# Unit 5: Anatomy and Physiology for Health and Social Care

**Unit code:** R/600/8956

**QCF Level 3:** BTEC Nationals

**Credit value:** 10

**Guided learning hours:** 60

## Aim and purpose

This unit aims to enable learners to understand aspects of the anatomy and physiology of human body systems. Learners will be able to gain an overview of the organisation of the human body before looking at how body systems work together to provide energy for the body. Learners will have the opportunity to investigate how homeostatic mechanisms operate in the body.

## Unit introduction

This unit introduces core knowledge of cellular structure and function, and the organisation of the body as a whole, and then builds on this to develop a more detailed knowledge of the fine anatomy and physiology of the systems involved in energy metabolism.

Learners will examine the homeostatic mechanisms involved in regulating these systems to maintain health. Learners will be given the opportunity to undertake practical activities which will require them to take measurements of the cardio-vascular system, the respiratory system and of body temperature, using non-invasive techniques to investigate normal responses to routine variations in body functioning.

This unit provides the core understanding of human physiology that underpins the study of the specialist physiology units within this programme. The unit also provides an overview of body functioning that is valuable for anyone working or intending to work in a field relating to health and social care.

## Learning outcomes

**On completion of this unit a learner should:**

1 Know the organisation of the human body

2 Understand the functioning of the body systems associated with energy metabolism

3 Understand how homeostatic mechanisms operate in the maintenance of an internal environment

4 Be able to interpret data obtained from monitoring routine activities with reference to the functioning of healthy body systems.

# Unit content

## 1 Know the organisation of the human body

*Organisation*: cells; tissues; organs; systems

*Cells*: cell membrane, nucleus, cytoplasm; organelles – mitochondria, endoplasmic reticulum (smooth and rough), Golgi apparatus, lysosome

*Tissues*:

- epithelial: simple (cuboidal, columnar, squamous, ciliated), compound (simple, keratinised)
- connective: blood, cartilage, bone, areolar, adipose
- muscle: striated, non-striated, cardiac
- nervous: neurones, neoroglia
- examples of where each tissue type might be found

*Body organs*: location of heart, lungs, brain, stomach, liver, pancreas, duodenum, ileum, colon, kidneys, bladder, ovaries/testes, uterus; structure and function of the skin

*Systems*: gross structure of cardiovascular, respiratory, digestive, renal, nervous, endocrine, reproductive, lymphatic, musculo-skeletal, immune

*Main functions of systems*: overall function of each system, eg digestion of food materials, maintenance of oxygen supply, transport and supply of materials to cells, receptors of information from the environment, co-ordination, eliminating waste products, reproduction; overview of interactions of the different structures within each system

## 2 Understand the functioning of the body systems associated with energy metabolism

*Energy*: forms, eg chemical, heat, sound, electrical, light

*Energy laws*: conservation of energy; transformation of energy

*Energy metabolism*: role of energy in the body; anabolism and catabolism; activities involved in supplying energy to the cells of the body– roles of cardiovascular, respiratory and digestive systems

*Cardiovascular system*: heart – structure, cardiac cycle, heart rate, stroke volume, blood pressure, blood vessels– arteries, arterioles, capillaries, venules, veins; pulmonary and systemic circulation; structure and function of the blood

*Respiratory system*: role of air passages in nose; structure and functions of trachea, bronchi, lungs- bronchial tree, alveoli; role of ciliated epithelial tissue; respiratory muscles– intercostal muscles, diaphragm; ventilation, gaseous exchange, diffusion

*Digestive system*: alimentary canal – oesophagus, stomach, duodenum, ileum, colon; liver, pancreas, salivary glands; role of digestive system in breakdown and absorption of food materials, ingestion, peristalsis, digestion, absorption, egestion

*Role of enzymes in digestion*: amylases, proteases, lipases; sites of secretion; role in digestion

*Major products of digestion*: peptides and amino acids, sugars, glycerol and fatty acids; roles in the body; storage of excess fats and carbohydrates; deamination of excess proteins and the fate of end products; role of the liver; role of the kidneys

