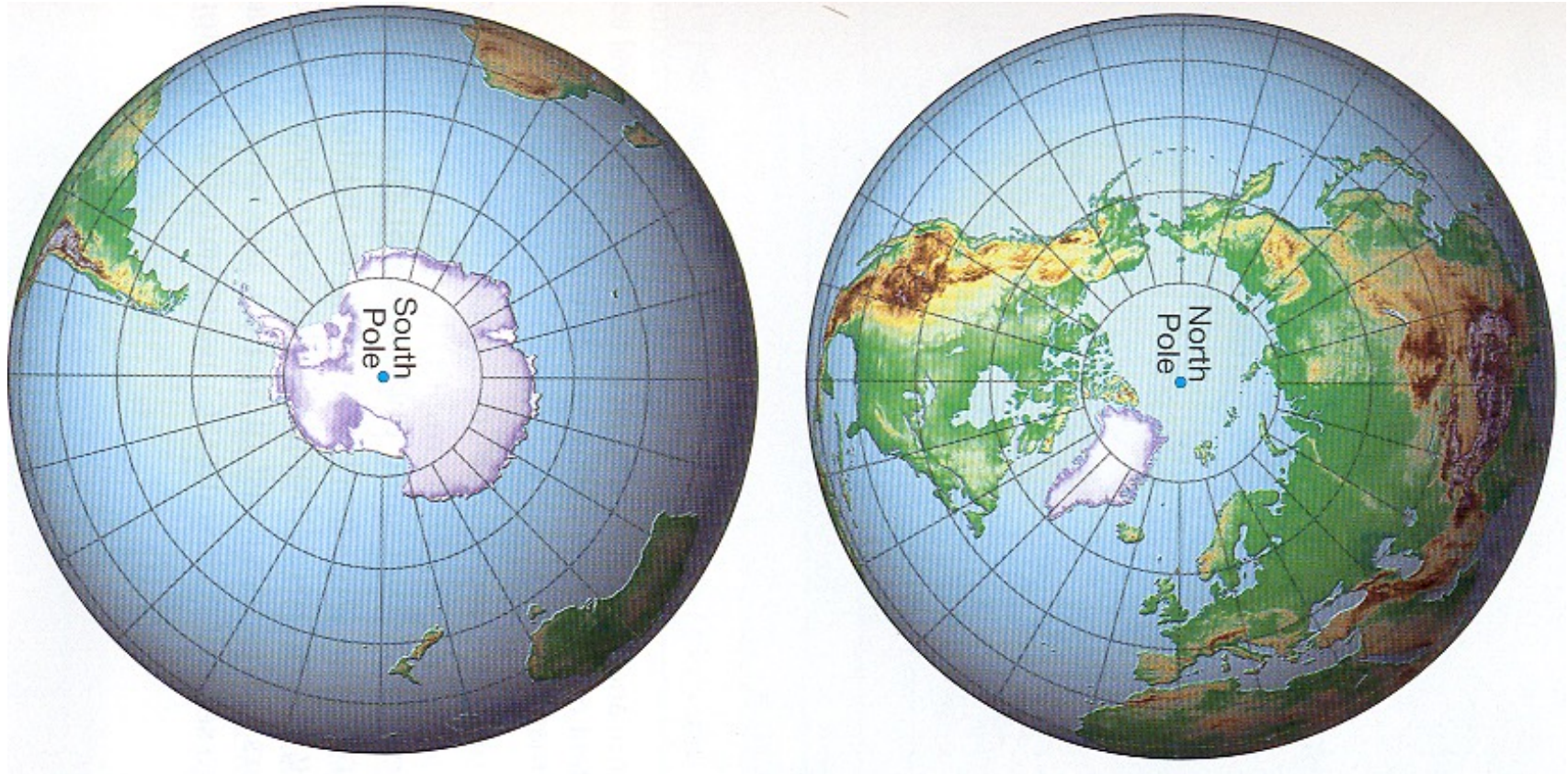
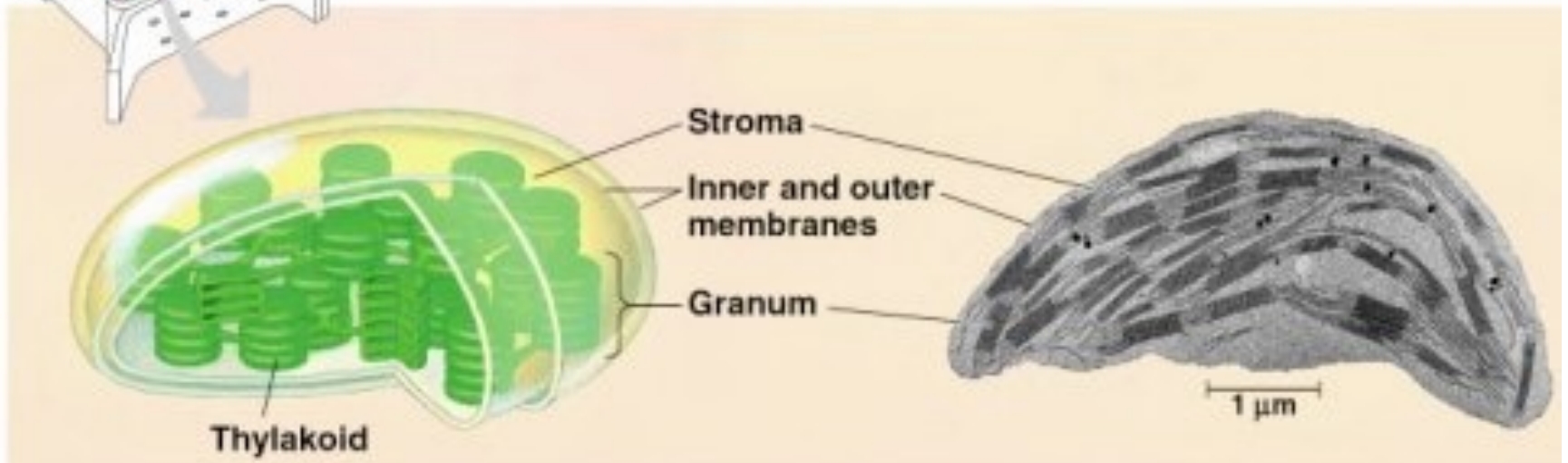
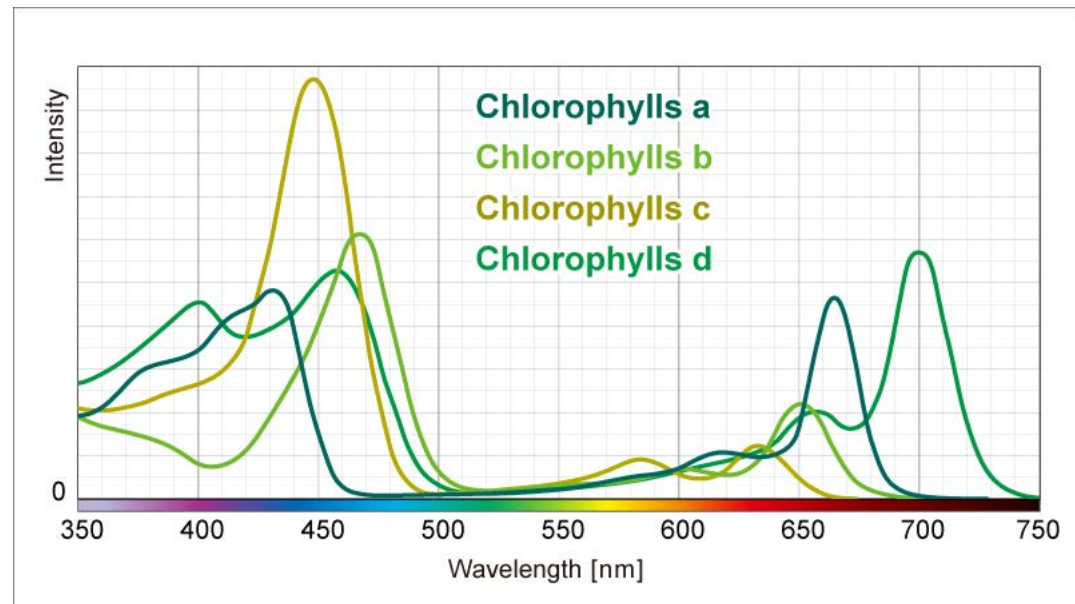
