Homeostasis and feedback loops worksheet answers

Steady as it goes This device looks simple, but it controls a complex system that keeps the house at a constant temperature. The device presents it with an old-fashioned thermostat. The dial shows the current temperature in the room, and also allows the passenger to set the thermostat to the desired temperature. Thermostat is a widely cited model of how living systems, including the human body, maintain a stable condition called homeostasis. Picture: Thermostat for {1} Building (PageIndex): Thermostat. (CC BY-SA4.0; Vincent de Groot via Wikimedia.org). Homeostasis is a condition in which a system such as the human body is maintained in a more or less stable state. It is the work of cells, tissues, organs and organ systems throughout the body to maintain many different variables in narrow ranges that are compatible with life. Maintaining a stable internal environment requires constant monitoring of the internal environment and constant adjustments to keep things in balance. For any variable, such as body temperature or blood glucose level, there is a certain set point, which is physiological optimal value. For example, the set human body temperature point is about 37 oC (98.6 oF). As the body works to maintain homeostasis for temperature or any other internal variable, the value usually fluctuates around the point of the set. Such fluctuations are normal as long as they do not become too extreme. The distribution of values within which such fluctuations are considered insignificant is called normal range. In the case of body temperature, for example, the normal range for an adult is about 36.5 to 37.5 oC (97.7 to 99.5 oF). Homeostasis is usually maintained in the human body by an extremely complex balance. Regardless of the fact that the variable is within its normal range, maintaining homeostasis requires at least four interacting components: stimulus, sensor, control center and effector. The stimulus is provided by a variable that is regulated. Typically, the stimulus indicates that the variable value has moved away from the established point or left the normal range. The sensor tracks the value of the variable and sends the data on it to the control center. The control center corresponds to data with normal values. If the value is not at the set point or is outside the normal range, the control center sends a signal to the effector. The effector is an organ, iron, muscle or other structure that acts on a signal from the control center to move the variable back to the point of the set. Each of these components is illustrated in the picture (PageIndex{2}). The diagram on the left is a common model showing how the components interact to support The diagram on the right shows an example of body temperature. In the diagrams you can see that the maintenance of homeostasis includes feedback, which is the data that Feedback can be negative, as in the example below, or positive. All feedback mechanisms that support homeostasis use negative reviews. Biological examples of positive feedback are much rarer. Figure : Maintaining the home{2}ostasis through feedback requires an incentive, sensor, control center and effector. (CC BY-NC 3.0 through the CK-12 Foundation). In the negative feedback loop, feedback helps reduce overreaction and keep the variable within the normal range. Examples of processes controlled by negative feedback include regulating body temperature and controlling blood glucose levels. Regulating body temperature includes negative feedback, regardless of whether it lowers the temperature or raises it (figure (PageIndex{3})). The temperature center of the human body is the hypothalamus in the brain. When the hypothalamus receives data from sensors in the skin and brain that the body temperature is higher than the set point, it sets in motion the following answers: The blood vessels in the skin expand (vasodilation) to allow more blood from the body's warm nucleus to flow close to the body surface so that heat can be emitted into the environment. As blood flow to the skin increases, the sweat glands in the skin are activated to increase their sweat output (diaphores). When the sweat evaporates from the surface of the skin into the surrounding air, it takes heat with it. Breathing becomes deeper and a person can breathe through his mouth instead of nasal passages. This increases the loss of heat from the lungs. Figure :(PageIndex{3}): The hypothalamus plays an important role in temperature regulation. (CC0; ChancroVet via Wikimedia.org). When the brain temperature control center receives evidence that the body temperature is below the set point, it sets in motion the following answers: the blood vessels in the skin contract (vasocenuing) to prevent blood flow close to the body surface. This reduces the loss of heat from the surface. As the temperature drops lower, random signals of skeletal muscles are triggered, causing them to contract. This causes a tremor that generates a small amount of heat. The thyroid gland can be stimulated by the brain (through the pituitary gland) to secrete more thyroid hormone. This hormone increases metabolic activity and heat production in cells throughout the body. The adrenal glands can also be stimulated to secrete