



Qualifications and
Curriculum Authority

Review of standards in biology

GCSE 1998 and 2003; A level 1999 and 2003

2005

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Introduction

QCA conducted enquiries into standards over time in GCSE biology in 1998 and in A level biology in 1997. The results were published in reports that are available on the Qualifications and Curriculum Authority (QCA) website: www.qca.org.uk. The key issues identified by the enquiries were considered as part of work on this review.

By reviewing GCSE and A level syllabuses at the same time, this study also provided the opportunity to consider the issue of progression between GCSE and A level.

Between them the GCSE syllabuses in this study attracted about 79 per cent of the 51,204 candidates who took GCSE biology in 2003. The A level syllabuses included in this review attracted about 78 per cent of the 46,062 candidates who took A level biology in 2003.

GCSE biology 1998–2003

Key issues identified in 1978/98 review of standards

In 2001 QCA conducted the first five-year review of standards in GCSE biology in response to the recommendations in Lord Dearing's *Review of qualifications for 16- to 19-year-olds*. Changes in 16+ biology examinations between 1978 and 1998 were influenced by a number of key events, including:

- the development in 1985 of national criteria for assessing GCSE biology
- the introduction of GCSE examinations in 1998
- the introduction in 1991 of the national curriculum for science, leading in 1995 to revised GCSE examinations in biology.

The 2001 review of standards concluded that:

- the changes in the range of assessment objectives were considered to have increased the demand on candidates between 1978 and 1998. Changes in the presentation of question papers had been largely neutral in terms of demand, although the increased focus on application rather than recall of knowledge increased demand.
- in 1998 there were some differences in performance across awarding bodies, in question papers and coursework, especially at grade A. It had proved impossible to gauge any changes in performance between 1978 and 1998, as candidates' work was unavailable for 1978.

Examination demand and standards of performance: summary

The review found that, between 1998 and 2003, the demand of GCSE biology specifications and examinations increased slightly and candidates' performance on the question papers decreased slightly at the key grade thresholds A, C and F. Taking all factors into account the effect of these changes indicated little if any perceived change in the overall demand of GCSE biology examinations during this five-year period.

The national curriculum for science was revised during the period 1998–2003 but the revisions were relatively minor. The GCSE biology specifications are based on the biological content of the national curriculum, supplemented by additional biological extension material. The minor changes to the national curriculum resulted in correspondingly minor changes to the GCSE biology specifications. The main changes to GCSE biology specifications and examinations between 1998 and 2003 were:

- an expansion of the aims in 2003 which required candidates to 'select, organise and present information clearly and logically, using appropriate scientific terms and conventions', and the introduction of specific references to the use of information and communication technology (ICT) in biology and biological investigations

- an expansion of the assessment objectives in 2003, and a change in the examination weighting of those objectives
- an increase in the range and demand of biological extension material in the 2003 specifications
- a trend towards more detail and clarity in the wording of specification content statements, making it clearer to teachers and examiners what should be taught and assessed
- inclusion of a new section in 2003 that highlighted cross-references between the specification requirements and key skills.

The tiers of assessment were unchanged during this period, and the coursework scheme was essentially unchanged although there were some alterations to the wording of criteria to improve clarity.

GCSE biology syllabuses in 1998 and 2003 conformed to the 1990 and 2000 national criteria for assessing science at GCSE respectively.

Examination demand

Materials available

Reviewers considered the specification documents, examiners' reports and question papers with associated mark schemes from each of the awarding bodies in 1998 and 2003. Details of the specifications included in the review are given in appendix A.

Assessment objectives

There were four assessment objectives for GCSE biology in 1998. For the 2003 specifications these were condensed into three new objectives (AO1 to AO3), which were prescribed in more detail than the previous set of objectives. A new fourth objective 'quality of written communication' was added for 2003. In the 2003 question papers, extended prose questions were specifically targeted for assessment of this objective. However the exact weighting attached to it was hard to judge.

The weighting attributed to the assessment objectives was changed in 2003, with a reduction in the weighting for 'knowledge and understanding' from 60 per cent to 50 per cent. The target for 'application analysis and evaluation' was increased significantly from 15 per cent to 30 per cent, and the target for experimental and investigative work was reduced from 25 per cent to 20 per cent. Experimental and investigative work was assessed via internally assessed and externally moderated coursework.

The reviewers judged that the changes to the 2003 assessment objectives resulted in a marginal increase in demand.

Syllabus content

The subject content of GCSE biology specifications is comprised of the core set out in the science national curriculum (Sc2: Life processes and living things) which forms two-thirds of the total content, and additional extension content that makes up the remaining third. There was no change to this basic structure between 1998 and 2003. There were relatively minor changes to Sc2 of the national curriculum during this five-year period. The specification content statements for 2003 were clearer and more detailed than in 1998. There was also an increase in the range and number of topics for the biology extension material and these changes were found to have increased demand.

