Diversity of phytoplankton and implications for the use of fluorescence of photosynthetic pigments as biomass proxies

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Photo Helena Höglander, source http://nordicmicroalgae.org

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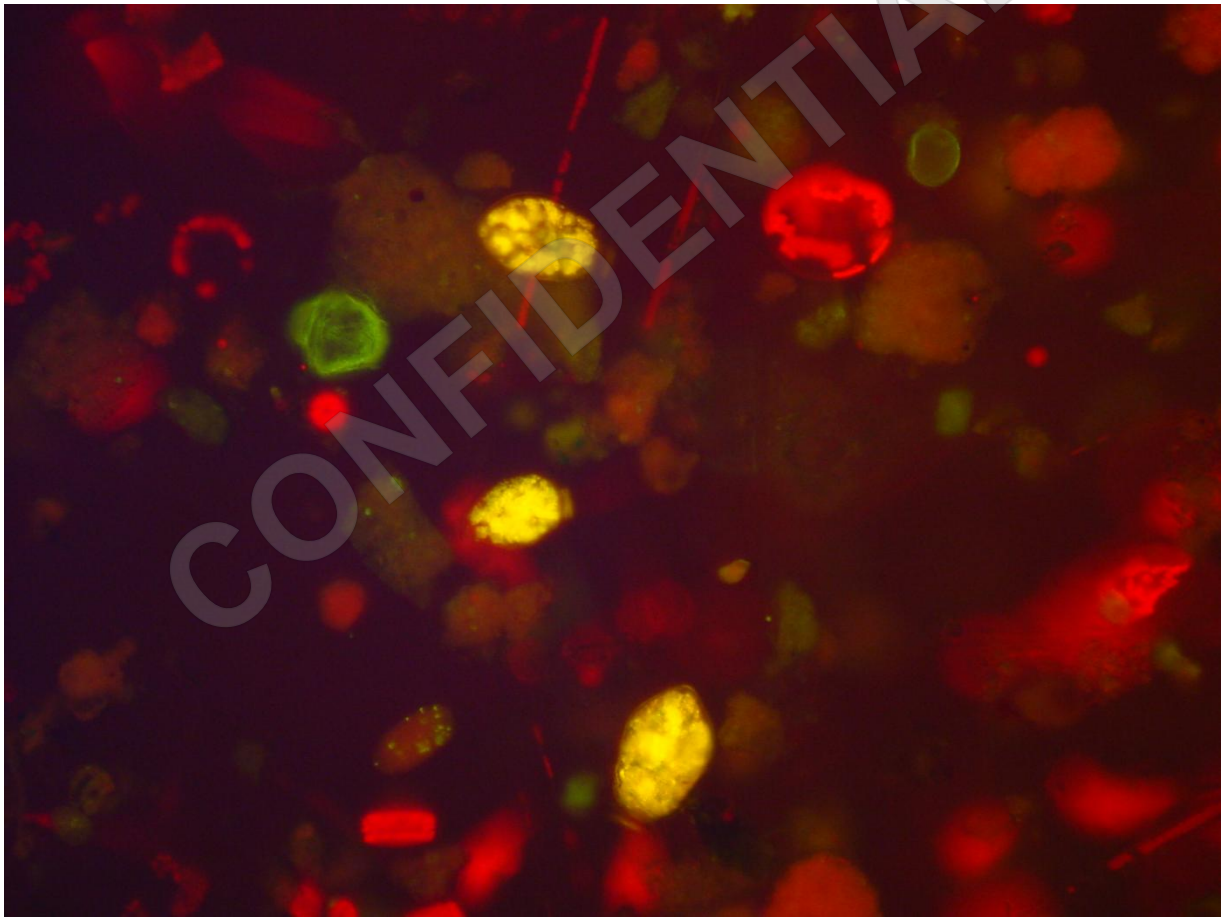
What is absorbing, fluorescing and scattering light in seawater?



Some phytoplankton species in the Baltic and the Kattegat-Skagerrak

Photos: Bengt Karlson, Ann-Turi Skjevik, Lars Edler, Jahn Throndsen and Wenche Eikrem

Number of described species is in the order of 2000

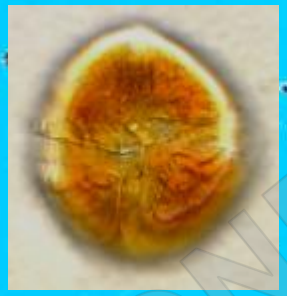
Dinophysis spp.

