

Arrangements Document

HND Biotechnology

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HND BIOTECHNOLOGY
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1 Introduction

This is the Arrangements document for the revised Group Award: HND Biotechnology and the associated Graded Units. The HN Units that make up the Group Award have been validated separately in accordance with the new design principles.

The Arrangements Document has been developed in order to assist centres in preparing for approval for the new HND Biotechnology Group Award and maintaining the award following successful approval. This award was validated in July 2004 and replaces the existing HND Biotechnology award.

This document includes details on the background to the development of the new award, its aims (both general and specific), recommended access requirements, information about the structure of the awards, recommendations on delivery and assessment and guidance for centres.

2 Rationale

2.1 HN Science Frameworks

One of the main objectives in this review was to develop a new HND which would be up-to-date and relevant for the Biotechnology industry. Most of the current courses that centres were delivering were approaching their lapsing period and it was considered the ideal time to rewrite the HN Biotechnology course. The review has provided an opportunity for inclusion of updated technical content, revised assessment strategies, flexibility to match current employment needs and more appropriate, recognition of the needs of candidates for progression to Higher Education.

The main project objective was:

- ◆ to design and provide high quality accredited education and training which supports the needs of the biotechnology and associated industries for well-trained staff

Specific objectives and outputs, relevant to this HND development are:

- ◆ a response to Scottish Enterprise's demand for increased support to developing biotechnology companies through access to appropriate training and development facilities
- ◆ the shared development of curriculum material, with content as advised by the industry, 30 credits over 2 years
- ◆ an increase in the number of young people studying science in schools and colleges
- ◆ an increase in the number of colleges offering biotechnology education and training

2.1.1 HND Biotechnology

In November 1999, in their document, 'Biotechnology — A Framework for Action', Scottish Enterprise set targets to be achieved over the following five years involving growth in company-based research employment, employment in the cluster, the

number of Biotechnology and support and supply companies and an improvement in the performance of the whole sector. Their strategic approach aims to allow key issues, such as skill gaps, to be addressed. A key element of sustaining and maintaining these targets is to develop the skills of the existing and potential workforce.

Significant growth is forecast in the medium to long term for this sector of Scotland's industrial and economic base. This is supported by the latest document produced by Scottish Enterprise: 'Life Sciences Scotland — Framework for Action 2003-2004' A key feature of Scottish Enterprise's inward investment strategy is the availability of a skilled workforce. The provision of well resourced training facilities and curricula for technicians supports the aims of the Biotechnology cluster.

Throughout the development of this proposal the development group has consulted with employers in the biotechnology industry. The views and needs of employers has provided information which has shaped this course and supported evidence of demand for such a qualification, with particular emphasis on underpinning knowledge and practical laboratory skills.

2.2 Consultation Process

Extensive consultation was carried out at all stages of the review process to ascertain both the level of uptake of the award as well as the relevance of the framework and Units.

This consultation involved:

- ◆ Colleges
- ◆ Employers
- ◆ Candidates
- ◆ Higher Education institutions to which successful candidates could articulate

In reviewing this award, consultations were undertaken at key stages in the development schedule. Development teams and the Team leaders of each group helped to guide the overall development process.

Stakeholder	Method of Consultation
Employers	◆ Questionnaire sent to employers (information gathered on the award content and structure)
Higher Education	◆ Questionnaires ◆ Face to face interviews
Centres	◆ All delivering centres invited onto development teams ◆ Postal questionnaire sent to all centres ◆ Conferences held in January 2003 and January 2004 to update and inform centres ◆ Information updates posted on SQA website — HN Science pages
Candidates	◆ Questionnaires given to existing candidates to gauge what changes, if any, students would like to see being made to the HNC

2.2.1 Feedback of Consultation

The consultation confirmed that there was considerable demand for the proposed awards from Colleges, candidates, employers and Higher Education Institutions. Through consultation, a number of changes were made to the framework, this included changes to the mandatory and optional areas of the framework and changes to individual Units.

2.2.2 Demand for Revised Courses

The need for the Group Awards has been clearly identified. These Group Awards contribute to an overall strategy for reducing the skills gap in the Biotechnology industry and enhancing the Scottish economy by further expansion of science knowledge.

The evidence of support from employers, professional bodies and universities indicates that the structure and content of the awards meets the needs identified.

3 Aims of the Qualification

3.1 General aims

The aims of the HND Biotechnology are as follows:

The overall aim is to provide a progressive, integrated and coherent education which will be responsive to the needs of candidates and employers. Specifically these are to:

- ◆ develop candidates' knowledge and skills such as planning, analysis and synthesising in the area of Biotechnology
- ◆ develop employment skills and enhance candidates employment prospects by providing the candidate with a wide range of practical laboratory skills
- ◆ facilitate students' access to HE
- ◆ introduce students to a broader view of science and Biotechnology
- ◆ enable progression within SCQF
- ◆ develop study and research skills in the area of Science and Biotechnology
- ◆ develop transferable skills including Core Skills
- ◆ provide a stimulating and intellectually satisfying learning experience. The level and content of knowledge necessary for successful completion of this award will require diligence and commitment from the candidate. The structure of the award, design of the assessment and the relationship between theory and observed good practice are intended to provide a balance between presented learning and developmental thinking on the part of the candidate.
- ◆ develop in the candidate skills of independent study and communication and an informal sense of the social responsibility attached to the work of biotechnologists
- ◆ provide the candidate with a deeper underpinning knowledge in biotechnology

3.2 Specific Aims

The aims of the HND Biotechnology specifying the knowledge and skills required in order to be deemed competent in this subject/occupational area are to:

- ◆ prepare candidates for an appropriate level of employment, in science areas such as research and industrial laboratories; biotechnology, chemical, microbiological, pharmaceutical, and environmental industries
- ◆ develop a range of contemporary vocational skills relating to the use, support and development of systems appropriate to employment at technician or professional level
- ◆ develop options to permit an element of vocational specialisation in a variety of science areas such as; biotechnological, chemical, therapeutics, diagnostics, agriculture, veterinary and environmental
- ◆ prepare candidates for progression to further studies in Biotechnology related disciplines
- ◆ provide a flexible route to a qualification, meeting demand, for example, for those already in employment. The unitised structure of the course and the intended modes of delivery will provide access to this qualification from those in employment through part-time provision and for direct entry or seconded candidates through full-time provision. Discrete Units will be available for study.
- ◆ provide the candidate with a sound academic basis for the continuing development of practical and conceptual skills. The course will do this by giving the candidate the necessary competences to deal with a variety of biotechnology industrial areas.
- ◆ provide candidates with a wider range of practical laboratory skills to further enhance job prospects

3.3 Target Audience

The award is designed for those who wish to take up a career in the science-based industries, specifically those in the Biotechnology field including:

- (a) Students articulating from the suite of National Certificate programmes.
- (b) Students articulating from ACCESS courses.
- (c) School leavers with a minimum of one Science Higher at C grade.
- (d) Students who may have partially completed one or two years of a degree programme.