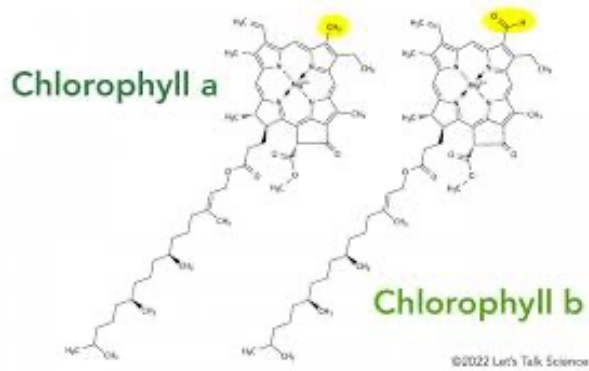
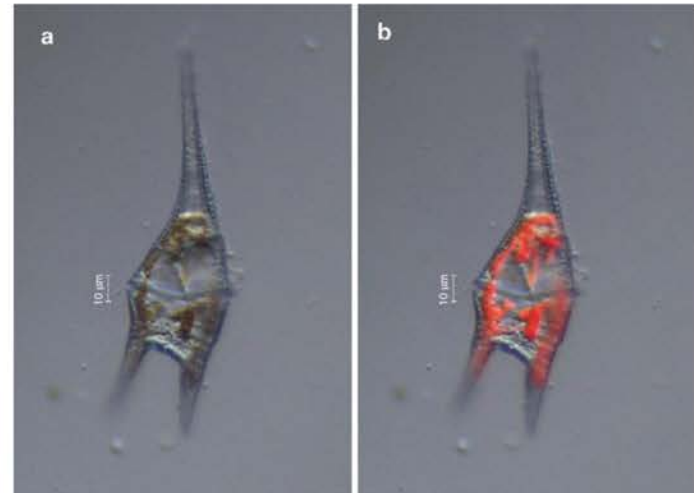
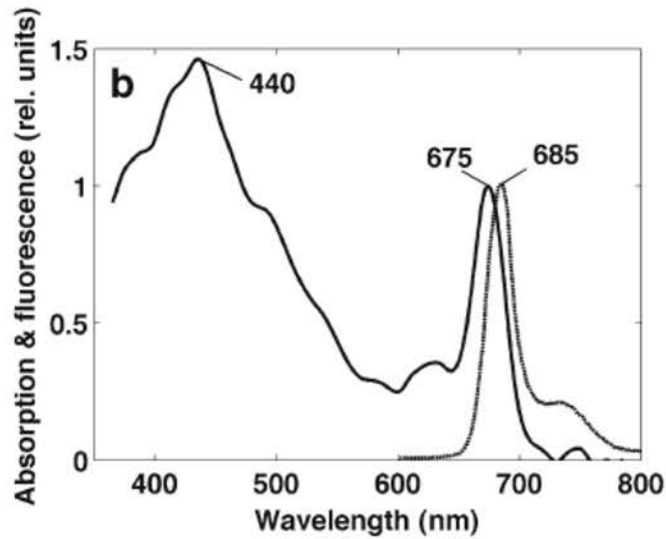


