

Name _____

Period _____

Algae Experiments

Why do we care about algae?

To some people algae is affectionately known as pond scum; it is also known by a variety of names ranging from plankton to kelp. Regardless of what you call it, humans use algae almost every single day. Brown algae produce a substance called alginate and red algae produce a substance called agar (also known as agarose) as well as a substance called carageenan. Alginate, agar and carageenan are found in many household items that you use (or eat) everyday. They are found in shampoo, conditioner, cosmetic products, dietary supplements, toothpaste, and many food products- even in ice-cream (they help give it its texture). Take a look at the ingredients of some of the products you use and eat every day and see which ones have algae in them, you'll probably be surprised!

In addition to being very useful to humans, algae are also vitally important in aquatic ecosystems since they are the base of the food chain and support all other aquatic life. They fill the same role in water that plants on land fill- they use the energy from the sun to photosynthesize, which makes them primary producers. They can also provide habitat for many other organisms. For example, kelp forests which are made up of giant kelp (a type of brown algae) are one of the most diverse habitats on earth because of all of the other organisms that depend on the kelp for food and shelter.

Garfield cartoon is pasted on here

The Basic Needs of Algae

You now know some of the reasons why algae are so important, but how do they live? What are the basic needs of algae? A basic need is something that you will die without. What are your basic needs? You need food, water and shelter. The basic needs of algae are very similar to ours. Algae need light (as an energy source- we get our energy from food), nutrients (which we also get from our food), and some sort of habitat (our homes, towns, and environment).

Light: algae need light to survive because it is their energy source. What happens to the light as you swim towards the bottom of an ocean or a lake? It gets dim. The general rule (and of course there are always exceptions to rules) is that algae cannot live when the light becomes so dim that it is less than 1% of the surface light. In the ocean, the 1% light level usually occurs somewhere around 100 meters (or approximately 300 feet) deep. So, you wouldn't expect to find algae deeper than this in the ocean.

What are some factors that may change the light levels in water? During the year the length of daylight hours changes with the seasons, this may affect algae growth. If it is a really cloudy day, the light may change and affect the algae. Big waves may stir up the ocean and increase the amount of sand floating in the water; this will change the light levels as well. Runoff from land after a big storm may add lots of dirt to the water, making it cloudier and decreasing the light that enters the ocean. Can you think of any living things that might change the light levels in the ocean or in a stream?

Nutrients: algae need nutrients to survive. They need macronutrients, micronutrients and vitamins. Sometimes algae don't have enough of one nutrient, this would make it a limiting factor. Other times, there is so much of one type of nutrient that it causes rapid algae growth, also known as an algae bloom. Humans often times add nutrients to aquatic environments and may contribute in causing algae blooms. Humans most commonly add nitrogen and phosphorus to the aquatic environment.

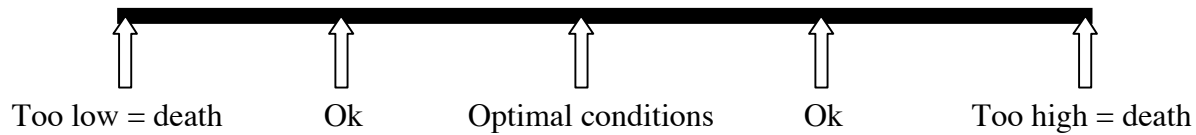
Nitrogen is found in fertilizers and even in pet feces. Phosphorus is also found in fertilizers and is a common ingredient in different types of soap. It used to be found in almost all laundry detergents, but now if you read the labels on laundry detergent almost all of them say "contains no phosphates". It was removed from this product because it was such a big environmental problem. You will still find it in some types of soap, especially in dishwasher detergent. One of the ways that we are trying to reduce the amount of nutrients that humans add to the environment is by removing them at wastewater treatment plants (which is where all of the water from your dishwasher, shower, sinks and toilets goes).

Habitat: there is a great diversity among algae; ranging from tiny microscopic cells to giant kelp. It makes sense that all of these different types of algae would live in many different habitats. All algae live in one of two general situations: they float in the water and are not attached to anything, or they are attached to the bottom. Algae that are attached to the bottom (such as kelp which is attached to rocky reefs at the bottom of the ocean) are considered benthic (they live on the bottom). Algae that float through the water are considered planktonic (plankton means drifter).