The HND Biotechnology Group Award is a specialised award which allows candidates to gain more advanced knowledge and technical skills in microbiology, DNA technology, immunology, cell culture and instrumentation together with related Biotechnology and quality issues. As such, it is intended to prepare candidates for employment at senior technician level.

The award is designed for both full and part-time candidates.

The award may be delivered by open and distance learning methods, provided that adequate preparations are made. Additional planning and resources will be needed for candidate support, assessment and laboratory work.

In respect of assessment, a combination of new and traditional authentication tools and techniques may have to be devised. Quality assurance procedures must also be sufficient and robust to support open and distance learning. Further advice and guidance is available in the SQA publication Assessment and Quality Assurance for Open and Distance Learning — SQA February 2001.

3.4 Progression Routes

In designing the award, the Development Group has been fully aware of the need for the qualifications to contain relevant technical and transferable skills to enable immediate entry to employment while at the same time allowing articulation to degree courses. The Development Group believes that an appropriate balance between academic and vocational knowledge and skills has been achieved through the mix of Unit content and teaching approaches.

Care has been taken in the design of the curriculum of these awards to ensure that topics and Units required to maintain articulation routes are included. Thus no difficulty is foreseen in maintaining existing articulation routes.

3.5 Title of the Group Award

The award title ‘HND Biotechnology’ reflects the specific nature of the award. The HND gives candidates in depth knowledge of Biotechnology and allows them to enhance their knowledge and technical skills in a variety of specific topics related to Biotechnology.

3.6 The Scottish Credit and Qualifications Framework

Due cognisance has been taken of the requirements of the Scottish Credit and Qualifications Framework (SCQF) during the design of these awards. The HND Biotechnology award is at SCQF level 8.

3.7 Employment Opportunities

The employment prospects for holders of the HND are excellent. For example **Futureskills Scotland** published jointly by Highlands and Islands enterprise and Scottish Enterprise make labour market projections for the years 2003–2008. These predictions are based on an economic forecasting model produced by the researchers at the universities of Warwick and Cambridge. This model forecast that within Scotland, in the periods covered, there

- ◆ will be 500,000 new jobs arising of which:
 - 103,000 will be in health and education
 - 5,000 will be in chemicals
 - 8,000 will be in manufacturing
 - 5,000 will be in the food, drink and tobacco industries and
- ◆ that 56% of these new jobs will require a qualification at HNC or above

This programme has been designed to meet the needs of this expanding employment market and candidates will develop the competences required to enhance their ability to obtain employment as a senior technician, junior laboratory manager or production process controller in a Biotechnology based industry.

4 Recommended Conditions for Entry to the Qualifications (Access)

4.1 Formal Qualifications

It is intended that admission to these awards should be as broadly based as possible, but that this should be consistent with the selection of candidates who have a reasonable chance of successfully completing the award (s). The following entry requirements are given as guidelines only:

4.1.1 HND Biotechnology Year 1 (HNC Applied Sciences)

- ◆ One Science Higher and not fewer than three Standard Grade 3 passes, including Chemistry, Biology, Biotechnology or Human Biology and Mathematics.
- ◆ National Qualification in an appropriate Science and Maths programme, such as Access to Science. Candidates should preferably possess some Units at Higher level.
- ◆ Scottish Group Award (SGA) in Science at Intermediate 2.
- ◆ Qualifications comparable to the above, gained through other awarding bodies, such as GCSE, City and Guilds, Edexcel.
- ◆ At the discretion of the Principal of the presenting centre for applicants with a different experiential background, who could benefit from taking the course or Units within the course, eg adult returners, overseas candidates.

4.1.2 HND Biotechnology Year 2

- ◆ Completion of the HND Biotechnology year 1 (HNC Applied Sciences) award including the option recommendations shown below:

Statistics for Science 1
Cell Biology Theory and Practice
Microbiology; Theory and Practice
Biotechnology: An Introduction
DNA Structure and Function

- ◆ Candidates need not have successfully completed all 15 credits of the HNC in order to progress to this award (although it is strongly recommended that they are re-sitting as few credits as possible from the HNC.) Delivering centres will specify their own limits on the maximum number credits which may be re-sat based on their own experience and any recommendations that may be made by the Quality review panel (see section 8).
- ◆ Qualifications comparable to the above, gained through other awarding bodies, such as GCSE, City and Guilds, Edexcel, University Certificates etc. Such other qualifications would need to be presented in a format which would allow delivering centres to give credits for the Units composing year 1 of the HND.

- ◆ At the discretion of the Principal of the presenting centre for applicants with a different experiential background, who could benefit from taking the course or Units within the course, eg adult returners, overseas candidates.

4.2 Alternative access arrangements

The presenting centre may operate alternative access arrangements in cases where the candidate is convinced s/he already has the required competences in a given area. These arrangements are as follows:

- ◆ Assessment on demand
- ◆ Credit Transfer
- ◆ Accreditation of Prior Learning
- ◆ Work Experience — mature candidates with suitable work experience may be accepted for entry provided the enrolling centre believes that the candidate is likely to benefit from undertaking the award.

Individual presenting centres will outline their systems for each of these as appropriate.