Nodularia spumigena

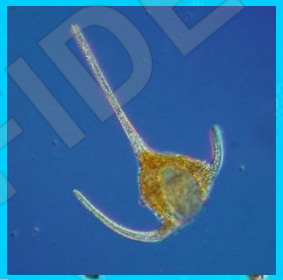
Photo: Ann-Turi Skjevik

Chrysochromulina polylepis

Pseudochattonella farcimen

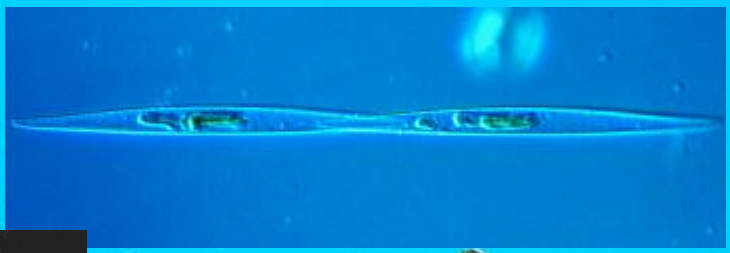


Alexandrium tamarense



Ceratium tripos

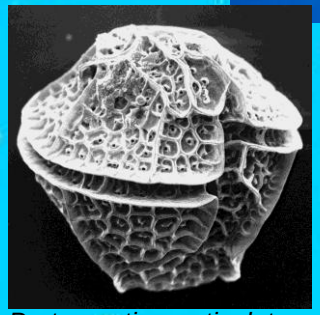
Synechococcus sp.



Pseudo-nitzschia sp.

