Unit 15: Diseases and Infections

Delivery guidance

Approaching the unit

For many learners, this will be the first opportunity they have had to explore the world of microbes, disease and infection. Most learners will be aware of 'bugs' and 'germs', and will know that people often become ill as a result of exposure to them. Understanding of the organisms that cause the diseases and infections that afflict us, and preventative treatments and cures, is often lacking.

This unit will allow learners to gain an understanding of five types of disease, their causes, possible prevention and how we try to treat them.

Outbreaks of infectious diseases like Bird Flu, SARS, Ebola and, more recently, COVID-19 (Corona virus) have caused global concerns about the possibility of pandemics and may motivate learners to want to know more about these infectious diseases and their causes.

Other learners may be keen to want to know more about non-infectious, but equally debilitating, degenerative, genetic, environmental and dietary diseases afflicting society today. Learners will have the opportunity to investigate some of these diseases, many of which are creating pressures on health services. The ability of the human body to respond and defend itself will also be studied.

Environmental pollutants and their effects on human health will be researched and described. Methods to reduce the effects of environmental pollution by global organisations will need to be analysed and evaluated.

There are opportunities for learners to undertake practical work, but there is no formal assessment of practical work in the unit.

Learners should be encouraged to 'read around' the subject, and they must access a range of secondary source materials. These should not be limited to textbooks, but should include the Internet, and scientific and popular science journals to ensure up-to-date information is used. Learners must reference sources they have accessed.

You can use a wide range of delivery methods to engage all types of learners and learning styles, for example:

- discussions, both as a class and in small groups, relating to research and developments in preventative and corrective treatments
- model-making to embed understanding of specific response mechanisms to disease and infection
- presentations of facts and information that individuals or small groups have researched to feed back to the rest of the class
- practical work on the transmission of pathogens
- use of simulations and software programmes to visualise the spread of infectious disease
- small group work to investigate global organisations involved in promoting clean energy sources, provision of waste management, reduction of the use of fertilisers and single-use plastics to decrease pollution and improve human health
- It may be possible to consider the inclusion of visits to or from practitioners involved in diagnosing and treating diseases, e.g. doctor, public health official, infection control nurse or environmental protection officer, visit to a diagnostic laboratory, etc.

Delivering the learning aims

Learning aim A requires learners to investigate and familiarise themselves with different types of diseases and infections that affect humans. Learners may have little prior knowledge and understanding of the five main types of pathogens, and diseases associated with them. Class discussion and mind mapping may be an effective way to establish knowledge and possible misunderstandings to help ensure effective delivery of the learning aim. Stimulus material from videos and TV programmes could be used to illustrate characteristics of pathogens and engage learners.

Dietary and genetic diseases should be more familiar to learners from previous work undertaken for GCSE or similar programmes. Assessment of prior learning using mind maps and vocabulary sheets for learners to indicate their own level of knowledge (as 'well known', 'some knowledge' or 'never heard of it') will give a baseline for each learner for progression. Many learners may have little first-hand experience of environmental diseases, but they may be familiar with recent outbreaks of drinking water contamination and might know people who have had skin cancer 'scares'.

Excerpts from TV programmes/documentaries, such as the *Embarrassing Bodies* (shown on the British Channel 4), can be a discussion point. Learners may have elderly relatives who have degenerative conditions, and may be able to communicate with other learners about these conditions and the issues they present. Group work and presentations to the class will allow learners to develop research and presentation/communication skills, and will enable the unit content to be covered. Learners can also use diseases with which they have some familiarity or interest for assessment purposes.

Learning aim B focuses attention on how infectious diseases are transmitted and how this can be prevented. There are opportunities for non-assessed practical work, as learners can swab surfaces and culture bacteria. (Health and safety guidance will need to be observed.) 'Sharing of body fluids' simulations can be undertaken. Discussion about preventative methods can lead learners to choose (or be given/select a card that lists) a method from the unit content to research, and then present this to the rest of the class. All learners should research an organisation involved in the management of infectious diseases, as suggested in the unit content, B3. Some learners may be interested in using software simulations/games to track the progress of an infectious disease from patient zero, or to try to track contacts from infected individuals back to patient zero.

Learning aim C requires learners to investigate causes of environmental pollution and the effects of pollutants on human health. This is very topical, and learners can be encouraged to watch documentaries, read articles, and research current global concerns about environmental pollutants and the harm they cause. It is important that learners concentrate on the impact on human health and do not get overly distracted by the effects on other organisms or the harm to the planet in their submissions for assessment.

Learners could work in small groups or pairs to research organisations and modern technologies aimed at reducing/solving the effects of environmental pollutants. Presenting their findings to the rest of the class will give opportunities for the development of intrapersonal skills.

It may be possible to arrange visiting speakers e.g. a doctor, public health official, infection control nurse or environmental protection officer, or a visit to a diagnostic laboratory, etc. Or virtual meetings could be arranged, allowing learners to question and discuss the issues with representatives from environmental agencies and/or global organisations.

