



PHYSIOLOGY AND ITS PHYSIOLOGICAL CONTROL TO THE HUMAN BODY WITH REFERENCE TO ITS PSYCHOLOGY

Prof. (Dr.) Ashok Kumar Singh¹ & Dr. Anurag Upadhyay²

¹*Principal, K. B. P. G. College Mirzapur Affiliated M.G.K.V.P. Varanasi, Uttar Pradesh*

²*Assistant Professor, Department of Psychology, Vindhayavasini Mahavidyalaya, Bharuhana, Mirzapur Affiliated M. G. K. V. P. Varanasi Uttar Pradesh.*

ABSTRACT:

Human physiology is concerned with how cells, tissues and organ systems work together through various chemical and physical processes to support the functions of life. The study of physiology primarily revolves around the body's tendency to maintain homeostasis, the ability to maintain the state of a stable internal environment and ensure survival. In this article, we will provide an overview of the physiology of different organ systems and lay the foundation for a deeper understanding of the human body.

Keywords: *Special senses, General senses, Homeostasis, Nervous System, Negative Feedback, Sensors and Control Centres, Temperature Regulation, Blood Pressure Regulation, Blood Sugar Regulation*

INTRODUCTION:

In terms of structure and function, the human body is organized into six levels: chemical (atoms and molecules), cellular, tissue, organ, organ system and organism.

Several Systems:

Circulatory, respiratory, digestive, endocrine, urinary, musculoskeletal, nervous, reproductive, integumentary, immune and lymphatic. Each system plays an important role in maintaining the body's homeostasis and overall health. Homeostasis and feedback mechanisms are pivotal in maintaining physiological balance. The ability of the body to maintain a stable internal environment is achieved through various negative and positive feedback loops. These loops

constantly adjust body processes in response to internal and external changes to maintain systems at a set point. Another critical aspect of the human body is the management of body fluids and fluid compartments. Water plays a vital role in several physiological processes. It is distributed between intracellular and extracellular fluid compartments, each with distinct compositions crucial for cellular functions. The functional organization of the human body, homeostatic mechanisms, as well as the management of body fluids and fluid compartments are fundamental in understanding how the body operates and responds to its environment. The cell and its functions Cells are the basic living units of the human body. Each organ consists of various cell types, each uniquely adapted to carry out specific functions. The cell membrane is an integral component of the cell and is primarily composed of a bilayer of phospholipids, interspersed with proteins, cholesterol and carbohydrates. It regulates the transport of substances in and out of the cell, through various processes such as diffusion, osmosis and active transport. The cytoplasm is a jelly-like substance that fills the interior of the cell and is primarily composed of water, salts and organic molecules. It contains various organelles, such as the mitochondria (the powerhouse of the cell), endoplasmic reticulum (involved in protein and lipid synthesis), Golgi apparatus (which modifies, sorts and packages proteins and lipids) and lysosomes (which break down waste materials). The cytoskeleton of the cell, comprising microtubules, microfilaments and intermediate filaments, provides structural support and facilitates cellular movement. The cell nucleus contains chromatin and chromosomes and is the control centre for genetic information and protein synthesis. It regulates gene expression and mediates the replication of DNA through transcription and translation processes, utilizing RNA and ribosomes. Generally, cells undergo a complex series of stages for growth, DNA replication and division called the cell cycle. This cycle ensures accurate duplication and distribution of genetic material to daughter cells, with checkpoints that help maintain cellular integrity and prevent diseases like cancer.

SELECTION PROCESS:

The nervous system is a complex network of nerve cells (neurons) responsible for controlling and coordinating various functions throughout the body. It is broadly categorized into two main functional divisions: the central nervous system (CNS), composed of the brain and spinal cord and the peripheral nervous system (PNS), comprising all neural elements outside the CNS.

(Berretta, S., Heckers, S., & Benes, F. M. (2015). Searching human brain for mechanisms of psychiatric disorders. *Schizophrenia Research*, 167(1–3), 91–97.)

The nervous system contains two primary types of cells: neurons and glia. Neurons form the basic functional units of the nervous system and are responsible for transmitting and processing information through electrical and chemical impulses. Glial cells on the other hand, provide support, protection and nutrition to neurons and play a vital role in maintaining the overall health and efficiency of the nervous system.

