

Cyanobacteria

New Hampshire Department of Environmental Services
Harmful Algal and Cyanobacterial Bloom Program

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Phytoplankton – microscopic plants, photosynthetic bacteria, etc.

Diatoms (Bacillariophyta)

Golden-browns (Chrysophyta)

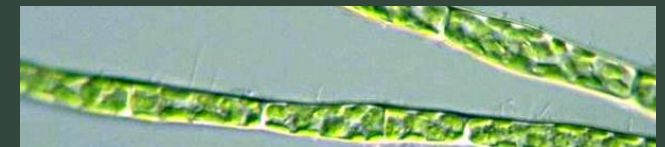
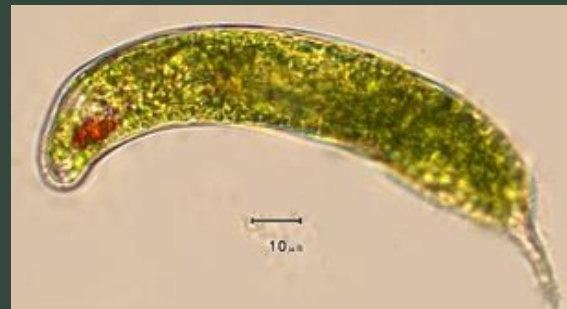
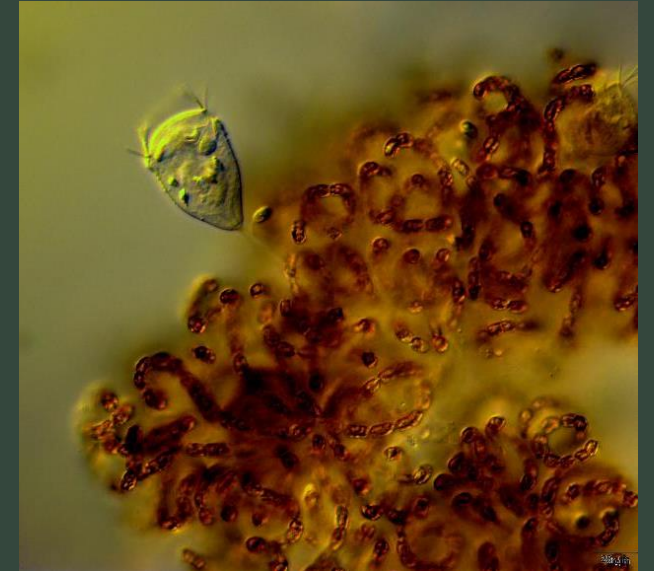
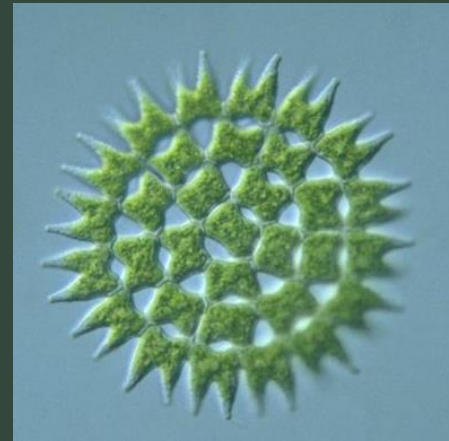
Dinoflagellates (Pyrrophyta/Dinophyta)

Greens (Chlorophyta)

Cyanobacteria (Cyanophyta)

Euglenoids (Euglenophyta)

Yellow-greens (Xanthophyta)