cf. Azadinium spinosum

May-Oct
Max 10 000 cells l^{-1}



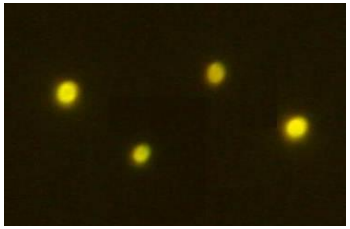
Protoceratium reticulatum

Chaetoceros concavicornis

Karenia mikimotoi

Size range 1-1000 µm

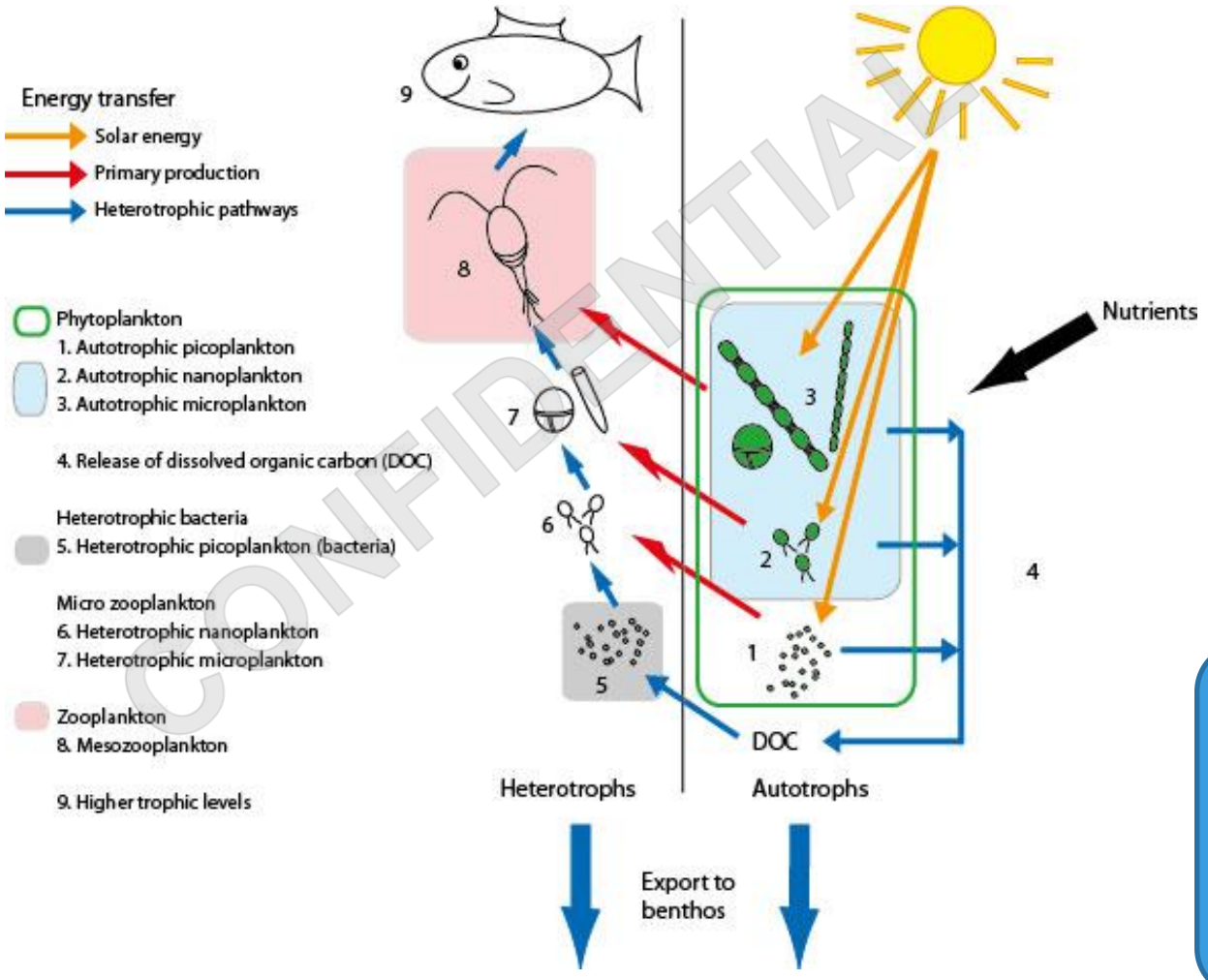
Large diatom, *Coscinodiscus concinnus*



Plankton photo by Mats Kuylenstierna

Small cyanobacteria, *Synechococcus* sp.

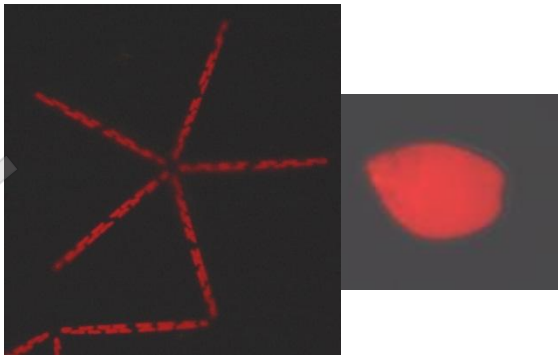
The classic food web and the microbial loop

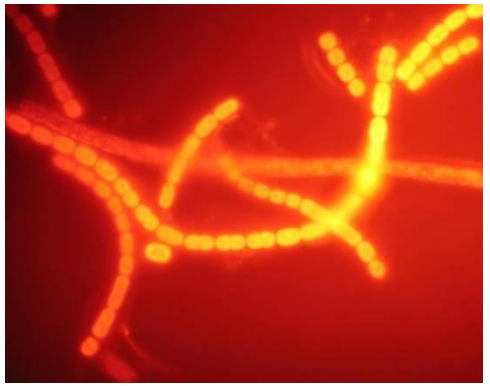


CDOM (humics), inorganic particles etc.

Pigments we are trying to detect using fluorescence

- Chlorophyll a – found in all phytoplankton except for *Prochlorococcus*
- *Phycocyanin* – found in some cyanobacteria but also in some cryptophytes
- *Phycoerythrin* – found in some cyanobacteria and in some cryptophytes, dinoflagellates and a ciliate





Photos by Bengt Karlson and Kevin Vikström

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Tree of life http://tolweb.org

