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Examples of homeostasis

Home | Biology | 10 Examples of Homeostasis September 12, 2023 Homeostasis is the ability of a system to maintain a relatively stable internal environment despite changes in the external environment. Body temperature regulation, Blood glucose regulation, pH regulation, and Electrolyte balance are few examples of homeostasis. Here are 10 examples of homeostasis in humans: Body temperature regulation is considered an example of homeostasis because the body maintains a relatively constant internal temperature of 37°C (98.6°F) despite changes in the external environment. This is done through a variety of mechanisms, including sweating, shivering, and changes in blood flow. Blood glucose regulation is an example of homeostasis because the body maintains a relatively constant level of glucose in the blood. This is done by the pancreas, which releases insulin when blood sugar levels are high and glucagon when blood sugar levels are low. Blood pressure regulation is an example of homeostasis as the body maintains a relatively constant blood pressure. This is done by the heart, blood vessels, and kidneys. When blood pressure is too high, the body releases hormones that help to lower it. When blood pressure is too low, the body releases hormones that help to raise it. Blood oxygen content regulation is an example of homeostasis. The body maintains a relatively constant level of oxygen in the blood. This is done by the lungs, heart, and blood vessels. When blood oxygen levels are too low, the body starts to breathe faster and deeper. pH regulation is considered an example of homeostasis because the body maintains a relatively constant pH of the blood. This is done by the kidneys, lungs, and blood buffers. When the body's pH gets too acidic or too alkaline, it can disrupt the function of cells and organs. Water balance is considered an example of homeostasis because the body maintains a relatively constant amount of water in the body. This is done by the kidneys, sweat glands, and thirst mechanism. When the body loses too much water, the thirst mechanism is activated and the person drinks more fluids. Electrolyte balance is considered an example of homeostasis because the body maintains a relatively constant balance of electrolytes in the blood. Electrolytes are minerals that carry electrical charges. They are important for many bodily functions, including blood pressure regulation, muscle contraction, and nerve signaling. When the body loses too much electrolytes, the kidneys work to retain them. Blood clotting is considered an example of homeostasis because it helps to stop bleeding and prevent blood loss. When a blood vessel is damaged, blood platelets stick together to form a clot. This clot helps to stop the bleeding and prevent blood loss. Immunity is considered an example of homeostasis because it helps the body fight infection. The immune system produces cells and proteins that attack foreign invaders, such as bacteria and viruses. This helps to prevent the spread of infection and keep the body healthy. Body weight regulation is considered an example of homeostasis because the body maintains a relatively constant weight over time. This is done by a complex interplay of factors, including the amount of food we eat, the amount of energy we use, and the hormones that control hunger and fullness. Homeostasis is a physiological process that keeps the internal environment of a living organism stable and balanced. The constant equilibrium created by homeostasis is vital to the survival of every species. Even when the external environment is rapidly changing, homeostasis keeps the body's internal environment constant and steady. This article defines the meaning of homeostasis, describes how the concept originated, explains how these physiological processes work via negative feedback loops, and details why maintaining a "milieu intérieur" (constant internal environment) is essential for all living things. Homeostasis is a term derived from the Greek words "homeo" (meaning similar to) and "stasis" (meaning standing still). In the 1920s, an American physiologist named Walter B. Cannon invented the word "homeostasis." Cannon described homeostasis as "coordinated physiological processes" that maintain "steady states" in a living organism. He clarified that the word doesn't imply something set in stone or stagnant but instead describes an automated, self-regulating process that varies but is "relatively constant." Cannon's concept of homeostasis can be traced back to the principles of milieu intérieur developed by a French physiologist Claude Bernard in the 1860s. "Homeostasis" and "milieu intérieur" are similar terms that highlight the importance of living organisms having internal mechanisms that can maintain inner balance and "relatively constant" stability. Even if the external environment changes rapidly, homeostasis makes it possible for the body to