Description, techniques, protocols, and methodologies of key variables: chl_a & CDOM



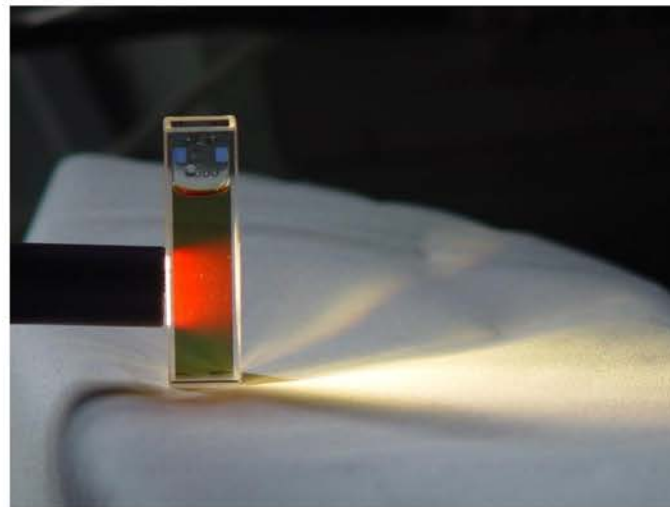
Aurea Maria Ciotti – ciotti@usp.br
Centro de Biologia Marinha da USP ([CEBIMar](#))





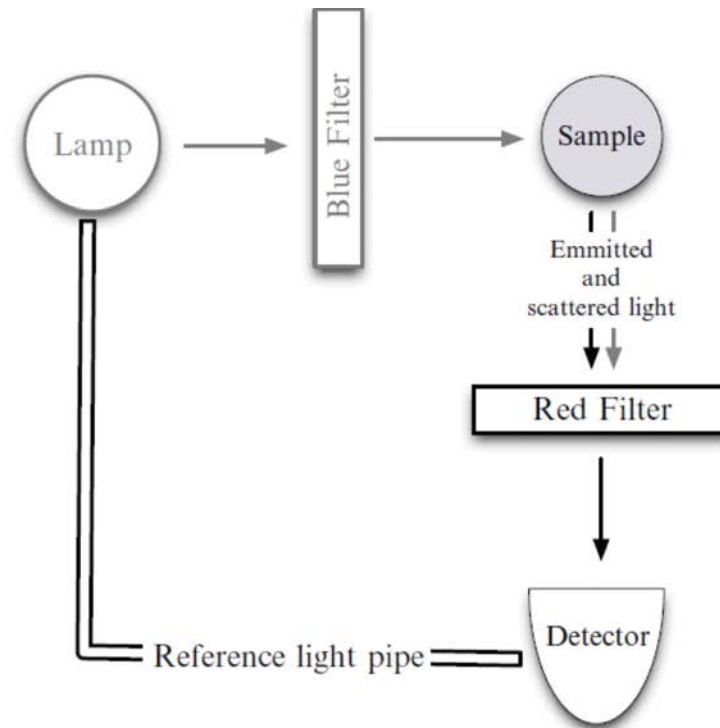
Chloroplast fluorescence in the dinoflagellate *Ceratium* sp.
 (Photo: L. Novoveska – Suggett et al, 2010)

Fluorescence –
 one of the 3 main
 “fates” of light
 absorption by
 organisms that have
 photosystems

