

Unit 31: Physiology of Co-ordination

Unit code:	L/600/8986
QCF Level 3:	BTEC Nationals
Credit value:	10
Guided learning hours:	60

● Aim and purpose

This unit aims to give learners an understanding of the physiology of the major body systems involved in the coordination of the human body. They will be able to gain an understanding of the effects of the nervous and endocrine systems and how these can be managed.

● Unit introduction

Coordination of the human body's activities is the function of two closely interrelated systems, the nervous and endocrine systems. Both accumulate information on the state of the internal and external environment, analyse the information and determine an appropriate response. Their activities complement one another as their systems operate using fundamentally different mechanisms.

This unit explores the coordination of the human body. Initially, learners will take an overview of the processes and systems involved in coordination and how they are integrated. Learners will then go on to investigate in detail the anatomy and physiology of the sense organs, and the nature of the information they receive. The structure of the central and autonomic nervous systems, and the characteristics of nervous tissue, will then be examined, including the transmission of nerve impulses along neurones and across synapses. The complementary actions of the endocrine system and specific hormones will be considered. Finally, disorders of these systems will be considered giving learners the opportunity to consider appropriate care strategies.

This unit builds on and further develop physiological knowledge gained in other units in the programme and completion of all these units will equip learners with a good understanding of the physiology of the major body systems to support progression to professional training into nursing and several of the professions allied to medicine.

● Learning outcomes

On completion of this unit a learner should:

- 1 Know how the body is coordinated
- 2 Understand the structure and function of the sense organs
- 3 Understand the physiology of the nervous system
- 4 Understand the physiology of the endocrine system
- 5 Understand the effects and management of disorders of the nervous and endocrine systems.

Unit content

1 Know how the body is coordinated

Environment: internal, external; reception of stimuli from the environment, eg raised carbon dioxide level in blood, light, sound

Nervous coordination: receptors – sense organs, electrical impulses along neural pathways; effectors – muscles (contraction); glands (secretion); specific target, fast and brief response

Endocrine coordination: endocrine glands, action of hormones, change in metabolic activities of body tissues; diffuse, slower and longer lasting response; feedback mechanisms

Integration: of nervous and endocrine coordination, eg role of hypothalamus and pituitary gland, role of adrenal medulla/actions of adrenaline, shock response

2 Understand the structure and function of the sense organs

Functions: sensations, eg touch, pressure, pain, temperature, taste, sight, hearing

Skin: sensory receptors: Meissner's corpuscles, Pacinian corpuscles, free nerve endings around hair follicles, distribution of cutaneous sensation

Olfactory and gustatory sense organs: taste buds, links between the two

Eye: structure and function of parts, retina (rods and cones), mechanism for adaptation to light intensity, focal length, colour vision, movements of eyes, visual cerebral cortex

Ear: structure and function of outer, middle and inner ear, organ of Corti, auditory cerebral cortex

3 Understand the physiology of the nervous system

Central nervous system: brain, spinal cord

Peripheral nervous system: cranial nerves, spinal nerves

Nervous tissue: neurone structure (sensory/afferent, motor/efferent accessory/intermediate); nerve fibres, myelin sheath, nodes of Ranvier; white matter, grey matter; major parts of the brain (medulla oblongata, cerebellum, thalamus, hypothalamus, cerebral cortex); spinal cord; meninges

Nerve pathways: reflex arc; afferent nerve fibres, efferent nerve fibres; transmission of a nerve impulse: resting potential, action potential, saltatory conduction, synapses, neurotransmitters; functioning of pain relief medication

Autonomic nervous system: sympathetic, parasympathetic; roles of each in regulating internal body functions, feedback mechanisms and homeostasis

4 Understand the physiology of the endocrine system

Endocrine glands: location in body, structure, secretions and actions at cellular level; pituitary gland (anterior and posterior), thyroid and parathyroid glands, adrenal gland (cortex and medulla), islets of Langerhans

Selected variables: diurnal variation (circadian rhythm), chronic emotional stress, shock, pain