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Cyanobacteria

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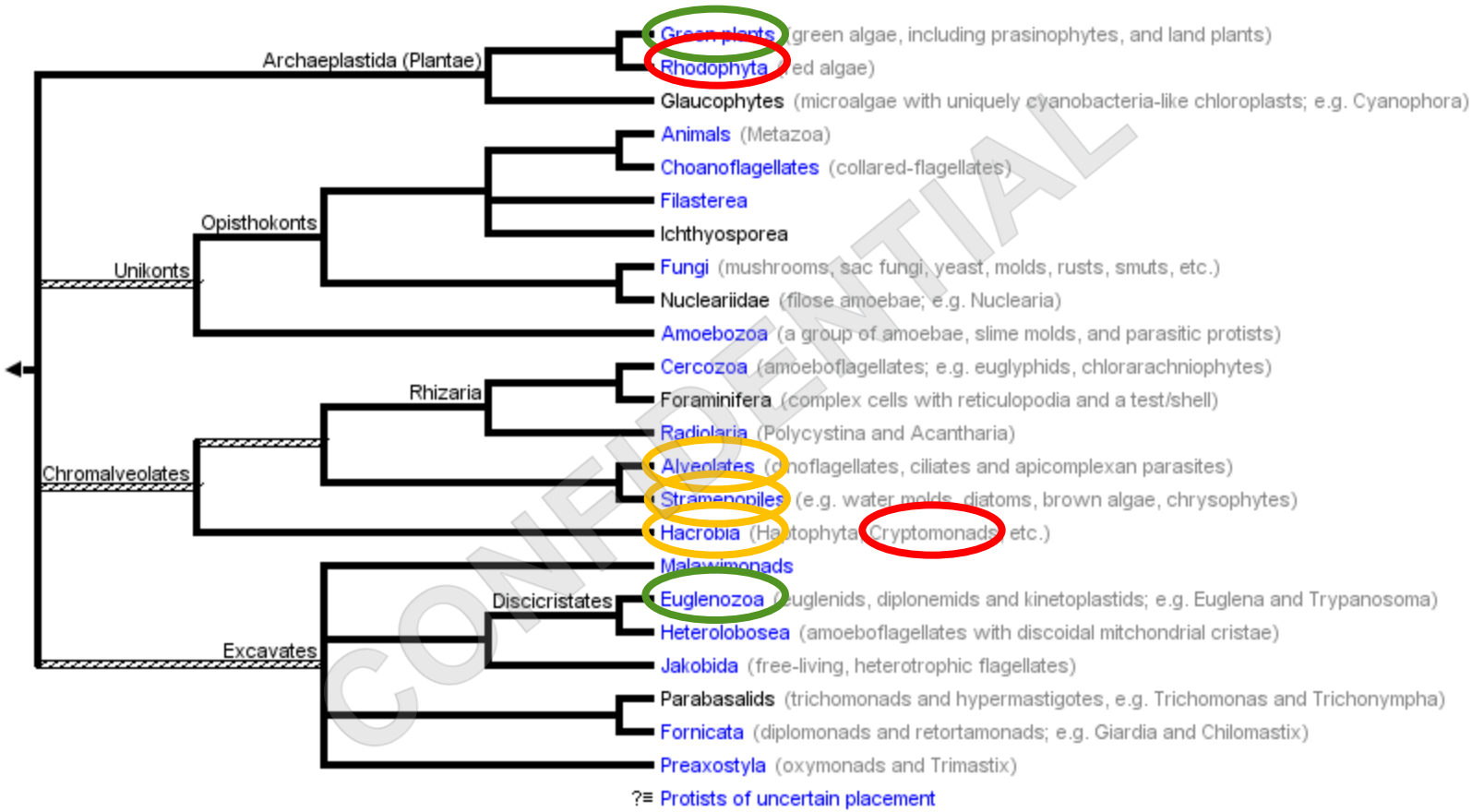
Eukaryotic algae



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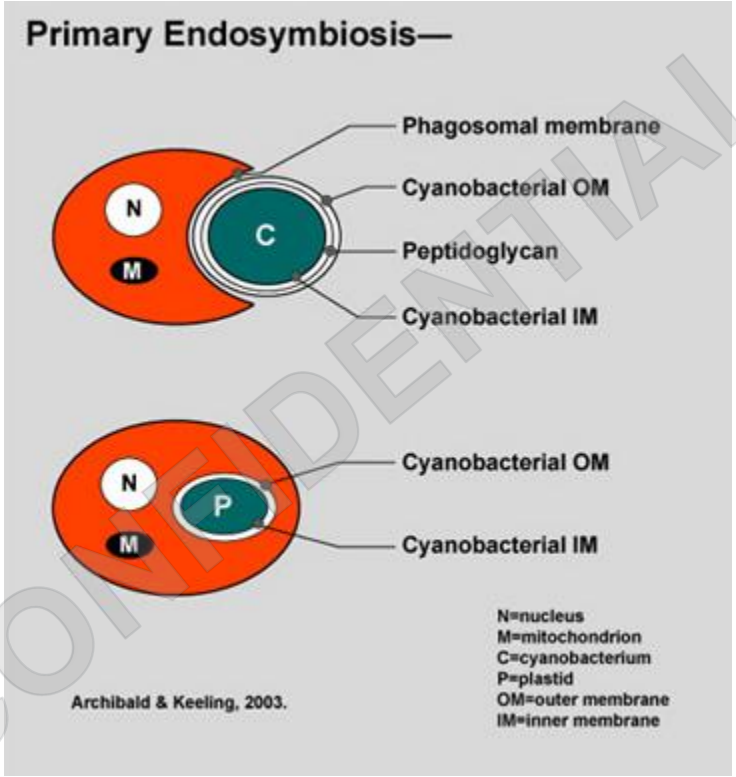
Primary endosymbiosis



