Fashion-A-Phyto

SouthEast Phytoplankton Monitoring Network (SEPMN)

Grades:
6th-College

Goal:
To understand the structure and function of phytoplankton and to learn about binomial taxonomy.

Objectives:
1. Students will construct a new species of phytoplankton with provided art supplies.
2. Students will classify their new species according to the binomial system of taxonomy.

Science Standards:
Observation, Biological classification, Communication, Create Scientific Models, Scientific Inquiry, Cell Structure/Function, Photosynthesis, Scientific History

Materials:
- Set of fashion cards (18 cards total)
- English to Latin Dictionary (small list included with lesson plan; a dictionary can be obtained at local library or book store)
- craft paper
- construction paper
- paper plates
- crayons/markers
- pipe cleaners
- aluminum foil
- white or colored tissue paper
- any other available craft supplies you have available
- ribbons
- tape
- stapler
- clay
- glue

Background:
Each animal and plant has its own scientific name that is recognized by scientists in America, Europe, or anywhere else in the world. This binomial system of taxonomy dates back to the 1750s, when Swedish naturalist Carl von Linne (Latinized to Carolus Linneas) adopted Latin, the scholarly language of the day, to describe organisms.

Each organism is assigned a Genus name (capitalized) and a species name (lower case). Both names are usually italicized. Organisms with the same genus names are closely related (such as *Canis* for all dogs), while those with similar species names may share common features (such as shape or color, as in *rubrum* for red) and generally can interbreed only among themselves. The species name is usually an adjective that describes something about the organism, the person who discovered the original, or where the organism was first located. For example, the scientific name for humans is *Homo sapiens* (Genus *Homo* = man, species *sapiens* = thinking). The literal Latin translation for *Homo sapiens* is thinking man.

By looking for the root meaning of the Latin names, students may deduce the characteristics of an organism. In this activity, by using Latin words to describe the characteristics of their "invented organisms", students can name the new species they create.

Students must follow the basics rules of taxonomy (the science of naming organisms) when naming their new species:
- No two different species can have the same combination of genus and specific names.
- No species is given more than one combination of genus and specific name.
- Genus name is always capitalized & italicized or underlined.
- Specific species name is not capitalized, but is always italicized or underlined.

Instructions:

1. Print Fashion cards so they are double-sided. There are 3 different hand outs (18 cards total). You will want to make copies of more than one set (if you have 30 students make at least 3 or 4 sets of Fashion cards).
2. Cut out fashion cards.
3. Divide the students into groups of 2 to 4 if desired.
4. Print enough English to Latin Dictionaries for each student/group.
5. Give each student/group a variety of art supplies to use.

Procedures:

1. Explain to the students that they will construct their own new species of phytoplankton using the art supplies provided.
2. Hand out four fashion cards to each student/group of students.
3. When handing out cards, make sure not to give two contradicting cards (example: centric vs. pinnate).
4. Each student/group will create a phytoplankton using the art supplies based on what cards they have received.
5. Each card has a definition and an example of the structure. These are to be used as guides only, not to copy.
6. Once they have created their new species, instruct the students to use an English-Latin dictionary to come up with a new name for their organism. Names can be based on:
   a. people
   b. region/location
   c. shape/size/color
   d. similarity to other species
   e. other defining characteristics
7. The goal for the student is to be creative and learn the different and sometimes unique characteristics of phytoplankton. This will help them identify the phytoplankton they see under the microscope.
8. Each student/group should present their phytoplankton to the class and explain the name, characteristics, and possible purposes of the organism's structures to the class. This will allow students to learn various structures and Latin names while enjoying what their classmates have created.

Observations:

1. What are phytoplankton?
2. Why are phytoplankton important?
3. What is it about phytoplankton that makes each one unique?
4. Why do scientists use scientific names?
5. What do the two parts of the scientific name represent and how are they written?
6. Who gives a new organism its scientific name?

Post-Activity Discussion:

Let your students be as creative as possible! For this activity, students can combine all the different characteristics of both diatoms and dinoflagellates. Once the students have discovered all of the "New Species", ask your students if any of these could be "true" diatoms or dinoflagellates. Explain to your students these few rules:

1. Stepped chain, frustules, process, raphe, pinnate, and centric are characteristics of diatoms.
2. Peduncle, trough, flagella, plated, bilobed, and eyespot are characteristics of dinoflagellates.
3. Spines, segmented, chain, theca, nucleus, and chloroplasts can be found in both diatoms and dinoflagellates.

Have your students discuss what characteristics can and can not intermix and why.

Teacher Information:

Phytoplankton are some of the most important organisms that live on earth. Phytoplankton are single-celled microscopic plants that drift in watery environments such as the ocean. *Phyto-* means plant and *plankton* is the Greek word for wandering or drifting. These drifting plants are the basis of the food web for most of the planet. All of the animals that live in the sea depend on phytoplankton for food and energy. Phytoplankton are also a source for commercial products such a swimming pool filters, cosmetics, lotions, detergents, paint remover, polishes, insulation, rubber, latex, fertilizers, cement, pharmaceuticals, dairy products, and more!