5 Understand the effects and management of disorders of the nervous and endocrine systems

Disorders: endocrine systems, eg Diabetes (types I and II), hypo and hyperthyroidism, growth hormone disorders, Addison's disease, Cushing's syndrome; nervous system, eg multiple sclerosis, Parkinson's disease, motor neurone disease, sciatica, dementia and Alzheimer's disease

Care strategies: neurophysiology of medication, eg for pain relief, hormonal imbalance; behaviour change for stress management; first aid for shock response, eg from haemorrhage or anaphylaxis

Management of disorders: including medication and lifestyle

Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:	To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:
P1 describe the roles of the nervous and endocrine systems in the coordination of the human body [SM2;SM3; SM5]	M1 explain how nervous and endocrine system coordination is integrated	D1 analyse the roles of the sensory, nervous and endocrine systems in the maintenance of the normal functioning of internal organs and structures
P2 explain the structure of the sense organs in relation to their functioning [IE4; SM2; SM3; SM5]		
P3 explain the structure and functioning of the central, peripheral and autonomic nervous systems [IE4; SM2; SM3; SM5]		
P4 explain how the endocrine system contributes to the regulation of the body's internal activities [IE4; SM2; SM3; SM5]		
P5 explain the physiological responses made by the body to two selected variables [IE4; SM2; SM3; SM5]	M2 discuss the effects on the body when the endocrine and nervous systems function abnormally	D2 justify ways of managing the two disorders.
P6 explain the care strategies available to manage two disorders of the nervous and endocrine system.	M3 assess how the care strategies will minimise the effects of the two disorders.	

PLTS: This summary references where applicable, in the square brackets, the elements of the personal, learning and thinking skills which are embedded in the assessment of this unit. By achieving the criteria, learners will have demonstrated effective application of the referenced elements of the skills.

Key	IE – independent enquirers CT – creative thinkers	RL – reflective learners TW – team workers	SM – self-managers EP – effective participators
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Essential guidance for tutors

Delivery

This unit needs to be delivered by an appropriately qualified tutor. The unit could be introduced by reviewing existing scientific and physiological knowledge. Previous knowledge will include the characteristics of animal cells, the concept of receptor sites on cell membranes, growth, homeostasis and the concept of negative feedback. Knowledge of the structure of molecules and particularly the characteristics of ions, behaviour of light and sound waves will also be useful.

The need for internal coordination of the complex activities of the different parts of the body needs to be explored during the introduction to this unit. This can then be built on as delivery progresses to an exploration of the nervous and endocrine systems. Tutor input will also be helpful in ensuring a clear understanding of the integration of nervous and endocrine coordination, the interrelationships between the hypothalamus and the anterior pituitary gland, and the role of the autonomic nervous system. This can then be revisited at the end of the unit to allow learners opportunities to meet the merit and distinction criteria.

Tutor input will be needed to introduce new, complex topics, for example those associated with understanding the passage of nerve impulses. This input could be supported by practical demonstrations or with the use of videos/DVDs. Other learning activities that might be included in are small-group work and informal presentations on key topics, with small groups exploring different topics such as different sense organs or endocrine glands. Anatomical models could be used to aid understanding, for example the anatomy of the eye and ear. There are strong links here with *Unit 33: Physical Science for Health*, in which the functioning of the eye and ear are considered from a physical science viewpoint. That is, in terms of the focusing of light rays on the retina of the eye, and concepts such as pitch and loudness of sound and the range of human hearing.

Simple tests to map the distribution of cutaneous nerve endings on, for example, fingertips against the anterior and posterior aspects of the forearm, could also be included. Learners could also try reading material in Braille. Other practical work could include reaction times where learners calculate the rate of nerve impulse transmission and mapping taste areas of the tongue.

Case studies of patients with disorders could be used as an introduction to aspects of the nervous and endocrine systems as well as a means of assessment.

Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan demonstrates one way in planning the delivery and assessment of this unit.

