Higher National Unit specification

General information for centres

Unit title: Genetics

Unit code: DP4P 34

Unit purpose: This Unit is designed to provide candidates with an understanding of the main concepts of inheritance and how genetic evolution may occur. The Unit covers a range of genetic disorders, their diagnosis and treatment and is intended for those who wish to progress to a Degree course or for students who intend to enter the workforce as Laboratory Technicians.

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

1 Describe the principles and patterns of inheritance in higher organisms.
2 Describe mechanisms for genetic evolution and population genetics.
3 Describe genetic disorders.
4 Explain the use of gene therapy in genetic disorders.

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 Standard Grade or Intermediate 2 Biology or have previously completed the HN Unit entitled *DNA: Structure and Function* (DJ6Y 34).

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: If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

Assessment: This Unit should be assessed by a closed-book, holistic, supervised test with a cut off score of 60%.

Higher National Unit specification: statement of standards

Unit title: Genetics

Unit code: DP4P 34

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 the principles and patterns of inheritance in higher organisms

Knowledge and/or Skills

- Mendelian theories and patterns of inheritance
- Non-Mendelian patterns of inheritance
- Chromosomal basis of sex determination

Outcome 2

Describe mechanisms for genetic evolution and population genetics

Knowledge and/or Skills

- linked genes
- population genetics
- mutation
- environmental effects

Outcome 3

Describe genetic disorders

Knowledge and/or Skills

- biological basis and characteristics of genetic disorders
- methods of predicting disorders
- diagnostic techniques
- genetic counselling

Higher National Unit specification: statement of standards (cont)

Unit title: Genetics

Outcome 4

Explain use of gene therapy in genetic disorders

Knowledge and/or Skills

- location of genes
- genetic engineering
- virus and liposome vectors
- application of gene therapy

Evidence Requirements for the Unit

Candidates need to provide evidence to demonstrate that they have gained the knowledge and/or skills by undertaking a holistic end-of-Unit test.

Evidence for the knowledge and/or skills will be provided on a sample basis.

Each candidate will need to demonstrate that they can answer questions based on a sample in any assessment:

Outcome 1: Two out of three knowledge and/or skills items should be sampled.
Outcome 2: Two out of four knowledge and/or skills items should be sampled.
Outcome 3: Two out of four knowledge and/or skills items should be sampled.
Outcome 4: Two out of four knowledge and/or skills items should be sampled.

In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample is required each time the Unit is assessed.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under closed-book conditions and as such candidates must not be allowed to bring any textbooks, handouts or notes to the assessment.

The candidate must achieve at least 60% of the total marks available in order to pass.

Assessment Guidelines for the Unit

This Unit should be assessed by a closed-book, holistic supervised test with a cut-off score of 60%. The test should take the form of a mixture of, short answer, structured and data analysis questions spread evenly across the Outcomes to reflect the workload of each Outcome.

Administrative Information

Unit code: DP4P 34

Unit title: Genetics

Superclass category: RH

Original date of publication: August 2005

Version: 02 (June 2009)

History of changes:

Version	Description of change	Date
02	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: Genetics

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 to form part of the Group Awards HNC Applied Sciences and a number of HND Science awards.

This Unit is designed to provide candidates with an understanding of the main concepts of inheritance and how genetic evolution may occur. The Unit also covers a range of genetic disorders, their diagnosis and treatment.

Outcome 1 provides an overview of the principles and patterns of inheritance in higher organisms.

Candidates should understand the following:

- Mendelian and Non-Mendelian theories and patterns of inheritance
  - Mendel's Laws
  - autosomal dominant
  - autosomal recessive
  - sex/X linked
  - Monohybrid and dihybrid crosses
  - incomplete dominance and co-dominance
  - multiple alleles
  - lethal alleles
  - polygenic inheritance
  - solving various genetic problems

- The chromosomal basis of sex determination
  - Heterogametic male; homogametic female (mammals)

Outcome 2 describes mechanisms for genetic evolution and population genetics.

Candidates should understand the following:

- Linked genes
  - effect on gene transmission
  - recombination by crossing over
  - use of COV/Recombination Frequency in gene mapping

- Population genetics (basic theory only)
  - gene pool
  - Allele frequencies
  - dominant and recessive alleles

Higher National Unit specification: support notes (cont)

Unit title: Genetics

- Mutation
  - source of new variation
  - Microbial evolution (eg antibiotic resistance, HIV and influenza virus mutation)

- Effect of the environment
  - agent of selection

Outcome 3: Describe Genetic Disorders

Candidates should understand the following:

- Biological basis of genetic disorders (eg haemophilia; cardiomyopathy, Inborn errors of Metabolism)
  - gene/chromosome mutation(Insertion, deletion, inversion, substitution, translocation, duplication, non-disjunction)
  - characteristics of disorder (phenotype)

- Methods of Predicting Genetic Disorders
  - pedigree/family tree
  - solving problems/calculating probabilities by analysis of pedigree data

- Importance of diagnostic techniques and genetic counselling
  - CVA, amniocentesis, karyotyping
  - biochemical testing (eg AFP, Guthrie test (early diagnosis))
  - informed decisions

Outcome 4: Explains the use of gene therapy in genetic disorders

Candidates should understand the following:

- Location of genes
  - chromosome banding patterns
  - chromosome/gene mapping

- Genetic Engineering
  - use of enzymes
  - use of bacteria/plasmids

- Virus and liposome vectors
  - characteristics of each type of vector
  - advantages and disadvantages of each type

- Applications of gene therapy (eg CF and Duchenne Muscular dystrophy)

Higher National Unit specification: support notes (cont)

Unit title: Genetics

Guidance on the delivery and assessment of this Unit

This Unit is designed to form part of the Group Awards HNC/D Applied Sciences and a number of HND Science awards.

It is essential that this Unit is delivered in such a way as to emphasise the key points of inheritance, evolution, genetic disorders and gene therapy. Instruments of assessment should be designed with this in mind.

It is recommended that evidence can be generated for Outcomes 1-4 by a closed-book, holistice, supervised assessment with 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: Genetics

This is a 1 credit HN Unit at SCQF Level 7 intended for candidates undertaking an HNC/HND Applied Sciences or HND Applied Biological Sciences. It is designed to provide you with an understanding of the concepts of inheritance, evolution, genetic disorders and gene therapy.

On completion of this Unit you should be able to:

1 Describe the principles and patterns of inheritance in higher organisms.
2 Describe mechanisms for genetic evolution.
3 Describe genetic disorders.
4 Explain the use of gene therapy in genetic disorders.

The four Outcomes that make up the Unit are described below:

Outcome 1

You will be introduced to Mendelian and non-Mendelian patterns of inheritance as well as the concept of the chromosomal basis of sex determination. - Solving various genetic problems.

Outcome 2

This Outcome allows you to discover the various mechanisms required for evolution of species. To include: linked genes, population genetics, mutation and environmental effects.

Outcome 3

In this Outcome you will describe different types of genetic disorders under the following headings: Biological basis of genetic disorder; Characteristics of disorders; Methods of predicting disorders; Importance of diagnostic techniques and genetic counselling; solving problems/calculating probabilities by analysis of genetic or pedigree data.

Outcome 4

This Outcome allows you to explore the use of gene therapy in genetic disorders under the following headings.

- location of Genes; Genetic Engineering; Virus and liposome vectors;Applications of gene therapy

Assessment of the underlying theory in Outcomes 1–4 is by production of appropriate evidence. It is recommended that this evidence should be generated by a single holistic end-of-Unit closed-book assessment with a cut-off score of 60%, although Outcome 4 may be assessed by a case study.