

Introduction

Welcome to *Microorganisms in the Macrocosm*! This classroom activity guide is designed to be a companion guide to the Utah State Office of Education Sixth Grade Science Teacher Resource Book. This guide was not designed as a curriculum or an instructional unit. This publication was designed to provide real-world, hands-on activities to meet the Utah Core Curriculum Standards and Objectives. *Microorganisms in the Macrocosm* is a special project of Utah Agriculture in the Classroom. Agriculture in the Classroom seeks to provide teachers with the necessary tools to increase agricultural literacy among their students and at the same time incorporate Utah Core Curriculum Standards. (For more information visit our web site at <http://www.ext.usu.edu/aitc>. This instructional unit was designed specifically for 6th grade, but nearly all of the activities could be adapted for various grade levels.

When scientists began to study microorganisms it wasn't because they could see them (they are too small for the naked eye) it was because they observed things that were happening in the world around them. Why did some people contract certain diseases or get sick after they ate a particular food? Why does milk sour and sometimes sour into something tasty that doesn't make you sick (yogurt)? What causes the bread to rise? Because microorganisms need water, oxygen, and food, it is no wonder that they thrive in our agricultural system. Microbes, good and bad, given the opportunity will invade our food products and agricultural system, and sometimes that's okay!

Before you begin the following activities, you should define the word agriculture with your students. Agriculture is probably a new word for them or they may think that agriculture is a word just used to describe farms and farming. Agriculture is much more. It is an intertwined system between humans, the environment, economics, and cultures. All civilizations began with agriculture. Perhaps one of the easiest ways to define agriculture is by using the five F's of agriculture: farming, food, fabric, forests, and flowers. These are "concept" words. Just about every product or job students can associate with these words are part of agriculture. ***Agriculture is our link to life!*** The

Utah Agriculture in the Classroom



Microorganisms in the Macrocosm

activities in this guide, for the most part, use agriculture as a theme for teaching students about microorganisms.

Microorganisms are everywhere, they are ubiquitous. If you have several high quality microscopes in your class, read no further, unless you really want to make the *study of microorganisms unforgettable*. If you have one or two poor quality microscopes where you and your students see something like a butterfly every time you blink (your own eyelash) this guide is for you!

Lenses to correct poor vision were the first “eye magnification devices.” It wasn’t long after that people discovered that they could change the thickness, curve, and type of glass to see the “microscopic world.” Microscopes in a crude form have been around for nearly 4000 years! Credit for the first compound microscope (meaning more than one lens) is usually given to Zacharias Jansen, in Middleburg, Holland, around the year 1595. (For a complete history on the microscope check out this great web site: http://www.utmem.edu/personal/thjones/hist/hist_mic.htm). Few improvements in the microscope occurred until the early 1800’s, when better glass-making methods produced lenses that provided undistorted images, allowing us to see the world of bacteria, viruses and to some extent, fungi.

Prices for microscopes begin at inexpensive, \$50.00 (cheap microscopes equal poor images, and yes you might see your eyelash), to many thousands of dollars. If your school is in a position to purchase good quality microscopes, about \$450, consider purchasing a microscope with a video camera, \$670, so you can project the images on a television that your entire class can see. A good microscope is less frustrating and your students will actually be able to see some microorganisms, and may even become more excited about science.

The first objective in the Utah 6th grade core on microorganisms translates into learning about how a microscope works. The microscope your school has may still have the literature that came with it, but probably not. One of the best resources for learning about how a microscope works can be found in your

