



Higher National Unit specification

General information for centres

Unit title: DNA Structure and Function

Unit code: DJ6Y 34

Unit purpose: This Unit is designed to provide candidates with an understanding of the main concepts of the structure of DNA, its role in gene expression and protein synthesis and finally, the principles of DNA technology.

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

1. Describe DNA structure and its replication.
2. Describe the stages of the cell cycle.
3. Explain the stages involved in protein synthesis.
4. Describe how genes are expressed.
5. Describe the applications of DNA technology.

Credit points and level: 1 HN credit at SCQF level 7: (8 SCQF credit points at SCQF level 7*)

**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 either Standard Grade Credit or Intermediate 2 biology or have previously completed the HN Unit, DJ1K 34 Cell Biology: Theory and Practice.

Core Skills: There may be opportunities to gather evidence towards 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 is included in the framework of the Group Award, HNC Applied Sciences, HND Biotechnology and HND Biomedical Sciences. It is recommended that it should be taught and assessed within the context of the particular Group Award to which it contributes.

General information for centres (cont)

Assessment: Assessment for this Unit should be a holistic closed-book supervised test with a cut off score of 60%.

Candidates must meet the level of performance specified in the Evidence Requirements for all five Outcomes to achieve the Unit.

Higher National Unit specification: statement of standards

Unit title: DNA Structure and Function

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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

Describe DNA structure and its replication

Knowledge and/or Skills

- ◆ DNA structure
- ◆ DNA replication

Evidence Requirements

A candidate's response will be judged satisfactory where the evidence provided is sufficient to meet the requirements for one bullet point listed under Knowledge and/or skills by showing that the candidate is able to:

- ◆ demonstrate a knowledge of components and bonds involved in a DNA double helix,
or
- ◆ demonstrate an understanding of the mechanism of semi-conservative replication.

Evidence could be gathered using a holistic, end of Unit test under closed-book conditions.

In any assessment, one out of two knowledge and skills items from Outcome 1 should be assessed.

Outcome 2

Describe the stages of the cell cycle

Knowledge and/or Skills

- ◆ Phases and control points of the cell cycle
- ◆ Chromosome behaviour during the stages of mitosis
- ◆ Meiotic events that give rise to genetic variation

Higher National Unit specification: statement of standards (cont)

Unit title: DNA Structure and Function

Evidence Requirements

A candidate's response will be judged satisfactory where the evidence provided is sufficient to meet the requirements for two out of three bullet points listed under Knowledge and/or skills by showing that the candidate is able to:

- ◆ identify the phases of the cell cycle including the check points employed in cell cycle control
- ◆ describe the stages of mitosis
- ◆ describe the organisation and behaviour of chromosomes during mitosis
- ◆ demonstrate an understanding of events which can occur during meiosis to bring about genetic variation.

Evidence could be gathered using a holistic, end of Unit test under closed-book conditions.

In any assessment, two out of three knowledge and skills items from Outcome 2 should be assessed.

Outcome 3

Explain the stages involved in protein synthesis

Knowledge and/or Skills

- ◆ Transcription
- ◆ Translation
- ◆ RNA roles

Evidence Requirements

A candidate's response will be judged satisfactory where the evidence provided is sufficient to meet the requirements for two out of three bullet points listed under Knowledge and/or skills by showing that the candidate is able to:

- ◆ describe the events involved in transcription,
- ◆ describe the events involved in translation,
- ◆ explain the roles of RNA in protein synthesis

Evidence should be gathered using a holistic, end of Unit test under closed-book conditions.

In any assessment, two out of three knowledge and skills items from Outcome 3 should be assessed.

Higher National Unit specification: statement of standards (cont)

Unit title: DNA Structure and Function

Outcome 4

Describe how genes are expressed.

Knowledge and/or Skills

- ◆ Gene organisation
- ◆ Control of gene expression

Evidence Requirements

A candidate's response will be judged satisfactory where the evidence provided is sufficient to meet the requirements for one out of two bullet points listed under Knowledge and/or skills by showing that the candidate is able to:

- ◆ describe the organisation of genes in eukaryotic and prokaryotic cells'
- ◆ describe the control of gene expression in eukaryotic and prokaryotic cells

Evidence could be gathered using a holistic, end of Unit test under closed-book conditions.

In any assessment, one out of two knowledge and skills items from Outcome 4 should be assessed.

Outcome 5

Describe the applications of DNA technology

Knowledge and/or Skills

- ◆ Restriction enzymes
- ◆ DNA electrophoresis
- ◆ Basic PCR
- ◆ Discussion of gene therapy

Evidence Requirements

A candidate's response will be judged satisfactory where the evidence provided is sufficient to meet the requirements for three out of four bullet points listed under Knowledge and/or skills by showing that the candidate is able to:

- ◆ discuss the uses of restriction enzymes,
- ◆ describe the methods used to perform DNA electrophoresis,
- ◆ demonstrate an understanding of the principles of PCR

Evidence could be gathered using a holistic, end of Unit test under closed-book conditions.

Higher National Unit specification: statement of standards (cont)

Unit title: DNA Structure and Function

In any assessment, three out of four knowledge and skills items from Outcome 5 should be assessed.

