A Student-Built Cell Counting Chamber

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It is easy for beginning students to determine the areas encompassed by the fields of view of the various objective lenses of a compound microscope. Such activities are done commonly at the start of a freshman lab. Diameters can be measured accurately by viewing the magnified image of a stage micrometer; acceptable values can be derived using only a millimeter ruler or square-millimeter graph paper. In addition to building familiarity with the microscope, these calibrations contain the seeds of a quantitative way of thinking about laboratory work. The cell counting chamber grew out of a desire to nurture these seeds so that by the time students leave my two-semester introductory lab they are comfortable with a quantitative view of biology and have the skills needed to function quantitatively in upper-level labs.

Simply determining the areas of fields of view involves calculations using exponential notation and the metric system. It is also a first step in dealing with dimensions beyond a student's normal range of perception, an experience that needs to be reinforced. I had them measure one of their coverslips and calculate the proportions of the area of the coverslip observed with each objective. The step from area to volume is then possible by way of finding the volume of water that just "fills" the space under the coverslip. Students did this using microcapillary pipets graduated at 1, 2, 3, 4, 5, and 10 µl. Volumes that are too small are obvious; volumes that are too large are identified by inspecting the edge of the coverslip with the scanning-power lens, looking for extra "puddles."

Building their own chamber makes a cell counting procedure more transparent to the student than it would be if I gave them a commercial product. Putting the chamber to use brings in the calculations, as well as the pipetting, necessary to master dilutions. The chamber could be used with any non-motile cells visible with the high-dry lens, for example, *Saccharomyces*, *Chlorella*, or *Bacillus*.

I used it to have students estimate the number of red blood cells in 1 ml of sheep's blood. It happens that the classic hemolysis demonstration, which involves adding one drop of blood to 10 ml saline, produces a countable, though high, cell density. I had students sample one of these tubes to derive a preliminary density estimate. They then designed another dilution, which they did in triplicate, providing a good example of true replication. The data are suitable for calculating standard deviations and for graphing as frequency histograms, bringing a great many quantitative skills into use around a simple lab situation that beginning students can comprehend readily.