Scheme of assessment

The scheme of assessment for GCSE biology is relatively straightforward, and all awarding bodies use a model that incorporates either: one question paper (covering the whole of the specification content) or two question papers. Where there are two papers the first covers the

core content of the national curriculum and the second covers the extension biology material. In all cases there is a compulsory coursework element. In 1998 the assessment weighting allocated to the question papers was 75 per cent, which increased to 80 per cent in 2003. The remaining weighting allocated to coursework decreased correspondingly from 25 per cent to 20 per cent. There were no options in GCSE biology.

The timing of question papers varied between awarding bodies. The shortest examining time was 2 hours offered by AQA foundation tier 1998, and the longest was 3½ hours offered by CCEA higher tier 1998 and 2003. All awarding bodies allocated the same or more time for their higher tier question papers than for the corresponding foundation tier papers. Awarding bodies made only minor changes to examining time between 1998 and 2003 and these were judged to have had no impact on demand.

Table 1: examination structures and timings

Awarding body	1998		2003	
	Foundation	Higher	Foundation	Higher
AQA	Paper 1 – 2hrs	Paper 1 – 2¼hrs	Paper 1 – 2¼hrs	Paper 1 – 2¼hrs
CCEA	Paper 1 – 1hr Paper 2 – 1½hrs	Paper 1 – 1½hrs Paper 2 – 2hrs	Paper 1 – 1hr Paper 2 – 1hr	Paper 1 – 1½hrs Paper 2 – 2hrs
Edexcel	Paper 1 – 1½hrs Paper 2 – 1hr	Paper 1 – 1½hrs Paper 2 – 1hr	Paper 1 – 1½hrs Paper 2 – 1hr	Paper 1 – 1½hrs Paper 2 – 1hr
OCR	Paper 1 – 1½hrs Paper 2 – ¾hr	Paper 1 – 1¾hrs Paper 2 – 1hr	Paper 1 – 1½hrs Paper 2 – ¾hr	Paper 1 – 1½hrs Paper 2 – ¾hr
WJEC	Paper 1 – 2hrs	Paper 1 – 2½hrs	Paper 1 – 2hrs	Paper 1 – 2½hrs

Question papers

The reviewers considered that the question papers and associated mark schemes were of slightly higher demand in 2003 compared with 1998. Reviewers judged that the main factors contributing to this slight increase in demand was the increase in the range of assessment objectives, coupled with the increased weighting for analysis, application and evaluation, and, for the biology extension material, an increase in the range and number of subject topics.

There was a general improvement in quality in 2003 question papers with the use of clearer layout, better quality diagrams and more accessible wording in the phrasing of questions. The quality of mark schemes showed more variation across awarding bodies, to some extent because they were in different stages of preparation – for example some were annotated working drafts and some were published versions. Reviewers judged that these variations might have led to differences in demand.

All awarding bodies used common questions and mark schemes for a proportion of questions targeting grades C and D that appeared on question papers at both tiers. This was designed to assist in the awarding of comparable grades across the two tiers. There was no change in the approach adopted by awarding bodies over the five-year period.

Tiering

The tiering arrangements were common across all awarding bodies and did not change between 1998 and 2003. Question papers were offered at either foundation tier (covering

grades C to G) or higher tier (covering grades A* to D). Coursework was not tiered and covered the full ability range.

Coursework

Except for relatively minor changes to the wording of the criteria for coursework, which helped to clarify interpretation, the scheme did not change between 1998 and 2003. Reviewers were unanimous in their view that the demand of the scheme had not altered between 1998 and 2003.

Summary

Given that there were only minor changes to the national curriculum between 1998 and 2003, many aspects of GCSE biology specifications remained the same, including: the overall assessment structure, the national curriculum core content and the coursework component. The demand of these aspects of the specifications was therefore unchanged over the five-year period.

Some factors in the 1998 specification did change and were perceived to have increased demand. These included:

- an expansion of the aims
- an expansion of the assessment objectives in 2003, and a change in the examination weighting of those objectives to increase the weighting allocated to the higher order skills of application, analysis and evaluation
- an increase in the range and demand of biological extension material in the 2003 specifications.

Standards of performance

Materials available

Reviewers considered candidates' work from all the awarding bodies in 1998 and 2003. No materials were available at grade F from CCEA for either year.

Details of the materials used are provided in appendix B.

Performance descriptors

Reviewers were asked to identify key features of candidate performance in 2003, based on the work seen at each of the key grades. Performance descriptors for each grade boundary were drawn up, focussing on the assessment objectives, as well as allowing for additional features of performance.

Standards of performance at GCSE grade A

GCSE grade A performance descriptor

Knowledge and understanding

Candidates at this level could normally:

- recall a wide range of the content from all areas of the specification
- use detailed knowledge and understanding to explain scientific systems and phenomena, and apply this to novel situations where these were presented to them
- select and use appropriate scientific terminology in their descriptions and explanations
- select, organise and present information in an ordered and logical manner
- show an understanding of the wider implications of science, including its benefits and drawbacks.

