



Higher National Unit specification

General information

Unit title: Animal and Plant Cell Culture: An Introduction
(SCQF level 7)

Unit code: H920 34

Superclass: RH

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Unit purpose

This Unit is designed to enable learners to understand key aspects of animal and plant cell culture, and to provide an introduction to the principles and techniques of animal and plant cell culture. Learners will also develop practical skills in techniques relevant to cell culture. The Unit is suitable for learners studying at HNC level, and will provide the necessary underpinning knowledge and skills to enable progression to further study of cell culture techniques at HND level or to seek employment in science based industries.

Outcomes

On successful completion of the Unit the learner will be able to:

- 1 Explain the principles and applications of animal cell culture.
- 2 Explain the principles and applications of plant cell culture.
- 3 Describe the techniques of animal and plant cell culture.
- 4 Perform practical experiments related to cell culture.

Credit points and level

1 Higher National Unit credit at SCQF level 7: (8 SCQF credit points at SCQF level 7)

Recommended entry to the Unit

Entry is at the discretion of the centre, however it is recommended that learners should have experience of Biology or Human Biology at Higher level.

Higher National Unit specification: General information (cont)

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Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes for this Unit specification.

There is no automatic certification of Core Skills or Core Skill components in this Unit.

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.

The Assessment Support Pack (ASP) for this Unit provides assessment and marking guidelines that exemplify the national standard for achievement. It is a valid, reliable and practicable assessment. Centres wishing to develop their own assessments should refer to the ASP to ensure a comparable standard. A list of existing ASPs is available to download from SQA's website (<http://www.sqa.org.uk/sqa/46233.2769.html>).

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.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

Higher National Unit specification: Statement of standards

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Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

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. Learners 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

Explain the principles and applications of animal cell culture.

Knowledge and/or Skills

- ◆ Principles of the growth of animal cells in culture
- ◆ Growth requirements of animal cells in culture
- ◆ Applications of animal cell culture

Outcome 2

Explain the principles and applications of plant cell culture.

Knowledge and/or Skills

- ◆ Principles of the growth of plant cells in culture
- ◆ Growth requirements of plant cells in culture
- ◆ Applications of plant cell culture

Outcome 3

Describe the techniques of animal and plant cell culture.

Knowledge and/or Skills

- ◆ Equipment required for animal and plant cell culture
- ◆ Materials required for animal and plant cell culture
- ◆ Techniques used to culture animal and plant cells

Higher National Unit specification: Statement of standards (cont)

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Outcome 4

Perform practical experiments related to cell culture.

Knowledge and/or Skills

- ◆ Cell culture experiments
- ◆ Working safely, within current health and safety regulations
- ◆ Consistent and accurate results
- ◆ Recording observations and results
- ◆ Evaluation skills
- ◆ Result analysis and conclusions

Evidence Requirements for this Unit

Written and/or oral recorded evidence for Outcomes 1 and 2 should be assessed using a holistic closed-book assessment under supervised conditions. The assessment will use a sampling approach to the Knowledge and/or Skills as detailed below. It is recommended that the assessment be completed within 45 minutes.

Written and/or oral recorded evidence for Outcome 3 should be assessed using an open-book assessment under supervised conditions. It is recommended that the assessment be completed within one hour. Learners can have access to any materials collected during the research stage when sitting the assessment.

Written and/or oral recorded evidence for Outcome 4 should be assessed by production of a full laboratory report. An assessor's observation checklist could be used to record performance evidence of practical experiments.

Outcome 1

The assessment will sample 2 of the 3 Knowledge and/or Skills items. Learners will not have prior knowledge of which items are being assessed. Those items which are not sampled must be covered in the alternative (re-sit) assessment.

Where an item is sampled, a learner's response will be judged satisfactory where the evidence shows that the learner can:

- ◆ Explain the principles of the growth of animal cells in vivo and in vitro.
- ◆ Explain the growth requirements of animal cells in culture in terms of growth media, environmental conditions and containers in which they are grown.
- ◆ Explain an application of animal cell culture.

