Equilibrium Encyclopedia Article

Equilibrium

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Equilibrium

Physiological equilibrium—the balance between processes and reactions—extends from the level of the cell membrane to the whole organism.

A well-known example of physiological equilibrium is the Donnan equilibrium. Named after its discoverer, British chemist Frederick George Donnan, this equilibrium is characterized by an unequal distribution of diffusible ions (ions that are capable of moving across a membrane) between two solutions of ions separated by a membrane. The inequality results because the membrane does not allow the passage of one of the ionic species. A result of the inequality of ions is an electrical potential across the membrane. Thus, current flow across the membrane is possible, which can power various enzyme activities and reactions within the membrane. Not surprisingly, the Donnan equilibrium is of fundamental importance in the functioning of cellular processes.

Equilibrium is also the basis of the physiological property of homeostasis (from two Greek words meaning to remain the same), a physiological resistance to change whereby automatically occurring mechanisms act to maintain a constant rate of concentration in the **blood** of certain molecules and ions that are essential to life and to maintain other facets of the body, such as temperature, at specified levels. Homeostasis has been known for a long time. In 1865, Claude Bernard noted, in his book *Introduction to Experimental Medicine,* that the "constancy of the internal milieu was the essential condition to a free life."

As humans begin to venture into space, it is becoming clear that environments different from that on Earth can alter physiological equilibrium. For example, the reduced force on muscles because of the reduced gravity of spaceflight produces atrophy (shrinkage) in muscles and weakens bone, because of an increased loss of **calcium**. Additionally, the equilibrium of gas exchange in the lung can be upset.