Higher National Unit specification

General information for centres

Unit title: Immunotechnology: Theory and Practice

Unit code: DH2M 35

Unit purpose: This Unit is designed to provide candidates with an understanding of the principles underlying the production of polyclonal and monoclonal antisera and some of the common uses of these antisera.

On completion of the Unit the candidate should be able to:

1. Demonstrate knowledge and understanding of the underlying principles involved in the production of antibodies.
2. Demonstrate knowledge and understanding of the procedures used in the production of polyclonal and monoclonal antisera.
3. Perform an enzyme linked immunoassay (ELISA).

Credit value: 1 HN credit at SCQF level 8: (8 SCQF credit points at SCQF level 8*)

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

Recommended prior knowledge and skills: Access to this Unit will be at the discretion of the centre, however it is recommended that candidates should have experience of studying biology at SCQF level 7.

Core Skills: There may be opportunities to gather evidence toward Core Skills in Communication at Higher level in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Context for delivery: This Unit could be used for all HN Bioscience qualifications. It is recommended that it should be taught and assessed within the subject area of the particular Group Award to which it contributes.

Assessment: Knowledge and understanding are assessed by a single holistic test for Outcomes one and two. This assessment should be taken under closed-book, supervised conditions with a cut off score of 60%. There is one practical exercise that requires the production of a written laboratory report and completion of a checklist for Outcome three**.**

Higher National Unit specification: statement of standards

Unit title: Immunotechnology: Theory and Practice

Unit code: DH2M 35

The sections of the Unit stating the Outcomes, knowledge and/or skills, and Evidence Requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Demonstrate knowledge and understanding of the underlying principles involved in the production of antibodies

Knowledge and/or Skills

- The role of B lymphocytes in antibody production
- The role of T lymphocytes in antibody production
- The structure and function of the structural components of antibodies
- The concept of antigenicity
- The properties of antigens which contribute to their immunogenicity
- The binding between epitopes on antigens and antigen binding sites with reference to valency, specificity, affinity and avidity

Evidence Requirements

The candidate will require written evidence to demonstrate their knowledge and understanding of the underlying principles involved in the production of polyclonal and monoclonal antibodies.

This evidence will take the form of a single holistic assessment which involves sampling of the knowledge and skills listed in Outcome one. On each occasion, 4 of the 6 bullet points in the knowledge and skills section for Outcome One must be assessed. A different sample should be chosen on each assessment occasion to prevent candidates being able to foresee what they will be asked. The questions used within the assessment will be a combination of structured and restricted responses.

Where knowledge and skills is sampled, a candidate's response will be judged to be satisfactory where the evidence provided is sufficient to meet the requirements for each knowledge and skills item by showing that the candidate is able to:

- explain the role of B lymphocytes in the production of antibodies in terms of clonal selection and expansion
- explain the role of T lymphocytes in activating B lymphocytes

- explain the function of the structural components of antibodies
- describe the properties of antigens which contribute to their immunogenicity
- describe the concept of antigenicity
- describe the binding between epitopes and their antigen binding sites with reference to valency or specificity or affinity or avidity

Assessment Guidelines

It is recommended that the candidate's knowledge and skills be demonstrated by a single holistic assessment that provides the opportunity to cover the Evidence Requirements in both Outcomes one and two. The assessment should be taken under supervised, closed-book conditions. The cut-off score should be set at 60%.

Outcome 2

Demonstrate knowledge and understanding of the procedures used in the production of polyclonal and monoclonal antisera

Knowledge and/or Skills

- The choice of experimental animals available
- The need for immunisation schedules
- The use of adjuvants
- Methods used to characterise antisera
- The formation, selection and screening of hybridoma cells in monoclonal antibody production
- Uses of polyclonal and monoclonal antisera

Evidence Requirements

The candidate will require written evidence to demonstrate their knowledge and understanding on the procedures used in the production of polyclonal and monoclonal antibodies.

