SPOTLIGHT feature

Pumps, Valves & Liquid Handling

Are you using the right micropipette?

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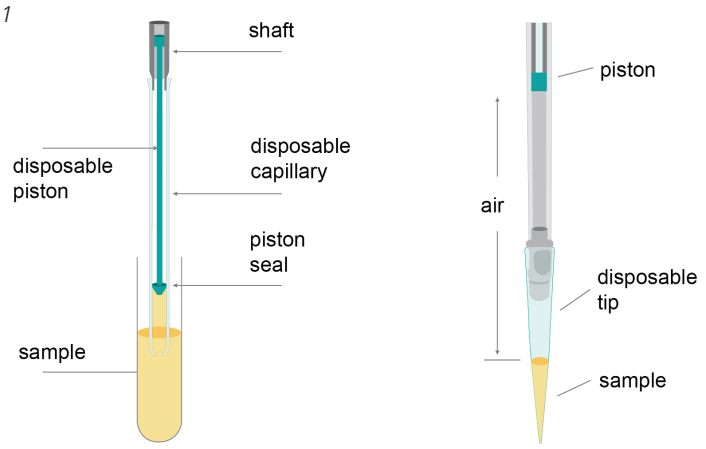
Lab professionals can spend numerous hours a day with a micropipette in their hand, and it is often a challenge to improve pipetting efficiency and guarantee reliable results. Selecting the right micropipette for any given application is key to the success of lab work; not only does it ensure the performance of any experiments, but it can also boost efficiency. Understanding the needs of a pipetting workflow allows users to select pipettes that are accurate and reproducible, but there are a number of other factors that should be considered to improve pipetting results and guarantee the success of an experiment.

Physical properties of the liquid

Broadly speaking, there are three main categories of liquids: aqueous, viscous and volatile. Most liquids are of the aqueous type, making air displacement pipettes the first choice for many. Although the majority of liquids will work perfectly well using this pipette type, positive displacement pipettes should be chosen used when working with very viscous or volatile liquids. The differences between these pipette types are shown in *Figure 1*. It is also essential that the correct pipetting technique is used – regardless of the liquid type – to achieve excellent results.

Figure 1



Positive displacement pipette: plastic tip contains an integrated piston.

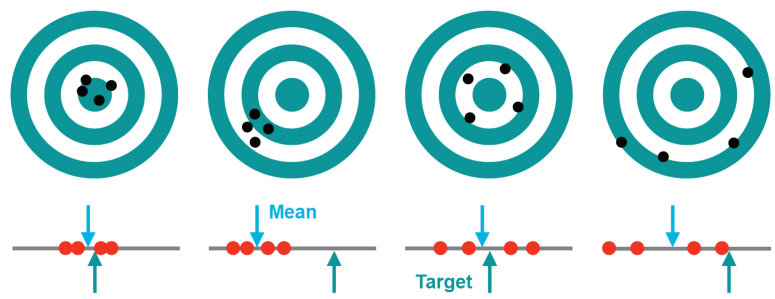
Air displacement pipette: the volume of air displaced corresponds to the selected aspiration volume.

Accuracy and precision

Two of the most critical parameters affecting pipetting results are accuracy and precision *(Figure 2)*.

There are several criteria that should be kept in mind in order to achieve maximum pipetting accuracy, precision and reliability. As a rule of thumb, users should always choose the smallest pipette capable of handling the required transfer volume. This is important, because accuracy decreases when the set volume is close to the pipette's minimum capacity. For example, if you dispense 50 µl using a 5,000 µl pipette, results may be poor. Using a 300 µl pipette will give you far better results, while a 50 µl pipette offers the best results. Additionally, volumes set on traditional manual pipettes can change while pipetting, due to unintentional plunger turns. This is why some pipette manufacturers have developed locking volume adjustment designs, preventing inadvertent changes while pipetting to further ensure accuracy. Calibration is another important aspect, helping to safeguard reliable results by certifying a pipette's accuracy and precision. The process should be easy for users; for instance, some electronic pipettes can set a calibration reminder, or save the calibration history.

