Week 6 (9/27/24)

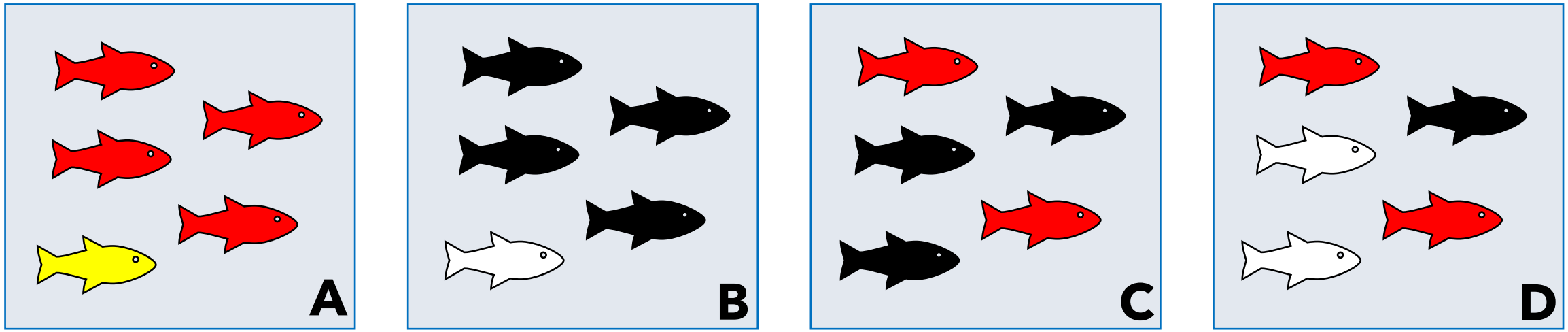
Phytoplankton ID Lab

Plan for today.

1. Diversity indices
2. Basic algal identification
3. Phytoplankton ID and diversity indices calculations

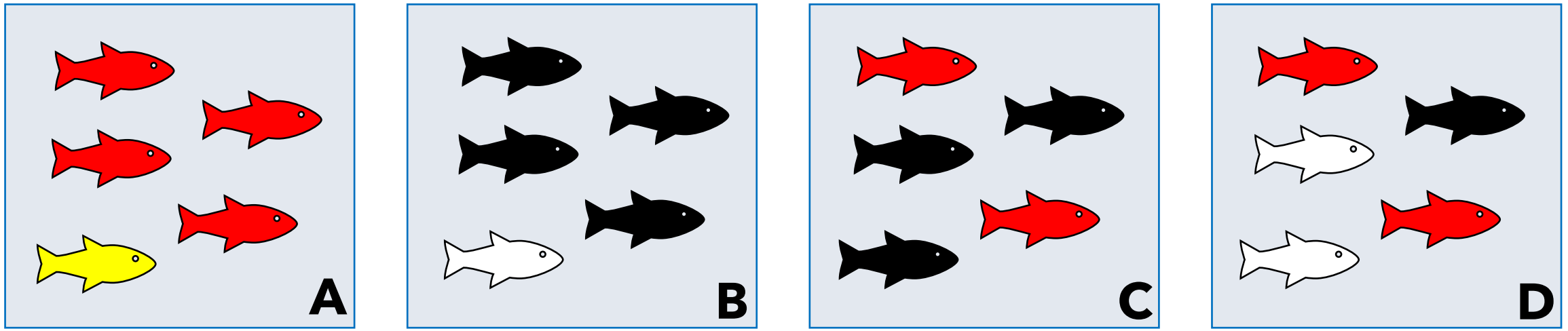
Diversity Indices (key terms)

- **Richness:** Total number of species found in an area
- **Evenness:** How equally represented is each species.



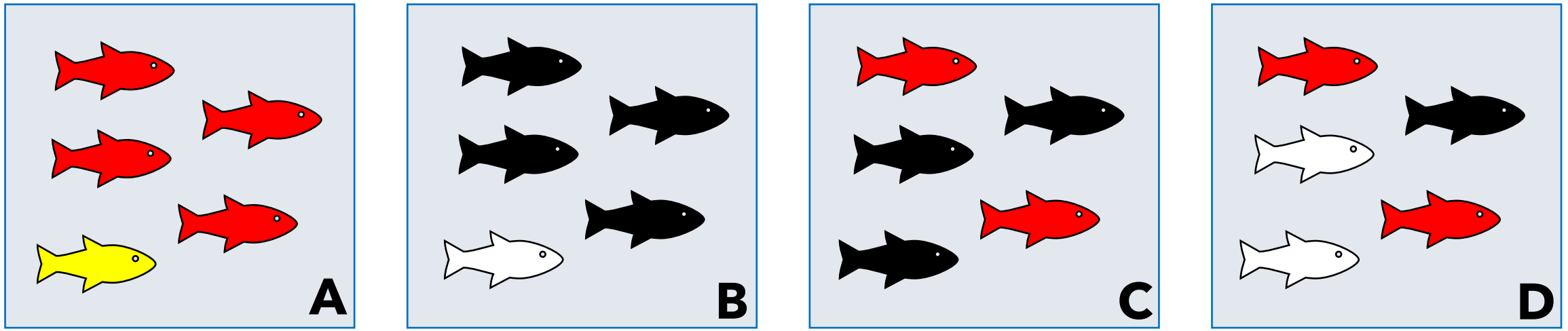
Diversity Indices (key terms)

All 4 ponds have the same **richness** (2 species), but C and D have greater **evenness** than A and B.



