

Introduction to Life Science

Section 3: Scientific Research & Tools

Science is a systematic way of gathering information and analyzing the world around us. It begins with **observations**, which are careful, organized ways of collecting information through the senses or tools. For example, a scientist might observe how plants grow in sunlight versus shade or record daily temperatures over time. From these observations, scientists collect **data**, which is the recorded information. Data can include measurements, notes, images, or recordings. Scientists then use this data, along with their prior knowledge and experience, to make **inferences**—logical explanations about what is happening. For instance, if plants in sunlight grow taller than those in shade, a scientist may infer that sunlight affects plant growth. These inferences can lead to a **hypothesis**, which is a testable explanation or prediction. A hypothesis is often written as an “if...then...” statement, such as: *If a plant receives more sunlight, then it will grow taller.*

Scientists use two main types of research to test hypotheses: quantitative and qualitative.

- **Quantitative research** involves numerical data—measurements that can be counted or expressed with numbers. For example, measuring temperature with a thermometer, mass with a balance, or time with a stopwatch.
- **Qualitative research** involves descriptive data—information that describes qualities or characteristics. For example, noting the color of leaves, recording animal behavior, or describing weather conditions using tools like cameras, binoculars, or audio recorders.

To ensure that scientific data is accurate and consistent worldwide, scientists use the International System of Units (SI), also known as the **metric system**. This system is based on multiples of ten, making it easy to convert between units. For example, 1-meter equals 100 centimeters, and 1 kilogram equals 1,000 grams. Because each unit increases or decreases by a factor of ten, scientists can easily compare and communicate their results across the globe.

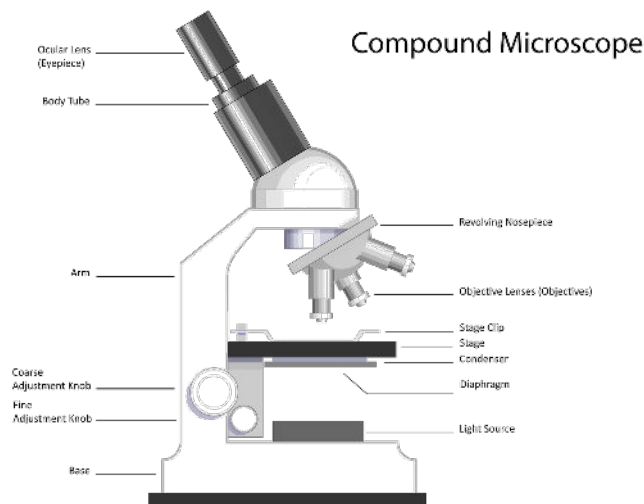
A **microscope** is a tool that allows scientists to see objects that are too small to be seen with the naked eye, such as cells and tiny organisms. By magnifying these structures, microscopes help scientists study how living things are built and how they function. A **compound microscope**, also called a light microscope, uses light to illuminate a specimen. Light passes through the specimen and is focused by two lenses—the objective lens and the eyepiece—to create a magnified image. These microscopes are commonly used in classrooms and laboratories to observe cells, tissues, and small organisms such as bacteria and algae.

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Section 3: Scientific Research & Tools Cont.

An **electron microscope** uses electron beams instead of light to produce images. Because electrons have much shorter wavelengths than light, electron microscopes can reveal much finer details—up to about 1,000 times more detailed than a light microscope. This allows scientists to see structures inside cells, such as organelles, and even very small particles, such as viruses.

Together, these tools allow scientists to explore the microscopic world, from whole cells down to the tiny structures inside them, helping us better understand life at its smallest levels.



Review:

1. What is an inference?
2. Compare quantitative and qualitative research.
3. What is a compound microscope?