the adrenaline hormone. This hormone causes the breakdown of glycogen (carbohydrates used to store energy in animals) by glucose, which can be used as an energy source. This catabolic chemical process is exothermic, or heat-sweeting. When controlling blood glucose levels, some endocrine cells in the pancreas, called alpha and beta cells, detect blood glucose levels. Then they appropriately to keep blood glucose levels within the normal range. If If Blood glucose levels rise above the normal range, the beta cells of the pancreas release the hormone insulin into the bloodstream. Insulin signals cells to take excess glucose out of the blood until blood glucose levels drop to normal range. If blood glucose levels fall below normal range, the alpha cells of the pancreas release the hormone glucagon into the bloodstream. Glucagon signals cells to break the stored glycogen into glucose and release glucose into the bloodstream until blood glucose levels increase to normal range. In the positive feedback loop, feedback can amplify the response until the end point is reached. Examples of processes controlled by positive feedback in the human body include blood clotting and childbirth. When the wound causes bleeding, the body reacts with positive feedback loops of the blood clot and stop the blood loss. Substances released by the affected blood vessel begin the process of blood clotting. Platelets in the blood begin to cling to the affected place and release chemicals that attract additional platelets. As platelets continue to accumulate, more chemicals are released and more platelets are attracted to the location of the clot. Positive feedback speeds up the clotting process until the clot is large enough to stop the bleeding. Figure :(PageIndex{4}): Normal births are due to positive feedback. Positive feedback causes a growing deviation from normal state to fixed endpoint, rather than returning to a normal set point, as in homeostasis. (CC ON 4.0; OpenStax via Wikimedia.org). The figure (PageIndex{4}) shows positive feedback that controls childbirth. The process usually begins when the baby's head pushes against the cervix. This stimulates nerve impulses that travel from the cervix to the hypothalamus in the brain. In response, the hypothalamus sends the hormone oxytocin to the pituitary gland, which releases it into the bloodstream so it can be carried into the uterus. Oxytocin stimulates uterine contractions that push the baby harder against the cervix. In response, the cervix begins to expand in preparation for the passage of the child. This cycle of positive feedback continues, with increased levels of oxytocin, stronger contractions of the uterus, and wider expansion of the cervix until the baby is pushed through the birth canal and out of the body. At this point, the cervix is no longer stimulated to send nerve impulses to the brain, and the whole process stops. Homeostatic mechanisms work continuously to maintain stable conditions in the human body. Sometimes, however, the mechanisms fail. When they Homeostatic imbalance can result in cells unable to get everything they need or toxic waste can accumulate in the body. If homeostasis is not restored, the imbalance can lead to illness or even death. Diabetes is an example disease caused by homeostatic imbalance. In the case of diabetes, blood glucose levels are no longer regulated and can be dangerously high. Medical intervention can help restore homeostasis and possibly prevent irreversible damage to the body. Normal aging can lead to a decrease in the effectiveness of the body's control systems. This makes the body more susceptible to disease. For example, older people may find it more difficult to regulate body temperature. This is one of the reasons why they are more likely than young people to develop serious heat conditions such as heat stroke. Feature: My diabetes of the human body is diagnosed in people who have abnormally high blood glucose levels after fasting for at least 12 hours. A blood glucose level below 100 is normal. The level between 100 and 125 places you in the pre-diabetes category, and a level above 125 leads to diabetes diagnosis. Of the two types of diabetes, type 2 diabetes is the most common, accounting for about 90 percent of all diabetes cases in the United States. Type 2 diabetes usually starts after the age of 40. However, due to the dramatic increase in recent decades of obesity in young people, the age at which type 2 diabetes is diagnosed has decreased. Even children are currently diagnosed with type 2 diabetes. Today, about 30 million Americans have type 2 diabetes, and another 90 million have pre-diabetes. You will probably have your blood glucose test during a routine medical examination. If your blood glucose level indicates that you have diabetes, it can come as a shock to you because you may not have any symptoms of the disease. You are not alone because as much as one in four diabetics do not know that they have the disease. Once the diagnosis of diabetes sinks, you may be devastated by the news. Diabetes can lead to heart attacks, strokes, blindness, kidney failure and loss of legs or legs. The risk of death in adults with diabetes is 50 percent higher than in adults without diabetes, and diabetes is the seventh