OCR
RECOGNISING ACHIEVEMENT

GCE

Biology

Advanced GCE **A2 H421**

Advanced Subsidiary GCE **AS H021**

Reports on the Units

June 2010

HX21/R/10

Oxford Cambridge and RSA Examinations

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It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support which keep pace with the changing needs of today's society.

This report on the Examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the Examination.

OCR will not enter into any discussion or correspondence in connection with this report.

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REPORTS ON UNITS

Chief Examiner's report

This June marks the first occasion on which all three AS and A2 units were offered and when candidates were able to aggregate the 'new' Biology A Level qualification (H421). A promising proportion of AS candidates continued to A2. The Principal Examiners have noted that some outstanding scripts have been seen this series.

Understanding and Answering the Questions

All question papers in this specification differ from those in previous ones as the new specification papers are required to demonstrate formal incorporation of 'How Science Works' (details of which can be found in Appendix B of the specification). This should be taken into consideration when covering the Learning Outcomes and when preparing candidates for the examinations. Candidates can expect to find questions in an examination that reference these statements, in addition to an increase in context-based material as well as social / ethical / moral aspects.

The weightings for the assessment objectives are also somewhat different from those in the previous specification. The relative weightings for each assessment objective are outlined in the table below.

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

As can be seen, the proportion of marks for AO1 (Knowledge & Understanding) decreases within AS, from F211 to F212, and from AS to A2. The implication of this is that the number of marks for pure recall of information is reduced and that some knowledge will instead be examined in a structured way with the use of photographs, diagrams and flow charts as well as being applied to unfamiliar contexts. Synoptic material will be tested in all papers (including F216) at A2 and so should be stressed and incorporated into the coverage of the learning outcomes at both AS and A2 (although only formally tested at A2). Candidates should therefore be prepared so that they can take full advantage of accumulating marks from the more straightforward and obvious questions. In order to capitalise on this, there are many key terms and definitions on the specification that can be 'rote learned'. They make good 'starters' for lessons and good 'quick tests' and 'word banks'. Candidates should also be prepared to perform a variety of calculations, which can also be a source of marks. It is also important that candidates are fully familiar with command words, a glossary of which can be found in the Practical Skills Handbook. The command word and context of the question will often indicate to the candidates whether they are expected to simply recall the information of to use their

knowledge to provide information relating to an unfamiliar context. They should not assume that they need to be familiar with all organisms and/or contexts with which they will be presented on a question paper. It is sometimes difficult for candidates to recognise the areas of the specification upon which they should draw when answering these questions and so candidates would benefit from as much experience as possible in dealing with material in this way.

Although care is taken to supply the candidates with adequate answer lines for each question, some candidates habitually use more space than that provided and continue answers on other parts of the page or paper or on additional answer sheets. This is not a problem, as Examiners will mark all answers. However candidates run the risk of wasting time and effort on a question that does not warrant it, given the mark allocation. Candidates should use the wording of the question and the mark allocation as the guide to the amount of information that is expected and tailor their answer accordingly, getting to the point as soon as possible. As these papers are marked electronically, involving examiners looking at a scanned image of each individual answer, if additional information needs to be considered then it is important that its location is clearly indicated as close to the lines provided for the question as possible.

Candidates should watch out for questions that require them to complete a diagram or to put a letter on a graph or some similar activity. As there is no dotted answer line, these questions can get overlooked, as was seen on this occasion in F211. Candidates should check the page for mark indicators to ensure that they do not omit questions that do not have dotted answer lines to prompt them.

A common feature of the Principal Examiners' Reports is that candidates have a tendency to write in vague or imprecise terms, often not using the appropriate technical terms (or using them incorrectly). This resulted in some answers that were not focussed and were not of the standard required for AS or A2. It is also important that candidates realise that they are unlikely to gain credit for simply lifting and reproducing information that had been given in the stem of the question. While this information can be a useful prompt, candidates are expected to perform some higher level processing and to incorporate the information with their own knowledge to provide an explanation or to address the question. While this is evident in all papers, this has been noted particularly in F215 this session.

Previous reports have commented that some candidates are poorly equipped to deal with some Learning Outcomes, particularly those that did not appear in the legacy specification. This is noted again, with particular reference to budding of yeast in F211, food preservation techniques in F212 and urine testing in F214. The mark schemes from questions that address these new Learning Outcomes should be used to inform teaching of the expected level of detail of these new areas of the specification.

Dealing with Data

Candidates will be expected to describe and discuss trends in data in both theory and practical papers. They should gain experience in developing techniques for describing trends in data and the relationship between parameters. Data quotes should be made accurately and units correctly quoted. If candidates are required to produce their own graph, they should choose a sensible scale and ensure that the plotted data covers at least 50% of the available space. Candidates should also appreciate the need for consistency in decimal points when expressing values in tables, whether these are recorded values or calculated data.

Practical Assessment

F213 and F216 are an integral part of the assessment. Facilities should be made available at the Centre and suitable arrangements should be in place for conducting the Tasks, although how many Tasks should be made available to the candidates would be at the discretion of the Centre.

It was evident that some Centres were not aware that candidates could submit tasks from different Task suites. All three Task types do not necessarily have to come from the same Task number; so, for example, a candidate could submit Qualitative Task 3, Quantitative Task 1 and Evaluative Task 2 if these were the highest scoring of each type.

F213 and F216 are free standing units and, as such, candidates can 're-sit' these units. However, the rules on re-submitting work are clear and Centres are strongly advised to familiarise themselves thoroughly with the procedure. In summary, candidates must submit at least one new Task type (either Qualitative, Quantitative or Evaluative), which must be selected from those available in the current year. The remaining two Tasks could either be new ones from the current year, carried over from the previous year (although remarked according to the original mark scheme and in the light of any comments from the Moderator) or one new one and one carried over. It should be stressed that **under no circumstances** should the Task sheet be returned to a candidate for 're-writing' and **under no circumstances** should a candidate 're-do' a Task they have already done – whether it was submitted as part of their final mark in a previous session or not.

A number of common issues relating to F213 and F216 have become evident during this examination session. One serious issue concerns the mark schemes. Centres are reminded that the mark schemes are strictly confidential. While it is expected that candidates should be well prepared for the Tasks, they **must not** have access (either directly or indirectly) to the mark schemes. Candidates are expected to have been prepared so that they can deal with the various Task paper formats and be proficient in the skills required to carry out the practical procedures. Candidates **must not**, however, carry out a 'practice' or 'mock' Task that is very similar in procedure and questions to the OCR Task being used for assessment. In the respect of 'knowing the mark scheme', it became evident from the responses of some candidates that they had been given an unfair advantage over the rest of the cohort and these instances have been dealt with accordingly under the procedures in place for cases of malpractice. Centres are alerted to the fact that Moderators look for key indicators of malpractice and that these will continue to be pursued when identified.

It was also apparent that, in a small number of Centres, candidates were allowed to work in groups and to use pooled data when using Tasks for assessment. It is stressed that this **is not permitted**, as each candidate **must** work individually to collect a set of data, whether Qualitative or Quantitative. It is also **not permitted** for candidates to be given sample data if their procedural technique does not yield the expected results. Reference to the mark scheme will often contain phrases such as 'credit statements relating to the candidate's own data' and correct mathematical processing of the data will normally be credited even if the raw data was not as expected. They would still be able to access some of the marks for the Task but would not access marks that related to successful procedure.

Many Centres are to be congratulated on their marking, internal moderation and administration. Some Centres, however, will have found that their work was returned due to errors in addition, transcription of marks or because the Moderator was unable to support the Centre's marks. The first two are easily avoidable, particularly if ticks are given when a mark has been awarded rather than when a bullet point that contributes to a single mark has been met. If the '1 tick = 1 mark' principle is adopted, it improves accuracy and internal moderation. Correct elements contributing to the mark can be indicated by a dot, a plus sign, a number or a letter. It is very important to maintain consistency in the application of the mark scheme across all candidates.

When applying professional judgement to crediting information that does not appear on the mark scheme, it is very important to ensure that this information is actually answering the question that has been set and is not just correct biological information that has some more tenuous link to the question. This will mean that some Centres will find that marks have been adjusted, not because the biology was incorrect but because of the context. The Additional Guidance column should always be consulted for clarification of the application of the mark points. If further help is required, Centres are encouraged to make use of the free 'Task query' or 'coursework consultancy' services offered by OCR, further details of which are given in the Practical Skills Handbook.

A comment that was received from a number of Centres was that work that had been returned to the Centre for review had not been annotated by the Moderator. It is important that Centres realise that Moderators are instructed that they are **not permitted** to put any mark or annotation on the candidates' work, so annotations will not appear on the candidates' work. The information accompanying the returned work will guide the Centre to the areas where the problems lie and this information should be used in conjunction with the mark scheme (including the Additional Guidance) to review the marking of the candidates' work.

Centres are also encouraged to check the material on Interchange periodically, and particularly before using a particular assessment task, in case any amendments or additional guidance has been included. By signing up to the email alerts, Centres can be informed of such notifications.

For moderation purposes, members of staff with responsibility for the subject are urged to ensure that the correct email address is currently registered with OCR and that this email address is checked regularly from mid May onwards, so that requests from OCR or the Moderator can be dealt with as soon as possible. This will reduce the possibility of any delay in the publication of the Centre's results in August.

INSET

From some comments received, it appears that some Centres are unaware that OCR runs courses relating to different aspects of the specification. OCR has a programme of training events for the autumn and spring terms. 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. It is therefore likely that this could be arranged for a date that is more suitable to you than the main training events. Further details can be obtained from the OCR website www.ocr.org.uk or by contacting the training department.

Note regarding Stretch & Challenge (A*) for June 2010

June 2010 sees the first award of the A* grade for new GCEs (see page 55 of the specification). To achieve an A* grade in their Advanced GCE, candidates must achieve 480 *uniform* marks (UMS) in their Advanced GCE, *ie* grade A, and also gain at least 270 *uniform* marks in their three A2 units. Two candidates with 480 UMS could have different grades depending on their AS and A2 performance, for example:

Candidate 1 – 211 UMS at AS, 269 UMS at A2, 480 UMS overall, grade A

Candidate 2 – 210 UMS at AS, 270 UMS at A2, 480 UMS overall, grade A*

A good explanation is given in the open letter to centres from OfQual, see www.ofqual.gov.uk/files/2010-02-11-open-letter-a-star-grade.pdf

Upcoming INSET events in 2010/2011

OCR AS/A Level Biology (H021/H421): Get started - guidance for first delivery (OSCL6)

This is a *register your interest* course.

This **full day** course will:

- Answer questions from teachers linked to the teaching of the standards
- Review the support and resources we offer
- Explain the administration procedures
- Enable delegates to network and share ideas for best practice.

Note: This course is an updated version of the sessions that ran in previous years.

Course dates – We would like to run this course if there is sufficient interest from customers. Please visit EventBooker or e-mail training@ocr.org.uk to register your interest. We will contact you with details as soon as we confirm a date and location.
Note: this course is an updated version of the sessions that ran in previous years.

OCR AS/A Level Biology (H021/H421): Get ahead - raising standards through exam feedback (OSCL7)

This **full day** course will:

- Consider post-summer results documentation, such as question papers, reports and mark schemes
- Consider the step up from AS to A2
- Discuss approaches for preparing candidates for the external examination
- Demonstrate standards for the internal assessment of coursework and externally assessed components
- Allow delegates to share good practice and ideas on new approaches.

