GCE

Biology

Advanced GCE **A2 H421**

Advanced Subsidiary GCE **AS H021**

Examiners' Reports

June 2011

HX21/R/11

CONTENTS

Advanced GCE Biology (H421)

Advanced Subsidiary GCE Biology (H021)

EXAMINERS' REPORTS

Chief Examiner's Report

General Comments

This has been another successful series with a significant number of new centres starting the course this year. To assist both existing and new Centres, some general points from this series have been provided by Principal Examiners and Principal Moderators in their separate reports.

In general, teachers are now familiar with the format and balance of the Assessment Objectives across the new GCE units. Candidates that have been well prepared for the assessments have performed well this session and many excellent examination scripts have been seen by examiners. However, it is evident that a number of candidates still have unrealistic expectations of the theory papers and the skills required to answer questions successfully.

Principal Examiners' have commented that candidates generally cope well with questions that ask them to recall information in a straightforward manner (AO1). The questions presented in the context of unfamiliar material that requires application of knowledge (AO2) and, in the A2 papers, which draw on synoptic knowledge are answered less well. All theory papers now also incorporate elements of How Science Works, including those aspects formally designated as AO3. Some candidates seemed unprepared for questions assessing AO3 and How Science Works within theory papers.

Previous Chief Examiner's Reports have explained the weightings of the particular skills that are assessed in each of the theory papers. The table below provides a useful summary and has been compiled from the information found in the specification. Reference can be made to the specification for further detail.

Unit	AO1 (raw marks) (%)	AO2 (raw marks) (%)	AO3 (raw marks) (%)	Synoptic (raw marks) (%)	Raw Mark to UMS
F211	28	28	4	-	60 to 90
	46.67	46.67	6.67		
F212	42	48	10	-	100 to 150
	42.00	48.00	10.00		
F214	20	36	4	12	60 to 90
	33.33	60.00	6.67	20.00	
F215	36	54	10	20	100 to 150
	36.00	54.00	10.00	20.00	

From the weightings observed in the table above, it can be seen that for all papers, candidates need to gain experience in applying their knowledge, particularly when confronted with unfamiliar contexts and/or the need to draw together material from different parts of a unit and previous units. Candidates should be given the opportunity to develop these skills both during the formal study of a topic and also in any further work that is set for reinforcement of knowledge. Periodic internal assessment provides an important opportunity for candidates to demonstrate these skills within an examination context.

The teaching of various aspects of the biology specification cannot be adequately carried out without the use of examples. Topics that spring to mind (not a comprehensive list) are behaviour, ecology and conservation. In F215 this session, some candidates were unclear about the use of examples in a question on behaviour and misinterpreted an 'Examiner's tip' in the OCR endorsed Heinemann text as meaning that *no* examples needed to be studied when the text indicated that *lots* of examples were not required. Candidates should be prepared to use examples in order to show understanding and to provide comprehensive answers but it is not necessary to have detailed knowledge of a vast range of examples. Any examples studied during teaching and learning will further benefit candidates if questions should use them for context.

In planning the question papers, care is taken to ensure that sufficient answer lines or space for calculation is provided. On occasion, however, candidates will find that the space supplied is insufficient, particularly if they have large handwriting or cross through part of their answer. In such cases, it is very important that the location of answers that continue in blank areas of the page or on the additional answer pages should be clearly stated close to the spaces allocated for answers. It is also very important that the places where the additional answers are written are clearly labelled with the correct question number and part question.

Unfortunately, some candidates do not always read the questions carefully. If the stem of the question is not carefully read, then information that is vital to the understanding of the context or data may be missed and will make it far more difficult for the candidate to provide a suitable response. They may initially identify a single word in the question without looking at its context and launch into a response that does not answer the question. Very often, candidates waste time and effort in providing unnecessary information before getting to the point of the answer. This not only means that they have less time available to provide the required information, but it also reduces the time available for answering other questions on the paper.

The focus of a question can also be lost if the command word or word that is key to the interpretation of the question is not noted. One good strategy is to underline or highlight the command word and salient facts in the question in order to better focus the response. A question that asks a candidate to 'comment' or 'justify' will expect a longer and more reasoned argument than one that is simply a 'state' question. The command word 'suggest' indicates that the candidate will not necessarily have been taught this information but is expected to use their knowledge from the specification to make deductive steps in providing a suitable response.

Another cause for concern expressed by Examiners is the lack of precision in the use of biological and scientific terminology. Specific examples encountered this session have been highlighted in the Principal Examiners' and Moderators' Reports. Candidates should be encouraged to be more precise in their use of scientific terms throughout their study of the specification. It is important that this precision extends to terms such as 'molecule', 'ion' and 'concentration', all of which are more closely associated with chemistry or terms such as 'intensity' and 'wavelength' that are associated with physics.

Centres should be aware that a range of mathematical skills are required to be tested in the A level assessment and is not confined to the practical Tasks. In the theory papers, candidates should be demonstrating knowledge and understanding of data handling and processing, looking for correlations in data, analysing and drawing conclusions from data and evaluating methods of investigation.

Practical Assessment

Certain points relating to the practical assessments (units F213 and F216) are worth noting here:

- The FAQs, most of which deal with aspects of the practical assessment, are to be found on Interchange. It is most important that a Science Coordinator has access to Interchange in order that periodic checks can be made and to receive vital course information. [It is worth noting that a Science Coordinator only has limited access to that part of Interchange relating to the science area and is unable to make global changes for which the examinations officer would be responsible].
- For those tasks where a calculation checker is supplied, it is important to appreciate that the checker uses the full, unrounded values to calculate subsequent columns. This can lead to minor discrepancies (usually consistent differences between the candidate's and checker's values) if the candidate has used rounded values from the previous column(s) in subsequent calculations.
- Centres are strongly recommended to supply trial data to the moderator when sending the samples of candidates' work. It provides the moderator with the necessary evidence to support a centre's decision on accepting unexpected data.
- It is not possible for candidates to work in collaboration with others for the practical assessment or to pool results. **Under no circumstances** should a candidate be supplied with data in the Qualitative or Quantitative Tasks if they are unable to obtain data for themselves.
- In the Evaluative Task, if candidates are drawing on their own experience of having carried out the related Quantitative Task, then they should make it clear that they are referring to their own previous experience. In any event, they should ensure that they are answering the question that has been set.

While candidates are expected to have developed the skills necessary for a particular task, they **must not** be prepared by carrying out a very similar task or by teaching to the mark scheme. Please see the individual Principal Moderators' Reports for further detail.

INSET

OCR runs courses relating to different aspects of the specification, with a new programme of training events for the autumn and spring terms in 2011/2012. It is also possible to arrange for in-house courses to be held at your centre, either for your centre alone or in conjunction with other centres in your locality, dealing with your specific requirements. Please contact training@ocr.org.uk for further details.

Based on centre feedback, OCR offered teachers three new types of practical masterclass in June and July 2011. These were held at Wakehurst Place (in Association with Kew Gardens) and one AS and one A2 ecology event at the Field Studies Council (FSC) field centres. These events provided delegates with hands-on experience of new ideas for teaching methods and activities, as well as important networking opportunities with other teachers. Feedback from these sessions was very positive and we hope to offer similar events in the future.

Active Results (new for GCE Sciences)

Since January 2011, GCE Biology has been included in Active Results, a free results analysis service helping you review the performance of individual candidates or your whole centre. Active Results provides access to detailed results data, enabling more comprehensive analysis of results in order to give a more accurate measure of the achievements of your centre and individual candidates. For more information, including a demonstration, please go to: www.ocr.org.uk/activeresults

F211 Cells, Exchange and Transport

General Comments

Examiners agreed that this paper was of appropriate difficulty and comparable to previous papers although some candidates may have felt it was more straightforward than the January paper as there was less emphasis on plant biology. Candidates were able to complete all the questions in the time available and the majority attempted every section.

The overall performance of the candidates showed a normal distribution of marks. There was a wide range of ability and attainment to match. More able candidates were able to display their knowledge and attained high marks. The less able candidates were able to achieve some marks in most questions – notably in areas where Assessment Objective one (AO1) was being tested. However, these candidates did not fare so well in questions where Assessment Objective two (AO2) was being tested. The testing of AO2 is an essential part of this examination and candidates must be trained to think through their responses and apply their knowledge.

Comments on Individual Questions

Q.1 In this question candidates were presented with a photomicrograph of a liver cell and candidates had to interpret the photograph. The question went on to test candidates' understanding of organs and how cells and tissues work together.

(a) **(i)** This was a straightforward opening question and was well done by most candidates. The most frequent answer was "packages proteins". Weaker candidates confused the function of the Golgi apparatus with that of ribosomes, lysosomes or endoplasmic reticulum. Candidates who missed out on this mark either did not state the name of a molecule that is packaged, or linked the word Golgi to transport of vesicles without stating that the Golgi makes or produces these vesicles. Some answers were devoted to describing the function of the acrosome.

(ii) There were many clearly-worded answers scoring both marks. The more able candidates correctly referred concisely to 'mRNA leaving the nucleus'. A common error was to say that molecules could move in and out of the nucleus (correct for one mark) but to then use RNA as an example in such a way that it seemed RNA would enter the nucleus as well as leave. Some candidates incorrectly stated that DNA moved out of the nucleus. Another common error (caused by carelessness) was to state that molecules could move in or out of the cell rather than the nucleus, or to describe molecules moving into or out of the nuclear envelope itself.

(iii) The majority of candidates scored either mark point 1 or 2, 'lysosomes contain digestive enzymes' being the phrase most commonly used to gain the mark. However, a lot of careless responses stated that 'lysosomes are digestive enzymes' or described lysosomes 'engulfing' various structures such as pathogens. Candidates must be sure that their detailed knowledge is correct and that they word their responses precisely.

(b) Many candidates quoted a learnt definition and scored two marks here. Unfortunately, poor use of English cost some candidates a mark. Examiners were looking for plural tissues and where a candidate wrote about 'a group of tissue' instead of 'a group of tissues' credit was lost.

(c) Well-prepared candidates who had learnt this section of the specification had no problem in collecting maximum marks. Key points to include were the names of the specialised cells and tissues linked to the function of each in contributing to effective gas exchange in the lungs. However, candidates needed factual knowledge of the histology of the lungs and the ability to link structure to function for each component. Weaker candidates gave general answers about gas exchange without reference to different cells and tissues. A few saw the question as an invitation to give detail of oxygen or carbon dioxide transport by erythrocytes and some candidates even responded by describing gaseous exchange in leaves! It is disappointing to note that so many candidates still consider a moist lining as 'speeding up diffusion'. Candidates at this level should understand that oxygen and carbon dioxide can diffuse through the cell surface membrane without first dissolving in water. The role of surfactant was rarely mentioned. There was generally a good use of terminology throughout.

