



Name: _____ Date: _____ Group: _____

Homeostasis and Feedback Loops

Background Information

Homeostasis is the regulation and maintenance of the internal environment by an organism to maintain a condition of balance or equilibrium. The human body, for example, maintains a temperature of 37°C (98.6°F). However, if you were to run a mile, your temperature would rise and your body would make adjustments to return to its steady, homeostatic state.

Homeostasis is an internal feedback mechanism sustained by a complex system of feedback loops that utilizes communication between the brain and body to respond to stimuli, such as temperature fluctuations. A feedback loop consists of three basic parts: a receptor, control center, and effector.

Receptors gather information about conditions inside and outside of an organism. The control center is typically the brain and receives signals from the receptors. It processes this information and compares it to set points or ideal conditions at which the organism functions best. When conditions move above or below a set point, the control center responds by sending a signal to an effector. Effectors are targets such as cells, muscles, or glands that change their level of activity in response to the stimuli.

An example of an internal feedback mechanism is the control center in your brain, which is responsible for thermoregulation. It is a small structure called the hypothalamus, which contains receptors that detect slight changes in the temperature of your blood. When you exercise, your temperature rises and your brain sends signals to sweat glands, blood vessels in the skin, as well as the heart and lungs. In this case, the response is to cause the sweat glands to increase their activity, dilate blood vessels near the skin, and increase both heart and breathing rates. This allows heat to be carried away from the center of the body to the surface, so that excess heat is released outward. As the sweat evaporates and heat radiates away from your skin, the temperature of your blood cools down to normal levels and the control center stops its signals to sweat glands and blood vessels. This is similar to the way an air conditioner turns off after the room reaches a set temperature.





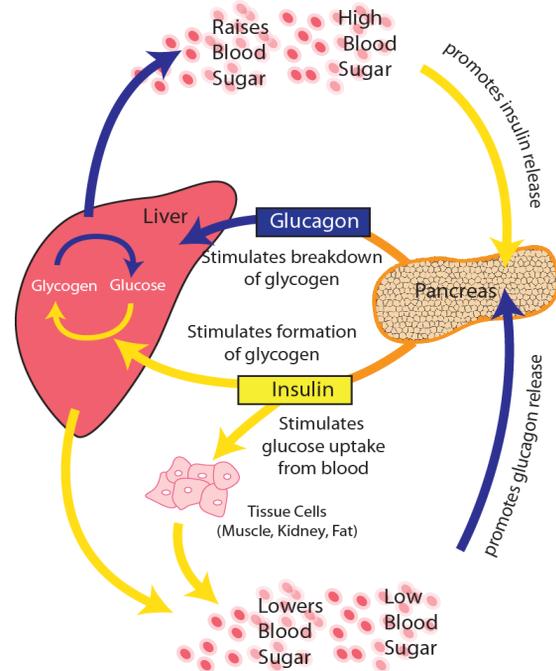
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Homeostasis and Feedback Loops, continued

Negative Feedback

In negative feedback, a control center reverses any change in the body that moves conditions above or below a set point, keeping the internal environment stable. Body temperature and regulation of blood sugar levels are examples of negative feedback loops.

To maintain a constant blood glucose level, your body relies on the hormones insulin and glucagon. If blood sugar levels are low, glucagon is released by the pancreas, which stimulates the liver to increase blood sugar levels. If the amount of glucose is too high, signals are sent to the pancreas to release insulin. Insulin causes the liver to convert more glucose to glycogen resulting in lower blood sugar.



Positive Feedback

In positive feedback, a stimulus increases a rate of change away from set points. For example, during childbirth, as the baby moves toward the birth canal, it pushes on receptors in the muscular part of the cervix. Nerve signals are sent to the hypothalamus, stimulating the pituitary gland to release the hormone oxytocin. Oxytocin stimulates contractions and speeds up labor. The loop will stop when the pressure is relieved, as the baby and the placenta leave the birth canal.

