



Experimental Methods for Engineering Mechanics

Group 6 - Bonus Contribution

Module 3: BROWNIAN MOTION WITH COLLOIDS

How to use a [Micropipette](#)?

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1 Micropipettes

The first step towards successfully preparing the water-colloid-glycerol sample for Experiment 3 (Brownian Motion with Colloids) revolves around extracting the correct proportions of each of these constituents from their containers up to a stringent accuracy [1]. Given the nature of the experiment, any volumetric deviation from the required volume to be extracted significantly affects the result. The volumes to be extracted are on the microliter scale ($< 1 \text{ mL}$); hence, micropipettes are used. Although using them may seem straightforward, we include this contribution as a first-usage guide for those who have never used a micropipette before, for those who need a refresher, or to shed the light on important details for those who are familiar.

1.1 General Information

The micropipettes we use in the lab are GILSON MyPIPETMAN[®] single channel micropipettes shown in Figure 1 [2]. This figure (red and blue boxes in the bottom right corner of the figure) also shows the disposable plastic tips that are used with the micropipette.



Figure 1: Micropipette Set in the Lab. The micropipettes available in the lab are of sizes: P2, P20, P200, and P1000.

The micropipette size can be seen on the round button on the plunger. Figure 2b gives an example of where to find the size and nominal volumes of a micropipette. The writings on the plunger also give the upper and lower volume limits. These limits for the micropipettes we have are:

- a. P2: $0.2 - 2 \mu\text{L}$
- b. P20: $2 - 20 \mu\text{L}$
- c. P200: $20 - 200 \mu\text{L}$
- d. P1000: $100 - 1000 \mu\text{L}$

The table in Figure 2a shows the operational volume range [minimum-middle-maximum] the most common micropipette sizes [3].

Pipette Volume, μL	
Nominal	Setting
2	2.0
	1.0
	0.2
2.5	2.5
	1.0
	0.2
10	10
	5
	1
20	20
	10
	2
50	50
	25
	5
100	100
	50
	10
200	200
	100
	20
500	500
	250
	50
1000	1000
	500
	100
2000	2000
	1000
	200
2500	2500
	1000
	500
5000	5000
	2500
	500



(a) Operational Volume Ranges for Different Pipette Sizes. The nominal size of a variable-volume pipette is the maximum volume that can be carried by this pipette. (b) P1000 Micropipette. This micropipette can hold volumes within: 100 - 1000 μL .

1.2 How to Adjust the Volume Needed

The micropipette also has a window on the front face with three digits inside. This is where you specify the volume you want the micropipette to extract. Figure 3 depicts this window with digits corresponding to a volume of a volume of 510 μL .



Figure 3: Display Window of P1000 Micropipette. The numbers specified on the window correspond to a volume of 510 μL .

To change the digits displayed in the window, wind the adjustment dial on the micropipette accordingly. Each number of the three vertically aligned numbers has a significance, and we use Figure 4 to explain this significance. Let us consider the case of a P1000 micropipette again which in its turn corresponds to the first column in Figure 4. First, the top digit is thousands of μL . The second and third digits correspond to 1/10 and 1/100 of the first digit which in this case correspond to hundreds of μL and tens of μL respectively. The same applies for the other pipette sizes. Additionally, columns 2 and 3 of Figure 4 show the significance of the displayed digits for the cases of a P200, P100, and P20 micropipettes.

On a separate note, a certain digit of the three vertical digits in the window may be red. This change in color indicates that the decimal point position changed. As an example, we present the following comparison based on Figure 4:

- **P1000:**
 - Red Digit: First Digit
 - Reading: X.XX mL
- **P200 & P100:**
 - Red Digit: None
 - Reading: XXX μL
- **P20:**
 - Red Digit: Third Digit
 - Reading: XX.X μL

P1000		P200 or P100		P20	
1	1000's	2, 1	100's	2	10's
0	100's	0	10's	0	1's
0	10's	0	1's	0	1/10ths

Figure 4: Significance of the 3 Vertically Aligned Digits on the Micropipette Window. This figure shows the significance of the digits for P1000, P200, P100, and P20 micropipettes [4].