Course dates – Thursday 14 October 2010 (London), Friday 3 November 2010 (Birmingham). We would also like to run this course in Belfast and South Wales (along with a second event in London and Birmingham) if there is sufficient interest from customers. Please visit EventBooker or e-mail training@ocr.org.uk to register your interest. We will contact you with details as soon as we confirm a date and location.

Fee – £182 including refreshments, lunch and course materials. £215 if you book within 7 days of the course date.

To book a course
Online: you can view and book your training event online (or to register your interest for events at other locations: York, Belfast or London) by visiting our new EventBooker service at **www.ocr.org.uk/eventbooker**

By e-mail: use the booking form on **www.ocr.org.uk** and e-mail it to: **training@ocr.org.uk**
By fax: please complete and return the booking form to: 024 7649 6399
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Please note: training programmes are correct at time of going to print. Please visit EventBooker at **www.ocr.org.uk/eventbooker** to search for the most up-to-date event details.

F211: Cells, Exchange and Transport

General Comments

Examiners agreed that this paper was of appropriate difficulty and certainly equivalent to previous years. It provided ample opportunity for candidates of all ability levels to demonstrate their knowledge and understanding and the range of marks achieved fit a normal distribution. There was no evidence that candidates ran short of time and no evidence that any particular areas of the specification caused more problems than others. The paper contained two questions in which the candidate was expected to annotate a graph and a diagram. These questions did not have a dotted answer line and were consequently missed by some candidates who were simply looking for answer lines rather than reading the question fully. A recurrent theme is the need to use correct scientific terminology appropriately. The use of appropriate terms can convert a vague response into a much more focused answer that will gain more credit. The low demand sections such as question 1(c) allowed all candidates to demonstrate their knowledge and understanding. The higher demand sections such as much of question 3 and question 5(b) discriminated well providing an opportunity for the more able and well organised candidates to demonstrate their skills.

Comments on Individual Questions

Q.1 As an easy starter question examiners expected high marks to be achieved by the majority of candidates. Largely, this proved to be the case, only let down in some cases by insufficient detail in the responses.

(a) (i) Many candidates gained a mark for naming A as the plasma membrane or cell surface membrane. However, some candidates were confused and called structure A the cell wall or called it simple the ‘cell membrane’. Candidates should be reminded of the need to be specific and use technical terms as much as possible in their responses. Structure B was usually identified correctly as DNA or genetic material. Common mistakes were to name it as a plasmid or nucleus.

(ii) This was well answered with many candidates mentioning ATP production and some even making reference to aerobic respiration. Failure to score a mark was usually due to describing the function as ‘creating or producing energy’. In some cases, the response ‘respiration’ was unqualified or written as ‘to make ATP for respiration’.

(iii) This question was well answered with the majority of candidates able to identify both processes correctly.

(b) It was pleasing to see that the majority of candidates have taken on board the advice about using the term ‘surface area to volume ratio’. The majority of candidates used the term correctly and recognised that a large surface area to volume ratio was significant. However, a smaller proportion of candidates gained the second mark as many were unable to link in the idea that diffusion alone would be adequate to meet the needs of the organism.

(c) The ability of elastic tissue to recoil, return to original size or prevent alveoli bursting was often correctly described. Some candidates still described the elastic tissue as 'contracting' or linked the response to the walls of blood vessels or muscle contraction.

The function of the ciliated epithelium was well known but some candidates failed to mention mucus, only describing movement of dust, particles etc. The idea that goblet cells secrete mucus was generally known and it was pleasing to see far fewer examples of the idea that goblet cells gobble up and devour dirt and pathogens which was so prevalent the last time this question was set.
Many candidates were less familiar with the role of the smooth muscle however, good answers described the constriction of the airway to control airflow. The most frequent errors were to describe it causing a widening of the airways or causing breathing movements. Candidates must be taught that the smooth muscle in the walls of the airways has nothing to do with the movement (particularly expulsion) of air in the lungs.

Teaching Tip:

Using the old model consisting of a bell jar containing two balloons attached to tubing to the exterior is still a valid way to teach how air is brought into and out of the lungs.

Q.2 This question started with some simple low demand questions which were answered well by many candidates. It went on to the much more demanding section on the Bohr shift in which many less able candidates struggled to gain credit.

(a) All candidates attempted this question and many gave a good clear description of how staining helped to make the slide contents more visible. However, responses were often insufficiently detailed to gain the second mark available. A good proportion of candidates described differential staining with parts of the tissue taking up more stain than other parts, but then failed to link this to an advantage such as increased contrast. Responses were often vague and many suggested that the 'cell contents' or simply 'cells' were now visible. Examiners were looking for more specific detail on what was now made visible such as the clearly stained nucleus of the white blood cells seen on the insert. Many candidates failed to apply their response to the specific slide and suggested that the red blood cells had been made visible.

(b) Many candidates knew that the transmission electron microscope enabled the details of organelles inside the cells to be seen but very few were able to name a suitable example. Most candidates simply specified 'organelles' or 'nucleus'. The nucleus would, of course, already be visible under a light microscope. Surprisingly, some candidates thought that the structure of the haemoglobin would be made visible. Few candidates seemed to know that a scanning electron microscope gives a view of the surface of objects such as the cells. A number of candidates confused the two types of microscope or misread the question and so did not gain any credit.

(c) The action of haemoglobin is generally acknowledged to be one of the tougher parts of the specification as it tests understanding at a high level. Examiners were pleased to see how well this question was answered. The majority of candidates used appropriate terminology and scored the QWC mark. However, some candidates did not score more than this. Many candidates knew that fetal haemoglobin has a higher affinity for oxygen but a considerable proportion did not gain the mark as they specified fetal oxyhaemoglobin having a higher affinity than

adult oxyhaemoglobin. Correct use of the terms is important to demonstrate good understanding. The more able candidates were able to discuss the fact that the fetal haemoglobin takes up oxygen at lower partial pressures of oxygen but few linked this to the conditions in the placenta.

(d) (i) In this question, candidates were asked to draw a curve on the graph already provided. Most candidates scored at least one mark for expressing the shape of the curve correctly. A good proportion of candidates, however, placed the curve to the left of the adult haemoglobin curve. The Bohr shift is, of course, to the right. Some candidates, including those who answered the rest of the question well, gave no response to this question – candidates must be encouraged to read the paper carefully rather than scan down until they find an answer line to write on.

(ii) Explaining the benefits of the Bohr shift proved quite difficult for many candidates. Many expressed their ideas using vague and confused terminology – often describing delivery of oxygen to the tissues which is the role of the circulatory system and nothing to do with the Bohr shift. The important aspect of the Bohr shift is that more carbon dioxide is released from actively respiring tissues and this causes the dissociation of more oxygen. Of those that did have the correct information, many did not gain credit as they had not included the word 'more' to explain the specific situation.

Teaching Tip:

As few Centres can afford an electron microscope, a visit to a local university or commercial scientific research centre can pay huge dividends in this section of the specification. Most universities and research Centres are more than happy to take groups and provide a brief talk about their equipment and how it is used.

Q.3 This question proved to be very discriminating. Candidates were provided with the results of an investigation carried out by a student. Candidates were expected to answer the question in the light of their AS studies of membrane structure and the mechanisms by which substances pass across membranes. The mark scheme took into account responses made by candidates (generally A2 candidates) who had more detailed knowledge of the role of methylene blue as a hydrogen acceptor so that suitable and relevant statements were credited.

(a) (i) Examiners were looking for evidence that transport was active. This included the fact that all the stain was taken out of the solution against its concentration gradient at lower temperatures but that at higher temperatures the stain returned to the solution. The best responses did suggest that as all the stain was taken up at the lower temperatures, this must have been against a concentration gradient. Many candidates made accurate references to carrier proteins or enzymes being denatured – however, many of those that stated enzymes were denatured failed to link this to active transport by stating that there would be less ATP available. Many answers included 'quotes' from the table that could not be interpreted as evidence for active transport unless further qualified. One fairly common misconception was that an increase in kinetic energy (with increase in temperature) led to an increase in active transport. Some candidates appeared to be confused, referring to the solution as 'surrounding cells', explaining loss of stain rather than the uptake of the stain or referring to diffusion instead of active transport.

(ii) A 'suggest' question is an invitation to the candidate to show how well they understand the topic. A good proportion of candidates stated that these cells may

be dead or have insufficient energy to perform active transport. Some candidates even suggested that these cells may not have the correct carrier proteins in their cell surface membranes. These are excellent responses and demonstrate that the candidates have a good understanding of the topic. However, there were many misconceptions such as 'there was not enough stain for all the cells' or that 'some cells would be denatured'. There were also several references to water potential.

(b) (i) This question was generally well answered and many responses mentioned that the membrane broke up, was destroyed or that the carrier proteins were denatured. Common errors included stating the membrane or the cells were denatured. Very few candidates suggested that the lipid bilayer may have melted or become more fluid.

(ii) Many candidates correctly indicated that the stain went out of the cell into the solution, however, the term 'diffusion' was rarely mentioned. Often, students rewrote what they had written in (b)(i) and described how the membrane had been damaged, however, they did not go on to point out that the membrane would therefore be more permeable.

(c) Making the experiment more accurate was most frequently answered by suggesting that the student could use 5 degree intervals rather than 10 degree intervals. The responses were not well worded and candidates sometimes lost a mark because they were imprecise with their description. Phrases such as 'extend the range of temperatures used' do not indicate that intermediate temperatures should be used. Also, many candidates did not indicate that narrower temperature intervals were needed in the range 50 – 70 degrees. Some candidates suggested using a colorimeter but did not always make it clear that it would be used to measure the intensity of colour left in the solution. Inexplicably, several candidates thought an electron microscope would improve accuracy.
The majority of candidates realised that reliability could be improved by repeating the experiment. However, a good number of candidates did confuse accuracy and reliability while others suggested controlling variables such as the number of yeast cells and volume of stain

(d) Most candidates had a basic understanding of budding but were often unable to access the marks as their answers were too vague and/or lacked scientific terminology. Many candidates gained marks by writing about mitosis or asexual reproduction, but failed to describe the bud formation and separation adequately. Simply stating 'a bud forms on the side of a cell' is never likely to generate a mark at AS level. A significant minority thought yeast cells came together in clusters during the budding process or gave an account sounding more like binary fission.

Teaching Tips:

Most of these questions required candidates to apply their knowledge and many would have done better if they had read the question more carefully, frequently looking back at the introductory paragraph and the data as they worked their way through the question. Candidates should check they are not just rewording the information without adding further detail or explanation. This is something that needs practice.

The correct meaning of 'denatured' needs clarifying. Many answers referred to denatured cells and membranes, candidates should be aware that the term refers to the structure of a molecule.

The detail of budding in yeast needs more emphasis.

Q.4 This was a very straightforward question in which many candidates gained some useful marks. However, examiners were disappointed that the majority of responses displayed a lack of detailed knowledge. In particular, part (a)(ii) was poorly answered as many candidates had obviously not studied the specialisations of guard cells in any depth.

(a) (i) The majority of candidates recognised the cell types and knew that plant cells possess permanent vacuoles, chloroplasts and cell walls. Only a few candidates did not achieve full credit.

