colony may not be formed from a single cell. This method (*plate counts*) is more suitable for bacteria and yeasts and much less suitable for molds. A large number of colonies must be counted to yield a statistically reliable number. Growth media have to be selected carefully, since some media support growth better than others. The *viable count* may vary, depending on the composition of the growth medium. From a single cell, it may require 25 generations to form an easily observable colony. Unless the correct medium and culture conditions are chosen, some cells that are metabolically active may not form colonies.

In an alternative method, an agar–gel medium is placed in a small ring mounted on a microscope slide, and cells are spread on this miniature culture dish. After an incubation period of a few doubling times, the slide is examined with a microscope to count cells. This method has many of the same limitations as plate counts, but it is more rapid, and cells capable of only limited reproduction will be counted.

Another method is based on the relatively high electrical resistance of cells (Fig. 6.1). Commercial *particle counters* employ two electrodes and an electrolyte solution. One electrode is placed in a tube containing an orifice. A vacuum is applied to the inner tube, which causes an electrolyte solution containing the cells to be sucked through the orifice. An electrical potential is applied across the electrodes. As cells pass through the orifice, the electrical resistance increases and causes pulses in electrical voltage. The number of pulses is a measure of the number of particles; particle concentration is known, since the counter is activated for a predetermined sample volume. The height of the pulse is a measure of cell size. Probes with various orifice sizes are used for different cell sizes. This method is suitable for discrete cells in a particulate-free medium and cannot be used for mycelial organisms.

The number of particles in solution can be determined from the measurement of scattered light intensity with the aid of a phototube (nephelometry). Light passes through

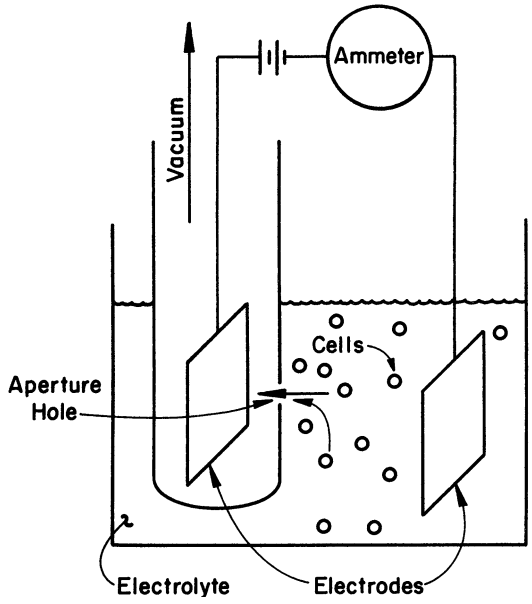

Figure 6.1. Diagram of a particle counter using the electrical resistance method for measuring cell number and cell size distribution. The ratio of volumes of a nonconducting particle to the orifice volume (altered by changing orifice diameter) determines the size of the voltage pulse. (Adapted with permission, from D. I. C. Wang and others, *Fermentation and Enzyme Technology*, John Wiley & Sons, New York, 1979, p. 64.)