How and why do organisms maintain, a constant internal environment essay sample

Literature, Russian Literature

The maintenance of a constant internal environment requires control systems that detect stimuli and make the necessary adjustments to return the environment to normal. They do this is by homeostasis. One example of homeostasis is thermoregulation. Heat can be lost and gained by radiation, conduction and convection. Evaporation also plays an important part in heat loss by using heat from the body to evaporate water, and therefore cooling the body down. Heat is also lost in substances leaving the body, such as exhaled air, urine and faeces.

Heat can also gained through metabolic activities inside the body cells, such as respiration. In mammals, body temperature is controlled by the hypothalamus, which acts like a thermostat. Sensory cells called thermoreceptors detect changes in body temperature. The central thermoreceptors in the hypothalamus measure the temperature of the blood passing through the hypothalamus. This is known as the core body temperature. There are also peripheral thermoreceptors in the skin, which measure the skin temperature.

Both receptors send nerve impulses to the hypothalamus. If the central thermoreceptors detect a decrease in core body temperature then the hypothalamus send impulses to the sweat glands, which reduce sweating, to the erector pilli muscles, which cause hairs to stand on end and to muscles in arterioles, which cause vasoconstriction to take place. If a fall in surrounding temperature is detected, impulses are sent to skeletal muscles, which induce shivering, and to adrenal glands, which release adrenaline to increase metabolic rate.

If thermoreceptors detect an increase in core body temperature, or in surrounding temperature, the hypothalamus sends impulses to muscles in arterioles, which causes vasodilatation, to sweat glands which then produce more sweat, and to thyroid glands, which release les thyroxin, and therefore reduce metabolic rate. Blood Glucose levels are also controlled. Glucose regulation depends upon a part of the pancreas called the islets of Langerhans.

This lowers glucose levels as insulin stimulates the uptake of glucose by all respiring cells, mainly liver and muscle cells. In some cells this is done by increasing the number of open glucose transport proteins in the cell surface membrane, allowing more glucose to enter these cells. Insulin also stimulates the increased use of glucose in respiration and activates enzymes in the liver and muscle cells, which increases the rate at which glucose is converted into glycogen.

Glycogen is then stored in the liver and muscles. If the islets of langerhans detect a fall in blood glucose levels, the ? -cells in the islets of langerhans secrete glucagons. This binds to receptor proteins on cell surface membranes, activating enzymes, which catalyse the conversion of glycogen to glucose, known as glycogenolysis. Glucagon also stimulates the conversion of amino acids to glycerol and glucose, known as gluconeogenesis. As a result glucose is released into the blood. A level of amino acids is also maintained within the body. Amino Acids from the gut enter the bloodstream, and are used in protein synthesis.

Excess amino acids that are not needed for use in protein synthesis are modified fro use in respiration. This is known as deamination and takes place in the liver. During this deamination process, the amino group, and a hydrogen atom are removed from the amino acid, forming ammonia. This leaves an organic acid, called carboxylic acid that can be used in respiration. Ammonia is then converted into urea in the liver. The kidneys regulate Blood urea content, blood water content and ion content. This is carried out in stages. The first of which is ultra filtration.

When blood enters the glomerulus from the afferent arteriole, it is under pressure. The efferent arteriole, which is much narrower causes there to be high pressure in the capillaries of the glomerulus, which means that the blood passes through the glomerulus and, due to the pressure, some water, ions and small molecules pass across the filtering system to the renal space. Many of the substances in the glomerular filtrate, such as glucose, amino acids and mineral ions, are then reabsorbed by active transport by epithelial cells lining the proximal convoluted tubule.

Where as urea is reabsorbed by diffusion. The loop of henle then creates a high concentration of salts in the medulla. The descending limb is permeable to water, but not salts. The thin ascending limb allows salts to move passively into the medulla. The thick ascending limb actively transports sodium chloride into the medulla. The result is a maintained concentration gradient between the two limbs all the way along the loop. This gradient allows water to be reabsorbed as the high concentration of salts in the medulla tissue fluid is needed as it causes water to be reabsorbed by the collecting ducts.

Regulating water potential of the blood is another example of homeostasis. Osmoreceptors in the hypothalamus of the brain are sensitive to changes in the water potential of the blood. When the water potential of the blood falls, these Osmoreceptors stimulate the pituitary gland. The pituitary gland releases the hormone ADH into the blood. ADH increases the permeability of the distal convoluted tubule and the collecting duct to water. As the water potential in the tubule is greater than that of the blood, water is reabsorbed from the distal convoluted tubule and collecting duct.

On the other hand, if fluid intake is high, the water potential of the blood rises. This is again detected by osmoreceptors in the hypothalamus, and ADH production in the pituitary gland is inhibited. This reduces the permeability of the distal convoluted tubule and collecting duct to water, so less water is reabsorbed from the urine. This is an example of negative feedback. Plants like xerophytes also control their water content. They do this using various adaptations such as having sunken stomata, which reduces transpiration since the humidity is usually greater in the stomata’s pit than in the surrounding air.

They can also have hinge cells, to allow the plant to roll up when it is short of water, or leaves that a reduced to spines, which also limit transpiration. They could also have a long, shallow root system, allowing them easier access to rain water as it moves through the soil profile. All these factors allow these plants to live in dry areas and conserve as much water as possible. Plants also regulate their internal environment by photosynthesis. This process involves a series of reactions during which light energy is converted into chemical energy, which other living organisms can use.

The process involves using light energy to obtain hydrogen ions and electrons from water. These are then used in the synthesis of ATP and reduced NADP. Carbon dioxide is used to synthesise sugars using reduced NADP and ATP. The whole process occurs by two interconnected, enzyme catalysed metabolic pathways: light-independent reactions and light-dependent reactions. These are just a few ways in which organisms maintain a constant internal environment. They must do this in order to make sure physiological processes, which depend on enzymes and other globular proteins, work properly.

Enzymes and other globular proteins need optimum conditions, such as the right temperature etc, to maintain full activity. Living organisms must constantly take substances from their environment, such as nutrients and gasses, and waste materials need to be removed. This means that living organisms must have the systems mentioned above in order to regulate their internal environment, while constantly exchanging substances with their external environment, otherwise they simple could not survive.