For **learning aim D**, learners will have some knowledge of human defence mechanisms from previous work undertaken for International GCSE or similar programmes. There are opportunities for kinaesthetic and visual learners to produce models of different lymphocytes or antigens to explore the mechanisms by which the body is protected. Learners could undertake practical work on antigen/antibody specificity. Aural learners could produce a poem, song or rap of the associated vocabulary and actions of the defence mechanism.

Summary of the unit

Learning aim	Key content areas	Recommended assessment approach
A Investigate different types of diseases and infections that can affect humans	**A1** Pathogens and infectious diseases **A2** Dietary diseases **A3** Genetic and degenerative diseases **A4** Progression of disease over time	Having researched a variety of infectious and non- infectious diseases, learners could produce case studies relating to their chosen diseases. The case studies would detail the causes and the effects the disease can have on body systems over time. The effect on the quality of life of the individual suffering from the disease must also be evaluated.
B Examine the transmission of infectious diseases and how this can be prevented	**B1** Methods by which infectious diseases can be spread **B2** Methods by which infectious diseases can be prevented from spreading **B3** Management of infectious diseases	In addition to research work, practical work and simulations should be used to ensure that learners are familiar with the methods by which infectious diseases can be transmitted. Prevention of transmission at a personal level and by organisations must be researched. A report or information leaflet can be produced as evidence.
C Investigate causes of environmental pollution and the effects of pollutants on human health	**C1** Water pollution **C2** Air pollution **C3** Radioactivity	Learners produce a detailed report examining how the introduction of contaminants into the natural environment causes risk to human health.
D Understand how the human body responds to diseases and infections	**D1** Defence mechanisms **D2** Non-specific **D3** Specific	Information leaflets detailing and comparing the components of the two defense mechanisms and their mode of action could be produced.

Assessment guidance

This is an internally assessed unit with a maximum of four 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.

For Learning Aim A, each learner must create case studies that explain the characteristics of the five types of pathogen and a disease associated with each type. They must explain causes of a non-infectious disease from each of the four categories. Learners can choose diseases other than those in the unit content to allow them to explore areas of interest or experience. To access higher grades they will need to assess the effect of a named infectious and non-infectious disease on body systems, and analyse how each will progress over time in relation to the effects that they will have on an individual.

For Learning Aim B, learners must use research to create a report or information leaflet which explains how infectious diseases can be transmitted. To access higher grades, learners must assess how they can be prevented from spreading and evaluate the role of organisations in limiting their spread.

For Learning Aim C, learners must produce a detailed report examining how the introduction of contaminants into the natural environment causes risk to human health. This must describe the causes and effects of three environmental diseases. To access higher grades, they must analyse methods that can be used to reduce the effects of environmental pollutants and evaluate the impact of environmental pollution on human health and potential solutions.

For Learning Aim D, learners can produce information leaflets which explain the components of the specific and the non-specific defences in protecting the body in relation to their mode of action. To access the higher grades, the leaflets should compare the roles of non-specific and specific defences, and evaluate the roles of cell mediated and humoral responses.

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 15: Diseases and Infection

Introduction

Prior to starting the unit, you could encourage learners to read a fictional book or watch a film about the spread of disease. A classic book (by Robin Cook) and film (2011) which may be familiar to some learners is *Contagion*. Stimulus material of this nature can be used for discussion about disease organisms, how they are spread and the impact they can have on society. It should also lead to a debate about boundaries relating to fact and fiction.

Alternatively, you could use some short video clips of diseases as a stimulus to initiate discussion to establish learners' prior knowledge and understanding (or possibly misunderstanding). Excerpts from *Monsters Inside Me* (a TV series/documentary) or *Embarrassing Bodies* could also be used.

Media headlines about pressure on health services due to an ageing population, increase in childhood diabetes or increasing incidence of skin cancer can be used to introduce some of the non-infectious diseases that are part of the unit.

Learning aim A: Investigate different types of diseases and infections that can affect humans

A1/A2/A3/A4

- You could use mind maps of vocabulary sheets/key areas of unit content for learners to indicate their prior knowledge and understanding, and to identify focus areas for your input and learner research.
- Learners could look at photographs/photomicrographs, Bioviewer slides of the different types of pathogens, and identify key characteristics and features.
- Learners could create a card-sorting game to allow them to match types of pathogen, features, life cycle (where appropriate) and disease. They can carry out a similar activity for non-infectious diseases.
- In groups or pairs, learners could be given 'case studies' of individuals with an example of an infectious, dietary, genetic, degenerative disease. They need to be encouraged to consider how the disease will progress over time and the impact this might have on the individual.
- Pairs or small groups of learners could then choose or be given a disease(s) (infectious, dietary, genetic, degenerative) to research in order to become an 'expert' before presenting their findings to the rest of the class. The presentation could take the form of PowerPoint, radio interview, a 'Mastermind' quiz, leaflets, fact file, etc..

