Concept of homeostasis

Explain the Concept of Homeostasis (P5)

The main concept of homeostasis is to maintain a constant environment inside the body. It does this by controlling certain systems throughout the body, keeping it at the normal environment. Although external influences can have a negative impact on this environment, homeostasis will then make the body react to these influences by correcting it back to the norm level; this is known as negative feedback. Negative feedback is how homeostasis keeps these systems throughout our body in balance. The process of negative feedback is when receptors in the body detects when something is off balance or wrong, this then triggers the receptors to send a message to the effectors in the body. Effectors then cause a reaction in the body to restore the balance back to the normal environment. Although the receptors will keep sending these signals to the effectors until the balance is completely restored back to normal. That’s why it is called negative feedback as it’s something negative happening to the body.

Homeostasis constantly maintains the environment of four main systems throughout the body, these systems are:

- Heart Rate
- Breathing Rate
- Body Temperature
- Blood Sugar Levels

Heart Rate

The circulatory system is made up of blood vessels, such as arteries and arterioles; these vessels takes oxygenated blood from the heart to the thin-

walled capillaries which is where exchange of oxygen and nutrients takes place and vessels known as venues and veins return the now deoxygenated blood back to the heart, this is an ongoing cycle. Nutrient molecules then leave the capillaries to be taken up by the cells, and waste molecules are transferred off by the cells and then are received by the capillaries to be taken away. Capillaries thrive in all parts of the body; blood is composed into two parts: formed elements and plasma. All of the produced elements donate to homeostasis; Oxygen is consumed throughout cellular respiration, this is a process that provides energy for metabolic activities. The body fights infection to keep the body unharmed and prevents it from giving way to diseases caused by viruses and bacteria. Plasma, too, donates to homeostasis. The nutrients required and the wastes given off by cells are carried in plasma. Nutrients then leave the plasma through the capillaries and wastes enter the plasma at the capillaries.

Breathing Rate

When the body breathes in air, oxygen is inhaled into the alveoli of the lungs this is where the exchange of oxygen and carbon dioxide takes place. Blood inside the pulmonary artery is oxygen-poor and holds a higher concentration of carbon dioxide. As blood passes through the capillaries close to the alveoli, oxygen is diffused into the blood and carbon dioxide then diffuses out of blood into the alveoli. Then after, carbon dioxide is exhaled by moving from the alveoli to the nose. As the blood within the pulmonary vein is oxygen-rich and holds a lower concentration of carbon dioxide, it is clear that carbon dioxide has been exported for oxygen as blood passes through the lungs. The respiratory centre, found in the medulla; which repeatedly

releases nerve impulses to the diaphragm and the muscles of the rib cage. In its relaxed state, the diaphragm is dome-shaped, but upon stimulation, it contracts and lowers. Also the rib cage moves upward and outward, therefore the thoracic cavity increases in size and air pressure within the expanded lungs lowers and is instantly rebalanced by air rushing in through the nose. When the respiratory centre stops sending out stimulatory nerve impulses, the diaphragm and rib cage return to their original positions and exhalation occurs. There are chemoreceptor’s next to the respiratory centre in the medulla oblongata that are quickly responsive to the carbon dioxide content of the blood, and chemoreceptor’s in aorta and carotid arteries that are responsive to both the carbon dioxide content and the pH of the blood. When the carbon dioxide concentration rises or when the pH lowers the respiratory centre is stimulated and the breathing rate increases.

Body Temperature

The body is able to maintain a normal body temperature of 37° C even if the external temperature ranges between 16° C and 54° C. The metabolic activity of cells is the heating system of the body because cellular reactions give off heat as a side-effect. When the body is resting, body heat is produced mainly by the heart, liver, brain, and endocrine glands but when the muscles are active they produce many times the heat produced by these organs. Therefore, increased muscle activity, such as by rubbing hands or stamping feet are used as a short-term measure to raise body temperature. On a long-term cause, the hormone thyroxin is produced by the thyroid gland stimulates cells to a higher metabolic rate. An expecting is that the persons living in a cold climate will have a higher metabolic rate than those

who live in a reasonable climate. The regulatory centre for body temperature, found in the hypothalamus, is responsive to temperature changes within the arterial where blood is flowing. Depending on the body temperature, the regulatory centre produces the adaptive responses, and body temperature then increases or decreases. The body cools when blood vessels near the skin are dilated and the warm blood passing through them this loses heat to the atmosphere by radiation. Sweating also cools the body because as it evaporates, the body loses heat. If body temperature falls too low, the body will begin to shivering. Shivering requires nerve impulses to be sent to the skeletal muscles. In cold temperatures, people wear clothing which traps an insulating layer of warm air next to the body to recompense for a lack of body hair. In warm temperatures, clothing is worn to protect the body against the burning rays of the sun, but such clothing should be loose so that heat may still be lost by radiation.

Blood Sugar Levels

Glucose is an important substance in the body as it is the main source

of energy for all natural functions and is in fact the only form of energy which can be used by the brain and central nervous system. The level of blood glucose in the body is important, as if blood glucose levels drop or rise dramatically there may be serious consequences such as hypo- or hyperglycaemia which can both cause death. Therefore it is necessary for blood glucose levels to be regulated and this is achieved through homeostasis. To work effectively homeostasis has an effective receptor that detects this. If the levels are too high the receptors would send a signal to

the pancreas to control the concentration of the glucose in the blood. The pancreas would then produce a hormone called insulin, which causes the glucose to be transport from the blood into the cells. This lowers the concentration of glucose in the blood if it becomes too high. This process usually happens after we eat a meal that is rich in carbohydrate such as, sweets, rice, pasta, bread or potatoes.

Bibliography

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