(ii) Candidates have not been given the opportunity to study the specialisations of guard cells to their function in any depth. There were frequent vague references to "shape" and "thick walls", but very few candidates noted the uneven thickening of the wall. It is this uneven thickening that is essential to cause distortion of the guard cell shape, so allowing the opening of the stomatal pore. A few candidates picked up on the presence of mitochondria, but only a small number of these made the link with the production of the ATP needed for active transport. Other candidates correctly identified the importance of the large vacuole and, in some cases, linked it with the ability to increase turgidity so that the stomatal pore would open. It was a concern that some candidates did not appreciate that increasing turgidity causes opening of stomata; too often they referred to opening and closing of stomata being caused by increased turgidity.

(b) (i) This part of the question was fairly well done and a good proportion of candidates were able to circle a correct pair of chromosomes. However, a significant number circled non-sister chromatids or just one chromosome.

(ii) Most candidates achieved just one of the two marks available marks. Many correctly knew that there should be 3 different lengths of chromosome but drew them as chromosomes consisting of two chromatids rather than as a single structure.

Teaching Tip:

Using pipe-cleaner models of chromosomes or even creating an annotated poster of mitosis helps to demonstrate that chromosomes replicate to form pairs of chromatids which then separate to form single structures. The same applies to meiosis which is studied in detail at A2.

Q.5 This question is based mostly on factual recall and as a result was one of the best answered questions on the paper. Candidates have been well taught in the factual information, it is in the application of that information that many tend to falter.

(a) (i) The majority of candidates were able to provide the correct response to this easy starter. However, less able candidates gave a range of answers including: diffusion, active transport, transpiration, root pressure, absorption and translocation.

(ii) Again, the majority of candidates were able to identify the correct pathways. However, some candidates got the pathways mixed up and, for quite a few, the spelling of the terms was rather challenging. Common incorrect responses included: cellular pathway, cytoplasm pathway, plasma pathway, cell wall pathway and cell membrane pathway. These responses did at least demonstrate that the candidates were thinking and describing the pathway when they could not recall the correct name.

(iii) Less than half of candidates were able to identify the endodermis as cell S. T and R were the most common incorrect answers. Examiners found this question to have a low success rate which was surprising in view of the importance of the endodermis which is easily identified by the Casparian strip.

(b) This question discriminated well between those candidates who read the question carefully and those who did not. Quite a number of candidates scored upwards of 3 marks in this question. However, a lot of candidates discussed at length the movement of water from the soil into the root and its passage across the root cortex into the xylem. Some candidates went on to describe the movement of water up the xylem but many stopped their description once the water was in the xylem. Candidates must be made aware of the need to use technical terms correctly. In many scripts, candidates used phrases such as 'water moves up the xylem by cohesion, adhesion…etc',. This just isn't sufficient detail to gain marks. The term 'transpiration' is often wrongly used for water moving up the stem. Candidates must be aware that transpiration is the loss of water vapour from the leaves and causes movement that is called the transpiration stream. Candidates are also confused by the use of 'water potentials' and 'hydrostatic pressure'. Water moves up the xylem by mass flow. This is caused by a difference in the hydrostatic pressures at either end of the xylem rather than a difference in water potentials.

(c) A number of candidates were unsure how to complete the table and used yes/no responses or ticks and crosses. The question gave no guidance other than the first row in which words had been entered. Candidates should be ready for a range of question types and should not expect all questions and responses to be the same as in previous years. If ticks and crosses are expected, then the question rubric will state this. Most candidates did achieve some good marks here but many failed to realise that both water and minerals are moved up the xylem, not just water on its own. For the direction of travel box, a lot of candidates suggested that the phloem transported substances down only, and some made vague statements like 'any direction/all directions'.

Q.6 This question was generally well answered with the majority of candidates attempting all parts. A few candidates seem uneasy at the idea of any question that involves numbers and so there were a few papers with blanks left for part (a).

(a) Many candidates successfully measured the correct length of the trace to determine the length of one heart beat in seconds and used this value correctly to find the heart rate. A reasonably wide tolerance was allowed to accommodate differing interpretation of the scale or starting point of each heartbeat. If a candidate did measure the length of one heartbeat inaccurately, they were still allowed one mark if they used this measurement correctly to calculate the heart rate. However, a number of candidates simply wrote down their answer without the working and took the chance that their answer was correct. Some candidates mistakenly multiplied the length of the heartbeat by 60 (seconds) to calculate a heart rate of well below 60 beats per minute. A few candidates showed an alarming lack of understanding as to what a normal heart rate might be giving answers such as '2' or '300' beats per minute.

(b) Many candidates made a good attempt at describing the differences between the two traces. Most candidates realised that in the trace of a heart treated with digitalis each single heartbeat was longer and that this reduced the heart rate. More able candidates recognised that R represented ventricular systole and T represented (ventricular) diastole and were able to make suitable comments about individual phases on the traces. Some candidates confused the regions in the traces associated with systole and diastole and consequently lost credit. Additionally, a few

candidates commented on larger potential differences in one trace and related this to the force of each contraction. This was not evident from the traces supplied and was not awarded credit.

(c) Overall this question discriminated well between candidates who knew only that the SAN was the pacemaker of the heart, compared to better prepared candidates who could correctly describe the sequence of events associated with both nodes. Many candidates correctly used terms such as 'impulse' and 'wave of excitation' to describe the features controlled by the SAN and AVN. However, candidates must be reminded that the correct terminology is required to earn credit. Some candidates described the excitation as 'shocks' being sent down the muscle and terms such as 'messages', 'signals', 'pulses', 'electric charge' and 'current' are not considered to be of sufficient scientific merit at AS-level. Many candidates also lost credit due to poor expression of their knowledge. Examiners wanted to see that the excitation wave was initiated in the SAN, not simply transmitted through it, and that the excitation passed over the walls of the atria not through the walls or through the lumen. Some candidates believed that the time taken for the wave to cross the atria is solely responsible for the 'delay' and others made references to the SAN and AVN controlling the opening and closing of valves. This is not a direct effect of these nodes but a result of the contractions they induce. It was pleasing to see that few candidates confused the SAN with the AVN but some candidates did describe confused sequences such as the SAN sending the impulse down the Purkyne fibres and then to the AVN.

Teaching Tip:

For calculations, candidates need to be encouraged to consider / estimate the sort of value that they might expect before they carry out the calculation so that they can be confident that their answer is a realistic value.

F212: Molecules, Biodiversity, Food and Health

General Comments

This was, for most candidates, a straightforward paper that allowed strong candidates to gain a high proportion of the marks available. It was gratifying to see that many candidates demonstrated good knowledge and understanding as well as being able to use technical terms correctly. Examples of areas in which candidates performed particularly well included biomolecules and the handling of data. On the other hand, it was disappointing to see some candidates who clearly understood certain concepts lose marks unnecessarily because of a lack of precision or failure to use the correct term, for example:

- *bacteria*, as opposed to molecules, having more energy,
- increased energy, rather than increased *kinetic* energy,
- 'bonds break' rather than naming the specific bond,
- 'bacterium *destroyed'* as opposed to digested or broken down.

Previous reports have noted the difficulty experienced by some candidates in distinguishing between 'describe' and 'explain' in question rubric. On this occasion that seemed to be less of a problem, with very few explaining when they should have described on Q1(c)(ii).

The environment topic tends to bring out a particular vagueness in candidates' answers and Q6(a) was notable in this regard. Many candidates lost time and marks by writing rambling answers that were unfocussed and barely scientific. Careless spelling throughout the paper also lost candidates some straightforward marks. Common non-creditworthy mis-spellings included, but were not limited to, 'artherosclerosis', 'conary', 'thyamine' and 'lyosome'. It is worth noting that *phonetically* correct spellings are usually accepted, but the correct number of syllables should be maintained, eg 'choronary' was accepted but not 'conary'.

There was no evidence that students had difficulty in completing all the questions in the time available.

Comments on Individual Questions

Q.1 The candidates in this session had clearly learned some biochemistry, which was encouraging.

(a) (i) While most candidates achieved some marks, few gained all three. Many candidates stated 'non reducing sugar' or just 'sugar' in the first box.

(ii) This was well answered; the vast majority achieved the mark. The most common mistake was to suggest problems with the experimental technique.

(iii) This part was generally well answered, with around 80% of candidates achieving two or more marks. The least common mark was for ester bonds. Candidates were able to score relatively easy, and quick, marks from a well labelled diagram, usually a rectangle with three arms. This diagrammatic representation is clearly a useful tool to aid learning of the basic structure.

(b) Most candidates scored well on this part. Marks were sometimes lost for separating very similar functions, e.g. energy source and energy store, or membrane structure and membrane stability. Candidates should really be able to state three distinct functions of lipids with relative ease.

(c) (i) This question was also answered well. An occasional error was to refer to animal fats having more LDL's. Some candidates stated that animal fats were solid but did not clarify this by including a reference to temperature.

(ii) Some candidates still find it difficult to describe graphs concisely, often concentrating on fluctuations in a line rather than on the general trend. Most candidates did achieve two marks for descriptions but many found it difficult to do this in the ample space available. Simple statements about how changes in the independent variable relate to changes in the dependent variable usually gain marks.

Teaching tip:

Students should practise using simple statements to describe graphs, eg " the higher the …, the higher the …"

Most candidates were aware that reference to figures is usually creditworthy. However, many struggled with units, either multiplying deaths by 10000 or ignoring units altogether, while some were unable to read from the graph or extrapolated a hypothetical figure at 3.5 mmol dm^{-3} blood cholesterol. It was pleasing that very few candidates attempted to *explain* the relationship between death and blood cholesterol.

Examination tip:

Candidates should use a ruler to read values off a graph.

Some candidates still have trouble reading axes correctly and there were several references to men having higher blood cholesterol than women.

(iii) The vast majority of candidates achieved one or more marks. Marks were often lost for repeating two aspects of CHD where distinct medical conditions were required. Some candidates think the C in CHD stands for chronic. Poor spelling of atherosclerosis cost some an occasional mark while the rare 'arteriosclerosis' gained no credit.

Q.2

(a) This part question demonstrated the value of teaching definitions for the more important terms; those who gained full marks often did so with a single sentence. Most candidates got the idea of grouping but fewer explained that this was done on the basis of similarity or difference. Some wasted time by giving criteria for grouping – it often pays to read ahead to the next question!

(b) (i) Most candidates were able to list relevant criteria easily, although some wasted time by listing multiple examples of each type of feature. A small but significant

number of candidates listed kingdom, phylum etc - presumably misinterpreting 'criteria' as 'taxa'.

(ii) It was pleasing to see most candidates get the order of classification hierarchy correct. From the scripts it was evident that many candidates had used a mnemonic successfully, one of the more memorable being "King Penguins Cheat On Family Game Shows".

(c) This was a more challenging part of the question in which few candidates gained full marks. Where candidates gained credit, it tended to be for listing kingdoms and, less often correctly, domains. Some candidates confused prokaryotes and bacteria. Making comparisons between the two classification systems, other than simply stating numbers, seemed more difficult for candidates. Surprisingly few were aware of the basis of the domain classification suggesting than this was a topic that had been missed from their teaching, or was a topic that the students did not consider it important enough for revision. There were some recurring misconceptions that are worth noting: 'the kingdom system uses physical features while the domain system uses DNA'; 'domains are more specific while kingdoms are more general'; 'some organisms are not in a kingdom at all, so domains were introduced to include everything'; 'a domain is where an animal lives'.