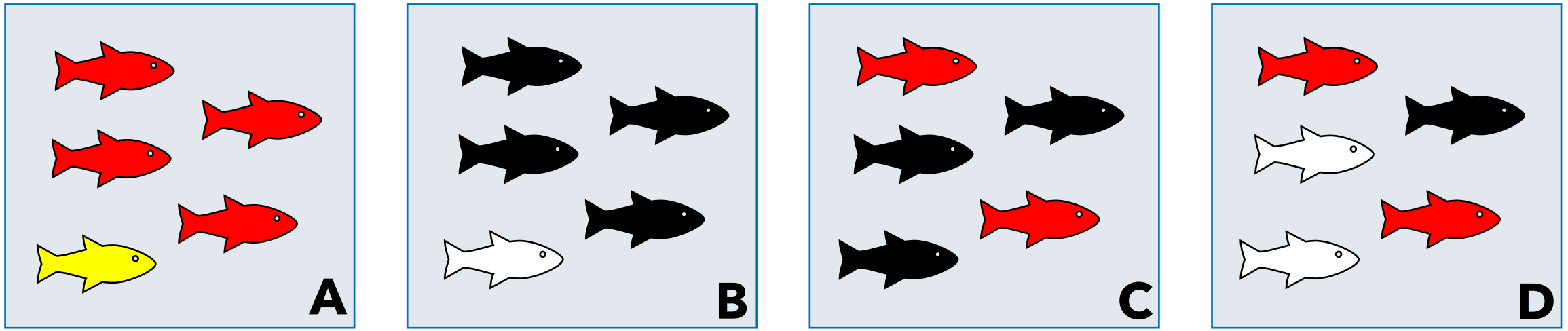
Diversity Indices (key terms)

- **α diversity:** with-in habitat diversity
- **β diversity :** between habitat diversity



Diversity Indices (key terms)

Ponds A and B have lower **α diversity** and higher **β diversity** than C and D.



Shannon Index (H′)

Includes both evenness and richness

$$H' = \sum_{j=1}^{s} p_j \ln(p_j)$$

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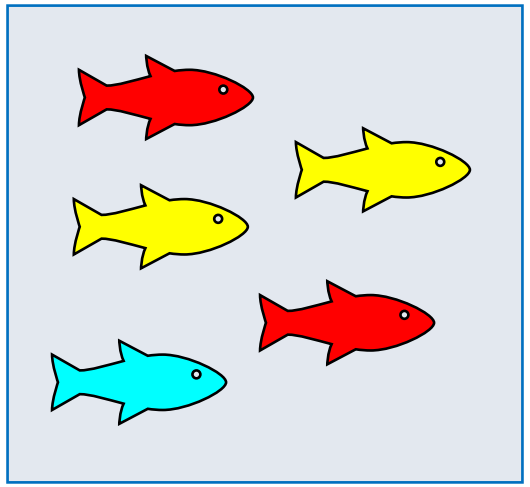
Species j

Number of individuals in the species j divided by the total number of organisms in the assemblage

Shannon Index (H′)

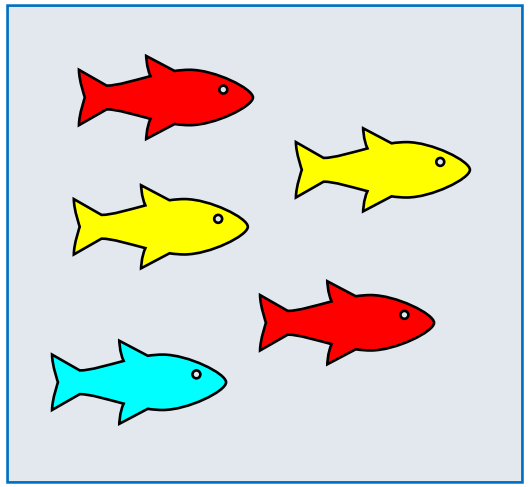
Includes both evenness and richness



$$H' = \sum_{j=1}^{2} .4 \ln(.4)$$

Shannon Index (H′)