keep its internal environment steady via dynamic equilibrium reactions. The body's ability to maintain a constant internal temperature of 98.6 degrees F (37 degrees C) is a perfect example of homeostasis. When the external environment is hot, the body sweats to cool itself down and maintain a steady internal temperature. When it's cold outside, the body shivers to stay warm. Homeostasis typically involves negative feedback loops. Within these loops, negative stimuli automatically trigger mechanisms to help homeostasis's dynamic equilibrium process. "Dynamic equilibrium" describes the process and reactions that occur as the body makes adjustments in response to negative feedback warnings of imbalance. Homeostasis's ultimate goal is to help the body maintain a constant and relatively stable internal environment whenever possible. For example, being in hot weather triggers cooling mechanisms, such as sweat, that keep the body's core temperature around 98.6 degrees F. When someone is in a cold environment, this negative stimulus activates homeostatic mechanisms designed to hold onto the body's heat, like shivering, in an attempt to maintain body temperature. The human body has a phenomenal ability to maintain internal balance in response to disruptive outside forces and different types of internal or external negative stimuli. Several types of homeostatic regulation maintain homeostasis in healthy human bodies, including: Body temperature homeostasis (thermoregulation): Keeps the body's temperature stable at around 98.6 degrees F and helps offset the risks of heat exhaustion or hypothermia (low body temperature) Water and electrolyte homeostasis (osmoregulation): Keeps fluid levels and electrolyte balance stable within the body by filtering and removing excess fluids via the kidneys (electrolytes are minerals that carry a charge dissolved in water, such as in the bloodstream, body fluids, and cells, including sodium, potassium, calcium, phosphorus, chloride, and magnesium) Oxygen (O₂) homeostasis: Keeps oxygen levels within a healthy range and helps the body avoid low oxygen levels (hypoxia) Blood sugar homeostasis (pancreatic regulation): Keeps blood sugar (glucose) at stable and healthy levels of between 70 and 120 milligrams per deciliter (mg/dL) via the pancreas Blood pressure homeostasis (baroreflex regulation): Sends homeostatic signals from the hypothalamus to the heart, blood vessels, and kidneys that keep blood pressure in a healthy range that isn't too high (hypertension) or too low (hypotension) Calcium homeostasis: Maintains serum calcium homeostasis via the synthesis and release of parathyroid hormone (PTH) from the parathyroid gland Potassium homeostasis: Keeps potassium levels within a healthy range of 3.6 to 5.2 milliequivalents per liter (mEq/L) and helps the body avoid having too much potassium in the blood (hyperkalemia) or too little (hypokalemia) It's impossible to overstate the importance of homeostasis. Every living thing relies on homeostatic processes for its survival. When homeostasis fails to function properly, internal imbalances can lead to sickness and even death. For example, when the body can't maintain blood sugar homeostasis due to low production of insulin or poor response to insulin, diabetes results. The inability to maintain potassium homeostasis can affect the heart's rhythm and nervous system activity, which can lead to death. George E. Billman, a U.S. physiologist, describes homeostasis as "the central organizing principle upon which the discipline of physiology is built." Centuries ago, Claude Bernard identified the importance of living organisms having the ability to maintain a stable inner environment, which he called milieu intérieur, meaning constant internal environment. In the early 20th century, Walter B. Cannon built on Bernard's concept of milieu intérieur and coined the term "homeostasis," which combines the Greek words "homeo" (similar to) and "stasis" (standing still). Homeostatic mechanisms are triggered by negative feedback or any stimuli that throw off the body's inner balance. There are seven types of homeostasis that maintain a stable and constant internal environment regardless of external environmental changes. Every living thing relies on homeostasis for its real-time and long-term survival. It helps organisms regulate themselves in response to changes in their environment. Even something as simple as sweating on a hot day is key to maintaining this balance and staying healthy. Homeostasis is the self-regulation of processes in the body that maintains equilibrium of temperature, blood sugar, and much more.Homeostasis is a fundamental concept in biology that refers to the self-regulating process by which biological systems maintain stability while adjusting to changing conditions. This stability, or equilibrium, is essential for organisms to function effectively and efficiently.Homeostasis is the ability of an organism to maintain a stable internal environment