*Absorption of food*: into blood; into lacteals; role of villi and microvilli

## 3 Understand how homeostatic mechanisms operate in the maintenance of an internal environment

*Homeostasis*: definition of homeostasis, internal environment, concept of negative feedback as a regulatory mechanism

*Homeostatic mechanisms for regulation of:*

- heart rate: roles of internal receptors, autonomic nervous system-sympathetic and parasympathetic nerve supply, cardiac centre, sinoatrial node; effects of increased body temperature and adrenaline on heart rate
- breathing rate: roles of internal receptors, autonomic nervous system – sympathetic and parasympathetic nerve supply, respiratory centre, diaphragm and intercostal muscles
- body temperature: production of heat by the body, eg through metabolic processes; loss of heat by the body – radiation, conduction, convection, evaporation; roles of hypothalamus, autonomic nervous system – sympathetic and parasympathetic, skin – role of arterioles and sweat glands; effects of shivering; implications of surface area to volume ratios, eg in the care of babies; fever
- blood glucose levels: roles of pancreas, liver, insulin, glucagon

## 4 Be able to interpret data obtained from monitoring routine activities with reference to the functioning of healthy body systems

*Measurements*: pulse rate, breathing rate, temperature; normal values and ranges; safe practice in taking measurements, recognition of factors affecting reliability of measurements

*Normal variations*: as measured at rest and then at intervals during recovery following a standard exercise test, eg Harvard step test

*Data presentation and interpretation*: graphs and charts; supporting explanations of collated data

# 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** outline the functions of the main cell components [RL6; SM2; SM5; EP4] | | |
| **P2** outline the structure of the main tissues of the body [IE2; TW1; SM2; SM5] | | |
| **P3** outline the gross structure of all the main body systems [CT1; RL6; SM2; SM5] | | |
| **P4** explain the physiology of two named body systems in relation to energy metabolism in the body [CT4; RL6; SM2; SM5] | **M1** discuss the role of energy in the body | **D1** analyse how two body systems interrelate to perform a named function/ functions |
| **P5** explain the concept of homeostasis [CT4; SM2; SM5] | **M2** discuss the probable homeostatic responses to changes in the internal environment during exercise | **D2** evaluate the importance of homeostasis in maintaining the healthy functioning of the body. |
| **P6** follow guidelines to interpret collected data for heart rate, breathing rate and temperature before and after a standard period of exercise. [CT4; TW2; SM2; SM5] | **M3** present data collected before and after a standard period of exercise with reference to validity. | |

**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 | RL – reflective learners | SM – self-managers |
| | CT – creative thinkers | TW – team workers | EP – effective participators |

# Essential guidance for tutors

## Delivery

Learners need to develop an awareness of the human body and how it functions at various levels, as well as an understanding of how cells, tissues, organs and systems work together in the healthy functioning of the body. Learners need to develop an understanding of the organisation of the body as a whole in order to gain a firm basis for further studies or work within the health and social care sectors. However, a detailed understanding of all the systems of the body is not required for this unit. An overview of cellular structure is required and learners may wish to investigate this using practical strategies such as prepared histology slides and simple microscope work.

Learners may wish to investigate the organisation of the body at cellular and tissue level through small-group work and to present their findings. Learners should be given the opportunity to investigate and research the gross anatomy and function of all body systems using appropriate methods, and to discuss these in order to reinforce their understanding.

Learners need to investigate in more detail the three systems of the body that are involved in providing the necessary requirements for the release of energy within cells. The opportunity to include a brief investigation into the physical aspects of energy should be embedded in order for learners to fully understand the nature of energy and its role within the body.

When investigating these three systems learners should initially be given an overview of the systems and then directed to discover in more detail the specific components of the three systems which link to energy production. For the cardiovascular system this should include the role of blood and, in particular, the transport of materials within the plasma and haemoglobin. The focus for the respiratory system should be on the role of gaseous exchange with the opportunity to differentiate between internal and external respiration. For the digestive system learners need to understand the structure and function of the system including an overview of digestion, the role of enzymes, absorption and assimilation.

