

**Colours of the Sea**  
Detailed pedagogical sheet  
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Learning objectives

- Variation 1 —Coloring cells activity
  - Children will be able to identify that living organisms get their color from pigments
- Variation 2 — Chromatography sleuthing activity
  - Children will be able to identify that living organisms get their color from pigments
  - Children will be able to identify that phytoplankton express different pigments and that phytoplankton taxa can be identified based on the pigments present in a sample
  - Children will be able to identify that the distribution of organisms in the water column is variable, and that microbial abundance and diversity is dependent upon physical processes regulating the availability of light and/or nutrients.

Activity summary

- Variation 1 (younger children)
  - Volunteer will explain that Living organisms get their color from pigments
    - Colorful bird photo
    - Leaves photo
    - Phytoplankton photo
  - Volunteer will explain that some pigments provide protection from the sun, others allow organisms to harness energy
  - Volunteer will explain that phytoplankton have pigments too, and that these pigments vary depending on the environment the phytoplankton lives in
    - Can elaborate on factors controlling pigment concentrations using poster images, if children seem interested
  - Volunteer will explain that today children will be giving a phytoplankter its pigments
  - Volunteer will provide children with color markers, and cut-out microbes, explaining that these drawings are of very tiny ocean bacteria and their body parts
    - *Prochlorococcus* (Cyanobacterium)
    - *Synechococcus* (Cyanobacterium)
    - *Chlamydomonas* (Chlorophyte)
    - *Alexandrium* (Dinoflagellate)
  - Children can color in the microbes and take them home.
- Variation 2 (older children)
  - Volunteer will explain that living organisms get their color from pigments
    - Photograph of colorful bird and butterflies

- Photograph of leaves
- Photograph of phytoplankton bloom in coastal ocean
- Volunteer will explain that some pigments provide protection from the sun, others allow organisms to harness energy
- Volunteer will explain that phytoplankton have pigments too, and that these pigments vary depending on the environment the phytoplankton lives in
  - Can elaborate on factors controlling pigment concentrations using poster images, if kiddo seems interested
- Volunteer will explain that phytoplankton can be identified by what pigments they contain
- Volunteer will explain that chromatography is one way of identifying pigments in a sample
- Volunteer will provide children with a prepared "sample" and a slip of chromatography paper:
- Take a drop of "sample" from eppendorf tube with a squeeze pipet containing.
- Place the drop on chromatography paper (approx. 1/2in. from the bottom)
- Volunteer will instruct children to submerge tip of paper (the part below the drop of sample) and to wait ~2 minutes
- Once colors have separated, volunteer will ask children to identify what organisms they might expect to be present in the sample
- Volunteer will direct children's attention to poster/handout describing pigments typically associated with different organisms (as reported by Jeffery 1996).
- Based on intensity of color, volunteer will ask children to identify whether "sample" might come from a region with high or low plankton abundance
- Based on children's response, and referring to ocean chlorophyll map, volunteer will ask kiddo to identify where in ocean sample might have been obtained



## Pigments/organisms

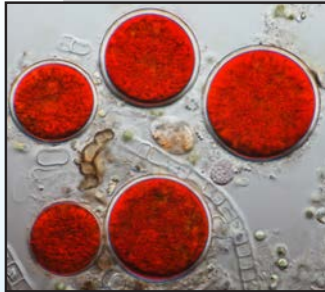
- Red - Astaxanthin - **Haematococcus pluvialis**
- Orange/red - Beta-carotene - **Alexandrium and other dinoflagellates**
- Green - Chlorophyll - **All chlorophytes**
- Brown/Green - Fucoxanthin - **Diatoms**
- Yellow - Zeaxanthin - **Chrysophytes**
- Blue - Phycocyanin - **Eucapsis and other cyanobacteria**

## Materials & preparations:

- Materials needed for the event:
  - Cups for water
  - Plastic squeeze pipets
  - Chromatography paper strips
  - Eppendorf tubes with the different "samples"
  - Racks for the tubes
  - Colored markers
  - Microbe cutouts
  - Poster "Colours of the Sea"
- "Sample" preparation:
  - Composition 1: 6x Lemon Yellow 2x red 2x pink 2x fruit green
    - Makes: Red, Orange, Brown/Dark green
    - Corresponding pigments: astaxanthin, beta-carotene, fucoxanthin
    - Organisms: Diatoms, dinoflagellates, haematococcus
    - Tube numbers: 6,11,15,13,14
  - Composition 2: 1x pink 6x lemon yellow 3x fruit green
    - Makes: pink, yellow, Bright green
    - Corresponding pigments: astaxanthin, zeaxanthin, chlorophyll
    - Organisms: Haematococcus, chrysophytes,
    - Tube numbers: 2,8,12,9,4
  - Composition 3: 6x Fruit green 2x lemon yellow 5x aqua blue
    - Makes: Bright green, yellow, blue
    - Corresponding pigments: chlorophyll, zeaxanthin, phycocyanin
    - Organisms: eucapsis (cyanobacteria), (chrysophyte)
    - Tube numbers: 3,5,10,7,1

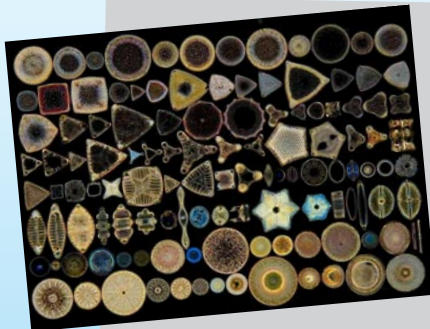


# Colours of the Sea



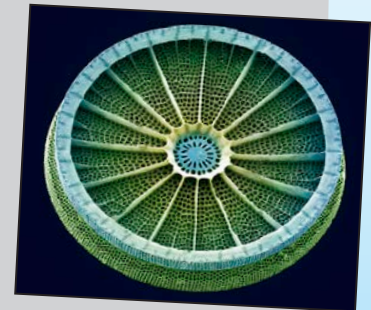
## Red algae

- Chlorophyll
- Astaxanthin



## Diatoms

- Chlorophyll
- Fucoxanthin



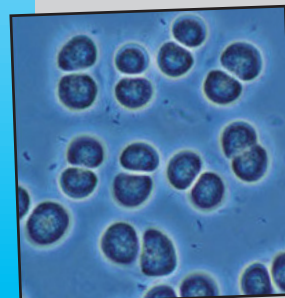
## Dinoflagellates

- Chlorophyll
- Beta-Carotene



## Golden algae

- Chlorophyll
- Zeaxanthin



## Cyanobacteria

- Chlorophyll
- Phycocyanin