Higher National Unit specification: Statement of standards (cont)

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Outcome 2

The assessment will sample 2 of the 3 Knowledge and/or Skills items. Learners will not have prior knowledge of which items are being assessed. Those items which are not sampled must be covered in the alternative (re-sit) assessment.

Where an item is sampled, a learner's response will be judged satisfactory where the evidence shows that the learner can:

- ◆ Explain the principles of the growth of plant cells in vivo and in vitro.
- ◆ Explain the growth requirements of plant cells in culture in terms of growth media, environmental conditions and containers in which they are grown.
- ◆ Explain an application of plant cell culture.

Outcome 3

The assessment will cover all of the Knowledge and/or Skills items. A learner's response will be judged satisfactory where the evidence shows that the learner can:

- ◆ Describe the equipment required for animal or plant cell culture.
- ◆ Describe the materials required for animal or plant cell culture.
- ◆ Describe the techniques used to culture animal or plant cells.

The assessment should cover either animal or plant cell culture.

Outcome 4

Learners will perform a minimum of two practical experiments, the content of which will be related to either two plant tissue cultures or one plant tissue culture and one animal tissue culture. A learner's response will be judged satisfactory where the evidence shows that the learner can achieve all of the following:

- ◆ Follow instructions to perform experiments related to cell culture.
- ◆ Work in a safe manner regarding current health and safety regulations.
- ◆ Achieve consistent and accurate results.
- ◆ Record experimental observations and results clearly and accurately.
- ◆ Evaluate validity of results in terms of sources of and values of experimental errors.
- ◆ Analyse results correctly and state valid conclusions.

An assessor observation checklist will be used to record the learner's performance of the practical work in line with given instructions and health and safety requirements.

Learners must report results by production of a full laboratory report.

Higher National Unit specification: Statement of standards (cont)

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Where a learner does not perform an assessed practical experiment to the required standard, they will be given the chance to either reattempt the same practical experiment, or to undertake a different practical experiment of similar complexity. Where a laboratory report does not meet the required standard, then the learner will be given a single opportunity to re-draft. If the required standard is still not attained, then an alternative practical experiment will be set.



Higher National Unit Support Notes

Unit title: Animal and Plant Cell Culture: An Introduction
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Unit Support Notes are offered as guidance and 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 as part of the framework for HNC/HND Applied Sciences and HND Applied Biological Sciences but may be suitable for inclusion in other HN Science awards. It is designed to develop key aspects of animal and plant cell culture, and to provide an introduction to the principles and techniques of animal and plant cell culture.

Outcome 1 — Explain the principles and applications of animal cell culture

This Outcome focuses on the theory of animal cell culture, namely principles, conditions and applications. Learners should be familiar with the following:

Principles — cell growth in vivo and vitro, establishing and characterisation of primary cultures and cell lines (clonal, continuous and transformed cell lines), immortalisation and the Hayflick limit, the cell cycle, types of cells used and types of growth (suspension and monolayers).

Growth requirements — composition and types of growth media, buffering systems and pH, temperature, oxygen and carbon dioxide requirements, use of serum and antibiotics, aseptic environment and containers in which to grow the cells.

Applications — research, diagnostic tools, monoclonal antibody production, vaccine production, genetic manipulation and tissue engineering.

Outcome 2 — Explain the principles and applications of plant cell culture.

This Outcome focuses on the theory of plant cell culture, namely principles, conditions and applications. Learners should be familiar with the following:

Principles — cell growth in vivo and vitro, establishing and characterisation of callus tissue and meristems, use of hormones, micropropagation, explants and transplantation, types of cells used and their growth, vegetative and sexual propagation.

Growth requirements — composition and types of growth media, plant hormone requirements, growth in flasks and on agar, incubation conditions and light intensity.

Higher National Unit Support Notes (cont)

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Applications — micropropagation in agriculture and horticulture, use in plant breeding programmes, genetic manipulation and germplasm conservation.

Outcome 3 — Describe the techniques of animal and plant cell culture

This Outcome looks at the practical aspects of cell culture and focuses on the materials, equipment and techniques used.

