

Unit 11: Functional Physiology of Human Body Systems

Delivery guidance

Approaching the unit

Physiology – the study of the physical and chemical systems in the human body – is a fascinating topic. Many learners looking for a career in nursing, medical, sports or veterinary sciences will be interested and excited by the topics in this unit, including the digestive, endocrine and nervous systems, and the role of homeostasis. Learners will need to research the systems to understand how they function normally.

Further research to gain an understanding of what can go wrong and the impact this may have on the health of the human body will be required. Some learners may have personal experience of disease and dysfunction of one or more of the systems, and sensitivity will be required when approaching the unit. Learners will need to develop an understanding of the treatments that may be available to alleviate, if not cure, some of the conditions that have been identified and researched. Access to a wide range of textbooks, journals, scientific magazines and the internet should be available to learners.

Along with opportunities for learners to engage in practical work, it is possible to use a wide range of delivery methods in this unit, for example:

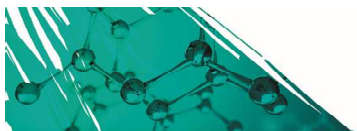
- use of models, practical work and simulations to assist understanding of the complex mechanisms involved in the three systems, and to help engage learners
- encouraging learners to create case studies, based on real or fictional characters, in order to demonstrate the impact of disease or dysfunction
- TV documentaries and newspaper articles about dysfunction and advances in treatments to give stimulus material for further research
- discussions in small groups to explore the issue of dysfunction and its impact
- opportunities to discuss conditions and treatments with practitioners diagnosing, treating or supporting people suffering from conditions
- dissection of animal tissues (although not required by the unit, this may be beneficial in helping learners to understand, for example, the structure of nerve fibres)
- opportunities to discuss conditions and treatments with affected individuals.

Learners can undertake group work, particularly in the teaching and learning stage, to ensure coverage of all the unit content. All learners must then produce their own individual evidence and present it for submission and assessment in their own way.

Delivering the learning aims

Learners need to undertake practical work, and assessors will assess and validate this for the unit. Centres must ensure they comply with all health and safety guidance and regulations. Learners should be encouraged to risk assess practical work to help ensure they are aware of the safety issues and follow the relevant procedures and guidelines.

There is opportunity for dissection within this unit. Specific groups of learners or tutors, for



ethical, religious or other reasons, may not feel that they are able to undertake dissection work. If practical dissection is not undertaken, suitable alternatives to enable learners to gain a full understanding of the anatomy and physiology of the body systems studied in the unit content should be available. This could involve the use of documentaries on dissections/operations, computer-generated simulations and model making.

For **learning aim A**, the digestive system and sources of nutrients in the diet should be familiar to learners from Level 1/2 work. You can establish learners' prior knowledge by having small groups working to make models and/or posters of the digestive system. Learners can then use these as the basis for discussion about the role of the components. Your input and secondary sources can be accessed to extend knowledge and understanding to meet the requirements of the level 3 programme and unit content. Learners should undertake practical work investigating the action of enzymes to emphasise chemical digestion in the various parts of the digestive system. You can use Visking tubing to model movement of the products of digestion from the gut into the blood.

Photomicrographs will aid understanding of the structure and adaptations of the small intestine to facilitate absorption. Simulations from the internet are available to model diffusion, facilitated diffusion and active uptake of digested nutrients for assimilation.

Learners should establish the sources of nutrients in the diet so will require opportunities to refresh and practise techniques for testing foods. Flame tests and testing for non-reducing sugars and vitamin C content of foods may not be familiar to learners.

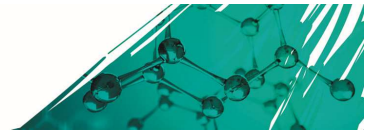
Opportunities for them to acquire and practise these skills and to understand their relevance will need to be available to learners. Some learners may have personal experience of disorders and dysfunctions of the digestive system and may be keen to understand and know more about the cause and treatments.

Others will have little or no experience. During teaching and learning, pairing learners with and without experience of specific diseases/dysfunctions will allow learners to collaborate and discuss the issues, carry out additional research to address misunderstandings and identify corrective treatments and their effectiveness. This will then need to be used to submit independent and individual evidence for assessment.

For **learning aim B**, learners could work collaboratively to produce annotated posters to show the position and function of the endocrine organs. Small groups of learners could each be assigned an endocrine organ to research and present to the class to build up a large-scale outline model of the human body. Learners should be encouraged to research and include information about the difference between exocrine and endocrine and exocrine/endocrine glands. The presentations should include accurate use of terminology and the location, structure, function and disorders associated with the endocrine organs.

