

## Unit 12: Human Regulation and Reproduction

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### Delivery guidance

Keeping the human body functioning at optimum performance is a big challenge. Many biochemical reactions will only work in a very narrow range of parameters. As humans, we constantly challenge ourselves to go faster, work harder, longer, and so on. This unit will allow learners to understand how homeostasis maintains a stable environment within the body for the nervous, cardiovascular, respiratory, endocrine and reproductive systems. It will also give opportunities to investigate homeostatic dysfunction.

Learners will have some familiarity with the structure and function of the human body's systems from previous work undertaken for GCSE or similar programmes. They will need to increase the depth and breadth of their knowledge and understanding to be able to assess the role of these systems in terms of how they are controlled and coordinated.

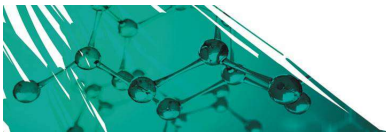
A variety of delivery methods is available to engage and motivate learners; for example:

- discussions – small group and class discussions will enable peer learning and encourage development of interpersonal skills
- practical work to study reflex actions, which will promote understanding and develop collaboration between learners, and skills in recording and analysing results
- use of images to show evidence/symptoms of homeostatic dysfunction, e.g. frostbite
- use of animations to show the healthy function of the cardiovascular system and respiratory system
- visiting speakers or visits to a local fertility clinic or health professional to discuss control of the cardiovascular or reproductive systems, to encourage communication skills and give a vocational context
- group work – this is acceptable during the teaching and learning phase. However, all learners must submit independently produced, valid and authentic work for assessment
- assessors could record TV documentaries and/or schools programmes on reproduction prior to delivery of the unit
- It may be necessary to order or obtain prepared microscope slides.
- It may be necessary to plan for visits to a gym or for visiting speakers to attend the centre.

### Approaching the unit

For **learning aim A**, learners should revisit and recap their knowledge from previous work undertaken for GCSE or similar programmes on the structure and function of neurons. Practical activities such as testing reaction time after drinking caffeine would engage learners to think about stimulus and response by effectors, and would give an interesting and engaging start to the unit. Making model neurons to construct a reflex arc using string and modelling clay will embed their structure and prompt discussion about function. Animations and simulations available on the internet can also be accessed.

Use anatomical models of the brain, spinal column, heart and lungs to allow learners to understand their anatomy. Some centres may wish to dissect a heart and lungs, but some learners and staff may prefer not to participate. Prepared slides of brain tissue, nervous tissue, neurons, cardiac muscle, alveoli, etc. could be observed by learners and compared with textbook and photomicrograph images.



Learners could carry out practical work to assess the effect of exercise on the cardiovascular system. Risk assessments must be carried out and health and safety guidance must be followed. A visit to a gym with monitoring equipment (spirometer) would allow learners to better understand inspiration, expiration and rate of ventilation. Your input, animations and access to secondary source material will be required to give learners access to the unfamiliar and new aspects of the unit content, i.e. the autonomic nervous system (sympathetic, parasympathetic systems) and cardiac cycle.

Learners will need your input about different neurological disorders and the impact that this has on movement and everyday life. Learners may wish to supplement this content with additional research; if so, they should reference their secondary sources.

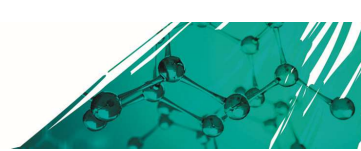
For **learning aim B**, learners could work collaboratively to produce annotated posters (ideally life-sized) to show the position and function of the endocrine organs. Encourage them to include information about the difference between exocrine and endocrine, and exocrine and endocrine glands.

Groups of learners could produce presentations about different homeostatic mechanisms – water, blood glucose and temperature. Your input and secondary sources will need to be available to extend learner knowledge. Each presentation must include feedback diagrams (positive/negative) as appropriate, identifying set point, receptors, coordinator(s) and effectors. For each homeostatic mechanism, learners will need to identify and discuss conditions caused by an imbalance in the homeostatic mechanism and how these can be managed. Learners could carry out practical work on testing blood glucose levels. (They will need to follow health and safety guidelines.)

For **learning aim C**, learners will need to recap the structure and function of the male and female reproductive systems. Opportunities to view live sperm under a microscope and videos, as well as studying photomicrographs, will allow learners to compare observed morphology with textbook diagrams. Your input will be required to ensure a full understanding of the role of hormones in gametogenesis, the menstrual cycle and conception. Graphic representation would aid understanding of the menstrual cycle and timescale.

