SCQF level 6
Unit Specification

Human Biology: Immunology and Public Health

SCQF: level 6 (3 SCQF credit points)

Unit code: J20M 76

Unit outline

The general aim of this Unit is to develop skills of scientific inquiry, investigation and analytical thinking, along with knowledge and understanding of immunology and public health. Learners will apply these skills when considering the applications of immunology and public health on our lives. This can be done by using a variety of approaches, including investigation and problem solving.

The Unit covers the key areas of:
non-specific defences; specific cellular defences; the transmission and control of infectious diseases; active immunisation and vaccination and the evasion of specific immune responses by pathogens.

Learners will research issues, apply scientific skills and communicate information related to their findings, which will develop skills of scientific literacy.

Learners who complete this Unit will be able to:

1 Apply skills of scientific inquiry and draw on knowledge and understanding of the key areas of this Unit to carry out an experiment or practical investigation
2 Draw on knowledge and understanding of the key areas of this Unit and apply scientific skills

This Unit is also available as a free-standing Unit. The *Unit Support Notes* in the Appendix, provide advice and guidance on delivery, assessment approaches and development of skills for learning, skills for life and skills for work. Exemplification of the standards in this Unit is given in Unit Assessment Support.
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Recommended entry

Entry to this Unit is at the discretion of the centre. However, learners would normally be expected to have attained the skills, knowledge and understanding required by one or more of the following or equivalent qualifications and/or experience:

- National 5 Biology Course or relevant Units

Equality and inclusion

This Unit Specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence. For further information, please refer to the Appendix: *Unit Support Notes.*

Standards

Outcomes and assessment standards

Outcome 1

The learner will:

1 Apply skills of scientific inquiry and draw on knowledge and understanding of the key areas of this Unit to carry out an experiment/practical investigation by:

1.1 Planning an experiment/practical investigation
1.2 Following procedures safely
1.3 Making and recording observations/measurements correctly
1.4 Presenting results in an appropriate format
1.5 Drawing valid conclusions
1.6 Evaluating experimental procedures

Outcome 2

The learner will:

2 Draw on knowledge and understanding of the key areas of this Unit and apply scientific skills by:

2.1 Making accurate statements
2.2 Solving problems

Evidence Requirements for the Unit

Assessors should use their professional judgement, subject knowledge and experience, and understanding of their learners, to determine the most appropriate ways to generate evidence and the conditions and contexts in which they are used.

The key areas covered in this Unit are:
non-specific defences; specific cellular defences; the transmission and control of infectious diseases; active immunisation and vaccination and the evasion of specific immune responses by pathogens.

Evidence can be drawn from a variety of sources and presented in a variety of formats.

The following table describes the evidence for the assessment standards which require exemplification. Evidence may be presented for individual outcomes, or gathered for the unit. If the latter approach is used, it must be clear how the evidence covers each outcome.

Assessment Standard	**Evidence required**
Planning an experiment	The plan should include: ♦ a clear statement of the aim ♦ a hypothesis ♦ a dependent and independent variable ♦ variables to be kept constant ♦ measurements/observations to be made ♦ the equipment/materials ♦ a clear and detailed description of how the experiment/practical investigation should be carried out, including safety considerations
Presenting results in an appropriate format	One format from: table, line graph, chart, key, diagram, flow chart, summary, extended text or other appropriate format
Drawing a valid conclusion	Include reference to the aim
Evaluating experimental procedures	Suggest two improvements with justification
Making accurate statements	At least half of the statements should be correct across the key areas of this Unit
Solving problems	One of each: ♦ make generalisations/predictions ♦ select information ♦ process information, including calculations, as appropriate ♦ analyse information

Exemplification of assessment is provided in Unit Assessment Support.
Advice and guidance on possible approaches to assessment is provided in the Appendix: *Unit Support Notes.*

Assessment Standard Thresholds

Outcome 1

Candidates are not required to show full mastery of the assessment standards to achieve Outcome 1. Instead, five out of the six assessment standards for Outcome 1 must be met to achieve a pass. Candidates must be given the opportunity to meet all assessment standards. The threshold has been put in place to reduce the volume of re-assessment where that is required.