Figure 2



Definition of accuracy and precision

Accuracy: systematic error (how close is the actual, measured value to the target value? Can be corrected.)

Precision: random error (measure of reproducibility; cannot be corrected.)

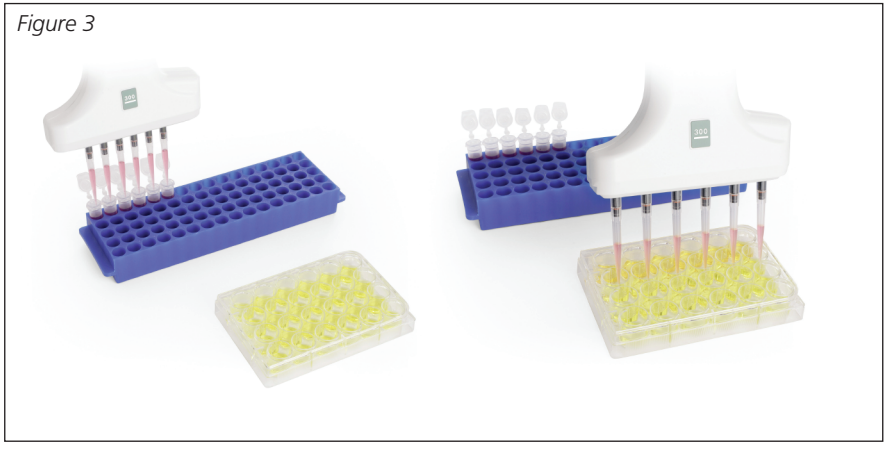
And it's not just the pipette that needs to be considered. Pipette tips can cause all manner of problems if they loosen, leak or fall off. This common issue in laboratories is normally caused by the use of universal pipette tips, as such tips frequently require 'hammering on'. This process stretches the pipette tip rim, and can lead to leaking or misalignment of tips, or even cause them to fall off the pipette completely. Choosing high quality micropipettes that were designed together with specific tips ensures a more secure connection, offering much higher levels of reliability and better results. In addition, something as simple as colour coding pipettes and tips also helps users to make sure that they choose the right tips for their pipette.

Efficiency

In a high throughput setting, it is important to be as efficient as possible while keeping pipetting processes reliable and consistent. There are many ways to improve pipetting efficiency, including the use of multichannel and/or electronic pipettes. These versatile instruments usually offer multiple different pipetting modes – such as reverse pipetting, variable dispensing, programmed serial dilutions and many more – streamlining processes. For example, programs such as repeat dispensing are perfect for dispensing multiple aliquots of the same volume, without having to refill the tips.

Transferring samples between labware of different formats can quickly become very tedious and error prone using single channel pipettes. Multichannel pipettes allow the transfer of multiple samples at once, in the blink of an eye. This not only improves efficiency, but also helps to prevent pipetting errors and repetitive strain injuries (RSIs). Some pipettes are even able to change tip spacing during pipetting, allowing parallel transfer of multiple samples between different labware sizes and formats, which can save hours of time *(Figure 3)*.

Figure 3



Ergonomics

Lab professionals often spend several hours pipetting each day. This can cause discomfort and, in more serious cases, even lead to hand or arm injuries. The best advice to avoid these potential risks is to reduce the time spent holding any pipette to the shortest amount of time possible. Alongside this, users should choose micropipettes that are lightweight and well-balanced, with the mass in the centre for better stability.

The pipette should fit comfortably into the hand, for both left- and right-handed users, with a good grip design, and adjusting the volume should be as comfortable and fast as possible to avoid unnecessary movements. Again, tips are also important, as tip loading and ejection often requires more force than pipetting and presents a potential risk for injuries, especially in high throughput settings. Pipette tips should snap into place with minimal force, provide a secure connection, and eject just as easily.

Conclusion

It is important to look at all aspects of the workflow when choosing the right micropipette for your application. By considering the pipette, its features, the type and volume of liquid being pipetted, as well as the tips used, scientists can guarantee accurate, precise and reliable results, while maintaining productivity and minimising the risk of injury.