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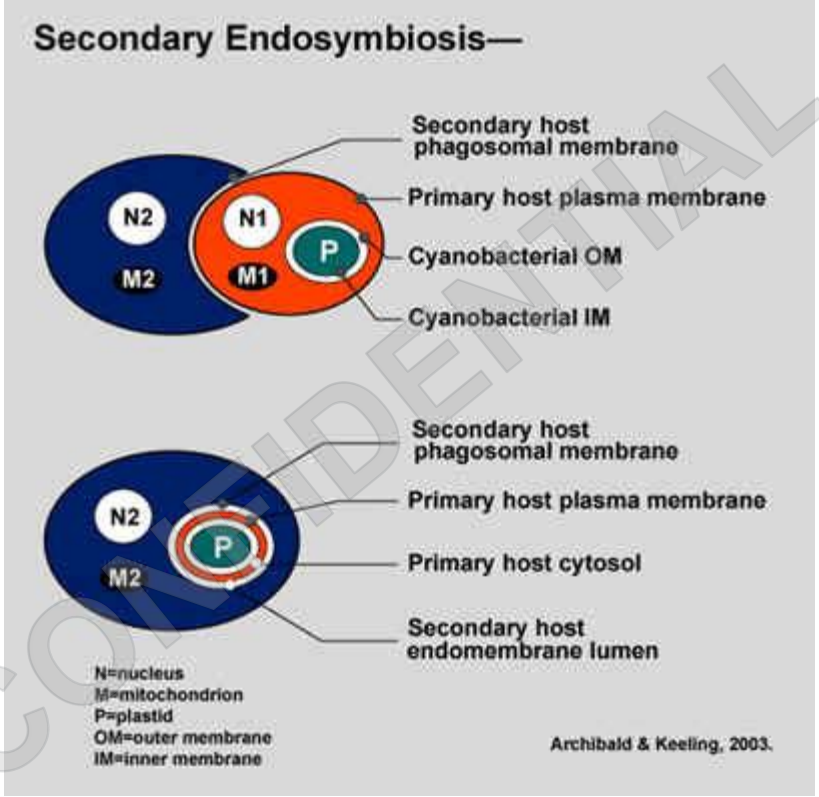
Secondary endosymbiosis



Stealing power plants and genes is common

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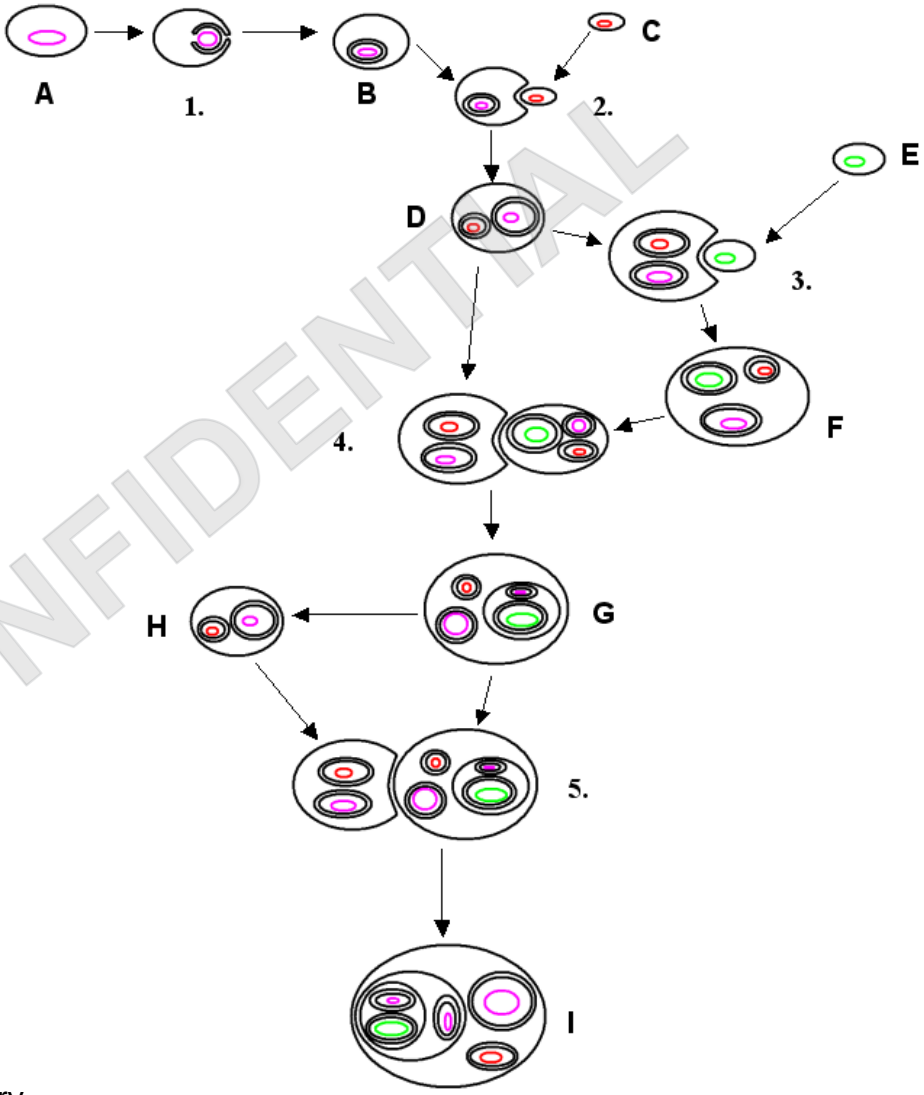


http://en.wikipedia.org/wiki/Endosymbiotic_theory

Does it matter for ocean optics? Yes!