Teaching tip:

Ask students to compare and contrast simple cladograms of the two classification systems and then peer mark each other's work checking for mistakes with, e.g. prokaryotes and bacteria.

A small number of students were still referring to protists as a kingdom.

Q.3

(a) This was generally well done, with young or elderly being the most common correct populations identified. Errors included citing geographical populations, e.g. 'people living in rural areas', when the question asked for a group within a population. Some candidates gave very vague non-creditworthy groups such as 'the poor', following such answers with vague or unscientific explanations such as 'poor hygiene'. This question also generated a number of humorous responses that included 'short sighted people because they don't read the sell by dates', 'those who cannot cook' or, because of the question stimulus 'people in Scotland'.

(b) Question 3 part (b) discriminated between weaker and stronger candidates well. Answers given in part (b)(i) might have gained more marks had they been written in part (b)(ii) and vice versa. Candidates are again reminded of the importance of careful reading of the question.

(i) Answers to this question varied in quality. Many seemed to confuse bacteria with mould or thought the former produced the latter. A worrying number of candidates believe that bacteria reproduces by mitosis. Credit would have been given to candidates who used their knowledge of biomolecules to exemplify the breakdown of food, eg stating that protein was broken down to amino acids, but hardly any candidates did this. Some candidates think that enzymes are excreted. A small but significant number of candidates suggested that the higher temperatures would 'denature enzymes in the meat' so that its 'immune system would not work'!

(ii) Many candidates merely restated their answers to part (i) and failed to convey the idea of 'more' or 'faster'. Several responses suggested that there was no

reproduction at 5°C! Kinetic energy was mentioned by many candidates but a proportion of these failed to gain credit because the responses applied the increased kinetic energy to the bacteria, rather than referring to the enzymes or other molecules involved. Some candidates seemed to confuse bacteria and enzymes, writing statements like 'the bacteria are denatured' or 'bacteria are close to their optimum temperature'. There were a lot of vague comments about bacteria thriving or being in the best conditions that did not come close to achieving any marks.

(iii) For those who had studied this part of the specification well there were some good clear answers. For the salting or sugaring, the commonest error was to use language that was below AS level, not linking water loss to osmosis or low water potential. There were some vague explanations of pickling: examiners were looking for precise explanations linked to denaturation. The occasional references to bacteria being denatured were not credited. A surprising number of candidates thought vinegar had a high pH and failed to gain credit for any subsequent explanation. Canning, etc, was rarely explained in terms of preventing aerobic respiration. Some chose two methods from heat, irradiation and smoking and explained both by rather vague references to 'killing'. This was only credited once. The specification is very clear about the list of food preservation techniques the candidates should know, consequently vague answers like 'keeping it in an airtight container' were not credited. Indeed, such answers were often linked to bacteria not being able to get in! Candidates who put 'freezing' had clearly not read the question.

(c) This was well answered by most candidates but some missed out on what were relatively straightforward marks. Given that the question clearly asked them to relate their answers to the data table, it was surprising how many strayed off into discourses about the economics of growing mycoprotein, its ethical value in terms of compassionate farming or vegetarianism, or even the perceived problems associated with eating fungus. Good answers worked through the data, gave comparative statements for mycoprotein and beef, backed up with correctly quoted data with units and then commented on the advantages and disadvantages of the quoted differences. It was relatively easy to achieve the QWC mark in this question but some candidates failed to refer to any figures at all or only referred to the energy values. A small number of candidates confused units, quoting 2.6 g of iron per 100 g of beef. Many candidates attempted comparative calculations but failed to gain credit because of imprecision, e.g. "mycoprotein has about a third of the energy of beef".

Q.4

(a) (i) Most candidates gained a mark here, the most common answer being 'DNA is double stranded'. It was pleasing to see the vast majority of candidates follow the rubric – very few gave an answer that could not be inferred from the diagram.

(ii) Was well done by most candidates. Some failed to compare DNA and RNA and only referred to one of the two. As ever, a small number of candidates think DNA contains a base called 'thyamine'.

(iii) Candidates were better at this question than they were at a similar question in the January session, with a small majority getting the correct answer 'gene'. However, this is such a basic principle that one would expect almost all candidates to get it right. The most common errors were 'codon', 'amino acid' and 'polynucleotide'.

(iv) Most answers were along the right lines (i.e. that the DNA molecule was to too big), but only around half mentioned nuclear pores.

(v) About half of candidates were able to say that mRNA copied only a section of DNA or coded for only one protein but few achieved a further mark. Some candidates lost the second mark by stating that a DNA molecule contained 'all the genes in the body'.

(b) (i) This was extremely well answered with many answers achieving all the points in the mark scheme beyond the maximum two. Candidates had clearly learned enzyme inhibition.

(ii) Few students were able to connect the inhibition with mRNA production, despite reference to this in the question. Most students talked generally about enzymes not working, as if α-amantin would inhibit all enzymes. Many candidates rambled about processes not taking place. Some credit was given to candidates who were prepared to name a vital process or protein that would be affected by a lack of protein synthesis but few were prepared to commit themselves.

(c) (i) Most candidates achieved a mark here.

(ii) The vast majority of candidates could identify the hydrogen bond. A smaller number identified the disulfide bond but some had trouble naming it correctly, 'sulfide' or 'disulfur' were occasional incorrect answers. Candidates were not penalised for using the traditional 'ph' spelling. Fewer candidates were able to identify the ionic bond, many wrote 'covalent' on line A.

(d) Most candidates achieved one mark, the most common being for vibration. Often increased energy was unspecified or kinetic energy was not referred to in terms of an increase. A significant number of candidates think that disulfide or other covalent bongs are broken, while others would not commit themselves to naming a bond. Surprisingly, only around half of responses mentioned denaturation. Candidates are reminded that repeating the stem of the question rarely achieves marks; hence references to disrupting the tertiary structure were not credited.

Q.5

(a) (i) This was well done by most candidates. The most common error was for candidates to discuss dust or particles or 'the infection' being trapped rather than referring to bacteria or pathogens. Some candidates thought that the cilia trapped the pathogens. Again there was evidence of candidates not reading the question: many unnecessarily described the role of goblet cells in mucus production, while some described the effects of smoking on the cilia.

(ii) Most candidates gained some credit in this question but high scoring answers were rare. It is possible that a number of candidates had learned an answer by rote, which did not quite match the diagram. Vague statements about phagocytes recognising bacteria were not credited and few candidates correctly referred to the receptor on the phagocyte. Many seemed to think that lysosomes were a type of enzyme, perhaps confusing them with lysins. A significant number of candidates used the term 'destroy' rather than answering in terms of digestion or breakdown, losing marks due to lack of precision. A significant minority misinterpreted the diagram for stage D and described antigen presentation despite the fact that the arrows ended within the cytoplasm and did not reach the membrane.

(b) (i) The best 40% of candidates gave plasma cell as the answer but, on this occasion, credit was given to the large number who put 'B lymphocyte'.

(ii) This question worked well. It allowed candidates who had learned the topic to gain marks easily. Many did really well, gaining full marks. Most candidates achieved at least marking point 1 for a descriptive point on basic structure. The idea of variable and constant regions was largely appreciated. The hinge region and flexibility were also common point scorers. Antibody specificity was generally understood, but less well explained was the concept of complementary shape. A factor which really discriminated between candidates was the volume of text required to answer the question. Well structured answers could make the points coherently, sequentially and very quickly; less effective responses resembled a set of facts thrown into the answer as and when the candidate brought them to mind and these tended to waste time. Most candidates producing reasonable answers gained the QWC mark. Many candidates used diagrams in their answers but, with a few exceptions, these tended to lack enough suitable annotations to gain much credit.

A small but significant number of candidates confused antibody with phagocyte and struggled to score at all.

(iii) Most responses were correct. The most common incorrect tick was natural active.

Q.6

(a) In this question, the candidates understood that the motorway was going to cause a problem, but didn't appear to really understand what the role of the EIA was and what it would entail. There were many answers discussing chemical pollution, light pollution and noise. Most candidates were able to gain some credit for reference to biodiversity but only a minority referred to rare or endangered species. Some described relocation but disappointingly few mentioned wildlife corridors. It was very rare for candidates to refer specifically to the rarity of the habitat or the legal status of the area. Attempts to describe the likely reduction in the size of the habitat tended to fall victim to the usual vagueness brought on by ecology questions.

(b) (i) Most candidates gained some credit in this part of the question. There were many references to sweep nets, using different paths and collecting at different times of year. However, many responses included 'generic' improvements that did really apply to this question, such as unqualified repetition, random number generators, 'getting someone else to collect the data to avoid bias', or even quadrats.

(ii) This was well answered by most candidates but some marks were lost through inconsistency in decimal places or sloppy arithmetic. Almost all candidates at least attempted this question, which was pleasing.

(iii) It was common for candidates to get one mark for explaining that a high Simpson's Diversity Index means a high diversity of species but a reluctance to make a definite statement about the implications of this often cost candidates a second mark. Good responses stated 'future development would be unlikely to go ahead' but many responses were of the 'plans may need further consideration' type. A minority of candidates thought that a high species diversity meant that the habitat was sufficiently robust to cope with any planned development!

(c) (i) All but a handful of candidates achieved full marks.

(ii) This question discriminated well between candidates of differing abilities. Amongst a number of candidates, there was considerable confusion between genus and species, while others substituted 'family' for 'species'.

F213: Practical Skills in Biology 1

General Comments

The tasks were comparable to last year's tasks in level of demand. There were a few misinterpretations of the rubric where candidates did not appreciate the difference between 'describe' and 'explain' and therefore lost the second mark. For example, Quantitative task 1 (Q3) and Evaluative task 1 (Q1). Overall the quality of work seemed to be better with more candidates achieving higher marks.

It was encouraging to note the number of Centres that 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. The biggest differences are still being seen in the marking of the Evaluative tasks.

Many more Centres this session 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 for the moderator.

Centres are requested to check for clerical errors as part of the internal moderation process within the Centre. This avoids delays in the moderation process when such errors are found. For the 2010-2011 tasks, a new style mark total has been provided on the front cover of each student task to help prevent clerical errors.

There was, worryingly, some evidence that some Centres had been coaching candidates to the mark scheme in order to boost the marks obtained. 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 attempted. The completed tasks must be kept securely until any possibility of re-entering for Unit F213 has passed for these candidates. At that time they should be securely destroyed as these tasks will remain live throughout the life of the current specification.

Centres are reminded that data may not be given to candidates nor may data be shared. Please see Frequently Asked Question (FAQ) 24 for further amplification of this point. The Frequently Asked Questions can be found on Interchange. 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 teacher or the moderator to make this 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.

Centres are encouraged to use the dedicated GCE Practical Task email address for clarification relating to any area of the Practical Tasks (gcesciencetasks@ocr.org.uk). Additionally, teachers or the nominated science co-ordinator for Interchange, are encouraged to subscribe for free to receive e-alerts relating to subject specific information should updates be published. The Practical Skills Handbook and the free Coursework Consultancy service may also be used for further guidance.