Learners need the opportunity to appreciate the importance of homeostasis and homeostatic mechanisms within the body. This could be linked to possible scenarios of what happens when homeostasis does not function correctly. Discussion of homeostasis and possible metabolic uses of the major products of digestion can be linked to diet, growth, exercise and weight change. Measurement of body temperature and breathing rate does not require more than standard clinical observation techniques and equipment available through a retailer

Guidance on the safe use of appropriate techniques should be provided for the practical activities, although learners should be encouraged to devise their own suitable exercise formats as appropriate. The standard exercise test used to generate the data for assessment needs to include a moderate level of exertion for learners carried out for a periods of 10 to 15 minutes, subject to individual capabilities. Examples should all follow appropriate health and safety guidelines.

It is recommended that learners take measurements before the exercise, immediately after cessation of the exercise, two to three further readings in the first five minutes of the recovery period, and then at longer intervals until readings have returned to pre-exercise levels.

Learners should be given an appropriate amount of time to both plan and carry out their practical activity.

Learners should be encouraged to be reflective and to develop their own independent enquiry at all times. They should also be encouraged to participate effectively within groups and to accept and provide feedback.

## 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**<br>Learner research: cell organelles.<br>Buzz group: on roles of organelles within the cell. |
| **Assignment 1: Structure of a typical cell (P1)**<br>Produce an annotated poster covering: nucleus, cytoplasm, mitochondria, endoplasmic reticulum (smooth and rough), Golgi apparatus, lysosome. |
| Tutor input: an outline of the four main tissue types found in the body with examples.<br>Learner research: specific tissues found within organs of the body. |
| **Assignment 2: The main tissue types of the body and the role these play in two named organs of the body (P2)**<br>Produce a written assignment which shows an understanding of the main tissue types and the role they play in two named organs: An outline of the four main tissue types and the role tissues play in two organs, which should be named. |
| Learner research: into all body systems and how these work.<br>Small-group work: investigate how two or more systems may perform together, with feedback to the main group. |
| **Assignment 3: The main body organs and their overall function (P3)**<br>Produce a series of annotated diagrams to provide an overview of each of the body systems.<br>An overview of each system and its general function. Inclusion of the main organs within the systems. |
| **Learning outcome 2**<br>Buzz group: reviewing systems covered in learning outcome 1 and their relevance to energy.<br>Discussion: related to the role of energy within the body.<br>Learner research: into energy production and utilisation<br>Tutor input: integration of two body systems. |
| **Assignment 4: The role of energy in the body (P4, M1, D1)**<br>Design and produce an information booklet covering an explanation of two of the respiratory, cardiovascular and digestive systems. An overview of how energy is utilised in the body and how the two named systems are linked to this utilisation. |
| **Learning outcome 3**<br>Buzz group: homeostatic processes in the body.<br>Small-group work: investigations: into how different homeostatic processes function. |

| Topic and suggested assignments/activities and/assessment |
| --- |
| **Learning outcome 4**<br><br>Practical activity: carry out an activity based on a standard period of exercise, observing health and safety considerations; produce a report of the data collected from the standard period of exercise using table and/or graphs. Include comments about the validity of the data.<br><br>Buzz group: the homeostatic responses of the body to exercise with links to data collected.<br><br>Learner research: the consequences of homeostatic responses not functioning adequately. |
| **Assignment 5: Homeostasis and how the body responds to exercise (P5, P6, M2, M3, D2)**<br><br>Plan, undertake and report on a period of activity: using a suitable activity and providing appropriately presented data. Use a logical argument to link theory to practice. Correlate the concept of homeostasis to the body's response to exercise. |
| Unit review and assessment. |

## Assessment

This unit should be delivered and assessed with an emphasis on linking theory to practice as much as possible.

The learning outcomes can be met through five different assessment assignments where learners are asked to produce their evidence using a variety of methods.