5 Structure of the Qualification

Mandatory Units

Product Code	Product title	Credit value	SCQF level	% Laboratory Content
DG70 34*	Presentation Skills in Science	1	7	0
DN8C 34*	Statistics for Science 1	1	7	0
D75X 34*	Information Technology Applications Software 1	1	7	0
DH2K 34*	Fundamental Chemistry: Theory and Practice	2	7	40
DJ1K 34*	Cell Biology: Theory and Practice	1	7	10
DJ6Y 34*	DNA Structure and Function	1	7	10
DH55 34*	Microbiology: Theory and Practice	2	7	20
DJ00 34*	Biotechnology: An Introduction	1	7	0
DF82 34*	Quality and Health and Safety systems in Science Industries	1	7	0
DJ89 34*	Applied Sciences Graded Unit 1	1	7	0
DJ6X 35*	DNA and molecular techniques: Theory and Practice	2	8	20
DJ2P 35*	Microbiological Techniques: Theory and Practice	2	8	20
DH2M 35	Immunotechnology: Theory and Practice	1	8	10
DH54 35	Instrumental techniques: Theory and Practice 1	1	8	20
DG6X 35*	Protein Structure and Function: Theory and Practice	1	8	10
DH2H 34*	Animal and Plant Cell Culture: An introduction	1	7	10
DP9M 34*	Science Industry: Key Issues	1	7	0
DJ8A 35*	Biotechnology Graded Unit 2	2	8	60

Optional Units

Product code	Product title	Credit value	SCQF level	% Laboratory Content
DH9Y 35	Food Science: Theory and Practice	1	8	15
DH2L 35*	Immunological Techniques: Theory and Practice	1	8	10
DH2J 34	Biochemistry: Theory and Practice	1	7	10
DG6Y 34	Applied Biochemical Techniques	1	7	10
DG71 35	Human Body Structure and Function	2	8	10
D033 13	Environmental Biology	1	7	20
D77H 34	Employment Experience 2	1	8	30
DH2N 35*	Instrumental Techniques: Theory and Practice 2	1	8	20
DX29 33	Fundamental Chemistry: An Introduction	1	6	0

Broadening Units

DE1K 33	Workplace Communication in English	1	6	0
DE3R 34	Personal Development Planning	1	7	0
DG6E 34	Work Role Effectiveness (2003)	3	7	0
or				
DG6G 35	Work Role Effectiveness (2003)	3	8	0

***Assessment exemplars to be produced**

5.1 Laboratory Content

The hours shown in the table are a minimum estimate based on mandatory practical assessment.

It is envisaged that this practical content will be much higher due to the release of time for practical work by the introduction of end-of-Unit assessment.

5.2 Graded Units

The purpose of the Graded Units is to assess the candidate's ability to integrate and apply the knowledge and skills gained in the individual Units to demonstrate that they have achieved the specific aims and to grade candidate achievement.

Candidates will undertake one Graded Unit at level 7 in the first year of the HND Biotechnology Award. This will be a one credit Unit involving an investigation report. Candidates will also undertake a two credit Graded Unit at level 8 in year two of the HND Biotechnology award. This will be based on a practical assignment.

5.2.1 Type of Graded Unit

HND Biotechnology (Year 1): Investigation Report

This Unit will be a project based on an investigation which should take place during the last block of the first year of study. It will cover a range of skills achieved through studying the mandatory Units of the award.

HND Biotechnology (Year 2): Practical Assignment

This Unit will be a project based on a practical assignment which should take place during the last block of the second year of study. It will cover a range of skills achieved through studying the mandatory Units of the award.

5.2.2 Rationale for Graded Unit assessment

Investigation Report (Year 1)

Candidates will be given a topic to research. They will produce a report covering the planning, developing and evaluation stages of the investigation.

An investigation report allows candidates to integrate knowledge and skills gained in the mandatory Units. It allows them to use research skills, set timescales, experience working with others, improve self motivation and identify main issues, methods and sources of research. It also allows them to use scientific reporting skills in setting out the aims, data, analysis, summary, evaluation and references relevant to their investigation.

Practical Assignment (Year 2)

Candidates will be given a practical assignment to carry out. They will produce a laboratory report covering the planning, developing and evaluation stages of the project.

A practical assignment allows candidates to integrate knowledge and skills gained in the mandatory Units. It also allows them to use research skills, set timescales, experience working with others, improve self motivation and identify main issues, methods and sources of research. In addition it allows them to use practical laboratory skills, GLP, risk assessments and other Health and Safety considerations as well as extending investigative skills to a practical situation. It also allows them to use laboratory reporting skills by producing a logbook/diary of their activities as well as the final laboratory report.

Should centres wish to develop their own assessment materials they can do so, but are strongly advised to contact SQA and seek prior moderation before use of their own devised assessments. Further guidance is available on Prior Moderation for Graded Units from SQA.

Moderation

Centre internal moderation processes should ensure that all candidates have been fairly treated, that the assessment has been valid and reliable, and that the assessment decisions, marks and grades allocated are fair and in accordance with national standards. A suggested method for the internal moderation of the marking process is for the internal moderator to:

- ◆ select and check a sample of scripts marked by the assessor — the sample should include A, B and C graded and fails
- ◆ decide whether the marking is:
 - at the appropriate standard
 - generally lenient, and by how much
 - generally severe, and by how much
 - lenient or severe at a particular point in the marks range, and by how much
 - inconsistent
- ◆ discuss any problem cases with the assessor and agree on the appropriate adjustments to be made to the sampled scripts and, if necessary, to other scripts marked by the assessor
- ◆ complete the documentation which underpins any further action required
- ◆ make a judgement on the type of training/guidance/support to offer the assessor

Further information on guidance in marking and making assessment decisions is available from SQA.

5.3 Core Skills

This award has been designed using the new design principles and therefore the importance of Core Skills has been recognised and these are developed throughout the award. These Core Skills may be embedded in the entry qualifications that the presenting candidates have already achieved in obtaining the HNC Award.

Core Skill	Recommended Entry Level at HNC	Recommended Exit Level at HND
Communication	Intermediate 2	Higher
Numeracy	Intermediate 2	Higher
Information Technology	Intermediate2	Higher
Problem Solving	Intermediate 2	Higher
Working With Others	Intermediate 2	Higher

5.3.1 Core Skills Signposting

There may be opportunities to gather evidence towards Core Skills or Core Skills Components (Appendix 1) however there is only automatic certification as detailed below:

Core Skill	Component	HN Unit	Level	Mandatory/Optional
Communication	Oral Communication	Presentation Skills in Science	H	M
	Written Communication	Presentation Skills in Science	H	M
Numeracy	Using Graphical Information			
	Using Number			
Information Technology	Using Information Technology	Information Technology: Applications Software 1	H	M
Problem Solving	Critical Thinking			
	Planning and Organising			
	Reviewing and Evaluating			
Working with Others				

5.4 SCQF levels

The tables below show the distribution of SCQF levels.