1.3 Usage Steps

Carefully follow these steps to properly use a micropipette: [4, 5]

1. **Familiarize** yourself with micropipettes by reading the above sections of this guide.
2. **Select** the suitable micropipette size.
To determine a suitable micropipette for the job, select the **SMALLEST** size pipette capable of carrying the needed volume. Although bigger micropipettes are capable of carrying the required volume, they are less accurate.
3. **Specify** the required volume to be extracted by turning the adjustment dials.
4. **Insert** sterile tips with the proper size on the end of the pipette depending its size.
5. **Extract** the volume.
 - (a) Press the plunger down to the first stop (first point of felt resistance). Refer to Figure 5.
 - (b) Submerge only 3-4 mm of the tip end in the mother liquid container.
 - (c) **Slowly** depress the plunger while making sure the tip is still submerged.
 - (d) Make sure no air bubbles are trapped in the micropipette tip; else, repeat this step.

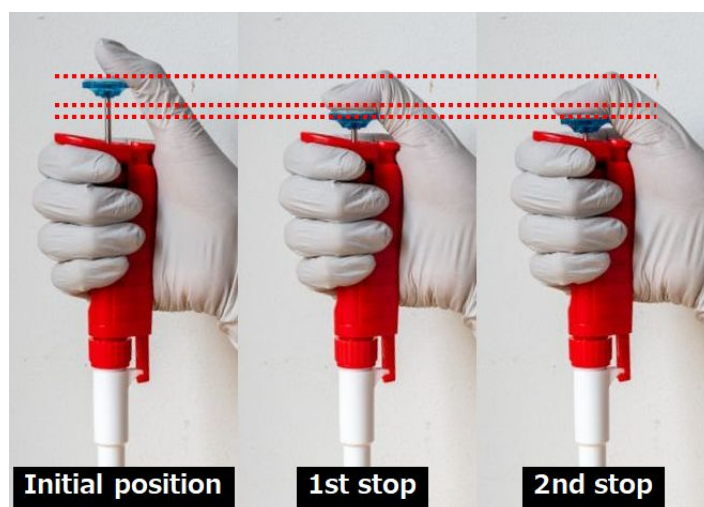


Figure 5: Micropipette Plunger Principle of Operation. The model of micropipette we use features two stops from the initial position [5].

6. **Expel** the volume.

- (a) Press the plunger to the first stop.
 - (b) Wait 1 second.
 - (c) Press the plunger to the second stop (all the way till the bottom).
 - (d) Withdraw the tip from the new host container without releasing the plunger.
7. **Discharge** the tip into an appropriate container by pressing the discharge slider on the back of the grip.

1.4 Tips

- Make sure not to exceed the maximum value of volume the micropipette can carry to avoid uncalibrating it.
- Avoid contact between the pipette tip and any other object.
- Do not point the pipette upward.
- Do not use the same tip for different kinds of liquids.
- For volumes of 0.2 - 10 μL , make sure the last droplet is expelled from the tip. You can make sure of this by expelling the last droplet on the side wall of the container [6]. Check Figure 6.



Figure 6: Side Wall Expelling. This figure shows the process of expelling extracted liquid while the tip touches the host container side wall to make sure all needed volume is reached [6].

2 References

- [1] URL: <https://wiki.epfl.ch/emem-2022/brownian-motion>.
- [2] URL: <https://ch.gilson.com/pipetman-classic-starter-kit.html>.
- [3] URL: https://www.artel.co/learning_center/setting-tolerances-for-pipettes-in-the-laboratory/.
- [4] URL: <https://tinyurl.com/f4zh8wba>.
- [5] URL: <https://nippongene-analysis.com/en/special-feature/sp004/>.
- [6] URL: <https://www.americanlaboratory.com/914-Application-Notes/240482-Ten-Tips-for-Proper-Pipetting/>.