Eutrophication

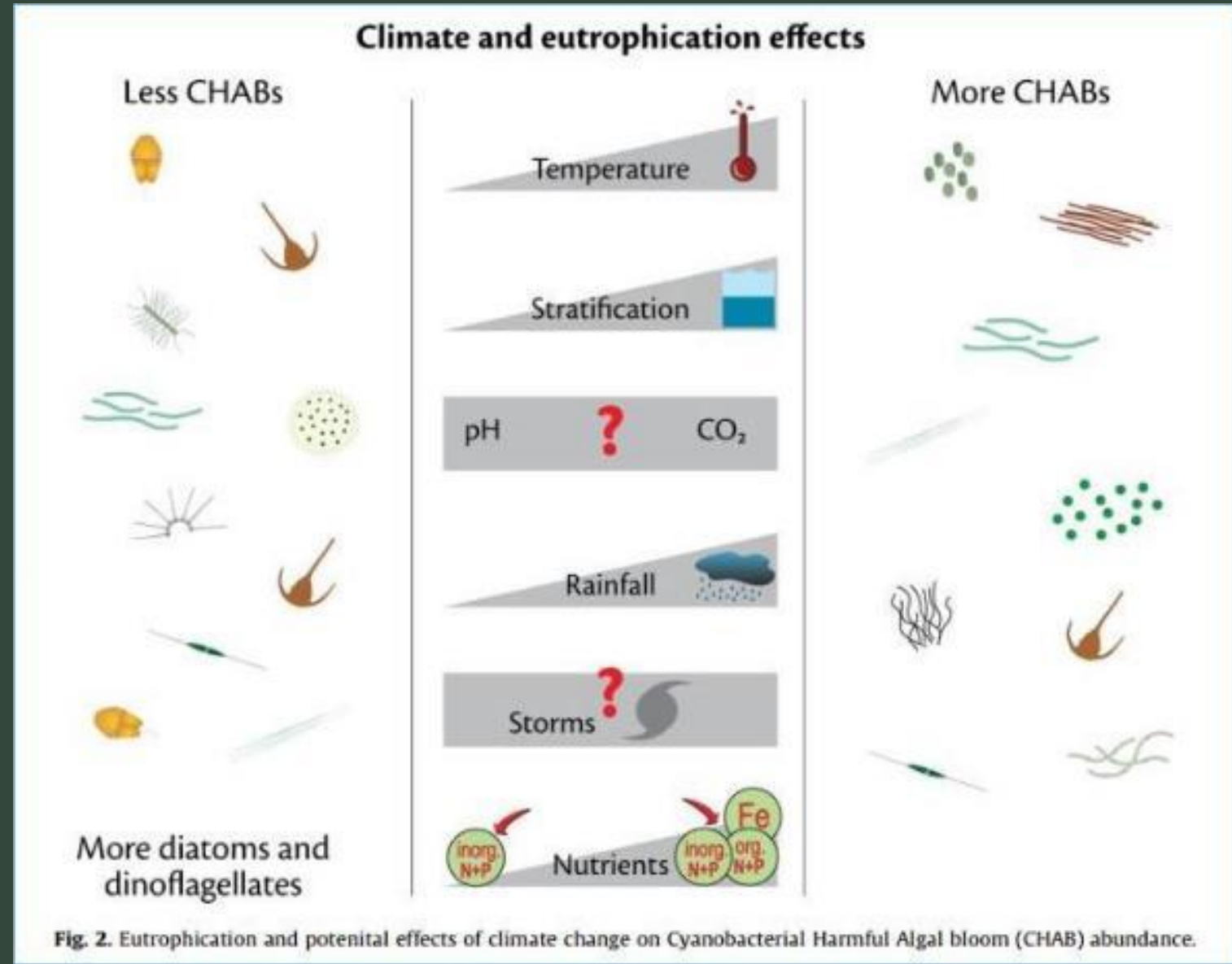
Hyper-eutrophic

Eutrophic
more phyto

Mesotrophic
moderate phyto

Oligotrophic
few phyto

Ultra-oligotrophic



Cyanobacteria...

- Formerly known as Blue-Green Algae
- Photosynthetic bacteria, they are not actually algae
- Inhabitants of Earth for over 3.5 billion years
- Thousands of species and hundreds of toxins
- Ubiquitous in the environment and globally



Cyanotoxin	Mode of action and/or symptoms
Microcystins (nearly 100 variants)	Hepatotoxic, targets the liver and digestive organs, tumor promoting, inhibition of protein phosphatases. Acute gastroenteritis, chronic tumor promotion.
Nodularins (similar in structure to microcystins)	Similar to microcystins, but not as toxic and common in brackish or marine systems.
Anatoxin-a	Neurotoxic, inhibits acetylcholine receptors (neurotransmitter). Fast-acting and may cause seizures or death (i.e. common for dogs or others animals to ingest and die).
Anatoxin-a (S)	Neurotoxic, similar to anatoxin-a (S)
Saxitoxins	Neurotoxic, blocking voltage gate of sodium ion channels. More common to marine organisms.
Cylindrospermopsins	Toxic to multiple organs, neurotoxic and genotoxic, affecting neurons and genes.
Lyngbyatoxins	Tumor promotion
BMAA/DAB	Neurotoxic, chronic exposure may be linked to neurodegenerative diseases such as ALS. (Individuals can have a genetic precursor).