Distribution of SCQF Levels

Level 6	Level 7	Level 8	Totals	SQA Minimum Requirement for Level 8 Units
	112 mandatory 24 optional	72 mandatory 48 optional	184 mandatory 72 optional	64 SCQF credit points

6 Approaches to Delivery and Assessment

6.1 Content and Context

The HND Biotechnology is a specialised award which allows candidates to gain more advanced knowledge and technical skills in microbiology, DNA technology, immunology, cell culture and instrumentation together with related biotechnology and quality issues. As such, it is intended to prepare candidates for employment at senior technician level.

The evidence of support from employers indicates that the structure and content of the awards meets their needs.

The award allows candidates to progress to a range of study options in Higher Education.

6.2 Delivery and Assessment

Although centres can choose what order in which to teach the Units within the awards, guidelines have been produced on timetabling the mandatory Units (Appendix 3). Every effort should be made to integrate both the teaching and assessment of Units wherever possible.

The assessment strategy of the design principles to encourage a more holistic approach to assessment has been adopted. The new HN Unit specification places the emphasis on reducing assessment load for candidates and centres by devising assessments which assess the entire theory content of the Unit where appropriate, and by sampling of knowledge and/or skills carried out under closed-book conditions on a random basis to ensure the candidates do not have prior knowledge of the sample.

Unit specifications detail the Evidence Requirements and assessment procedures for each assessment event. Should centres wish to use a different mode of assessment from that recommended they should seek prior moderation from SQA.

6.3 Re-assessment

The way in which centres reassess candidates is integral to the way they manage the award assessment process as a whole. Reassessment should be subject to rigorous internal moderation in exactly the same way as assessment is.

Candidates may require to be reassessed on only a part of an assessment where their evidence has been generated over a period of time and/or a discrete part of the Unit, such as an Outcome, has been assessed previously. On other occasions it may not be possible to reassess candidates on parts of their performance which are unsatisfactory. Situations where candidates may have to re-do a whole assessment include:

- ◆ assessments which test knowledge and understanding and where it may not be possible to extract some of the items for reassessment purposes
- ◆ where parts of several Outcomes are involved
- ◆ where a project has been designed as an integral assessment and where there is a requirement to complete the project as a single complex task

6.3.1 Re-assessment Opportunities

Re-assessment should operate in accordance with a centre's assessment policy and the professional judgement of the assessor. SQA advises that there should normally be one, or in exceptional circumstances two reassessment opportunities. Please refer to the SQA publication *Guide to Assessment and Quality Assurance for Colleges of Further Education*, August 2003 revision

6.3.2 Developing Alternative Assessments

The design of original assessments should inform the reassessment process to a large extent, as the original determines the type of assessment instruments used and the purpose of the assessment. It is normal practice for centres to build up a bank of assessments which can be used in whole or in part for reassessment purposes. Assessment writers should always refer to the Unit specification when developing an alternative assessment to ensure that it is of equal demand to the original assessment and that it covers all the necessary criteria. Where candidates have not provided satisfactory evidence for knowledge and/or skills items which have been sampled, they should be reassessed on a different sample.

Prior moderation

We strongly encourage centres to seek prior moderation of the assessment instrument and associated scheme they intend to use where these are not:

- ◆ NAB material
- ◆ on SQA approved assessment instrument and associated assessment scheme which has been successfully moderated

The use of prior moderation may prevent problems arising at a later date.

Assessment Exemplars

Exemplar assessment instruments will be available for all mandatory Units and a selection of optional Units. The exemplars provide guidance on content, conduct, evidence required and marking and grading. Centres are expected to use these exemplars as templates when producing further assessment instruments.

6.3.3 Re-assessing HN Graded Units

Re-assessment would be at the discretion of the centre and should be subject to rigorous internal moderation.

6.3.4 Relationship to other Awards

This award is designed to provide a national HND qualification in a specialised area of science. It is a two year programme of which the first year is HNC Applied Sciences (Only recommended options provide entry to HND Biotechnology — see Appendix 3). HNC Applied Sciences also forms the first year of the following HND awards:

Applied Sciences
Applied Biological Sciences
Biomedical Science
Applied Chemistry
Environmental Science
Biomedical Sciences

Providing that the recommended options (**Appendix 2**) for progression to HND level are selected.

7 Guidance for Centres

7.1 Assessment Moderation

All assessment instruments used within the award should be internally moderated, including assessment exemplar materials, using appropriate policies within the centre and guidelines provided by SQA. This will ensure the validity and reliability of the instruments of assessment used within the centre.

External moderation will be carried out by SQA to ensure that internal assessment is within the national guidelines for these qualifications.

For further information on internal and external moderation refer to the SQA publication *Guide to Assessment and Quality Assurance for Colleges of Further Education*, August 2003 Revision.

7.2 Open and Distance Learning

HND Biotechnology could be delivered by Open Learning. Candidates would have to attend the presenting centre or other agreed institution to complete the practical assessments. Centre-devised supervision agreement should detail controlled conditions to ensure authenticity of evidence.

7.3 Candidates with additional support needs

There should be no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences and selecting assessment instruments. For example, some candidates may require a longer period for the single assessment or may require that it be split into more than one event. Additional guidance on special needs can be found in *Guidance on Special Assessment Arrangements* (AA0645/3, December 2001).

7.4 Credit Transfer Transition Arrangements

In principle, candidates can be given credit transfer between current HNC/D Units and new HN Units. Details of these arrangements are available from SQA and in the Validation panel members' guide, Section 5.7.

Given that there are several different new HNC/D Science awards currently being delivered containing varying HN descriptors, mapping Units and awards for credit transfer should be done on an individual basis for those candidates seeking 2nd year entry in the future.

However, it is recommended that current candidates complete the 2nd year of current HND Science awards.

7.5 General Information for Candidates

It is recommended that all candidates are given a copy of this section with clarification and explanation as appropriate.

7.5.1 Course Content

The course content is shown in the tables on the next page. In order to achieve the HND you must accumulate 30 credits made up as follows:

Routes to obtaining 30 credits

Route	Core Credits	Optional Credits	Total Credits
1	23	7	30

7.5.2 Laboratory Content

The hours shown in the table are a minimum estimate based on mandatory practical assessment.