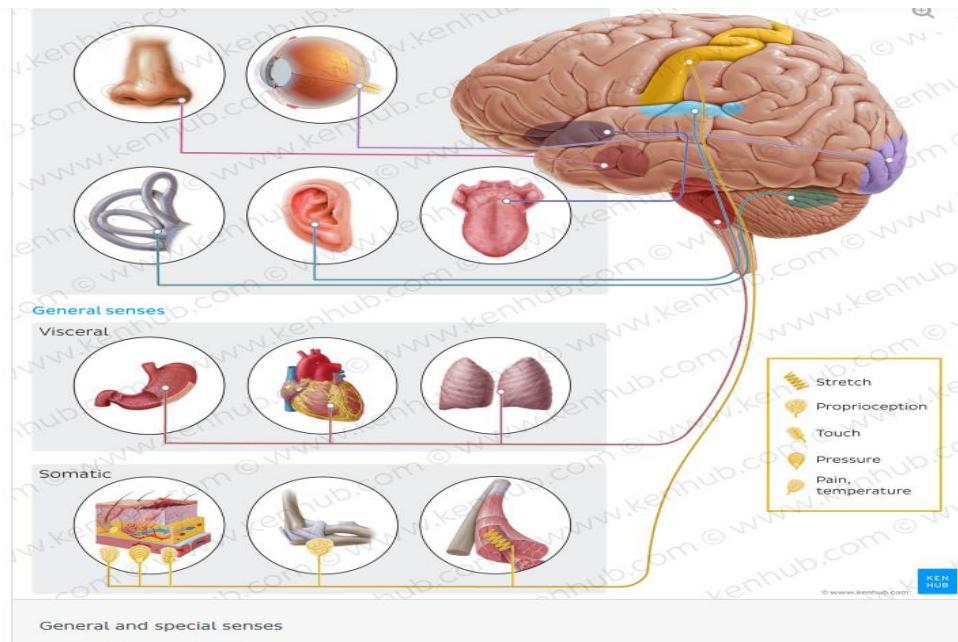
Action Potential and Synapses: Action potentials and synapses play a pivotal role in neural communication. An action potential, a swift change in a neuron's membrane charge, enables signal transmission. At neuronal synapses, where neurons connect, the action potential triggers the release of neurotransmitters, facilitating signal transfer between neurons. Neurotransmitters are key in conveying and regulating neural messages between nerves and target tissues throughout the nervous system. (Barnard, C. J. (1983). *Physiological mechanisms and behaviour*. In C. J. Barnard (Ed.), *Animal behaviour: Ecology and evolution* (pp. 11–59)

General Senses: The general senses of the human body encompass a range of sensations including temperature, pain, touch, stretch, pressure and vibration. These stimuli are detected by specialized sensory receptors distributed throughout the body. These receptors monitor and detect stimuli from both external and internal environments. Touch, stretch, pressure and vibration sensations are categorized under mechanoreceptive somatic senses, while pain and temperature sensations are categorized as nociceptive and chemoreceptive respectively. (Barnard, C. J. (1983). *Physiological mechanisms and behaviour*. In C. J. Barnard (Ed.), *Animal behaviour: Ecology and evolution* (pp. 11–59).

Special Senses: Special senses, including smell (olfaction), taste (gustation), vision, hearing and vestibular sensations (equilibrium), are essential for our interaction with the environment. Smell involves detecting airborne chemicals (odorants) by olfactory receptors, taste is mediated by taste buds which house gustatory receptors for different Flavors and vision processes light, colour and movement via photoreceptors in the retina to form visual images of objects in our environment. Hearing interprets sound waves via the spiral organ, while vestibular sensations in the inner ear are detected by the macula and crista ampullar is, specialized structures which are important for balance and spatial orientation. These senses enrich our experiences and perception of our

environment. (Feder, M. E., Bennett, A. F., & Huey, R. B. (2000). Evolutionary physiology. *Annual Review of Ecology and Systematics*, 31(1), 315–341.)

DISCUSSION:



Understanding Physiological Control:

- **Homeostasis:** Physiology revolves around the concept of homeostasis, the maintenance of a stable internal environment despite external changes. This involves regulating factors like body temperature, blood pressure, and blood sugar levels.
- **Nervous System:** The nervous system uses electrical and chemical signals to quickly transmit information and coordinate bodily functions. It's involved in reflexes, sensory input, and motor control.
- **Endocrine System:** The endocrine system uses hormones to regulate various physiological processes, including growth, metabolism, and reproduction.
- **Negative Feedback:** Many physiological control systems rely on negative feedback loops, where a change in a parameter triggers a response to return it to the normal range.
- **Sensors and Control Centres:** Control systems often involve sensors (receptors) that detect changes in a variable and control centres (like the brain) that process the information and initiate appropriate responses.
- **Effectors:** Effectors are the muscles or glands that carry out the responses initiated by the control centre.