Q.2 In this question candidates were tested on their knowledge of cell membranes and how substances are moved through membranes.

(a) The majority of candidates scored well on this straightforward question. Correct responses most commonly listed proteins, glycoproteins and phospholipids. Some candidates referred to the functions or properties of a membrane rather than components and some listed different types of proteins found in membranes rather than a range of different molecules.

(b) **(i)** This was again answered correctly by the majority of candidates. The need for energy and moving substances against a concentration gradient were commonly stated. However, weaker candidates gave just one of these points or made confusing statements such as 'diffusion against a concentration gradient'. Only the best candidates described the involvement of carrier proteins. A consistent error that has been mentioned in reports previously is the description of molecules moving 'along a gradient' or 'across a gradient'. Candidates should remember that diffusion is movement of molecules down a concentration gradient while active transport involves movement up or against the concentration gradient.

(ii) It was clear that many candidates do not learn examples or have not yet gained the ability to link different parts of the unit together. Examples of active transport covered by this unit include movement of ions into the root hair cells, movement of ions across the endodermis and active pumping of hydrogen ions out of the companion cells. Credit was given for other correct examples. Candidates should also be aware of the distinction between active transport (such as pumping hydrogen ions out of the companion cells) and an active process (such as active loading of sucrose into the sieve tubes). The most common reasons for losing credit were candidates not referring to 'ions' or not specifically naming cells.

(c) This was straightforward and the majority of candidates were able to give correct responses. Some candidates did confuse diffusion and facilitated diffusion.

Q.3 This question tested candidates' knowledge about the structure and action of the heart.

(a) **(i)** Many candidates achieved full marks. Most candidates correctly labelled X as the right atrium but Y (the aorta) and Z (the pulmonary artery) were often confused. Candidates should look at the whole diagram and follow the arteries back to their origin in the heart in order to identify the correct name.

(ii) Responses revealed that many candidates do not fully understand the role of muscle in the walls of the chambers of the heart. There are still many candidates who believe that the muscles are there to withstand pressure rather than create a force to do some work. The majority of candidates understood that the left ventricle pushes the blood a greater distance or against a greater resistance and therefore needs to have a thicker wall. However, only a minority linked this to the need for a greater force to push the blood. Many candidates lost credit as they had apparently not read the question and compared the left ventricle to the right ventricle rather than to the left atrium.

(iii) The action of the valves in the heart is still not well understood by many candidates. Many wasted time by describing how the atrium pushed the blood into the ventricle. However, the main error for most was to describe the valve shutting due to increased pressure caused by blood flowing into the ventricle from the atrium. Candidates should understand that the valves snap shut when the pressure in the ventricles rises above that in the atria and blood starts to move up towards the main arteries. Ventricular systole or contraction of the ventricle walls was seldom mentioned.

(b) Most candidates appreciated the role of arteries in maintaining blood pressure, with many references to smooth muscle, elastic tissue and narrow lumens as features of the arteries that help to maintain pressure. Some answers such as 'blood vessels' were too vague. Many candidates were confused by the term 'transport medium', as many suggested 'blood vessels' or 'red blood cells', rather than referring to 'plasma' or simply 'blood'. In the third part, many candidates suggested 'alveoli' as the exchange surface in the circulatory system – obviously not realising that all organs must contain exchange surfaces so that substances transported in the blood can be transferred to or from the cells in that organ.

Q.4 **(a)** This question gave students an opportunity to show their more detailed knowledge about the distribution of tissues in plants. However, surprisingly few gained both marks. Many responses suggested that candidates had a limited idea of where plant meristems might be found. Common responses were 'root' and 'stem', sometimes 'leaves' and also 'meristem' were seen. These responses were not sufficiently specific to gain credit. Hardly any candidates gave the precise response '*just behind*' (the root tip/shoot tip). One notable poor guess was the suggestion of 'heart' and 'brain'!

(b) **(i)** Many responses tended to be rather vague and candidates seemed unsure how to express the reasons for staining. Many candidates responded with suggestions such as 'to tell the difference between meristematic tissues and other cells' despite the question stating that the candidate was looking at meristematic tissue. Many candidates will have carried out practical work in which they have stained the chromosomes in a root tip squash. Candidates should learn to apply the knowledge from such practicals to their examination questions. Examiners were looking for the idea of making the chromosomes visible so that the student could identify the stage of the mitotic division. Many candidates did gain credit for suggesting that staining helped the student identify the correct stage of the cell cycle shown by each cell.

A useful tip to help candidates gain greater credit is to train them to underline key words in the rubric of the question. In this case the words 'for *this* investigation' should tell the candidate to focus on what exactly will be viewed and counted rather than giving a vague response about making cells or tissues easier to see.

(ii) Most candidates correctly suggested 'mitosis'. On rare occasions the spelling was incorrect or ambiguous 'mytosis', 'meitosis'. The few incorrect responses included 'meiosis', cytokinesis' and 'cell division'.

(c) Many candidates gained both marks with 18.00 % as the correct answer. However a significant few had little idea what to do. A number of these selected just 2 or 3 of the percentage figures and added them together, showing lack of knowledge of what is going on during the cell cycle. For example one of the most frequent errors was to omit 7.20 from the calculation, arriving at '10.80 %'. Others added all the percentages including the 80 % and arrived, unsurprisingly, at 100%. Some calculated 18/80 to arrive at 22.5%.

(d) This was well answered, and in a variety of ways. The commonest answer was 'not genetically identical', but all the possible correct responses appeared, although 'gametes' was seen less frequently than the others. Many candidates gave more than one point and so risked losing the mark for an error – candidates should understand that if the question asks for *one* point the examiner will mark only one point. However, if two points are given and the second is not correct the candidate may lose the mark. Many candidates gave both sides of the comparison and, in doing so, a few got their meiosis and mitosis mixed up. One or two candidates showed misunderstanding, by identifying fertilisation as the source of genetic variation. Weaker candidates omitted the word 'genetically' from marking point 1.

Q.5 In this question candidates were given a diagram of a spirometer and needed to explain how it could be used to generate data on lung function. Many candidates found it hard to describe the use of the spirometer and its trace clearly. Therefore the question discriminated well between those candidates who had a clear understanding of how to use the apparatus and could therefore word their responses clearly and concisely and those who had only a vague idea about how it works.

(a) **(i)** The majority of candidates gave sufficient detail to gain credit for describing how the spirometer works. However, many candidates were confused by the movements of the air chamber and described it moving the wrong way during inspiration and expiration or described the water levels changing. Overall there was a basic inability to explain how tidal volume could be measured and the most common error was to define tidal volume rather than describe how it could be measured. A good number of candidates referred to vital capacity rather than tidal volume. It should also be noted that measurements of tidal volume are not restricted to subjects at rest. The tidal volume can also be measured in a subject who is exercising or recovering from exercise.

(ii) Most candidates gained at least one mark here and the majority gained two marks. It was more frequent to award the mark for ten even waves although some candidates drew only nine waves and some decided to copy a trace from memory and included a trace showing the vital capacity being measured. These candidates had presumably not read the question in sufficient detail to notice the emboldened command to draw 'ten further breaths'. Fewer candidates understood that the trace should gradually fall as oxygen is used and carbon dioxide is absorbed.

(iii) This was clearly the most challenging part of the question and only a small proportion of candidates achieved full marks. A relatively few very able candidates gave good clear descriptions involving drawing a line across the peaks of the waves and calculating the gradient of the line. However, the majority of candidates found this hard to describe in words. Those candidates who found this difficult could have resorted to annotating the graph they had drawn above or could have re-drawn a graph. Few candidates thought to do this and those few had generally gained full credit in their written text anyway. Many candidates understood that they had to calculate the volume of oxygen used – but many had difficulty in phrasing this succinctly and clearly. Far fewer candidates understood that in order to calculate rate they also needed to measure the length of time over which the oxygen was used. As ever, there were candidates using imprecise terms such as 'amount' instead of 'volume'. Again, many candidates did not read the question and got bogged down in describing and explaining how the spirometer works rather than how the trace should be used.

(b) Most candidates gained one mark here and many gained both marks. Candidates were aware of the need to check the health of the subject and that carbon dioxide build up could be a problem. All possible correct responses were seen. Again, some candidates were not sufficiently precise with their terms and felt that 'cleaning' the mouthpiece was sufficient for 'sterilising'. Some candidates obviously did not read or understand the word 'risk' and their answers referred to ways of getting an accurate or valid value such as reference to use of a nose clip.

Q.6 This question about translocation and the phloem differentiated well between the less able candidates and those of medium to high ability.

(a) (i)The vast majority of candidates knew that sucrose is transported in the phloem. The most common incorrect response was glucose.

(ii) The majority of candidates got all three responses correct. The most common error was to label an actively growing root tip as a 'source' rather than a 'sink'. However, weaker candidates were prone to a number of errors and appeared to be guessing at the responses.

(b) Most candidates gained at least one mark on this question, but significantly fewer gained two marks. Weaker candidates trotted out features of the phloem such as 'have companion cells associated with the sieve tubes' which did not address the question asked. Other candidates wrote statements that were either vague, such as 'sieve tubes possess pores' or were not accurate, such as 'no organelles to impede the flow'.

(c) There were some excellent responses here and the more able candidates were able to provide clear and concise responses that incorporated many of the mark points available. However, the responses tended to be polarised and at the other end of the scale many responses were awarded zero credit. A good proportion of candidates did not appreciate that the question was asking specifically about how sugars are loaded into the sieve tubes. Many of these described mass flow in the sieve tubes or, more worryingly, described assimilates moving through apoplast and symplast pathways. It was apparent that many candidates believe that 'sieve tube' and 'phloem' are synonymous, with companion cells being something else. Candidates should understand that the phloem is a tissue which includes both sieve tubes and companion cells.

F212 Molecules, Biodiversity, Food and Health

General Comments

The paper differentiated well between candidates, in particular questions 1, 3 and 4. As always, there was a variety of question styles covering each of the assessment objectives and it was reassuring to see that candidates tackled all of these different types of questions well. Candidates appear to have had enough time to complete the paper despite some 'no responses' from candidates in parts of the final question.

A large number of candidates were again writing outside the lines provided. This was particularly apparent in the graph-based questions. Candidates have improved in their ability to describe a graph and this was demonstrated well in question 2ci. However, questions 1b and 5ai did not ask candidates to 'describe' and many wasted time on irrelevant descriptions. Question 5ai had two available marks but some candidates wrote the equivalent of 10 or more lines of answer. It is worth reminding candidates not only to read the command word in the question but to look at the number of marks available. An answer scoring full marks can usually fit comfortably within the number of lines provided for each question

> *Teaching Tip*
> Underline command words in the question to keep you focussed on what you are doing.