The poster evidence for Assignment 1 must be assessed/witnessed by the tutor and an observation/witness record must be completed detailing where learners have met the learning outcome and the tutor's written justification for this.

For P1, it may also be relevant to use a display of the poster/s and to photograph these as evidence. P2 could be met using group activities for research and presentation. If this is adopted the tutor should ensure that individual learners have contributed fully and that a witness/observation record is produced to this effect. For P3, an overview of each system is all that is required. To achieve P3 it is important that each system is covered.

P4 should relate to the production of energy and the process of cellular respiration. For M1, a more in-depth discussion of the cardiovascular, respiratory and digestive systems is required but with the focus on energy metabolism. D1 requires learners to analyse how two body systems interrelate in performing a particular function. This could be achieved by designing an information booklet for an athlete or a person with a restricted diet.

P6 should be led by a practical activity with reference to the control of heart rate, breathing rate, body temperature and blood glucose levels and will give learners the opportunity to link understanding from P5, M2 and D2. Learners may like to carry out their plans and investigations/research in small friendship groups, this is acceptable but final evidence for assessment must be individually produced pieces of work presented for M3.

You are encouraged to embed personal, learning and thinking Skills (PLTS) for as many opportunities as is appropriate within classroom-based activities, applied learning/contextualised activities and assessment.

### Programme of suggested assignments

The table below shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the assessment and 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 |
|---|---|---|---|
| P1 | Structure of a typical cell | Produce an annotated presentation for your peer group which will help them to understand the structure and function of a cell. | Poster/presentation/display and annotation/notes. |
| P2 | The main tissue types of the body and the role these play in two named organs of the body | Your study group has been asked to investigate different tissue types and then present their findings to the whole group. | Individual written report. |
| P3 | The main body organs and their overall function | You have been asked to prepare a series of diagrams for a display in the local health centre explaining how the body works. | Annotated diagrams.<br>A detailed outline of all the main body systems. |
| P4, M1, D1 | The role of energy in the body | As an adviser in the local sports centre you have been asked to prepare a booklet to explain to clients how the body requires and utilises energy. | An information booklet. |
| P5, P6, M2, M3, D2 | Homeostasis and how the body responds to exercise | You are a science technician supporting a colleague who is carrying out tests related to homeostasis. | Practical work.<br>Written 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

Learners will require access to full library facilities including textbooks, journals, professional magazines, relevant newspaper articles, electron micrographs and photographs. Anatomical models and interactive websites would be valuable. Learners will also require access to the internet, with tutor guidance to avoid inappropriate use and to make the best use of time.

For practical activities, it would also be beneficial, although not essential, to have laboratory access with microscopes available. It is essential that there is an appropriate facility for learners to undertake a period of exercise in a safe environment.

Equipment for practical tasks, such as clinical thermometers, will also be required.

## Employer engagement and vocational contexts

Visits from guest speakers such as laboratory technicians involved in the health sector would enhance the learning experience and give learners with opportunity to link theory to practice.

Visit a scientific laboratory, preferably linked to a health care setting, would also enhance the learning experience.

All learners should be given the opportunity to experience a health care setting in order to re-enforce the concepts of how the body functions. This could be incorporated in *Unit 6: Personal and Professional Development in Health and Social Care*, but if learners are not placed in a health setting to undertake their work placement, they should have the opportunity to visit such a setting.

Tutors should also investigate other opportunities for learners to access information from relevant areas as appropriate.

Centres are encouraged to make links with local organisations.