Transfer of evidence
Evidence of Outcome 1 in a unit is transferrable between the other units at SCQF level 6.

Re-assessment
Candidates can be given the opportunity to re-draft their original Outcome 1 report or to carry out a new experiment/practical investigation.

Outcome 2

There is no requirement to pass assessment standard 2.1 (making accurate statements) and assessment standard 2.2 (solving problems) independently. Candidates can be assessed using a single test that contains marks and a cut-off score.
A suitable unit assessment will cover all of the key areas (assessment standard 2.1) **and** assess each of the problem-solving skills (assessment standard 2.2).

Where a candidate achieves 50% or more of the total marks available in a single unit assessment, they will pass Outcome 2 for that unit. Existing unit assessment support packs (UASPs) can be used, or centres can replace the questions with suitable alternatives of a similar standard

Unit assessment support pack 1 contains questions on all of the key areas (AS 2.1) and questions covering each of the problem solving skills (AS 2.2), and may be adapted for use as a single assessment. The number of marks available for each question should be combined to give the total number of marks available. A cut-off score of 50% should be applied to the unit assessments.

Outcome 2: assessment activity 2 – tests contain questions covering assessment standards 2.1 and 2.2 in a single assessment. These do not require to be adapted.

Important note: Centres can continue to assess AS 2.1 and 2.2 separately using the existing UASPs. If this option is chosen, 50% or more of the KU statements (AS 2.1) made by candidates must be correct in the unit assessment and at least one correct response for each problem solving skill (AS 2.2) is required to pass outcome 2. However, if a candidate is given more than one opportunity in a unit assessment to provide a response for a problem solving skill, then they must answer 50% or more correctly.

Re-assessment

SQA's guidance on re-assessment is that there should only be one or, in exceptional circumstances, two re-assessment opportunities. Re-assessment should be carried out under the same conditions as the original assessment. It is at the teacher or lecturer's discretion how they re-assess their candidates. Candidates may be given a full re-assessment opportunity, or be re-assessed on individual key areas and/or problem-solving skills. As there is no requirement to pass assessment standard 2.1 (making accurate statements) and assessment standard 2.2 (solving problems) independently, candidates must achieve 50% of the marks available in the re-assessment.

Development of skills for learning, skills for life and skills for work

It is expected that learners will develop broad, generic skills through this Unit. The skills that learners will be expected to improve on and develop through the Unit are based on SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work* and drawn from the main skills areas listed below. These must be built into the Unit where there are appropriate opportunities.

1 Literacy

1.2 Writing

2 Numeracy

2.1 Number processes
2.2 Money, time and measurement
2.3 Information handling

5 Thinking skills

5.3 Applying
5.4 Analysing and evaluating
5.5 Creating

Amplification of these is given in SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work.* The level of these skills should be at the same SCQF level of the Unit and be consistent with the SCQF level descriptor. Further information on building in skills for learning, skills for life and skills for work is given in the Appendix: *Unit Support Notes.*

Appendix: Unit support notes

Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing this Unit. They are intended for teachers and lecturers who are delivering this Unit. They should be read in conjunction with:

- the *Unit Assessment Support packs*

Developing skills, knowledge and understanding

Teachers and lecturers are free to select the skills, knowledge, understanding and contexts which are most appropriate for delivery in their centres.

Approaches to learning and teaching

key areas	Suggested learning activities	Exemplification of key areas
1 Non-specific defences (a) Physical and chemical defences. Epithelial cells form a physical barrier and produce secretions against infection. (b) Inflammatory response to include release of histamine by mast cells causing vasodilation and increased capillary permeability. The increased blood flow and secretion of cytokines leads to an accumulation of phagocytes and the delivery of antimicrobial proteins and clotting elements to the site of infection. (c) Phagocytes and apoptosis by natural killer (NK) cells. Phagocytes and NK cells release cytokines which stimulate the specific immune response. Phagocytes recognise surface antigen molecules on pathogens and destroy them by phagocytosis. NK cells induce the viral infected cells to produce self-destructive enzymes in apoptosis. **2 Specific cellular defences** (a) Immune surveillance. A range of white blood cells constantly		The human body has the capacity to protect itself against pathogens, some toxins and cancer cells through the immune system. A variety of specialised white blood cells provide protection against pathogens.