Question 8 was poorly answered. Once again for this module, it suggests that candidates are treating ecology too lightly in their revision, perhaps in the mistaken belief that questions on this topic will be easy to answer.

Despite warnings in previous reports, many candidates are still using the term 'immunity' as a generic term to imply the ability to withstand any kind of biological assault. Teachers should guide their students carefully and check their understanding of the terms 'immunity' and 'resistance' so that they can apply them correctly, as required.

Comments on Individual Questions

Q.1 This question discriminated well overall and tested candidates' application of knowledge with three very different sub-questions.

(a) Although 'missing words' questions are often perceived as easy this proved quite challenging despite a choice of words being given, with only a small proportion of candidates gaining full marks. Almost everyone knew that plants carried out photosynthesis and that starch was a storage compound, but a surprisingly large number thought that proteins contained phosphate, while some thought sucrose could not be digested or were unsure of the term 'monomer'.

(b) Although the question asked candidates to use their own knowledge and *explain,* many wasted time and space describing the graph. Most candidates gained one or two marks, usually by stating the likely effect of nitrogen fertiliser on yield, the role of nitrogen in plants, or simple statements about the effect of nitrogen on plant growth or the nitrogen content of the soil. References to leaching, solubility or denitrification were almost never seen. Many candidates referred to minerals or nutrients, perhaps missing the point that the question was about nitrogen.

(c) As is often the case with natural selection questions, this part differentiated well between strong and weak candidates. Only the best candidates achieved full marks. It was pleasing to see a higher proportion of candidates using the term 'selection pressure' correctly. However, many candidates are still referring to a characteristic being passed on, without mentioning an allele or a gene. It is apparent that large numbers of candidates believe that the resistance-conferring mutation is caused by the insecticide.

Q.2 **(a)** Candidates had clearly learned the definition of a catalyst and almost all gained a mark for this. However, the question asked for the definition of a *biological* catalyst. Both words were italicised, so some description of what 'biological' meant in the context of catalysis was also required. Both available marks were awarded relatively infrequently. Repeating words in the stem of the question, 'enzymes' or 'biological', gained no credit.

(b) **(i)** The correct response was given by the majority of candidates. However, 'concentration' and 'volume of hydrogen peroxide' were frequently seen incorrect responses. The link between rate and time does not seem to be as concrete in the minds of candidates as one might assume and this needs to be taught.

(ii) Of all the sub-questions, this was perhaps the most poorly answered. Generally, if a candidate correctly identified differing catalase concentrations as the problem, they would make a sensible suggestion for improvement. However, this happened in fewer than half the scripts seen. Common misconceptions included water in the celery causing more oxygen to be produced, the blending process damaging the catalase and celery containing relatively small concentrations of catalase in the first place.

(iii) This part was answered well, with many candidates providing more than the two answers needed for the mark. Candidates are comfortable with the connection between repeats and reliability. Some candidates failed to gain the 'mean' mark by writing a less-specific 'average'. It is worth reminding candidates that repeating experiments will allow identification of anomalous results, but a repeat will not automatically remove an anomalous result!

(c) **(i)** Most candidates answered this well, noticing that they were asked to *describe* rather than *explain* and doing it well; many scored full marks. It is particularly pleasing to report that strong candidates are beginning to spot changes in the gradient of lines in addition to simple directional descriptions. As ever, where explanations, as opposed to descriptions, were seen, no marks were awarded.

(ii) The Q_{10} was calculated correctly in a little over half the scripts, but a common wrong calculation was to add 25 and 10 and divide by 15, giving 2.3. Although Q_{10} has none, the inclusion of units did not, on this occasion, prevent access to the one available mark.

(iii) This was generally well answered with most candidates gaining full marks.

Q.3 Many candidates seemed to be challenged by the range of biochemical knowledge tested, with a large number, even of strong candidates, failing to get full marks in many of the sections. It was good to see that few were losing marks due to entering more than one response for a single letter or leaving an ambiguous 'hybrid' letter.

(a) (i) Good candidates got all three correct; most candidates got the first 2 letters correct but quite often put 'C' (amino acid) instead of 'F' for the final letter.

(ii) This differentiated very well between candidates. Surprisingly few candidates got all 4 marks. Some candidates seemed to be reluctant to use 'F' twice as an answer and often got the middle two responses wrong.

(b) Good candidates produced excellent answers for this question, communicating their ideas eloquently, concisely and with all the requisite key terms. Most candidates were able to gain at least one mark, often identifying the compact nature of glycogen. Those who identified insolubility invariably went on to state that water potential remained unaffected. Attempts at describing ease of breakdown were often let down by a lack of precision or the term 'break-up'. Only the best candidates described energy density successfully or mentioned the role of branching in facilitating enzyme action.

(c) (i) This was generally well answered but some candidates failed to recognise the relevance of *precise* in the question rubric and just stated 'glucose'.

(ii) Candidates also answered this reasonably well, especially if they kept it simple - longer answers had the ability to shoot themselves in the foot, with references to producing or creating energy; it is worth noting that such glaringly incorrect statements often make it hard to credit other parts of the same answer. A small, but disappointing, number of candidates identified energy *storage* as a function of glucose. Very few candidates referred to the synthesis of other compounds.

(iii) This was extremely well answered. It was expected that most candidates would choose 'D' but a surprising number answered 'F'. The most common incorrect response was 'B', suggesting some confusion in the minds of candidates between phospholipids and triglycerides.

(d) Although a rather higher number of candidates than in the past realised that it was necessary to compare like with like, this question was nevertheless quite poorly answered, with relatively few candidates achieving 3 marks. Many did gain credit for branched/unbranched or α/β-glucose, but many only filled in two rows and some did not respond at all. Many candidates gave functional differences and some showed a complete lack of knowledge of biological molecules, referring to properties of proteins even though the question states that cellulose is a carbohydrate.

> *Teaching tip*
> Students model molecules using unusual and memorable resources, eg carbohydrates out of sweets, fats out of modeling-clay and proteins out of cheese.

Q.4 **(a)** **(i)** The majority of candidates gained both marks by identifying the elderly and young people. Pregnant women and HIV/AIDS sufferers were also popular choices.

(ii) Despite similar questions having appeared in previous sessions, surprisingly few candidates scored the 2 marks available. There was a considerable lack of precision seen in phrases like 'influenza mutating' and 'different *strands*' of the virus. Weak candidates often referred incorrectly to viruses developing immunity. Too few candidates had confidence in using the terms 'antigen' and 'antibody' correctly.

(iii) This part was generally well answered. The minority who failed to score 2 marks were often not using the information provided, or trying to *explain* the differences rather than adhering to the question rubric and *stating* the differences.

(iv) This part was too often poorly answered with few candidates gaining the maximum 3 marks. A significant number described a primary immune response with the formation of memory cells as the bulk of their answer. The precise role of memory cells was poorly understood. Many were not aware that they differentiate into plasma cells. Some candidates thought that memory cells were packed full of antibodies waiting to be released, while others believed they could perform phagocytosis. The first marking point 'memory cells recognise the virus' should have been easier to award but too many candidates used vague terms like 'find' or 'detect'; 'memory cells remember the virus' was a common phrase that did not get a mark.

(b) **(i)** Most candidates gained the 1 mark available but a significant number did not. 'Influenza is caused by a virus' was commonly seen without further qualification. Many candidates thought that the virus would rapidly develop resistance to the antibiotic. 'Immunity' (of viruses to antibiotics) also made a number of appearances.

(ii) This question part was pleasingly answered with most candidates realising it was testing their knowledge of enzyme inhibition. There was, however, some confusion between enzyme and substrate in the juxtaposition of Tamiflu® and neuraminidase. Imprecision in not referring to the active site of neuraminidase denied some candidates a second mark.

(iii) The few candidates who scored 2 marks for this question usually showed an appreciation that the virus could not leave the cell in the presence of Tamiflu® or infect other cells. However, for the majority, the problem was either one of simply repeating their answer to part (ii) or not taking forward the information from the question stem. Some candidates regarded Tamiflu® as a form of vaccination and were not credited.

(c) Few candidates scored more than 1 mark for this question. Most were able to say that there is a reasonable chance that plants used in traditional medicine do indeed have medicinal properties, though some focused on plants in general and gained no mark. A number thought that influenza was unheard of in Nepal and this was because the plants there had antiviral properties. Rarely did candidates develop their answers beyond a reference to efficacy, and if they did, it was often down the wrong path of talking about lack of ethical concerns, ease of cultivation or biodiversity. There is a disappointing belief among a significant minority of candidates that traditional medicines have been *proven* to work or that they will have no side effects.

Q.5 **(a)** **(i)** Most candidates did this reasonably well and a large number gained both available marks. All the marking points related to identifying either similarities or differences between the changes in smoking behaviour of men and women. Answers that focused on individual dates or on lung cancer gained no credit. Many candidates described the graphs in some detail and answered well beyond the given answer lines.

(ii) Generally, this was less well attempted than part (i). The majority of candidates simply stated that as smoking increases so does the incidence of lung cancer, failing to notice the key feature of the graph, namely a 20-30 year delay between an increase in smoking and an increase in lung cancer.

(b) The best candidates tended to pick up all 6 marks in only a few lines of response and the QWC was frequently awarded. Often candidates who recognised the relevance of carcinogens did not state precisely that they were in the smoke and/or tar and instead just said 'in cigarettes'. Very few linked cilia destruction to increased contact of carcinogens with cells. Perhaps because they had misread the question, there were a large number of candidates who simply wrote everything they knew about the dangers of smoking, wasting a lot of time and perhaps gaining 1-3 marks. Some candidates described the development of emphysema in some detail and were awarded no marks. There were very few references to oncogenes.

(c) Two marks out of three were common for this question. Many candidates omitted to qualify bronchitis with 'chronic' and hypertension was often seen.

Q.6 As this question relied on *observation*, it became apparent to examiners that many candidates have not had sufficient time to practice what many would regard as a fundamental skill in Biology.

Teaching tip
Teach students to observe and describe. Get them to write answers for 6a then compare each other's answers and create a mark scheme.

(a) **(i)** Most candidates gained 2 out of 3 marks, usually for 'segments' and 'lateral spines'. Perhaps because candidates, understandably, do not tend to study insects, it should not be surprising that very few identified three parts to the body or named all three parts. Some candidates thought the heads were a similar shape.

(ii) Most candidates gained a mark for identifying the anterior spine but many failed to state whether the feature was present in species A or species B. 'Different shaped heads' was a frequently seen, but rather a weak response that gained no credit and a significant minority referred to size even though they were told (in bold) to disregard this.