Teaching tip:
The following web sites may be helpful for teachers:
www.biology4all.com or www.gettingpractical.org.uk.

Guidance on Tasks

Qualitative Tasks

In general terms, these tasks were well answered with many candidates, including the less able, scoring well providing the instructions were followed carefully. Some candidates did not understand the requirements for drawings from a microscope or understand the requirements for drawing up a results table. Candidates were polarised between those that demonstrated the skills well, and those that were not aware and lost marks unnecessarily. In some cases, the drawings represented images remembered from a text book, not what they had seen. Some tables were incorrectly drawn up with incomplete borders, split tables or the independent variable not in the first column. See Chapter 7 of the Practical Skills Handbook for further guidance. Only Question 2 in Qualitative task 2 caused issues as candidates failed to note that *reasons* were required and not just simple statements on the use of hydrochloric acid.

Quantitative Tasks

There was a common issue with all three tasks in terms of calculation errors, incorrect rounding, inconsistency in decimal places or incorrect numbers of decimal places. It is expected that all calculations in a column will be correct and be rounded correctly. Calculated data should show the same number of decimal places or one more place than the raw data up to a maximum of 2 decimal places, unless otherwise stipulated. 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.

A significant number of candidates showed poor basic graphing skills, 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 also caused problems.

Centres are advised to consult the Practical Skills Handbook or the task email address for guidance concerning data recording, scaling graphs and good use of graph paper.

Evaluative Tasks

There were two main concerns with the Evaluative tasks; the first is lack of understanding of the terminology used and the second being marking issues.

Some candidates lacked an understanding of the term '*accuracy'*. 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.

There was a lack of understanding of the term '*reliability'*. Reliability can be assessed by the concurrence of replicate data.

The term '*precision'* was also poorly understood and frequently muddled with these other terms. Precision is 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.

The terms '*limitation'* and *'error'* were also frequently confused. Limitations are inherent problems with the procedure which will affect all data collected, whilst errors are one off problems frequently referred to as operator errors. Suitable explanations and modifications for these 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 if the limitation given is not awarded the mark.

The second concern with these tasks were marking issues. Annotations of marking points, by placing a number or letter adjacent to 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 general, candidates performed less well in these tasks than in the other two task types.

F214: Communication, Homeostasis and Energy

General Comments

A wide range of marks were seen, with some candidates demonstrating good knowledge and understanding. It was evident that candidates had been prepared to cope with the AO2 questions, testing application of knowledge, that make up a high proportion of this paper. This is one way in which this paper of the new specification differs from the equivalent paper in the legacy specification. There was no evidence that candidates were short of time, although some of the less able candidates did not attempt some of the questions.

One feature that was noted by examiners was that there is a tendency for some candidates to write far more than the space provided for a response. While it is important that examiners are alerted to the location of any additional response, candidates should consider the mark allocation for the part question and take care to construct an answer that addresses the question that has been asked rather than launching into a lengthy response that is not totally relevant to the question. Clarity of information is important and candidates should bear this in mind in the presentation of their work.

Comments on Individual Questions

Q.1

(a) (i) Most candidates scored at least two marks in this question. Very few failed to score any marks. Common errors included identifying X as adenosine, and failing to specify ribose for the sugar. A small proportion of candidates named Z as triose phosphate. Other errors included "phosphoryl" for Z or a hexose sugar for Y, when a 5 carbon sugar is clearly drawn.

(ii) Most candidates scored at least one mark in this question, usually getting the accessible mark for the idea of ATP transferring energy. A few candidates unfortunately still mentioned the idea of "producing" energy. Far fewer candidates obtained marking point 2, as many were unable to state that the phosphates were removed by hydrolysis, instead just describing the bonds "breaking". Most candidates could supply a suitable use to which the energy is put, with a variety of different reactions suggested including active transport, endocytosis, exocytosis and glycolysis. However, some candidates failed to gain this mark as they did not include an A level standard of detail in their answer; for example stating that the energy was released for "processes" in the cell. A small proportion of candidates incorrectly stated that ATP was used for facilitated diffusion. The units for the energy release were not always quoted correctly, for example joules rather than kilo joules. The really good answers explained how the energy was released when ATP is hydrolysed to ADP and Pi and gave details of its formation in respiration or photosynthesis.

(b) (i) Most candidates scored the mark in this part question, although with various spellings of crista. A minority of candidates identified the structure as belonging to a chloroplast, despite being told it was a mitochondrion. Candidates who didn't score here often stated "inner membrane" rather than "inner mitochondrial membrane". Matrix was a common error.

(ii) Most candidates recognised the process involved in this part question. However, a significant proportion of candidates only gave a description, for example electron transport chain, when the question asked for a named process. Oxidative phosphorylation was the most common correct answer given.

(c) (i) Many candidates will not have come across RQ values before, but plenty of information was given in the stem of the question for them to access the marks in (i). Most correctly stated that the hamster started respiring carbohydrates or a mixture of carbohydrates and protein and then moved on to lipids after a period of torpor. Some candidates correctly explained the change in terms of the hamster's carbohydrate stores being exhausted but many missed out on this mark. Many candidates over-complicated their answers by discussing the energy values of the three different substrates and relating this to the opening line of the question; 'some animals conserve energy stores by entering a state of torpor'. Others tried to discuss the exchange of gases for each substrate or stated that the decrease in the RQ value indicated that the amount of substrate respired during the period of torpor decreased.

(ii) In this part question, some candidates gave excellent answers gaining full marks. Unfortunately many candidates gave GCSE answers, without giving enough detail. For example, some candidates stated that the hair on the skin would rise, but without mentioning the erector muscles. Many candidates failed to mention the role of thermoreceptors and the hypothalamus. Descriptions of vasoconstriction were very poor with a large proportion of candidates stating that capillaries will constrict. The most common terms stated to gain the Quality of Written Communication (QWC) mark were vasoconstriction, radiation and erector. Surprisingly, at this level, there were still some candidates who suggested that the blood vessels themselves moved deeper into the tissue. A few candidates answered in terms of ectotherms, or increasing heat loss to cool the body. Candidates often failed to fully explain their statements, for example stating that increased metabolism occurs, but failing to state that this generates heat.

Q.2

(a) Candidates experience problems in distinguishing between the liver and the pancreas, with reference both to structure and function.

(i) A minority of candidates simply stated 'vein' or 'venule' in (i); many tried to qualify the vein with varying degrees of success. The most common errors were to suggest renal vein or hepatic portal vein or even non-blood structures such as alpha or beta cells.

(ii) This part question was generally well answered, although some candidates simply stated 'liver cells' or other inappropriate cells such as islets of Langerhans or endothelium.

(b) This question discriminated well. Most candidates successfully identified deamination, although some inappropriate versions of the term were seen. The remaining compounds were not well recognised by many candidates, with the correct compounds often incorrectly assigned to a letter. Common incorrect compounds included ATP, NAD, ammonia and keto acid.

(c) (i) Although candidates picked up marks in (i), only a minority were able to produce a thorough and logical account of how the test worked. This is one of the learning outcomes that is new to the specification and in future it is hoped that candidates will be better able to answer questions based on this principle. More able candidates included plenty of marking points, often going beyond the maximum, but frequently failed to produce three terms for the QWC mark, limiting their marks to 3 out of 4. Spelling of terms such as 'complementary' and 'immobilised' was often incorrect. The abbreviation hCG was more frequently seen than the full hormone name which, if attempted, was not always correct with several chronic gonadotrophins seen. Candidates frequently gave superficial accounts, the most

common errors being to refer to the antibodies as receptors or enzymes and to refer to a reaction with antibodies producing a colour change.

(ii) Candidates tackled (ii) extremely well and displayed a good level of knowledge and concern about the use of steroids in sport. The question produced lengthy and highly opinionated accounts. There was little resistance to the applied nature of the question or its ethical dimension. All marking points were awarded and accessible. Most candidates opened with a statement about the unfairness of steroid use. Some felt quite strongly that their use undermined the principles of sport - using statements such as "harming the spirit of competition" or " hollow victories" or "reduces personal and national pride". Candidates showed an awareness of harmful effects with good knowledge of medical side effects.

Q.3 Confusion between photosynthesis and respiration is evident, particularly with respect to Krebs cycle and Calvin cycle.

(a) (i) In (i), most candidates identified ATP, but many variations on NADPH were seen, including NAD, FAD, oxygen, chlorophyll and several enzymes. A number of candidates misread the question and gave either all products of the light dependent reaction or the final products of photosynthesis.

(ii) Many candidates achieved the full 3 marks in (ii). Those who did not tended to concentrate on the products outside the Calvin cycle, omitting the recycling to RuBP. Some confusion between glucose, glycerol and glycogen was seen in some answers. Some candidates seem unaware of the meaning of the word “fate”, and devoted their answer to a description of how TP is produced. In an error also seen in Q1, some assumed triose phosphate refers to the three phosphate groups in ATP, and described either phosphorylation or ATP hydrolysis.

(b) (i) Only the more able candidates achieved both marks in (i). Common errors were mentioning either oxygen use or carbon dioxide production, but not both. References to the light dependent stage rather than light were frequent. Many erroneously stated that respiration was involved, despite having been directed towards the figures on the previous page.

(ii) This part question proved a good discriminator. The strongest candidates clearly stated 3 or 4 correct points, but many candidates became hopelessly confused. Of those who did give correct responses, reduction of rate of photosynthesis and the idea of competition were usually present in the answer, but there was frequent confusion between rubisco and RuBP. A common error was to assume that the carbon dioxide given off as a result of photorespiration would increase the rate of photosynthesis. Several candidates simply described the flow charts. A number of less able candidates gave no response.

(iii) The majority of candidates in this part question identified that oxygen could not bind to PEP carboxylase, although it was not always clearly expressed. A frequently seen error was that PEP carboxylase would not bind to RuBP.

Q.4

(a) (i) In this part question, most candidates understood that starch contains just glucose while sucrose consists of glucose and fructose, although this was not always expressed clearly and there were very few references to sucrose being comprised of 50% of each monosaccharide. Very few candidates mentioned hydrolysis of either molecule.

(ii) This part question was often poorly answered. Very few candidates stated that starch and cellulose are both made of glucose, although more able candidates made correct references to alpha and beta glucose. Many thought that cellulose is a fibrous protein and others thought that, as it is a structural component of plants, it has nothing to do with a food component for humans. A significant proportion of candidates thought that starch is a storage product in humans and circulates freely in the blood. Better responses included some kind of explanation as to how starch can be digested while cellulose cannot; some mentioning enzymes or even correctly named enzymes.

(b) In order to answer this question successfully, candidates needed to appreciate that the question was about controlling Type 2 diabetes, which meant that steps would need to be taken in order to prevent blood glucose levels becoming too high. Some candidates confused Type 1 with Type 2, even if they had already correctly defined Type 2 diabetes. Others gave more generalised answers concerned with keeping blood glucose levels within acceptable levels, i.e. what to do if blood glucose levels were too low as well as too high, sometimes focussing exclusively on low blood sugar levels. Most appreciated that the amount of starch in the diet should be reduced and that an increase in fat/protein or other suitable alternative was also advisable, as there would be no effect on blood glucose concentration. However, some candidates failed to either link the latter two points or to state that starch produced the greatest increase in blood glucose, simply restating the information given in the question. There were very few correct references to including a moderate amount of sugar in the diet - many felt that it should be avoided completely. Although many candidates commented that various components in the diet should be limited, this was not related to the fact that they would cause an increase in insulin concentration and the subsequent effect on the responsiveness of the cells.

