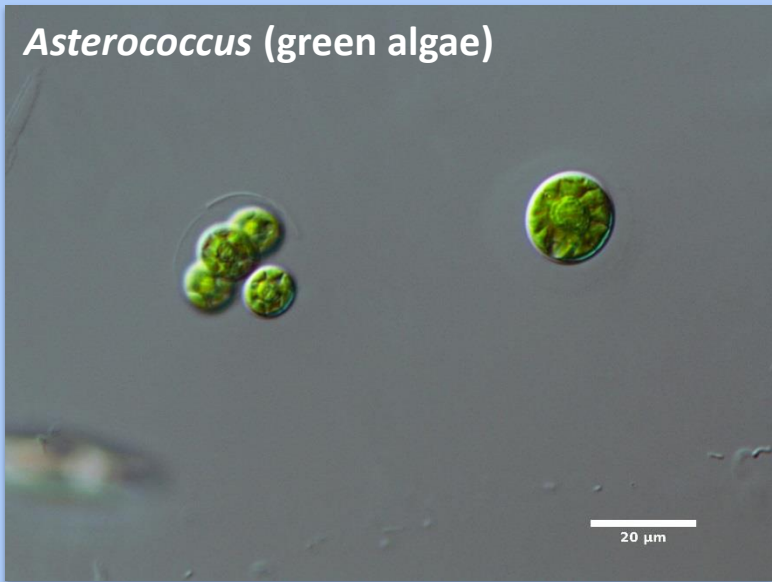
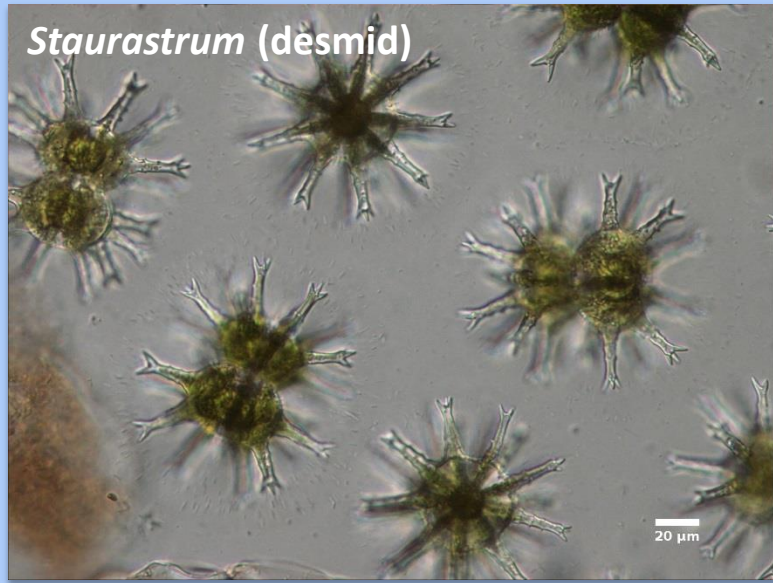
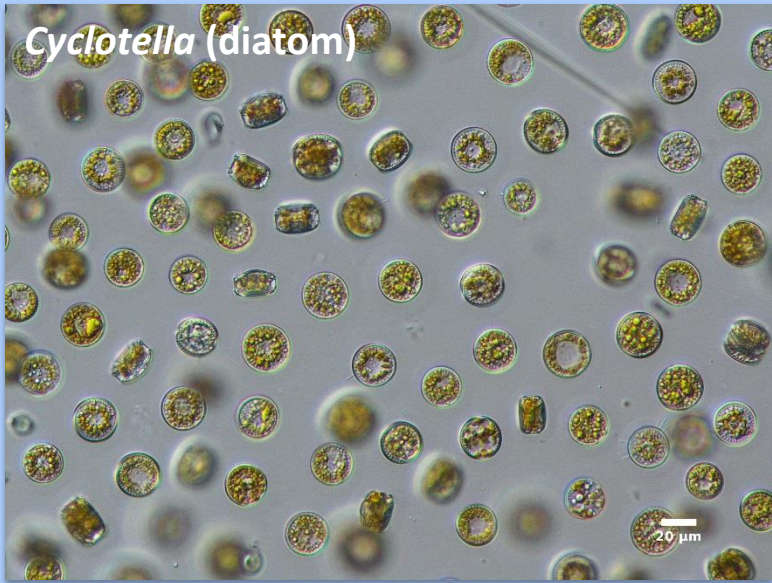
Common Freshwater Algae – Motile Colonial Cells (Not Cyanobacteria)



Key to Common Freshwater Algae

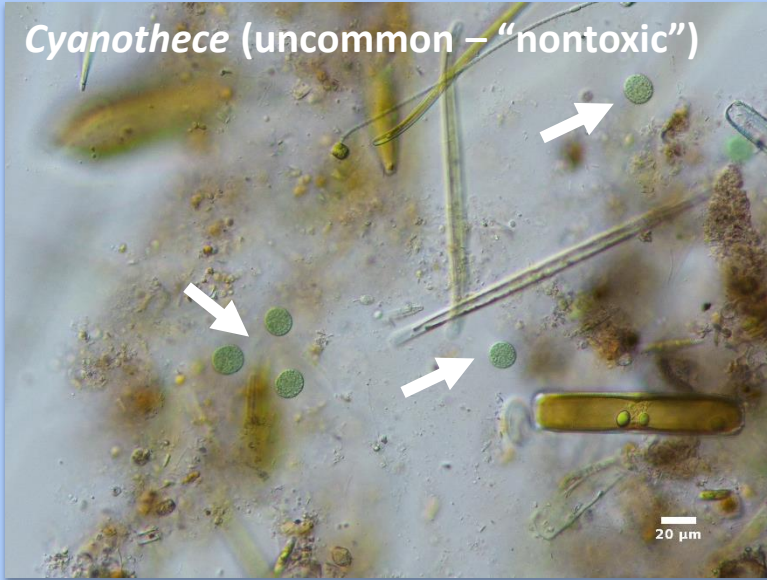


Common Freshwater Algae – Nonmotile Solitary Cells (Not Cyanobacteria)



Common Freshwater Algae – Nonmotile Solitary Cells (Cyanobacteria)

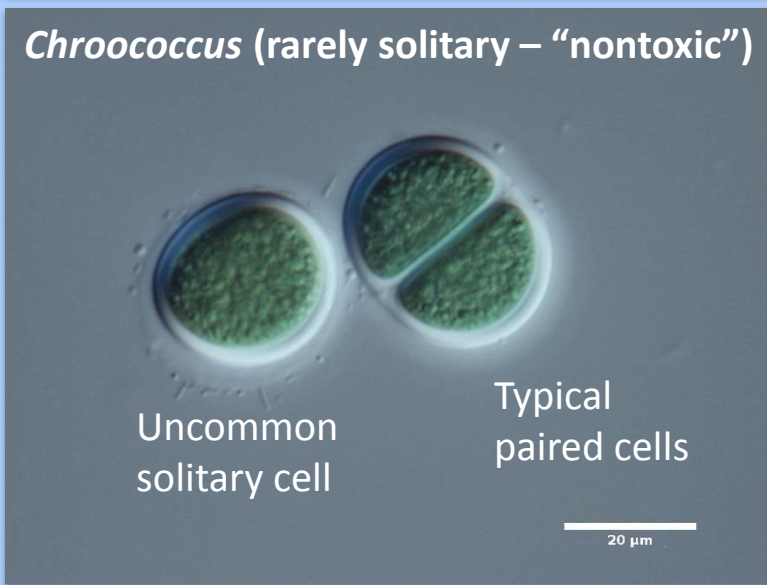
Cyanothece (uncommon – “nontoxic”)



Cyanothece (uncommon – “nontoxic”)