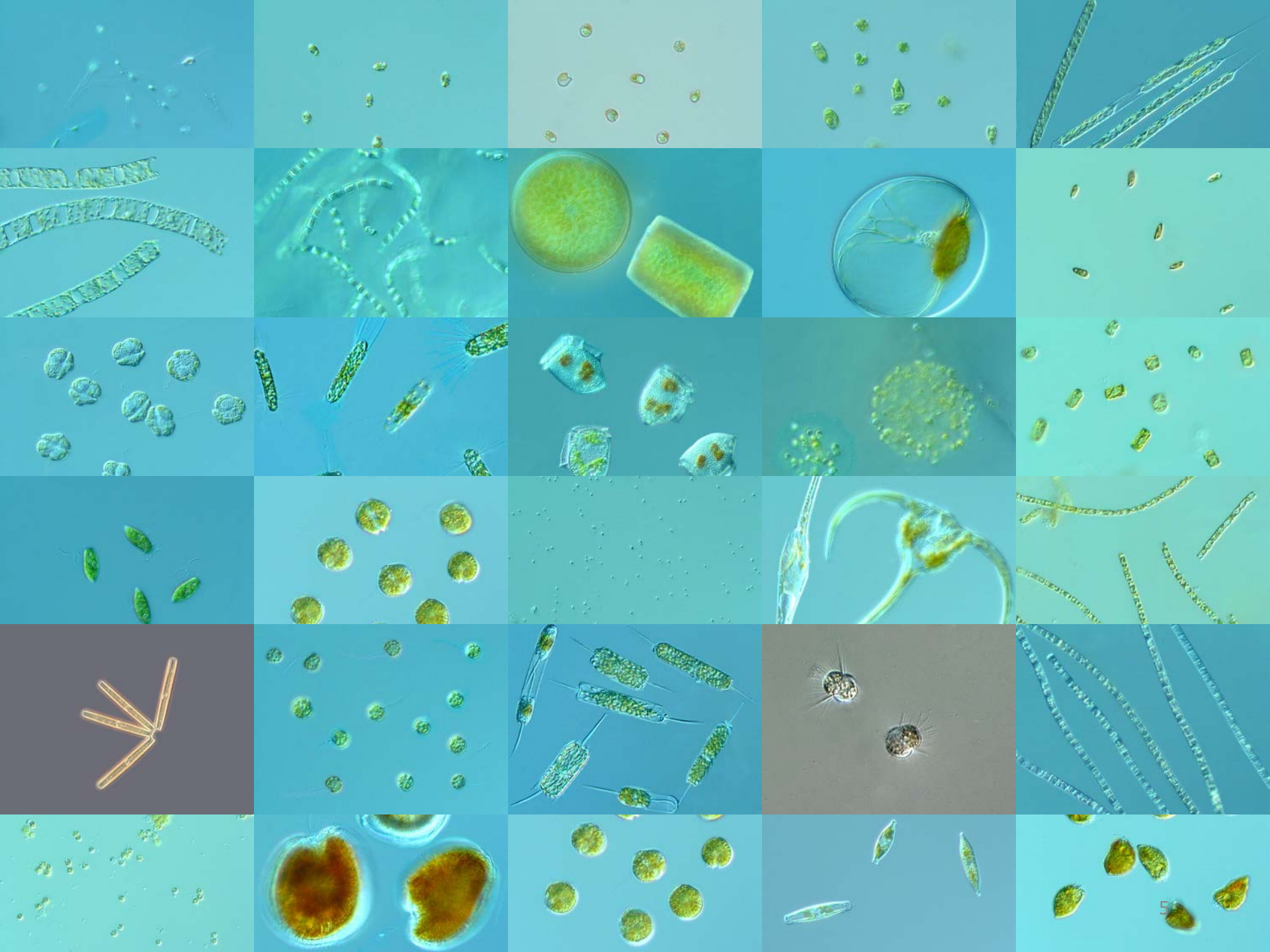


Fluorescence – easy, robust, sensitive – allowed to measure biology in the same space scales than Temperature in the ocean - “little green spheres”

- a) Heat
- b) Photochemistry – making more cells
- c) Fluorescence – return in state for excited molecules.



Huot & Babin, 2010



Spectrophotometer

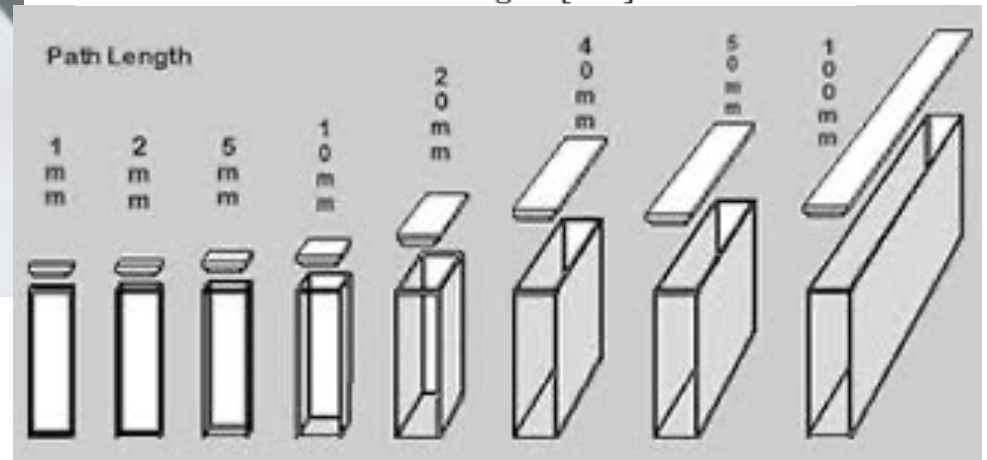
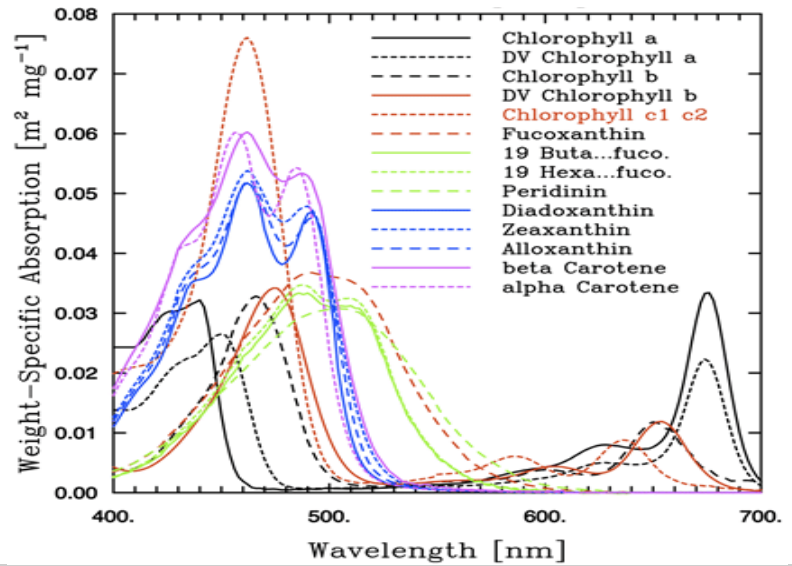