Equipment — plastic ware, incubators, laminar flow hood, culture vessels and agar plates.

Materials — cell lines, culture media, trypsinisation solutions, plant material and culture media.

Techniques — asepsis, trypsinisation and passage of cells, cell counting and trypan blue exclusion, use of inverted microscope, assessment of growth, cryopreservation, transplantation of plant lets, cauliflower meristem and carrot callus culture.

Outcome 4 — Perform practical experiments related to cell culture

Guidance on suitable practical experiments for assessment purposes is given elsewhere in this document. However, it is envisaged that learners will also participate in a range of other practical experiments which will both develop their laboratory skills and support the theory covered in Outcomes 1 and 2.

Due to the limited availability of specialist equipment within centres, it is anticipated that the practical experiments will focus on plant cell culture. However, it is strongly advised that where possible a practical activity involving animal cells is carried out. Opportunities also exist for other laboratory techniques to be carried out ie techniques such as viability counts.

In carrying out such activities, learners should follow Good Laboratory Practice (GLP) and carry out or be familiar with the risk and Control of Substances Hazardous to Health (COSHH) assessments on all procedures undertaken. Opportunities should be taken to develop awareness of the sources of experimental error and of the accuracy of measurements, with quantification of errors where possible.

Guidance on approaches to delivery of this Unit

It is anticipated that Outcomes 1 and 2 are delivered (in either order) first to give learners the necessary underpinning knowledge and skills to carry out practical experiments which may be integrated within learning and teaching.

For both Outcomes 1 and 2 it is recommended that the principles of the type of cell culture and the growth requirements are covered prior to teaching how each type of cell culture is applied. These lessons are most likely to be lecturer led presentations followed by learner focussed tutorial questions to enforce what has been taught. In discussion of the applications of each type of culture learners may carry out their own research on an application and bring it back to class to share with others in the form of a poster or a presentation.

Higher National Unit Support Notes (cont)

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After the theory has been delivered it may be appropriate at this stage to assess learners on these Outcomes. Where possible it should be encouraged to take the learners on a trip to an organisation that carries out cell culture on a regular basis to emphasise GLP and quality procedures involved. Throughout Outcomes 1 and 2 it is recommended that practical experiments are carried out to demonstrate the points being made.

Outcome 3 should be learner focussed activities where learners can access information from companies, websites, brochures and catalogues. Learners should be given adequate time in which to research and collate the information that they need (approximately 4 hours), and learners should be provided with guidance on where the information could be accessed.

It is envisaged that Outcome 4 will be delivered alongside the theoretical based Outcomes 1 and 2. A range of practical experiments could be utilised to both support understanding of the underlying theory and to prepare learners for undertaking the assessed practical experiments. Aspects suitable for experimental investigation might include the culture and passaging of animal cells, plant callus culture, carrot or cauliflower cultures, protoplast production and observation, the effect of plant hormones on mustard seedlings in culture.

Guidance on approaches to assessment of this Unit

Evidence can be generated using different types of assessment. The following are suggestions only. There may be other methods that would be more suitable to learners.

Outcomes 1 and 2 could be assessed by a single holistic closed-book assessment with an appropriate cut-off score that covers the sampling requirements as detailed in the Evidence Requirements. Assessment should be carried out in supervised conditions, and it is recommended that the assessment be completed within 45 minutes.

Where evidence of Outcomes 1 and 2 is assessed by sampling, the whole of the content listed in the Knowledge and/or Skills must be taught and available for assessment. Learners should not know in advance the items on which they will be assessed, and different items should be sampled on each assessment occasion. Any items not sampled in the first assessment, must be included in the alternative (re-sit) assessment.

Outcome 3 could be assessed by a single open-book assessment with an appropriate cut-off score that covers the sampling requirements as detailed in the Evidence Requirements. Assessment should be carried out in supervised conditions, and it is recommended that the assessment be completed within 60 minutes. Learners can have access to any materials collected during the research stage when sitting the assessment.

Assessment for Outcome 3 should take the form of a problem solving assignment that covers all of the Knowledge and/or Skills items. The assessment should cover either animal or plant cell culture.