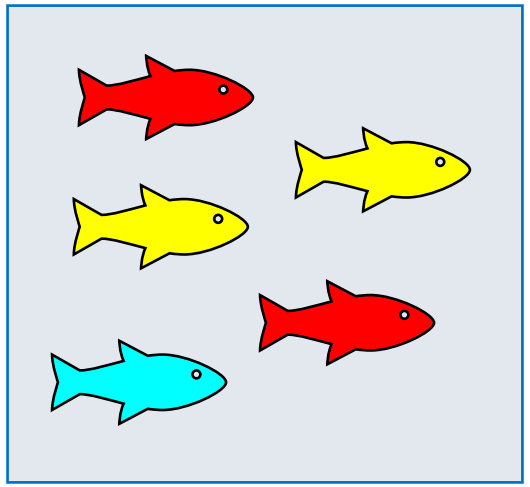
Includes both evenness and richness



$$H' = \sum_{j=1}^{2} .4 \ln(.4)$$

Shannon Index (H′)

Includes both evenness and richness



$$H' = \sum_{j=1}^{1} .2 \ln(.2)$$

Simpson Index (D’)

Includes both evenness and richness

Same concept… different math

$$\frac{1}{\sum_{j=1}^{s} p_j^2}$$

> Which metric you use will depend on your question (often you use both).

Shannon is strongly influenced by species richness and by rare species.

Simpson give more weight to evenness.

We will use both to look at our phytoplankton samples (and let R do the math).

Types of Algae

- Cyanobacteria
- Green algae (chlorophyta)
- Diatoms
- Dinoflagellates
- Chrysophytes
- Euglenoids

Phytoplankton Identification

- Based on morphology and physiology
  - Pigments
  - Locomotion
  - Size
  - Unique Biology

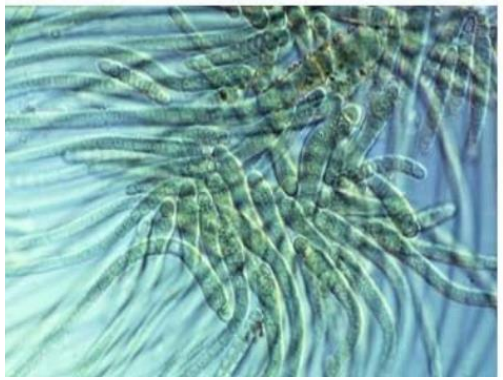
*DNA sequencing

Slides adapted from teaching materials from Dr. Whitney Beck

Cyanobacteria

Key features:

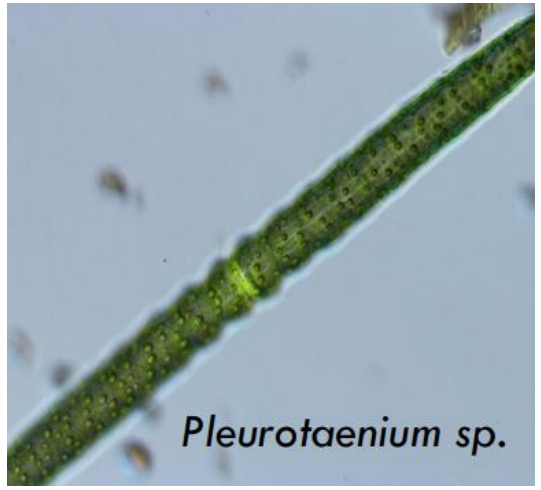
- No nucleus
- (Usually) heterocysts



Green algae (chlorophyta)

Can be…

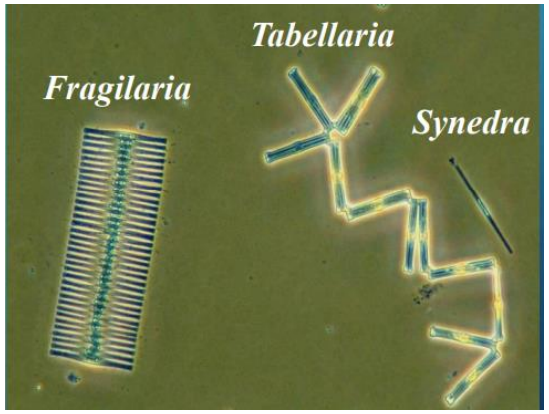
- Unicellular
- Colonial
- Filamentous
- Branching