leading cause of death in adults. In addition, fighting diabetes usually requires frequent blood glucose testing, watching what and when you eat, and taking medications or even insulin injections. All of this may seem overwhelming. The good news is that lifestyle changes can stop the progression of type 2 diabetes or even reverse it. By adopting healthy habits, you may be able to keep your blood glucose levels within the normal range without medication or insulin. Here's how: Lose weight. Any weight loss is beneficial. Losing just seven percent of your weight can be all you need to stop diabetes in your tracks. It is especially important to eliminate excess weight around your waistline. Exercise regularly. You have to try five days a week for at least 30 minutes. It will not only lower your your Sugar and help insulin work better; it will also lower your blood pressure and improve your heart health. Another bonus of exercise is that it will help you lose weight by increasing your basal metabolism. Adopt a healthy diet. Reduce your intake of refined carbohydrates such as sweets and sugary drinks. Increase your intake of fiber-rich foods such as fruits, vegetables and whole grains. About a quarter of each meal should consist of foods high in protein, such as fish, chicken, dairy, legumes or nuts. Stress control. Stress can increase blood glucose levels as well as increase blood pressure and risk heart disease. When you feel stressed, do breathing exercises or take a brisk walk or jog. Also, try to replace stressful thoughts with more soothing thoughts. Create a support system. Enlist the help and support of loved ones as well as health professionals such as a nutritionist and diabetes educator. Having a support system will help ensure that you are on the road to recovery and that you can stick to your plan. Summary of homeostasis is a condition in which a system such as the human body is maintained in a more or less stable state. It is the work of cells, tissues, organs and organ systems throughout the body to maintain homeostasis. For any variable, such as body temperature, there is a certain set point, which is physiological optimal value. The spread of values around a set point, which is considered insignificant, is called a normal range. Homeostasis is usually supported by negative feedback loops, which includes stimulus, sensor, control center, and effector. Negative feedback helps reduce overreaction and keep the variable within the normal range. Negative feedback loops control body temperature and blood glucose levels. Positive feedback cycles are not common in biological systems. Positive feedback serves to amplify the response until the end point is reached. Positive feedback loops control blood clotting and childbirth. Sometimes homeostatic mechanisms fail, leading to homeostatic imbalances. Diabetes is an example of a disease caused by homeostatic imbalance. Aging can reduce the effectiveness of the body's control system, making older people more susceptible to disease. Review What is homeostasis? Identify the established point and the normal range for physiological measures. Identify and identify four interacting components that support homeostasis in feedback loops. Compare and compare negative and positive feedback cycles Explain how negative feedback controls body temperature. Cite two examples of physiological processes that are controlled by positive feedback loops. Negative feedback loops: A. brings the variable level back to normal B. range may lower, but not raise, body temperature C. is the type of feedback involved in blood clotting D. A and B a. a. Breastfeeding, the child's incentive to suck the nipple increases the amount of milk produced by the mother. The more sucking, the more milk is usually produced. Is this an example of negative or positive feedback? Explain your answer. B. What do you think could be the evolutionary advantage of the mechanism for regulating milk production described in part? Explain why homeostasis is governed by negative feedback cycles rather than positive feedback cycles. The set point is usually: A. at the top of the normal B. range at the bottom of the normal C. range in the middle of the normal D. range is the point at which changes can no longer occur sex hormone level, testosterone (T), controlled by negative feedback. Another hormone, gonadotropin-releasing hormone (GnRH), is released by the brain's hypothalamus, which causes the pituitary gland to release the luteinizing hormone (LH). LH stimulates gonads to produce T. When there is too much T in the blood, it feeds on the hypothalamus, causing it to produce less GnRH. Although this does not describe all feedback cycles associated with regulation T, answer the following questions about this particular feedback loop. What is the incentive in this system? Explain your answer. B. What is a control center in this system? Explain your answer. C. What is the pituitary gland considered in this system: stimulus, sensor, control center, or effector? Explain your answer. You can learn how the body supports homeostasis in its water content by watching this video: Check out this video for a comparison between positive and negative reviews: feedback:

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