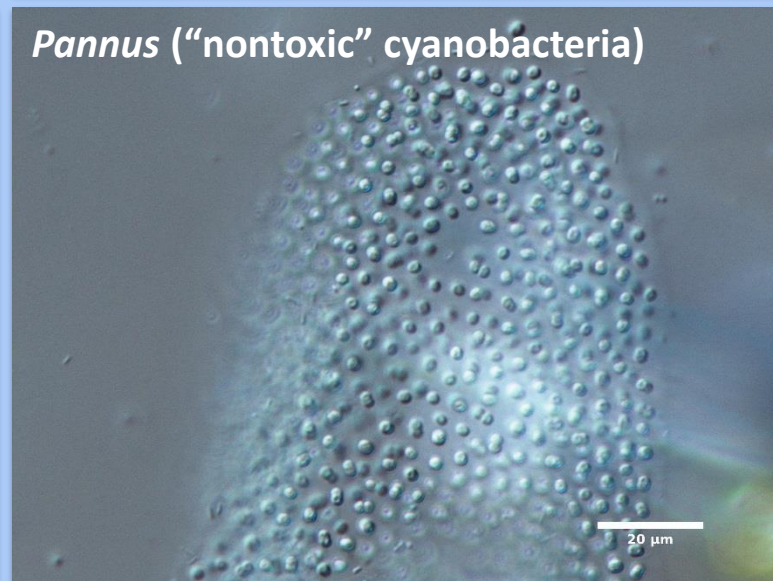
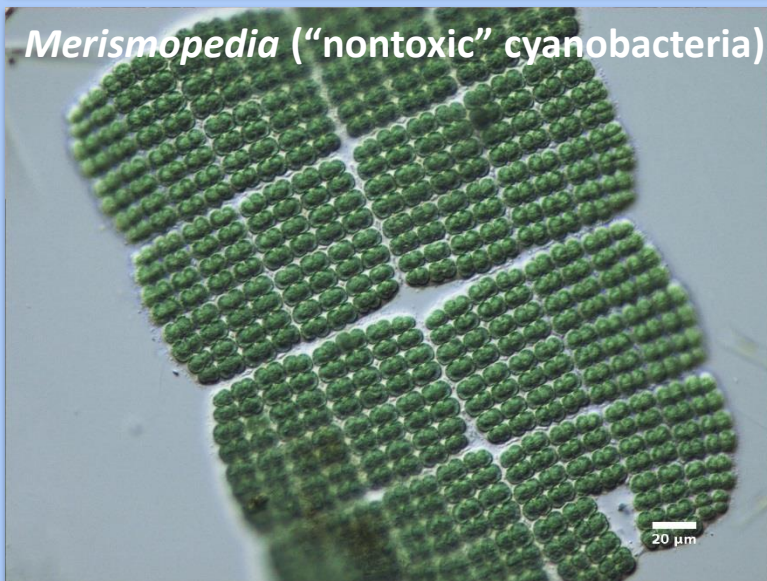
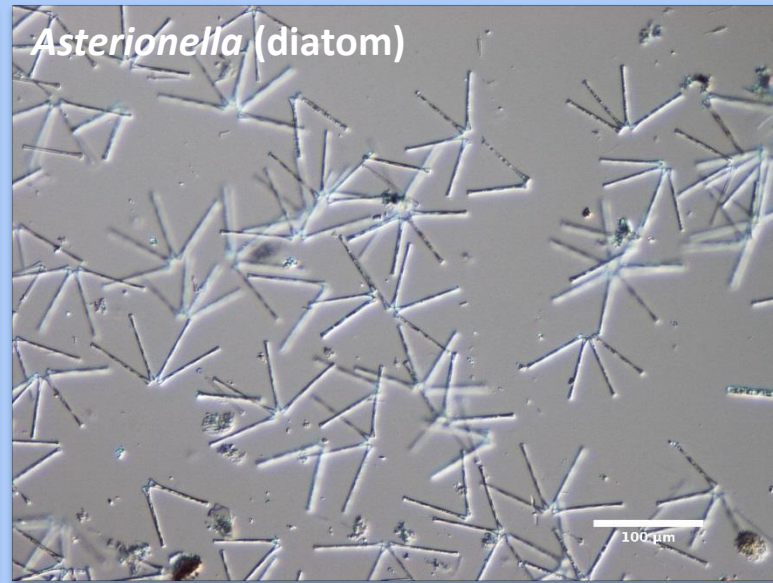
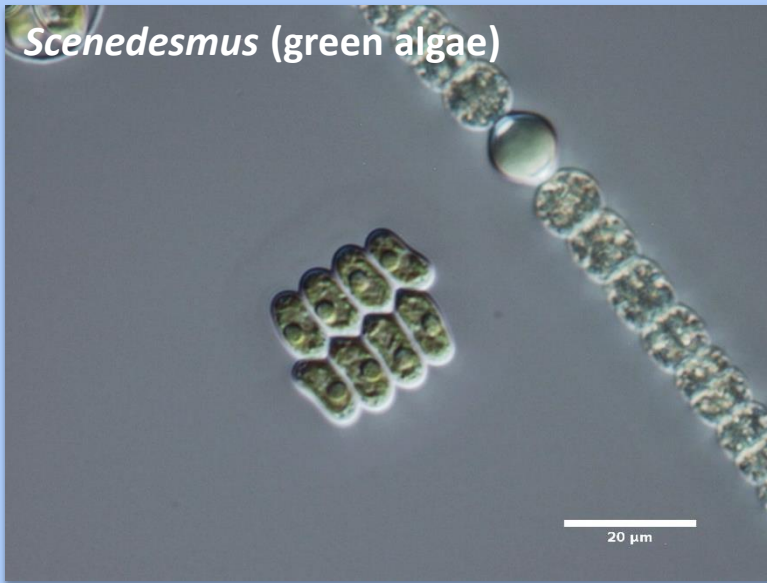
Chroococcus (rarely solitary – “nontoxic”)



Aphanizomenon akinetes (resting cells)
filaments potentially toxic

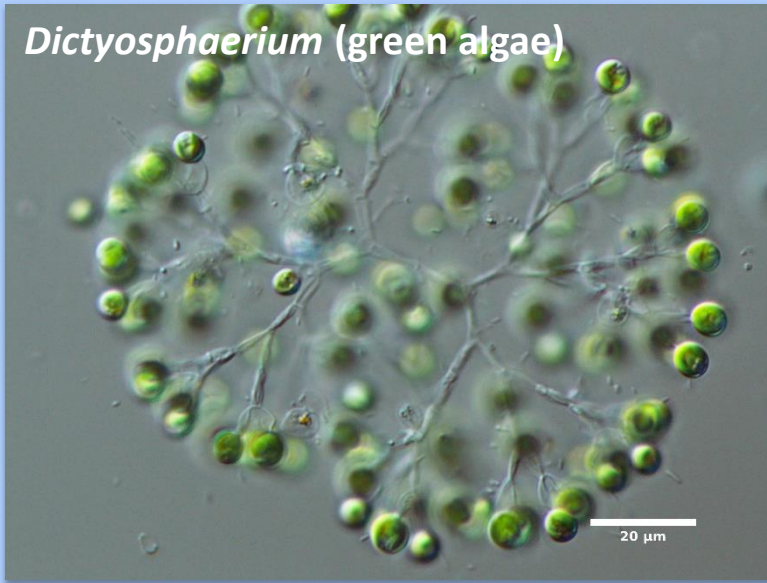


Common Freshwater Algae – Nonmotile Flat or Ribbon-like Colonies



Common Freshwater Algae – Nonmotile Spherical Colonies (Not Cyanobacteria)

Dictyosphaerium (green algae)



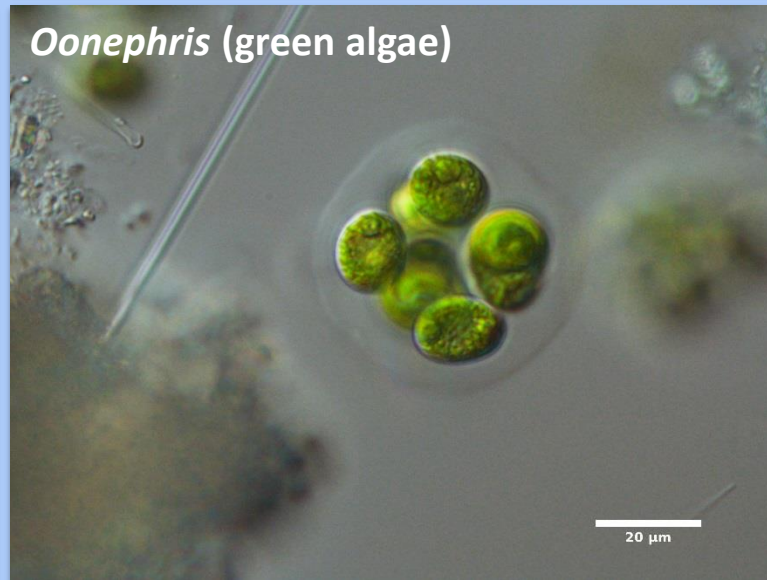
Gloeocystis (green algae)



Oocystis (green algae)

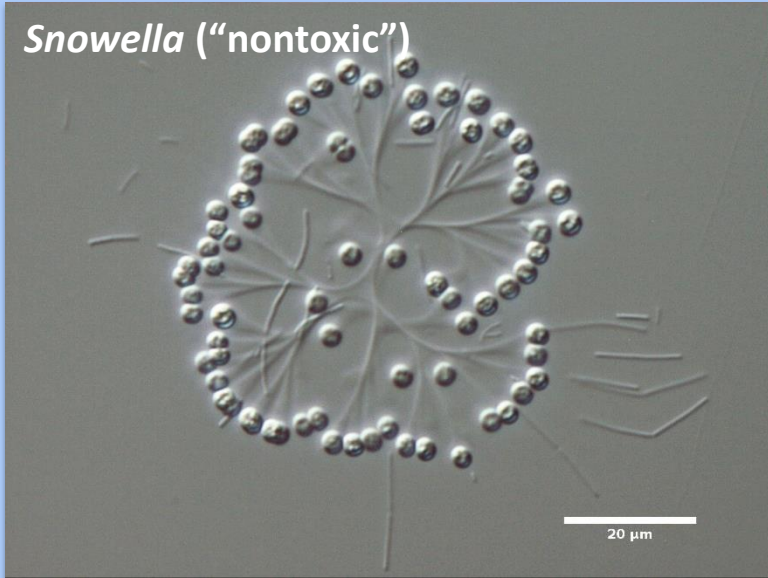


Oonephris (green algae)



Common Freshwater Algae – Nonmotile Spherical Colonies (Cyanobacteria)

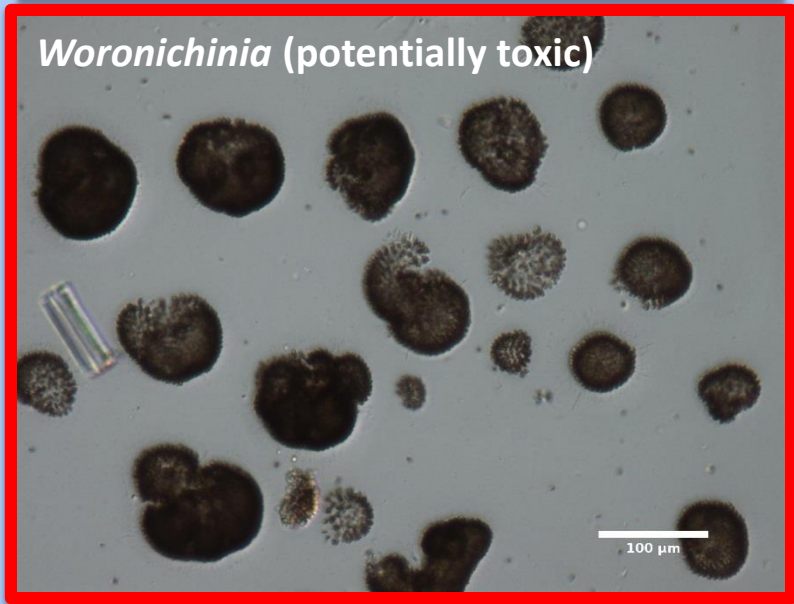
Snowella ("nontoxic")



Gomphosphaeria ("nontoxic")