Dinophysis acuta -
a dinoflagellate with cryptophyte chloroplasts

Photo Bengt Karlson, source http://nordicmicroalgae.org

Karenia mikimotoi -
a dinoflagellate with diatom chloroplasts

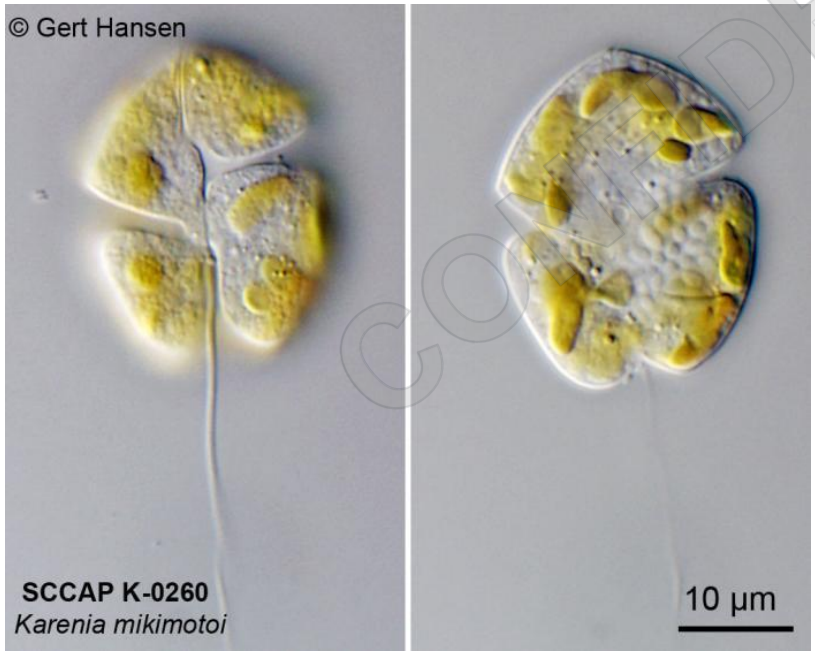
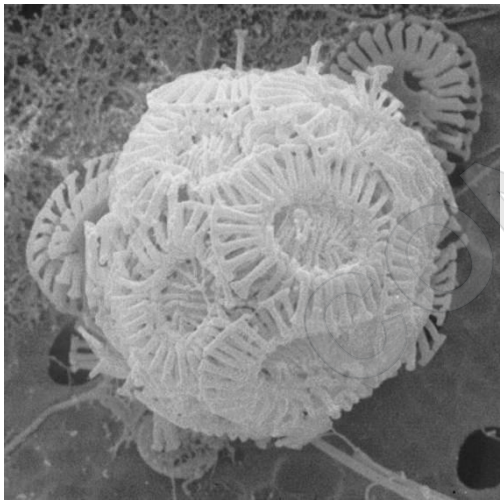


