5.4 Homeostasis in the Human Body

Homeostasis is the process by which living organisms maintain a stable internal environment despite changes in the external environment. The human body controls body temperature, water balance, blood sugar, and many other conditions to keep cells functioning properly.

Definition of Homeostasis

Homeostasis refers to the maintenance of a constant internal environment in the body. It involves coordination between organs and body systems through feedback mechanisms.

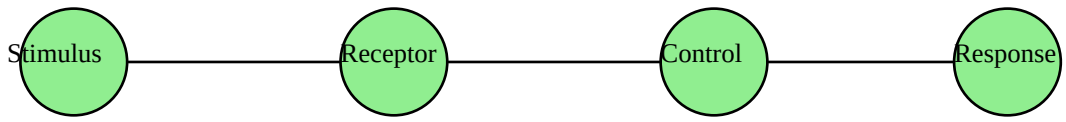
Importance of Homeostasis

Maintains suitable conditions for enzyme activity. Ensures normal body temperature. Controls water and salt balance. Maintains blood glucose level. Supports healthy functioning of cells and organs.

Feedback Mechanisms

Homeostasis is controlled mainly by negative feedback mechanisms. In negative feedback, a change in the body is detected and corrected to return conditions to normal. For example, when body temperature rises, sweating helps cool the body.

Simple Feedback Diagram



5.4.1 Thermoregulation

Thermoregulation is the process of maintaining a constant body temperature. The normal human body temperature is about 37°C. The hypothalamus in the brain acts as the control center for temperature regulation.

How the Body Cools Down

When body temperature rises: Sweat glands produce sweat. Blood vessels near the skin widen (vasodilation). Heat is lost through evaporation and radiation.

How the Body Warms Up

When body temperature falls: Muscles shiver to generate heat. Blood vessels narrow (vasoconstriction). Hair stands up to trap warm air.

Comparison of Temperature Responses

Condition	Body Response
Body too hot	Sweating and vasodilation
Body too cold	Shivering and vasoconstriction

5.4.2 Osmoregulation

Osmoregulation is the regulation of water and salt balance in the body. The kidneys play the main role in osmoregulation by filtering blood and adjusting the amount of water in urine.

Functions of the Kidneys

Remove waste products from blood. Maintain water balance. Control salt concentration. Produce urine.

Role of ADH Hormone

Antidiuretic hormone (ADH) controls water reabsorption in the kidneys. When the body lacks water, more ADH is released so more water is reabsorbed.

5.4.3 Chemical Regulation

Chemical regulation maintains normal levels of substances such as glucose, oxygen, and carbon dioxide. Hormones and enzymes help regulate these substances.

Blood Glucose Regulation

The pancreas produces insulin and glucagon hormones. Insulin lowers blood sugar. Glucagon increases blood sugar. This helps maintain a stable glucose level in the blood.

5.4.4 Side Effects of Drugs on Nervous and Endocrine Systems

Drug abuse can affect normal functioning of the nervous and endocrine systems. Some drugs alter hormone production and damage nerve cells. Common effects include: Addiction Poor coordination Memory problems Hormonal imbalance Damage to organs

Important Notes

- Homeostasis keeps the body's internal environment stable.
- Negative feedback is the main control mechanism.
- The hypothalamus controls body temperature.
- Kidneys are important in osmoregulation.
- Insulin regulates blood glucose level.

Summary

Homeostasis is essential for survival. It allows the body to maintain stable internal conditions such as temperature, water balance, and chemical concentration. Thermoregulation, osmoregulation, and chemical regulation are

examples of homeostatic processes. The nervous and endocrine systems work together to maintain balance in the body.

Review Questions and Answers

1. What is homeostasis?

Homeostasis is the maintenance of a stable internal environment.

2. Which organ controls body temperature?

The hypothalamus controls body temperature.

3. What is osmoregulation?

It is the regulation of water and salt balance in the body.

4. Which organs are mainly responsible for osmoregulation?

The kidneys are mainly responsible.

5. What hormone lowers blood sugar?

Insulin lowers blood sugar.

6. Give one effect of drug abuse.

Drug abuse may cause addiction or hormonal imbalance.

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