Application of knowledge and understanding, analysis and evaluation

Candidates at this level could normally:

- plot graphical data accurately, and describe trends in data
- perform complex calculations involving more than one step
- interpret and analyse data presented to them and relate this to their knowledge and understanding of content in the specification
- understand the development of scientific ideas
- sequence scientific concepts and processes in a logical and orderly manner.

Investigative skills

Candidates at this level could normally:

- plan and safely carry out investigations based on a sound knowledge and understanding of the specification content
- interpret their results fully, using a variety of techniques
- evaluate the results of their investigations and the methods used.

Performance at the GCSE grade A boundary

The performance of candidates was broadly comparable across awarding bodies, although in 2003 Edexcel candidates demonstrated slightly stronger performance across the range of assessment objectives. Performance over time was broadly consistent although there was some evidence that the standard of performance of AQA candidates had declined.

Standards of performance at GCSE grade C

GCSE grade C performance descriptor

Knowledge and understanding

Candidates at this level could normally:

- recall some aspects of the content from the specification, but with some significant

<p>omissions – performance at grade C was described as ‘patchy’</p> <ul style="list-style-type: none"> • use some knowledge and understanding to explain scientific systems and phenomena, but demonstrate a limited ability to communicate this clearly • select and use some scientific terminology in their descriptions and explanations • sometimes struggle to interpret questions, often relying on prompts and clear structuring to guide them to a creditworthy response.
<p>Application of knowledge and understanding, analysis and evaluation</p> <p>Candidates at this level could normally:</p> <ul style="list-style-type: none"> • show some ability to plot graphical data accurately, and describe trends in data, but they were unable to demonstrate this ability consistently and in all situations • translate data from one form to another • interpret and analyse broad trends in data presented to them and relate this to their knowledge and understanding of content in the specification • apply their scientific knowledge and understanding to familiar concepts, but they struggled to interpret unfamiliar situations and data.
<p>Investigative skills</p> <p>Candidates at this level could normally:</p> <ul style="list-style-type: none"> • plan and safely carry out investigations based on a limited knowledge and understanding of the specification content • understand the need to control variables and describe and explain straightforward practical techniques • analyse and interpret the results of their investigations, sometimes failing to offer an evaluation of the investigation and methods used.

Performance at the GCSE grade C boundary

Overall performance across most of the awarding bodies in 2003 was judged as being relatively consistent at grade C. However AQA candidates, particularly at higher tier, were judged to be slightly weaker across the range of assessment objectives. Performance over time was broadly consistent at higher tier, with the exception of CCEA where performance was better in 1998 than in 2003. At foundation tier candidates from OCR and WJEC were judged to be better in 1998 than in 2003.

Comparison across tiers

Reviewers found that the standard of performance of higher tier grade C candidates tended to be higher than for foundation tier candidates, particularly for CCEA. Typically candidates who took the CCEA higher tier paper were judged to have demonstrated better recall, knowledge and understanding on the questions common to the higher and foundation tier papers.

Reviewers also commented that candidates achieving grade C via the foundation tier route were able to demonstrate more competence in AO1 ‘knowledge and understanding’ than higher tier candidates, whereas candidates achieving grade C via the higher tier route demonstrated more competence in AO2 ‘application of knowledge and understanding, analysis and evaluation’ than candidates on foundation tier.

Standards of performance at GCSE grade F

GCSE grade F performance descriptor

<p>Knowledge and understanding</p> <p>Candidates at this level could normally:</p> <ul style="list-style-type: none"> • recall some basic facts the content from the specification, but with some significant omissions, and label and interpret basic diagrams

<ul style="list-style-type: none"> • recognise limited scientific terminology in use this in their descriptions and explanations, but often with poor understanding of the terms used • interpret questions, only if clear structure, guidance and prompting was included in the question.
Application of knowledge and understanding, analysis and evaluation
<p>Candidates at this level could normally:</p> <ul style="list-style-type: none"> • understand and interpret simple bar charts, but struggle to plot and interpret line graphs • identify simple trends and patterns in data • successfully undertake simple one-stage calculations.
Investigative skills
<p>Candidates at this level could normally:</p> <ul style="list-style-type: none"> • plan and carry out investigations when some structure and guidance have been provided • understand the need for a fair test • record data and identify simple trends in their results • identify some, but not all, variables which need to be controlled in an investigation.

Performance at the GCSE grade F boundary

Reviewers found that the standard of performance of Edexcel candidates was higher than the other awarding bodies at this grade boundary, while the AQA candidates demonstrated a lower standard of performance. Performance of candidates at grade F tended to be very 'patchy' with candidates tending to pick up marks in specific questions rather than consistently across the paper. In general reviewers noted that Edexcel candidates at this level demonstrated a higher level of knowledge and understanding than for other awarding bodies, and AQA candidates a relatively lower level of knowledge and understanding. Candidates from AQA and OCR were judged to have performed better in 1998 than in 2003.