This is not a complete list of the cyanotoxins

Canine Cyanotoxin Poisonings in the United States (1920s–2012): Review of Suspected and Confirmed Cases from Three Data Sources

Lorraine C. Backer, Jan H. Landsberg, Melissa Miller, Kevin Keel, and Tegwin K. Taylor

“reported 67 suspected or confirmed cases of canine intoxications associated with HABs. Of these 67 cases, 58 (87%) followed exposure to fresh waters and 1 (1%) followed exposure to marine waters.”

“...duration of illness ranged from <1 day to 6 weeks.”



“Dog's death fuels lake cyanobacteria scare”

<http://www.burlingtonfreepress.com/story/news/local/2015/08/12/death-dog-heightens-cyanobacteria-concerns/31555091/>

What are the possible routes of exposure to humans?

- Ingestion: swallowing contaminated water or eating seafood contaminated with toxins
- Inhalation: breathing in aerosolized toxins
- Skin contact: direct contact with contaminated water when swimming or boating





EXPOSED?

Shower immediately.
See a doctor or vet if
symptoms occur.

SYMPTOMS OF EXPOSURE

Vary depending on how the person or animal was exposed, and whether the HAB is in salt or fresh water.



Ear, eye, nose,
skin, and throat
irritation, and
headache



Paralysis,
respiratory
illness, and
seizures



Abdominal pain,
diarrhea, liver and
kidney damage, and
vomiting



Drooling, diarrhea,
low energy, not
eating, stumbling,
tremors, and
vomiting

WHEN IN DOUBT, STAY OUT!

Stay away from the water when a suspected HAB is present.



DON'T
Play with scum
or mats on
the shore



DON'T
Let animals
drink water, eat
algae, or swim



DON'T
Swim



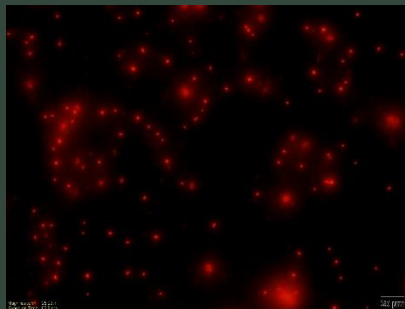
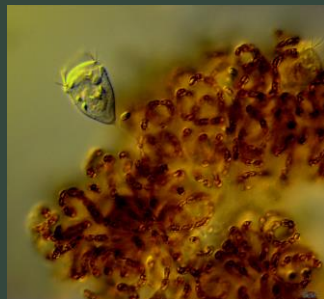
DON'T
Fish or wade



DON'T
Boat or kayak

FOR MORE INFORMATION OR TO REPORT POSSIBLE
HARMFUL ALGAL BLOOMS:
(603) 848-8094 | HAB@des.nh.gov





Top carnivores
(large fish, birds, mammals)

Tertiary consumers/ carnivores
(medium fish)

Secondary consumers/ carnivores
(predatory zooplankton,
small fish)

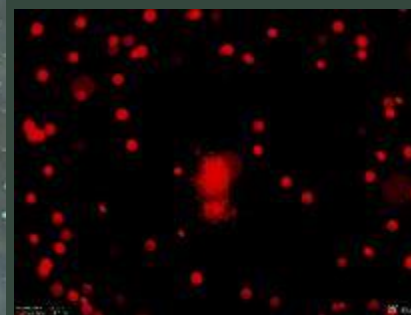
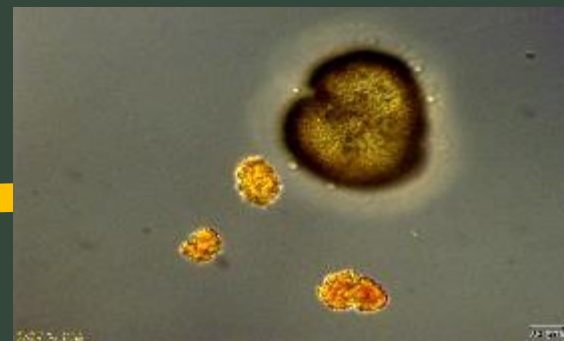
Primary consumers/
herbivores
(zooplankton and
herbivorous fish)

