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# Bio Lab Basics (Quickstudy: Academic)

**Quick Study ACADEMIC** **BIO LAB BASICS**  
Essentials of lab concepts, use & safety—including helpful hints & tips

What is bio lab? Most introductory biology classes have two components: lecture and lab. This guide focuses on the basic concepts demonstrated by the lab aspect of these classes, and also describes basic lab safety procedures.

### Essential Methods & Tools

#### Scientific Method

- The first time a child touches a hot stove and experiences a burn, the scientific method is instinctively employed, that is, he/she made an observation that a hot stove can cause pain. He/she then, most likely, speculates that if he/she touches hot stoves again, a burn will occur.
- Specifically, observe phenomena and formulate testable, falsifiable hypotheses.
  - Hypotheses that are un-testable and un-falsifiable are of little use in science.
- Test hypotheses.
  - observation** – mostly viewing events, with little direct interference.
  - experimentation** – manipulation of some variables to record differences in outcomes.
  - treatment** – trials where variables are manipulated.
  - control** – trials used for comparison to determine whether there are treatment effects.
- Statistical analysis.
  - Most tests of hypothesis require comparing data statistically for differences between control and treatment groups.
- Methods used to test hypothesis should be explicit enough for independent verification (i.e., so others can repeat the test).

To expose students directly to the scientific method, some introductory biology lab exercises involve doing experiments in which data can be recorded and analyzed.

#### Measurements

- We make measurements throughout our lives, such as our weight, ingredients when cooking, sizes of shoes and clothing, and filling automobile tires with air.
- Scientists use measurements as a critical tool of observation for the scientific method.
  - qualitative measurements** – a description characterizing an important aspect of a phenomenon (e.g., the bear displayed his teeth aggressively).
  - quantitative measurements** – a numerical description of an aspect of a phenomenon (e.g., the bear displayed his teeth aggressively 4 times during the 30-minute observation period).
  - Specific examples of phenomena measured are speed, length, width, depth, height, weight and temperature.
  - There are two major systems of measurement.

**American Standard**  
length → feet/yards/miles  
volume → cups/quarts/pounds  
temperature → Fahrenheit (°F)  
time → seconds/minutes/hours

**Metric**  
length → meter  
volume → gram  
temperature → Celsius/Centigrade (°C)  
time → seconds/minutes/hours

Science primarily uses the metric system.

In its lab, it is important to differentiate between **precision** and **accuracy** in measurements.

- An analogy can best demonstrate the relationship of these two closely related terms.
- Mass is frequently measured with balances (scales) of an item's mass is measured 10 different times on the same balance, and each time the measurement is 52 grams, ± 0.1 grams, then the scale is precise.
- However, the same item is measured 10 times on another balance, and the mass is 34 grams, ± 0.1 grams, while both balances are precise, the accuracy of one or both balances is questionable.
- A third balance that has been shown to be both precise and accurate demonstrates the actual mass of the item to be 52 grams, ± 0.1 grams, thus, the second balance is precise, but not very accurate.
- Precision is necessary for accuracy in individual measurements.

Almost all introductory biology labs involve measurements of some kind.



#### Microscopy

- Much of life can be observed directly by using our eyes, that is, macroscopically.
  - Because all organisms are made up of cells and come from cells (cell theory), and some whole organisms are single cells (microscopic), a considerable part of the biological world had to wait until the advent of microscopes to even be discovered!
- Today, microscopes are available not only to scientists, but even to those with just a casual or developing interest.
  - Many parents purchase entry-level microscopes for their children, only to find themselves equally frustrated by the multitude of life present in a drop of pond water.
- Today's microscopes can magnify images thousands of times, including some types that are approaching 1 million times magnification; there are two basic varieties of microscopy:
  - electron microscopy** – electron beams are used either to bounce off surfaces (Scanning Electron Microscopy or SEM) or to go through them (Transmission Electron Microscopy or TEM); computers translate the deflected (transmitted) electrons into images.
  - These types of microscopes have the greatest resolution capabilities, but are rarely used in introductory biology labs.

because of expense and difficulty in preparing materials for observation

- light microscopes** – light waves are used to magnify items; because of the physical characteristics of light waves, most of these microscopes have maximum magnification factors of usually about 1,000-2,000x; there are two basic types of light microscopes:
  - dissecting (stereoscopic) light microscopes** – maximum resolution (~100x); used for relatively large or thick microscopic items.
  - compound light microscopes** – wide resolution range (~100x to 1,000-2,000x); used for many microscopic items.

Almost all introductory biology lab exercises involve microscopy.




## Synopsis

Focusing on safety and ease of laboratory use, this 2-panel guide is a one-stop resource for all biology lab students. It covers everything from dissection to microscopes.

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## Customer Reviews

If I could own every one of these charts, I would. They are large [note-paper sized], and packed with information. I am a substitute teacher, and have purchased many of these cards to help in case I am called in to sub for the sciences, communication arts, history, government and computer programming. They have been incredibly valuable for that purpose, as well as in my efforts to brush up on subjects because of my personal interest in continuing my own education.

Quick and easy cheat sheet for bio.

Purchased for my son's first year college Biology class. I am a firm believer in every little bit helps. This fits well in his binder and covers the basics for a nice quick glance/refresher. In the world of Smart phones and tech gadgets this may seem a little old school. It's a great item to have. The guide is laminated, holds up to wear and tear, and is a nice price. I have purchased several of the BarCharts for my medical coding classes, medical terminology, anatomy & physiology, and my sons classes. Great references.

summary fashion - easy for guidance in topics

Just as displayed. Great shipping time.

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Great class addition!

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