key areas	Suggested learning activities	Exemplification of key areas
circulate monitoring the tissues. If tissues become damaged or invaded, cells release cytokines which increase blood flow resulting in specific white blood cells accumulating at the site of infection or tissue damage. (b) Clonal selection theory. Lymphocytes have a single type of membrane receptor specific for one antigen. Antigen binding leads to repeated lymphocyte division resulting in a clonal population of lymphocytes. (c) T and B lymphocytes. Lymphocytes respond specifically to antigens on foreign cells, cells infected by pathogens and toxins released by pathogens. T-lymphocytes have specific surface proteins that allow them to distinguish between the surface molecules of the body's own cells and cells with foreign molecules on their surface. Immune system regulation failure leads to T-lymphocyte immune response to self antigens (auto immune disease). Allergy is a hypersensitive B lymphocyte response to an antigen that is normally	ABO and Rh blood typing. Case studies on: Rheumatoid arthritis (cells in the joints produce cytokines that promote an immune response), Type 1 diabetes (T-cells attack insulin producing cells), multiple sclerosis (T- cells attack	

key areas	Suggested learning activities	Exemplification of key areas
harmless. T-lymphocytes. One group of T lymphocytes destroy infected cells by inducing apoptosis. Another group of T lymphocytes secrete cytokines that activate B lymphocytes and phagocytes. When pathogens infect tissue, some phagocytes capture the pathogen and display fragments of its antigens on their surface. These antigen presenting cells activate the production of a clone of T lymphocytes that move to the site of infection under the direction of cytokines. B lymphocytes. Each B lymphocyte clone produces a specific antibody molecule that will recognise a specific antigen surface molecule on a pathogen or a toxin. Antigen-antibody complexes may inactivate a pathogen or toxin or render it more susceptible to phagocytosis. In other cases the antigen-antibody complex stimulates a response which results in cell lysis. B lymphocytes activated by antigen presenting cells and T lymphocytes produce a clone of B lymphocytes that secrete antibodies into the lymph and blood	antigens on the myelin sheath). Case studies on hay fever, anaphylactic shock and allergic asthma.	

key areas	Suggested learning activities	Exemplification of key areas
where they make their way to the infected area. (d) Immunological memory. Some T and B lymphocytes produced in response to antigens by clonal selection survive long-term as memory cells. A secondary exposure to the same antigen rapidly gives rise to a new clone of lymphocytes producing a rapid and greater immunological response.		
3 The transmission and control of infectious diseases (a) Infectious diseases caused by pathogens, transmitted by direct physical contact, water, food, body fluids, inhaled air or vector organisms and controlled by quarantine, antisepsis, individual responsibility (good hygiene, care in sexual health and appropriate storage/handling of food), community responsibility (quality water supply, safe food webs and appropriate waste disposal systems) and vector control. (b) Epidemiological studies of infectious diseases. Description of spread to include sporadic	Case study: comparison of the transmission methods of different pathogens, eg measles (air borne), HIV (body fluids) and cholera (water or food).	Due to its role in maintaining health and combating infectious diseases on a global level, the immune system is at the centre of much of the research in public health. Infectious diseases are caused by pathogens such as viruses, bacteria, fungi, protozoa and multicellular parasites. Epidemiologists study the outbreak and pattern of infectious diseases to determine