Primary producers
(cyanobacteria,
algae)

Bioaccumulation of cyanotoxins

- BioMagnification?
- BioDilution?



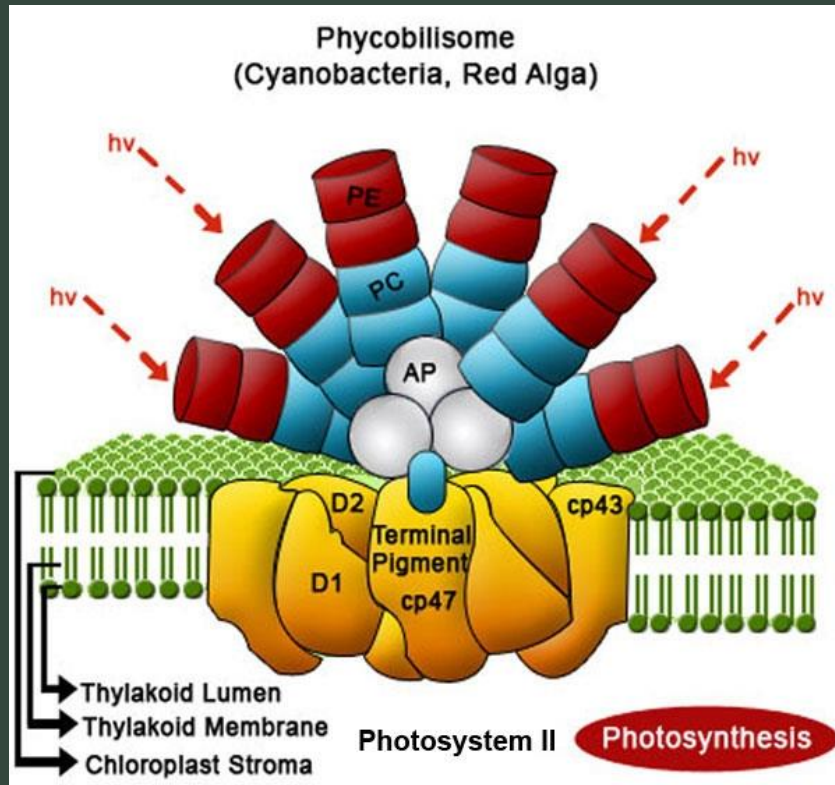


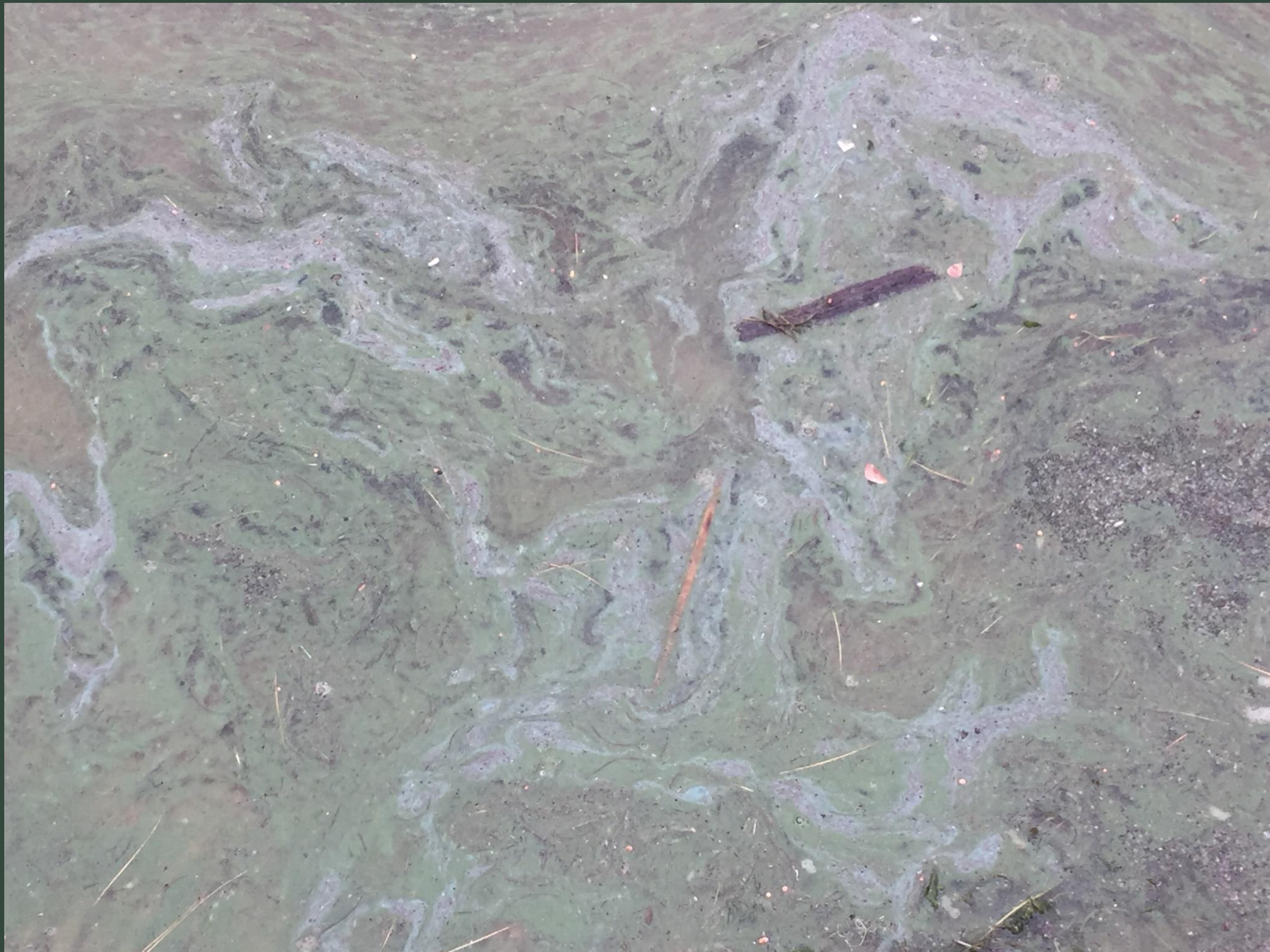


Public awareness and citizen-science on the rise!

Antennal Pigments (of the Phycobilisome)
branch off of the Chloroplast
Phycobillins: Phycocyanin (PC), Phycoerythrin (PE), and
Allophycocyanin (AP)

Zeaxanthin (marine picocyanobacteria also)

