How the Microscope Changed the World

Lesson Objective:
In this activity, you will be creating a timeline examining advances in microscope technology and tying them to scientific theories and discoveries of the same time period.

State Goals:
13.A.4c Describe how scientific knowledge, explanation and technological designs may change with new information over time.
13.B.5e Assess how scientific and technological progress has affected other fields of study, careers, and job markets and aspects of everyday life.

Introduction
Throughout time, man has been curious about the world around him. As technology progresses, so too do the views of the scientific world. As we discover new ways to examine the world, we are forced to question our current theories and decide whether or not they are accurate or outdated. One invention, the microscope, was one of the most significant developments in scientific history. It allowed scientists a look at items so small, they weren’t even believed to exist.

The creation of the microscope was not one that came over night. It took hundreds of years for the technology to finally accrue to the level where the building of this sort of instrument was possible. As we continue on in our scientific research, we continue to improve the microscope, so much as to where we once could only magnify objects up to 9 times their original size, where we now can see things as small as the diameter of an atom!

Instructions
On a sheet of butcher paper, create a timeline. Your paper should have a straight line going across the middle of the page. On the following pages you will find short excerpts about the history of the microscope called “Advances in Microscopy”. Read the excerpts and decide where they belong in relation to each other and place them on the timeline in chronological order. Glue or tape them in order above the line on the paper. It is not necessary to know exact dates- read the passages and determine which came first, second, third, etc.

The next page has information regarding scientific developments that came about because of the invention of and technological advances in microscopy entitled “Advances in Scientific Theory…”. Read them carefully and determine where they fall chronologically and in relation to the previous timeline. Glue or tape them below the line on your paper.

Lastly, arrange the “Microscope Images” as to how you think they have evolved- from the first images seen by microscopes to the last. Glue or tape them below or above the line wherever they fit best chronologically. It would be a VERY good idea to “dry fit” them first before gluing or taping. When you have completed the timeline, answer the following questions ON YOUR OWN, without your partner. Do NOT have the same answers.
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Study Questions

Answer the following questions independently- each person must hand one in.

1) Had Anton von Leeuwenhoek never invented the microscope, our society would be quite different. Explain *in detail* how our society has changed because of the use of the microscope.

2) As technology advances, so does the microscope. Describe *in detail* how the design of the microscope changed over time *due to* advances in scientific knowledge and technology.

3) The creation of the microscope also impacted the society in terms of the job market. List and describe 5 jobs that were created due to the making and usage of the microscope.
Anton von Leeuwenhoek built a **simple microscope** with only one lens to examine blood, yeast, insects, and many other tiny objects. He also developed a technique for grinding and polishing lenses to allow for magnification up to 270X.

Robert Hooke looked at a sliver of cork (dead tree bark) through a microscope lens and noticed it was made up of many small structures. The structures resembled the “cells” in which monks lived in a monastery, which is how they got their name.

Two Dutch eyeglass makers, **Zaccharias and Hans Janssen** experiment with lenses placed in a tube. They observed that objects viewed in front of the tube appeared greatly enlarged.

**Ernst Ruska** co-invented the **electron microscope**, for which he won a Nobel Prize in Physics. An electron microscope depends on electrons rather than light to view an object. Electron microscopes make it possible to view objects as small as the diameter of an atom.

**Fritz Ziernike** invented the **phase-contrast microscope**. It allowed for the study of colorless and transparent materials. He won a Nobel Prize in Physics for his work.

**Gerd Binnig** and **Heinrich Rohrer** invented the **scanning tunneling microscope** that gives 3-D images of objects down to the atomic level. For this they won the Nobel Prize in Physics. It is the strongest microscope to date.

The **first vision aid** was invented. It was called a reading stone and was used to magnify reading materials by placing it on top of them.
Microscope Images

Cross-section of a plant stem

Paramecium, a single-celled organism

Paramecium, a single-celled organism

Cork Cells

Hair Follicle
Advances in Scientific Theory
Due to Advances in Microscopy

The general understanding of blood circulation is developed due to the ability to see the individual blood cells.

Spontaneous generation, a theory stating that living organisms come from non-living organisms, is widely accepted in the field of science. Microscopy reveals a whole new world of organisms that appeared to arise spontaneously.

The belief that sicknesses are caused by things such as curses or natural spirits prevails during this time due to lack of scientific knowledge.

Using a scanning electron microscope to see the external structure of a bacterium, scientists are able to develop new ideas on how to combat the organism.

A scientific friend of Leeuwenhoek hypothesized that these little "animalcules" seen in his microscope might be small enough to float in the air and, on reaching water, reproduce themselves. Because the idea criticized a popular theory at the time it was investigated no further.

The visualization of living plant and animal cells helps in the development of the cell theory. The cell theory states that all living things are made of cells; cells are the basic unit of life; and living cells come from other living cells.