Key Physiological Systems and Their Control:

- **Temperature Regulation:** The hypothalamus acts as a central control centre for body temperature, using mechanisms like sweating, shivering, and vasoconstriction/vasodilation to maintain a stable temperature.
- **Blood Pressure Regulation:** The baroreceptor reflex, located in blood vessels, senses changes in blood pressure and adjusts heart rate and blood vessel diameter to maintain a stable blood pressure.
- **Blood Sugar Regulation:** The pancreas releases hormones like insulin and glucagon to regulate blood sugar levels, ensuring a constant supply of energy to the body.

In summary, physiology is the study of how the body functions, and physiological control systems, particularly the nervous and endocrine systems, are essential for maintaining a stable internal environment and enabling the body to adapt to external stimuli. These systems rely on mechanisms like negative feedback, sensors, control centres, and effectors to regulate various bodily functions. (CNS), composed of the brain and spinal cord and the peripheral nervous system (PNS), comprising all neural elements outside the CNS. The nervous system contains two primary types of cells: neurons and glia. Neurons form the basic functional units of the nervous system and are responsible for transmitting and processing information through electrical and chemical impulses. Glial cells on the other hand, provide support, protection and nutrition to neurons and play a vital role in maintaining the overall health and efficiency of the nervous system.

Action Potential and Synapses:

Action potentials and synapses play a pivotal role in neural communication. An action potential, a swift change in a neuron's membrane charge, enables signal transmission. At neuronal synapses, where neurons connect, the action potential triggers the release of neurotransmitters, facilitating signal transfer between neurons. Neurotransmitters are key in conveying and regulating neural messages between nerves and target tissues throughout the nervous system.

General Senses:

The general senses of the human body encompass a range of sensations including temperature, pain, touch, stretch, pressure and vibration. These stimuli are detected by specialized sensory receptors distributed throughout the body. These receptors monitor and detect stimuli from both external and internal environments. Touch, stretch, pressure and vibration sensations are categorized

under mechanoreceptive somatic senses, while pain and temperature sensations are categorized as nociceptive and chemoreceptive respectively.

Special Senses:

Special senses, including smell (olfaction), taste (gustation), vision, hearing and vestibular sensations (equilibrium), are essential for our interaction with the environment. Smell involves detecting airborne chemicals (odorants) by olfactory receptors, taste is mediated by taste buds which house gustatory receptors for different Flavors and vision processes light, colour and movement via photoreceptors in the retina to form visual images of objects in our environment. Hearing interprets sound waves via the spiral organ, while vestibular sensations in the inner ear are detected by the macula and crista ampullar is, specialized structures which are important for balance and spatial orientation. These senses enrich our experiences and perception of our environment. (Berretta, S., Heckers, S., & Benes, F. M. (2015))

REFERENCES:

1. Barnard, C. J. (1983). Physiological mechanisms and behaviour. In C. J. Barnard (Ed.), *Animal behaviour: Ecology and evolution* (pp. 11–59).
2. Berens, A. E., Jensen, S. K. G., & Nelson, C. A. (2017). Biological embedding of childhood adversity: From physiological mechanisms to clinical implications. *BMC Medicine*, 15(1), 135.
3. Berretta, S., Heckers, S., & Benes, F. M. (2015). Searching human brain for mechanisms of psychiatric disorders. *Schizophrenia Research*, 167(1–3), 91–97.
4. Feder, M. E., Bennett, A. F., & Huey, R. B. (2000). Evolutionary physiology. *Annual Review of Ecology and Systematics*, 31(1), 315–341.
5. Gates, R. D., & Edmunds, P. J. (1999). The physiological mechanisms of acclimatization in tropical reef corals. *American Zoologist*, 39(1), 30–43.
6. Barnard, C. J. (1983). Physiological mechanisms and behaviour. In C. J. Barnard (Ed.), *Animal behaviour: Ecology and evolution* (pp. 11–59).
7. Berens, A. E., Jensen, S. K. G., & Nelson, C. A. (2017). Biological embedding of childhood adversity: From physiological mechanisms to clinical implications. *BMC Medicine*, 15(1), 135.
8. Berretta, S., Heckers, S., & Benes, F. M. (2015). Searching human brain for mechanisms of psychiatric disorders. *Schizophrenia Research*, 167(1–3), 91–97.