Topic and suggested assignments/activities and/assessment
Unit introduction.
Learning outcome 1 Tutor input: roles of nervous and endocrine systems in the coordination of the human body should be introduced at the start of the unit and run as a thread throughout delivery. Case studies could be used to illustrate how the systems are integrated. NB: this learning outcome is probably best assessed at the end of the unit to give learners the opportunity to achieve the higher grades which require an understanding of how the systems are integrated.
Assignment 1: Coordination in the human body (P1, M1, D1)
Learning outcome 2 Learner research: the structure and function of different sense organs and present to the rest of the group. Workshop/demonstration: anatomical models would be useful ways of showing the structure of the eyes and ears. Practical work: taste maps of the tongue, cutaneous distribution of nerve endings of the fingertips and forearms. Access to material in Braille would also be an interesting practical activity.
Assignment 2: Sensory system (P2)
Learning outcome 3 Tutor input: an overview of the nervous system. Tutor input: the structure of nerve cells and conduction of impulses. Practical work: simple reaction time experiments to determine the speed of nerve impulse conduction. Guest speaker: introduction to nervous system disorders.
Assignment 3: Nervous system (P3)
Learning outcome 4 Group work: different endocrine organs and their secretions could be researched in small groups and presented to the rest of the group. Guest speaker: introduction to endocrine system disorders.
Assignment 4: Endocrine system (P4)
Learning outcome 5 Case studies/group work: disorders of the nervous and endocrine systems are probably best delivered after each of the relevant systems has been understood. Different disorders could be addressed through the use of case studies. Small groups could research different disorders and present their findings to the rest of the group to allow the unit content to be covered.
Assignment 5: Disorders of the nervous and endocrine systems (P5, P6, M2, M3, D2)
Unit review and assessment.

Assessment

It is expected that assessment evidence will be presented as written work with extensive use of annotated visual images. It would be expected that, if a diagram is required as the main focus of evidence, then the completed image presented by each learner should be an assimilation of data from several sources so that evidence is unique to each learner.

Learners should receive guidance on how to do this, for example adding supplementary images to explore a structural detail, additional labelling or written annotation, and preferably all of these for more-able learners. Data presented should be individual even when relying on visual images, for example presentations by the tutor of a diagram of the eye to be labelled is not acceptable. In designing assessment activities for inclusion in the assignment brief, tutors should consider carefully what format is appropriate in order to enable learners to include the detail required to demonstrate higher levels of achievement. Where analysis or evaluation is required, written evidence in the form of continuous prose, possibly using a report format, would be more appropriate to enable learners to develop coherent arguments and ideas.

Assessment evidence for this unit could be based on one holistic assignment, or a few smaller ones. The first assignment would be based on P1, M1 and D1 and may be best addressed at the end of the unit. Individual assignments could assess P2, P3 and P4. The final assignment would be the largest, based on P5, P6, M2, M3 and D2.

P1 requires an overview of the functions of the nervous and endocrine systems in the coordination of the human body, extended for M1 to include an explanation of how the two systems are integrated. D1 draws together many aspects of the unit, requiring learners to analyse the roles of the sensory, nervous and endocrine systems working in an integrated manner in the maintenance of normal functioning of internal organs and structures. In other words, how the three systems of the body work together in terms of receiving information about changes in the external/internal environments, and coordinating responses to these in order to protect the body and maintain cell environments within the ranges necessary for life.

Evidence for P2 will include annotated diagrams supported by written evidence. Evidence for P3 and P4 will include annotated diagrams supported by written evidence.

P5 requires learners to explain how the body responds to variations in the normal functioning of the nervous and endocrine systems. Learners must briefly explain how disorders manifest and for P6, to explain common care strategies for managing these disorders. This needs to be extended to assess how effects of the disorders can be minimised for M3. For M2, learners must discuss further effects on the body when the disorders manifest. To achieve D2, learners must consider the care strategies available and present a justification for which ones should be used to manage each of the disorders.