Assessment Guidelines for the Unit

It is recommended that assessment of this Unit is by completion of a holistic end of Unit test covering all five Outcomes which could be based on short answer questions and/or extended response questions and be taken under supervised closed-book conditions. Candidates must achieve a cut off score of 60%.

Administrative Information

Unit code:	DJ6Y 34
Unit title:	DNA Structure and Function
Superclass category:	RH
Original date of publication:	August 2004
Version:	05 (June 2009)

History of changes:

Version	Description of change	Date
02	Previous versions were made before the introduction of the History of Changes table.	-
03	Outcome 3 — The paragraph ‘The candidate must demonstrate an understanding of the concept of separation based on affinity for a specific ligand’ has been deleted. This was an error and not specific to DNA.	January 2007
04	Minor typographical errors.	November 2007
05	Changes made to standardise assessment guidelines.	June 2009

Source: SQA

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Higher National Unit specification: support notes

Unit title: DNA Structure and Function

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 primarily intended to provide the candidate with understanding of the main concepts of DNA structure and replication, how the cell cycle is controlled, how protein is synthesised, how genes are expressed and the applications of DNA technology. The Unit allows for the integration of practical activities which could be used in other Units. The essential underpinning knowledge and skills gained here will be useful in Units such as Cell Biology and Biochemistry.

Outcome 1 provides an overview of DNA structure and how it is replicated. Candidates should become familiar with the following:

- ◆ DNA structure: helical structure; sugar phosphate backbone; bases; anti-parallel strands; hydrogen bonds
- ◆ DNA replication: leading and lagging strands; Okazaki fragments; semi-conservative replication; base pairing; templates; enzyme involved

Outcome 2 looks at the cell cycle and how it is controlled. This should be kept as simple as possible, but candidates should be familiar with:

- ◆ Cell cycle: G₀/G₁; S; G₂; M
- ◆ Chromosome behaviour: interphase; prophase; metaphase; anaphase; telophase; cytokinesis
- ◆ Meiosis: comparison with mitosis; homologous chromosomes; cross over

Outcome 3 concentrates on providing candidates with knowledge on how protein is synthesised. Candidates should be familiar with:

- ◆ Transcription: RNA polymerases; DNA template; mRNA.
- ◆ Translation: recognition sites; ribosomes; genetic code; post-translational modifications
- ◆ RNA roles: rRNA; mRNA; tRNA; small RNA

Higher National Unit specification: support notes (cont)

Unit title: DNA Structure and Function

Outcome 4 should include the basic concepts of how genes are organised and expressed in prokaryotic and eukaryotic cells. Candidates should become familiar with:

- ◆ Gene organisation: introns; exons; operons.
- ◆ Control of gene expression: initiation and termination sites; enhancers; inducers

Outcome 5 encompasses a wide range of techniques used in DNA technology. It is recommended that the candidate has the opportunity to carry out a practical activity relevant to this Outcome. The candidate should become familiar with:

- ◆ restriction enzymes: restriction sites; recognition sequences; sticky ends; blunt ends
- ◆ DNA electrophoresis: flat bed; agarose; acrylamide; separation based on size
- ◆ basic PCR: reverse transcription; proof reading; mutagenesis
- ◆ discussion of gene therapy: anisense oligonucleotides; gene targeting

Guidance on the delivery and assessment of this Unit

This Unit is designed to form part of the Group Award, HNC Applied Sciences and HND Biotechnology.

It is essential that this Unit is delivered in such a way as to emphasise the key points about the structure of DNA and its function in the cell. Instruments of assessments should be designed with this in mind.

It is recommended that assessment of this Unit is by completion of a holistic end of Unit test covering all five Outcomes which could be based on short answer questions and/or extended response questions and be taken under supervised closed-book conditions. Candidates must achieve a cut off score of 60%.

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 re-assessment 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: DNA Structure and Function

This is a 1 credit HN Unit at SCQF Level 7 intended for candidates undertaking an HNC Applied Sciences, HND Biotechnology or HND Biomedical Sciences. It is designed to provide you with an introduction to the concept of DNA structure and function, the cell cycle and commonly used techniques in DNA technology.

On completion of this Unit you should be able to:

1. Describe DNA structure and its replication
2. Describe the stages of the cell cycle
3. Explain the stages involved in protein synthesis
4. Describe gene expression
5. Describe the applications of DNA technology

The five Outcomes which make up the Unit are described below;

Outcome 1

You will be introduced to the concept of the structural features of DNA and how it is replicated inside the cell.

Outcome 2

This Outcome focuses on the cell cycle in which you will look at its control. You will also study the behaviour of chromosomes during mitosis as well as comparing mitosis with meiosis.

Outcome 3

In this Outcome you will look at the mechanisms involved in protein synthesis. Namely, how DNA is transcribed into RNA which is then translated into protein.

Outcome 4

In this Outcome you will look at how genes are organised and how their expression is controlled.

Outcome 5

This Outcome concentrates on the application of DNA technology. You will look at the various methods of DNA analysis as well as a chance to discuss the implications and uses of gene therapy.

To pass in this Unit you must achieve 60% pass in the closed-book assessment.