Summary

At each grade boundary reviewers found that the standard of performance in 1998 was judged more frequently to be higher than in 2003. However the trend was not sufficiently clear-cut to state with confidence that overall performance on the 1998 papers was higher than that for 2003, nor that the differences were associated with one particular awarding body or assessment objective.

In terms of comparisons of candidates' performance across awarding bodies at the key grade thresholds, Edexcel candidates were judged to be marginally better at grades A and F and AQA candidates were judged to be marginally weaker at grades C and F than candidates from other awarding bodies.

A level biology 1997–2003

Key issues identified in 1977/97 review of standards

In 1998 QCA conducted the first five-year review of standards in A level biology in response to the recommendations in Lord Dearing's *Review of qualifications for 16- to 19-year-olds*. Changes in A level biology examinations between 1977 and 1997 were influenced by several factors, among the most significant being:

- the introduction in the 1980s of a 'common core' of content
- the introduction in 1988 of GCSE examinations in biology with a defined set of national criteria.

In terms of the demand of specifications, there were a number of changes between 1977 and 1997, which included:

- greater attention to the presentation of examination papers
- a switch from practical tests to the assessment of coursework
- the introduction of modular specifications.

In addition there was a move towards increasing transparency in the system due to improved feedback from awarding bodies to teachers via in-service training programmes and more comprehensive reports, as well as provision of textbooks that targeted specific syllabuses.

Reviewers in 1998 judged that overall these changes tended to cancel each other out, resulting in no appreciable effect on examination demand.

In terms of standards of performance at the key judgmental grades, the review concluded that most awarding bodies applied appropriate standards at grades A and E over time. However neither AQA (formerly the NEAB) nor WJEC candidates were considered to have met the expected standards at either grade in 1997.

Examination demand and standards of performance: summary

The most significant factor affecting the demand of A level biology specifications during the period 1997 to 2003 was the change in design of the A level qualification in line with the Curriculum 2000 reforms.

The most significant changes in 2003 were:

- a move to less demanding AS unit assessments and more demanding A2 units
- the revised synoptic requirement
- less scope for optional material and so more restricted content coverage.

The main requirement of the changes was to carry forward the full A level standard. Taking all factors into account, reviewers felt that this had been achieved, as they found no significant change in the overall demand of GCE A level biology examinations between 1997 and 2003.

The major issue that affected all A level specifications between 1997 and 2003 was the move to unitised assessment based on a six-unit structure, in line with the Curriculum 2000 A level criteria. The overall assessment of the A level qualification was split into the first half, advanced subsidiary (AS) and the second half, A2. The AS and A2 sections of the course were each assessed by three units, making six units for the A level overall. The level of demand of the AS qualification was reduced from the former advanced supplementary qualification, to allow a smoother transition for students moving from GCSE to A level and to allow the new AS to stand as a 'broadening' qualification in its own right.

The main changes to A level biology examinations between 1997 and 2003 were:

- the change to a mandatory six-unit AS/A2 assessment structure as described above

- a move to less demanding AS assessment units, to reflect the standard for the new AS qualification
- allocation of weighting for assessment objective 3 (AO3) 'experiment and investigation' across AS and A2, resulting in internally assessed coursework units at AS and A2
- allocation of a minimum of 20 per cent weighting for A level overall to assessment objective 4 (AO4) 'synthesis of knowledge, understanding and skills', to be allocated only to A2 units
- inclusion of a new section in 2003 that highlighted cross-references between the specification requirements and key skills.

A level syllabuses in 1997 were developed in the light of the 1993 subject core. The 2003 specifications conformed to the Curriculum 2000 A level biology subject criteria.

Examination demand

Materials available

Reviewers considered the syllabus documents, question papers and associated mark schemes from each of the awarding bodies in 1997 and 2003.

Details of the syllabuses included in the review are given in appendix A.

Assessment objectives

Reviewers judged that there was relatively little change in the demand of the assessment objectives between 1997 and 2003. The three assessment objectives AO1 'knowledge and understanding'; AO2 'application, analysis and evaluation' and AO3 'experiment and investigation' had similar weightings in 1997 and 2003, although a range is quoted in the subject criteria for 2003 allowing slightly different interpretations across the awarding bodies. The most significant change was the inclusion of AO4 'synthesis of knowledge, understanding and skills' (commonly called synoptic assessment) for 2003, carrying a minimum weighting of 20 per cent for the A level overall and the requirement that this is assessed in the A2 units. This resulted in some very demanding questions in A2 synoptic question papers that drew together previous aspects of the course. In the OCR specification, reviewers noted that the content was specified for the synoptic A2 unit, 'unifying concepts in biology', and this was not the case for other awarding bodies' 2003 specifications. Reviewers concluded that the revised requirements for synoptic assessment in 2003 increased the demand of A2 questions for some awarding bodies. This was particularly the case for OCR.