Photo Gert Hansen, source http://nordicmicroalgae.org

Coccolithophorids

Emiliania huxleyi
is covered with calcium carbonate scales



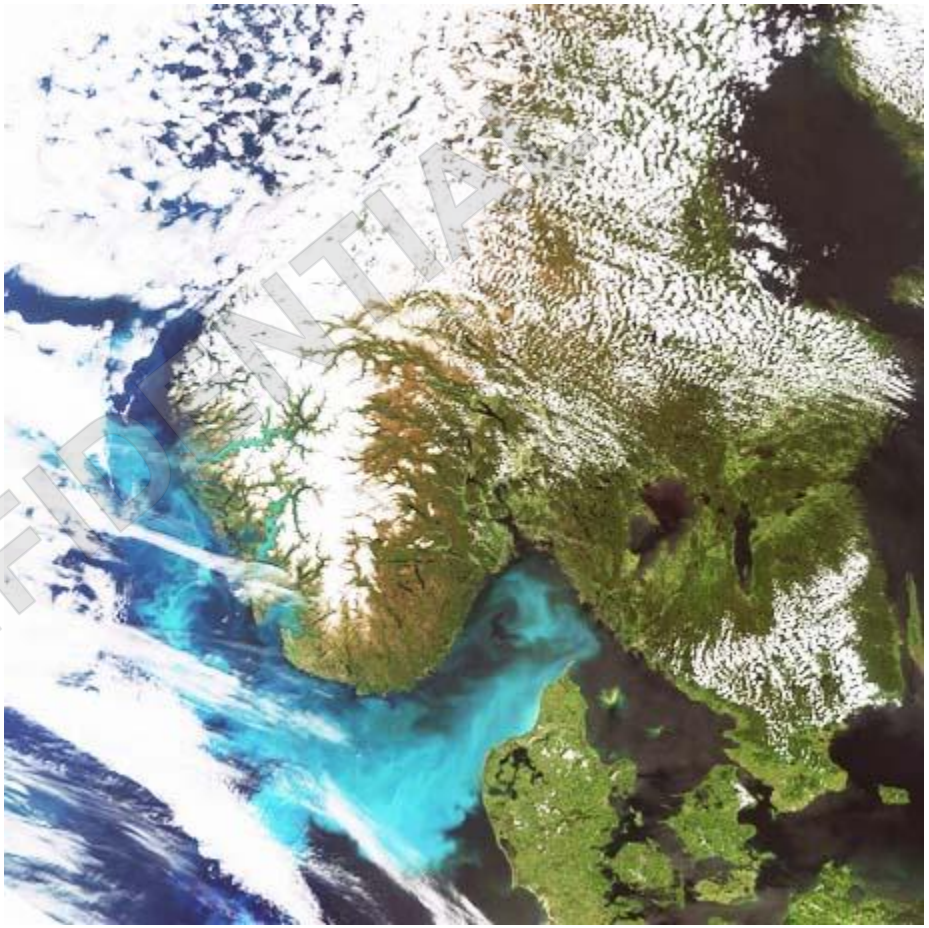


Photo Bengt Karlson, source
http://nordicmicroalgae.org

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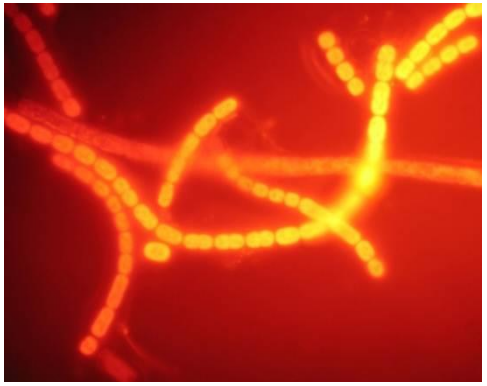
Cyanobacteria

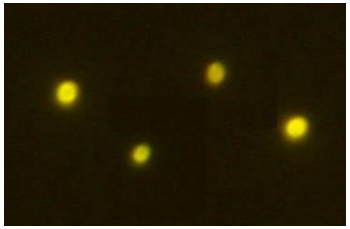
Aphanizomenon sp.

Nodularia spumigena

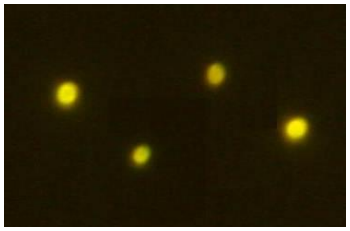
Dolichospermum sp.



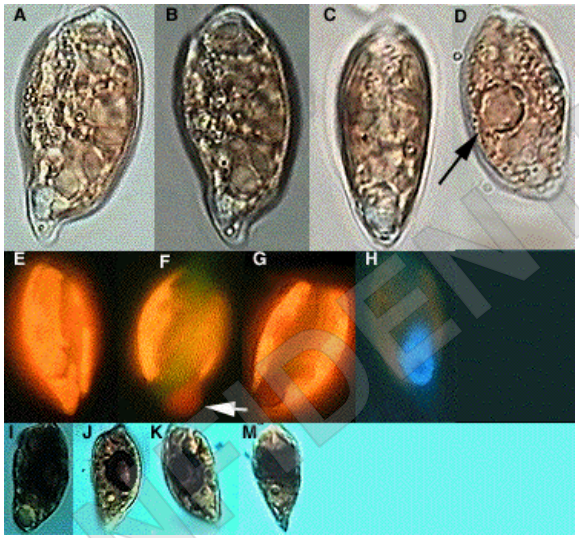
Synechococcus sp.



