Introduction to Equipment and Supplies

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Introduction to Materials

Goal

In this lab, you will learn to use the key devices used in this course: the microscale, micropipette, and the bentoLab which contains a centrifuge, thermocycler, and gel electrophoresis apparatus. The main purpose is to teach you how to use your materials with precision and proper care to prevent any mechanical use error. You should have an idea of the basic mechanics and circumstances in which these tools will be applied.

Learning Objectives

- Understand parts on a micropipette
- Know which micropipette to use and how to differentiate between sizes
- Calculate standard deviation and error

- Correctly load a centrifuge
- Create settings on a thermocycler
- Properly set up and run gel electrophoresis

Safety

ALWAYS WEAR NECESSARY PPE

This safety sheet has been designed to provide you with the tips and guidelines to follow in order to maintain the utmost safety when doing this experiment. This lab's focus is to have you become familiar with the equipment being used as they requires a lot of precaution. You must read these safety precautions before using their equipment to prevent any breakage of the materials. These are valuable pieces of material that should be handled with the utmost respect at all times.

In this lab, you will not have to mess with any harmful reagents; however, they should treat every reagent used as if it were harmful. This creates care and good practice.

Tips and Hazards

Do's

- Only take tips from the tip rack.
- Immerse tip 1 cm in the liquid when aspirating
- Release the Operating button slowly
- Choose proper pipette technique for appropriate volume and liquid
- Service pipette after 3 months if used daily
- Balance the centrifuge tubes

Don'ts

- Don't attach tips by hand
- Don't turn the pipette on its side when liquid is still in it
- Don't contaminate yourself or the pipette; always use the tip ejector
- Don't force volume setting beyond its stated range
- Don't place objects in front of the vent for the thermocycler

Background

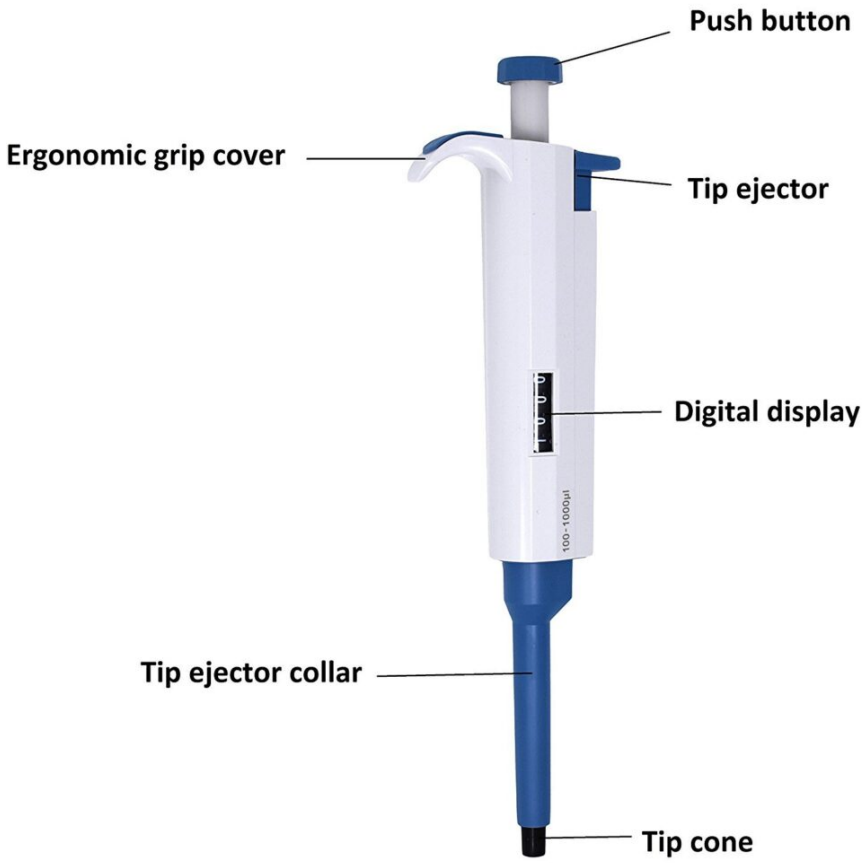
Bento Lab

One of the biggest hurdles in conducting lab experiments remotely is having adequate lab equipment. The Bento Lab presents a solution to this and it makes it possible to do primary DNA analytical techniques. The Bento Lab includes a microcentrifuge, a thermocycler, a blue LED transilluminator, and a gel box with a power supply for gel electrophoresis. All of this conveniently comes in this portable lab and it makes it possible to carry out lab experiments without being limited to a lab setting.