Learners should be encouraged to consider and discuss factors that may affect fertility during all of the teaching for this unit. For example, when labelling parts of the male and female reproductive systems and learning their functions, give them 'Pause and think' question cards, e.g. 'What do you think would happen if there was a blockage in the oviduct?' or 'What do you think the impact of testosterone not being produced would be on spermatogenesis?'

Learners could undertake group work based on given scenarios, and then present their findings to the whole class about the efficacy of methods of promoting and methods of preventing conception. Learners should be encouraged to include recent local/national data relating to these topics.



### Assessment model

Learning aim	Key content areas	Recommended assessment approach
<b>A</b> Understand the interrelationship and nervous control of the cardiovascular and respiratory systems	<b>A1</b> Nervous system organisation <b>A2</b> Cardiovascular and respiratory system regulation and control	A report looking at the organisation and function of the human nervous system, along with the importance of coordinating the cardiovascular and respiratory systems.
<b>B</b> Understand the homeostatic mechanisms used by the human body	<b>B1</b> Feedback and control <b>B2</b> Glands and organs <b>B3</b> Homeostatic mechanisms <b>B4</b> Impact of an imbalance	A presentation on the mechanisms used to maintain homeostasis and the importance of normal homeostatic function.
<b>C</b> Understand the role of hormones in the regulation and control of the reproductive system	<b>C1</b> Structure and function of reproductive anatomy <b>C2</b> Reproductive processes	Learners put together a series of informative leaflets on the control of fertility.

### Assessment guidance

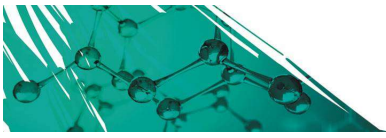
This is an internally assessed unit with a maximum of three summative assessments – one for each learning aim. Learners must give independent, valid and authentic evidence to meet the assessment criteria. Learners should reference any secondary sources and supply a bibliography.

Pearson-authorized assignment briefs are available and use a holistic approach, which gives access to all assessment criteria.

For learning aim A, learners must produce a report describing the organisation and function of the nervous system in relation to cardiovascular and respiratory requirements. Initiation and transmission of nervous impulses and coordination and control of the cardiovascular and respiratory systems must be explained and assessed.

For learning aim B, learners should provide a presentation describing how homeostatic mechanisms maintain normal function and explain the role of hormones in homeostatic mechanisms. The impact of homeostatic dysfunction on the human body must be analysed.

For learning aim C, a series of leaflets should be produced to describe the structure and function of the reproductive system and how hormones are involved in gamete production. The leaflets should contain an explanation of how at least four examples of infertility can develop as result of physiological or morphological changes. Learners must evaluate at least four different methods of hormonal control, both in preventing conception taking place and in managing infertility.



## Getting started

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

### Unit 12: Human Regulation and Reproduction

#### Introduction

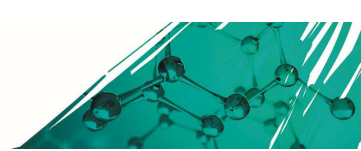
You could link this unit with a major sporting event (marathon, football, rugby, tennis, athletics) to put the idea of regulation of body systems and the requirement for homeostatic mechanisms into context. Critical thinking skills can be developed by asking learners to consider and discuss, for example:

- Why do we not have to think about heartbeat and breathing when we are asleep?
- How and why can we survive extreme internal (as a result of extreme activity) and external (as a result of factors like environmental temperatures) conditions?
- How do drugs like ecstasy and alcohol affect osmoregulation in the body?
- Why are some people unable to produce eggs or sperm?

### Learning aim A - Understand the interrelationship and nervous control of the cardiovascular and respiratory systems

#### A1

- Use practical activities investigating reflex actions – e.g. pupil reflex, knee jerk, catching a ruler – to introduce the unit.
- Making models of neurons and linking them to form a reflex arc would 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, spinal cord, heart and lungs (corrosion preparation of lungs) will give an insight into their structure, which you can link through discussion to their function.
- Undertake dissection to show the structure of the heart and lungs in relation to anatomical models and textbook diagrams.
- A visit to a gym with physiological measuring equipment or use of scientific practical equipment would allow learners to observe, measure and record changes to heart and breathing rate in relation to exercise.
- Use of an ECG recording would allow learners to follow and understand the cardiac cycle. Learners could include these recordings in the assessment evidence for interpretation.
- Secondary source material and your input will be required to allow learners to understand how the physiological changes are regulated by feedback mechanisms.
- Have learners work in small groups and use lesson material to present their findings to the class on the autonomic system and the role of neurotransmitters.



