Turning a Postive Feedback System into a Negative Feedback System

Overview: Students select one of three feedback examples from the human body and develop a diagrammatic model of the feedback system. Diagrams should be detailed and label key aspects such as signal, input, response, output, etc. Students are then challenged to use their diagram to illustrate the reverse, a negative feedback system that would function in the same biological system.

Developed by Dr. Melody Hopkins-Tucker, Citronelle High School, Citronelle, AL. Example mechanisms adapted from Anatomy & Physiology: a learning initiative (http://anatomyandphysiologyi.com/homeostasis-positivenegative-feedback-mechanisms/)

Students will use one of the specific examples of positive feedback system below to develop a model. The model will be a graphic that depicts the various components of the system like sensors, control center, inputs, outputs, target, information and communication. Students will then take their positive feedback system and turn it into a negative system.

a. Pepsinogen is an inactive protein found in the glands lining the stomach. When protein enters the stomach, the vagus nerve impulse and the hormonal secretions of gastrin and secretin stimulates the release of pepsinogen. Pepsinogen mixes with hydrochloric acid and is rapidly converted to Pepsin. Pepsin is a powerful enzyme in gastric juice that digests proteins such as those in meat, eggs, seeds and dairy products. Pepsin increases as increasing proteins enter the stomach. This is a positive feedback system which only occurs in the presence of protein and an acid environment for a short period of time.

b. Oxytocin is a hormone that is made in the hypothalamus of the brain. It is transported to, and secreted by, the pituitary gland. The pituitary gland is located at the base of the brain. The release of the oxytocin during labor increases uterine motility, making the muscles of the uterus (womb) contract. The release of oxytocin is triggered by the widening of the cervix and vagina during labor. This effect is in turn increased by the subsequent contractions. This is an example of a positive feedback system which only occurs for a short period of time.

c. Thrombin is formed in the blood when tissue is damaged and hemorrhaging occurs. Thrombin is needed to help form a blood clot and stop hemorrhaging. The amount of thrombin formed in the blood is proportional to the amount of tissue damaged. Once a blood clot begins to form, it promotes more thrombin to be produced. This is an example of a positive feedback system which only occurs for a short period of time.

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