Unit title: Neurophysiology and Homeostatic Control of the Human Body

Unit code: **Y/601/0224**

QCF level: **5**

Credit value: **15**

Aim

This unit provides learners with an understanding of cellular communication via the central nervous system, homeostatic control mechanisms and how the human body organ systems maintain a constant internal environment.

Unit abstract

The ability to utilise underpinning knowledge and apply theoretical concepts to the practical elements of human physiology is fundamental for learners at this level of study.

Neurophysiology covers the nervous function ranging from individual nerve cells to the complex behaviours of the central nervous system. Additionally, the nervous system not only functions at the cellular and system levels, but also at a mechanistic level.

This unit provides learners with an understanding of cellular communication and homeostasis in the human body. Homeostasis is a function that maintains natural balances within the body. It is the ability, or tendency, of an organism or cell to maintain internal equilibrium by adjusting its physiological processes.

The unit considers the role of the central nervous system in communicating between tissues and organs. Detailed features of a neurone are discussed and learners will study the function of the central nervous system and consider how homeostatic control mechanisms are regulated.

Learning outcomes

On successful completion of this unit a learner will:

1 Understand the processes of nervous communication between distinct tissues and organs

2 Understand the components of the nervous system and homeostatic control

3 Understand the coordinated activity of organ systems in the maintenance of a constant internal environment.

Unit content

1 **Understand the processes of nervous communication between distinct tissues and organs**

Central nervous system: brain (cerebral hemispheres, hypothalamus, cerebellum and medulla oblongata); spinal cord (tracts and nuclei)

Structure of an individual neurone: dendrites; cell body; axon; terminal; sensory, motor neurones; interneurones; ionic basis of the resting membrane potential

Formation and transmission of an action potential: the all-or-none principle; initiation and propagation; saltatory conduction; synapse and synaptic transmission; principle of spatial and temporal summation

2 **Understand the components of the nervous system and homeostatic control**

Central nervous system: brain eg cerebrospinal fluid (CSF), cerebrum, hypothalamus, medulla oblongata, pons, the meninges (dura mater, arachnoid mater, pia mater); spinal cord eg vertebrae, transverse and spinal processes, spinal nerves, sensory (dorsal) roots, motor (ventral) root, dermatones

Peripheral nervous system: somatic nervous system (reflex arcs, efferent nerves, motor end plate, synapse, neurons, sensory organs, skeletal muscle); autonomic nervous system (sympathetic and parasympathetic activity)

Reflex arcs: monosynaptic and polysynaptic

Endocrine system: endocrine glands (pituitary, pancreas, ovaries, testes, thyroid, adrenal, hypothalamus); roles

Homeostatic control: positive and negative feedback mechanisms; homeostatic imbalance

3 **Understand the coordinated activity of organ systems in the maintenance of a constant internal environment**

Thermoregulation: body temperature; hypothermia/hyperthermia; the role of skin in temperature regulation

Osmoregulation: structure of the kidney (the nephron, glomerulus and Bowman's capsule, proximal convoluted tubule, loop of Henle, distal convoluted tubule); the influence of antidiuretic hormone (ADH); the role of osmoreceptors in the hypothalamus

Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:	**Assessment criteria for pass** The learner can:
LO1 Understand the processes of nervous communication between distinct tissues and organs	1.1 explain the structure of the central nervous system 1.2 explain the structure of the nerve cell 1.3 discuss the generation of a resting membrane potential 1.4 explain the formation and transmission of an action potential
LO2 Understand the components of the nervous system and homeostatic control	2.1 review the key functions of the central nervous system 2.2 review the key features of the peripheral nervous system and compare the structure of a monosynaptic (stretch reflex) and a polysynaptic reflex arc 2.3 discuss the relationship between the nervous system and the endocrine system 2.4 assess two different ways in which the body uses the nervous and endocrine system to gain homeostatic control
LO3 Understand the coordinated activity of organ systems in the maintenance of a constant internal environment	3.1 explain mechanisms of temperature regulation 3.2 review the process of osmoregulation.

Guidance

Links

This unit has particular links with the following units within this qualification:

- *Unit reference number T/601/0215: Cell Biology*
- *Unit reference number F/601/0217: Biochemistry of Macromolecules and Metabolic Pathways*
- *Unit reference number M/601/0228: The Immune Response System*
- *Unit reference number M/601/0231: Infectious Diseases*
- *Unit reference number K/601/0227: Pharmacological Principles of Drug Actions*

Delivery

Essential requirements

The use of practical work throughout each of the three learning outcomes is highly recommended. Learners should use clinical and/or fitness testing procedures in order to fully understand how the body responds to specific stimuli.

Assessment

In terms of assessment, the learning outcomes can be treated separately, although an integrated approach to delivery is possible. Assessment evidence may be in the form of assignments, laboratory reports, or practical investigations.

Resources

Learners will need access to well-equipped laboratory facilities, technical support, library and ICT resources.

Employer engagement and vocational contexts

Visits to laboratories and employers engaged in neurophysiological practice would facilitate learner understanding of the concepts developed in this unit. The use of research scientists as guest speakers would also put some theoretical aspects into context.

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