(c) This question was not answered well and demonstrated some confusion and gaps in knowledge of a significant proportion of candidates. The types of compound were not well known, with confusion between proteins and carbohydrates particularly evident. The role of the compounds was better understood, although some candidates mentioned as many reactions involving the liver as possible for glucagon. While many candidates correctly identified the sites of production, the confusion between liver and pancreas noted in Q2(a) was also evident here.

Q.5

(a) (i) to (iv) Parts (i) and (iv) were the parts that were answered with the greatest success. The common mistake in (ii) was to give either A or F but not both. C was a common incorrect response to (iii).

(b) (i) & (iii) The majority of candidates answered (i) correctly and many could make a suitable suggestion for (ii). Despite having been told in the question that the toxin is stored in the body, some suggested that it is broken down and excreted while others suggested that fish do not have a nervous system.

(c) (i) More able candidates expressed themselves clearly and scored well in (i). Responses from less able candidates did not refer to the immune system, stated that the immune system was damaged or interpreted ‘auto’ as an automatic response.

(ii) This part question was generally well answered, with the part of the neurone that was damaged being correctly identified and a suitable comment relating to its effect on the conduction of the nerve impulse. Only the more able candidates related the loss of sensation to the sensory neurones or the direction of the impulse towards the brain and CNS.

F215: Control, Genomes & Environment

General Comments

This paper, the first testing this area of the specification, was well-received by candidates and Centres. It covered a great deal of ground and gave hard-working candidates an opportunity to show what they knew. Candidates were able to complete all questions in the time available and most attempted every section, though some of the stretch and challenge type questions, and questions with a synoptic content drawing on the AS units, were omitted by weaker candidates. There was a very large spread of candidates in terms of the mark range they attained, with excellent performances at the top end and very weak performances at the lower end.

A problem commented upon by examiners however lies with the haphazard way in which candidates set out their answers. It is imperative that candidates are made aware of the rubric on the front page of the examination booklet, stating that extended answers should continue on the additional space page at the back of the booklet. Candidates must not write in the side margins beyond the limits of the black right-angle marks in each corner of the page. If they continue their answers beyond the lines provided, even if they are continuing into a blank space directly below the lines, some indication of the fact that the answer continues beyond the lines should be given. A very large number of the candidates were unable to express their answers adequately in the lines spaces provided, and whilst handwriting size obviously varies, the problem generally comes about because candidates fill up space with irrelevancies and crossings-out before getting to the point of the question.

One of the skills taught to candidates should be selectivity about choosing and wording their answers with care, rather than adopting a scattergun approach. In questions where a set number of suggestions are asked for, additional suggestions that exceed the number asked for are ignored in the examining process, so in these questions it is even more important that candidates rank their ideas and write them in order of importance. Where a wrong and a right answer are given together, the wrong answer negates the correct one.

Comments on Individual Questions

Q.1 This question provided a high-scoring, confidence-building introduction to the paper, despite including some synoptic assessment, and candidates across the ability range scored well on it. Three-quarters of candidates scored full marks on all sections of this question apart from 1 (b) (i), where around half the candidates scored full marks.

(a) (i) Candidates were presented with a flow diagram showing steps in the production of cheese and were asked why this can be described as a biotechnological process. Nearly all candidates achieved two marks here. Many candidates had learnt a definition of biotechnology and correctly referred to use being made of living organisms or microorganisms for human benefit in an industrial or food-making process. Candidates lost a mark if they talked only of cheese making or “a process”, drawing on words from the question stem, without relating the stimulus material to their own knowledge of the general meaning of “biotechnological”.

(ii) Candidates were asked to suggest two benefits of the pasteurization stage within the context given, and most answered well, again with a high number of candidates scoring two marks. The commonest correct answers were to state that bacteria were killed, and that this was important either because the bacterial were harmful to health, or that they might compete with the other microorganisms used in the process. Candidates also referred to the denaturing of enzymes. Weaker

candidates described bacteria being denatured and this error did not score.

(b) (i) This section was a little harder than the part-questions that preceded and followed it. It included an element of synoptic assessment, requiring candidates to recognize what type of protein rennin is, and to explain how it operates. Most candidates correctly named rennin as an enzyme, though candidates could also score a mark with the terms globular, catalytic and tertiary. Those who stated it was an enzyme usually went on to explain that as such it would not be used up and could act repeatedly, therefore converting a large quantity of substrate to products.
To score more than two marks candidates needed to describe how the enzyme operates in terms of binding to the substrate and then being released from the products. Some candidates again made the mistake of quoting directly from the flow diagram, “soluble casein to soluble paracasein”, without then relating this to the action of the enzyme. A few candidates wrote inappropriately about immobilised rennin here.

(ii) The majority of candidates were well-prepared for this question, possibly having considered the immobilization of enzymes in the practical task that investigated the effects of immobilization on lipase. Common correct answers were reference to the less complex purification or downstream processing angle, the capability to re-use the same immobilized enzyme, and the greater stability of the enzyme in more extreme temperatures of pHs.

(c) This opportunity for extended writing was seized upon with enthusiasm by most candidates. Three quarters of candidates achieved the maximum mark, and we saw many excellent answers with far more correct points than the maximum of eight allowed. It is clear that the topic of genetic engineering has been well-taught and learnt.

The commonest approach was to cut out the gene with a restriction enzyme and to insert it into a plasmid. A significant minority of candidates however took the alternative route of obtaining cDNA by the action of reverse transcriptase on mRNA. Good candidates appreciated the difference between annealing (complementary base pairing of the unpaired bases of the sticky ends by hydrogen bonding) and ligation (sealing of the sugar-phosphate backbone by DNA ligase) in the formation of recombinant DNA. However only the better candidates went on to explain exactly how this recombinant DNA is introduced back into a host cell. Weaker candidates failed to appreciate that obtaining the recombinant plasmid is not the end of the process, or merely stated that it should be put in bacteria without outlining the process by which this occurs, as asked for in the question.

Common errors shown in candidates’ understanding of the process of genetic modification are to confuse the names of the enzymes used (DNA helicase and DNA polymerase made many surprise appearances here), to talk of “cutting” the gene rather than cutting it out, to think that a section is removed from the plasmid rather than that a single cut is made in the circle, and to use the term DNA probe rather than to be more specific and say a gene probe (that will only bind to a certain gene). A more fundamental and serious error that occasionally surfaced is where candidates used the terms “rennin gene” and “rennin protein” as being synonomous with each other.

The commonest error in exam technique was for a candidate to write too much. Some did not stop after describing the process by which bacteria can be genetically modified to produce rennin, but continued to describe mass production of the protein by fermentation, in great detail. Others more reasonably went on to describe using antibiotic resistance to select the GM bacteria, but this was beyond the scope

of a simple outline of how a GM bacterium is made.
Where candidates did not achieve the quality of written communication mark, here given for correct sequencing of the steps in the process, it was usually because they gave up before the transformation stage in section III (mark points 17-19). Candidates could start with cutting the plasmid (mark points 11 and 12) and then obtain the gene (by one of the three 3-mark routes given in mark points 1-9), so long as these two steps preceded the joining of the two sections of DNA (mark points 13-16).

Teaching Tip:

Candidates should be taught the idea that a good answer generally synthesises the stimulus material with their own knowledge, producing a depth of insight greater than is provided in the question text or diagram alone. Unless candidates are specifically asked to select one piece of information from several facts provided, they will not score marks by simply quoting the material given without adding any extra knowledge or insight.

On essay questions they need to be sure they understand exactly what part of their knowledge the question is asking for, and when to stop writing. Excess writing here wastes time that would be better used analysing other parts of the question paper that need time to be properly read and the ideas digested.

The Quality of Written Communication marks on this paper, indicated by a pencil icon, always require candidates to perform a certain task to do with organising information, and candidates need to check they understand exactly what this task is in each case.

Q.2 This question proved much tougher although well-prepared candidates appreciated the opportunity to show they recognised epistasis, to set out a genetic cross and to work through a chi-squared calculation.

(a) (i) For this question, candidates had to relate trihybrid genotypes to a flow diagram of pigment synthesis. In this context, candidates had no problem with the words genotype and phenotype, but a minority did confuse these words in part (b) (ii). The vast majority of candidates scored three easy marks here for red, vermillion and cinnabar. However a minority of candidates gave more than one answer on each line. Candidates should be told to avoid this, as answers of this nature do not gain any credit even if the correct answer is included as a contradictory wrong answer negates the mark.

(ii) This was the first part of the paper where a small but significant number of candidates wrote no response. Still most candidates correctly recognised epistasis. A few spoiled their answer by stating it was dominant epistasis, which it was not. Another common mistake was to give “co-dominance” as the answer.

(iii) This was the hardest question on the paper, with about one in ten candidates failing to provide an answer at all. It was designed to be a stretch and challenge type question. There was a synoptic element to it in that the key idea for scoring at least one mark and indeed accessing all three if the idea was developed, was “enzyme”. The problem with the question from the candidates’ point of view is that they were not making a distinction between a gene and a gene product, despite the use of bold type in the question to help them with this. Poorer answers simply presented learnt information about epistasis, or described the flow diagram in Fig. 2.1 in words. Few candidates realised this was not about genes per se, but about the interaction of their products in a multi-step enzyme pathway.

Those candidates who did score here realised that the products of these genes are enzymes, talked about the product of one reaction being the substrate for the next enzyme, and in the best cases talked about the dominant and recessive alleles coding for different, or functional and non-functional versions, of the enzyme.

(b) (i) There was a significant quantity of information about the gene, the cross and the results obtained to read and digest here. This always causes problems to those candidates who are too eager to get writing on the dotted lines, and who consequently fail to read the necessary information carefully enough. A second problem here was with those candidates who read the information and worked out that the R / r gene was sex-linked, but who then wrote this conclusion down in the space, rather than answering the question asked. A correct explanation was not asked for. Instead they were asked to provide evidence from the data as to why the incorrect hypothesis was wrong. Many candidates did score two marks, usually for working out that the hypothesis given, if true, would give equal numbers of all four possible phenotypes (scoring mark points 2 and 3). Many candidates provided a partial answer and said if this were the case both red-eye males and white-eyed females would also appear in the offspring.

A worrying minority of candidates talked about the expectation of a 1:1 ratio and highlighted that clearly this was not the case as the offspring numbers were 27 and 23. Candidates should be trained to spot ratios and to realise that they are unlikely to be exact, such as 25 and 25 in this case.

(ii) Only around half the candidates scored all 3 marks on this standard genetic cross involving sex-linked genes. The most common mistake was erroneously annotating the Y chromosome with an allele. Many candidates did not show the inheritance of the X and Y chromosomes at all, despite the attention drawn in the question stem to the X and Y chromosomes of male *Drosophila*, and gave a simple monohybrid cross. Another error that cropped up was writing F1 phenotypes in the space designated for the F1 genotypes.

A few candidates opted to use different letters to represent the alleles. It was still possible to gain all 3 marks in this case, as long as candidates gave a key illustrating which letter represented which allele. It would be advised however to use the letters suggested in the question to avoid confusion.

