Bacteria Testing of Drinking Water

Adapted from: an original Creek Connections activity.

Grade Level: intermediate, advanced

Duration: depends on what is done, 30 min to a few class periods

Setting: classroom, collection from the field perhaps

Summary: Students will test drinking water and possibly surface waters for bacteria, and will learn about various water-borne microorganisms and the illnesses they cause.

Objectives:

Vocabulary: pathogen, indicator

Related Module Resources:
- Bacteria section of Module Resource Folder

Materials (Included in Module):
- 1 Hach Paddle Tester: Total Aerobic Bacteria/Total Coliform Test Kit
- 1 Easygel Coliscan Water Monitoring Kit
- 3 Science Project Bacteria Kits
- 1 Plastic bag of Whirl-Pak bags
- 1 bottle of bleach
- 2 Sets of Bacteria/Protozoa Slides
- Worksheet
- Waterborne Microorganism Info. Sheets

Additional Materials (NOT Included in Module):
- Any other type of bacteria kits
- Incubator
- Autoclave

ACADEMIC STANDARDS:

10th Grade

4.1.C Describe the physical characteristics of a stream and determine the types of organisms found in aquatic environments
- identify terrestrial and aquatic organisms that live in a watershed.

4.1.E Identify and describe natural and human events on watersheds and wetlands.
- identify the effects of humans and human events on watersheds.

12th Grade

4.1.C Analyze the parameters of a watershed.
- interpret physical, chemical and biological data as a means of assessing the environmental quality of a watershed

apply appropriate techniques in the analysis of a watershed (e.g., water quality, biological diversity, erosion, sedimentation)

4.3.C Analyze the need for a healthy environment.
- Research the relationships of some chronic disease to an environmental pollutant.
- explain how man-made systems may affect the environment.

BACKGROUND:

Coliform bacteria are generally harmless bacteria that live naturally in the intestines of mammals, including humans. They actually aid in the digestion of food. Coliform bacteria are abundant in animal feces, but do not naturally occur elsewhere. Their presence in water may mean there is sewage or fecal contamination. We do not want this in our drinking water. While most types of coliform bacteria are harmless, some strains act as **pathogens** (disease causing organisms) and have caused illnesses and disease outbreaks. Presence of any coliform bacteria (even if they are harmless) serves as an **indicator** that the dangerous strains of the bacteria could be present in the water and that fecal contamination probably occurred. An indicator is an organism whose presence suggests the presence of other organisms.

Four indicators most commonly used today by microbiologists include total coliforms, fecal coliforms, E.coli, and enterococci. All are found in human intestines.

Monitoring for coliform presence can help us determine the probability of contracting a disease from the water. Human illness can result from drinking or swimming in water that contains pathogens or from eating shellfish harvested from such waters.

Bacteria amounts are recorded as colonies in a certain volume of water. Coliform standards have been set for drinking water, recreational waters, and treated sewage.

OVERVIEW:

Students will test drinking water and possibly surface waters for bacteria, and will learn about various water-borne microorganisms and the illnesses they cause.

PROCEDURE: TESTING

1. READ THE INSTRUCTIONS SHEET FOR HOW TO COLLECT WATER SAMPLES FOR BACTERIA TESTING
2. Use the 3 different types of coliform bacteria testing enclosed in the module to test a variety of water samples. Instructions for these tests are in the test instructions section of the module resource folder.
   a) Tap water from drinking fountain – hopefully it is safe and free of bacteria
   b) Tap water from restroom faucet – learn whether or not you should drink from this tap
   c) Bottled water
   d) Small stream or spring – show students that even a clean looking stream might have microorganisms in it.
   e) From surface water that you know is used for municipal drinking water supply (maybe there will be bacteria present and you can discuss how this bacteria will have to be eliminated by the water authority before sent to the faucet).
   f) Private well water (that may not have chlorination)
   g) Water from a stream running through an agricultural area or out of a pasture.

BACTERIA TESTS AVAILABLE:

- 1 Hach Paddle Tester: Total Aerobic Bacteria/Total Coliform Test Kit
- 1 Easygel Coliscan Water Monitoring Kit
- 3 Science Project Bacteria Kits

3. Have students record their data on the bacteria data sheet.

PROCEDURE: VIEWING MICROSCOPE SLIDES

1. There are microscope slides of waterborne microorganisms available in the module for viewing. These can be used as part of an in depth study about bacteria and protozoa during a biology class or to enhance pre-existing work on bacteria that is being conducted in class. These slides can just be simply used as visual exposure of some other things that live in water that may make you sick.
2. The slides can be used with the Water Microorganism Information Sheets and/or the Water Microorganism and Illness Worksheet.

PROCEDURE: WORKSHEET

1. There is a worksheet that will make students use the Water Microorganism Information Sheets to learn more about the background and sources of these organisms and the illnesses they produce.

DISCUSSION:

It should be obvious to students when they are done with portions of this activity that they should not drink untreated water from a stream.

Why is groundwater less likely to have bacteria in it compared to surface water?
(There is less chance of human and animal waste entering groundwater, especially deep groundwater. Groundwater is naturally filtered by the soil and rocks through which it passes. Rainwater (and maybe some of the contaminants that it picks up) that enters the ground filters down through soil and rock also before coming part of the groundwater aquifers. Since many microorganisms can be removed by filtration, the natural filter of the soil and rocks may eliminate many harmful microorganisms. Groundwater can also be devoid of oxygen, which can limit some of the microorganism growth and survival.)

Have any students been ill in the past due to a microorganism in the water?

How could a community do to reduce the risk of having harmful microorganisms enter drinking water resources? What could a farmer do to minimize the risk?
(Encourage your community to update any outdated sewage treatment facilities and encourage homeowners to maintain their private septic systems properly. Farmers should minimize the contact that their animals have with the stream – possibly by fencing off streams. Streamside vegetation can help reduce the amount of pollutants (including animal waste) from entering a stream directly. Animal waste should be managed and stored properly near barns. Manure should not be placed on fields that are fallow (nothing growing) because they are more likely to be washed off and into a waterway.)

EVALUATION:

- Students are able to identify some of the common microorganisms found in water that can be harmful, the illnesses and symptoms they produce, and how they get into the water.

EXTENSIONS AND MODIFICATIONS:

- Do some web surfing to investigate some of the microorganisms further.
- Find more pictures of the microorganisms.
- Have students create reports about a particular microorganism and present their research to the class.

NOTES (PLEASE WRITE ANY SUGGESTIONS YOU HAVE FOR TEACHERS USING THIS ACTIVITY IN THE FUTURE