(b) Candidates often achieved one, but rarely both, marks. Many missed the point of the question and focused on describing evolution rather than the evidence provided by fossils, with phrases like 'fossils show that organisms have evolved over time'. This effectively just restated what was in the stem of the question. Showing changes over time and links between groups were the most common creditworthy responses but, surprisingly, reference to the presence of now extinct organisms or simpler organisms in older rocks was almost never seen. Some candidates, stretching the definition of 'fossil' slightly, referred to DNA extraction – on this occasion credited was given because of what is studied on some GCSE specifications.

Q.7 **(a)** This differentiated very well. Only the strong candidates gained all 3 marks. Commonly, answers lacked precision, stating, eg 'pentose sugar' or 'nitrogenous base'. Other candidates wrote incorrect answers, eg 'phosphate head' or 'phosphate molecule'. Incorrect spelling, in particular 'thiamine' and 'dioxyribose' were not credited in this question because 'thiamine' is the name of a compound that is not thymine and the prefix 'di-' has a scientific meaning that is different from 'de-'.

(b) Once again, a question about DNA replication has been well answered. It is clear that this has been effectively taught and thoroughly learned. Many candidates displayed in-depth knowledge and a lot of further detail was included in many answers. Where candidates failed to score full marks it was often in omitting the term 'helix' in reference to unwinding or in failing to state that the sugar-phosphate backbone reforms. Some candidates described the structure of DNA rather than the process of replication and wasted time and space. As ever, a small minority of candidates described transcription.

Q.8 This question afforded less opportunity for 'waffle' than previous ecology-based questions and, perhaps for this reason, a number of candidates failed to attempt some parts.

(a) Well over half of candidates identified the two birds as different species, and some spotted the difference in genus also. A significant number of candidates were too imprecise with respect to the genetic incompatibility with statements like 'they have different genes' – all individuals (other than identical twins etc.) have different genes. Many candidates failed to notice that mating had already occurred and others seemed to misinterpret the question and referred to the offspring being infertile.

(b) **(i)** The vast majority of candidates had not learned this acronym and there was an endless array of incorrect attempts. "T" was often given as "Trafficking" and "C" often "Conservation". A significant number of candidates did not answer this question. It was something of a relief to see the odd candidate get this right, even adding 'of Wild Flora and Fauna'.

(ii) It is clear that most candidates had not learned this part of the specification. Vague statements such as "to protect endangered species", "to prevent trafficking of ivory tusks", "to educate people about endangered species" and "to increase biodiversity" were very common. A minority gained one mark for some reduction in trade of endangered species but very few gained both available marks.

(c) Many candidates correctly identified that the health, fertility or unrelatedness of individuals were important, although there is still some confusion in candidates' minds about the difference between inbreeding and interbreeding. Very few candidates mentioned, perhaps because they thought it too obvious, that a male and a female were needed. Irrelevant comments about the birds being of the same species were seen on some occasions.

(d) Most answers seen were worth 1 or 2 marks. It was pleasing that some candidates did seem to be aware of a variety of genuine methods of reintroducing, monitoring and protecting individuals. A minority of candidates did not appreciate that the female was being introduced into the male's territory and hence answers suggesting the selection of an appropriate habitat were irrelevant. A similar group of candidates dwelt on procedures to ensure that the male and female met beforehand and were attracted to each other, clearly failing to understand that there was only one male, and that he was wild.

F213 Practical Skills in Biology 1

General Comments

The tasks were of the same level of demand as in previous sessions. There were a few misinterpretations of the rubric where candidates did not appreciate the difference between 'Describe' and 'Explain' (Ev 2 Q1) and therefore lost the second mark, or between 'error' and 'limitation' (Ev 1 Q5). Overall, the quality of work seemed to be better, with more candidates achieving higher marks and fewer achieving lower grades.

An increasing number of Centres were marking closely to the mark scheme and following marking guidelines using a single tick per marking point and a matching numerical value in the 'for teacher's use' column. It was encouraging to note more Centres were correctly collating a candidate's three tasks together securely with a treasury tag and in some cases using different coloured front sheets for each task type, which was helpful. The use of the candidate front sheet acted as a useful summary of tasks for each candidate and helped reduce the number of clerical errors. These front sheets can be obtained from the public website. The front covers should be correctly filled in with the task number completed and the session from which the task was derived if any tasks were resubmissions from previous sessions.

Centres are requested to check for clerical errors as part of the internal moderation process within the Centre to reduce delays in the moderation process.

There was still evidence that some Centres continue to coach candidates to the mark scheme to improve marks. Centres need to be reminded that the mark scheme must not be used in this way and that candidates may not revisit a task once it has been set. Also, completed tasks must be kept securely until any possibility of re-sits has passed for those candidates. At that time they may be securely destroyed as these tasks will remain as live examinations throughout the life of the specification. Centres are also reminded that data may not be given to candidates, nor may data be shared. Please see FAQ 24 for further amplification of this point. Centres are also to be reminded that any second attempt at an answer, including tables and graphs, can only occur if the student requests it at the time of completing the task and not at a subsequent date. The original answer must clearly crossed through by the candidate and not rely on the marker and moderator making the choice. This last point also applies to any question where two answers are given, unless both are correct, in which case the first answer will be marked.

The Practical Skills Handbook and OCR's free coursework consultancy service may both used for further guidance.

The following web sites may also be helpful www.biology4all.com or www.gettingpractical.org.uk.

Qualitative Tasks

These tasks were well answered this session with many candidates, including the less able, scoring well when the instructions were followed closely. However, weaker candidates had not mastered either drawing skills or the requirements for correct drawing of a results table.

Candidates were polarised between those that demonstrated the skills well and those that were not aware and lost marks unnecessarily. Drawings should correctly represent the observations and not diagrams remembered from a text book. Tables should be correctly drawn up with complete borders, a single table with the independent variable in the first column and with no units in the table cells. See Chapter 7 of the Practical Skills Handbook for guidance.

In Qualitative 1, Q3, only the more able candidates understood that the changes in the trypsin tube only occurred as the tube warmed up. In Qualitative 2, Q2 was generally not well answered as candidates failed to understand why the strips curled and made little or no reference to the cortex cells or to the water movement. In Qualitative 3, Q2 generally only gained two marks by the more able candidates. This task was the least attempted with Qualitative 1 being the most attempted task.

Quantitative Tasks

Calculation errors, incorrect rounding, inconsistency in decimal places or incorrect numbers of decimal places were common for all three tasks. It is expected that all calculations in a column will be correct and be rounded correctly. Any guidance on the use of decimal places must be followed or in the absence of guidance, 2 decimal places is considered the norm. Calculated data should show the same number of decimal places or one more place than the raw data. In addition they should all be the same within a column of figures. However, when an error has occurred, Centres are encouraged to allow an error carried forward (ecf) for any further columns showing the same error.

Frequently the additional guidance on the expected trend was ignored in Quantitative 1 and 2. In Quantitative 1, Q2b, 3 and 4 were not well done other than by the more able candidates. In Quantitative 3, the diversity index did not seem to be well understood by many of the candidates. Poor basic graphing skills were a common theme in Tasks 1 and 2, with errors such as incorrect lines especially when using line of best fit, which seemed to be poorly understood. Incorrect scaling, including covering 50% of the available paper, and lack of complete labels or units and even plotting errors caused problems. Centres are advised to consult the Practical Skills Handbook or the consultancy service for guidelines concerning data recording, scaling graphs and good use of graph paper.

Evaluative Tasks

There is still some evidence of a lack of understanding of the terminology used. This was especially evident in the use of the terms 'accuracy', 'reliability' and 'precision'. Note that accuracy is an assessment of how close the obtained value is to the true value and so can be assessed by the calculation of the percentage error, or a comment on the accuracy of pieces of apparatus.

Reliability can be assessed by the concurrence of replicate data, whilst precision is a measure of the exactness of the data and so can be determined by the number of decimal places to which any measurement can be recorded, as determined by the apparatus used. The exception to this is timing where the precision of the timing apparatus is limited by human reaction times and so one decimal place is the maximum and usually timing will be only accepted to the nearest whole second or the nearest half second. This is usually specified in the recording point of the tasks eg Quant 1.

The terms 'limitation' and 'error' were also frequently confused. Limitations are problems within the procedure which will affect all data collected, whilst errors are one off issues frequently referred to as operator errors. Human error alone, however, will rarely be awarded the mark since there needs to be some detail of the error. Suitable explanations and modifications for either limitations or errors should be correctly linked to the limitation or error and should not be awarded if this link is not apparent. An error carried forward mark may be awarded for a correctly linked explanation or modification when the first marking point is not awarded the mark. Annotations of marking points, by placing a number or letter within the tick, where there are several marking points possible, is important to prevent awarding the same point again simply because the candidate has restated it in a slightly different way.

In Evaluative task 1, Q2b and Q3b were poorly understood by less able candidates so these discriminated well. Responses were generally too vague or simply restated the question. Questions 4 and 5 caused some problems since there was no recognition that the questions referred to the task carried out on the SES which was accepted as having been followed exactly. In Evaluative task 2, the biggest issue was with Q1 as few Centres recognised that the question required reference to the changes that occurred as the concentration increased from 0.0 to 0.5 mol dm^{-3}. Consequently marks were awarded for good water potential explanations and comments that did not answer the question.

In Evaluative task 3, poor understanding of the diversity index and terms such as species richness and species evenness hampered some candidates, as did incomplete statements for Q 7 which did not gain the mark.

All Evaluative three tasks were attempted by centres, although in general, candidates performed less well in these tasks than in the other two task types.

F214 Communication, Homeostasis and Energy

General Comments

Some excellent answers were seen and those candidates who had been well prepared, particularly with reference to AO2, AO3 and synoptic material, performed well.

In some cases candidates misinterpreted the requirements of the question and, while providing accurate biological information, did not answer the question that was asked. This was particularly noticeable in questions **1(a)**, **3(b)** and **6(b)(iii)**. Candidates are reminded of the need to read the questions carefully and not to attach undue importance to a single word without looking at its context.

It was noticeable in some cases that whilst candidates were supplying answers that demonstrated a general understanding of the material, their use of basic biological and scientific terms was imprecise or incorrect. Candidates need to have a clear understanding of biological and scientific terms and to be able to use them in the appropriate contexts.

Spelling and grammar continues to improve. However, there are still numerous crossings out on scripts and candidates should be advised to take time to read the questions carefully, noting what they require, and to think carefully about their responses before starting to write.

Candidates should also take care when spelling technical terms and with the way in which the terms are written. It is not possible to credit terms towards the QWC (Quality of Written Communication) mark if two or three letters run together in a word, are indistinctly formed or if letters are over-written. All of these make interpretation of the intended spelling impossible.