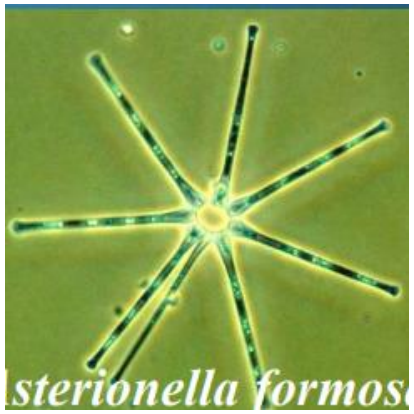


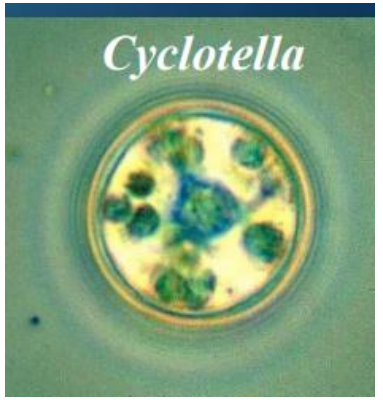
Diatoms

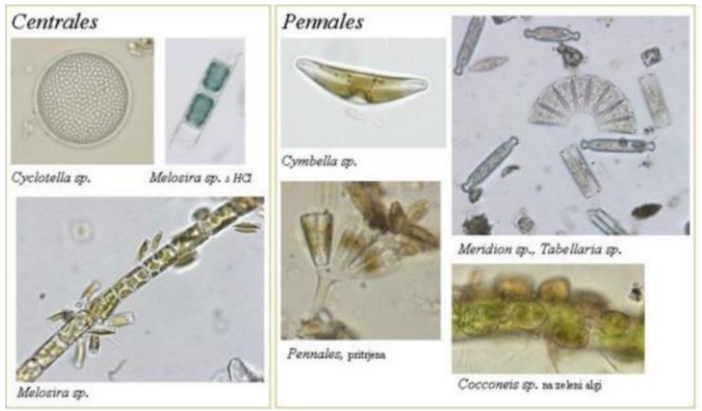
Key features:

- Silica cell walls (“frustules”)
- Two dominant shapes: centric or pennate





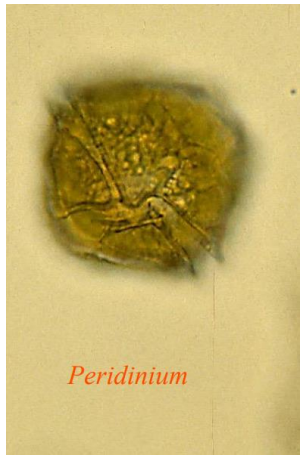




Dinoflagellates

Key features:

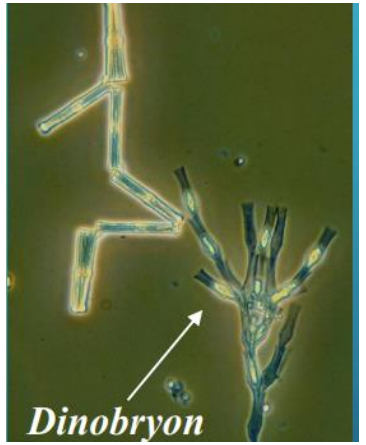
- unicellular
- have flagella (various lengths)



Chrysophytes

Key features:

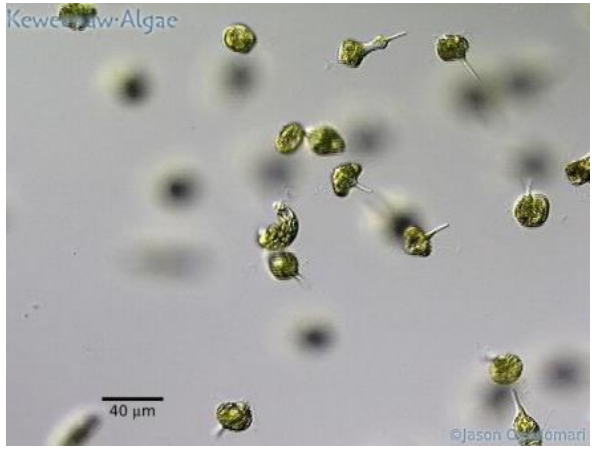
- Golden in color
  - Why might this be unhelpful with our samples?
- 1 or 2 flagella



Euglenoids

Key features:

- Flagella
- Thrives in high nutrient environments



A wildly oversimplified cheat sheet

- If it has heterocycts… **Cyanobacteria**
- If it's pretty…**Diatom**
- If it looks like the Eifel tower…**Dinoflagellates**
- If it looks like a seed… **Chrysophytes**
- If it has got rounded edges…**Euglenoids**
- If you can't figure out what else it could be… **Green algae**
  - Can breakdown further into unicellular, colonial etc.

We will be calculating **relative** abundance of these groups

- Mix your sample thoroughly but gently
- Pipette a small drop on your slide (volume does not matter since this is about relative abundance)
- Place the cover slide on without making an air bubble
- Start at the lowest magnification, zoom in slowly and don’t crack your slide.

Goals for the day….

- Understand basic principles of diversity indices and how to calculate them using R

- Have a good time looking at tiny organisms under a microscope.