Syllabus content

Reviewers found little change in the nature and range of topics covered by the specifications in 1997 and 2003, but judged that there was slight reduction in the overall number of topics covered. This is most likely due to the more prescriptive assessment scheme in 2003, which reduced the scope for inclusion of optional material into the specifications.

Scheme of assessment

The major change was the change to mandatory unit-based assessment in 2003, with a six-unit structure as described in 'Examination demand and standards of performance: summary' above.

Table 2: examination structures and timings

Awarding body	1997	2003
AQA	2 core modules + 4 optional modules (from a wide choice) 1 ¹ / ₂ hrs each	AS: Unit 1 – 1hr Unit 2 – 1hr Unit 3 – 1hr + coursework
	OR	

	<p>Paper 1 – 3hrs Paper 2 – 2¹/₂hrs</p> <p>AND Coursework (compulsory)</p>	<p>A2: Unit 4 – 1¹/₂hrs Unit 5 – 1¹/₄hrs + coursework Unit 6 – 2¹/₄hrs choice of three papers</p>
CCEA	<p>Paper 1 – 1¹/₂hrs Paper 2 – 2hrs Paper 3 – 2¹/₂hrs hrs</p> <p>Coursework</p>	<p>AS: Unit 1 – 1hr Unit 2 – 1hr Unit 3 – ³/₄hr + coursework</p> <p>A2: Unit 4 – 1¹/₂hrs Unit 5 – 1¹/₂hrs Unit 6 – 1hr + coursework</p>
Edexcel	<p>4 modules with 1hr 20min papers 2 synoptic papers, 1hr 20min and 2hrs Route TA1 compulsory coursework Route TA2 coursework or alternative written paper 1¹/₂hrs</p>	<p>AS: Unit1 – 1hr Unit 2 – 1hr Unit 3 – 1hr + coursework</p> <p>A2: Unit 4 – 1¹/₂hrs Unit 5 – 1¹/₂hrs Unit 6 – 1hr 10min + coursework or written alternative 1hr 20min</p>
OCR	<p>Paper 1 – 2¹/₂hrs Paper 2 – 1hr Paper 3 – 1¹/₂hrs</p> <p>And Paper 4 (teacher-assessed investigation) or Paper 5 (practical examination) or Paper 6 (teacher-assessed experimental skills)</p>	<p>AS: Unit 1 – 1hr Unit 2 – 1hr Unit 3 – ³/₄hr + coursework or practical exam 1¹/₂hrs</p> <p>A2: Unit 4 – 1¹/₂hrs Unit 5 – 1¹/₂hrs (choice of 5 units) Unit 6 – 1¹/₄hrs + coursework or practical exam 1¹/₂hrs</p>
WJEC	<p>Modules 1 to 4, each 1hr 20 mins duration</p> <p>Teacher-assessed practical (compulsory)</p>	<p>AS: Unit 1 – 1hr 30min Unit 2 – 1hr 30min Unit 3 – Practical assessment 3³/₄hrs</p> <p>A2: Unit 4 – 1hr 40min Unit 5 – 2hrs Unit 6 – Practical assessment 4hrs</p>

The overall examining time (excluding practical examinations) for 2003 increased to between 7–8 hours per specification, although individual unit examinations tended to be shorter (typically 1–1½ hours) than in 1997. Where awarding bodies moved from linear to unitised schemes in 2003 the overall examining time increased. Where an awarding body offered a modular specification in 1997, examining time remained similar in 2003.

Options

The constraints of the criteria and assessment scheme for 2003 reduced the scope for optional material. OCR was the only awarding body to offer any choice at AS, with a written paper as an alternative to coursework. At A2 the 2003 specifications for WJEC and CCEA included only compulsory content and assessment units. AQA, Edexcel and OCR offered some choice: AQA offered a choice of three A2 units covering different content; Edexcel offered a written alternative to the practical paper in A2. OCR offered the widest variation with a choice of five A2 units covering different content and written alternative to practical papers at both AS and A2.

In 1997 more scope was available, for example the AQA modular scheme contained two core modules and a further choice of four from a total of 17 in their ‘science framework’.

Reviewers concluded that, while there was less optional material available in 2003, this had not affected the overall demand of the specifications.

Question papers

The most significant change to assessment schemes in 2003 was the development of new AS units, specifically designed to be at an appropriate level of demand for students completing the first year of an A level course. Reviewers noted that the questions in the AS unit question papers tended to be shorter than for A2, using more accessible language and offering more direction and cueing for students. Overall reviewers judged that the AS questions and mark schemes represented an appropriately lower level of demand than the corresponding A2 papers, reflecting the design of new A level.