## Indicative reading for learners

### Textbooks


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

Crittenden M, Pope S, Shakels E, Thompson A, Thomson D – *BTEC National Health and Social Care Book 1* (Edexcel, 2007) ISBN 9781405868105

Givens P, Reiss M – *Human Biology and Health Studies* (Nelson Thornes, 2002) ISBN 9780174900603

Jenkins M – *Human Physiology and Health* (Hodder and Stoughton, 2000) ISBN 9780340658529

Mader S – *Understanding Human Anatomy and Physiology* (McGraw, 2004) ISBN 9780071111607

Minett P, Wayne D, Rubenstein D – *Human Form and Function* (Hyman, 1989) ISBN 9780713527148

Shaw L – *Anatomy and Physiology* (Nelson Thornes, 2005) ISBN 9780748785841

Stretch B – *Core Themes in Health and Social Care* (Heinemann, 2007) ISBN 9780435464257

Stretch B and Whitehouse M (editors) – *Health and Social Care Book 1* (Heinemann, 2007) ISBN 9780435499150

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

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

Wright D – *Human Physiology and Health* (Heinemann, 2007) ISBN 9780435633097

Wright D – *Human Biology* (Heinemann, 1989) ISBN 9780435599607


### Journals and magazines

*Biological Science Review*

*New Scientist*

*Nursing Times*

**Websites**

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|---|---|
| www.bbc.co.uk/schools/gesebitesize/biology | A simpler site for `bite size' biology |
| www.bbc.co.uk/science/humanbody | BBC resource page on the human body and mind |
| www.biologyguide.net | A level biology revision notes |
| www.getbodysmart.com | A fun site for interactive learning |
| homepage.smc.edu/wissmann paul/anatomy l | Information and anatomy photographs |
| www.instantanatomy.net/anatonomy.html | An interactive site with illustrations of the human body |
| www.le.ac.uk/pa/teach/va/anatomy/frmst/html | A biology information site |
| www.s-cool.co.uk/alavel/biology.html | An educational biology site |

## Delivery of personal, learning and thinking skills

The table below 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** | [IE2] planning and carrying out research, appreciating the consequences of decisions when researching the tissues of the body and linking them to specific named organs |
| **Creative thinkers** | [CT1] generating ideas and exploring possibilities when producing information about all the gross structures of the body systems<br><br>[CT4] questioning their own and others' assumptions when explaining the role of energy in the body and how specific body systems work to assist in this role; carrying out an activity and recording data |
| **Reflective learners** | [RL6] communicating their learning in relevant ways when preparing posters to demonstrate understanding of the structure of a cell; preparing the diagrams of the body systems to display in a health centre; producing an information booklet |
| **Team workers** | [TW1] collaborating with others to work towards a common goal when working in small groups to research the structure and function of different tissue types<br><br>[TW2] reaching agreements and managing decisions to achieve results when undertaking an exercise session and working in small groups to collect and record data |
| **Self-managers** | [SM2] working towards goals showing initiative and commitment perseverance, when preparing material in different formats to meet completion dates<br><br>[SM5] dealing with competing pressures, including personal and work-related demands when completing and submitting |
| **Effective participators** | [EP4] identifying improvements that would benefit others as well as themselves when preparing and reflecting on a variety of posters which have been displayed; taking part in physical activity. |

## Functional Skills – Level 2

| Skill | When learners are ... |
|---|---|
| **ICT – Use ICT systems** | |
| Select, interact with and use ICT systems independently for a complex task to meet a variety of needs | using ICT systems to investigate the structure and function of human body tissues and systems |
| Manage information storage to enable efficient retrieval | saving their notes and write ups from their investigations and research |
| Follow and understand the need for safety and security practices | making a copy of their stored work onto a pen drive/CD and using a password for security |
| **ICT – Find and select information** | |
| Access, search for, select and use ICT-based information and evaluate its fitness for purpose | using a variety of different websites in their research and investigations |
| **ICT – Develop, present and communicate information** | |
| Evaluate the selection and use of ICT tools and facilities used to present information | using ICT tools to present information in presentations and leaflets |
| **English** | |
| Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts | participating in class discussions<br>listening to staff and clients in a work-placement setting<br>listening to guest speakers and questioning them as appropriate |
| Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions | reading selected texts such as articles, reference books and handouts to extract the relevant information for each task |
| Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively | writing reports and content of the information booklet<br>annotating images, posters and leaflets. |