key areas	Suggested learning activities	Exemplification of key areas
(occasional occurrence), endemic (regular cases occurring in an area), epidemic (unusually high number of cases in an area) or pandemic (a global epidemic). Control measures to include preventing transmission, drug therapy, immunisation or a combination of these. **4 Active immunisation and vaccination and the evasion of specific immune response by pathogens** (a) Active immunity can be developed by vaccination with antigens from infectious pathogens, so creating an immunological memory. Antigens from infectious pathogens, usually mixed with an adjuvant to enhance the immune response, include inactivated pathogen toxins, dead pathogens, parts of pathogens and weakened pathogens. The design of vaccine clinical trials including randomised, double-blind and placebo-controlled protocols. Importance of group size to reduce experimental error and statistical significance.	Suitable examples of antigens include: inactivated pathogen toxins (tetanus and diphtheria), dead pathogens (polio and hepatitis A), parts of pathogens (HPV and hepatitis B) and weakened pathogens (measles, mumps and rubella).	the factors which affect the spread of infectious disease. Based on epidemiological studies control measures can be considered. Vaccines are subjected to clinical trials in the same way as other pharmaceutical medicines to establish their safety and

key areas	Suggested learning activities	Exemplification of key areas
The importance of herd immunity in infectious disease control. Herd immunity occurs when a large percentage of a population are immunised. Non-immune individuals are protected as there is a lower probability they will come into contact with infected individuals. The herd immunity threshold depends on the disease, the efficacy of the vaccine and the contact parameters for the population. Public health immunisation programmes. Establishing herd immunity to a number of diseases. Difficulties when widespread vaccination is not possible due to malnutrition, poverty or vaccine rejected by a percentage of the population. (b) Many pathogens have evolved mechanisms that evade the specific	Case study: Mass vaccination programmes (TB, polio, smallpox) and the eradication of diseases.	efficacy before being licensed for use. Clinical trials use randomised, double-blind, placebo-controlled protocols. Subjects are split into groups in a randomised way in which neither the subjects nor the researchers know which group they are in to eliminate bias. One group of subjects receives the vaccine, while the second group receives a placebo control to ensure valid comparisons. At the end of the trial, results from the two groups, which must be of a suitable size to reduce the magnitude of experimental error are compared to determine whether there are any statistically significant differences between the groups. This herd immunity is important in reducing the spread of diseases and in protecting vulnerable and non-vaccinated individuals.

key areas	Suggested learning activities	Exemplification of key areas
immune system which has consequences for vaccination strategies. Antigenic variation. Some pathogens can change their antigens avoiding the effect of immunological memory. Role and impact in diseases like malaria, trypanosomiasis and influenza. Direct attack on the immune system. HIV attacks lymphocytes which is the major cause of AIDS. Tuberculosis (TB) survives within phagocytes and avoids immune detection.	Comparison of the estimated herd immunity thresholds for vaccine preventable diseases. Use bioinformatics software to study the DNA sequence/protein differences between different types and strains of influenza viruses. Case study on HIV including the public health measures and drug therapies for its control.	In most countries, policy in public health medicine is to establish herd immunity to a number of diseases. Difficulties can arise when widespread vaccination is not possible due to malnutrition and poverty (the developing world), or when vaccines are rejected by a percentage of the population (the developed world). Antigenic variation occurs in diseases like malaria and trypanosomiasis and is one of the reasons why they are still so common in many parts of the world. Antigenic variation also occurs in the influenza virus explaining why it remains a major public health problem and why at risk individuals require to be vaccinated every year. The absence or failure of some component of the immune system results in increased susceptibility to infection. HIV is the major cause of acquired immunodeficiency in adults.

Administrative information

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Superclass: RH

History of changes to National Unit Specification

Version	Description of change	Authorised by	Date
2.0	Page 1 – the description of key areas under 'Unit outline' has been revised to give more information Page 4 – in Outcome 1.3, the word 'accurately' has been replaced by 'correctly'. Page 5– the Evidence requirements have been rewritten to better explain what is required Page 5 – information has been added on Transfer of Evidence	Qualifications Development Manager	April 2014
3.0	Assessment Standards 2.2 & 2.3 removed	Qualifications Development Manager	June 2014
4.0	Level changed from Higher to SCQF level 6. Unit support notes added. Assessment standard threshold added.	Qualifications Manager	September 2018
5.0	Unit code updated	Qualifications Manager	July 2019