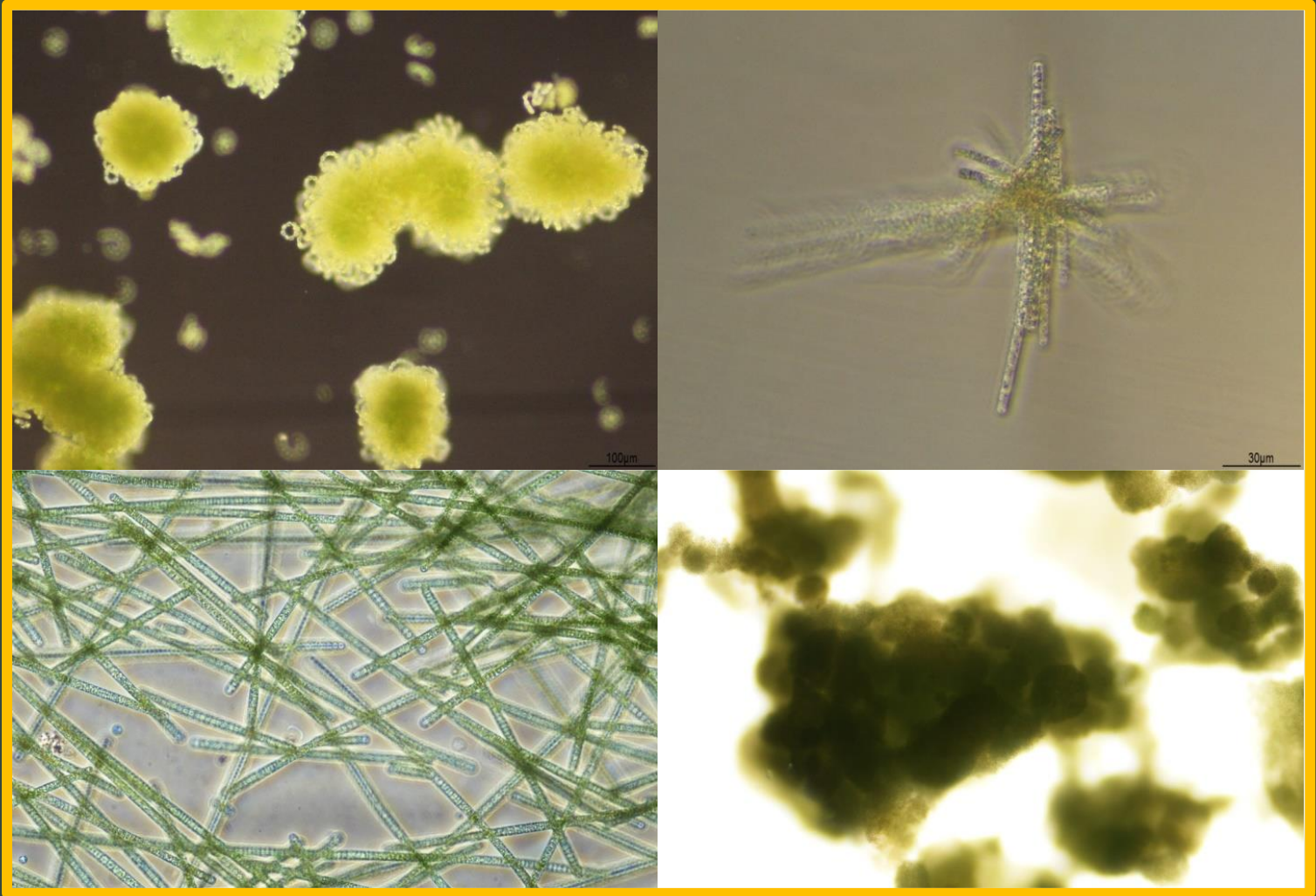




Cyanobacteria may produce toxins called **CYANOTOXINS**

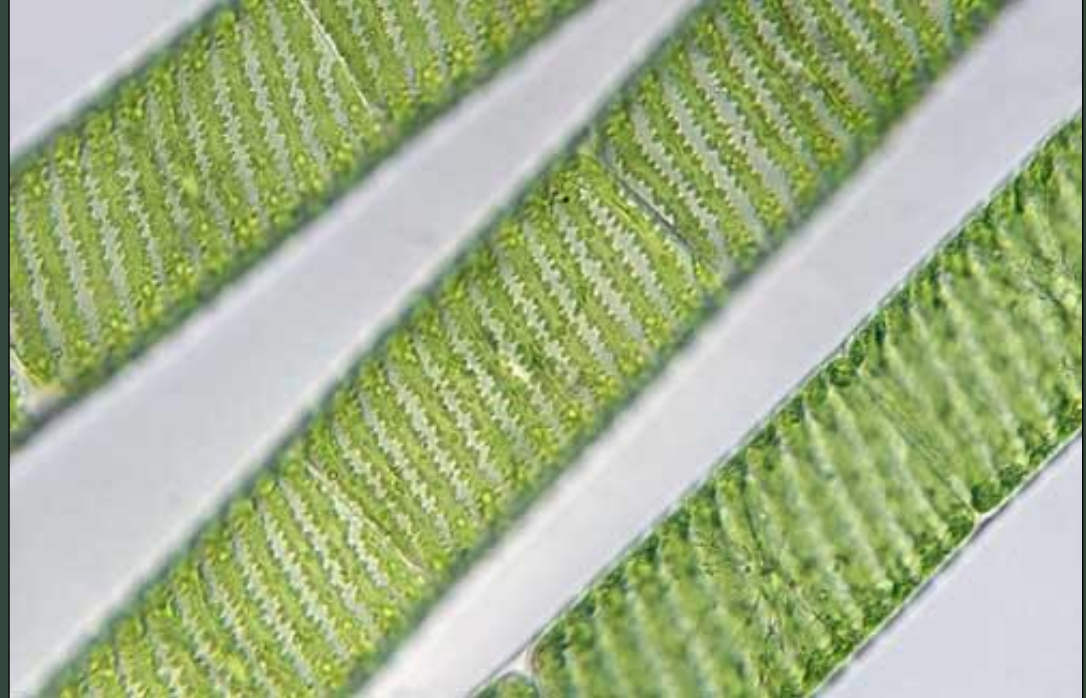
Toxins may cause skin irritations, gastroenteritis, seizures, chronic illness and death.