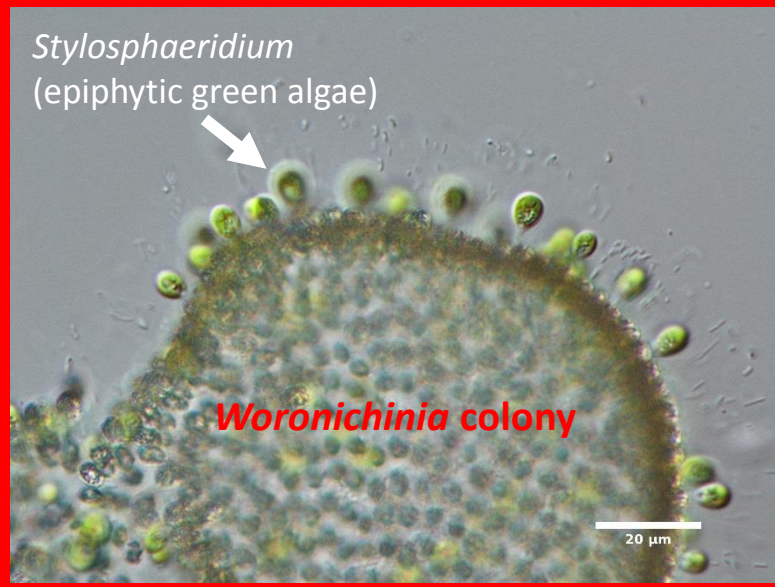
Woronichinia (potentially toxic)



Coelosphaerium ("nontoxic")

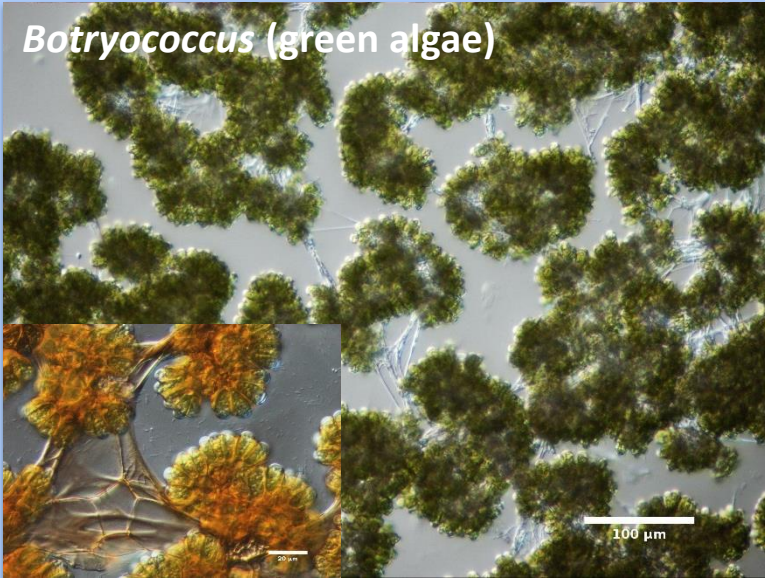


Common Freshwater Algae – Woronichinia Variations (Potentially Toxic Cyanobacteria)

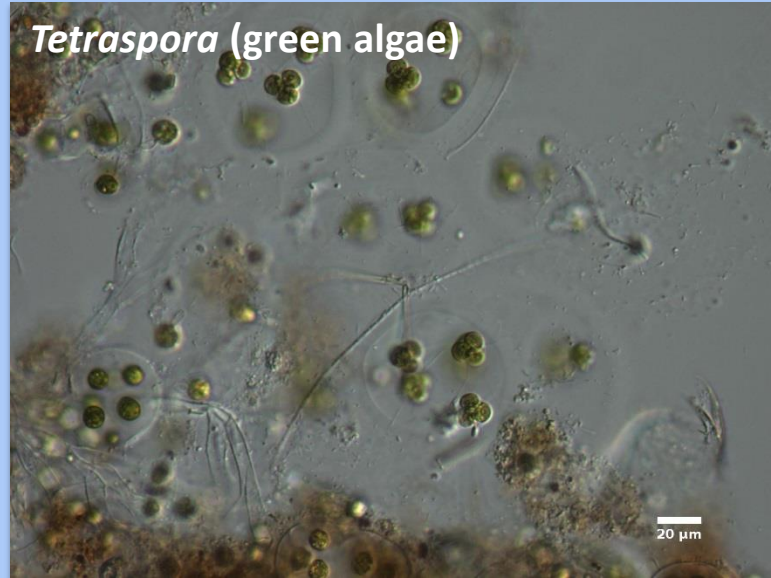


Common Freshwater Algae – Nonmotile Amorphous Colonies (Not Cyanobacteria)

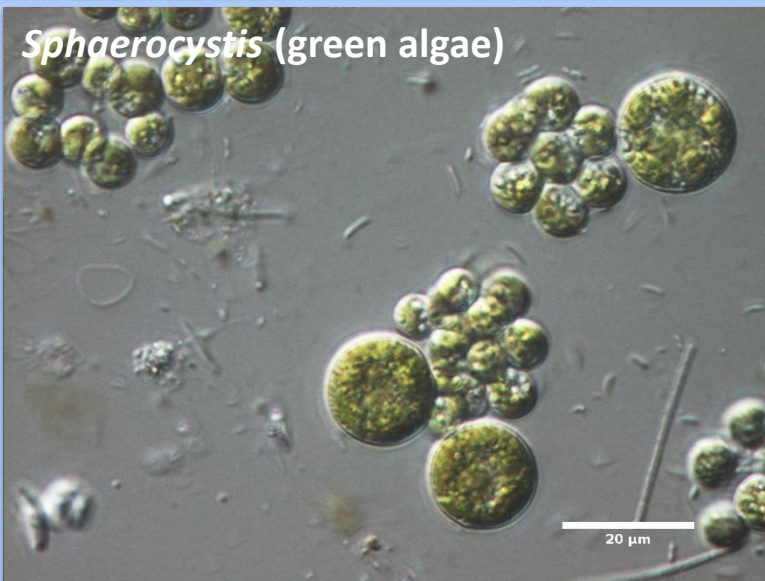
Botryococcus (green algae)



Tetraspora (green algae)



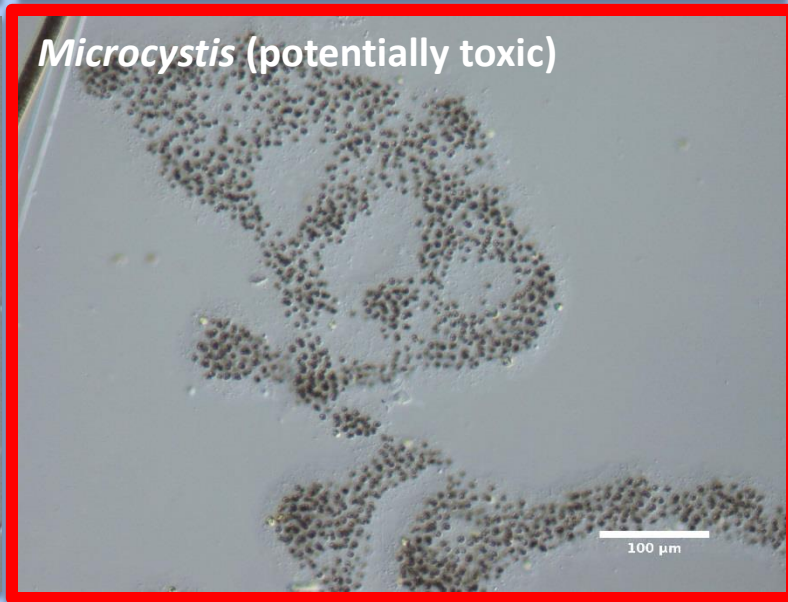
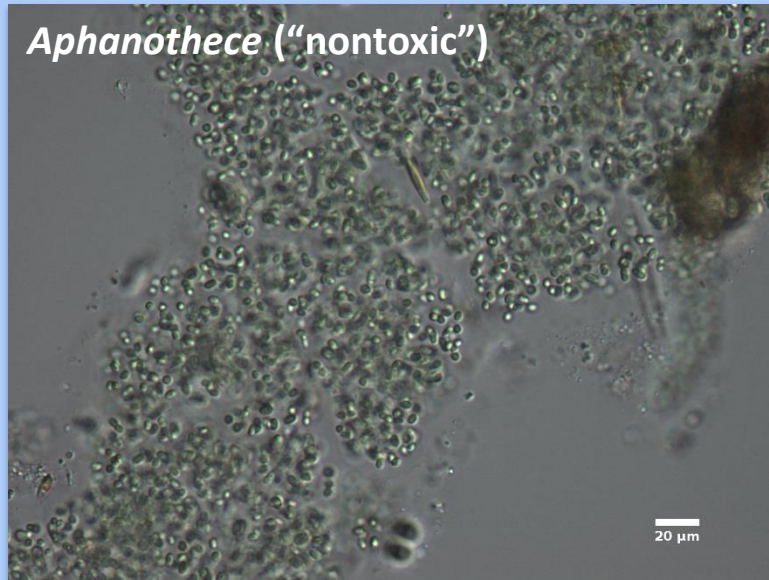
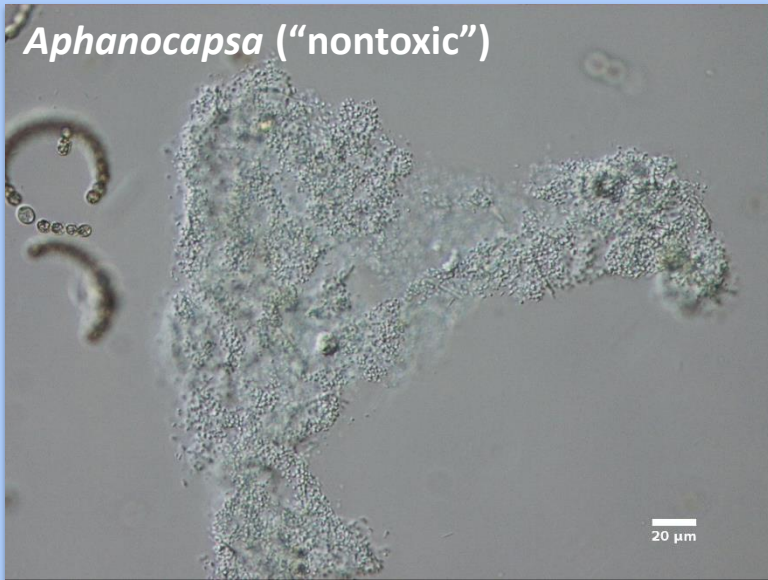
Sphaerocystis (green algae)