Candidates will benefit from making clear indications that their answer continues on an additional answer sheet and when writing in the additional space, making it clear to which question or part-question the answer refers.

Comments on Individual Questions

Q.1   This question was designed to be an accessible start to the exam. Part **(a)** was intended to be a gentle introduction but proved to be more testing than that.

   (a)   Candidates were generally able to make comparative statements in the same row and those who concentrated their efforts on comparing structure were able to score some marks. There was, however, considerable confusion with aspects of the structure with some candidates completely reversing the features of the types of neurone. Information relating to *dendrons* and *dendrites* was frequently confused and candidates attempted to compare the two rather than dealing with them separately. Significant numbers compared function rather than structure.

   (b)   Many candidates performed well in this question, often scoring 4+ marks. Common errors included '-40' for the resting potential (or a figure between 60 and 70 but without the minus sign), 'resting potential' for gap 3 and few could supply a suitable suggestion for gap 5. A significant number failed to supply a suggestion for gap 4.

Q.2 This question assessed both AO2 and AO3 skills, with candidates being required to analyse data and offer explanations for the observations.

(a) **(i)** Many candidates were able to perform the calculation correctly. Answers were expected to be given to 4 decimal places in accordance with the rest of the data in the relevant column in the table. A working mark was available for those candidates who did not round appropriately or who presented the answer in standard form.

> *Teaching Tip:*
> All data in a particular column should be given to the same number of decimal places – it can be emphasised by explaining it in the context of making the table 'look pretty'.
> Candidates need experience in ensuring that data is presented in this way, both in the practical assessments and theory papers. Tables with in-built errors can be given to candidates and they could be asked to identify the errors.

(ii) Many candidates were able to suggest an appropriate piece of information. As the length of the bubble had been measured in the capillary tube, references to the plastic tubing or syringe were inappropriate.

(iii) Candidates who answered this in terms of adding hydrogencarbonate or bubbling carbon dioxide into the solution gained credit. Common errors were to suggest adding a carbonate or hydroxide. Adding aquatic animals was not considered to be a suitable suggestion.

(b) **(i)** Candidates were generally able to supply at least one reason for not all the oxygen being collected. The most common reason was that the plant would use it in respiration. Answers that referred vaguely to being absorbed by the solution or escaping were not credited but some answers explained the dissolving of the gas in the solution or described the possible route that the gas would take when escaping from the apparatus.

(ii) Weaker candidates struggled to recognise which aspect of their knowledge they should be concentrating on in order to answer this question. Many answers tried to draw on knowledge of the nitrogen cycle and referred to the process of denitrification or suggested that nitrogen gas would be an excretory produce of amino acid or protein metabolism. There were a number of statements that nitrogen was in the air but few answers presented a clear explanation by giving further detail that the air would be within the air spaces of the plant. Few candidates appreciated that nitrogen gas would be released from the plant with oxygen and hardly any commented on the decrease in solubility of nitrogen in warm water.

(iii) Some candidates appreciated that the level of carbon dioxide was higher than that of normal air, although some appeared to think that 6% was lower than that of air. Most answers referred to respiration and photosynthesis but tended to compare relative rates of these processes rather than to use them to explain the high figure or to say why it was less than it could have been. References to the comparative values of the gases were not credited.

(c) This section proved to be challenging for most candidates. Many offered general detail as to the purpose of accessory pigments in allowing the plant to absorb a greater range of wavelengths than those absorbed by chlorophyll alone, without making their response specific to the fact that fewer wavelengths would be able to penetrate at greater depths. Others believed that light of different wavelengths would be found. While some recognised that there would be fewer wavelengths penetrating, they then provided incorrect detail (red rather than blue/green).
In better answers, the most common comment was that the light reaching the seaweed would be of lower intensity and therefore the pigments would allow absorption of what limited light was available. However, some failed to stipulate 'intensity', simply stating that there would be less light. Occasionally, candidates discussed how the different coloured seaweeds were able to be camouflaged from predators.

Q.3 This question related respiration to a number of unfamiliar contexts. It required good understanding and the ability to apply their knowledge in order to perform well. Those candidates who drew effectively on synoptic information were those who were able to gain the most credit.

(a) A concerning aspect of answers to this question was that candidates either appeared to be unable to remember anything about emphysema (synoptic from F212) or thought that it was related to glucose concentration in the blood. Some candidates realised that emphysema would lead to less oxygen in the blood, but many failed to appreciate that the idea of entering the blood was key here. Some candidates stated that lactate or CO_2 would build up, but often did not link this to an effect on enzymes or respiratory metabolism. Some candidates referred to 'no respiration' or 'no oxygen' without realising that this would immediately lead to death. Some confusion was evident between ventilation, breathing and respiration – the terms being used as synonymous. Candidates often missed mark point 1 as they had supplied a description of the change in alveoli rather than an explanation of the effect this would have.

(b) This proved to be the part of the question that candidates found most challenging. Many candidates focused on the role of insulin rather than answering the question. Many candidates gave detailed answers relating to water potential changes of the blood plasma: 'If more glucose remains in the blood, water potential values fall, water moves out of cells by osmosis and this leads to feeling of fatigue.' Some good biology was therefore expressed but not worthy of marks on this occasion. Few realised that less glucose will be taken up into the cells. The most common mark to be awarded was mark point 3. Confusion was seen between the terms 'glycogen' and 'glucagon'. A few candidates tried to explain the fatigue in terms of the body working extra hard to respire the extra blood glucose.

(c) Better answers were seen to this part of the question. The most frequently awarded marking points were 2, 3 and 4. Common errors, as in **(a)**, included candidates mentioning 'no respiration' and 'no oxygen'. Even those candidates who started their explanation with 'there is less oxygen' then failed to mention 'for respiration', using instead vague explanations such as 'for the body' or 'for work'. It was common to see the idea of less blood flowing around the body rather than the rate of blood flow being lower. Credit was not given for vague statements relating to the way in which the heart was or should have been working.

(d) **(i)** A good proportion of candidates scored full marks on this question. Many showed a clear understanding of the processes involved and were able to use the terms correctly. Some candidates had not appreciated the need to link the processes to the symptoms, which was necessary to gain mark points 3 and 5. However, full marks could still be obtained even if these particular points were not awarded. A few candidates took many lines describing the link reaction, Krebs cycle and oxidative phosphorylation without stating what the effect of a reduction in pyruvate would be. One common misconception was that it was the lack of ATP that caused muscle aching rather than the pH change due to lactate accumulation.

(ii) Those candidates who realised that they needed to draw on their AS knowledge of the specific immune response performed well. This, however, was restricted to few candidates. Some were able to state that there would be little ATP, but could not go on to link this to the important stages of the specific immune response. Most candidates mentioned T lymphocytes after reading the stem of the question and did not realise that it is the B lymphocytes that have to divide and then produce antibodies.

Q.4 This question proved to be accessible for most candidates and many performed well. This is probably related to the fact that it had a relatively high proportion of AO1 (recall of knowledge) marks and so a candidate who had revised thoroughly could answer with confidence.

(a) **(i)** Most candidates answered this correctly. Some candidates stated alpha or beta cells, which was too restrictive. There were many variations on spelling but the majority were phonetic and therefore credited.

(ii) Most candidates referred to both the endocrine and exocrine functions in their answers. Many candidates scored 1 or 2 marks, the most common being the secretion of glucagon and insulin by the alpha and beta cells. Some candidates, however, associated the cells and the hormones incorrectly. More marks were achieved for the endocrine component than the exocrine component as the endocrine aspect of the pancreas was better understood. Some candidates confused exocrine and endocrine, either stating that hormones were released into ducts or reversing the functions. Candidates who had the right idea sometimes did not clarify their statements by indicating that hormones are secreted into the blood or enzymes are secreted into a duct. Some candidates thought that bile was produced in the pancreas and the duct was therefore the bile duct, while others thought that the pancreatic secretions emptied into the stomach. Few candidates referred to the detection of blood glucose concentration by the islet cells, many stating they are involved in regulating/control glucose levels. The majority of candidates who were clear about the differences between exocrine and endocrine were awarded the mark for Quality of Written Communication.

(b) Candidates performed well on this question, with many achieving full marks. For those who did not, A was normally placed before G but in the incorrect part of the sequence. The most common errors were to not place D and F in the correct positions and placing C before H.

(c) **(i)** Many candidates achieved full marks as they were able to supply two suitable advantages. The most frequent suggestions related to ethical and religious advantages, although sometimes there was a blurring between them. Many candidates referring to no rejection with some referring to no immune response, without specifying allergic response, usually in the context of infection. Some candidates stated that the insulin was similar to rather than identical to human insulin although some referred to the DNA and/or gene being identical without reference to the protein. Consequently, 'genetically identical insulin' was a commonly seen suggestion.

(ii) Almost all candidates could identify a suitable benefit of using stem cells as a treatment.

Q.5 This question dealt with the kidney and, apart from the information directly required to answer the questions, candidates needed to draw on information from AS in order to link detail of channel proteins to the functioning of the kidney, with respect to aquaporins.

(a) Various answers were seen to this question, with many indicating confusion with the details of the gross structure of the kidney. In order to avoid any ambiguity with similar biological terms, only the correct spelling of 'ureter' was credited.

(b) **(i)** Most candidates concentrated their efforts on the question that had been set and few answers that presented a full and 'standard' account of the functioning of the nephron were seen. Some very good answers were seen that scored full marks, many achieving up to seven or eight of the marking points available. The main reason for poor performance on this question was a lack of detail and precision in the answers.

(ii) Some good reasoning was seen here, with many candidates suggesting at least two ways in which the urine would differ. A common error was to suggest that 'more glucose' would be present, implying that it was normally found in the urine of a healthy person.

(c) **(i)** Candidates who linked the idea of a channel within the membrane to the structure of the cell surface membrane were able to correctly identify the molecule as a protein. Common incorrect suggestions included ADH, DNA, phospholipid, glycoprotein, ER, cholesterol, protein receptor and amino acid.

(ii) Despite a context with which the candidates should have been familiar, this question proved challenging to many. A lack of precision in the use of terms (treating 'ions' and 'molecules' as interchangeable terms, for example) and description of the ways in which the channel would prevent the passage of ions.

Q.6 This question required candidates, in **(a)**, to precisely locate processes within the organism and, in **(b)**, give clear and unambiguous names to the descriptions supplied.

> *Teaching tip:*
> Precision of language is often very important in answering examination questions. Students could play a version of 'top trumps', where each one tries to give a more precise location or name for a process than the previous one.

(a) **(i)** Those candidates who had a clear perception of the function of the adrenal glands were well-equipped to answer this question. Many and varied incorrect guesses were seen.

