

Human Biology

Advanced GCE **A2 7886**

Advanced Subsidiary GCE **AS 3886**

Report on the Units

June 2006

3886/7886/MS/R/06

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All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

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Advanced GCE Human Biology (7886)
Advanced Subsidiary GCE Human Biology (3886)

REPORT ON THE UNITS

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Chief Examiner's Comments

This examination series saw the first large cohort complete their A2 examinations and also saw a significant increase in the number of centres at AS. This shows that the specification continues to be well received; candidates and teachers are clearly enjoying the innovative approach and the intrinsic interest of the topics. The enthusiasm and thorough learning of the content of the specification shown by many of the candidates, has made it possible for them to achieve their full potential. We would like to congratulate Centres on this positive approach. In particular, the case study showed that candidates had read around the pre-release material and learned well lots of interesting human biology.

Candidates may still perceive Human Biology to be more accessible than Biology. This perception however is based on the title alone and this examination series, as the others that preceded it, showed that the level of demand of the questions and the answers required in the mark schemes, were comparable to Biology in every way.

As would be expected the candidature for Units 2856 and 2866 included candidates resitting from January. This strategy is well informed as it may allow candidates to improve their UMS scores and also helps their preparation for the synoptic elements of Unit 2867 (when taken). This series, however, there was evidence that many resit candidates did not show significant improvement. Teachers may wish to review the arrangements they have in place for supporting resitting candidates.

There was evidence that many of the weaker candidates had significant gaps in their knowledge. This specification is set in a 'real world context' and for that reason, practical procedures, as indicated in the learning outcomes, will be tested on theory papers. Unit 2856 in particular showed that many candidates have confused different practical procedures.

Centres are reminded that definitions should be learned for all the words emboldened in the specification. The OCR endorsed textbook covers these as would any good dictionary of biology.

Teaching tip

Weaker Candidates benefit from high levels of repetition and reinforcement. Starter activities can be used to provide frequent recaps of previously covered material. Key terms and definition can be recapped as matching pairs activities. This activity lend itself to delivery using ILT particularly hot potatoes software www.halfbakedsoftware.com

Understanding the questions

As an Advanced Level Science, Human Biology requires an appropriate standard of literacy, which includes the specialist vocabulary associated with the learning outcomes. The use of command words in questions was not universally understood by candidates. Page 91 of the specification provides a comprehensive glossary of the main command words used in our question papers.

Teaching tip

Encourage candidates to study the glossary on page 91 of the specification. Present data to students and get them to translate the data into prose and to identify trends in the data separately. This will help candidates to see that identifying trends is a different skill to simply reading data.

Sadly, rubrics were often ignored by candidates and commands such as “*give two*” or “*give your answer to the nearest whole number*” were not universally followed. Candidates were not always able to make comparative statements when required to by the questions.

There was a lot of evidence that candidates had not always read the questions properly before answering. Candidates regularly gave responses based on the prompt material rather than the actual question asked. It appeared that they assumed what the question would be rather than what it actually was.

Teaching tip

As this specification is now established there are more past papers available than before. These can be used to help students develop the reading and comprehension skills required. Attention should be given to training students to follow rubrics.

Information, Tables and Graphs

Graphs on the question papers are now drawn on a 2mm graph paper grid. This is to allow candidate to quote figures accurately, with units, from graphs. Candidates would find it useful to use a ruler to draw intercepts on the graph so that they might read the figures off accurately. Candidates regularly failed to read correctly from graphs in 2866 and 2867.

Teaching tip

Teachers would be well advised to practise very basic skills such as reading figures from graphs at regular intervals. Experience has shown the examiners that skills learned during GCSE and AS courses are often missing from A2 examinations.

Mathematical requirements

The mathematical questions in this series were only attempted by approximately 50% of the candidates. In addition to this, the large number of candidates giving incorrect responses indicated that this is not an area of strength for many candidates. Centres are reminded that the specification gives details of the mathematical skills required on page 89. As such, these specific skills are likely to be tested on theory papers at the appropriate level. Candidates are not required to remember complex formulae but are required to be able to use them appropriately.