Fluorimeter



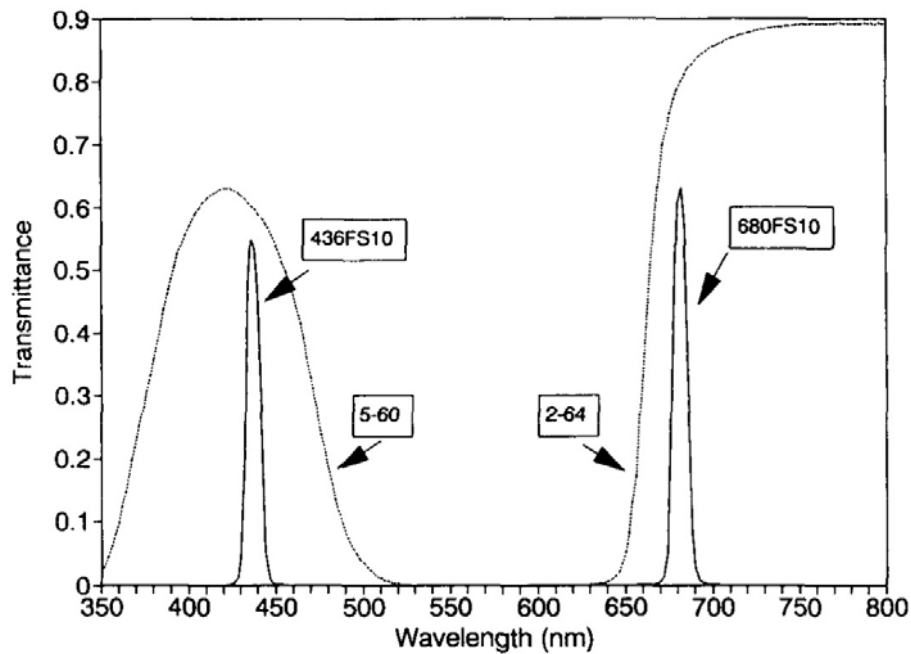
HPLC – High Performance
Liquid Chromatography

Spectrophotometer



- a) Solvents and cuvette material
- b) Lamps and cuvette material

- a) Cleaning of material – do not use HCl – or after use soap and ultrapure water
- b) Try filtering samples as soon as possible – grazing and degradation
- c) Avoid direct light and changes in temperature – “room temperature”
- d) Emissions and excitations for fluorimeter



Easy to calibrate – easy to verify drifts - solid standards and air measurements time series

10-AU fluorometer



Aquafluor – hand held



Fluorometer Trilogy – Turner Designs



C3 – Turner Designs



Cyclops – Turner Designs



Fluorescence – in vitro; in vivo (excited by a known wavelength artificially or by sunlight, and variable/active)

Phyto-PAM



Azul, vermelho ou multicolor

FIRe – Fluorescence Induction and Relaxation System



•Tortell, P.D. and Suggett, D.J. (eds) (2021) A User Guide for the Application of Single Turnover Active Chlorophyll Fluorescence for Phytoplankton Productivity Measurements. Version 1. Scientific Committee on Oceanic Research Working Group 156, 20pp. DOI: <http://dx.doi.org/10.25607/OBP-1084>

FRRf – fast repetition rate fluorometer



Azul ou multicolor

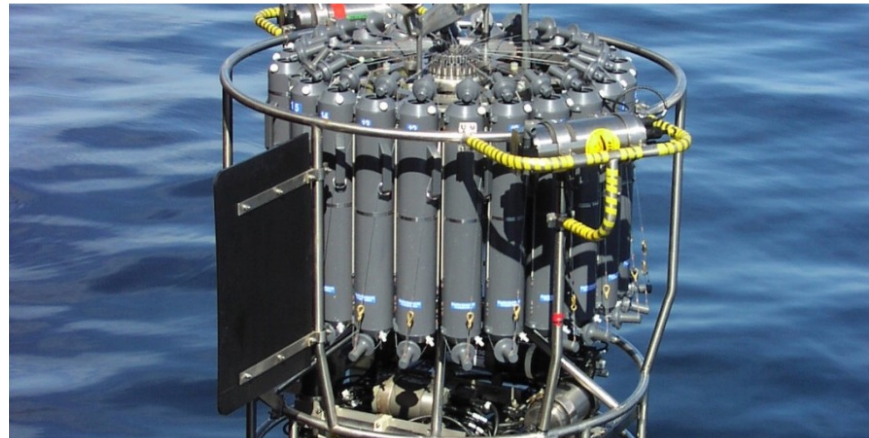
FIRe in situ

SCOR Working Group 156



Active Chlorophyll fluorescence for autonomous measurements of global marine primary productivity

