Microscope Calibration

K. Michael Foos

The concept of calibrating a microscope is relatively simple. However, when students approach it for the first time they are often baffled by the process. In the 20 years or so that I have been teaching microbiology, one of the laboratory exercises that has been most difficult for some of the students is the calibration of the microscope. Yet, some years ago I devised a simple visual aid that has been very helpful in conveying the concept of microscope calibration. This aid has been useful in my classes and those of my colleagues since.

One of the difficulties in teaching the procedure of microscope calibration is that students all too often don't understand the reason for doing it until the exercise is completed. If the concept of calibrating a ruler is discussed prior to work with the microscope it seems to go much better. The visual aid I created is nothing more than a ruler with hash marks, but no scale (see Figure 1). The ruler is about 15 inches long with hash marks at 3-cm intervals. At this length it has about eight hash marks that can be used to measure quite a number of items in the laboratory. It is possible to measure such things as slide boxes, pencils and chalk erasers. After measuring a couple of items with the help of students, one can note that these items have certain dimensions. For example, with this ruler the length of a new pencil is approximately 6. It becomes immediately obvious that making the statement, "The pencil is 6 long" makes no sense. In most classes a number of students are quick to point out that the statement has no meaning without a unit of measurement.

With a few well-directed questions it quickly becomes apparent that it is necessary to measure the length of the distance between hash marks with a standard ruler. An available meter stick can be used to measure the length of the unknown units. It is important for the students to be able to see that the markings on the uncalibrated ruler and the meter stick line up precisely. By the time one student reports that the unknown units are 3 centimeters long, another will call out that the pencil is approximately 18 centimeters long.

It is not difficult to visualize this macroscopic example as analogous to the uncalibrated ocular micrometer and the calibrated stage micrometer. Having seen the use of a meter stick to measure the distance between hash marks on the uncalibrated ruler, it makes sense to the students to line up the hash marks on the ocular and stage micrometers. After lining up the appropriate hash marks students invariably ask, "Which one is divided by which one"? By making reference to the macroscopic example it is possible to help students make correct inferences about the relationship of the calibrated and uncalibrated micrometers.

Using this analogy between marked and unmarked rulers and ocular and stage micrometers is the best way I have found to help students understand the process of converting scales. All too often students fall into the trap of trying to remember to divide the large number by the small number, or to memorize the scales that they have calculated. Obviously, these systems don't work. This laboratory demonstration does. At least, in the classes where I have used this demonstration for a number of years, it appears that students understand the process more quickly and more thoroughly than students who have not seen the demonstration.
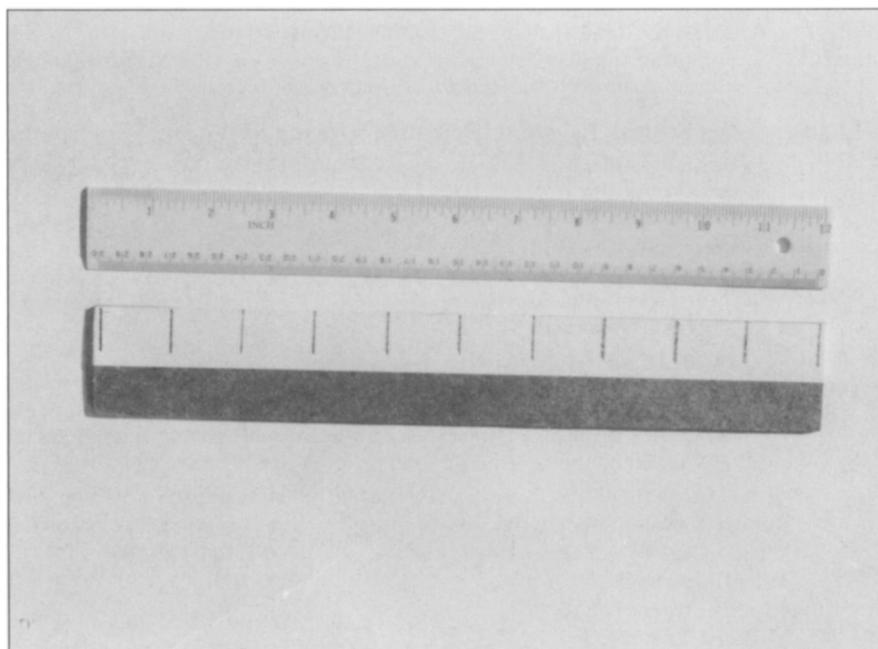
An uncalibrated ruler with hash marks at even distances and a meter stick. By aligning the uncalibrated ruler with the meter stick it is possible to determine the distance between hash marks of the uncalibrated ruler.

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