It is envisaged that this practical content will be much higher due to the release of time for practical work by the introduction of end-of-Unit assessment.

7.5.3 Access

7.5.3.1 Formal Qualifications

It is intended that admission to this award should be as broadly based as possible, but that this should be consistent with the selection of candidates who have a reasonable chance of successfully completing the award (s). The following entry requirements are given as guidelines only:

HND Biotechnology Year 1

- ◆ One Science Higher and not fewer than three Standard Grade 3 passes, including Chemistry, Biology, Biotechnology or Human Biology and Mathematics.
- ◆ National Qualification in an appropriate Science and Mathematics programme, such as Access to Science. Candidates should preferably possess some Units at Higher level.
- ◆ Scottish Group Award (SGA) in Science at Intermediate 2.
- ◆ Qualification comparable to the above, gained through other awarding bodies, such as GCSE, City and Guilds, Edexcel.
- ◆ At the discretion of the Principal of the presenting centre for applicants with a different experiential background, who could benefit from taking the course or Units within the course, eg adult returners, overseas candidates.

HND Biotechnology Year 2

- ◆ Completion of the HNC Applied Sciences award including the optional recommendations shown below:

Statistics for Science 1
Cell Biology Theory and Practice
Microbiology; Theory and Practice
Biotechnology: An Introduction
DNA Structure and Function
Animal and Plant Cell Culture: An Introduction

- ◆ Candidates need not have successfully completed all 15 credits of the HNC in order to progress to this award (although it is strongly recommended that they are re-sitting as few credits as possible from the HNC). Delivering centres will specify their own limits on the maximum number credits which may be re-sat based on their own experience and any recommendations that may be made by the Quality review panel (see Section 8).
- ◆ Qualifications comparable to the above, gained through other awarding bodies, such as GCSE, City and Guilds, Edexcel, University Certificates etc. Such other qualifications would need to be presented in a format which would allow delivering centres to give credits for the Units composing year 1 of the HND.
- ◆ At the discretion of the Principal of the presenting centre for applicants with a different experiential background, who could benefit from taking the course or Units within the course, eg adult returners, overseas candidates.

7.5.3.2 Alternative access arrangements

Most delivering centres are able to relax entrance requirements for mature applicants so if candidates do not have the formal qualifications listed above then it may still be possible for them to be accepted providing that they are able to demonstrate, for example, that they have a background of work experience in the science area and possess Core Skills such as numeracy and literacy to the required levels. Candidates will be asked to provide this evidence using one of the following methods:

- ◆ Assessment on demand
- ◆ Credit Transfer
- ◆ Accreditation of Prior Learning
- ◆ Work Experience — mature candidates with suitable work experience may be accepted for entry provided the enrolling centre believes that the candidate is likely to benefit from undertaking the award.

Individual presenting centres will outline their systems for each of these as appropriate.

7.5.4 Articulation

The award has been designed to provide the qualifications to demonstrate the relevant technical and transferable skills to enable immediate entry to employment while at the same time allowing articulation to degree courses. Care has been taken in the design of the curriculum of these awards to ensure that topics and Units required to maintain articulation routes are included. Thus no difficulty is foreseen in maintaining existing articulation routes. Candidates should expect to progress to second or third years of degree courses if they pass 30 credits (paying due regard to mandatory requirements). For possible third year entry candidates would be expected to obtain high passmarks in all Units together with an 'A' in the Graded Unit. The relationship between the degree applied for and the mixture of Units passed would also be taken into account. Entry into third year is at the discretion of the HEI.

7.5.5 Employment opportunities

The employment prospects for holders of the HND are excellent. For example Futureskills Scotland published jointly by Highlands and Islands enterprise and Scottish Enterprise make labour market projections for the years 2003–2008. These predictions are based on an economic forecasting model produced by the researchers at the universities of Warwick and Cambridge. This model forecast that within Scotland, in the periods covered, there

- ◆ will be 500,000 new jobs arising of which:
 - 103,000 will be in health and education
 - 5,000 will be in chemicals
 - 8,000 will be in manufacturing
 - 5,000 will be in the food, drink and tobacco industries and
- ◆ that 56% of these new jobs will require a qualification at HNC or above

This programme has been designed to meet the needs of this expanding employment market and candidates will develop the competences required to enhance their abilities to obtain employment as a senior technician, junior laboratory manager or production process controller in Science based industries.

Typical job opportunities are diverse and include posts in:

- ◆ Industrial research and development laboratories
- ◆ Quality assurance laboratories
- ◆ College, university and research institute laboratories and local authority laboratories. Much of contemporary industrial production involves complex hi-tech processes. Supervision and control of such processes requires the knowledge and competences incorporated in the HND Biotechnology. Production control posts also exist in a wide range of industrial sectors including:
 - chemical
 - bio-medical
 - pharmaceutical
 - food processing
 - textiles
 - bio-technology
 - soft drinks, brewing and distilling

The health care industry offers a wide range of technician posts including:

- ◆ Perfusionists — following further training
- ◆ Phlebotomists — following further training
- ◆ Cytoscreeners — following further training
- ◆ Immunology research technician
- ◆ Biotechnology research technician
- ◆ Forensic Science technician

8 History of Changes

The SQA has set up a review panel to monitor and evaluate the appropriateness of the ward with respect to content, delivery and assessment.

It is therefore anticipated that changes will take place during the life of the qualification eg additional optional Units/updated specifications and this section will record these changes.

The updated Arrangements document will be published on the SQA website and course leaders should ensure they check this document on a regular basis.

Date	Version Number	Author	Description of Change
June 06	2	Moira Duncan	Amendment to framework. Removal of Graded Unit from Arrangements documents.