Asterococcus (green algae)

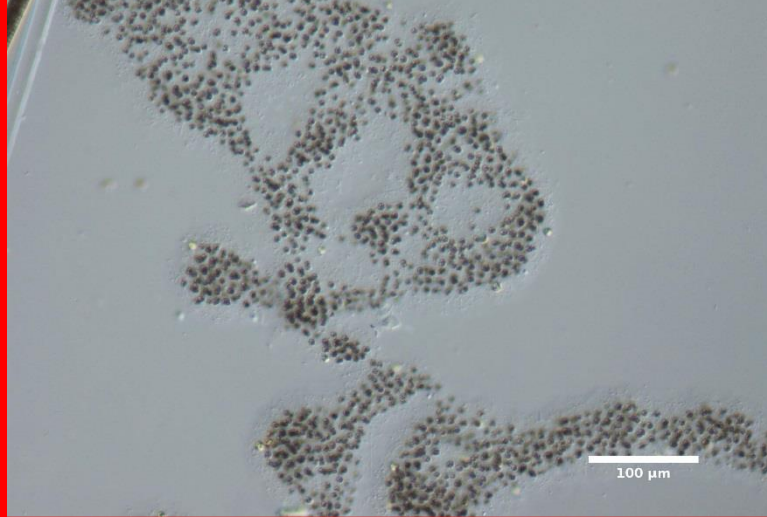


Common Freshwater Algae – Nonmotile Amorphous Colonies (Cyanobacteria)



Common Freshwater Algae – Microcystis Variations (Potentially Toxic Cyanobacteria)

Microcystis aeruginosa

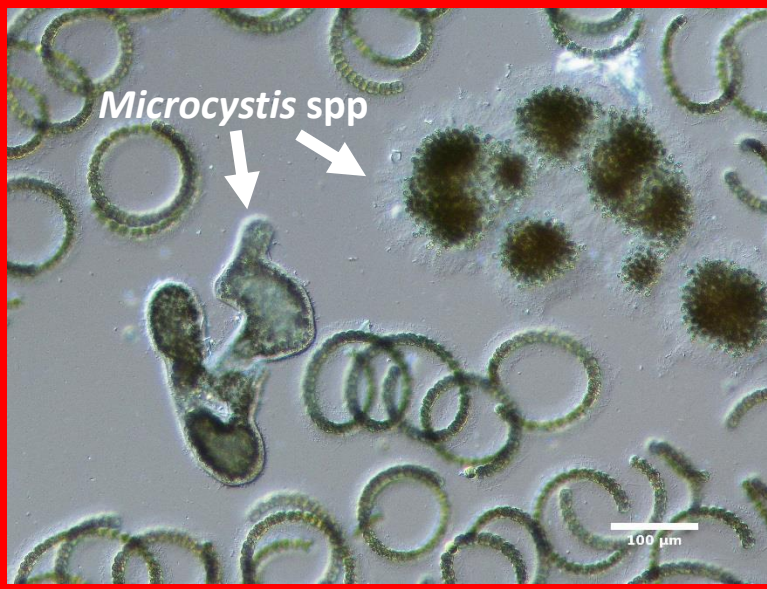


Microcystis aeruginosa (or *flos-aquae*)



Pseudanabaena
(cyanobacteria)

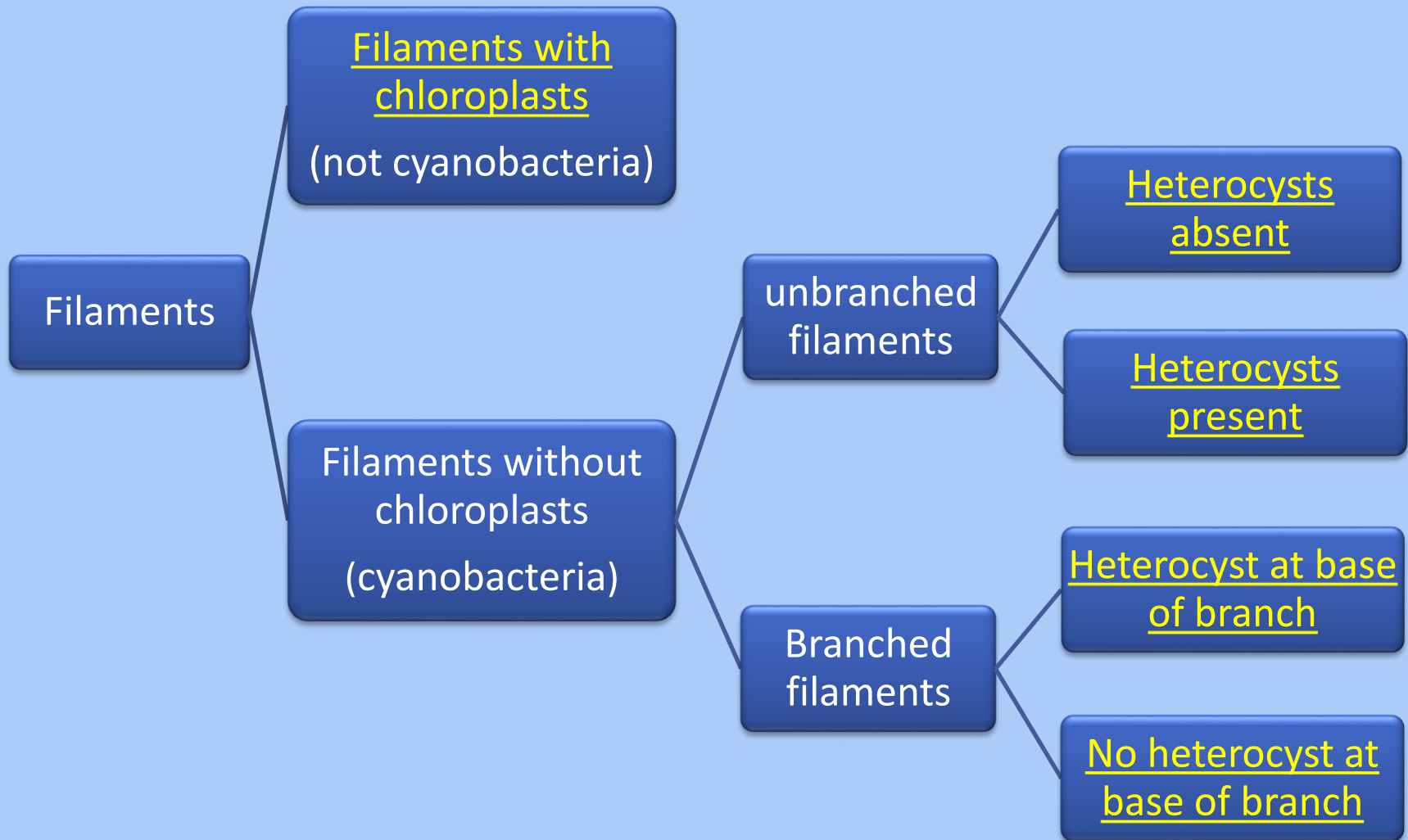
Microcystis spp



Microcystis wesenbergii
(less likely to be toxic?)

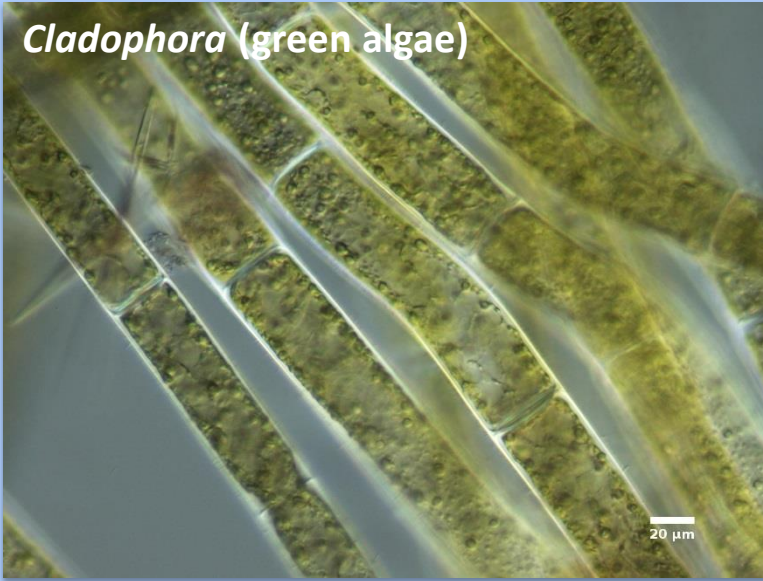


Key to Common Freshwater Algae

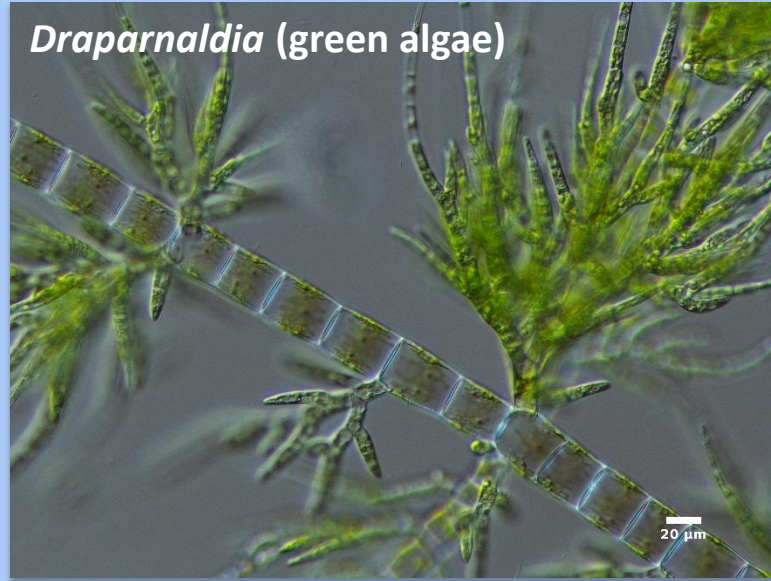


Common Freshwater Algae – Filaments With Chloroplasts (Not Cyanobacteria)