Another general category of algae habitat is the type of water that they live in: is it freshwater or saltwater? Algae live in streams, creeks, lakes, estuaries, and the ocean; in fact you will find algae in almost every body of water.

Algae are usually specialized to live in a particular type of habitat (floating or anchored, saltwater or freshwater) and to the conditions that exist in that habitat (such as

the amount of light and nutrients). For example, the algae living at the surface of the water is going to get more intense light than algae which lives 50 feet below the ocean's surface. Each type of algae has ideal living conditions and usually can handle a range of conditions on either side of their optimal conditions. If the conditions vary too much from the optimal conditions, then the algae may die.



Other Factors: while light, nutrients and habitat are the most basic needs of algae, there are many other environmental and biological factors that affect where they live, how they live and *if* they live!

The environmental (or physical) factors that affect algae are light, temperature, pH (how acidic or basic the water is) salinity (how much salt is in the water), water motion and nutrients. All of these physical factors together define what a particular habitat is like. Some algae are adjusted to habitats that have high levels of light, warm temperatures, high salinity, not much water motion and low nutrient concentrations. If these particular algae were put in another habitat where there was low light, cold water, low salinity, lots of water motion and lots of nutrients; they may not do as well or they may even die.

The two important biological factors that affect algae are predators and competition. If an alga has lots of predators around, it will be difficult for it to grow (since the predators will keep eating it). Off the coast of Santa Barbara there are lots of kelp forests. However, urchins love to eat kelp and if there are too many urchins they can eat an entire kelp forest pretty quickly! When this happens, the remains (or lack there of) of the kelp forest are called an urchin barren. Competition can affect algae growth in many different ways. One example is if you have two types of algae that both like to live close to the surface of water where there is a lot of light and one is able to grow faster than the other, it may block out the light and make it more difficult for the second alga to grow. They may also compete for nutrients, rocky reef to attach to (if they are benthic), and in numerous other ways.

Lab Activity

There are a group of scientists at UCSB that are part of a research project called the Long Term Ecological Research (LTER) project. They are currently looking at how the land and the ocean interact and how people are involved. They are extremely interested in algae since it is such an important member of aquatic ecosystems (since it is the base of the food chain). These scientists need your help! They need to learn more about algae, how it grows, factors that affect its growth, and how humans might be involved in causing algae blooms. It is your job to design an experiment to test a factor (or multiple factors) that affect algae growth. After you design and run your experiment, you need to write up your results so that we can give the LTER scientists a report of your findings.

Algae Experiment Report Rubric

Name _____

Introduction

5 points

- Restate problem/question
- Develop a hypothesis
- Provide relevant background information (from algae experiments handout or other appropriate sources)

Methods and Materials

5 points

- List of equipment
- Quantity of each piece of equipment
- Procedure for your experiment written in paragraph form
- Create data tables appropriate for the type of data you will be collecting in your experiment

Results

8 points

- Data from experiment in data table
- Data table is labeled appropriately and has a title
- Units are included on all measurements
- Graph (if appropriate)
- All graphing rules are followed

Conclusion

8 points

- Restate problem and hypothesis
- How did you come to the hypothesis you created?
- Explain how data did or did not support hypothesis
- Discuss variables that may have effected experiment
- Did you use a control? Why or why not?
- What variables were controlled in the experiment?
- What variables were left uncontrolled?
- Did human error influence the results?
- Did you need to change your original procedure? If so, why?
- Did anything unexpected happen?
- Did this experiment help you answer your question or solve the problem?
- What new questions were generated by this experiment?
- What new experiments would you suggest performing?
- How would you make this experiment better, scientifically speaking?

Format

4 points

- 12 point font in Times New Roman, Arial, or Georgia font
- Single spaced paragraphs with headings for each section
- Space between each section
- No excessive spelling or grammatical errors
- Correct use of present and past tense
- Thoroughness: Enough detail is provided to understand thought

Possible Points: 30

Total _____