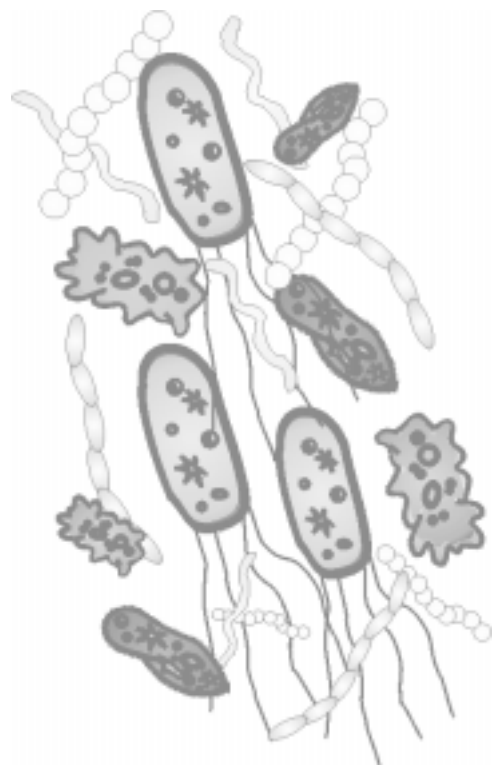


school library in any good encyclopedia. You can also find more information about microscopes on the Utah Science home page, <http://www.usoe.k12.ut.us/curr/science/core/7thgrd/integrated/micro.htm>.

Sound like a somewhat boring or dry way to learn about microscopes? While these two sources might serve as background information, what about making your own microscope with a 35 mm film can, 10x lens, and a 2-liter bottle? This activity will certainly help your students understand how a microscope works, and they will also enjoy the project. The instructions for making this “instrument” are found in a book titled “Bottle Biology” (see the “Bottle Biology” reference in the Appendix). Another plan for building your own microscope out of wood, pvc, and a lens can be found at <http://www.mos.org/sln/sem.html>.

Microorganisms are simply small creatures we cannot see with our naked eye. While microscopes may be the ultimate tool for studying these creatures, your students can learn about microorganisms without a microscope. How? Begin by studying scientists that have used “crude” microscopes. What led them to use this tool? Was it an innate desire to see what was floating in our environment? No. Men and women of science observed the world around them and then from their observations, experimentation, and study deduced that perhaps something they could not see was causing the phenomena.

Marcello Malpighi (1628-1694) was one of the first great microscopists, and even today is considered the father of embryology and early histology. His first discovery with the microscope was of monumental importance in animal physiology. Another great scientist was Louis Pasteur. Louis Pasteur (1822-1895) is probably best known for his work in controlling bacteria through pasteurization (and how animals develop immunity and can fight off microbes with a vaccination, saving countless lives). Pasteurization is a method of preserving food by heat and cold. Louis Pasteur developed this process to save the wine industry in France. Pasteurizing the wine kept out harmful microbes. Pasteurization is most commonly used in milk. This is accomplished by heating the milk



Properties and Classification of Microorganisms

Background

Just what are microorganisms? They are small living forms of life, which we cannot see with the naked eye. Bacteria, yeasts, and molds are three types of microorganisms. Some people often confuse, and almost always misunderstand, their functions, but they are just as real and alive as you are. They eat and grow. They reproduce and die.

Have you ever wondered just how small microorganisms really are? Molds can be seen with only slight magnification and use of an ordinary magnifying glass. Yeasts must be viewed through a microscope that magnifies several hundred times. Bacteria can best be seen when studied with a more powerful microscope that enlarges 1,000 times.

Bacteria, yeasts, and molds can be found everywhere. Scientists have gathered them from clouds above mountain tops and in the deepest parts of the ocean. They are present on animals, people, and even in the air we breathe.

Microorganisms have a direct impact on our daily lives. Some are helpful. They aid our bodily processes by helping break down complex foods into simpler substances. Some, called germs, are harmful to us by the role they play in causing diseases.

The Universal Cell

All living organisms, large and small, have one thing in common; the cell. This is a tiny living factory capable of converting simple food substances into energy and new cell material and of reproducing itself.

Large organisms, including people, are composed of billions of cells with many different roles. They make up your body's parts from your brain to your big toe. Microorganisms, on the other hand, are made up of a very few or even a single cell capable of carrying on all of life's processes. So a basic understanding of cell structure and function is essential to understanding the actions of bacteria, yeasts and molds.