Teaching tip

Teachers may wish to consider trawling through the past papers and mark schemes available to produce a booklet of mathematical questions, which could be used for individual study and student support sessions. This would give candidates more practice at the mathematical questions and also highlight to them how frequently they appear and the importance of being able to attempt them.

Presentation

The standard of presentation is not assessed generally when marking Human Biology papers. However, this session produced a higher than usual number of examination papers which were very hard to read. The Quality of Written Communication (QWC) mark for spelling, punctuation and grammar requires the answer to be legible and this mark is lost too frequently. The Examiners try extremely hard to decipher such papers but the risk to the candidate is obvious.

In particular, scripts where the candidate has written an extra line inbetween every dotted line are especially difficult to read. Diagrams and flow charts are acceptable parts of a candidate's response but should always be annotated. This examination series showed that some candidates are not able to distinguish between equations and flow diagrams and consequently lost marks. An example of this was from Unit 2856, where processes occurring in blood clotting were presented as equations e.g. thromboplastin + prothrombin \rightarrow thrombin. Bullet points in answers are acceptable, but the meaning of what is written should be clear and grammatically-correct sentences should be used.

The language of written responses for the longer questions at times led to candidates failing to score marks. Examiners can only give credit for what is presented to them. It is therefore important that candidates can communicate their ideas in writing. Although Examiners are aware that Centres are continually aiming to develop their candidates written communication skills, it is still an area of weakness and should be given due attention in the delivery of this course.

INSET

OCR is offering a programme of in-service training for teachers on the delivery of the specification, during the Autumn 2006 and Spring 2007 terms. The booklet containing details of these INSET courses arrived in Centres during the Summer term 2006. This booklet contains full details of the courses listed below and is available from the web at http://www.ocr.org.uk/Data/publications/training_booklets/Training_B2683.pdf Alternatively further information may be obtained from the OCR website (www.ocr.org.uk) or by telephone on 0121 628 2950. A summary of the courses offered are given below.

Human Biology INSET Programme 2006-2007

- **OCR AS Level Human Biology (3886): Get started – successful first delivery: 3rd and 5th October 2006**
- **OCR A2 Level Human Biology (7886): Get started – successful first delivery: 16th and 22nd January 2007**
- **OCR AS/A Level Human Biology (3886/7886): Get ahead – getting the coursework right: 14th November 2006 and 10th January 2007**
- **OCR AS/A Level Human Biology (3886/7886): Get ahead – improving candidate performance: 18th February 2007**

2856 Blood, Circulation and Gaseous Exchange

General Comments

Candidates achieved a wide range of marks for this paper. It was pleasing to see that even where candidates were struggling, there was good evidence of knowledge and understanding which indicated an interest in the subject. Candidates who scored low marks overall often scored highly on some questions and many centres have clearly done an excellent job preparing candidates of lower ability to be able to access many of the questions on this paper. The average marks scored for this paper were lower than in previous sessions and the detailed comments on questions 2 and 3 may help to explain this.

Any science paper will involve dealing with data. Clear understanding of the difference between the words 'describe' and 'explain' continue to be a problem for many candidates, as are the calculations. Examiners commented that the word trend did not seem to be understood by large numbers of candidates

Teaching tip

Teaching interventions that aim at teaching the meaning of the command words used in exams and what they require of candidates would clearly be beneficial for many candidates. A matching activity of words descriptions and "what I need to do to get the marks" could be devised to meet this need.

Comments on Individual Questions

Q.1 This question was intended to be a question on a familiar topic which was accessible to candidates. Though few candidates scored few marks and in many cases candidates did not answer fully enough to earn all the marks available.

(a) **(i)** Many candidates correctly identified the two cells and scored both marks. The commonest error was to refer to the epithelial cell simply as an alveolar cell.

(ii) The examiners found that candidates were mostly able to explain that surfactant prevents the alveoli sticking together but did not explain fully in terms of surface tension so were unable to obtain more than one mark

(b) **(i)** Candidates either identified both changes and scored the mark or only responded with a single change such as it becomes more frequent and so did not score.