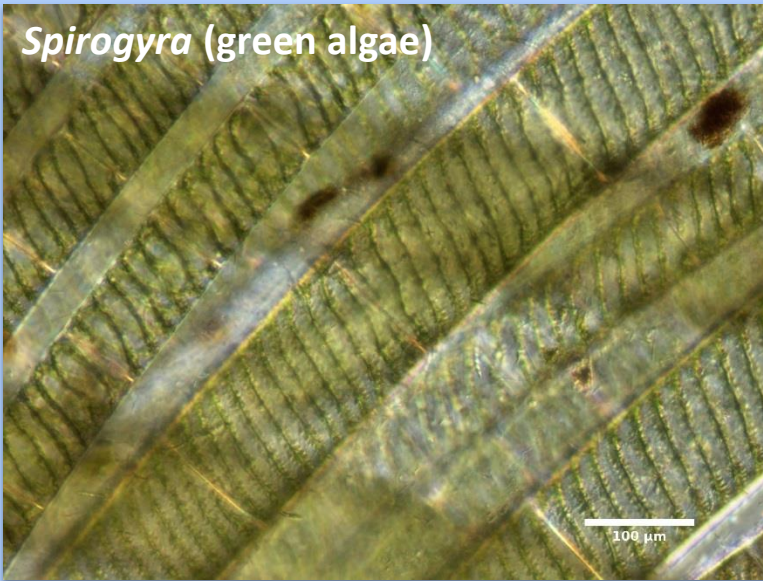
Cladophora (green algae)



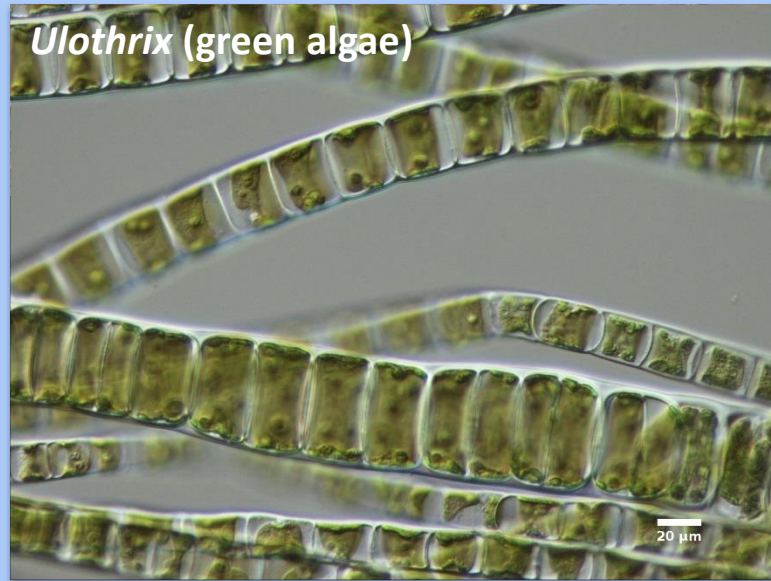
Draparnaldia (green algae)



Spirogyra (green algae)

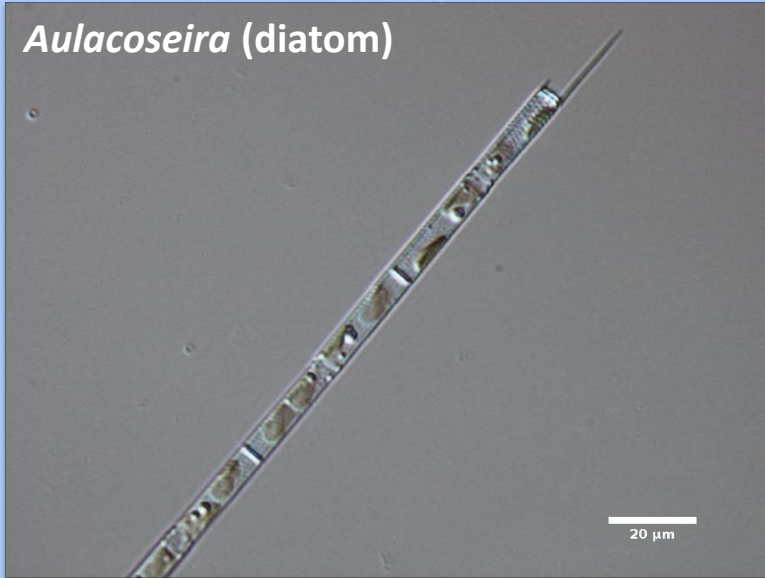


Ulothrix (green algae)

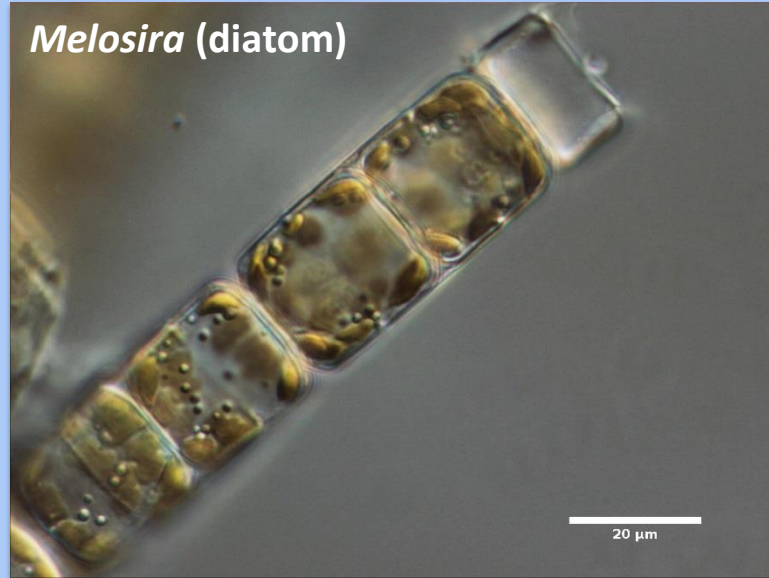


Common Freshwater Algae – Filaments With Chloroplasts (Not Cyanobacteria)

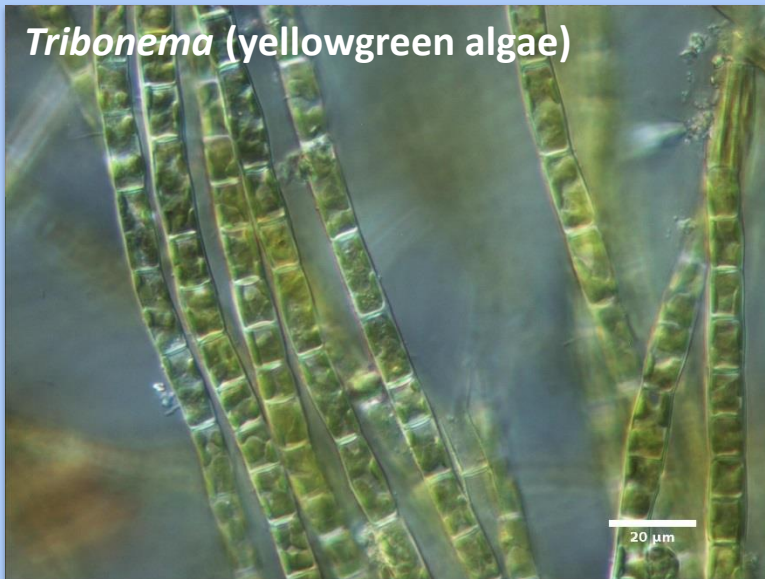
Aulacoseira (diatom)



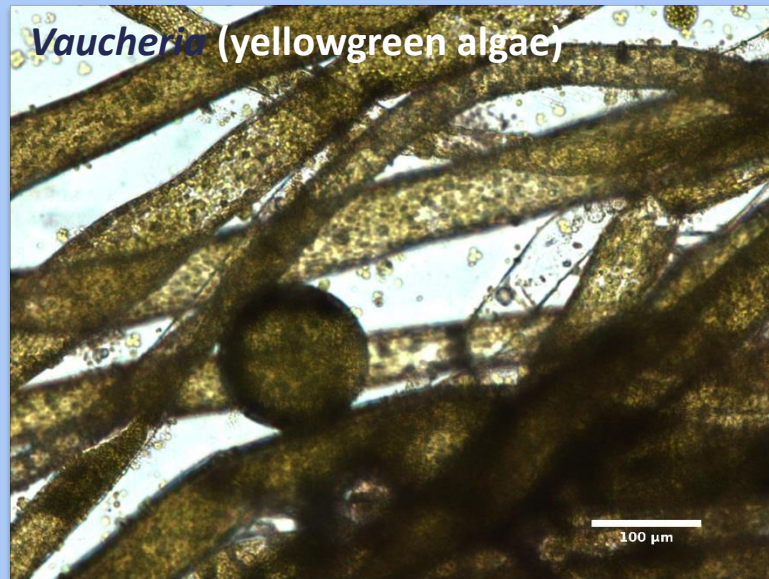
Melosira (diatom)