- Give learners scenarios/case studies including the symptoms and causes of different neurological conditions. Have them present their findings to the class.

### **A2**

- Use practical demonstrations to help learners visualise inspiration and expiration using breathing techniques which allow them to see changes in the thorax.
- Have learners make models of alveoli and annotate gas exchange in tissues and across alveoli walls, to get them to think about concentration gradients.
- Have learners use microscopy to look at different blood vessels, including arteries and veins, alongside photomicrographs and textbook diagrams, to help them understand about structure and elasticity.
- Animation and simulations available on the internet will help learners visualise the autonomic nervous system: sympathetic and parasympathetic.
- Use anatomical models of the brain structure to show the medulla oblongata, and link it to coordination.
- Secondary source material and your input will be required to allow learners to understand chemoreceptors and baroreceptors and their role in regulation.
- Ask learners to work in small groups, using lesson material given to them, and present their findings to the class on the role and action of Purkinje fibres, the bundle of His, and sinoatrial and atrioventricular nodes.
- Give learners scenarios/case studies including the symptoms and causes of different cardiovascular and respiratory conditions. Ask learners to present their findings to the class.

## **Learning aim B – Understand the homeostatic mechanisms used by the human body**

### **B2**

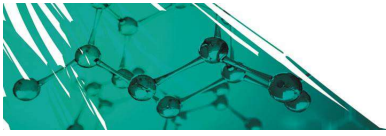
- Introduce this learning aim with images of the endocrine body system.
- Learners could produce a poster (ideally life-sized) to identify the position and function of the endocrine and exocrine glands in the body.

### **B1**

- Feedback mechanisms can be simulated by giving some learners appropriate body part labels (receptors and effectors) and other learners labels for water/glucose, heat, hormones and moving round the feedback loop.
- Secondary sources will need to be accessed to allow learners to identify 'normal' parameters.
- Tutor-led questioning, mind-mapping and discussion will allow learners to focus on and analyse the impact each system may have on the other systems.

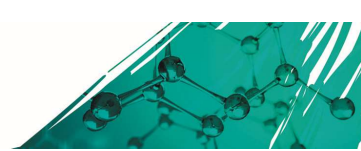
### **B3 and B4**

- Design lessons on each homeostatic mechanism and have learners complete class notes on water/osmoregulation, blood glucose, temperature regulation and how feedback mechanisms operate under normal circumstances.
- Use simulations and animations to allow learners to visualise the homeostatic processes.
- You will also need to cover the impact on health of dysfunction for each system. Give the learners resources on each area so they can make notes on the effects of dysfunction of each feedback mechanism.



**Learning aim C - Understand the role of hormones in the regulation and control of the reproductive system**

- Use media headlines about advances/breakthroughs in fertility treatment as stimulus material for discussion about control and regulation of the reproductive system.
- C1**
- Use interactive resources, PPTs and smart board activities (drop and drag) to identify the structure of the male and female reproductive systems. Your input will be needed to explain the function of each structure and associated hormones.
- C2**
- A visit to a local fertility clinic or a visit from personnel working there would add a vocational context to the unit and allow learners to develop their questioning and interpersonal skills.
  - Access to educational videos on reproductive technology and simulations/ animations of meiosis, gametogenesis, implantation and zygote development would allow learners to visualise the processes and gain a better understanding.



## 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 11: Functional Physiology of Human Body Systems.

## 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

*BTEC Nationals Applied Science: Student Book Level 3* (Pearson, 2016) ISBN 9781292134093. This book is an up-to-date reference with a range of supportive features to aid learning and teaching.

### Journals

*New Scientist*

*Scientific American*

*Nursing Times*

These technical journals require high-level reading skills and the ability to use and understand technical terms. They contain articles and the latest news and research into related topics.

### Videos

BBC Active publishes a range of interactive resources and videos to support schools in their delivery of science.

### Websites

Visit the website of the National Heart, Lung and Blood Institute – this US organisation promotes research, training and education for heart, lung and blood diseases. For a useful video showing animation of the cardiac cycle, search for 'health topics/electrical'.

Visit the website of the ABPI (Association of the British Pharmaceutical Industry), which offers curriculum resources for tutors and learners. The site contains animations and interactive content for many topics, including reproduction and hormones.

Visit the NHS or World Health Organization website and search for links to a variety of topics relevant to this unit, including artificial insemination, and hormonal and barrier methods of contraception. The site gives advice on how contraception works, how it is taken and who should not use contraception.

Visit the website of the Wellcome Trust charitable organisation – this website features science education resources, including a post-16 section to help young people engage with biomedical science.

*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 learners to access them through the school/college intranet.*