Teaching tip

Candidates need to practise describing data and identifying differences and trends. Use as many past papers as are available to expose candidates to as many different presentation of biological data as possible

(ii) The examiners were pleased to find the majority of candidates been clearly familiar with spirometer traces and giving the correct response.

(iii) Low level responses such as use a clean mouthpiece or use sodalime did not earn credit. Examiners were looking for a more sophisticated response or qualification of a more basic response. Responses such as “ensure the soda lime cannot be inhaled” were credited

(iv) Unfortunately most candidates did not correctly interpret the question. It appear to examiners that the main reason for not doing so was a lack of reading skills. Most candidates answered in terms of cycling and exercise and its effect on breathing rather than the simple fact that human use up oxygen and the carbon dioxide we produce is absorbed by spirometers.

Q.2 Candidates did not appear to be expecting a question on water and perhaps would rather have answered a question on carbohydrates, lipids or proteins. The responses to this question and the next were largely responsible for a lower average mark on the question paper than previous sessions.

(a) **(i)** Most candidates correctly gave the dissolving of substances in water as a response. Very few however actually linked this to the transport of dissolved substances in a named body fluid. Alternative approaches were few and far between.

(ii) The concept of sweat evaporating causing cooling was well understood by candidates but most were unable to provide further detail and many simply rewrote material from the stem as their justification.

- (b) (i) The principal examiner fondly expected to see responses along the lines of “the average kinetic energy of water molecule present in a solution.” Candidates did not show any rehearsed responses to this question, which may indicate that the teaching of this particular section of the specification could be emphasized a little more.

Teaching tip

Teachers are advised to use the main textbook for this specification. However for topics such as water potential where exposition is more effective than written information teachers are advised to use their own materials.

- (c) Surprisingly candidates that had not score in sections (a) and (b) often scored a mark here. Examiners were pleased that the majority of candidates clearly understood the effect of solute on water potential.

Q.3 This was possibly the least accessible question on the paper. Examiners attempted to credit as many valid responses as possible but many candidates scored very few marks on this question.

The specification clearly outlines all the techniques that candidates should be familiar with. Previous examination papers have tested several of these and in general candidates have answered them well. This question was not answered well by the majority of candidates. It appeared that candidates were simply not familiar with a technique for measuring haemoglobin concentration. A reasonable proportion of candidates produced some strange hybrid answers that contained aspects of several techniques used in human biology! However candidates that have prepared well often scored full marks on this question

Q.4 Most candidates achieved some good marks on this question and interpreted the graph well.

- (a) There were many good responses to this question although one common and disturbing error was seen by examiners. Several candidate explained that one circulation was to the lungs and head and the other circulation was to the organs and legs.

(b) The majority of candidates correctly identified the two vessels.

- (c) The number of incorrect responses indicated that presentation of the information was unfamiliar to most candidates. The more able candidates usually obtained four marks here so the question appeared to

discriminate well.

- (d) Many candidates correctly understood the idea of the rapid heart rate maintaining the flow of blood. The redistribution of blood away from the skin was less well understood and the detail of vasoconstriction not clear at all. In a module with a reasonable number of resitting candidates it was disappointing not to see more responses with detail of vasoconstriction or vascular shunting in them.

Q.5 Candidates showed very good knowledge of blood clotting but were less clear on the nature of enzyme inhibition.

- (a) The majority of candidates were able to name a white blood cell however a few gave "leukocyte" as their response.
- (b) Scores varied from 0 to 5 for this section. There were many excellent responses that scored all five marks with a two or three well worded sentences. Some candidates failed to understand that aspirin binds to the enzyme and instead gave responses where aspirin bound to the substrate. In general candidates knowledge of enzyme inhibition appeared patchy and teachers would be advised to make sure this area of the specification is adequately covered.
- (c) The examiners all reported that the majority of candidates gave excellent answers. Common error however included inappropriate flow diagrams that used equals signs and confusion of the words thromboplastin and prothrombin.
- (d) Although candidates were able to explain the role of aspirin well they were less able relate this to the context required by the question.

Q.6 This question produced a full range of responses with the more able candidates scoring very highly.