despite changes in external conditions. This process involves various biological mechanisms that detect changes, trigger responses, and restore balance. Examples of things that homeostasis controls include body temperature, chemical energy, pH levels, oxygen levels, blood pressure, and blood sugar.The word "homeostasis" originates from the Greek words 'homeo,' meaning similar, and 'stasis,' meaning standing still. Walter Cannon, an American physiologist, coined the term in the early 20th century. He built upon the work of Claude Bernard, a French physiologist who first recognized the concept of an internal milieu in the mid-19th century.Homeostasis involves three primary components:Receptors: These are structures that detect changes in the environment (internal or external) and send this information to the control center.Control Center: Usually the brain or endocrine system, it processes the information and determines the appropriate response.Effectors: These are organs or cells that enact the response determined by the control center, thereby restoring balance.A classic example of homeostasis involving receptors, control center, and effectors is the regulation of blood glucose levels in the human body. This process maintains the energy supply to cells and is tightly controlled.In this context, receptors are specialized cells in the pancreas that monitor glucose levels in the blood. These cells are known as pancreatic beta cells. When blood glucose levels rise (such as after eating), these cells detect the increased glucose.Upon detecting high glucose levels, the beta cells of the pancreas serve as the control center. They assess the information from the receptors and determine the necessary response to restore glucose levels to a normal range. The pancreas then synthesizes and releases the hormone insulin into the bloodstream.The effectors in this process are primarily the liver and muscle cells, which respond to the insulin released by the pancreas. Insulin signals these cells to increase the uptake of glucose from the blood. Muscle cells use glucose for energy, especially during physical activity. The liver converts excess glucose into glycogen for storage, effectively lowering the blood glucose level and restoring equilibrium.Feedback mechanisms maintain the stability in the body's internal environment. There are two types of regulatory mechanisms: negative feedback and positive feedback.Negative feedback is the most common feedback mechanism in homeostasis. It counteracts or negates a change, bringing the system back to its set point or equilibrium. When a deviation from a set point is detected, negative feedback mechanisms initiate responses that reverse the change and restore balance. Key characteristics include:Self-limiting: Once the desired level is reached, the response diminishes or stops.Examples: Body temperature regulation (sweating to cool down when hot, shivering to warm up when cold), blood glucose regulation (insulin and glucagon balancing glucose levels).Positive feedback is less common in homeostasis. This type of feedback amplifies a change or deviation, pushing the system further away from its set point. This mechanism is useful in situations where a rapid, decisive change is beneficial. Characteristics of positive feedback include:Self-amplifying: The response enhances the change, leading to an even greater response.Controlled and Temporary: Usually, positive feedback is part of a larger negative feedback system and is short-lived.Examples: Blood clotting (where each step in the clotting process triggers the next), the release of oxytocin during childbirth to intensify labor contractions.Both negative and positive feedback mechanisms are crucial for maintaining homeostasis, though they operate differently. Negative feedback maintains stability and balance, while positive feedback aids specific, often critical, functions that require a rapid or substantial change.Water Balance: The body regulates water balance through mechanisms like thirst, urine production, and sweating to prevent dehydration or overhydration.Temperature Regulation: The body maintains an internal temperature around 37°C. When body temperature rises, mechanisms like sweating and increased blood flow to the skin help cool the body.Blood pH Regulation: The body maintains the pH of blood (around 7.35-7.45) through the respiratory system (by altering breathing rates) and kidneys (by excreting H+ ions).Calcium Levels: Regulation of calcium levels in the blood is controlled by hormones like parathyroid hormone and calcitonin, affecting bone, kidney, and intestinal activities.Oxygen and Carbon Dioxide Levels: The respiratory system maintains a balance in oxygen and carbon dioxide levels in the blood through changes in breathing rate and depth.Electrolyte Balance: Sodium, potassium, and chloride ions are regulated to maintain nerve and muscle function, fluid balance, and acid-base balance.Thermoregulation in Birds and Mammals: Many birds