Phytoplankton are primary producers, utilizing photosynthesis to make their own food. During photosynthesis, phytoplankton remove carbon dioxide from the ocean and release oxygen as a by-product. Because of phytoplankton, the ocean is able to sequester carbon dioxide from the atmosphere, helping to maintain the global carbon cycle. These amazing organisms also produce 40-50% of the world's oxygen that we breathe.

There are an estimated 102,000 species of phytoplankton that are categorized into 15 phyla and 3 kingdoms. Major taxonomic groups of phytoplankton include diatoms, dinoflagellates, raphidophytes, coccolithophores, and cyanobacteria. Diatoms and dinoflagellates are the most common and are described below. All species of Raphidophytes have been linked to fish kills and unlike the dinoflagellates, are characterized by having 2 longitudinal flagella. Coccolithophores have outer shells made of calcium carbonate and are used to produce chalk. The most famous representative of a large collection of coccolithophores is the White Cliffs of Dover in England. Cyanobacteria, or blue-green algae, are considered the oldest living organisms on the planet. The Red Sea got its name from the blooms of *Trichodesium*, a common planktonic cyanobacterium.

Diatoms are some of the most beautiful organisms to look at under a microscope! Their two-part cell walls are made of silica (SiO_2) and are shaped like delicate glass pill boxes, with an amazing array of sizes, shapes, and ornamentation.

You can find diatoms drifting in just about any type of environment with water. Some diatoms are not able to move on their own. With the help of the oil pockets within their ornamental shells, diatoms can stay aloft in the water column and closer to the sunlight. Others can move using the raphe. The raphe allows pennate diatoms to glide against a solid surface by secreting sugary mucous filaments.

There are two basic cell shapes in diatoms: centric (round, Order Centrales) and pennate (thin ellipse, Order Pennales). The centric diatoms may be solitary or chain-linked by projections from their cell walls or membrane; while the pennate diatoms are solitary cells.

When nutrient and light conditions are right, all diatoms are able to bloom (ability to reproduce very quickly into large numbers of individual or different species). Some diatoms can cause harm because of their spiny glass structures by clogging and cutting fish gills, while others can carry a toxin.

Dinoflagellates are perhaps the most charismatic of the phytoplankton. Not only are they beautiful to look at under the microscope, they also have the most diverse types of life histories and unique adaptations to the marine environment.

The theca (cell wall) of dinoflagellates is complex and variable consisting of a layer of vesicles (small sac-like organelles) with or without cellulosic plates. If the plates are

present, the cells are called thecate or armored. If no plates are present, the cells are called athecate or unarmored. The theca may have horns or spines, and the plates may be decorated with pores, depressions, spines, ridges, and reticulations.

Dinoflagellates have two flagella. The transverse flagellum wraps around the middle of the dinoflagellates, allowing it to have forward momentum. The longitudinal flagellum trails the cell like a rudder, causing the cell to spin and move forward.

Like other phytoplankton, dinoflagellates can go through bloom cycles. Some of these blooms can be toxic or bioluminescent. Remember, not all algal blooms are toxic or harmful!

Check out our website to learn more about Phytoplankton and Harmful Algal Blooms: http://www.chbr.noaa.gov/CoastalResearch/SEPMN/.

Definitions:

Bilobed- Dinoflagellates that are divided into two lobes.
Centric- Taxonomic order of diatoms with valve striae arranged in relation to a point or central areola; often round or circular.
Chain- Algae of the same species linked together.
Chloroplasts- Organelles in the cytoplasm that contains the cell pigments.
Eyespot- A red spot found in dinoflagellates and involved in light perception
Flagella- Whip-like structure used primarily for locomotion in dinoflagellates
Frustule- In diatoms, the siliceous parts of the cell wall or the skeleton
Nucleus- The organelle in eukaryotic cells containing most of the cell's genetic material
Peduncle- Mouth used for engulfing food (heterotrophic dinoflagellates)
Pennate- Taxonomic order of diatoms with the valve striae arranged in relation to a line; cells are often boat shaped
Plated- Armored plate composed of cellulose found in cell walls of some dinoflagellates
Process- An oriented projection of a silicate cell wall in diatoms
Raphe- In pennate diatoms, a longitudinal fissure associated with and involved in gliding locomotion
Stepped chain- An organism linked together to form a series of steps
Spines- In diatoms, closed or solid structures projecting from the cell wall; in dinoflagellates, solid protuberances that usually taper to a point
Segmented- The separation of the main body into sections, may be equal or unequal
Theca- Cell wall. In diatoms, composed of silica. In dinoflagellates, a multiple membrane complex with vesicles and some species with scales.
Trough- A depression in the main body of the cell in dinoflagellates

Sources:

Van Den Hoek, C., Mann, D.G., & Jahns, H.M. Algae: An Introduction to Phycology. United Kingdom: Cambridge University Press, 1995.

Horner, Rita A. A Taxonomic Guide to Some Common Marine Phytoplantkon. England: Biopress Ltd., 2002.