Pipetting: A Practical Guide

Karen Guzman

In many fields of science, including cell biology, microbiology, biotechnology, biochemistry and quantitative chemistry, pipetting is an essential skill that must be mastered. Despite this, I was surprised to find few resources, especially in the life sciences, available to the student and teacher that explain the theory and practice of pipetting in a clear and accurate manner. This motivated me to create a guide for the identification and use of pipets to accomplish three purposes. The first purpose is to clarify the identification of pipets. Many sources provide information that is inaccurate or confusing because of insufficient explanation. For example, etched rings are sometimes described as a means of identifying a blowout pipet. But do colored rings on a pipet indicate it is a blowout pipet? (The answer is no.) The second purpose is to familiarize students with the basic terminology that applies to pipets. The third purpose is to describe how to use various types of pipets. Even a single pipet is sometimes used in more than one manner. For example, push button pipets can be used in the standard or the reverse mode. This guide should help both teachers and students understand that these are both acceptable, but optional, methods of using this type of pipet. Although we can provide students with a series of steps to follow when using each type of pipet, understanding the terms and why pipets are used in certain ways will simplify the use of a variety of pipets for different purposes.

The guide is divided into several sections with tables provided for easier reference. The guide is written in this manner so it can be used directly or can be easily adapted for use in the classroom. Although the information provided is not new, the guide brings together many pieces of information to answer many questions that may arise about pipets. Because of the general nature of the information, references are not indicated in the text, but several general resources are provided at the end.

Karen Guzman, Ph.D., is an Assistant Professor in the Department of Biology and Health Sciences at Meredith College, Raleigh, NC 27607; e-mail: guzmank@meredith.edu.

Introduction

The pipet is an important tool in many fields of science. But what is TD? What is a serological pipet? Even though most scientists know how to use the pipets they need, the names and markings on pipets are not always clearly understood. This guide is meant to give you brief definitions of the terms you encounter when using pipets, give you some very practical tips on distinguishing different types of pipets, and explain the use of different pipets. A glossary of terms and markings is provided in Table 1.

Distinguishing Different Types of Pipets

Pipets are used to transfer accurately, known volumes of liquid from one container to another. Table 2 lists some pipets commonly used, their function, and the proper method of drainage.

The number of different pipets available may at first seem overwhelming. Furthermore, the type of pipet is rarely labelled on the pipet itself. Fortunately, you do not need this information to be able to use most pipets. Generally, the method of use can be determined quickly by locating information that is available on the pipet. Near the end where suction is applied to fill the pipet, you can locate several key pieces of information: (1) how the pipet is calibrated, i.e. TD or TC (2) the total volume, and increments thereof, that can be delivered, and (3) if the pipet has blowout rings that indicate a blowout type pipet. Figure 1 illustrates these and other common features of pipets.

TD vs. TC

The abbreviation TD or TC is marked at the end of the pipet. The temperature at which the pipet has been calibrated is also often supplied. Although most pipets you encounter will be TD, in rare circumstances you may encounter one that is TC. Since a TC pipet will *contain* the specified volume, it is important that you rinse out the pipet after transferring your sample and add this rinse to the portion already transferred. This ensures that any sample adhering to the inner surface of the pipet is included in the amount transferred.

Volume Delivered

Next, determine the volume that the pipet is able to deliver and how the pipet is graduated. This information will help you determine the method that must be used to drain the pipet. The first number indicates the total volume that the pipet will hold; the second number indicates the increments that are used for the divisions. For example, ''1 mL in 1/100'' means that the pipet can hold a total volume of 1 mL and that it is graduated in increments of $1/100^{th}$ of a mL. If the pipet is a fixed volume pipet, such as a volumetric, only one volume will be given since the total volume cannot be delivered in increments. In general, volumetric pipets are calibrated to be accurate to two decimal places. For example, a pipet labelled as 10 mL will transfer 10.00 mL. The accuracy of specific pipets is sometimes marked on the pipet.

Measuring pipets, such as a Mohr or a serological pipet, are calibrated in convenient units to allow delivery of volumes up to the maximum capacity of the pipet. Push-button pipets can be variable or fixed volume pipets and are dealt with separately below.

Method of Drainage

The method of drainage of a measuring pipet is easily determined by comparing the maximum capacity and the