Practical work assessing reflex actions will allow a recap of Level 1/2 work on the structure and give an interesting and engaging start to work on the nervous system. Making model neurons to construct a reflex arc using liquorice sweets (or string) and modelling clay will embed their structure and prompt discussion about function. Animations and simulations available on the internet can also be accessed. Learners could attempt to make their own animations.

You should source anatomical models of the brain, spinal column and diagrams of the peripheral nervous system to allow learners to understand and analyse the organisation and function of the component parts. You must cover the function of the components of



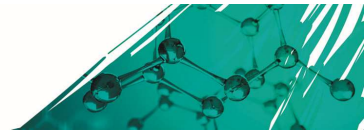
the systems, along with changes and the impact of the changes that occur throughout life. Learners must explore the relationship between the endocrine and nervous systems. Advantages and disadvantages should be considered. Learners should understand and analyse developmental milestones and evaluate their impact. You should encourage learners to consider individuals that they know who are at different life stages (younger and older) – siblings, parents, grandparents and possibly great grandparents – and how the two systems are similar and different for each of the life stages. Learners should research the causes and symptoms of Parkinson’s disease, multiple sclerosis and motor neurone disease.

For **learning aim C**, learners will need to be familiar with the terminology associated with homeostasis. They need to understand examples of positive and negative feedback. Accessing animations on the internet can assist understanding. Learners must explore and understand the role of the nervous and endocrine systems in maintaining homeostasis and factors affecting homeostasis. You could task pairs or small groups of learners with researching aspects of the interrelationship between the nervous and endocrine systems to produce posters or PowerPoint presentations of their findings.



Assessment Model

Learning aim	Key content areas	Recommended assessment approach
<p>A Explore the physiology of the digestive system and the use of corrective treatments for dietary related diseases</p>	<p>A1 Structure of the digestive system</p> <p>A2 Function of the digestive system</p> <p>A3 Health matters and treatments related to the digestive system</p>	<p>A lab book/record of investigations modelling the functioning of the various parts of the digestive system. Photographs and information from the investigations will be used to create an information leaflet that explains the role and location of organs and evaluates dietary disorder in the system and possible treatments.</p> <p>Observation records of practical work undertaken to assess the nutrient content of food will be required. Evidence and conclusions from the investigations will be incorporated.</p>
<p>B Understand the structure, function and disorders of the endocrine and nervous systems</p>	<p>B1 Endocrine system</p> <p>B2 Disorders of the endocrine system</p> <p>B3 Nervous system</p> <p>B4 Disorders of the nervous system</p>	<p>A booklet which:</p> <ul style="list-style-type: none"> • explains the organisation and role of the endocrine and nervous systems and analyses the changes that occur throughout the life of individuals • discusses the impact of overproduction and underproduction of hormones • discusses the advantages/ disadvantages of the nervous system.
<p>C Understand the role of homeostasis in controlling and coordinating the body systems</p>	<p>C1 Homeostasis</p> <p>C2 Interrelationship between nervous and endocrine system</p> <p>C3 Disturbance of homeostasis</p>	<p>A leaflet which explains the relationship between the nervous and endocrine systems in maintaining homeostasis and analyses the disruptive effects of some substances on homeostasis.</p>



Assessment guidance

This is an internally assessed unit with one practically assessed criterion which requires learners to correctly carry out investigations to establish sources of key nutrients for a balanced diet.

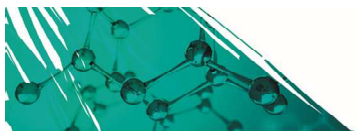
There is a maximum of three summative assignments for the unit – one for each learning aim. A holistic approach to the pass, merit and distinction criteria is required.

Learners must provide independent, valid and authentic evidence to meet the assessment criteria. Secondary sources must be referenced and learners are expected to include a bibliography.

For learning aim A, evidence could be tables of results, photographs/video of tests, and/or a write up of the practical work undertaken. Observation records are not sufficient on their own; there must always be learner-generated evidence available for standards verification. Information describing, explaining and analysing the role of the digestive system and symptoms of nutrient deficiency as a result of dietary -related disease is also required. Corrective treatments for nutrient deficiency must be explained and the effect of a diet related disease and its corrective treatments must be evaluated. Learners could produce the evaluative evidence of the impact of named nutritional deficiency and corrective treatments as a case study. Assessor input may be required to ensure that each learner chooses an appropriate disorder to allow the assessment guidance to be met for the distinction criterion. Different learners should be focusing on different disorders in order to help ensure work is authentic and valid. Learners will need to cite their references.

For learning aim B, learners must explain the organisation of the endocrine and nervous systems and analyse how they are interrelated. They must evaluate the impact of changes to each system as a result of disorders of the system as a result of age/degeneration disorders.

For learning aim C, the need for homeostasis and its purpose must be explained and the relationship between the endocrine and nervous system in maintaining homeostasis must be analysed. Disruptive effects on homeostasis of two factors from ageing, deficiency, toxicity, genetics, lifestyle must be evaluated.