(iii) The statistics question was very well answered and proved to be one of the highest scoring questions on the paper. Clearly candidates have been very well-taught and drilled in performing the chi-squared test. However there was a significant discriminator in the question, because the conclusion was asked for in very precise terms. Candidates were asked to test the significance of the difference between the observed and expected results, and answers for the fourth mark had to refer to the significance or otherwise of the difference. Many candidates however simply relayed a conclusion in the language they had been taught, often with respect to the null hypothesis or the probability of results being due to chance, and did not show the understanding to rephrase it in terms of the significance of the difference. This fourth mark point had been designed to be stretch and challenge, and it did indeed discriminate between the most able candidates and the rest.

One error in working that appeared occasionally was calculating minus 2 squared as being minus four. A few candidates left off the minus sign for 23 – 25. Where errors in working occurred, error carried forward marks were awarded, hence a χ^2 value of 0 due to the minus 4 error could still score three marks out of four if a correct conclusion was drawn from the 0 figure.

Teaching Tip:

The message to be derived from this question is the importance of reading the question carefully and appreciating exactly what it is asking. Only about a third of the marks on an F215 paper are for simple recall of factual knowledge. The bulk of the rest of the marks are for more sophisticated mental processing and analysis, hence the questions are very often not the straightforward "tell us what you know" type that candidates prefer. More attention needs to be paid to the demands of the question, as was seen here particularly in 2 (a)(iii), (b)(i) and (b)(iii).

Q.3 This question started with some testing stretch and challenge "suggest" questions but ended with most candidates scoring highly on the extended writing section.

(a) (i) Around a third of candidates answered this higher demand question well. The best answers homed in on shared homeotic genes causing shared patterns of development. Some students lost marks by making vague statements such as "DNA" or "genetic code" were similar, rather than stating that some genes were common to all the organisms. A few candidates applied their knowledge of evolution and correctly referred to the shared ancestry of the organisms listed. Some candidates lost marks due to reading the question as 'how' the information can be applied rather than 'why' it can be applied to humans.

(ii) The practicality of this question evaded most candidates, who were thinking in terms of features of the genome rather than the practical considerations of lab research and breeding experiments. Around 10% of the marks on an F215 paper are for issues relating to the reality of scientific research as it is carried out, as detailed in the "How Science Works" section of the specification, and it would help candidates to be aware of these areas and to be on the look-out for questions of this type.
Some candidates did score marks for the idea that it is easier to house organisms of small size and that in breeding experiments a rapid life cycle and rate of breeding are positives. An avoidable error here is shown by the answer that occasionally came up, "size". Candidates are thinking along the right track but are not fully considering the issue and making a decision, stating what sort of size is desirable.

(b) (i) Most scored just one mark for "electron microscope", as they failed to realise the 3D image was evidence of a scanning electron microscope. Candidates need to remember that a 2 mark allocation to the question needs 2 separate pieces of information to score both marks. "Electro" and "electronic" were not acceptable mis-spellings. A few candidates thought the pictures of the fly heads had been taken with a light microscope.

(ii) About two thirds of the candidates gained this mark. A number lost the mark for reference to 'larger' rather than 'longer' antennae. A significant few who did correctly observe the legs in place of the antennae lost the mark for not specifying which fly or photograph they were referring to. Lack of clear descriptive language was evident, but there were also lots of good answers and many candidates were obviously aware of this mutation and had studied similar images in the A level texts.

(iii) Most candidates knew that the antennapedia phenotype in Fig. 3.2 was the result of a mutation in a homeotic gene and this cued them in to answer the question phrased in more general terms successfully.

(c) This extended writing question had two parts to it and candidates need to be aware that when they are asked to cover two aspects of a topic like this, they will not be able to access full marks by only writing about one of them. The majority of candidates scored extremely well on the first section, with the maximum mark of six being the norm. A clear understanding of transcription and translation was evident in many well written answers, though inevitably some candidates did mix up transcription and translation, or implicated DNA polymerase in the making of mRNA. Another quite common error in weaker candidates is to talk of mRNA binding to a DNA strand as though it starts off fully formed, rather than being gradually assembled according to the DNA base sequence from free RNA nucleotides.

However the second section, on how polypeptides control the physical development of an organism, was poorly done by most candidates. A reason and tip for avoiding this problem is given in the teaching tip below.

Most candidates, after using most or all of page 9 and sometimes half of page 20 to describe protein synthesis, only devoted a couple of lines at the bottom to the roles of polypeptides in physical development. They needed to score at least two marks in this section in order to access the structuring and organization mark denoted by the pencil icon. Those who did score two in this section mostly gave enzymes and hormones as their examples, though a few mentioned homeotic gene products acting as transcription factors, and some remembered apoptosis as being a factor in development. It was disappointing, given the content of section 5.4.2 of the specification, to see candidates making vague references to building muscle but being unable to name a polypeptide in muscle structure, though some candidates did name a structural protein, usually collagen.

Teaching Tip:

Attention should be drawn to how candidates should plan to satisfy all the demands of a free response question like 3(c), including the structuring and organising component, which here required candidates to achieve some balance across answering both parts of the question, rather than focussing exclusively on one or the other.
When teachers teach and candidates learn from the syllabus they generally work through bit by bit, section 5.1.1 (a), then (b) and so on. The pre-amble on the left hand side about section 5.1.1 is likely to be ignored, yet these summaries of the specific learning outcomes often tie facts in together and provide a valuable synoptic overview of why the learning outcomes have been placed together. This question aimed to allow candidates to show their knowledge of the latter part of section 5.1.1 in a free response fashion, but all too few had related the individual facts together in their minds, or recognised what part of the specification this question was homing in on. A tip therefore is to use the introductory paragraphs from the specification in teaching so as to draw topics together in an integrated way.

Q.4 This question provided a range of challenges. Candidates had to use diagrammatic information, interpret new information in the light of a familiar context, and answer questions on diverse topics such as synapse function, molecular genetics and natural selection when presented together in an integrated way.

(a) All candidates attempted this question. The format looked inviting and the question required recording of observations of Figs. 4.1 and 4.2 for the structure marks, and integration of this information with their own knowledge for the function marks (see teaching tip below). However despite the importance of the distinction between structure and function in biology, many candidates confused the two and were not

selective enough in choosing which information to put in which box. Marks were also lost for sloppy use of terminology and vagueness, such as muscles "being affected" rather than contracting, or "signals" passing from neurone to neurone rather than electrical impulses.

One common error is the belief that vesicles of neurotransmitter diffuse across the synapse, suggesting some candidates don't understand the idea of exocytosis at the pre-synaptic membrane, nor the meaning of diffusion. A surprising number of candidates identified the wavy pre-synaptic membrane of the neuromuscular junction as a brush border consisting of microvilli. A third common error was to confuse the neurotransmitters with the enzymes that break down the neurotransmitter.

(b) (i) & (ii) This part question and part (ii) were well answered and most candidates gained two marks for identifying phenelzine and explaining the reason for their choice. Less able candidates repeated the question stem by just stating that this drug inhibited MAO, but many identified that it was probably acting as a non-competitive inhibitor. Also, many were credited with the fact that it does not bind to the dopamine receptor whereas the other two do.

A significant minority of candidates used the terms active site and inhibition to describe not the enzyme but the receptor. Candidates need to be made aware that the terms are enzyme-specific, even though the principles of molecules binding and altering the shape or blocking part of a protein are the same.

(ii) Candidates again scored highly here, though one mark for saying the drug blocked the dopamine receptor was common, and fewer candidates than on part (i) accessed a second mark for explaining how this blocking of the receptor altered the impact of a high level of dopamine. Many candidates wrongly stated that the blocking of the receptors "decreases the levels of dopamine present" or, even more mysteriously, the "amount of dopamine reaching the brain", instead of explaining that with the receptors blocked dopamine will have less effect as less of it can attach to the receptors.

(c) (i) While many candidates found this question quite straightforward, it had been designed to make candidates think and to be higher demand, and a significant number of weaker candidates left it out altogether. Those candidates who did have an inkling of the reason why humans can only possess two alleles of a gene found the idea difficult to fully express. One mark was commonly awarded for the idea of individuals receiving one allele from each parent, but there was seldom a following through of this to include terms like diploid or making reference to chromosomes existing as homologous pairs. Poorly expressed answers let some candidates down, for example, "offspring inherit one chromosome from each parent" and other candidates stated that humans only have two chromosomes. A number of candidates wrote about dopamine receptors rather than allele, reflecting the inability to clearly distinguish between gene and protein mentioned above in 1(c) and in 2 (a)(iii).

(ii) Most candidates earned a mark for electrophoresis here. Some of those who did not score wrote two answers on the line, in which case the first answer was marked irrespective of the second answer given. The importance of giving only the number of answers asked for is highlighted above in the general comments.

(d) Candidates here were mostly very good, scoring three marks easily with authoritative answers identifying the 13-base pair deletion, the problem of frameshift and the change of all amino acids after the deletion, or very confused, often scoring

zero. Some candidates do not really understand the concept of altering the reading frame and claimed the 21 base pair deletion would cause a frameshift. A surprising number of candidates also seemed to think that the single base pair substitution would be most disastrous.

The commonest cause of marks being lost in an otherwise good answer was for candidates to talk not of changes to the structure of the protein receptor, but only of changes to the DNA. This is again a case of not meeting the demands of the question accurately enough and for the fourth time in this paper a case where candidates who made no distinction between gene and protein lost marks. Given that the relationship between DNA, mRNA and protein sequence has been described as the central dogma of molecular biology, it is important that candidates are reminded often of this relationship and retain enough AS knowledge of biochemistry to appreciate the difference between these molecules.

(e) While some candidates did not provide a response, most candidates approached this question with enthusiasm and a degree of humour. The majority gained at least two marks and plenty of candidates gained all four marks.

The most common marks awarded were for the ideas of survival or breeding success being greater in people who possessed this particular allele of DRD4, and for the allele being passed on to offspring. Some candidates achieved the latter mark in the context of genetic drift, though we were looking for an explanation centred on natural selection. The term natural selection was infrequently used and even fewer candidates referred to selective advantage.

The perennial problem of candidates talking about the passing on of a gene rather than the specific allele re-surfaced, while others assumed it must be a dominant allele and thought that this alone could explain the increase in frequency of the allele in the population, without the need for selection to operate in its favour. Surprisingly few candidates imagined that an exploratory nature could lead to finding improved food or other resources, increasing survival, and most candidates homed in on impulsive social and sexual behavior leading to increased reproduction instead.

Teaching tip:

Candidates should have the distinction between structure and function firmly engrained after studying A level Biology for two years. In a question of this sort involving a diagram, structural points will be visible on the diagram, since it shows the structure of the components. The function however must be deduced in the light of the candidate's own knowledge. This guideline can be applied to questions of this sort.

Q.5 This question provided candidates with the opportunity to show knowledge of ecological terms and the factors affecting population size within the context of data on logging in a tropical rainforest habitat. It also gave them the chance to display their knowledge of reasons for conservation and sustainable management of timber resources in a straightforward way.

(a) Of the six spaces provided, the first four were commonly completed correctly, showing candidates understood the terms ecosystem, producer, primary consumer and trophic level (though not all could spell trophic), but candidates had more trouble with the word biotic and in stating that elements (or minerals, nutrients or a named element or ion) are recycled. Unfortunately many candidates are happy to state that energy is recycled in ecosystems.

