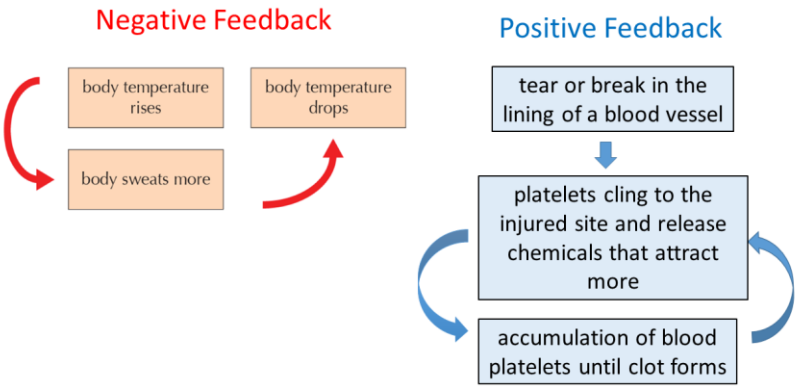
Name: _____ Date: _____ Group: _____

The Balancing Act

(Lexile 1160L)



1 All living organisms are exposed to changes every day, every minute, even every second. By definition, any change in the environment that causes an organism to respond is called a stimulus. These changes can include such dynamics as hunger, thirst, heat, cold, or any number of other external or internal stimuli. Some of these changes may be positive and helpful, while some are negative and harmful. It is critical that organisms have a constant internal environment. Why is it critical that internal balance is maintained? Organisms must quickly adjust to their ever-changing internal and external environments, or they might die.

2 Organisms adjust to the stimuli from their environments through a process known as homeostasis. The word homeostasis literally means "steady state," and it is through the processes of homeostasis that organisms maintain their steady internal balance. Changes in the organism's external environment can affect the organism's internal environment. The organism must maintain internal balance in order to function properly, so various homeostatic processes will occur in order to balance the internal environment in response to the fluctuating external environment.

3 There are two main types of systems, called feedback systems, which help an organism maintain homeostasis. These systems are described as positive feedback loops and negative feedback loops. In order for a feedback loop to be triggered, there are three different factors that must be affected. The first is a receptor. The receptor senses the change in the organism's external or internal environment. The second is the control center. The control center will process the information that it receives from the receptor and will direct a response to the effector, the third component of the system. The effector will then create the appropriate response to the stimulus.

4 But, what are positive and negative feedback loops? Positive feedback loops trigger processes that amplify the change occurring, or the stimulus response from the environment. In a positive feedback loop, a stimulus will produce product X, which will in turn produce product Y. The production of Y will produce more of product X, which will produce more of product Y and so on, until the process is completed. In other words, the response made by the effector causes the original receptors to be stimulated again. The control center causes the effector to respond again, which strengthens the original response.

5 The amplification process of this loop propels the process to completion as quickly as possible in order to attempt to return the system to balance. An example would include the process of childbirth. Once that process is initiated, it cannot be stopped. In fact, the longer this process goes on, the more amplified it becomes. Contractions stimulate the release of a hormone called oxytocin, which stimulates further contractions, which stimulate the release of more oxytocin, and so on. This positive feedback loop will continue until the child is born, at which point the system returns back to balance. Other examples of positive feedback loops include sneezing, vomiting, and blood clotting.

6 Negative feedback loops trigger processes that prevent small changes from getting larger. Most animal homeostatic systems are negative feedback loops. The variable that changes is regulated to stop further changes in the same direction. In a negative feedback loop, a stimulus will produce product X, which in turn will produce product Y, just as in a positive feedback loop. However, in a negative feedback loop, product Y should stop or reverse the effects of product X, thereby ending the process.

7 For example, if a human is hot, the body system will regulate itself to prevent overheating. It is critical that the human body maintain a steady internal temperature of 98.6º F. This is the ideal temperature for cell function and system health. Once the system begins to overheat, whether from being in the hot sun (external) or through high fever (internal), the body will attempt to counterbalance that effect by several means. The skin may become flushed and red as blood vessels close to the surface dilate in an attempt to put the circulating blood closer to the surface of the skin, where the air may be cooler. The body will begin to sweat, also an attempt to cool the surface through the process of evaporation.

8 The response to overheating is considered a negative feedback loop because this response is an attempt to prevent the overheating from getting worse. If the negative feedback loop cannot stop this progression, then the organism could die. Other examples of negative feedback loops include the regulation of blood sugars, blood pressure, and stomach acids during digestion.

1 Paragraph 1 states that, "All organisms are exposed to changes all the time, sometimes even every second." Which of the following statements is true?

A These changes could be internal stimuli.

B These changes could be external stimuli.

C Organisms must respond quickly to internal and external changes.

D All of the above.

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2 Processes that amplify a response to an external stimulus are known as —

A positive feedback loops.

B negative feedback loops.

C external stimuli.

D internal stimuli.

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3 What is the term "steady state" referring to with the process of homeostasis?

A A balanced external environment.

B A balanced internal environment.

C A changing external environment.

D A changing internal environment.

4 What could be a potential consequence of an organism failing to maintain homeostasis?

A A lack of internal balance.

B The eventual death of the organism.

C Difficulty in carrying on metabolism

D All of the above.

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5 Feedback loops help an organism to maintain homeostasis. What is the correct order of the three factors to these loops?

A Control center, receptor, effector.

B Receptor, effector, control center.

C Receptor, control center, effector.

D Effector, control center, receptor.

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6 Negative feedback loops —

A are amplification processes.

B stop further changes in the same direction.

C are initiated during childbirth.

D are only found in plants.