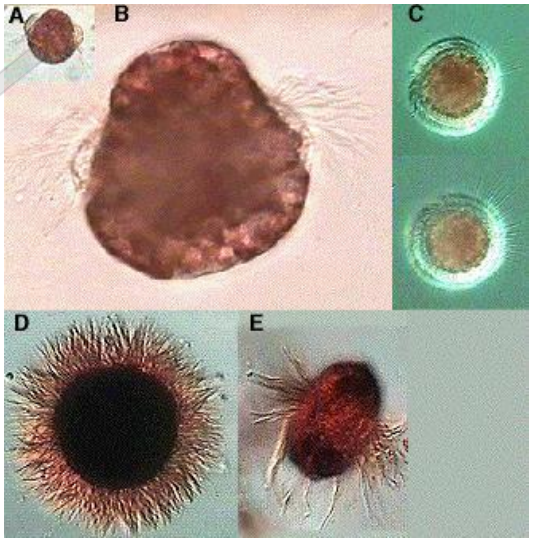
Phycoerythrin rich plankton



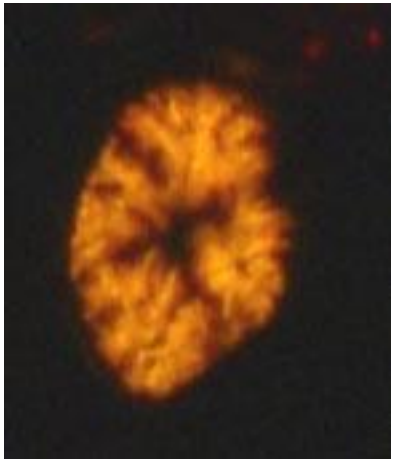
Synechococcus sp.



Rhodomonas marina

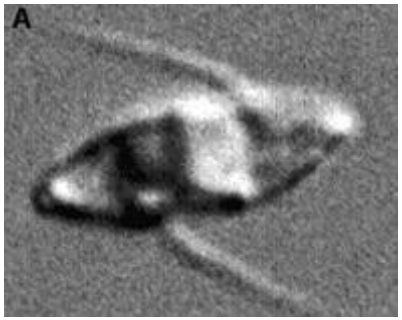


Mesodinum rubrum = *Myrionecta rubra*

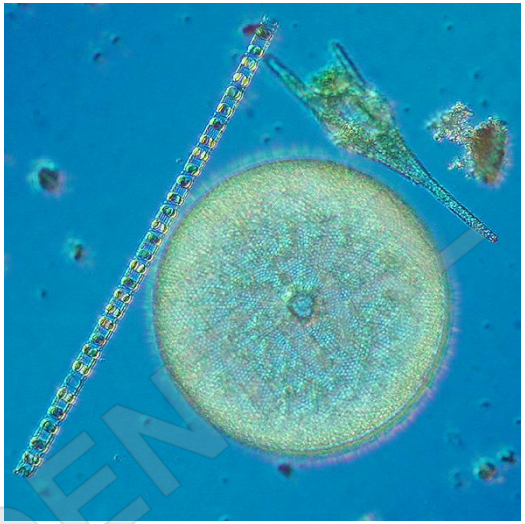


Dinophysis spp.

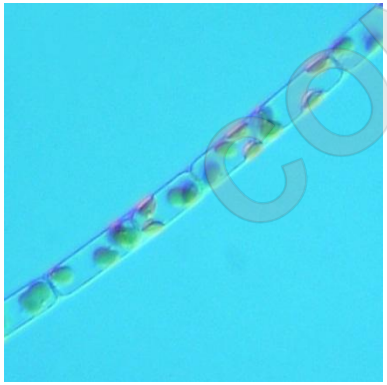
Diatoms



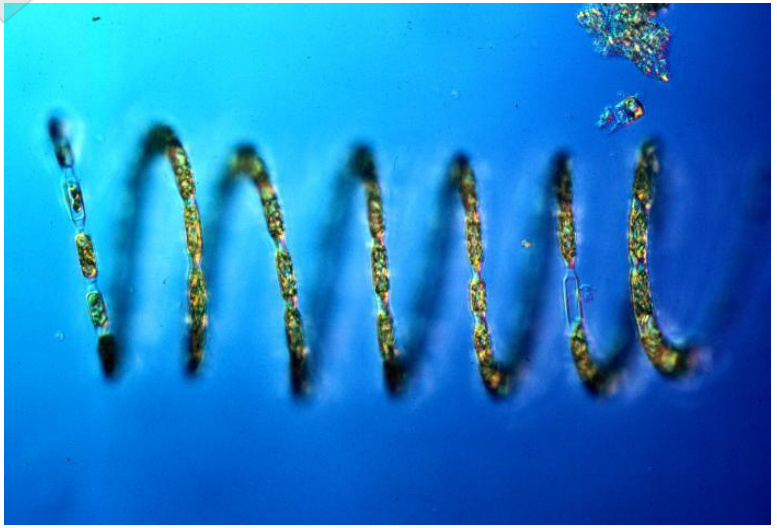
Solitary diatom,
Minutocellus polymorphus



Large diatom, *Coscinodiscus concinnus*



Chain forming diatom,
Leptocylindrus danicus



Chain forming diatom, *Eucampia zodiacus*

Thank you for your attention