Although the Bento Lab makes it possible to do lab experiments practically anywhere, it is pertinent to practice proper lab techniques and that you handle all of the equipment with care to minimize possible areas of contamination and putting your safety at risk. In this lab, you will find summaries of all of the equipment included with the Bento Lab, their specifications, and the potential hazards they may cause.

Micropipettes

Micropipettes are the most commonly used tools in the laboratory. They are used to measure and transfer small amounts of liquid. They range in size from being able to contain 1mL (P1000 micropipette) to 0.2uL (P2 micropipette). Each micropipette size has its own respective disposable micropipette tip. Each time a tip is used it must be disposed of afterward.



All micropipettes have the same fundamental features and design. The micropipette body has a volume indicator on it; which describes the amount of volume to be picked up. The volume adjuster allows for the change of volume between the maximum and minimum volume for the micropipette (ex: P200; max 200uL and min 1uL). The tip ejector is used to remove the disposable tip by pushing down the ejector's arm. This process allows for no contact tip disposal. The plastic shaft is used to hold the disposable tip. The plunger on the top is used to capture the liquid's reagent. The plunger is pushed down when the disposable tip is submerged in the liquid and then it is able to capture the liquid.

All micropipettes are not precise. When pipetting, there is always an error involved in the exact volume extracted. So when pipetting, you never truly get the exact volume you wish to get. Each micropipette is different and it is important to know how inaccuracies affect your own micropipettes. You can find the standard deviation and error of your micropipette with the following equations.

Standard **D**eviation= $((\sum(x-y)^2))/(n-1))^{(1/2)}$

For help with Standard deviation look here.
x = summation of individual values
y = mean of all values
n = # of trials

% Error = $((x-z)/z)(100)$

For help with Percent Error look here.
x = mean value

z = set volume (intended volume on scale)

For pipettes with nominal volumes between those provided in this table, systematic error limits are equal to ±2.0% of the pipette's nominal volume, and the tolerance limit for random error is 1% of the pipette's nominal volume [setting tolerance]. If your micropipette does not fit under regular systematic error then your micropipette might not be tuned correctly and should be repaired.

Pipette Volume, µL		Relative Error		Absolute Error	
Nominal	Setting	Systematic ± % (Inaccuracy)	Random ≤ % (CV)	Systematic ± µL (Inaccuracy)	Random ≤ µL (Std. Dev.)
2	2.0 1.0 0.2	2.0 4.0 20.0	1.0 2.0 10.0	0.04	0.02
2.5	2.5 1.0 0.2	2.0 5.0 25.0	1.0 2.5 12.5	0.05	0.025
10	10 5 1	2.0 4.0 20.0	1.0 2.0 10.0	0.20	0.10
20	20 10 2	2.0 4.0 20.0	1.0 2.0 10.0	0.4	0.2
50	50 25 5	2.0 4.0 20.0	1.0 2.0 10.0	1.0	0.5
100	100 50 10	2.0 4.0 20.0	1.0 2.0 10.0	2.0	1.0
200	200 100 20	2.0 4.0 20.0	1.0 2.0 10.0	4.0	2.0
500	500 250 50	2.0 4.0 20.0	1.0 2.0 10.0	10.0	5.0
1000	1000 500 100	2.0 4.0 20.0	1.0 2.0 10.0	20.0	10.0
2000	2000 1000 200	2.0 4.0 20.0	1.0 2.0 10.0	40.0	20.0
2500	2500 1000 500	2.0 5.0 10.0	1.0 2.5 5.0	50.0	25.0
5000	5000 2500 500	2.0 4.0 20.0	1.0 2.0 10.0	100.0	50.0

Resources

In-depth Guide on How to Use a Micropipette(PDF)
Pipette Routine Check-up (PDF)
Help on Standard Deviation (wiki article)
Help on Percent Error (Calculator.net article)

Disclaimer:

The information provided on this document is intended for the educational purposes of the BME 22L laboratory course. It is worth noting that the information listed on this document is subject to change and is not finalized. Therefore, the information on this document should not be used outside of this course.