Reviewers judged that the level of demand of AS question papers was comparable across awarding bodies, with the exception of CCEA. The high degree of structure and guidance in the CCEA papers lowered their demand and also did not give candidates opportunity to demonstrate sufficient coverage of AO1 and AO2. Evidence seen at the script review supported this finding.

Overall A2 questions were regarded as appropriately challenging, many requiring extended writing or essay-based responses. Some of the questions in the OCR A2 ‘unifying concepts’ unit were considered particularly demanding.

Reviewers judged that overall the demand of the 2003 AS/A2 package of question papers was broadly comparable with the A level papers in 1997.

Coursework

Unlike GCSE biology, where coursework is a common element and all awarding bodies follow the same scheme, there was significant variation between the A level coursework schemes both across awarding bodies and between 1997 and 2003.

Table 3: coursework requirements

Awarding body	1997	2003
AQA	Four skill areas, each assessed 0 – 5 mark scale for each skill area	Five skill areas (includes synthesis of skills and concepts) 0 – 8 mark scale for 4 skill areas

		0 – 6 mark scale for “evaluating evidence and procedures”
CCEA	Three skill areas, each assessed on a 1 – 5 point scale. Each candidate to be assessed on at least two occasions	Three skill areas 0 – 40 marks overall
Edexcel	TA1: three skill areas 0 – 40 marks overall TA2: two skill areas including individual study 0 – 40 marks overall	T1: four skill areas 0 – 32 marks overall T2: individual study 0 – 32 marks overall
OCR	Three skill areas, each assessed on a 0 – 2 point scale. Each candidate to be assessed for ‘experimental skills’ on at least two occasions	Four skill areas 0 – 8 mark scale for each skill
WJEC	Three skill areas, each assessed on a 0 – 10 criterion-based mark scheme. Each candidate to be assessed on at least four occasions	Directed and timed activities provided by WJEC 105-mark total Up to six additional teacher-assessed marks for practical skills

Despite the variation between schemes and across time, reviewers found there to be little difference in demand between 1997 and 2003.

Summary

The most significant factor affecting the demand of A level biology specifications during the period 1997 to 2003 was the change in design of the A level qualification in line with the Curriculum 2000 reforms. Reviewers found it difficult to judge the impact of these design changes on overall demand, but the following key factors emerged:

- the new AS unit assessments were less demanding (by design) than the corresponding A level units of 1997
- the new A2 units were, in some cases, more demanding than the corresponding A level units of 1997. This was because the requirements for synoptic assessment were made more explicit, given a greater weighting, and placed exclusively in the A2 part of the qualification
- the requirements of the criteria and the new assessment rules did not allow as much scope for including optional material in 2003, and so content coverage was more restricted in the 2003 specifications.

Taking all factors into account the team of reviewers was unable to detect any significant change in the overall demand of A level biology examinations during this five-year period.

Standards of performance

Materials available

Reviewers considered candidates' work from all the awarding bodies in 1997 and 2003. They commented on the particular difficulty of judging standards of performance over time in view of the design changes introduced to all A levels by the Curriculum 2000 reforms.

A2 scripts from 2003 were compared with A level scripts from 1997. AS scripts from 2003 were compared across awarding bodies but not with 1997 A level scripts as the advanced subsidiary is a new qualification. No materials were available for AQA at A level grade A, and for AQA and CCEA at A level grade E. No AS scripts were available for AQA at grade E.

Further details of the materials used are provided in appendix B.

Performance descriptors

Reviewers were asked to identify key features of candidate performance at AS and at A level in 2003, based on the work seen at each of the key grades. Performance descriptors for each grade boundary were drawn up, focusing on the assessment objectives, as well as allowing for additional features of performance.

Standards of performance at GCE AS level grades A and E

GCE AS level grade A performance descriptor

<p>Knowledge with understanding</p> <p>Candidates at this level could normally:</p> <ul style="list-style-type: none"> • have a broad knowledge of biological facts building on GCSE, and display a sound understanding of underlying principles • have sufficient analytical ability to analyse longer questions, responding with well-ordered and logical answers incorporating detailed factual knowledge • interpret familiar, and some new, phenomena in terms of relevant biological knowledge • show an understanding of the wider implications of science (social, environmental and ethical).
<p>Application of knowledge and understanding, analysis, synthesis and evaluation</p> <p>Candidates at this level could normally:</p> <ul style="list-style-type: none"> • construct graphs from tabulated data • identify trends and patterns in a range of data and suggest appropriate explanations of the trends and patterns • apply biological knowledge to familiar and some unfamiliar contexts • calculate, for example rates, percentages, simple statistical tests, ratio, magnification.
<p>Experiment and investigation</p> <p>Candidates at this level could normally:</p> <ul style="list-style-type: none"> • apply principles of experimental design in a variety of situations • judge the worth of experimental techniques and results. • demonstrate an understanding of the nature of anomalous data.