(b) (i) There was good use of terms like limiting factor and carrying capacity here but unfortunately many candidates spent most of the space discussing the initial increase in the small squirrel population, rather than the reasons why the increase could not continue indefinitely. Again, candidates need to answer the question set and fully appreciate what information it is asking for *before* they set pen to paper. The relevant part of a candidate's answer was often therefore squashed into the last couple of lines and they failed to repeat relevant points like the influence of intraspecific competition within the correct context, having used the term already without scoring in the incorrect context.

Candidates who had not read the information given carefully enough named herbivorous species like tree shrews and barking deer as predators. Candidates who mentioned predation as a factor regulating population size often failed to score because they didn't tailor their answer to the question, and explain that an increase in small squirrels would in itself attract or support a greater number of predators, which would then halt the increase in prey numbers. Surprisingly disease as a factor controlling population size was rarely mentioned.

(ii) The terms 'species richness' and 'species evenness', drawn from the AS specification as a synoptic element to the assessment, were widely misunderstood and frequently got round the wrong way. A large number of candidates talked about species evenness in terms of density – the number of a species within a km^2. Many correctly identified that species richness decreased, but then went on to say that species evenness has changed which gave no indication of an increase or a decrease. Candidates often correctly identified one as decreasing but failed to state what had happened to the other. Answers ideally needed to make reference to numbers from the table or text to support statements relating to each term. A significant minority did not talk about all the species as a whole and instead described how the evenness increased for one species and decreased for another.

(c) (i) This one mark question proved surprisingly difficult for candidates. Possibly some had missed the information on page 14 that marbled cats and otters are carnivores, but this (and the decrease in most of their prey species after logging seen in Table 5.1) and the low numbers of the populations of the two species before logging, were the key points here.

Incorrect responses included the ideas that they themselves were preyed upon, that they relied more on trees for food or habitat than animals like tree shrews and squirrels, and that they were unable to adapt to change whereas the others were. Candidates do need to be warned about reserving the word "adapt" purely for evolutionary scenarios in biology. Clearly in a four year period there are unlikely to be significant adaptation to change by any of the Sarawak species. The same incorrect use of "adapt" surfaced in question 6 (a).

(ii) Single word responses, for example "ethical" and "economic" are not sufficient to score here. Candidates should hopefully receive some guidance on this from the fact that two lines are provided for each reason, and that the questions says "outline" not "name" or "state". Around half the candidates scored full marks and the

commonest credit-worthy statements related to ecotourism, the aesthetic value of the rainforest, the potential for new developments in medicine and genetic engineering, and the need to preserve biodiversity. Candidates with two years biological training covering population dynamics and animal breeding for food production should not be confusing the worthy goal of the preservation of species over time with untenable statements like “every animal has the right to life”.

Many candidates talked about plants being used for medicines but referred to the present rather than the future/potential use of them. This is something that needs to be stressed by teachers. Once the relevant ‘curing’ compounds have been identified in species from the rainforest, then the drugs are made artificially by pharmaceutical companies. A large number of candidates mentioned that we should conserve the rainforest so as to ensure that we can still get resources from them, such as rubber, but large-scale production involves making plantations of useful trees and references to sustainable rainforest products should have been geared to the needs of indigenous people.

(d) Most candidates managed to name or describe at least two management practices, coppicing and selective felling being the commonest, but far fewer candidates described benefits other than that wood is always available, which is clearly implied in the question by the word sustainable. The benefits expected related to the impact on the environment, following on as it did from data on species loss and decline in abundance in Sarawak, and reasons for conservation. Those candidates who did appreciate this context scored for mentioning minimization of habitat disruption, preservation of biodiversity and prevention of soil erosion.

Teaching tip:

Candidates frequently see ecology as an easy option but there were plenty of challenges in this question which exposed weaknesses in candidates’ grasp of basic terminology, the dynamic nature of ecosystem interactions and the real extent and purpose of sustainable and conservation-oriented habitat management practices. Candidates should be taught not to underestimate the sophistication of some of these ideas, and to avoid clouding the real issues of sustainability by over-romanticising the importance of individuals as opposed to maintaining viable populations.

Q.6 This question involved data interpretation, an understanding of the reasoning behind experimental design and recall of unit 5.4.1 material.

(a) Perhaps surprisingly, few candidates gained any marks for this as they merely repeated the question. It was very rare to award two marks. Good candidates homed in on the need to react to *changing* conditions but few went on to give an example of this, such as the need to maximise photosynthesis when light conditions changed, or to prevent grazing. Herbivory is the preferred term to refer to grazing of plants by animals. The inappropriate use of the word “adapt”, referred to above under question 5 (c)(i), lost many candidates a mark when they considered plants’ response to change in the environment.

(b) (i) No factual recall was required for this section. Candidates simply had to read the information given and describe the results shown in Fig 6.1. It was disappointing that few candidates made good use of the information. The main errors were not identifying which treatment they were referring to, A or B, careless quoting of the graph figures, and omission of units, particularly those referring to gibberellin

concentration. Candidates were very keen to interpret the information and provide explanations rather than just describe the results, as requested. Many stated that abscisic acid inhibits germination which was more a conclusion than a simple description of the data and so gained no credit. Some candidates lost marks as they referred to growth rather than germination. As germination involves loss of dry mass growth is not a suitable synonym for it. The same point is reiterated in (b)(ii).

(ii) This was generally well attempted and many candidates scored one mark. A common error was stating that this was the best temperature for growth, rather than germination. A significant number of candidates described the idea of a fair test in a variety of acceptable wordings, but only the better candidates also gained the second mark, usually for reference to the effect of temperature on enzymes.

(iii) Very few candidates scored more than one mark in this section on experimental design. Even strong candidates were happy to put "amount" or "level" of a liquid instead of volume, or, additionally in the case of abscisic acid, concentration. These imprecise terms are not acceptable in an A2 science paper within this sort of context, where it is expected that candidates will have measured out liquids in practical work before and should be familiar with appropriate methods and units of measurement. Similarly candidates wrote "light" or "light levels" without giving any relevant qualification such as light intensity, wavelength or duration. There is an underlying weakness of precision in describing parameters important in experimental design and candidates would be advised to tighten up on this and get used to specifying more exactly what they mean, and also to consider more critically whether a factor is in fact relevant. Many candidates stated carbon dioxide concentration as a factor, but germination largely involves respiration rather than photosynthesis, so a little thought should have allowed them to reject this idea and consider something else. Candidates who listed number or mass of seeds had not picked up on the information given on page 18, where it is stated that the seeds were divided into eight equal batches.

(c) This was generally well answered with all but the weakest candidates scoring at least one mark. Most students seemed to be familiar with the commercial applications of plant growth regulators and supplied often detailed examples of their use.

Teaching tip:

Candidates' attention should be repeatedly drawn to the importance of parameters and units used in measuring substances in practical work and should be made aware that around 10% of the marks on the F215 paper draw on their knowledge of How Science Works. Candidates should also be trained to read graphs accurately, and to describe them using figure quotes which include coordinates on both axes with both units included.

F216: Practical Skills in Biology 2

General Comments

Marking

The standard of marking has generally been high; in a substantial number of Centres it has been outstanding so that supporting Centres decisions has been straightforward. Clear marking and annotation permits candidate specific feedback to Centres by the moderator, enabling further development of marking skills. It also makes it easy for the moderator to understand a Centre's judgements. This in turn makes it less likely that those judgements will not be supported.

Wherever possible, those marking scripts should add written annotations that enable the moderator to fully understand why an otherwise ambiguous mark has been credited. In particular, explanations of why the benefit of the doubt (BOD) has been given are helpful. In general, the principle of error carried forward (ECF) should be applied. The most likely circumstance is where a candidate has collected qualitative or quantitative results which do not match the mark scheme. With careful thought, the marker ought to be able to salvage some marks where this incorrect data has been used or manipulated appropriately in a subsequent question.

It is important to place a tick in the candidate's text exactly at the point where the marker considers enough has been done to credit the mark. Ticks anywhere else in the text or margins can lead to clerical errors as well as making it difficult for the moderator to understand why marks have been credited.

The mark scheme has to be applied exactly as it is. There is no procedure that permits the addition of extra points. The standard of rigour is determined by the Task paper setters and some apparently correct responses are deliberately excluded because they simply are not of adequate A2 standard. The crediting of good biology which does not answer the question is an easy trap to fall into and great care needs to be exercised in this context. There are, however, clearly defined parts of some Task mark schemes where Centres are free to accept alternatives. This is particularly the case where candidates are asked to outline and/or explain limitations. Also see also the ECF context above.

It is important that Centres use any marking point identification letters and/or numbers. These are provided so that Centres are less likely to duplicate marking points where candidates digress and return to a point. They also help moderators understand how and why credit has been given making it more likely that Centres' judgements can be supported.

The additional guidance column in each Task mark scheme is intended to assist Centres in applying the individual bullet points or explain the expected scope or rigour of some parts of a question. There is also an assortment of reminders such as the use of alternative wording and application of the error carried forward principle. This column should be essential reading for all those who have to mark scripts. However, the moderation process revealed that this is clearly not the case for a small but important minority of Centres.

Invalid order of merit

Sometimes, one or two candidates' work is marked with more leniency that others. Usually this is caused by an accumulation of marking errors which have not been flagged up during internal moderation. Some parts of some Tasks are more challenging to mark than others and can cause differences in judgement. When this happens, an invalid order of merit would result if the Centre was also judged to be out of tolerance to the extent that the marks needed to be adjusted.

Further, the degree of adjustment may be magnified by the one or two candidates that have been more leniently marked than others. To reduce the impact of this on other candidates, Centres may be asked to remark some scripts. Naturally this causes concern. It is very important that Centres do not misunderstand this process. It is intended to benefit as may candidates as possible; challenging the moderation decision at this stage will not affect the outcome. The appropriate procedure is to request a remoderation in due course. Different Tasks may not be substituted for those candidates since the rule of selecting the highest scoring Tasks no longer applies once a sample has been submitted.

Tables, graphs and drawings

Candidates have, by the time they arrive at A2, been completing tables and graphs for at least five or six years, probably more. The mark schemes often contain multiple bullet points for a single mark, emphasising the degree of rigour required for what ought to be a simple task. This frees up other marks for using/interpreting the data in the graph or table.

The specification requires that candidates be taught SI units. All units must be marked exactly as in the mark scheme; for example, Time (mins) will not do instead of Time (min).

For graphs, the correct use of the graph paper applies to the area covered by the plotted data and lines. This should not be applied pedantically; 'half a page' is a guide to sensible presentation and means that a good area of the paper is used for the plot area. Four lines in the top two centimetres of a full page graph would not constitute sensible use of the paper. The plots themselves should be made with a sharp pencil and the lines similarly, thin and done with a ruler. Centres should not accept poor quality graphs in the hope that a margin of error of +/- 1mm will be accepted as a tolerance for the plots. It may be, but equally the Task paper setters may not wish that to be applied across all Tasks.

Section 7 Data Presentation in 'Support Materials, GCE Biology H021/H421: Practical Skills Handbook' provides guidelines for teaching graphs and tables.

Centres' are commended for the quality of candidates work submitted and for the quality of marking this year.

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