<https://scor-int.org/group/156/>



Water sampling rosette with fluorometer

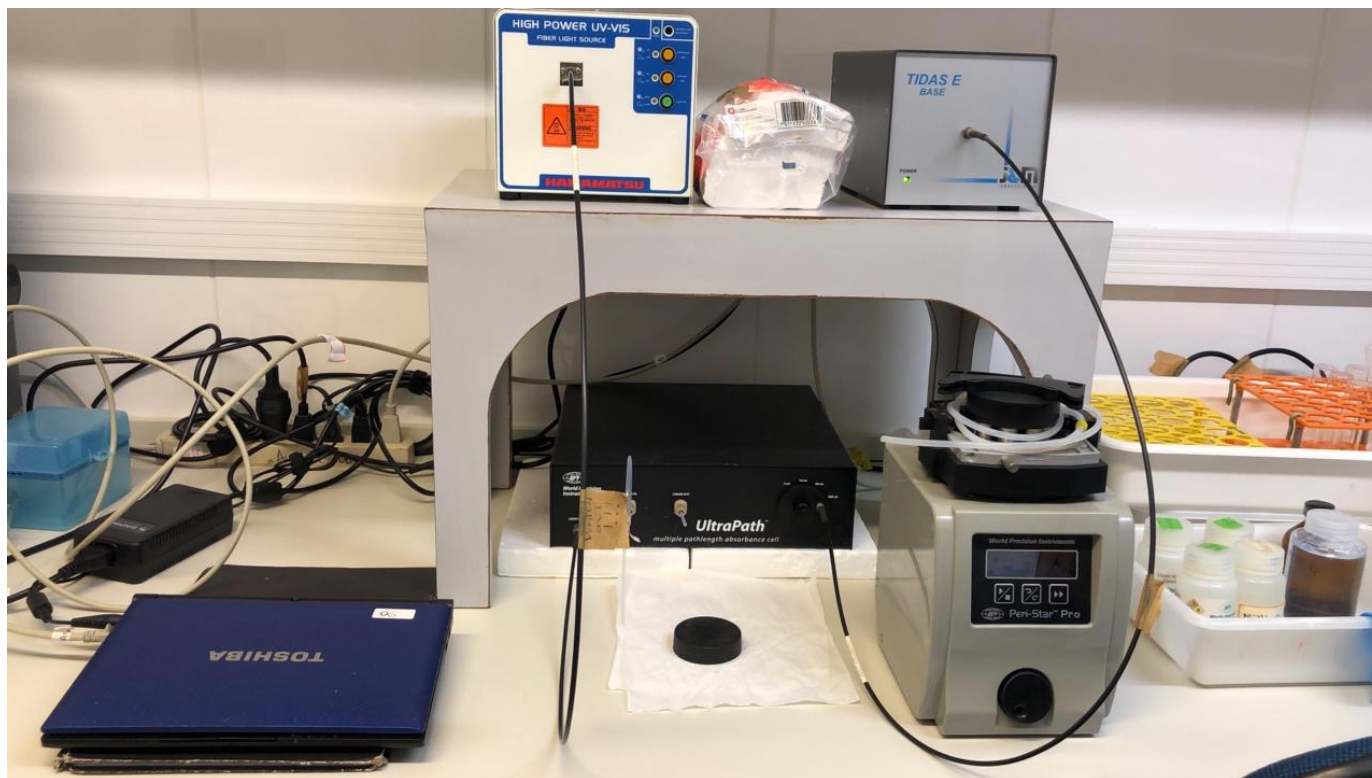
- Colored Dissolved Organic Matter (CDOM)
- gelbstoff, gilvin, yellow matter, chromophoric DOM
- a small fraction of the total DOM, variable composition
- CDOM is defined operationally by filtering
 - Using a 0.2 μm filter
 - Absorption relative to "pure water" standard
- Typically, spectrum decreases exponentially
 - $$a_g(\lambda) = a_g(\lambda_0) \exp(-S(\lambda - \lambda_0))$$
 - S varies from 0.015 to 0.024 nm^{-1}

- Colored Dissolved Organic Matter (CDOM)
- gelbstoff, gilvin, yellow matter, chromophoric DOM
- a small fraction of the total DOM, variable composition
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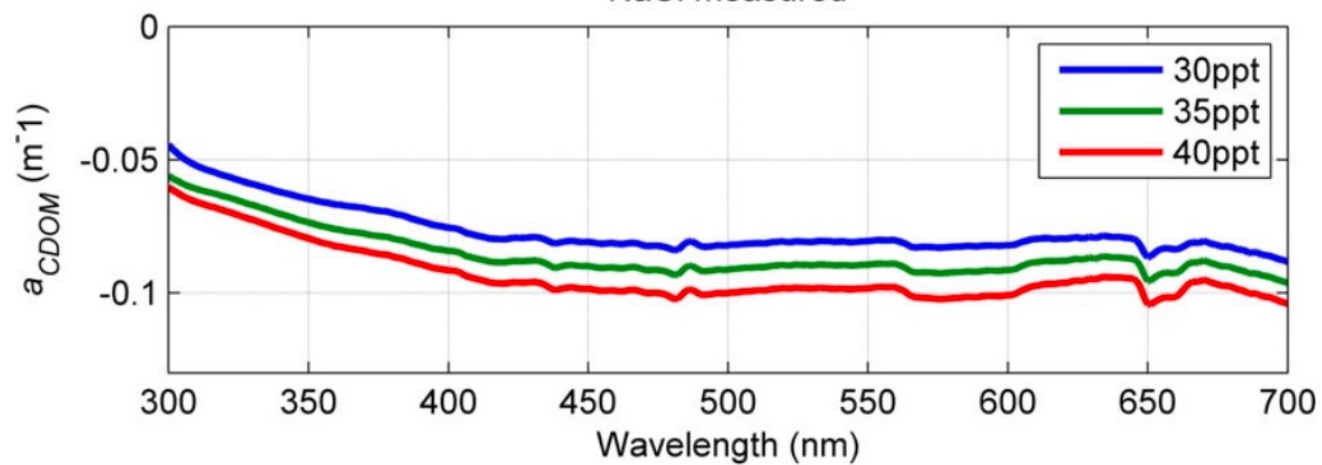
Using a 0.2 μm filter

