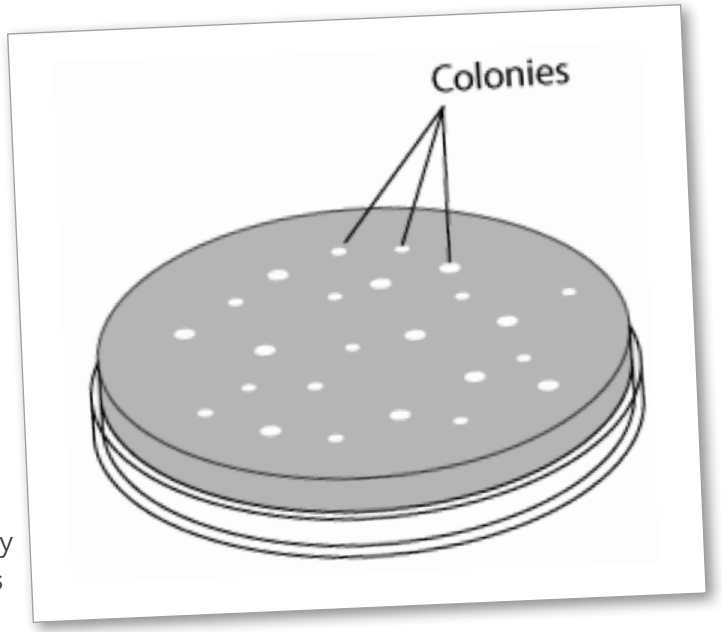
Culturing Great Salt Lake Microbes

Background



Microbes are everywhere, living by the billions in our water, soil, and air. They are a vital part of any ecosystem, as they recycle nutrients, produce oxygen, provide nitrogen for plants, breakdown pollutants, and are a food source for other organisms. Yet because they are so tiny, we barely notice them.

If you give microbes the food they need and a comfortable environment, an individual microscopic cell can grow and multiply to form a visible "colony." If you have seen spots of mold on a piece of bread, or slimy spots on leftover food in the refrigerator, then you have seen colonies. A colony is made up of millions of genetically identical cells that are all descendants of a single cell. Different kinds of microbes form colonies with different colors, shapes, and textures.

What do the microbes of Great Salt Lake look like? For this lab, you will grow colonies of Great Salt Lake microbes. You will begin by spreading a sample on a plate filled with sterile growth media, which gives the microbes the basic nutrients they need to grow and reproduce. With time and under the right conditions, the microbes will form colonies that you can observe.

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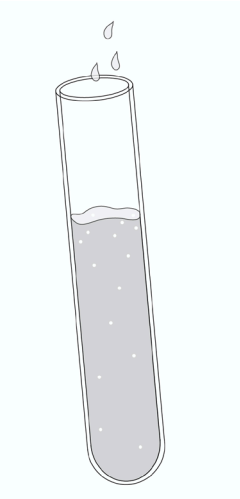
NAME _____ DATE _____

FOR LIQUID SAMPLES



You will need the following materials:

- Agar plate(s)
- Water sample(s)
- Sterile pipet(s)
- Sterile spreading tool(s)
- Markers
- Tape or Parafilm

1. Label your plate(s) with the following:

- Your name
- Today's date
- Description of the sample

2. Determine how much sample you will put on your agar plate. The suggestions below are for a 100 mm agar plate, adjust as needed:

- Clear sample from the lake = 10-15 drops
- Murky sample from the lake = 5-10 drops
- Sample from an incubated Winogradsky Column = 3-5 drops

Holding the lid slightly open, use a sterile pipet to drip your water sample onto the surface of the agar. Do not let the pipet touch the agar.

3. Use a sterile spreading tool to gently spread the water sample across the surface of the agar. Be careful not to dig into the agar, just barely smudge the surface.

4. Replace the lid and leave the plate to sit until all the liquid is absorbed. Seal the edges of the plate with tape or Parafilm.