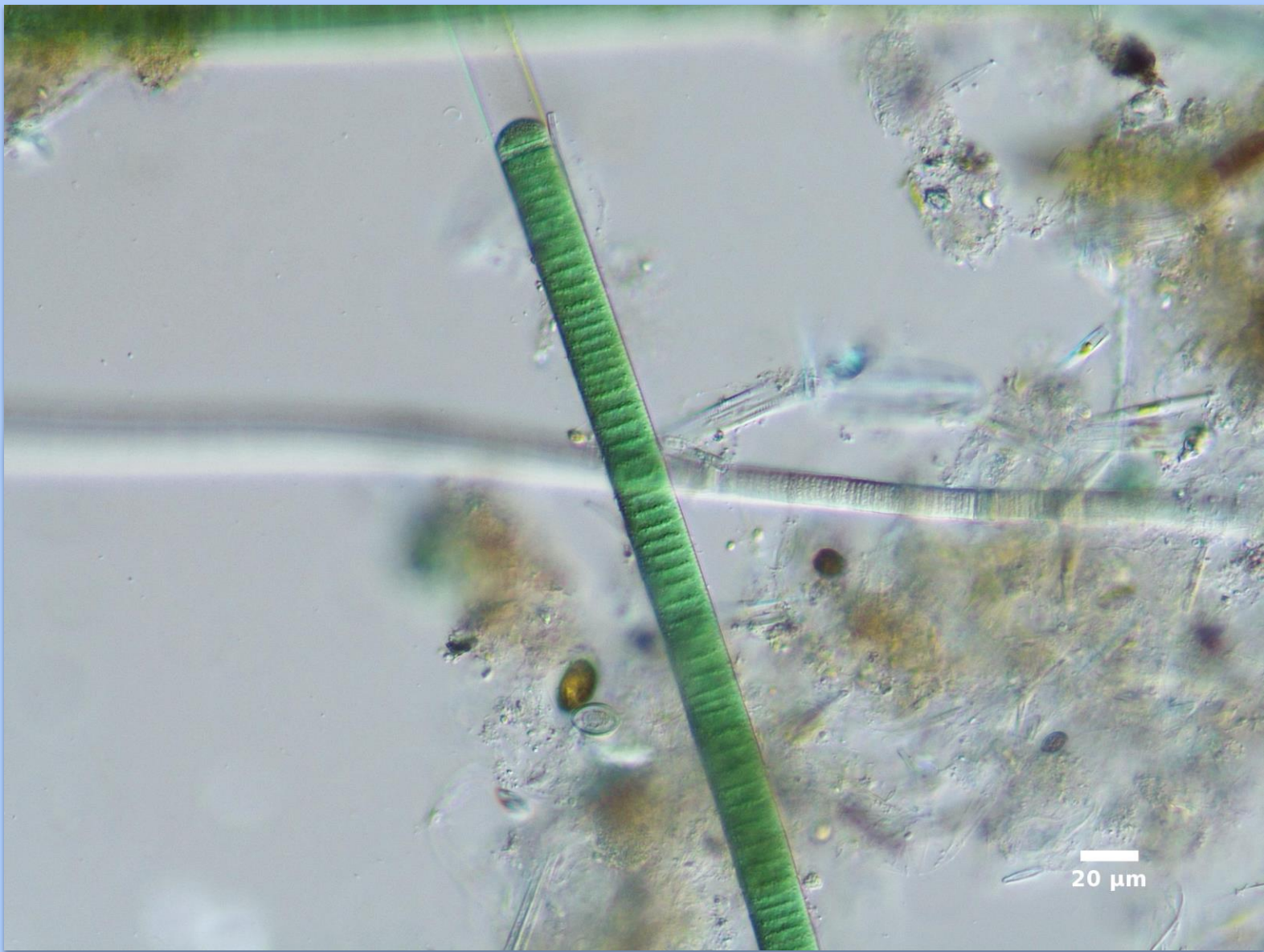


Tribonema (yellowgreen algae)



Vaucheria (yellowgreen algae)

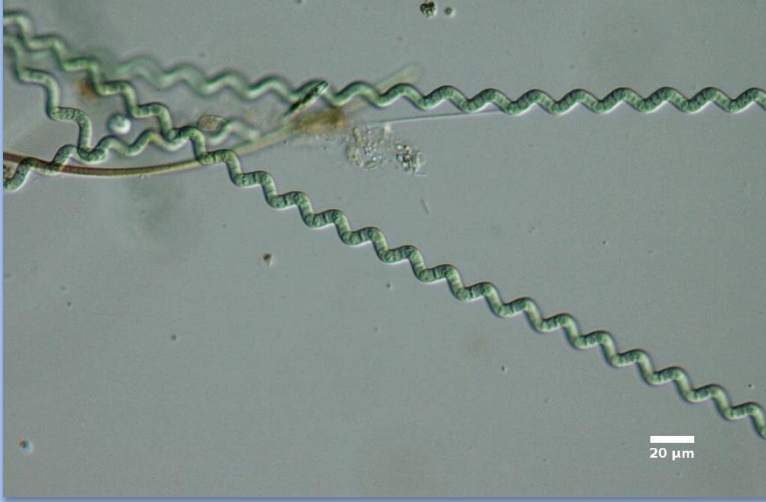




Common Freshwater Algae
Unbranched Filaments Without Heterocysts (Cyanobacteria)

Common Freshwater Algae – Unbranched Filaments Without Heterocysts (Cyanobacteria)

Arthrospira (“nontoxic”)



Cyanodictyon (“nontoxic”)



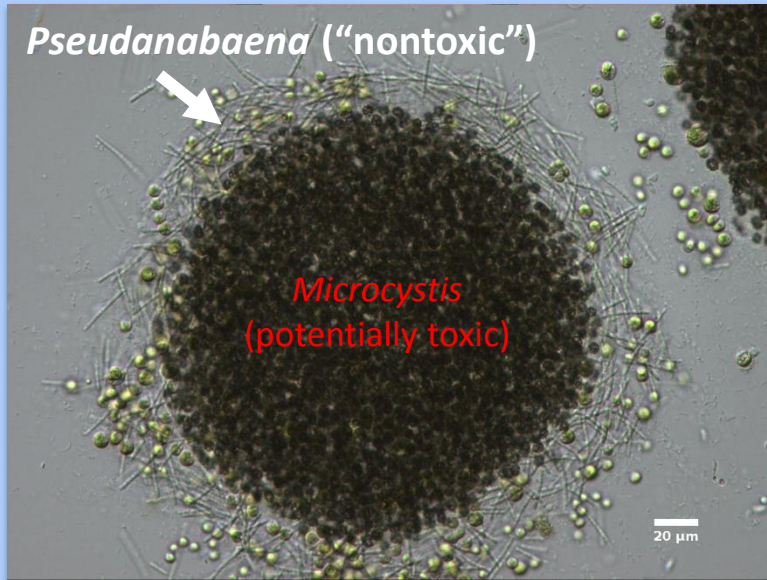
Microcoleus (“nontoxic”)



Tychonema
(potentially toxic but uncommon)

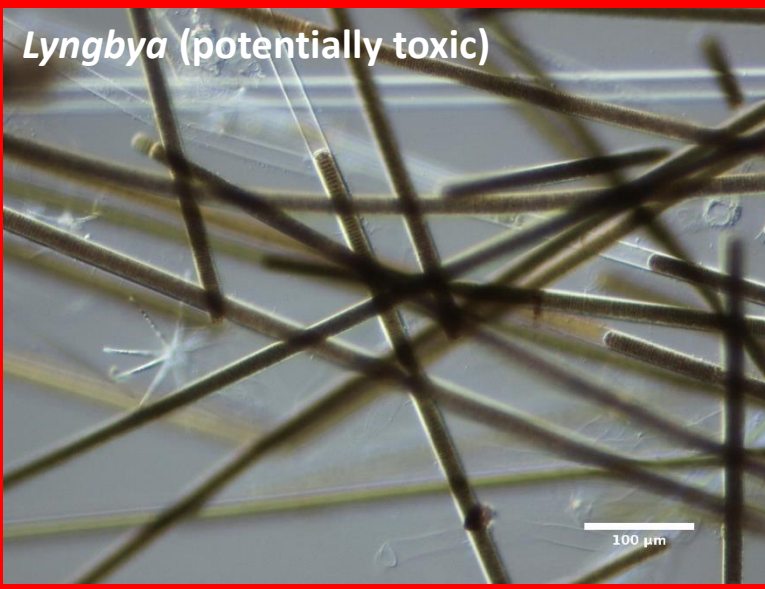


Common Freshwater Algae – Unbranched Filaments Without Heterocysts (Cyanobacteria)



Common Freshwater Algae – Unbranched Filaments Without Heterocysts (Cyanobacteria)

Lyngbya (potentially toxic)



Oscillatoria/Phormidium
(potentially toxic)



Oscillatoria/Phormidium
(potentially toxic)



Planktothrix (potentially toxic)





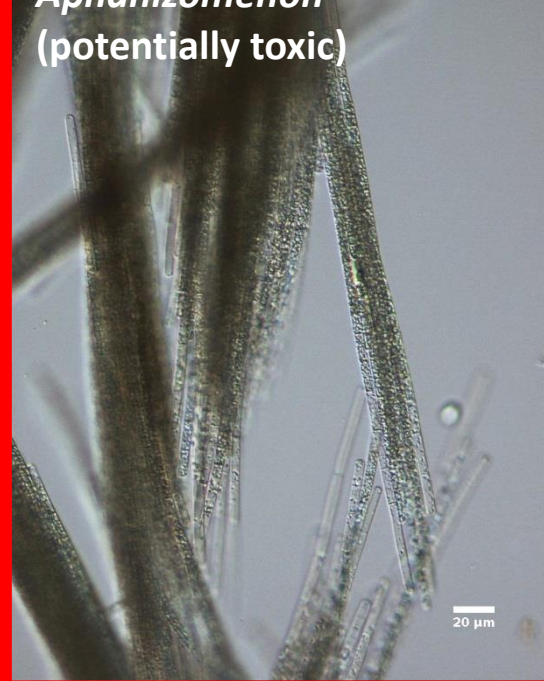
Common Freshwater Algae
Unbranched Filaments With Heterocysts (Cyanobacteria)

Common Freshwater Algae – Unbranched Filaments With Heterocysts (Cyanobacteria)

Anabaena/Dolichospermum
(potentially toxic)



Aphanizomenon
(potentially toxic)



Gloeotrichia
(potentially toxic)



Nostoc
(potentially toxic)



Cylindrospermum
(potentially toxic but uncommon)



Common Freshwater Algae – *Anabaena* and *Dolichospermum* (Cyanobacteria)