Appendix 1

Core Skills Profile

Core Skills Profile

HNC Applied Sciences & HND Biotechnology

Units	Core Skills				
	Numeracy	Communication	Information Technology	Problem Solving	Working with others
Statistics for Science 1	✓ Higher				
Presentation Skills in Science		✓ Embedded Higher			
Information Technology: Applications Software 1			✓ Embedded Higher		
Quality and Health & Safety systems in science industries		✓ Higher			✓ Intermediate 2
Fundamental Chemistry: Theory and Practice	✓ Higher	✓ Higher		✓ Higher	
Cell Biology: Theory and Practice		✓ Higher			
DNA Structure and Function		✓ Higher			
Microbiology: Theory and Practice	✓ Higher				
DNA Molecular Techniques: Theory & Practice		✓ Higher		✓ Higher	
Microbiological Techniques: Theory & Practice	✓ Higher	✓ Higher			
Protein Structure and Function				✓ Higher	✓ Intermediate 2
Immunological Techniques		✓ Higher		✓ Higher	
Instrumental Techniques: Theory and Practice 1		✓ Higher		✓ Higher	
Animal and Plant Cell Culture: An Introduction		✓ Higher		✓ Higher	
HNC Graded Unit		✓ Higher		✓ Higher	
HND Graded Unit		✓ Higher		✓ Higher	
Food Science: Theory and Practice		✓ Higher			
Immunotechnology: Theory and Practice		✓ Higher			
Biochemistry: Theory and Practice		✓ Higher			
Applied Biochemical Techniques: An Introduction	✓ Higher	✓ Higher		✓ Higher	
Instrumental Techniques: Theory and Practice 2	✓ Higher	✓ Higher		✓ Higher	
Human Body Structure and Function	✓ Higher	✓ Higher			
Biotechnology Industry: Key Issues					
Employment Experience 2					✓ Embedded Higher
Environmental Biology					
Biotechnology: An Introduction		✓ Higher			✓ Higher

Communication (Higher)

Skill component Written Communication (Reading)

Read and Understand complex written communication.

- a Identify and summarise all significant information, ideas and supporting details in a complex written environment
- b evaluate fully the effectiveness of a communication in meeting its purpose and needs of its intended readership

Unit	Knowledge and Skills/Evidence	Developed/ Assessed	a	b
Presentation Skills in Science	Outcome 2	Assessed	√	√
Quality and Health & Safety in Science Industry	Outcome 1 and 2	Developed	√	√
Fundamental Chemistry: Theory and Practice	Outcome 1	Developed	√	√
Cell Biology: Theory and Practice	Outcomes 1, 2 and 4	Developed	√	√
DNA Structure and Function	Outcomes 1–5	Developed	√	√
DNA Molecular Techniques: Theory and Practice	Outcomes 1–4	Developed	√	√
Microbiological Techniques: Theory and Practice	Outcomes 1-4	Developed	√	√
Immunological Techniques	Outcomes 1 and 2	Developed	√	√
Instrumental Techniques: Theory and Practice 1	Outcomes 1 and 2	Developed	√	√
Animal and Plant Cell Culture: An Introduction	Outcomes 1–3	Developed	√	√
Food Science: Theory and Practice	Outcomes 1–3	Developed	√	√
Immunotechnology: Theory and Practice	Outcomes 1–3	Developed	√	√
Biochemistry: Theory and Practice	Outcomes 1–3	Developed	√	√
Applied Biochemical Techniques: An Introduction	Outcomes 1–4	Developed	√	√
Instrumental Techniques: Theory and Practice 2	Outcomes 1–3	Developed	√	√
Human Body Structure and Function	Outcomes 1–6	Developed	√	√

Written Communication (Writing)

Produce well-structured Written Communication on complex topics

- a Present all essential ideas/information and supporting detail in a logical and effective order
- b Use a structure which takes account of purpose and audience and links major and minor points in ways which assist the clarity and impact of the writing
- c Use conventions which are effective in achieving the purpose and adapted as necessary for the target audience
- d Use spelling, punctuation and sentence structures which are consistently accurate
- e Vary sentence structure, paragraphing and vocabulary to suit the purpose and target audience

Unit	Knowledge/Skills/Evidence	Developed/ Assessed	a	b	c	d	e
Presentation Skills in Science	Outcomes 1 and 3	Assessed	√	√	√	√	√
Quality and Health & Safety in Science Industry	Outcome 3	Developed	√	√	√	√	√
Fundamental Chemistry: Theory and Practice	Outcomes 1 and 2	Developed	√	√	√		
Cell Biology: Theory and Practice	Outcomes 1,2 and 4	Developed	√	√	√		
DNA Structure and Function	Outcomes 1–5	Developed	√	√	√		
DNA Molecular Techniques: Theory and Practice	Outcomes 1-4	Developed	√	√	√		
Microbiological Techniques: Theory and Practice	Outcomes 1–5	Developed	√	√	√	√	√
Immunological Techniques	Outcomes 1–3	Developed	√	√	√	√	√
Instrumental Techniques: Theory and Practice 1	Outcomes 1–3	Developed	√	√	√		
Animal and Plant Cell Culture: An Introduction	Outcomes 1-4	Developed	√	√	√		
Food Science: Theory and Practice	Outcomes 1–3	Developed	√	√	√	√	√
Immunotechnology: Theory and Practice	Outcomes 1–3	Developed	√	√	√	√	√
Biochemistry: Theory and Practice	Outcomes 1–3	Developed	√	√	√	√	√
Applied Biochemical Techniques: An Introduction	Outcomes 1–4	Developed	√	√	√	√	√
Instrumental Techniques: Theory and Practice 2	Outcomes 1–3	Developed	√	√	√	√	√
Human Body Structure and Function	Outcomes 1–6	Developed	√	√	√	√	√

Oral Communication

Produce and respond to oral Communication on a complex topic.

- a Use vocabulary and a range of spoken language structures consistently and effectively at an appropriate level of formality
- b Convey all essential information, opinions or ideas with supporting detail accurately and coherently and with varied emphasis as appropriate
- c Structure communication to take full account of purpose and audience
- d Take account of situation and audience during delivery
- e Respond to others, taking account of their contributions

Unit	Knowledge/Skills/Evidence	Developed/ Assessed	a	b	c	d	e
Presentation Skills in Science	Outcome 4	Assessed	√	√	√	√	√
Biotechnology: An Introduction	Outcome 5	Developed	√	√	√		√

Using Information Technology (Higher)

Use an IT system independently to process a range of information

- a Use a range of IT equipment paying attention to security and other users
- b Resolve one simple hardware or software problem
- c Use software in an unfamiliar context requiring some analysis and design, integration of data decision on output format
- d Carry out two searches to extract and present information from electronic data sources

Unit	Knowledge/Skills/Evidence	Developed/ Assessed	a	b	c	d
Information Technology: Applications Software 1	Embedded in Unit	Assessed	√	√	√	√

Numeracy (Higher)

Skill component Using Number

Apply a wide range of numerical skills.