Performance at GCE AS level grade A boundary

Standards of performance were broadly comparable across awarding bodies, with the exception of CCEA candidates who were found to demonstrate a slightly lower standard of performance. The high degree of structure and guidance in the CCEA question papers meant that candidates were unable to demonstrate the coverage of AO1 and AO2 seen in candidates' work from the other awarding bodies. Also performance in practical and experimental work was of a lower standard, with weaker coverage of AO3.

GCE AS level grade E performance descriptor

Knowledge with understanding
Candidates at this level could normally: <ul style="list-style-type: none"> • have a limited knowledge of factual material and display some understanding of the more basic biological principles • respond to key words in longer questions and select occasional relevant facts to produce a coherent response.
Application of knowledge and understanding, analysis, synthesis and evaluation
Candidates at this level could normally: <ul style="list-style-type: none"> • interpret closely related information, and select the relevant principles on which to base an answer • represent straightforward tabulated data on graphs • identify more basic trends and obvious patterns using relevant biological knowledge, to offer explanations of familiar material.
Experiment and investigation
Candidates at this level could normally: <ul style="list-style-type: none"> • adapt principles of experimental design to specific situations when provided with guidance • criticise some aspects of personal experimental design and procedure, and identify clearly anomalous data.

Performance at GCE AS level grade E boundary

Standards of performance were broadly comparable across awarding bodies.

Standards of performance at GCE A level grades A and E

GCE A level grade A performance descriptor

Knowledge with understanding
Candidates at this level could normally: <ul style="list-style-type: none"> • recall a wide range of the content from all areas of the specification • use detailed knowledge and understanding to explain scientific systems and phenomena, and apply this to novel situations where these were presented to them • select and use appropriate scientific terminology in their descriptions and explanations • select, organise and present information in an ordered and logical manner • show an understanding of the wider implications of science, including its benefits and drawbacks.
Application of knowledge and understanding, analysis, synthesis and evaluation
Candidates at this level could normally: <ul style="list-style-type: none"> • plot graphical data accurately, and describe trends in data • perform complex calculations involving more than one step • interpret and analyse data presented to them and relate this to their knowledge and understanding of content in the specification • understand the development of scientific ideas • sequence scientific concepts and processes in a logical and orderly manner • use extended writing in their responses to questions.
Experiment and investigation
Candidates at this level could normally: <ul style="list-style-type: none"> • plan and safely carry out investigations based on a sound knowledge and understanding of the specification content • interpret their results fully, using a variety of techniques

- evaluate the results of their investigations and the methods used
- produce a wide range of relevant results and use appropriate statistical techniques to analyse them.

Synthesis of knowledge, understanding and skills

Candidates at this level could normally:

- produce sophisticated responses to questions, drawing on the scientific knowledge and understanding set out in the specification
- apply their knowledge and understanding successfully to unfamiliar contexts and data.

Performance at GCE A level grade A boundary

The majority of judgements found that CCEA candidates performed less well at grade A than candidates from the other awarding bodies. As at AS grade A, reviewers judged that the CCEA question papers did not enable candidates to demonstrate sufficient coverage of the assessment objectives. Other than that, performance across awarding bodies was found to be relatively consistent at this grade. Reviewers did not identify any significant change in standards of performance between 1997 and 2003 at this grade boundary.

GCE A level grade E performance descriptor

Knowledge with understanding

Candidates at this level could normally:

- show a patchy recall of knowledge and facts set out in the specification
- use only limited biological terminology in their descriptions and explanations
- produce straightforward answers to questions, but experienced difficulty in sequencing and ordering their answers.

Application of knowledge and understanding, analysis, synthesis and evaluation

Candidates at this level could normally:

- plot graphical data accurately but experienced difficulty in interpreting their data, able to describe only simple patterns and trends
- interpret and analyse relatively straightforward data presented to them and relate this to their knowledge and understanding of content in the specification
- understand familiar concepts and scientific ideas.

Experiment and investigation

Candidates at this level could normally:

- plan and safely carry out investigations based on a limited knowledge and understanding of the specification content, sometimes showing a lack of overall direction in the planning phase
- understand the need to control variables and describe and explain straightforward practical techniques
- make methodical observations.

Synthesis of knowledge, understanding and skills

Candidates at this level could normally:

- recall information from the specification, but experienced difficulty in sequencing this in a logical and consistent way.

Performance at GCE A level grade E boundary

Reviewers judged that candidates' work was broadly comparable across the awarding bodies at this grade boundary. On the limited evidence available, reviewers did not identify any significant change in standards of performance between 1997 and 2003.

Summary

The most significant factor affecting the demand of A level biology specifications during the period 1997 to 2003 was the change in design of the A level qualification in line with the Curriculum 2000 reforms. Reviewers found it difficult to judge the impact of these design changes on standards of performance overall, because of the change in demand between the 1997 A level papers and the A2 papers in 2003. It was not possible to draw any conclusions about performance over time for the new advanced subsidiary qualification as no such qualification existed in 1997.