(ii) This was answered correctly by many candidates. The most common errors were to suggest an incorrect location within the mitochondrion.

(b) **(i)** While a good proportion of candidates supplied the correct answer, the 'knee-jerk' response of 'negative feedback' was a common incorrect answer.

(ii) The common errors were a lack of precision, either omitting 'cyclic' or 'photo'. As the description was not applicable to the whole of the light dependent stage, this was not credited.

(iii) Many candidates had homed in on the initial part of the description and therefore suggested homeostasis. More careful reading would have revealed that the emphasis of the description was that of cell signalling.

F215 Control, Genomes and Environment

General Comments

The examination paper discriminated across the ability range, producing a similar range of marks to that of the June 2010 paper. It was pleasing to see the impressive depth and breadth of understanding of the high-achieving candidates, who together with their teachers had clearly worked very hard to master a lengthy syllabus covering varied topics, some of which are new to A level teaching.

Where candidates performed less well were on questions where they were required to think synoptically and apply their knowledge, either in a new context (AO2) and/or where the questions were stretch and challenge and where mathematical skills were required.   Problems included a lack of awareness of or preparation for the 20% synoptic (AO2) and 10% How Science Works and AO3 elements of this assessment. Whilst candidates generally do best on questions that require straightforward recall of areas of the specification, teachers and candidates should be aware that the AO1 content of this unit is only 36% (see the Chief Examiner's Introduction to the June 2011 Report).

Candidates who placed an over-reliance on a single text source without supporting reference to the prescribed specification, or those who had a very weak underpinning in the biochemical basis of biology, also met challenges they were under-prepared for. It is recommended that the teaching of biochemistry is not isolated as a topic, but integrated into the teaching of all parts of the specification, including physiological and ecological topics. The examiners found that unless questions were overtly biochemical, candidates tended not to use biochemical ideas in support of their answers. Both cellular biochemistry and evolution are key ingredients of a synoptic understanding of biology. Best practice should also include candidates being exposed to a variety of sources of information during the course, including science periodicals and the internet, extending horizons and giving students an appreciation of the changing nature of scientific discovery.

Candidates do need to be trained to think logically, to sift through their ideas and then pen a concise, factual answer using the mark tariff of the question as a general guide. Sentences should be precise with a defined factual content and in many questions, bullet points are an acceptable form of response. Candidates can also be helped by being given ample opportunities to practice written work - from the short, concise answers required for objective style questions, to the longer, detailed responses required for the assessment of QWC (Quality of Written Communication). For any assessment by way of a written exam, candidates must have had enough experience of writing answers by hand, as opposed to using a keyboard, in order to have developed a clear, legible hand.

Candidates should clearly indicate at the end of the answer space where they have continued their answer on the additional pages (or elsewhere) if they have written more than the space allows. Extended responses should be clearly labelled with the question part number and letter to ensure that examiners mark all responses.

This paper included a range of organisms exemplifying some of the principles tested, and offered the opportunity in one of the longer essays for candidates to reference diverse examples of behaviour in different animals. Some candidates did not answer the question fully and wrote about academic principles divorced from actual examples. Some candidates misinterpreted an 'Examiner's tip' in the OCR endorsed Heinemann text as meaning that *no* examples needed to be studied although that is not what was stated in the text. Students of AS and A2 level Biology should be expected to take a real interest in and have some knowledge of the diversity of organisms, and to continually try to relate their A level studies to the biological world around them.

Comments on Individual Questions

Q.1 The flow diagram of the nitrogen cycle within the context of a farm producing cabbages and raising sheep provided opportunities for candidates to display knowledge and understanding of a wide range of learning outcomes from the first three modules of the F215 content, as well as information first encountered in unit F212. The more synoptic parts (a)(i), (b) and (c), proved challenging but not inaccessible, while the more straightforward analysis of events in the nitrogen cycle in (a) (ii) – (v) allowed marks to be gained by most candidates.

(a) In **(i)** candidates needed to explain that animals eat the plant protein, digest it to amino acids and then use these in their own cells for the translation stage of protein synthesis. This question was a good discriminator as only candidates with a clear, logical overview of biology successfully drew these principles together from different areas of the specification. Answers that tried to put the whole of Fig. 1.1 into words, despite the question asking about arrow A only, scored few marks.

Part **(ii)** was less demanding, with any two marking points from death, decomposition, excretion and egestion gaining credit. The instruction was to 'list' two processes, so lengthy descriptions of situations rather than named processes were not required.

The straight recall needed to name **C** (*Nitrosomonas*) and **D** (*Nitrobacter*) in **(iii)** suited most candidates, although there was confusion over the classification of these bacteria as nitrifying rather than denitrifying or nitrogen-fixing. The third mark required nitrates to be identified as the main form in which plants take up nitrogen atoms, and a reason for this uptake such as 'to make amino acids' was needed, rather than just a repetition of the question stem 'to grow'.

The best answers to part **(iv)** were concise and logical and followed the instruction to use the letters from the diagram in their explanation. The question provided good discrimination, favouring the candidates who integrated the information presented with the general knowledge that crops are grown to be harvested and taken away. This key fact led them to conclude that process **E** (uptake of nitrates by cabbages) continues but that process **B** (rotting), followed by processes **C** and **D** (nitrification), will not now happen or only to a lesser extent. Candidates who were over-keen to deliver their learned information verbatim deviated with a variety of explanations involving irrelevant aspects of the nitrogen cycle such as nitrogen fixation, denitrification and the Haber process.

In **(v)** candidates mostly scored two marks, for identifying legumes or a named leguminous plant as the crop of choice, and for naming *Rhizobium* or nitrogen-fixing bacteria. It was rarer for a third mark to be awarded, as these bacteria convert nitrogen gas to ammonium compounds within the plant, not directly to nitrates in the soil as many candidates described. The point that the plants need to be ploughed in and left to decay to increase the soil nitrate content was only occasionally stated by candidates.

(b) This was an invitation to candidates to apply some of their knowledge of genetics from module 1 of the F215 specification, and its modern applications from module 2, to a real context. Most candidates did not bring this knowledge to bear however, and answers that referred to the potential use of rare breeds in selective breeding or genetic engineering cropped up only occasionally. Generally a single mark was scored for saying that the continued existence of rare breeds is desirable 'to maintain biodiversity'. The answer 'to increase biodiversity' was not accepted and in a number of cases on this paper candidates had to be careful about

inappropriately using terms that suggested a change, or comparison with an unidentified imaginary starting point, rather than maintenance of a *status quo*. Given that nearly half of the specification content of F215 has a link to genetics, candidates also need to be taught to be much more precise in their use of the terms genes and alleles, a problem that resurfaced in Q.7 (c) (i).

(c) Part **(i)** was well done with most candidates writing either 'mutation' or a form of 'selection' and many concisely stating both. The instruction here was 'state', so lengthy descriptions wasted the candidate's time unnecessarily. Being able to select the key information and summarise it succinctly is a skill candidates need to be prepared for.

The word 'suggest' in part **(ii)** of the question indicates that a creative synoptic approach is required, and that there may be a variety of reasonable answers which the candidate is unlikely to have encountered in this context before. Candidates will have touched on the problems of inbreeding in small captive populations in the F212 conservation topic, but few candidates here identified the small population size of the North Ronaldsay sheep as a problem. Most candidates did score for pointing out the difficulty of raising sheep with such specific dietary requirements, and some elaborated on this and realised that to keep the sheep inland would be expensive. Few candidates incorporated any biochemical ideas into their answers.

Teaching tip

Draw the attention of candidates to the variety of prompt words used in the questions (list, state, etc) and explain that a different approach is needed for different types of questions. A list of the terms used together with their meanings is provided towards the back of the support material Practical Skills Handbook. This can be found by following the link:
http://www.ocr.org.uk/download/sm/ocr_32336_sm_gce_pract_skills_hb.pdf.

Many candidates see the specification as a series of separate chunks of facts to be learnt in isolation from each other. While this approach may suffice for the AS units, for success in the A2 papers they must be encouraged to integrate their knowledge across AS and A2. The F215 paper as the terminal paper in the assessment framework is required to test understanding across all four theory units (F211, F212, F214 and the specific additional content for F215) and to devote 10% of marks to the AO3 science objective. Teachers can get a clearer idea of what is required by studying the table explaining the aims of the AO1, AO2 and AO3 objectives in the specification appendix A, and also appendix B on 'How Science Works'.

As with the 2806/01 Unifying Concepts paper on the legacy specification, candidates taking F215 need to be well prepared and to think for themselves. The reward for rising to the challenge of the synoptic and higher demand tasks is the A* grade on offer at A2. Well-prepared students will undoubtedly have the knowledge they require but will need to dig deep to match and select the knowledge that is most relevant to the question being asked.

Q.2 Candidates were required to distinguish between the meanings of 'innate' and 'learned' in the context of animal behaviour. They were then invited to relate examples of innate and learned behaviour and to describe how these types of behaviour in general or their specific examples were advantageous to the animals concerned. As these tasks relied heavily on learning, many candidates scored high marks. Others did not follow the QWC instructions given and therefore did not use their knowledge effectively.

(a) Well-prepared candidates had learned definitions of these terms and scored full marks. The mark scheme lists the key points identifying each type of behaviour. Clearly candidates need to avoid using the word they are trying to explain as part of their explanations, and should describe unique features of each type of behaviour rather than giving one answer which is the converse of their other answer, eg 'innate is instinctive' followed by 'learned is not instinctive', or even worse, 'innate is not learned' and 'learned is learned'. Candidates confused 'experience' with 'environment' and sometimes wrote answers that suggested only learned behaviour involves an environmental trigger at all. Where an idea is quite hard to put into words clearly, the only solution for candidates is to learn a correct definition.

(b) It was a pleasure to read an answer from a good candidate who gave a list of clear named examples of the types of innate and learned behaviour they had studied and linked each to the advantages conferred. The range of behaviours that gained marks included escape reflexes, taxes and kineses, imprinting, habituation, latent learning, conditioning (operant or classical) and insight learning. Many candidates knew the names of the types of behaviour but lost a mark for either not describing an example concerning a particular type of animal, or not describing the advantage of the behaviour to the animal. See teaching tip below.

Candidates who had not prepared for this learning outcome could generally write for a while from their general experience about how animals behave and why, but they tended to focus on learning by association in mammals, particularly primates and including humans, and to miss out on the range of other examples of learned behaviour and the diverse examples of invertebrate innate behaviour. Areas of confusion for candidates included the differences between operant and classical conditioning, kineses and taxes, and confusion of animal phototaxis with plant phototropism. Nonsensical statements cropped up along the lines of "kinesis is a non-directional response in which the woodlouse moves towards…". Guidance on key features of the types of behaviour listed on the specification is given under teaching tips.