Written and/or oral recorded evidence for Outcome 4 should be assessed by production of a full laboratory report. An assessor's observation checklist could be used to record performance evidence of practical experiments.

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In Outcome 4 learners are required to undertake two assessed practical experiments, the content of which will be related to either two plant tissue cultures or one plant tissue culture and one animal tissue culture. Examples of suitable experiments are given below. However, this list is not prescriptive, and other practical experiments of similar complexity may be used by the centre.

Suitable practical experiments are:

- ◆ the culture and passaging of animal cells
- ◆ plant callus culture
- ◆ carrot or cauliflower cultures
- ◆ protoplast production and observation
- ◆ the effect of plant hormones on mustard seedlings in culture

Assessed practical experiments will usually be performed individually. However, there may be some experiments that are suitable to be undertaken in pairs or small groups. If this is the case then the assessor should ensure that all participants are actively involved and are able to adequately demonstrate the required skills.

An exemplar instrument of assessment with marking guidelines has been produced to indicate the national standard of achievement at SCQF level 7.

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at www.sqa.org.uk/e-assessment.

Opportunities for developing Core and other essential skills

The delivery and assessment of this Unit will provide learners with the opportunity to develop the Core Skills of *Problem Solving* at SCQF level 6 and *Information and Communication Technology (ICT)* at SCQF level 4.

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Problem Solving — Reviewing and Evaluating at SCQF level 6

Following assessed practical experiments learners will be required to review and evaluate the effectiveness of the exercise with a thorough interpretation of random and systematic sources or error. Learners will be required to reach sound conclusions on the basis of the data collected and the inherent errors.

Information and Communication Technology — Providing/Creating Information at SCQF level 4

Learners will make effective and appropriate use of ICT packages to produce a laboratory report in an appropriate format. Packages used will likely include word processing, spreadsheets, and graph drawing software. Learners will also be required to utilise internet search engines to source information on research topics.

History of changes to Unit

Version	Description of change	Date

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General information for learners

Unit title: Animal and Plant Cell Culture: An Introduction
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This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit and opportunities for further learning and employment.

This is a 1 credit Unit at SCQF level 7, which you are likely to be studying as part of the first year of an HNC/HND science programme. Before progressing to this Unit it would be beneficial to have had experience of Biology or Human Biology at Higher level. The Unit is designed to enable learners to understand key aspects of animal and plant cell culture, and to provide an introduction to the principles and techniques of animal and plant cell culture.

On completion of the Unit you should be able to:

- 1 Explain the principles and applications of animal cell culture.
- 2 Explain the principles and applications of plant cell culture.
- 3 Describe the techniques of animal and plant cell culture.
- 4 Perform practical experiments related to cell culture.

Outcomes 1 and 2

In Outcomes 1 and 2 you will cover the principles of animal and plant cell culture, the growth requirements of the different cell types and how these cultures are used in research and in industrial situations.

Outcome 3

In Outcome 3 you will carry out research on a cell type of your choice. You will research the cell type to find out the equipment and materials needed to carry out the techniques.

Outcome 4

In this Outcome you will undertake practical experiments, relating to plant and/or animal tissue culture.

During this practical work, you will also be expected to develop good laboratory practices as well as improve your skills of manipulation, observation and measurement. You will be encouraged to develop safe working practices and to strive constantly to improve the accuracy and reliability of your results. The reporting and analysis of experimental data is an important aspect of the practical sessions.

Assessment

For Outcomes 1 and 2 you will take a closed-book assessment.

For Outcome 3 you will take an open-book assessment.

Outcome 4 will be assessed after you have learned the necessary practical skills, and will take the form of two practical experiments, for which you will report your results in full laboratory reports.

General information for learners (cont)

Unit title: Animal and Plant Cell Culture: An Introduction
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Core Skills

Although there is no automatic certification of Core Skills in the Unit, you will have opportunities to develop the Core Skills of *Problem Solving* at SCQF level 6 and *Information and Communication Technology (ICT)* at SCQF level 4.