Learning aim B: Examine the transmission of infectious diseases and how this can be prevented

B1

- You could ask learners to pass round an object that has been covered in a germ simulating gel/powder (commercially available) that will fluoresce under UV light; This could give a tangible model of how many pathogens can be transmitted. A practical exercise can also be used to demonstrate a good hand-washing technique, leading on to one aspect of preventing transmission.
- Transfer of pathogens via body fluids can also be simulated practically.
- Learners could use agar plates to culture swabs taken from surfaces in the laboratory. (Health and safety guidance and risk assessments must be in place.)

B2

- You could discuss methods of preventing the spread of disease and divide learners into small groups to research and present information to the rest of the class.
- A class discussion could be used to consider why vaccination of babies is important and the consequences of non-vaccination.
- Learners could be asked to produce a spider diagram to show Personal Protective Equipment (PPE) and how/why it might be required.
- Learners can be given an example of a disease and associated vaccination to research how vaccination can help prevent the spread of the disease.

B3

- Individual learners will need to choose an organisation to research in order to achieve the distinction criterion. Opportunities to give a presentation summarising the organisation and its work with infectious disease can be given to the rest of the class.
- Newspaper/media reports about diseases like Ebola, SARS and, very recently, Coronavirus and the role of organisations in managing and controlling their spread could be used to stimulate discussion.

Learning aim C: Investigate causes of environmental pollution and the effects of pollutants on human health

C1, C2, C3

- In pairs or small groups, learners can research the causes of environmental pollutants and then present their findings to the rest of the class.
- In small groups or pairs, learners can investigate the effects of the pollutants in the unit content, how the pollutant enters the environment and the impacts it may have on human health. The information can be presented to the rest of the class.
- Global initiatives and associated organisations that aim to reduce disease and deaths from atmospheric and water pollution will need to be investigated. Learners could be presented with cards with named organisations and/or pollutants can be produced and selected at random by learners. Presentations to the rest of the group will need to be monitored to ensure full coverage and that accurate information has been collected and understood.
- Global initiatives to potentially solve environmental issues and protect the environment and lead to improvements in public health will need to be researched.

- Visiting speakers or virtual meetings with 'visitors' would help stimulate learners and add a vocational dimension to the topic.

Learning aim D: Understand how the human body responds to diseases and infections

D1/D2

- You could use vocabulary sheets or unit content for learners to identify their prior knowledge and aid you in delivering the content.
- You could use a song or poem about the immune system to give an engaging introduction to this learning aim.
- Learners could produce collaborative posters or flow charts in small groups to ascertain their prior knowledge of specific and non-specific defense mechanisms.
- Posters could be produced, individually or collaboratively, to show the features of the specific and non-specific defense mechanisms and how they help protect us from disease.

D3

- To assist learners to visualise antigen and antibody models of the components of the specific defence mechanism, you could use mini marshmallows, gummy sweets, jelly beans, etc. and cocktail sticks. Some learners may be able to produce animations.
- Your own input, secondary source material, textbooks, the Internet and journals will need to be accessed by learners to extend their knowledge and understanding to meet the level required for this level 3 programme.
- Learners could produce a computer-generated storyboard/animation to demonstrate components of the specific defense system.
- An Ouchterlony double diffusion assay could be demonstrated/carried out by learners to show antigen and antibody specificity to support the distinction criterion.

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 10: Climate Change*
- *Unit 14: Genetics and Genetic engineering*
- *Unit 19: Microbiology and Microbiological Techniques*
- *Unit 24: Pollution and Waste Management*

Resources

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

Textbooks

Annets, F, Foale, S, Hartley, J, Hocking, S, Hudson, L, Kelly, T, Llewellyn, R, Musa, I, and Sorenson, J, *BTEC Level 3 National Applied Science Student Book* (Pearson, 2010) ISBN 9781846906800

Any current A-level textbook with a section on genetics and genetic engineering could also be used for reference.

Journals

Scientific American

New Scientist

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

Videos

YouTube**:**

- *"How bacteria cause disease" – a lecture about how bacteria cause disease.*
  "What you need to know about infectious disease"
- *"Ever feel like there's something in your eye? | Monsters inside me" - YouTube video from TV series "Monsters inside me".*
- *"Beyond the science: environmental problems… cultural solutions | Paul K. Doss | TEDxEvansville" – a talk about environmental issues and accepting responsibility for them.*
- *"ABCs* of pollution and your control | David Klanecky | TEDxLSU"

Websites

Visit the “Songs for teaching” website and search “Microorganisms” - songs and lyrics about biological topics can be downloaded from this website.

The “Education world” website has an introduction with short videos about three pandemics in history. It could be used as an introduction to the unit.

Visit the “Discovery education” website and search “great resources to teach epidemiology”. This site has ideas for simulations of the spread of contagious diseases.

The Microbiology Society online journal, Microbiology Today, has videos and information relating to microbiology.

The “BioInteractive” website offers multimedia resources, virtual laboratories, simulations and teacher guides on a variety of scientific topics.

Visit the “Brain facts” website and search “diseases and disorders” for information about a range of diseases and disorders.

Search Greta Thunberg on "The Guardian” website for articles relating to Greta Thunberg in 2019.

Pearson is not responsible for the content of any external Internet sites. It is essential for teachers 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 teachers bookmark useful websites and consider enabling students to access them through the school/college intranet.