This evidence will take the form of a single holistic assessment that involves sampling of the knowledge and skills listed in Outcome 2. On each occasion, 4 of the 6 bullet points in the knowledge and skills in Outcome Two must be assessed. A different sample should be chosen on each assessment occasion to prevent candidates being able to foresee what they will be asked.

The questions used within the assessment will be a combination of structured and restricted responses.

Higher National Unit specification: statement of standards (cont)

Unit title: Immunotechnology: Theory and Practice

Where knowledge and skills is sampled, a candidate's response will be judged to be satisfactory where the evidence provided is sufficient to meet the requirements for each knowledge and skills item by showing that the candidate is able to:

- explain why a particular experimental animal is chosen
- explain why a particular immunisation schedule is chosen
- explain why different adjuvants are chosen
- describe how hybridoma cells are formed, selected and screened in monoclonal antibody production
- describe one use of monoclonal or polyclonal antiserum in industry, or research or clinical medicine

Assessment Guidelines

It is recommended that the candidate's knowledge and skills be demonstrated by a single, holistic assessment that provides the opportunity to cover the Evidence Requirements for both Outcomes one and two. The assessment should be taken under supervised, closed-book conditions. The cut-off score should be set at 60%.

Outcome 3

Perform an enzyme linked immunoassay (ELISA)

Knowledge and/or Skills

- Plan and perform an ELISA
- Record measurements and/or observations in an appropriate format
- Analyse recorded information
- Draw valid conclusions
- Evaluate the results and/or technique with supporting argument

Evidence Requirements

Evidence that the candidate can plan and perform an ELISA will be recorded in the form of a checklist that is completed and signed by the lecturer/supervisor.

The candidate will be required to produce one written standard laboratory report as evidence for the other knowledge and skills items not covered by the checklist.

Assessment Guidelines

The candidate should perform one practical exercise using an ELISA under supervised conditions. A checklist and the production of one laboratory report should provide evidence covering all of the bullet points under knowledge and skills

Administrative Information

Unit code: DH2M 35

Unit title: Immunotechnology: Theory and Practice

Superclass category: RH

Original date of publication: August 2004

Version: 03 (June 2009)

History of changes:

Version	Description of change	Date
02	Previous versions were made before the introduction of the History of Changes table.	04/06
03	Changes made to standardise assessment guidelines.	03/06/09

Source: SQA

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of Higher National qualifications.

Additional copies of this Unit specification can be purchased from the Scottish Qualifications Authority. Please contact the Customer Contact Centre for further details, telephone 0845 279 1000.

Higher National Unit specification: support notes

Unit title: Immunotechnology: Theory and Practice

This part of the Unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

This Unit is intended for a candidate who is studying for the Group Award, HN Biosciences and who is intending to work or is already working in an environment involving immunology. The Unit is intended to provide the candidate with underpinning knowledge of the basic concepts of immunology. This Unit is a prerequisite for HN Unit Immunological Techniques and should be delivered prior to it.

Outcome 1

Function of B-lymphocytes, production of plasma cells and memory cells. Role of surface immunoglobulin (SIg) in binding to epitopes on the antigen and resultant clonal expansion.

Role of cytokines produced by T-lymphocytes which control the expansion of B cells.

Structure of antibodies: F(ab)2, Fc antigen binding, complement fixing, diversity of antigen binding sites (VDL rearrangements), isotypes of immunoglobulin (IgA, IgE, IgD, IgG, IgM)

Immunogenicity of antigens: foreignness to host molecular size, chemical composition, degradability of antigen, dosage and route of administration of the antigen.

Antigenicity: illustrate by use of haptens. Methods of making haptens antigenic.

Epitopes: properties of epitopes recognised by B cells and T cells

B cell epitopes: easily accessible, contiguous amino acid sequences (sequential epitopes) and non-contiguous amino and sequences.

T cell epitopes: internal epitopes, hydrophobic, become accessible only after processing of the antigen.