Absorption relative to "pure water" standard

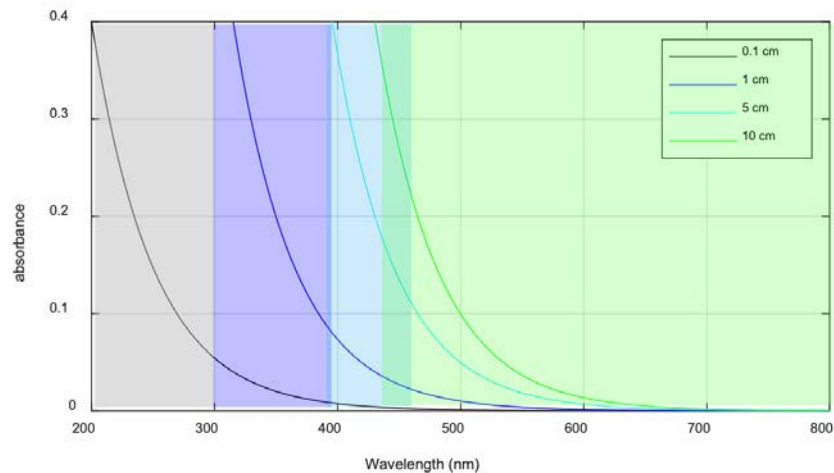
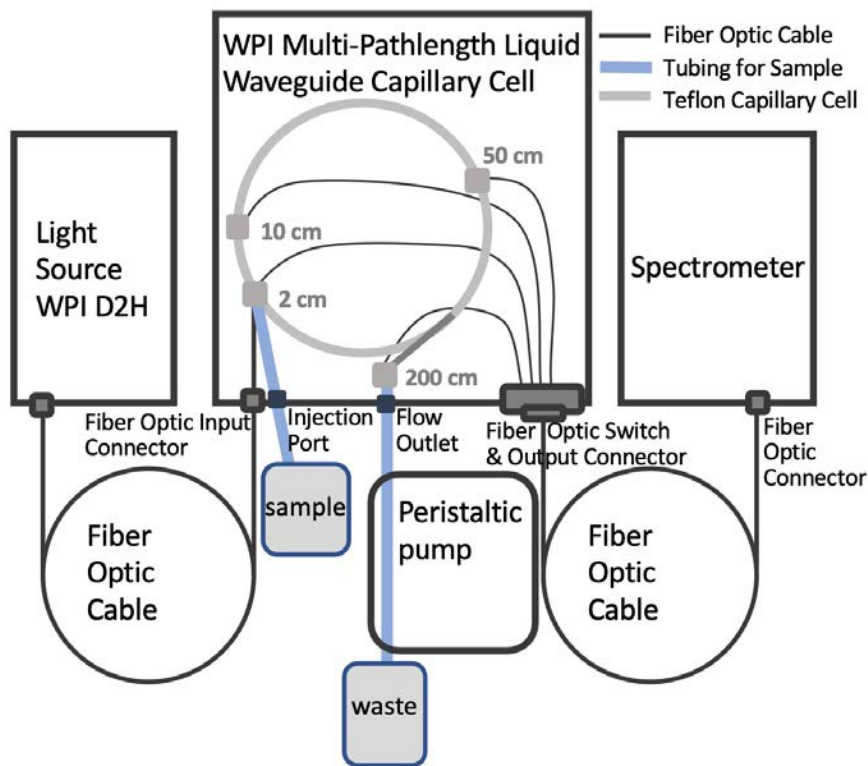




NaCl measured



Pathlength is important



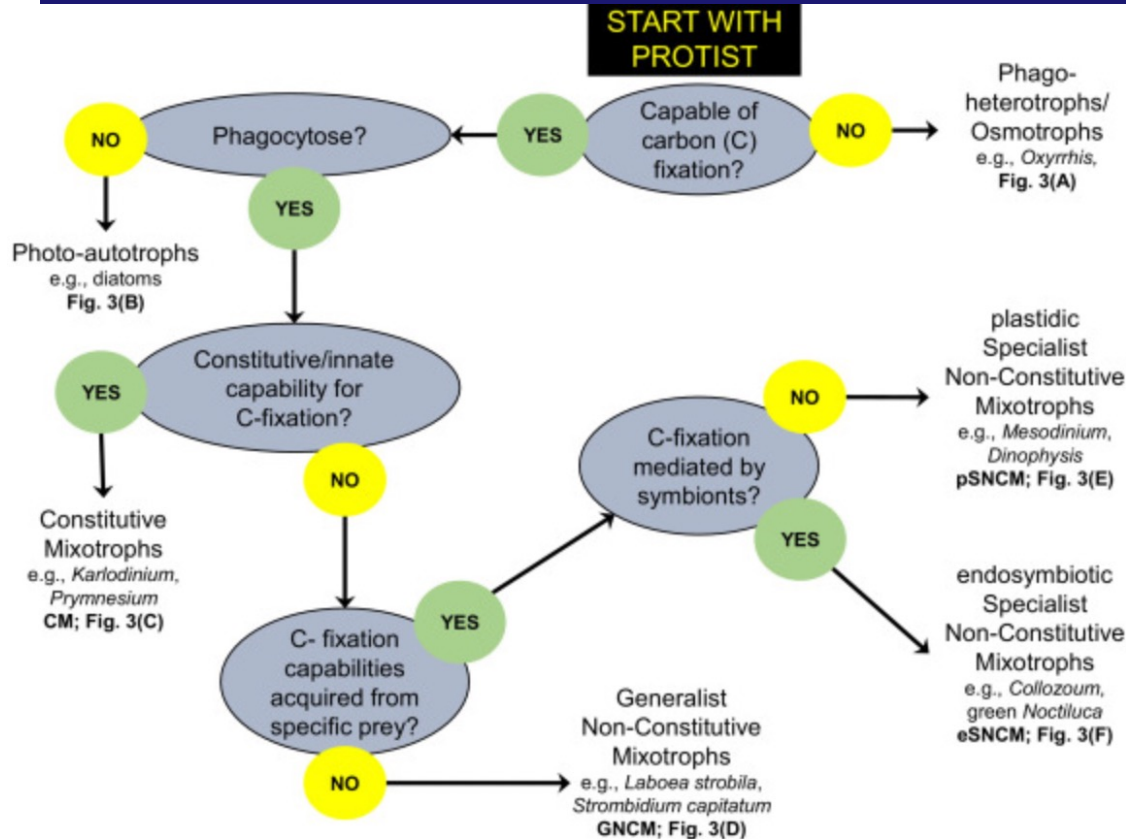
- a) Cleaning of material – now DO USE HCl 😊
- b) Muffle furnace