Dolichospermum flosaquae



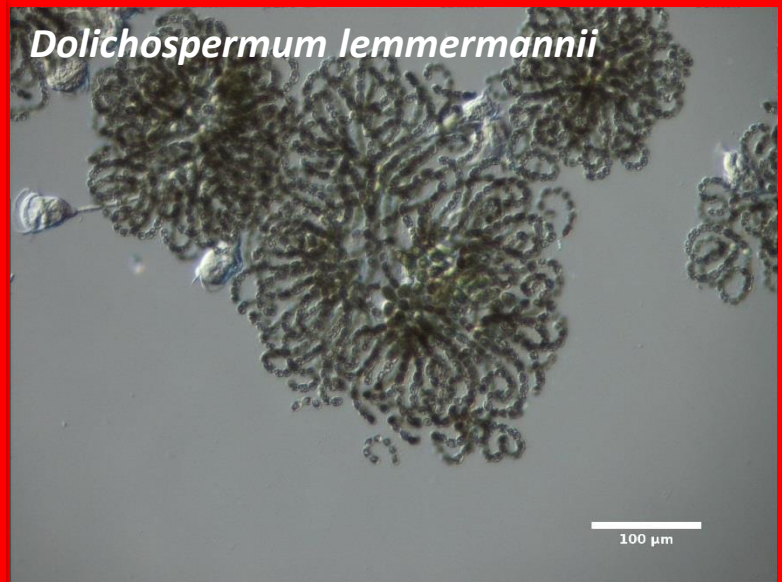
Dolichospermum crassum



Dolichospermum circinalis

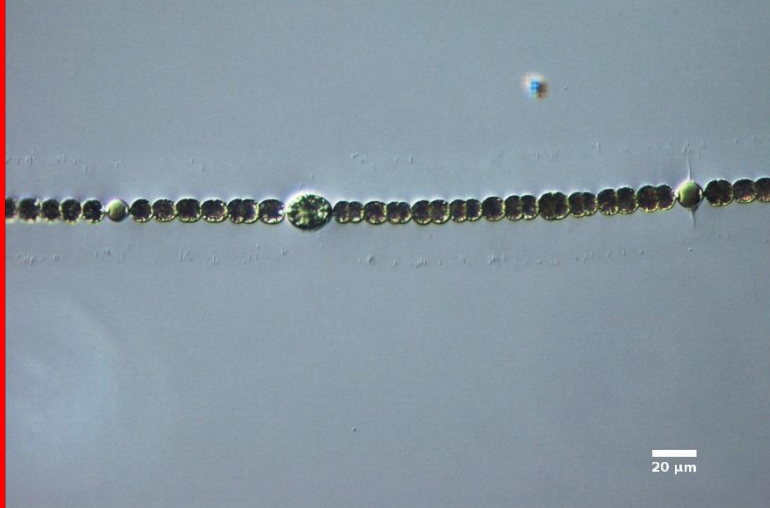


Dolichospermum lemmermannii



Common Freshwater Algae – *Anabaena* and *Dolichospermum* (Cyanobacteria)

Dolichospermum planctonicum



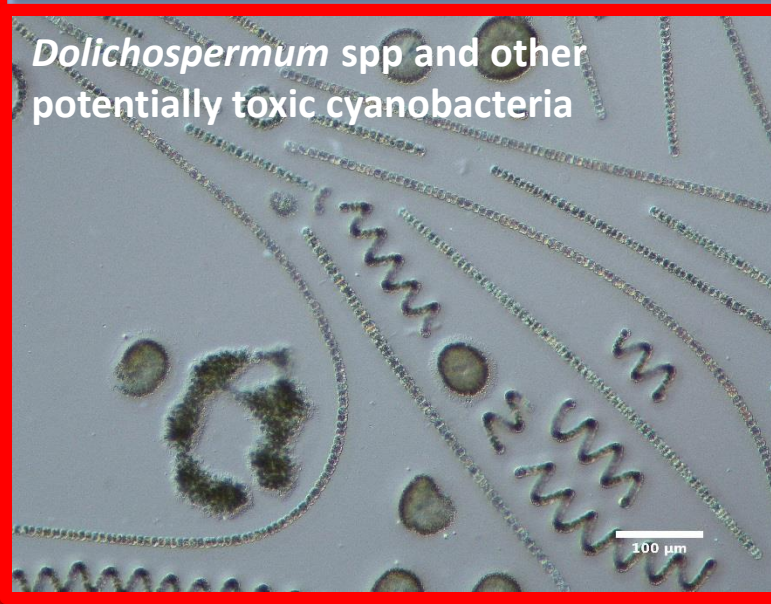
Anabaena echinospora (not toxic?)



Dolichospermum spp (potentially toxic)

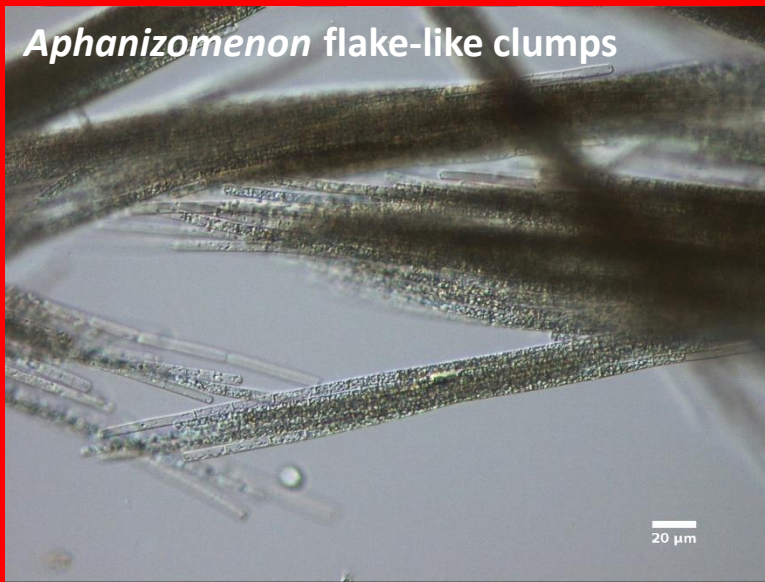


Dolichospermum spp and other potentially toxic cyanobacteria

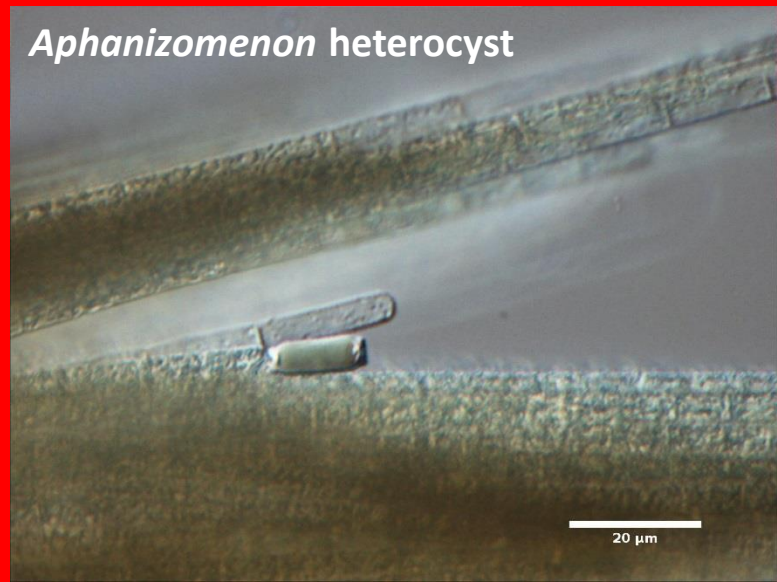


Common Freshwater Algae – *Aphanizomenon* (Cyanobacteria)

Aphanizomenon flake-like clumps



Aphanizomenon heterocyst



Aphanizomenon akinetes



Flattened *Aphanizomenon* clump



Common Freshwater Algae – *Gloeotrichia* (Cyanobacteria)

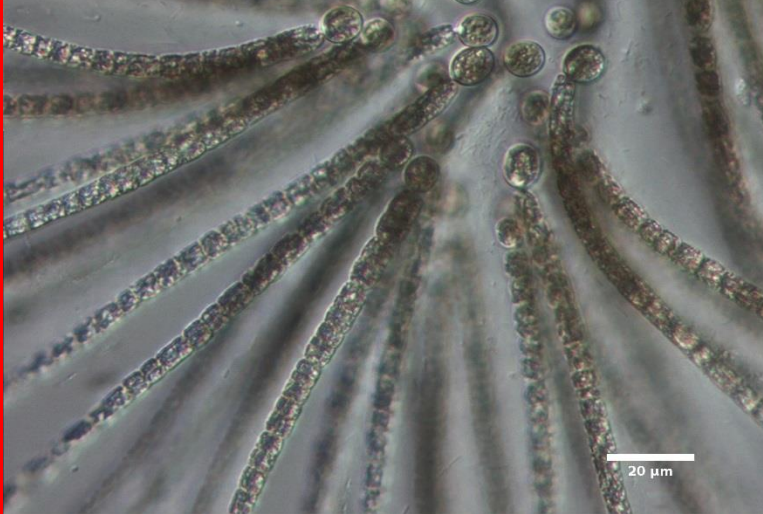
Gloeotrichia colonies



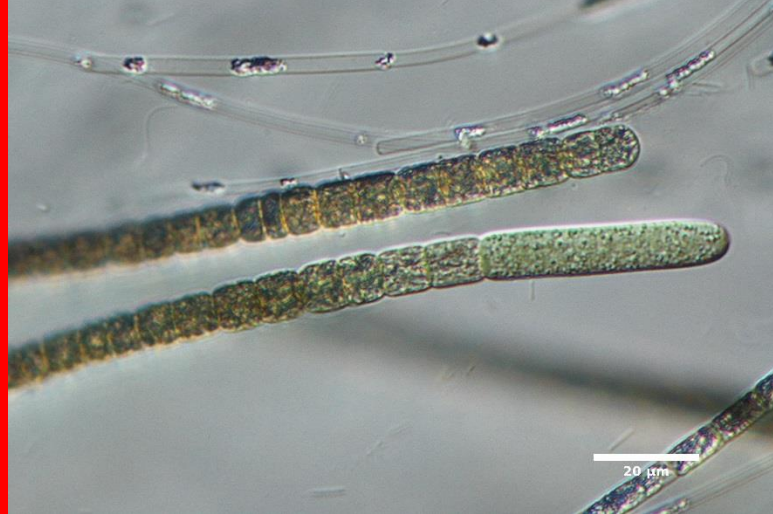
Gloeotrichia colonies



Gloeotrichia basal heterocysts

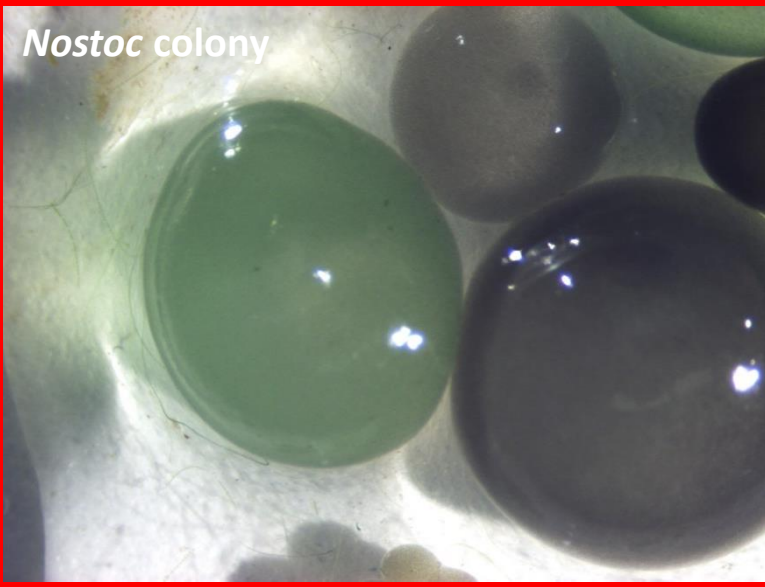


Gloeotrichia basal akinetes (uncommon)