and mammals maintain a constant body temperature through mechanisms like shivering, sweating, panting, and adjusting their metabolic rate.Osmoregulation in Fish: Fish maintain the balance of water and salts in their bodies, despite the salt concentration in their environment. Freshwater fish actively excrete water and retain salts, while marine fish do the opposite.Stomatal Regulation in Plants: Plants open and close stomata to balance CO2 intake for photosynthesis with water loss through transpiration.pH Regulation in Marine Life: Marine organisms like corals and mollusks regulate the pH within their cells and bodily fluids to counteract the acidification of ocean water.Hibernation in Bears and Other Animals: Hibernation is a form of long-term homeostasis where animals slow their metabolism, reduce body temperature, and conserve energy during scarce food availability in winter.Even microorganisms like bacteria exhibit homeostasis. For instance, they regulate their internal pH, ion concentrations, and respond to osmotic stress by synthesizing or importing compatible solutes.Homeostasis is crucial for the survival of organisms. It ensures optimal operating conditions for cells and organs, facilitates physiological processes, and maintains a balance despite environmental changes. Disruption in homeostasis often lead to diseases or disorders, reflecting its importance in health and disease.Aronoff, Stephen L.; Berkowitz, Kathy; et al. (2004). "Glucose Metabolism and Regulation: Beyond Insulin and Glucagon". *Diabetes Spectrum*. 17 (3): 183-190. doi:10.2337/diaspect.17.3.183Betts, J. Gordon; Desaix, P.; et al. (2013) *Anatomy and Physiology* (1st ed.). OpenStax. ISBN: 9781947172043.Boron, W.F.; Boulpaep, E.L. (2009). *Medical Physiology: A Cellular and Molecular Approach* (2nd International ed.). Philadelphia, PA: Saunders/Elsevier. ISBN 9781416031154.Kalaany, N.Y.; Mangelsdorf, D.J. (2006). "LXR^s and FXR: the yin and yang of cholesterol and fat metabolism". *Annual Review of Physiology*. 68: 159-91. doi:10.1146/annurev.physiol.68.033104.152158Mariel, E.N.; Hoehn, K.N. (2009). *Essentials of Human Anatomy & Physiology* (9th ed.). San Francisco: Pearson/Benjamin Cummings. ISBN 978-0321313427.Related Posts Human body with internal organs Homeostasis refers to the ability of an organism or environment to maintain a state of internal balance and physical wellbeing in spite of changes or outside factors. Successful homeostasis is vital to the survival of any living thing, and being able to maintain homeostasis even in adverse conditions is one of the most important evolutionary advantages. Here are some homeostasis examples, beginning with the human body, then moving on to examples in animals and plants. The human body is an amazingly complex machine, but many of its parts and processes exist simply to maintain homeostasis. That is, the machine exists so the machine can continue to exist. Humans' internal body temperature is a great example of homeostasis. When someone is healthy, their body maintains a temperature close to 98.6 degrees Fahrenheit (37 degrees Celsius). Being warm-blooded creatures, humans can increase or decrease temperature internally to keep it at a desirable level. Whether you're lying in the summer sun or playing in the winter snow, your body temperature only changes by a degree or two. That's an example of homeostasis being maintained. When you get shivery in the cold, or sweat in the summer, that's your body trying to maintain homeostasis.Glucose is the most basic form of sugar, and the only type the body can use directly. The body must maintain proper glucose levels to ensure a person remains healthy. When glucose levels get too high, the pancreas releases a hormone known as insulin. If blood glucose levels drop too low, the liver converts glycogen in the blood to glucose again, raising the levels.When bacteria or viruses that can make you ill get into your body, your lymphatic system kicks in to help maintain homeostasis. It works to fight the infection before it has the opportunity to make you sick, ensuring that you remain healthy.The maintenance of healthy blood pressure is an example of homeostasis. The heart can sense changes in blood pressure, sending signals to the brain, which then sends appropriate instructions back to the heart. If blood pressure is too high, the heart should slow down; if it is too low, the heart should speed up.More than half of a human's body weight percentage is water, and maintaining the correct balance of water is an example of homeostasis. Cells that have too much water bloat and can even blow up. Cells with too little water can end up shrinking. Your body (and a healthy intake of fluids) maintains a proper water balance so that neither of these situations occurs.Calcium levels in the blood must be maintained at proper levels. The body regulates those levels in an example of homeostasis. When levels decrease, the parathyroid releases hormones. If calcium levels become