prevents them from collapsing between breaths. This also allows gas exchange to occur continually, even when inspiration is not occurring.

The sum of inspiratory reserve volume, tidal volume and expiratory reserve volume is known as the *vital capacity* (VC = IRV+TV+ERV) of the lungs.

The total volume of air that can be accommodated into the lungs when they are fully inflated, that is, the sum of inspiratory reserve volume, tidal volume, expiratory reserve volume and residual volume, is known as the *total lung capacity* (=IRV+TV+ERV+RV).

The number of breaths taken per minute is known as the *respiratory rate*. *Pulmonary ventilation* is the product of respiratory rate and tidal volume.

PV = *respiratory rate* × *TV*

All of the air taken into the lungs by inspiration does not reach the alveoli and is expired without undergoing any gaseous exchange. This air remains in the trachea and bronchial tubes, collectively known as the *dead space*. For his eason, alveolar ventilation, that is, air that actually reaches the tracheoli, is always less than pulmonary ventilation.



In <u>Amoeba</u>, the **surface area:volume** ratio is large, so gaseous exchange can occur rapidly by diffusion. Oxygen dissolved in the surrounding water is diffused across the cell surface membrane into the cytoplasm while carbon dioxide is diffused out.

As the <u>Amoeba</u> grows is size, its **surface area:volume** ratio falls. At one stage, the cell divides into two to maintain an optimum **surface area:volume** ratio.

About Surface Area and Volume

Large multicellular organisms have a low **surface area:volume** ratio and exchange of gases through the body surface may not be enough to meet the metabolic needs of the organisms. In such cases, a specialised respiratory surface exists in the form of lungs or gills, providing a large surface area for gas exchange.

Increase in size also results in an increase in the distance of respiring cells from the respiratory surface, slowing the rate of diffusion. To overcome this problem,