Outcome 2

Choice of animal, need for a home office licence if working with animals

Immunisation schedules (boosters, timings of immunisations), routes of administration of antigen, methods available for obtaining antisera from experimental animals.

Higher National Unit specification: support notes (cont)

Unit title: Immunotechnology: Theory and Practice

Use of adjuvants (mineral oil, mycobacterium) Freunds complete and incomplete adjuvant,

Methods of obtaining antiserum (from the heart, through veins),
Formation of hybridoma cells: isolation of B cells, use of PEG to fuse with myeloma cells.

Selection of hybridoma cells: use of HAT medium to select for hybridoma. Role of each component within HAT medium.

Brief outline of methods of characterising polyclonals (eg western blots, ELISA).

Screening of hybridomas for monoclonal antibody production: use of ELISA, immunofluorescent techniques (brief outline only is required of the method).

Uses of monoclonal antibodies: protein purification (interferon), tumour detection, tumour killing, diagnostic kits.

Outcome 3

A variety of ELISA protocols and many diagnostic kits are available. The one which is most pertinent to the candidates undertaking this Unit should be used.

Guidance on the delivery and assessment of this Unit

This Unit is likely to form part of a Group Award which is primarily designed to prepare candidates for employment in a biological sciences related post. The Unit provides the theory necessary for candidates to have an understanding of the way in which polyclonal and monoclonal antiserum is prepared and some of the uses of them. This Unit should be delivered in the 2nd year of a biosciences programme.

Independent study should be encouraged by using candidate-centred, resource based methodologies.

Assessment of this Unit is by the generation of evidence using a closed-book holistic test which integrates the theory in Outcomes One and Two. In addition there is a practical exercise which requires the production of a written laboratory report for Outcome 3.

Where evidence for Outcome 3 is found to be unsatisfactory, candidates may be questioned orally to identify particular problems with specific areas. Support tutorials may be useful in helping to provide a solution to these problems.

Higher National Unit specification: support notes (cont)

Unit title: Immunotechnology: Theory and Practice

Open learning

If this Unit is delivered by open or distance learning methods, additional planning resources may be required for candidate support, assessment and quality assurance.

A combination of new and traditional authentication tools may have to be devised for assessment and reassessment purposes.

Disabled candidates and/or those with additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website **www.sqa.org.uk/assessmentarrangements**

General information for candidates

Unit title: Immunotechnology: Theory and Practice

This is a one credit HN Unit at SCQF level 8 and is intended for candidates undertaking the second year of a biological science-related qualification. It is designed to provide you with underpinning knowledge required for you to understand how polyclonal and monoclonal antisera are produced. You will be given the opportunity to gain some hands-on experience of one of the most common techniques in immunotechnology, namely the ELISA technique. On completion of this Unit you should be able to:

1. Demonstrate knowledge and understanding of the underlying principles involved in the production of antibodies.

2. Demonstrate knowledge and understanding of the procedures used in the production of polyclonal and monoclonal antisera

3. Perform an enzyme linked immunoassay (ELISA)

Outcome 1

In this Outcome you will find out how B and T-lymphocytes are involved in the production of polyclonal antibodies and how memory cells are involved in the continued production of antibodies. Also, in this Outcome you will discover the reasons why some molecules (antigens) are very good at causing the production of antibodies whereas others are not. You will find out how an antigen and an antibody interact with each other.

Outcome 2

This Outcome explores the methods and procedures required to produce polyclonal antiserum and monoclonal antibodies and you will discover some of the uses of these antibodies in industry, research and in clinical medicine.

Outcome 3

You will have the opportunity to perform an ELISA assay which is one of the most commonly used techniques in immunotechnology.

Your knowledge and skills of the topics covered in this Unit will be tested by a combination of a laboratory exercise and a closed-book holistic assessment.

To pass this Unit, you must achieve a satisfactory level of performance in all assessments.