- a Work confidently with a numerical or statistical concept
- b Decide on the steps and operations to be carried out
- c Carry out a number of sustained, complex calculations

Unit	Knowledge/Skills/Evidence	Developed/ Assessed	a	b	c
Statistics for Science	Outcomes 1 and 2	Developed	√	√	√
Fundamental Chemistry: Theory and Practice	Outcomes 1 and 2	Developed	√	√	√
Microbiology: Theory and Practice	Outcomes 2, 3 and 4	Developed	√	√	√
Microbiological Techniques: Theory and Practice	Outcomes 2 and 4	Developed	√	√	√
Applied Biochemical Techniques: An Introduction	Outcomes 1 and 2	Developed	√	√	√
Instrumental Techniques: Theory and Practice 2	Outcomes 1–3	Developed	√	√	√
Human Body Structure and Function	Outcome 3, 4 and 6	Developed	√	√	√

Numeracy (Higher)

Skill component Using graphical information

Interpret and communicate graphical information in everyday and generalised contexts.

- a Analyse and interpret complex graphical information
- b Select an appropriate form of table, graph, chart, diagram or qualitative form and communicate information in that form

Unit	Knowledge/Skills/Evidence	Developed/ Assessed	a	b
Statistics for Science	Outcomes 1 and 2	Developed	√	√
Fundamental Chemistry: Theory and Practice	Outcomes 1 and 2	Developed	√	√
Microbiology: Theory and Practice	Outcomes 2, 3 and 4	Developed	√	√
Applied Biochemical Techniques: An Introduction	Outcomes 2 and 4	Developed	√	√
Instrumental Techniques: Theory and Practice 2	Outcomes 1–3	Developed	√	√
Human Body Structure and Function	Outcome 4 and 6	Developed	√	√

Numeracy (Higher)

Skill component Using Number

Apply in combination a wide range of numerical/statistical and other mathematical skills to process complex information.

- a Work confidently with a numerical or statistical concept
- b Decide on the steps and operations to be carried out
- c Carry out a number of sustained, complex calculations

Unit	Knowledge/Skills/Evidence	Developed/ Assessed	a	b	c
Statistics for Science	Outcomes 1 and 2	Developed	√	√	√
Fundamental Chemistry: Theory and Practice	Outcomes 1 and 2	Developed	√	√	
Microbiology: Theory and Practice	Outcomes 2, 3 and 4	Developed	√	√	√
Applied Biochemical Techniques: An Introduction	Outcomes 2 and 4	Developed	√	√	√
Instrumental Techniques: Theory and Practice 2	Outcomes 1-4	Developed	√	√	√

Problem Solving (Higher)

Skill components Critical Thinking

Analyse a complex situation or issue.

- a Identify the factors involved in the situation or issue
- b Assess the relevance of these factors to the situation or issue
- c Develop and justify an approach to deal with the situation or issue

Unit	Knowledge/Skills/Evidence	Developed/ Assessed	a	b	c
Fundamental Chemistry: Theory and Practice	Outcomes 1 and 2	Developed	√	√	√
DNA Molecular Techniques: Theory and Practice	Outcome 5	Developed	√	√	√
Protein Structure and Function	Outcomes 1-4	Developed	√	√	√
Immunological Techniques	Outcome 1-3	Developed	√	√	√
Instrumental Techniques: Theory and Practice 1	Outcomes 1-3	Developed	√	√	√
Animal and Plant Cell Culture: An Introduction	Outcomes 1-4	Developed	√	√	√
Applied Biochemical Techniques: An Introduction	Outcomes 1-4	Developed	√	√	√
Instrumental Techniques: Theory and Practice 2	Outcomes 1-3	Developed	√	√	√

Problem Solving (Higher)

Skill components Planning and Organising

Plan, organise and complete a very simple, familiar task.

- a Identify some very simple steps in the plan
- b Select appropriate resources to carry out the plan
- c Carry out the task

Unit	Knowledge/Skills/Evidence	Developed/ Assessed	a	b	c
Fundamental Chemistry: Theory and Practice	Outcome 2	Developed	√	√	√
DNA Molecular Techniques: Theory and Practice	Outcome 5	Developed	√	√	√
Protein Structure and Function	Outcome 4	Developed	√	√	√
Immunological Techniques	Outcome 3	Developed	√	√	√
Instrumental Techniques: Theory and Practice	Outcomes 1–3	Developed	√	√	√
Animal and Plant Cell Culture: An Introduction	Outcome 4	Developed	√	√	√
Applied Biochemical Techniques: An Introduction	Outcomes 1–4	Developed	√	√	√
Instrumental Techniques: Theory and Practice 2	Outcomes 1–3	Developed	√	√	√

Problem Solving (Higher)

Skill components Reviewing and Evaluating

Review and evaluate a complex problem solving activity.

- a Evaluate the effectiveness of the strategy/strategies
- b Identify and gather appropriate evidence
- c Draw conclusions and make recommendations

Unit	Knowledge/Skills/Evidence	Developed/ Assessed	a	b	c
Fundamental Chemistry: Theory and Practice	Outcome 3	Developed	√	√	√
Immunological Techniques	Outcome 3	Developed	√	√	√
Instrumental Techniques: Theory and Practice 1	Outcomes 1–3	Developed	√	√	√
Applied Biochemical Techniques: An Introduction	Outcomes 1–4	Developed	√	√	√
Instrumental Techniques: Theory and Practice 2	Outcomes 1–3	Developed	√	√	√

Working with Others (Intermediate 2)

Work with Others in a group to analyse, plan and complete an activity

- a analyse the activity and identify the component tasks and roles which make up the activity
- b agree allocation of responsibilities taking account of own strengths and weaknesses and those of others
- c support co-operative working
- d evaluate and draw a conclusion about own contribution to group activity, and justify this by referring to supporting evidence

Unit	Knowledge/Skills/Evidence	Developed/ Assessed	a	b	c	d
Quality and Health & Safety Systems in Science Industries	Outcome 3	Developed	√	√	√	
Protein Structure and Function	Outcome 4	Developed	√	√	√	

Working with Others (Higher)

Work with Others in a group to analyse, plan and complete a complex activity

- a analyse the activity by defining the goal to analyse, plan and complete a complex activity
- b negotiate roles and responsibilities with others, taking account of own strengths and weaknesses and those of colleagues
- c negotiate working methods and rules for managing the group's work
- d support co-operative working
- e evaluate and draw conclusions about own contribution to group activity, and justify this by referring to supporting evidence