There was some concern that candidates taking the CCEA examination in 2003 were not demonstrating the levels of performance represented by the other awarding bodies. This was apparent at the grade A boundary for both AS and A2.

Relationship between GCSE and A level

Reviewers noted that there was broad progression from the aims of the GCSE specifications to the A level specifications, with two notable exceptions. The GCSE aims state that students should *'appreciate how scientific ideas develop, and factors that may affect their development and their power and limitations'*. This was considered to be a demanding conceptual aim for GCSE and there was no evidence of a related aim in the A level specifications. Conversely the A level aims include *'sustain and develop enjoyment of, and interest in, biology'* – this is an important aspiration but no equivalent aim is present in the GCSE specifications.

In terms of the weighting of assessment objectives, for AO1 'knowledge and understanding' the weighting is 45–55 per cent for both GCSE and the AS specifications. In A2 the weighting falls to 30–40 per cent with more emphasis on higher level interpreting and evaluating skills and the synoptic element, which does demonstrate a natural progression. For coursework although the GCSE and A level biology criteria specify the same maximum weighting of 30 per cent, in practice GCSE syllabuses mostly have a 25 per cent coursework allocation, while at A level it falls to usually 20 per cent. There is no real logic for having different coursework weightings at GCSE and A level.

In terms of specification content reviewers reported that there was limited progression from GCSE to AS, with some overlap of content and some extension in terms of breadth and depth of coverage. This is not surprising given the design of the AS as an intermediate step between GCSE and the full A level. The majority of progression takes place between AS and A2. There is a need for the GCSE programme of study and the AS/A2 core content to be developed as a whole to allow a smoother progression from GCSE through AS to A2.

In terms of externally assessed written papers there is a progression in terms of overall timing as follows:

Table 4: examination times

GCSE	AS	A2	A level overall
120–150mins	165–180mins	220–300mins	405–480mins

However there is limited progression in terms of the length of individual papers, as papers at all levels have a maximum length of 1½–2 hours (although AS and A2 papers are often timetabled consecutively, effectively giving up to 3 hours in one examination session.)

There is significant variation in terms of the interpretation of 'extended writing' at GCSE and 'quality of communication' at AS/A2. Details are given in mark schemes and there is some

variation in terms of the number of marks allocated for assessment of this skill across awarding bodies. The fourth assessment objective introduced for the 2003 GCSE examinations 'quality of written communication' for the assessment of extended prose does not appear to have formal weighting, with assessment objectives 1, 2 and 3 adding up to 100 per cent. There is a need to clarify the nature and extent to which 'extended writing' contributes to any given written paper, to ensure consistency of interpretation across the awarding bodies, and to make the requirements very clear to teachers and candidates in the specification documents.

In terms of performance reviewers commented that there was significant progress in candidates' ability to interpret and analyse data presented to them and relate this to their knowledge and understanding of content in the specification between GCSE grade A and A level grade A. The same was true of candidates' skills in evaluating the results of their investigations and the methods used.

Appendix A: specifications used in the syllabus review**GCSE**

Year	Awarding body and specification code				
	AQA	CCEA	Edexcel	OCR	WJEC
1998	1161	–	1026	1780	–
2003	3411	G09	1520	1980	117

AS/A level

Year	Awarding body and specification code				
	AQA	CCEA	Edexcel	OCR	WJEC
1997	4161	–	9043	9264	006
2003	6416	A1010	9040	7881	310

Appendix B: details of numbers of scripts reviewed**GCSE**

	AQA		CCEA		Edexcel		OCR		WJEC	
	98	03	98	03	98	03	98	03	98	03
A	15	15	5	15	15	15	15	10	15	15
C (higher tier)	15	15	5	6	15	10	15	5	15	15
C (foundation tier)	15	15	-	5	15	10	5	10	15	15
F	15	15	-	-	15	5	10	5	5	5

A level

AQA		CCEA		Edexcel		OCR		WJEC	
97	03	97	03	97	03	97	03	97	03
A-15	A (AS) 15	A-15	A (AS) 15	A-15	A (AS) 15 E (AS) 15	-	A (AS) 10 E (AS) 10	A-15	A (AS) 15 E (AS) 15
E-15	-	E-15	A (A2) 15 E (A2) 3	E-15	A (A2) 15 E (A2) 15	-	A (A2) 10 E (A2) 10	E-15	A (A2) 15 E (A2) 15

Appendix C: list of reviewers

Review team	
Coordinator	David Barrett
Syllabus reviewers	Martin Brown Susan Hoare Edward Little Mark Rothery Adrian Schmit Mark Smith
Script reviewers	John Boyd John Campton John Carey Alan Clamp Paul Collison Elaine Gill Hugh Graham Sue Hocking Bill Indge Gwen Low Sue Madden Alan McMurdo Janet Pan Svetlana Bajic Raymond Anne Whitehead