Programme of suggested assignments

The table below shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
		As part of your nursing training you are required to carry out a number of investigations.	
P1, M1, D1	Coordination in the human body	Using a case study describe how the nervous and endocrine systems are integrated. A good example would be of someone suffering from a pituitary problem which would link with either the thyroid or adrenal glands.	Essay linked to a case study.
P2	Sensory system	Carry out investigations into the functioning of skin, tongue and olfactory receptors. Write up your results and include annotated diagrams which explain the structure and function of the eyes and ears.	Practical report; annotated diagrams.
P3	Nervous system	Give a brief explanation of how nerve impulses are conducted, including synaptic transmissions and include an annotated diagram of the brain and spinal cord. Explain the autonomic nervous system giving examples of the effects of stimulation by each division on some of the body's organs.	Report and annotated diagrams.
P4	Endocrine system	Produce an annotated diagram of the main endocrine organs and their secretions, explaining how these secretions contribute to the regulation of the body's internal activities.	Annotated diagram.
P5, P6, M2, M3, D2	Disorders of the nervous and endocrine systems	Using given case studies, explain the effects and management of one disorder of the nervous system and one disorder of the endocrine system.	Case study and report.

Links to National Occupational Standards (NOS), other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC Health and Social Care sector suite (see *Appendix A*) and has links with units from other qualifications in that suite. See *Appendix E* for NOS links and *Appendix G* for a mapping of the NHS Knowledge and Skills Framework against particular units in this qualification.

Essential resources

The following resources are essential for delivery of this unit:

- an appropriately qualified tutor
- library resources with key texts and other reference materials.

In addition, the following resources are considered to be highly valuable:

- models/charts
- audio and visual records.

Indicative reading for learners

Textbooks

Clancy J and McVicar A – *Physiology and Anatomy: A Homeostatic Approach* (Hodder Arnold, 2002) ISBN 9780340762394

Kent M – *Advanced Biology (Advanced Science)* (Oxford University Press, 2000) ISBN 9780199141951

Myers B – *The Natural Sciences* (Nelson Thornes, 2004) ISBN 9780748785834

Ross J and Wilson K – *Anatomy and Physiology in Health and Illness* (Ninth Edition) (Churchill Livingstone, 2004) ISBN 9780443064685

Shaw L – *Anatomy and Physiology* (Nelson Thornes, 2004) ISBN 9780748785841

Stretch B and Whitehouse M – *BTEC Level 3 Nationals in Health and Social Care Student Book 1* (Pearson, 2010) ISBN 9781846907663

Stretch B and Whitehouse M – *BTEC Level 3 Nationals in Health and Social Care Student Book 2* (Pearson, 2010) ISBN 9781846907470

Toole A and S – *Understanding Biology for Advanced Level* (Nelson Thornes, 1999) ISBN 9780748739578

Tortora G – *Principles of Anatomy and Physiology* (John Wiley and Sons, 2005) ISBN 9780471718710

Ward J, Clarke R W and Linden R – *Physiology at a Glance* (Blackwell Publishing, 2005) ISBN 9781405113281

Journals and magazines

Biological Science

New Scientist

Nursing Times

Websites

www.bbc.co.uk/health

www.bbc.co.uk/science/humanbody

www.cellsalive.co.uk

www.innerbody.com/htm/body.html

BBC health

BBC science and nature – interactive body

Biology site

Human anatomy online

Delivery of personal, learning and thinking skills

The following table identifies the opportunities for personal, learning and thinking skills (PLTS) that have been included within the pass assessment criteria of this unit.

Skill	When learners are ...
Independent enquirers	[IE4] researching information to enable them to annotate diagrams; analysing and evaluating the information they find to judge its relevance and value
Self-managers	[SM2] planning in order to complete assignments on time [SM3] planning their time to complete assignments, prioritising actions [SM5] dealing with competing pressures.

● Functional Skills – Level 2

Skill	When learners are ...
ICT – Find and select information	
Select and use a variety of sources of information independently for a complex task	selecting information from a variety of sources for their assignments
Access, search for, select and use ICT-based information and evaluate its fitness for purpose	using search engines and assessing the relevance of the information retrieved
ICT – Develop, present and communicate information	
Bring together information to suit content and purpose	bringing together and organising components of images and text when annotating diagrams
Present information in ways that are fit for purpose and audience	proofreading written work to ensure accuracy using an accepted convention when producing practical reports on their experiments
English	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	researching different disorders of the nervous and endocrine systems, delivering presentations and contributing to group discussions
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	researching for assignments obtaining relevant information from a variety of sources and summarising it.
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	