Not all
cyanobacteria
are toxic





Green Filamentous Algae



Spirogyra

Stick test:

Does it stick?

Can you lift it?

Does it cloud the water?

*NOT CYANOBACTERIA



An Image-Based Key:

Wolffia
(Watermeal)
(Viridiplantae)

cfb.unh.edu

Click on images for larger format.



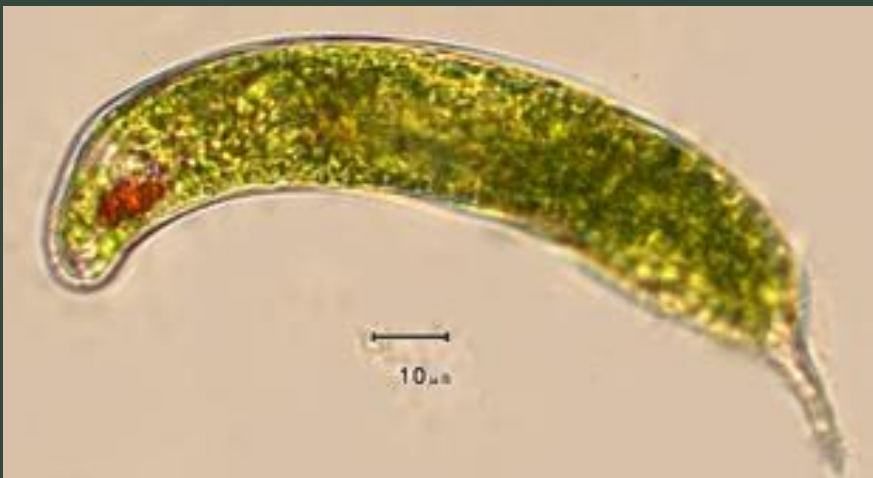
Wolffia



***NOT CYANOBACTERIA**

Euglena

*NOT CYANOBACTERIA



Ichthyotoxins are produced by this species, and by *E. granulate* (Triemer et al. 2004).



What should I do if I see a bloom or if the water changes colors?

1. Avoid contact; keep pets and children out of the water.
2. Take a photo and record your location.
3. Contact NHDES by phone (603-848-8094) or email (HAB@des.nh.gov).

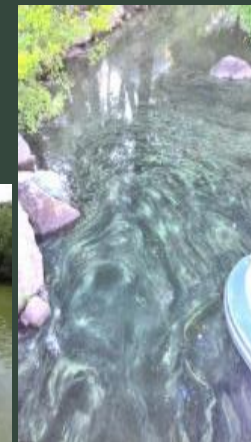


Volunteer Involvement



bloomWatch

- General public
- No connection to established VM/CBM program
- Good for tracking blooms
- Generating awareness



cyanoMonitoring

- Best if involved with established VM/CBM program
- Experienced volunteers
- Easy to train for sample collection
- Need an organization for processing/analysis



cyanoScope

- Interested/dedicated individuals
- University education/research
- Agencies, water suppliers



Every Lake is Unique



Thank you!

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