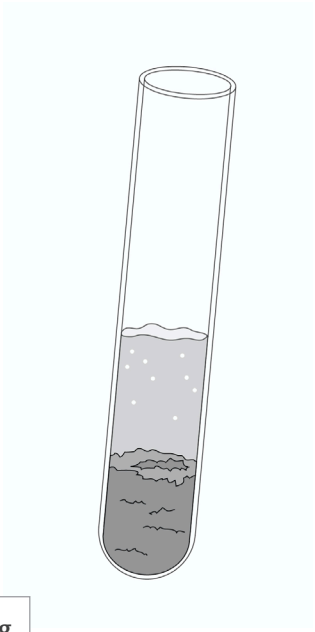
5. If you are plating multiple samples, repeat the steps above with a clean pipet and spreading tool each time.

6. Store your plates upside down in an incubator, or a dark, warm place. Observe and record microbial growth each day.

Observations:

NAME _____ DATE _____

FOR SEDIMENT SAMPLES



You will need the following materials:

- Agar plate(s)
- Sediment sample(s)
- Inoculating loop(s) (optional)
- Sterile pipets
- Small sterile container(s) or tube(s)
- Distilled water
- Sterile spreading tool(s)
- Markers
- Tape or Parafilm

1. Label your plate(s) with the following:

- Your name
- Today's date
- Description of the sample

TIP: It's ok if you don't see anything on your plate right away. Microbes are very tiny–they're on there, even though you can't see them.

2. Scoop out a small amount of sample with a pipet or an inoculating loop and put it into a sterile container or tube.

3. Add a small amount of distilled water and pipet up and down to mix the solid with the liquid. Let the solids settle out of the sample for a few seconds.

4. Holding the lid slightly open, use a sterile pipet to drip 1–3 drops of the liquid onto your agar plate. Do not let the pipet touch the agar.

5. Use a sterile spreading tool to gently spread the sample across the surface of the agar. Be careful not to dig into the agar, just barely smudge the surface.

6. Replace the lid and seal the edge with tape or Parafilm.

7. If you are plating multiple samples, repeat the steps above with new sterile containers, pipettes, and spreading tools each time.

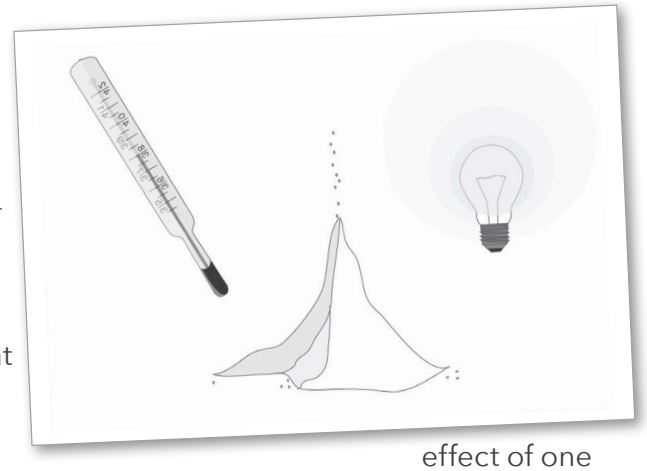
8. Store your plates upside down in an incubator, or a dark, warm place. Observe and record microbial growth each day.

Observations:

NAME _____ DATE _____

Culturing Great Salt Lake Microbes

Abiotic Factors Challenge



Background

Like plants and animals, different types of microbes thrive under different conditions. Some microbes can even survive in extreme conditions where other organisms can't. Environmental factors such as temperature, pH, salinity, and oxygen concentration can influence whether or not a type of microbe survives. Which conditions are ideal for Great Salt Lake Microbes? What extremes can they handle?

Your challenge: Design an experiment that tests the effect of one or more environmental factors on the growth of Great Salt Lake microbes.

1. Review the Culturing Great Salt Lake Microbes lab protocol as a place to start.
2. Use the questions below to help you think about how to expand or alter the protocol to test environmental factors.

