**Algae Bloom Lab**

**Background**

Lakes undergo a natural succession. When a lake is young and deep, there are fewer aquatic organisms because the nutrients they require are scarce. Over time, runoff into the lakes brings nutrients needed to sustain phytoplankton and other primary producers. This allows an increase in the level of the food web and in the overall biomass of the lake. At this point the lake is becoming **eutrophic** (“good food”).

Ironically, because of humans, runoff into lakes and ponds can have devastating effects. Runoff from agricultural lands transports **nitrogen** and **phosphorous** used for fertilization into the surrounding bodies of water. Phosphorous, from agricultural runoff combined with phosphates used in laundry detergents, is the most destructive.

There are several sources of nitrogen and phosphate pollution. Waste disposal plants often cannot remove enough of the organic compounds in the water being processed. As a result, this nitrogen rich water often ends up being discharged into the ground water, and finds its ways to ponds and lakes. In addition, erosion of well fertilized farm lands dumps enriched soils directly into rivers and streams, often causing serious plant and algae growth which can clog these vital waterways. Some factories also yield phosphorous rich waste which all too often ends up being dumped into the water system because it is deemed non-toxic.

Nitrogen and phosphorous stimulate a rapid growth of vegetation in lakes and ponds. Shallow areas quickly become choked with weeds, destroying their recreational value. As these weeds die, large amounts of organic debris accumulate on the lake bottoms, filling them in. **Eutrophication**, which normally takes thousands of years, has been drastically accelerated.

In severe cases surface algae reproduces at an astounding rate. This is called an algal bloom. At first glance this may seem a positive thing. However, although the algae produces oxygen at first, the excessive biomass consumes more oxygen during night time respiration than it produces in the day. Also, this dense growth of surface algae creates a thick green scum which blocks out light to lower-level algae and submerged vegetation. Starved of light, this vegetation dies. An explosion of bacteria decompose the dead vegetation, using up oxygen in the process. With the food web damaged and the dissolved oxygen levels drastically reduced, aquatic organisms, including fish, begin to die.

**Objective**

Using different concentrations of nitrogen and phosphorous, you will create an algal bloom. The results will be qualitatively and quantitatively evaluated.

**Procedure**

1. Each group will obtain three jars. Label one ‘control’. The other two containers will be labeled respectively as ‘low’ and ‘high’ followed by a **N**, **P**, or **NP**, depending on which pollutant the group was assigned.
2. Place the correct concentrations in each of the containers by following the chart below:

|  |  |  |  |
| --- | --- | --- | --- |
| **Test Container** | **Amount of Algae Culture** | **Amount of N, P, or NP pollutant** | **Amount of Water** |
| Control | 5.0 ml | 0 ml | 25.0 ml |
| Low Concentration | 5.0 ml | 1.0 ml | 24.0 ml |
| High Concentration | 5.0 ml | 3.0 ml | 22.0 ml |

1. Swirl containers thoroughly after introduction of all ingredients. Cover all containers lightly. DO NOT tighten so tightly that air can not pass into and out of the containers!
2. Place all containers on a sheet of white paper by a light source for 5-7 days.

**Observation of Algal Blooms**

Make a visual inspection of each container after you have placed them into the light. Note the differences in color intensity, and cloudiness between each cup. Make additional observations every other day, filling in the chart below with a brief description of the appearance of each test. Circle N, P, or NP in the heading column for which ever test your group is responsible for.

|  |  |  |  |
| --- | --- | --- | --- |
| **Day** | **Control** | **Low N, P, NP** | **High N, P, NP** |
| 1 |  |  |  |
| 3 |  |  |  |
| 5 |  |  |  |
| 7 |  |  |  |

**Algae Identification**

Observe a sample of algae underneath the microscope. First scan the slide under low power magnification in order to locate cells for observation and identification. Once you have located the cells, then try switching to a higher magnification in order to get a better look. Use the following dichotomous key to identify the different species of algae.

Place a check next to each species that you are able to identify.

1. Cells do not contain chloroplasts, but have blue-green pigments seemingly distributed and diffused throughout the cell………………………………………………………………………………………………2

Cells contain chloroplasts with green pigments……………………………………………………………………3

1. Filamentous cells are wider than they are long………………………………………………..……Oscillatoria
2. Cells are arranged in filaments………………………………………………………………………………………….4

Cells are not arranged in filaments………………………………………………………………….…………………5

1. Cells have distinctive green spiral-shaped chloroplasts………………………………………......Spirogyra

Cells have bandlike chloroplasts………………………………………………………………………….…..Ulothrix

1. Cells are in groups…………………………………………………………………………………………………………..6

Single cells……………………………………………………………………………………………………………………..7

1. Groups of four or eight cells with rounded or pointed ends………………………………..…Scenedesmus

Spherical or oval colony with 8-32 pear-shaped, bi-flagellated cells in each colony……...Pandorina

1. Oval-shaped cell with two conspicuous flagella………………………………………..…….Chlamydomonas