Unit	Knowledge/Skills/Evidence	Developed/ Assessed	a	b	c	d	e
Employment Experience 2	Embedded Unit	Assessed	√	√	√	√	√
Biotechnology: An Introduction	Outcome 5	Developed		√	√	√	

Appendix 2

Progression Routes to the HND Awards: Recommended HNC Content

Recommended options for progression to **HND Applied Sciences** could include:

Cell Biology: Theory and Practice
Microbiology; Theory and Practice
DNA Structure and Function
Organic Chemistry: Theory and Practice 1
Inorganic Chemistry: Theory and Practice 1
Physical Chemistry: Theory and Practice 1
Physics 1
Maths for Science 1

Recommended options for progression to **HND Biomedical Sciences** could include:

Statistics for Science 1
Cell Biology Theory and Practice
Human Body Structure and Function
Microbiology; Theory and Practice
DNA Structure and Function
Biochemistry : Theory and Practice
Applied Biochemical Techniques

Recommended options for progression to **HND Applied Biological Sciences** could include:

Statistics for Science 1
Cell Biology Theory and Practice
Microbiology; Theory and Practice
Animal Biology 1
Plant Biology
DNA Structure and Function
Protein Structure and Function
Biochemistry : Theory and Practice

Recommended options for progression to **HND Biotechnology** could include:

Statistics for Science 1
Cell Biology Theory and Practice
Microbiology; Theory and Practice
Biotechnology: An Introduction
DNA Structure and Function

Recommended options for progression to **HND Chemistry** could include:

Statistics for Science 1/Mathematics for Science 1
Biochemistry: Theory and Practice
Fundamental concepts of Inorganic Chemistry
Fundamental concepts of Organic Chemistry
Fundamental concepts of Physical Chemistry
Physics 1

Recommended options for progression to **HND Environmental Sciences** could include:

Statistics for Science 1
Ecology and Ecosystems
Earth Science
Genetics
Environmental Biology
Sustainable Development

Appendix 3

Guidelines for timetabling of mandatory Units

HNC Applied Sciences/HND Biotechnology year 1

Block 1	Fundamental Chemistry: C	Microbiology: Theory and Practice C	Quality and H&S Systems C	Cell Biology C	IT:AS 1 C
Block 2			Presentation Skills in Science C	Optional Unit	Biotechnology: An Introduction C
Block 3	Graded Unit 1 C	DNA Structure and Function C	Statistics for Science 1 C	Optional Unit	Optional Unit

HND Biotechnology year 2

Block 1	DNA and Molecular Techniques C	Protein Structure and Function C	Instrumental Techniques 1 C	Optional Unit	Microbiological Techniques C
Block 2		Immunological Technology: Theory and Practice C	Science Industry: Key Issues C	Optional Unit	
Block 3	Graded Unit 2 C		Optional Unit	Optional Unit	Animal and Plant Culture C

Plus additional optional Units as appropriate.

Delivering Centres not operating a three block delivery system may wish to timetable Units in the order shown below

HNC Applied Sciences/HND Biotechnology Year 1

Fundamental Chemistry: Theory and Practice
Microbiology: Theory and Practice
Quality and H&S Systems
Cell Biology: Theory and Practice
IT: Application Systems 1
Presentation Skills in Science
Biochemistry: Theory and Practice (Optional Unit)
Biotechnology: An Introduction
Graded Unit 1
DNA Structure and Function
Statistics for Science 1
Applied Biochemical Techniques (optional Unit)
Environmental Biology (optional Unit)

HND Biotechnology Year 2

DNA and Molecular Techniques
Protein Structure and Function
Instrumental Techniques 1 (optional Unit)
Microbiological Techniques
Immunological Techniques
Biotech Industry: Key Issues
Graded Unit 2
Animal and Plant Culture

All the above schemes show the HNC Applied Sciences options for HND1 Biotechnology. Similar schemes should be drawn up by centres offering other versions of HNC applied Sciences appropriate to the HND (s) they intend to offer their students.

These schemes are for guidance only and centres are encouraged to consider alternative timetables particularly with regard to integrating delivery and assessment. For example it may be possible to deliver and assess Fundamental Chemistry concurrently with Presentation Skills for Science and thereby reduce the assessment burden for students as these two Units have a degree of overlap in the assessment evidence requirements.

Appendix 4

Credit Transfer between Frameworks Exemplar

Alternative route for candidates transferring from current HNC/D (year 1) Biotechnology to revised HND Biotechnology (year 2)

New Unit	Credit value	Core/Option	Old Unit	Credit value	Core/Option	Old Outcomes covering new Unit	Outcomes in new Unit not covered
Presentation Skills in Science DG70 34	1	C	Presentation Skills in Science D3AY 04	1	Recommended additional HND Unit for year 2 progression	all	
Statistics for Science 1 DN8C 34	1	C	Probability and Statistics D41Y 04	1.5	O	all	
			Biotechnology: Physical Aspects, Instrumentation and Numerical Analysis, Part 1 D5XK 04	1	O	2,4	
Information Technology: Applications Software 1 D75X 34	1	C	Information Technology Applications 1 A6AM 04	1	Recommended additional HND Unit for year 2 progression	all	
Fundamental Chemistry: Theory and Practice DH2K 34	2	C	Chemistry for Biological Sciences D3FV 04	2	C	all	
Quality and Health & Safety in Science Industries DF82 34	1	C	Quality and Safety Systems in Biotechnology D3B6 04	1	Recommended additional HND Unit for year 2 progression	all	
Applied Sciences: Graded Unit 1 – Investigation DJ89 34	1	C					all
Cell Biology: Theory and Practice DJ1K 34	1	C	Cell Biology A53J 04	1	HND core Unit	1,2,4	4
DNA: Structure and Function DJ6Y 34	1	O	Introduction to Genetics A6K2 04	1	O	1,4	
Microbiology: Theory and Practice DH55 34	2	O	Introductory Microbiology D3FW 04	1.5	C	1,4	Parts of 1, 2, 3

New Unit	Credit value	Core/Option	Old Unit	Credit value	Core/Option	Old Outcomes covering new Unit	Outcomes in new Unit not covered
Biochemistry: Theory and Practice DH2J 34	1	O	Biological Molecules A53D 04	1	C	all	