   List the environmental factors and extremes Great Salt Lake microbes encounter. Indicate the factor, or factors, you'd like to test.

   Will you need to alter the growth media? How?

   Will you need to alter the conditions (UV exposure, temperature, etc. at which you'll incubate your agar plates? How?

3. Describe how you will design your experiment. You may write it out or make a labeled drawing.

NAME _____ DATE _____

Culturing Great Salt Lake Microbes

Pollutants Challenge

Background

Human activity is introducing pollutants in to Great Salt Lake and the wetland areas that surround it. Salt and brine shrimp harvesting, wastewater treatment, by-products from nearby mining operations and runoff from urban and agricultural areas are adding foreign contaminants to the ecosystem. Some microbes actually process pollutants in to harmless products, while others are unaffected, and some are unable to thrive in the presence of pollutants. How do Great Salt Lake microbes respond to pollution?

Your challenge: Design an experiment that tests the effect of one or more pollutants on the growth of Great Salt Lake microbes.

1. Review the Culturing Great Salt Lake Microbes lab protocol as a place to start.
2. Use the questions below to help you think about how to expand or alter the protocol to test pollutants.

   Research or obtain a list of the pollutants found in Great Salt Lake from your teacher. Which pollutant or pollutants will you test?

   What will be your source of the pollutant for the lab?

   You can introduce the pollutant you are testing in one of two ways. Place a checkmark next to your method of choice.

   - Add pollutant to water sample, then culture the water sample.
   - Place 2-3 small drops of the pollutant on to an agar plate, then add sample.

3. Describe how you will design your experiment. Include how you will observe and record microbial growth each day. You may write it out or make a labeled drawing..

Culturing Great Salt Lake Microbes Challenges

Abiotic Factor	What to Use	Background
Salinity	Culture samples on agar plates of varied salinity. Add different amounts of NaCl (or Instant Ocean™ or non-iodized salt) to the growth medium before pouring plates. Calculate percent salinity in grams per 100 mL.	The salinity of Great Salt Lake varies between 1% and 28% depending on location and time of year. Salt concentration is less where freshwater enters the lake and higher in the North arm of the lake which is cut off by a railroad causeway.
pH	Adjust the pH of the growth medium before pouring plates by adding NaOH.	
UV Exposure	A UV light box can provide direct exposure. If you don't have access to a UV light box, the "sterilize" function on many goggle cabinets uses UV light.	At 4,200 feet in elevation, microbes of the Great Salt Lake receive ultraviolet light levels that are about 15% higher than at sea level.
Temperature	An incubator, heat lamp, refrigerator and freezer can be used to alter the temperature at which you incubate Great Salt Lake Microbes.	The optimal temperature for Great Salt Lake Microbes is between 30 - 40 degrees Celsius. Microbe growth is kept in check by temperatures at the lake which range seasonally from below freezing to near 27 degrees Celsius.

Pollutant	Source	What to use
Selenium	Mining operation byproduct	Selenium is an essential micronutrient that is mainly acquired in the proper dosage through diet. High levels of selenium can have adverse affects however. Supplements are available in most vitamin and health food stores. Use the desired number of supplements (crush if not in powder form) to introduce this pollutant to samples.
Triclosan	Wastewater treatment discharge	Triclosan is used in many products for its antibacterial properties. It can be found in many hand soaps, and mouthwashes.
Herbicides	Urban storm water	Common lawn and yard care "weed killer" products.
Pesticides	Urban storm water	Common lawn and yard care "pest killer" products, or common ant and roach sprays.
Nitrates and Phosphates	Urban storm water (fertilizers). wastewater treatment discharge	Common lawn and plant care products.
Oil	Urban run off, brine shrimp harvesting operations	Motor oil from any auto care center.
Ammonia	Wastewater treatment discharge	Dilute household ammonia used for cleaning
Endocrine disruptors, such as pthalates and parabens	Wastewater treatment discharge	Many liquid soaps and shampoos contain these products.