Getting started

This gives you a starting place for one way of delivering the unit, based around the recommended assessment approach in the specification.

Unit 11: Functional Physiology of Human Body Systems

Introduction

Splitting learners into pairs or small groups to map their current understanding of each of the three learning aims would elicit information about current learner knowledge and understanding, and assist planning for delivery of the unit.

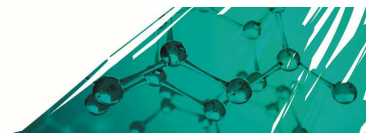
Learners could produce mind maps or have a topic list of simplified unit content to identify current knowledge in terms of 'good understanding', 'heard of it' or 'no understanding'. Encourage discussion between learners about the topics/unit content, in particular about dysfunctions, the impact on quality of life, and treatments and their impact/availability.

It may be expedient to do this for each learning aim separately, as you are due to deliver them, rather than covering all three at the start of the unit.

Learning aim A – Explore the physiology of the digestive system and the use of corrective treatments for dietary related diseases

A1 and A2

- Learners should be familiar with the structure and function of the digestive system and some food tests from previous studies. Recall of this may be required. You (or a learner) wearing a long T-shirt with a representation of the digestive system painted/sewn on could spark interest and encourage discussion as an introductory activity.
- Production of a model gut using plastic pipe and outlines of digestive organs could be an exciting activity if learners are not familiar with it from previous work. Photographs could be taken for inclusion in the work to be produced for assessment.
- Use of an anatomical model of the digestive system, or a dissection or video of a dissection, would help learners appreciate the proximity of organs to each other and the overall scale of the digestive system.
- Producing a life-size poster of the digestive system and annotating the parts and their function in chemical/physical digestion would allow learners to demonstrate and build on their previous knowledge.
- To support learners in explaining the role of digestive enzymes on nutrient uptake, opportunities for practical work on hydrolysis and assimilation should be undertaken. This is an opportunity to encourage learners to work collaboratively in pairs or groups to develop investigative skills. You should cover the full range of enzymes in the unit content. Different groups of learners can investigate different enzymes and report their findings to the whole class.
- Videos, simulations and photomicrographs will help visual learners understand the structure and relevance of the adaptations found in the digestive system for absorption, active transport and diffusion of nutrients to occur.
- Consider the use of Visking tubing to simulate the gut in practical investigations.



A3

- Practical work will need to be undertaken to familiarise learners with skills and techniques involved in testing for nutrients in foods. Learners will need to have the opportunity to acquire skills and techniques in carrying out flame tests and testing for non-reducing sugars and vitamin C. You should encourage learners to develop recording techniques and to be analytical in their approach to recording results, taking into account how a quantitative analysis can be achieved.
- There will need to be a formal opportunity for learners to be assessed individually on their skills in carrying out investigations to establish sources of the key ingredients/macronutrients of a balanced diet, as indicated in the unit content. The assessor will need to validate the assessed practical work and learners will need to record their findings in the evidence submitted for assessment. The food substances used for assessment should be different to those used for teaching and learning. A range of substances should be available so that not all learners are using the same substances, to help ensure valid and authentic evidence is produced.
- Opportunities for learners to research how and why deficiency diseases occur must be available. Some learners may have personal knowledge and/or experience of diseases like coeliac disease, irritable bowel syndrome or colitis and may wish to concentrate their research on these conditions. Encourage learners to research a wider range of deficiency diseases to cover the unit content. Groups of learners can focus on different nutrients and related deficiency diseases and then present their findings to the class.
- Research work using information leaflets, scientific journals and textbooks will need to be undertaken to allow learners to familiarise themselves with corrective treatments on human health. Encourage learners to produce bibliographies.

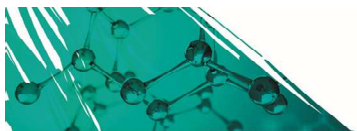
Learning aim B – Understand the structure, function and disorders of the endocrine and nervous systems

B1

- Introduce and review the endocrine system using a song about it. These can be found on the internet. Ask learners, individually or collaboratively, to produce a poster (possibly life-sized) to identify the position and function of endocrine and exocrine glands in the body.
- Use practical activities investigating reflex actions – e.g. pupil reflex, knee jerk, catching a ruler – to introduce the nervous system.

B3

- Making models of neurons and linking them to form a reflex arc would engage kinaesthetic learners and allow visualisation of the process.
- Microscopy to look at neurons, spinal cord and other nervous tissue, alongside photomicrographs and textbook diagrams, would help learners understand the structure of the components of the nervous system.
- Animation and simulations available on the internet will help learners visualise the reflex arc and transmission of nervous impulses.
- Anatomical models of the brain and spinal cord will give an insight into their structure, which you can link through discussion to their function.
- Ask learners to work in small groups to research and present their findings to the class on the autonomic system and the role of neurotransmitters.