There was little evidence of individuality in the range of examples chosen by candidates, although in one refreshing exception the behaviour of hedgehogs, chameleons and moray eels on coral reefs was described. Other useful examples are to be found in the published mark scheme.

Teaching tip

Examples of animal behaviour are sometimes not described in sufficient detail. Guidelines for this have been previously established in the mark scheme and report for the January 2011 paper. Ideally candidates should state the animal (1), the stimulus (2) and the response (3). For example, the earthworm (1) responds to vibrations or a shadow (2) by withdrawing into its burrow (3). In describing habituation this means candidates must state the normal response of birds flying away from a scarecrow before explaining that this observable behaviour ceases when they become habituated to the sight of the scarecrow. Similarly it is not enough to state that initially lambs are 'scared' of an umbrella being opened and shut. An observable response such as backing off or running away needs to be described, with the further explanation that this behaviour stops after repeated exposure to the stimulus results in no punishment.

Q.3 Candidates used knowledge from module 2 of the F215 specification to analyse information about the destruction of English elm trees by Dutch elm disease, concentrating on the fact that the trees formed a clone. Analysis of how the disease kills the tree allowed for some synoptic assessment of plant physiology. An extended writing task on artificial cloning by plant tissue culture was well done. Candidates were then asked to list two advantages and two disadvantages of this propagation technique and needed to be careful about exam technique in order to select and to clearly express an appropriate fact for each line.

(a) Most candidates gained a mark in **(i)** for naming a technique to give molecular evidence of a relationship. A range of acceptable variations on the theme of DNA or protein electrophoresis is given on the mark scheme. Imprecise lay terms (eg gene testing), incorrect terms (gene probing) and inappropriate techniques (eg mapping or sequencing the entire genome – too expensive) did not gain credit.

For part **(ii)** the candidate needed to make use of information given in the opening paragraphs of the question. Many candidates, despite advice in previous reports, seem to jump to the dotted lines without properly reading all the background information supplied.

In **(iii)** the correct answer of 'vegetative propagation' was commonly given.

(b) Most candidates gained two of the four marks for stating that the elms were genetically identical and all therefore lacked genetic resistance to the fungus. Candidates who noticed the mark allocation figure and who had studied the information given were able to offer other useful comments regarding the movement of beetles as vectors between the trees, the human attempts at disease control contributing to the rapid spread of the disease and the close spacing of the trees as a result of the clonal patch growth pattern.

(c) Both parts of this question drew on AS knowledge and understanding and candidates with a firmer grasp of biochemistry had an advantage. In **(i)** most candidates realised water supply would be cut off but few also mentioned mineral ions, specifically magnesium ions, or the link to the formation of chlorophyll. Some candidates made correct statements but did not then develop explanations. They knew the biology, but could not apply it, so correctly stated the function of xylem to transport water and minerals, but did not state explicitly that *no* or *less* water and minerals will be transported if the xylem vessels are blocked.

Similarly in **(ii)** most candidates mentioned that photosynthesis takes place in the leaves, but some failed to say that there would be *less* or *none* occurring if the leaves were lost. Candidates who recalled AS well were able to explain that less photosynthesis meant less sucrose would be available for metabolic processes such as respiration or active transport in the roots. Answers that incorrectly described energy or ATP being transported from the leaves to the roots were not credited, nor was the wording 'energy is produced' with respect to either respiration or photosynthesis.

(d) The tissue culture extended writing question was well answered and earned most candidates 5 or 6 marks out of 7. The level of detail required is indicated on the mark scheme and attention is drawn to the main points that were missed by many candidates in the teaching tips below. For most candidates an inclusion of aseptic technique would have enabled them to reach full marks.

(e)   Most candidates accessed some of the marks on offer but gaining full marks was rare. As well as candidates preparing adequately by learning a list of advantages and disadvantages of a technique like tissue culture, they do need to be trained to use their knowledge to best effect. Putting 'genetically identical' both as an advantage and a disadvantage did not score two marks, while the advantage 'the good traits will be passed on' and converse disadvantage 'the bad traits will be passed on' scored nothing. Pairing the advantage 'quick' with the disadvantage 'time consuming' or advantage 'cheap' with disadvantage 'expensive' is clearly a self-defeating strategy also. Selection of the clearest and most important independent advantages and disadvantages is essential. The first answer on each line will be marked where numbered prompt lines are given so candidates need to avoid repeating themselves or putting vague points that are unlikely to gain credit at the beginning of a line.

Teaching tip

A common error in **(c)(i)** was to use the word 'nutrients' instead of minerals. Due to the possible confusion between organic nutrients made in photosynthesis and the inorganic minerals supplied from the roots, this word is not acceptable and should not be taught or used unless qualified, eg 'mineral nutrients' or conversely, 'organic nutrients'. For the latter, named molecules such as glucose and sucrose are preferable, and the word 'food' for photosynthetic products should be avoided.

Key points in the process of cloning plants by tissue culture as it is practiced in a commercial setting are that *many* explants are cut, not one, and that these are *surface sterilised* in bleach or alcohol before being placed on the Murashige & Skoog nutrient agar or similar (aerated nutrient solution, for example) using aseptic technique. The callus that forms is subdivided into *pieces,* not single cells. These pieces are moved on progressively (again using aseptic technique) to new, separate growth media for the root and shoot forming stages, and to achieve this differentiation different ratios of the same two hormones, auxin and cytokinin, are required. Worksheets are available for students to be able to perform the first stage of tissue culture (callus formation) themselves using cauliflower florets. eg
http://www.ncbe.reading.ac.uk/ncbe/protocols/PRACBIOTECH/PDF/cauli.pdf
http://www.saps.org.uk/attachments/article/188/Kew%20Schools%20Cauliflower%20Tissue%20Culture%20Method.pdf.

Members of a clone are susceptible to the *same* diseases but cloned plants are *not* more susceptible to disease in general, indeed, many have been selected to be cloned precisely because they carry useful resistance alleles to certain diseases. An advantage of tissue culture that was rarely stated by candidates is that meristematic cells do not harbor viruses so tissue culture is a way of propagating new disease-free stock.

Candidates should be strictly warned against using the word 'immunity' which relates to a vertebrate individual's acquisition of defence against disease during its lifetime, when they really mean 'resistance', a genetically based defence against either a disease or a chemical agent such as an antiobiotic or pesticide, that can occur in organisms across all kingdoms / domains.

Q.4   Data from Scottish National Heritage's research into the serious decline of wader species in their internationally important breeding grounds in the Western Isles was presented as a table. Candidates calculated a percentage change, described and explained how the introduction of hedgehogs had impacted on one study area, and used their knowledge of population dynamics to suggest why the hedgehog population had increased. 'How Science Works' statement 6b (see specification appendix B) was the target in asking candidates to comment on the ethical issues raised by three proposed methods of reducing the impact of hedgehogs on wader numbers.

(a)   Many candidates were able to calculate a percentage change when asked in **(i)** but did not spontaneously apply the technique to help them make sense of the data better in **(ii)**. This is a mathematical skill that needs teaching or reinforcing during the biology course, as a significant number of candidates could not do it. See teaching tip below. Candidates could also be encouraged to spot for themselves cases where this type of analysis helps to clarify the pattern hidden in the data.

In **(ii)** candidates generally filled the space but the dual instruction to both describe and explain, and the consequently high mark tariff, seemed to pass some by. Most candidates described how the number of waders in all four species had decreased for two marks. The best answers also summarised the differences between this situation and that of the area without hedgehogs, and sensibly quoted a couple of % differences to illustrate the points made. There were four mark points related to explanation, which good candidates often accessed. For those candidates who attempted no explanation of the figures, or who digressed into explaining why the hedgehog population had risen, the advice must be to read the question more carefully.

In part **(iii)** candidates ideally integrated knowledge of intraspecific competition and predator-prey relationships. The commonly identified factors were little competition amongst hedgehogs for a large supply of prey (wader eggs) and a low number of predators of hedgehogs. Explanations needed to focus on how these impacted on each generation of hedgehogs at an individual level, i.e many hedgehogs survived, bred and were able to rear large numbers of offspring successfully. The question required some thought and analysis as to **why** population numbers rise, so vague comments about the ample food supply simply allowing 'growth' did not earn marks. Referring back to the list of question terms mentioned as a teaching tip for Q.1, candidates can be taught that 'explain' is a 'why' question while 'describe' is asking 'what' or 'how'.

(b)   The A level specification has for many years contained a section relating to moral and ethical issues, currently section 6.4. This is picked up in the 'How Science Works' objectives in appendix B, which are required to be targeted on this paper, and in the requirement that A/B candidates should be able to 'comment effectively on ethical issues' which is expressly stated under the AO3 performance description in appendix A. Thoughtful candidates did point out three areas that raise an ethical question, ie how right or wrong something is. Killing hedgehogs, letting wader biodiversity be reduced, and causing stress to captive animals were the commonest suggestions of actions that might be seen as wrong, but human action in upsetting an existing ecosystem and the idea that doing nothing to remedy a problem humans created also sometimes appeared. Phrases candidates should avoid in questions like this are the clichés 'playing God' and the naive idea that 'every organism has a right to life'. The work candidates do on population dynamics and natural selection should make them aware that in nature every animal does not have a 'right to life'.

Q.5   Most candidates tackled this straightforward question on translation and the genetic code very successfully, obtaining full or nearly full marks.

   (a)   Candidates used the circular format of the genetic code to name four amino acids, with most candidates scoring two marks. A tiny minority were unable to work out the diagram or made a slip in identifying the amino acids.

   (b)   Most correctly named 'translation' and located it at 'ribosomes'. A few incorrectly stated 'transcription' instead and some gave the location as 'cytoplasm' or 'nucleus'.

   (c)   This was the hardest part of Q.5 with a minority giving no response. Many candidates did gain both marks on offer by stating 'mRNA'. Candidates who wrote RNA without any qualification may not have noticed the mark allocation. Others incorrectly qualified their answer as 'tRNA', gaining one mark only. The answers 'DNA', 'peptide bond' and 'amino acid' showed a significant degree of misunderstanding at the biochemical level.

   (d)   Candidates commonly identified the stop codons UAA, UAG and UGA and some were also able to explain that there is no matching tRNA or amino acid for these codons.

   (e)   This mark was scored almost universally, for 'substitution' or 'point' or less commonly for the more sophisticated 'silent' or 'neutral'.

Q.6 Many candidates find making comparisons difficult. This question ranged widely over material from modules 2, 4 and 1 of the F215 learning outcomes. The least well-known area was how the mammalian nervous system is structurally and functionally organised into its central and peripheral parts.