Common Freshwater Algae – *Nostoc* (Cyanobacteria)

Nostoc colony



Nostoc colony



Nostoc filaments



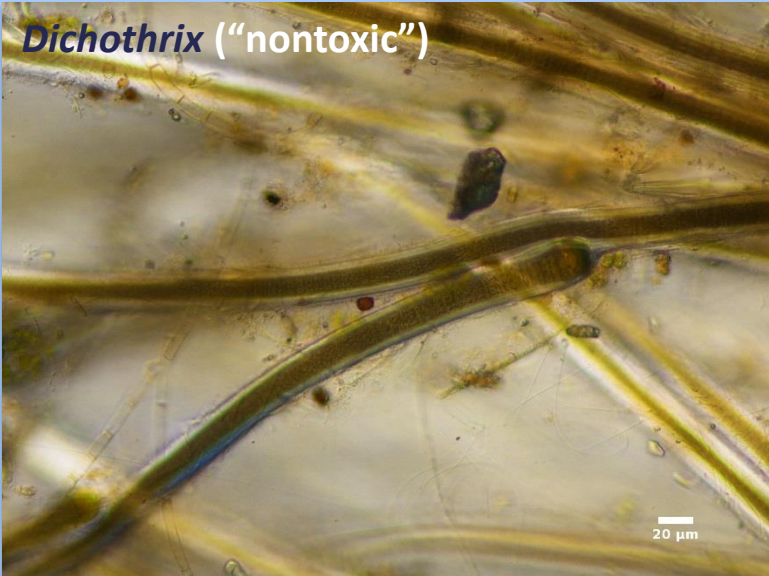
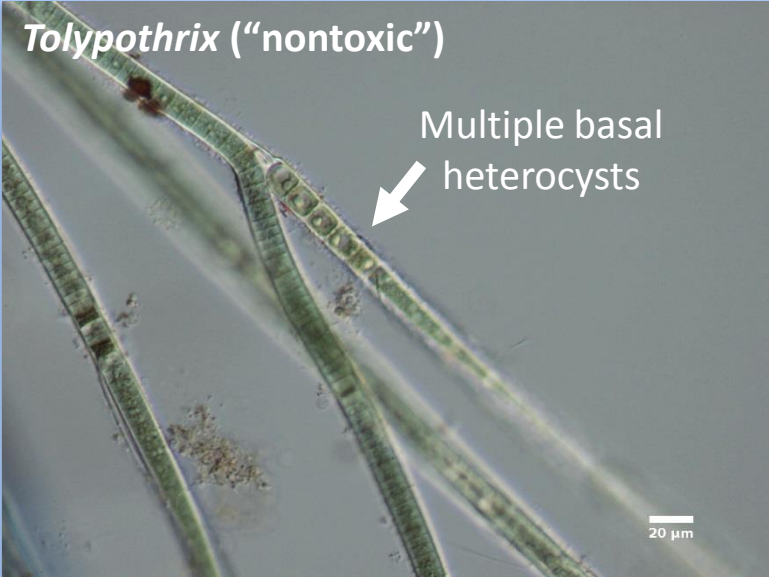
Nostoc filaments





Common Freshwater Algae
Branched Filaments With Basal Heterocysts (Cyanobacteria)

Common Freshwater Algae – Branched Filaments With Basal Heterocysts (Cyanobacteria)





Usually has heterocysts
in the filaments, but
occasionally has basal
heterocysts

100 μm

Common Freshwater Algae
Branched Filaments “Without” Basal Heterocysts (Cyanobacteria)

Common Freshwater Algae – Branched Filaments Without Basal Heterocyst (Cyanobacteria)

Fischerella
(potentially toxic but uncommon)



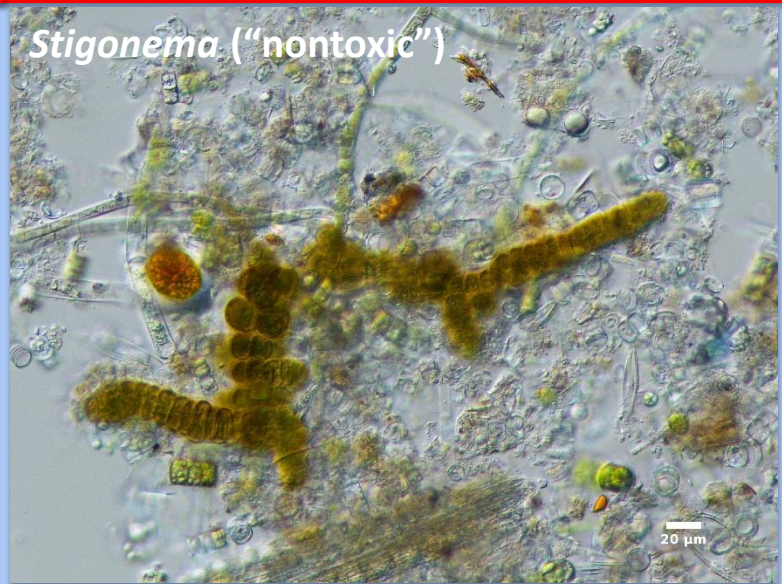
Hapalosiphon
(potentially toxic but uncommon)

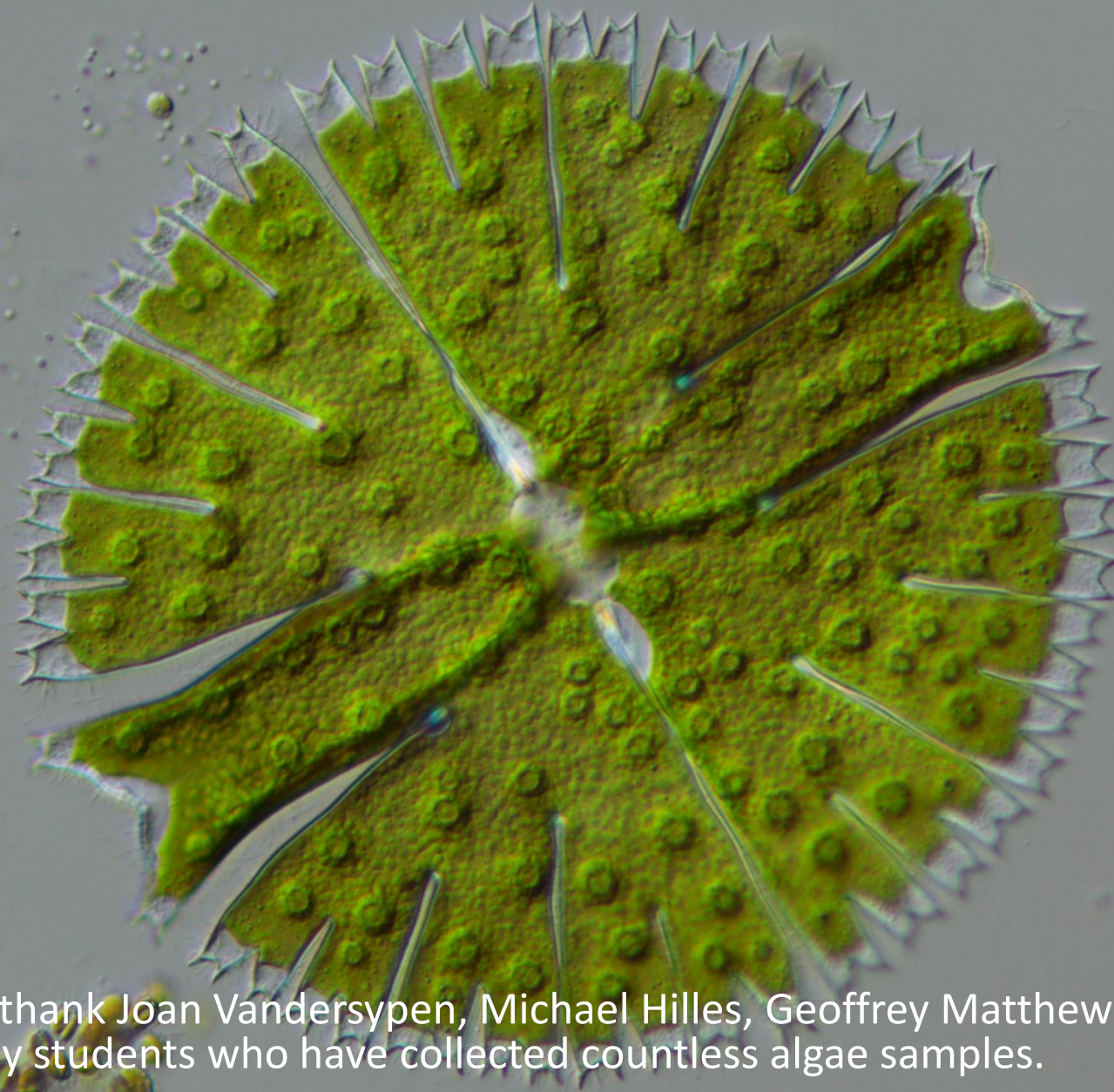


Scytonema ("nontoxic?")



Stigonema ("nontoxic")





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Unless otherwise noted, all algal photographs were taken by R. Matthews