Figure 10. Schematic of the World Precision Instrument (WPI) UltraPath UPUV system, which includes the UltraPath absorbance sample cell (center) with four nominal optical pathlengths (2, 10, 50 and 200 cm), deuterium/tungsten light source (left), photodiode array spectrometer (right), and peristaltic pump.



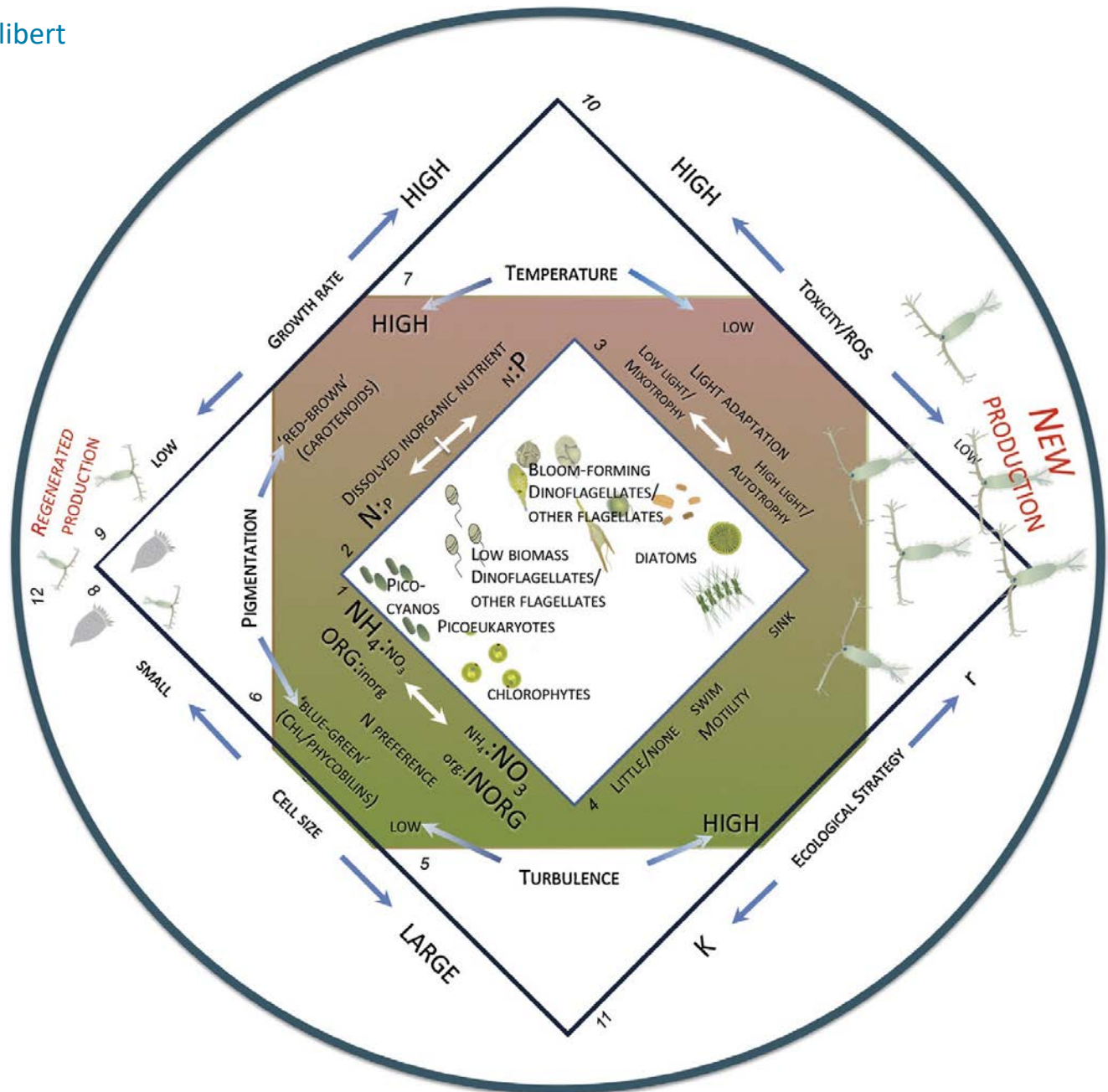


Aditee Mitra

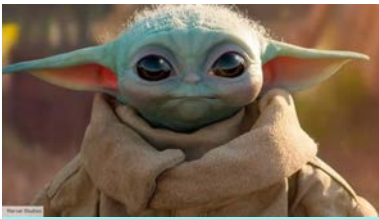




Patricia Glibert



Yoda



Teach you will. The machine will learn.