(a) Most candidates were familiar with the terms somatic and germline gene therapy and scored two marks for naming the two types types of cells altered, or alternatively for identifying gametes or embryo cells in germline and for saying changes can be inherited by offspring in this case. A few commented on the illegality of germline changes in humans. The point of the process, to treat a genetic disorder, was not often discussed. Details of specific examples such as targeting lung epithelial cells to treat cystic fibrosis also appeared very rarely.

(b) The best answers here integrated information learnt from the F214 unit with the extension material in F215. Candidates were eager to move on to discuss further division of the peripheral system into somatic, autonomic and its two branches but didn't give the impression of being able to picture the physical layout of the mammalian nervous system as seen in humans, for example. Only a tiny number of candidates paired a description of the CNS being brain and spinal cord with a similar morphological statement about the PNS being composed of nerves and where they ran from or to. When candidates described types of neurone, few realised that the CNS is composed largely of relay neurones, while sensory and motor neurones form the PNS. Marks were not awarded for descriptions of signals, messages and information (rather than impulses or action potentials) travelling along neurones. Most candidates gained at least a mark or two but very few had enough clarity of knowledge to achieve four marks on this section. Some candidates confused spine or spinal column with spinal cord, and a model skeleton and some vertebrae to show the central chamber where the soft spinal cord tissue runs can be useful in teaching this area.

(c) Many candidates scored both marks for stating that homologous chromosomes pair up and that chiasmata or crossing-over events occur in prophase 1 only. Irrelevant additional detail about behaviour of centrioles and spindle fibres common to both muddled some answers. A few candidates confused the terms *chromosomes* and *chromatids*, or *sister chromatids* with *non-sister chromatids*.

Q.7 This question presented challenges relating to experimental methodology, data analysis and evaluating conclusions, all AO3 tasks that candidates find quite difficult. The experiment was deliberately presented as a student exercise with a limited data set to make it more comparable with the candidates' own experience of carrying out investigations and processing the results. The use of the Hardy-Weinberg equations to calculate allele frequencies was placed at the end of the paper to guard against candidates who did not fully understand it on this first time of testing from wasting time.

(a) For **(i)** most candidates thought that placing quadrats along a belt transect would allow them to count ladybirds. They did not realise that as insects have a much sparser abundance than plants and are able to move they would need a more active method of collection such as sweep netting or beating combined with use of a pooter. Pitfall trapping was accepted as a suggestion although this would be more likely to catch ladybird larvae than adults.

Part **(ii)** was well-answered with 'to make results more reliable' being the commonest correct answer. Many candidates also used the word 'representative' correctly or mentioned being able to identify anomalies.

(b) Table 7.1 should provide a useful teaching tool. Very few candidates in the exam assessed and made sense of the two columns of data before answering the questions asked. They should have been looking at the two columns in proportion to each other, as explained in the introduction to the question on page 19. Instead most candidates ignored the column for number of red ladybirds. Those who referred to it thought that because the numbers were larger, the student should have used this data, not the figures for black ladybirds, and that this data showed a clearer correlation with altitude. The idea that the two colour polymorphisms fluctuate inversely to each other within a breeding population was lost on most candidates, possibly due to their not reading the information given carefully enough.

Candidates who did clearly see the link between the two columns for **(i)** suggested re-calculating the figures as percentages of the total ladybird numbers at each altitude. The ideas of ratios also came up. The commonest answer though was to draw a line graph, although the comparison aspect would make a bar chart with altitude on the x axis and paired bars more useful. Candidates should also have encountered kite diagrams as a way of presenting ecological data taken along a transect. In either case, the idea that the visual presentation would make it easier to compare or see the pattern in the data gained a mark. Answers that suggested amending the method of collecting the data rather than *processing* the data did not score.

It was a pleasure to see the clear logical thinking shown by those candidates who scored three marks on **(ii)** but many candidates did not fully evaluate both sections of the student's statement. In teaching this skill, emphasis should be placed on assessing each claim independently. In this case sentence one was correct, but most candidates did not process the data into percentage form to see the clear correlation (7%, 14%, 18%, 21% black). Nevertheless, candidates still scored a mark if they described how the raw numbers alone showed an increase in the black form as altitude increases to 300m. Candidates who knew that correlation alone is not proof of causation confidently demolished the student's second sentence argument, and many candidates scored for suggesting that other factors could be causing the pattern seen. Poor answers did not differentiate between the two parts of the student's statement. A step by step approach to unpicking the truth of arguments should be encouraged.

(c)   Part **(i)** was very well done, with candidates clearly having learnt a careful definition in most cases. A few candidates fell foul of using the word gene instead of allele and lost the mark. The answer needed to refer to the expression or phenotype aspect, and a few candidates missed saying this.

A fair number of candidates accomplished task **(ii)** with ease but two types of mistakes were commonly made, which future candidates and their teachers can learn from. A guide to how to carry out this type of calculation is presented in the teaching tip below. The first common mistake was to assume the black ladybirds were homozygous recessive, perhaps because they appeared in smaller numbers or because candidates realised they are the mutant form, although the question stated that black was the dominant allele. The candidates therefore started with 50 / 346 instead of 296 / 346. A second mistake was to work out q^2 but then to subtract that from 1 without going through the stage of finding the true value of q, which was the square root of q^2. Candidates received credit for performing stages correctly in the context of an error carried forward however, so most candidates received one or two marks, if not the full three.

Teaching tip

The Hardy-Weinberg Principle. In order to achieve the learning outcome, to be able to calculate allele frequencies in a population, the following is the best order of work.

1. Identify the recessive phenotype (here it was red, corresponding to genotype bb).

2. Identify the number of recessive trait individuals and the total number of individuals in the population (here there were 296 red individuals in a total population of 346). It is essential to start with the recessive trait individuals because these are the only individuals whose genotype is known, bb. The black ladybirds are a mixture of BB and Bb genotypes.

3. Divide the number of recessive trait individuals by the total population number (296 / 346) to find q^2, corresponding to the number of bb genotypes in the population.

4. Find the square root of this number to obtain q, the frequency of the recessive allele.

5. Subtract q from 1 to find p, the frequency of the dominant allele.

F216 Practical Skills in Biology 2

General Comments

The general standard of candidate performance improved this year although Centre marking still remains a cause of concern in some cases. Centre administration has been less conscientiously conducted by a greater proportion of Centres than previously. Clerical errors were alarmingly common and were more frequent in Centres who did not use the optional candidate coversheets or spreadsheet. As a counterpoint to this, scripts which contained good quality annotations were seen from a considerable proportion of Centres, and it is notable that these were often where Moderators were in close agreement with the Centre's marking. Centres are reminded that marks for skilful practice and safe working must be recorded at the appropriate places within scripts.

The qualitative and quantitative task papers contain a high proportion of marks that are very much of the 'can-do' type and good marks can be achieved even by lower ability candidates. The evaluative tasks are designed to be more discriminating and expectations here are that only the very best candidates are likely to obtain full marks. Responses to some questions often lacked biological detail and markers were less rigorous in their application of the mark schemes. Marks may not be credited for answers that contain good quality biology which do not actually answer the questions.

Administration

Part of the preparation for conducting the tasks includes collecting trial data. This data, included with the sample for moderation, greatly improves the moderator's understanding of any specific Centre-based contexts which affect the candidates' responses. This is particularly important where a candidate does not obtain the expected results and the mark scheme allows for credit to be given based on the candidates' results. In this case, it is not always possible to support the Centre's decisions without trial data. Further, sometimes the marker misses points which could have been given, but the moderator is unable to proceed without trial data. Any task which involves candidate determination of colour can be challenging to mark and to moderate. Candidates' confusion over what to call some colours (especially where no trial data is included) can lead to difficulty in justifying alternative colours to mark scheme. Centres are reminded that there is a free service which permits Centres to seek clarification by email or consultancy. In addition to improving the task delivery and marking performance, this provides a paper trail, copies of which, if relevant, should be included with the sample sent for moderation.

Preparation of the sample sent to the moderator has been well completed by the majority of Centres. However, there are some examples of poor practice which lead to unnecessary confusion. These include failure to add candidate numbers to all papers, not stapling all sheets together or adding extra sheets without securing them. Treasury tags should be used to loosely secure, by candidate, all the scripts for the tasks completed. The looseness of the tag permits the moderator to access any task without separating the scripts. The use of poly-pockets is undesirable because the moderator has to remove the scripts which is time consuming and can result in confusion of the scripts.

Sometimes, as an outcome of the moderation process, the rank order of candidates in the sample submitted could be changed. In this situation, the Centre is sent an Invalid Order of Merit document via email, the purpose of which is to assist the Centre in reviewing its marking process. Where the differences between the moderator's mark and the Centre's marks are such they may adversely affect some candidates more than others, it is desirable that those candidates work is remarked by the Centre. This is an important procedure which is designed to

benefit candidates by reducing or removing the impact of, for example, the misinterpretation of the mark scheme. Quite often the problem is caused by different standards being applied across groups of candidates, often by different teachers or between different tasks. Centres are advised to pay particular attention to these areas during internal moderation.

Marking advice and support

Candidates' understanding of how to draw a graph of appropriate quality has improved this year. There have been very few instances of loss of marks for this, the exception being inappropriate scaling on the x axis.

This year there have, unfortunately, again been a number of problems with the acceptance of non-standard units, or simply failure to apply the mark scheme in this context. Where equipment used by candidates has units printed on it, the Centre is advised to annotate scripts if these differ from the units required in the mark scheme. Where there is uncertainty, Centres are reminded that an email query can resolve the matter comparatively quickly.

Occasionally there are minor changes to mark scheme. Where this occurs they are posted on Interchange. It is evident that many Centres download all the Tasks at the start of the year and do not make any further visits to Interchange. Centres are reminded that there is an email service which flags up these changes. To subscribe to the e-mail updates service please send an e-mail to GCEsciencetasks@ocr.org.uk including your Centre number, Centre name and a contact name, and include GCE Biology in the subject line.

The great majority of Centre's will have found that their marking has been endorsed and that any differences have been listed in the moderator's report. It cannot be stressed enough that effective communication can either prevent or reduce the differences between the Centre's marking and the moderator's assessment. Good quality annotation explaining the markers decisions are a very important part of this process, particularly with the evaluative tasks where judgements often more complex.

Centres can seek advice on the implementation and marking of Tasks in future sessions by e-mailing GCEsciencetasks@ocr.org.uk. Please include your name and Centre number, state clearly which Task your query relates to, and describe which points of the Task, Technician's Instructions or Mark Scheme you would like to receive clarification for.

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

(General Qualifications)
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance
programme your call may be recorded or monitored