- Have learners undertake individual research into neurological disorders.

B2 and B4

- You will also need to cover the impact on health of the dysfunction for each system. Allocate groups a different system to research the effects of dysfunction. Secondary sources will need to be accessed to allow learners to identify 'normal' parameters.
- Tutor-led questioning and discussion will allow learners to focus on and analyse the impact each system may have on the other systems. Encourage learners to access secondary source materials, textbooks, scientific journals and research articles and use these in their evidence for assessment.
- Encourage learners to research developmental milestones and the development of gross and fine motor skills.
- Changes to the endocrine and nervous systems throughout a person's life will need to be researched. Encourage learners to produce case studies of individuals and share these as part of teaching and learning. Sensitivity will be required as some learners may have personal experience of the disorders being discussed.
- Learners need to understand the impact of changes at puberty and menopause, and to evaluate the emotional and intellectual changes and impact.

Learning aim C – Understand the role of homeostasis in controlling and coordinating the body systems

C1

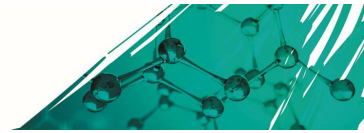
- Start by introducing the topic of homeostasis. Give an overview of its purpose and how different body systems are interrelated to maintain it, along with the impact different factors can have (disruption of homeostasis) throughout a person's life.
- Use card games to ensure familiarity with terminology for starter/plenary sessions. Encourage learners to produce these for themselves with definitions on one set of coloured cards (or on one side of a card) and the word being defined on a different coloured card (or on the reverse of the definition card).
- Animations and simulations of feedback loops from the internet can be helpful to consolidate understanding of positive and negative feedback loops and their importance and relevance to control and coordination.

C2

- Use a daily activity such as walking or getting dressed to give an insight into how systems work together and are controlled and coordinated.
- Ask learners individually to research examples of the relationship between the nervous and endocrine systems in establishing and maintaining a stable environment (breathing, heart rate, fight and flight, hunger, sleep, control of secretion of hormones from major endocrine glands) and present their findings for peer assessment and review.

C3

- Have learners research lifestyle activities, nutrition, physical activity, drug/alcohol abuse and the disturbance to homeostasis they cause. Encourage learners to select an athlete or high profile cases from news articles to demonstrate the issues that can arise in a person's life to disturb and disrupt this process.



Details of links to other BTEC units and qualifications, and to other relevant units/qualifications

This unit links to:

- Unit 1: Principles and Applications of Biology I
- Unit 5: Principles and Applications of Biology II
- Unit 9: Biomedical Science
- Unit 12: Human Regulation and Reproduction
- Unit 15: Diseases and Infections.

Resources

In addition to the resources listed below, publishers are likely to produce Pearson-endorsed textbooks that support this unit of the BTEC International L3 Qualifications in Applied Science. Check the Pearson website (<http://qualifications.pearson.com/endorsed-resources>) for more information as titles achieve endorsement.

Textbooks

Hartley, J, Annets, F, Meunier, C, Llewellyn, R, Hocking, S, Peers, A and Parmar, C – *BTEC Nationals Applied Science: Student Book Level 3* (Pearson, 2016) ISBN 9781292134093. This book is a useful general reference and contains sections on the musculoskeletal system, lymphatic system and digestive system.

Videos

Digestive system:

'Digestive System Anatomy Lecture' – introduction to structure of the alimentary canal and its modifications

'Protein Digestion and Absorption' – a ten-minute video about digestion and absorption of protein

'What is Crohn's disease?' - a four-minute video about Crohn's disease and its effects on the digestive system

Nervous system:

'The Nervous System in 9 Minutes'

'Nervous System Overview'

Websites

Visit the Anatomy Physiology Study Guide website; this site has a number of tracks and lyrics to help learners understand physiology.

Visit coeliac.org – most conditions/disabilities have a support group, which is a good starting place for learners to obtain information and details of research.

Visit the Biology-Resources website and search 'Biology Experiments' for teaching and learning resources by D G Mackean. Experimental work in biology, available for download. Includes enzyme practicals.

Visit the Medline Plus website and search 'Ageing changes in the nervous system'.

Visit the Medline Plus website and search 'Ageing changes in hormone production'.



Visit the MSD Manual Consumer Version website and search 'Effects of Ageing on the Nervous System'.

Visit the PubMed Central website and search 'The physiology of endocrine systems with ageing'.

Pearson is not responsible for the content of any external internet sites. It is essential for tutors to preview each website before using it in class so as to ensure that the URL is still accurate, relevant and appropriate. We suggest that tutors bookmark useful websites and consider enabling students to access them through the school/college intranet.