too high, the thyroid helps out by fixing calcium in the bones and lowering blood calcium levels.The nervous system helps keep homeostasis in breathing patterns. Because breathing is mostly involuntary, the nervous system ensures that the body is getting much needed oxygen through breathing the appropriate amount of oxygen.Eating, drinking, even simple breathing can introduce indigestible and even dangerous substances into the body. The body maintains homeostasis by eliminating these substances through the urinary and digestive systems. An individual simply urinates and defecates the toxins and other nasty things from the blood, restoring homeostasis to the human body. You can find examples of homeostasis through the animal kingdom, from fish drinking water to animals seeking salt licks! Did you know that many of your pets' behaviors are meant to maintain homeostasis? When your dog hangs his tongue out and pants, for example, he's basically sweating, bringing his body temperature down. Does your cat like to sleep in sunbeams? Same deal, only your cat is trying to get warmer. It's all about maintaining that homeostasis.Homeostasis is everything in cold-blooded animals. Lacking the ability to control their own body temperature, reptiles, amphibians and fish go to amazing lengths to find the right climate. The African lungfish, for example, estivates. When summer comes around, lungfish wrap themselves in a ball of mud and mucus and sleep the heat away, coming out months later when things have cooled off.Body temperature isn't the only component of homeostasis. There's also the microbiome, bacteria and other organisms that grow inside animals and keep them healthy. To get and keep those microorganisms, young animals from koalas to elephants will eat the feces of their parents. Thankfully, we humans are born with the proper bugs.Salt licks are another example of animals maintaining homeostasis. When their diet doesn't provide certain necessary minerals, animals like moose and woodchucks will seek out and lick rocks and other objects that contain those minerals. That's been going on for millions of years. Just look at Big Bone Lick State Park in Kentucky. They had mammoths at their salt lick!Ever wonder whether fish drink water? They do! Keeping up your water levels is a vital homeostatic process. Freshwater fish take in water through their gills, while saltwater fish drink through the mouth. To avoid salt overdose, saltwater fish have special cells that pump salt out of their bodies. Humans and animals aren't the only ones who rely on homeostasis. Plants need to maintain the same balance in order to survive and thrive too. Like animals, plants also "breathe," though the exchange is the reverse of what we do. Plants take in carbon dioxide and release oxygen. Did you know they also regulate how much they take in and let out? Leaves have stomata, holes on the underside, that expand and contract to get just the right combination. That's homeostasis.Leaves are machines for maintaining homeostasis. In addition to the process of photosynthesis described above, those same stomata take in and excrete nutrients, including salt and many others, based on whether the plant needs more or less.Stomata are a triple threat. They regulate photosynthesis and plant nutrition, but they also maintain a plant at the optimum water level. When stomata open wide, they dry the plant out. When they close, they help retain water.Plants go to great lengths to maintain the proper temperature too. Being less mobile than the average animal, plants have to get creative. Sunflowers, for example, got their name for a reason: they're heliotropes, following the sun across the sky to maximize photosynthesis. Plants also undergo gravitropism, using gravity to guide their growth. Roots have evolved to go towards gravitational pull, while shoots shoot up against it.Plants have beneficial bacteria in their system just like animals. There's a whole category of microorganisms called PGPR, or "plant-growth promoting rhizobacteria." The bacteria occurs in soil and likes to hang out in roots. In fact, they like it so much, they pay rent: PGPR fend off other microbes that cause disease and help plants use minerals and make important hormones. Homeostasis is universal. In fact, many biologists describe the whole natural world as maintaining homeostasis, responding to changing climate and species diversity to keep planet Earth in the most livable possible state.At a more personal level, homeostasis is simply a word for living things ordering their bodies in order to continue living. Illness disrupts homeostasis, and health is largely defined by how well an organism maintains homeostatic balance. If you want to continue your journey through the human body, you can get deep into proteins, its fundamental building blocks. Alternatively, you could go big and read up on macroevolution for examples of massive systems maintaining their own homeostasis on a species-wide scale.