- (a) There were many good definitions given. It was noted by examiners that many candidates were unable to recall a definition that was creditworthy. The ability to define key terms is regularly tested and candidates should be prepared for these type of questions.
- (b) Most candidates were able to describe trends though weaker candidates tended to simply translate the data to text without identifying any trends in the data.
- (c) (i) The examiners found that the ability of candidates to perform calculations was not good. Many candidates failed to understand the OCR rubric that answers should be given to the same degree of

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accuracy as the data provided unless stated otherwise. As has been reported in previous sessions some candidates are still sitting the exam paper without a calculator.

(ii) The effect of training on heart muscle is reasonably well understood though few candidates used the technical term hypertrophy in their responses.

(iii) Most candidates were able to give two valid reasons why the data were not reliable for drawing conclusions from.

2857: Growth, Development & Disease

General Comments

This paper produced a wide range of marks and provided a positive examination experience for the majority of candidates. The questions were straightforward and each question was well answered by at least some centres.

A number of candidates are still failing to describe and explain trends shown by graphical presentation of data and opportunities to teach and practise this skill need to be identified and incorporated into schemes of work.

Candidates are still experiencing difficulty in calculating percentages and this was reflected in many poor responses to **Q.2(a)iii**.

Comments on the Individual Questions

Q.1 Many candidates were able to score almost full marks on this question but rather more lost marks by failing to describe how X-rays detect cancers of the breast.

(a) The majority of candidates scored full marks on this question and were able to correctly identify the genes which control cell division as proto-oncogenes or repressor genes. A small number of candidates were confused and gave oncogenes which was not allowed since these genes result in loss of control of cell division. A small number of candidates stated that 'proto-oncogenes keep dividing' which was not allowed.

(b) Almost all candidates were able to state that there is a loss of control of cell division in cancer cells but many didn't go on to state that the cell keeps on dividing or divides more rapidly and so were limited to one mark. Some candidates stated that the proto-oncogenes keep dividing instead of the cell.

(c) There were many correct answers but some candidates gave risk factors for other types cancers such as exposure to UV light instead of stating factors that increase the risk of breast cancer.

(d) There were some good answers but many candidates did not know the detail of how X-rays produce an image of the breast and went on to name and describe

Teaching tip

After teaching the topic ask students to complete a table summarising the different ways (ultrasound, X-ray, thermography, PET scan, MRI scan) of detecting cancer. Include in the table: name of technique, description of technique, explanation of how it detects cancer, type / stage of cancer it is used for, advantages and disadvantages.

Q.2 Some candidates scored almost full marks on this question but some lost marks because they could not describe trends in the data and failed to correctly calculate the percentage increase in mean weight.

(a) (i) There were many clear descriptions of trends but some lost marks because their answers were either not specific (e.g. 'There is a correlation.') or the comments referred only to the data at one age (e.g. 'They weighed the same at age 8.')

(ii) The majority of candidates scored well on this question by referring to early puberty, early growth spurt and the development of breasts, hips or fat reserves.

(iii) There were a number of correct answers but many had no idea how to calculate the percentage increase in mean weight. Others misread the figures from the graph or failed to give the answer to the nearest whole number.

Teaching tip

Teach students how to describe trends in shown by graphs. Select appropriate data and ask students to work in pairs and write down trends that can be seen in the data. Let one pair at a time write one trend on the board. Let class discuss whether this is a trend and how the wording can be improved to describe the trend more clearly. Ask students to suggest reasons for the trend. Follow this by giving students a second set of data to individually describe and explain the trends shown by the data.

(iv) Many candidates scored full marks on this question and correctly suggested that less exercise, eating more fast foods and more food with a high fat content may account for the increase in mean weight of boys and girls between 1994 and 2002. A few candidates misread the question and suggested reasons for the increase in weight with age.

- a. Most candidates correctly stated height or length as a means of measuring infant growth but a few confused infant growth with foetal growth and incorrectly suggested crown- rump length or biparietal diameter.
- b. There was a very mixed response to this question across the ability range. Some candidates scored full marks by stating that the weight of a child would be measured in kg at two different times, the increase in weight calculated and the relative growth rate calculated by dividing this increase by the starting weight. Many candidates were confused, they didn't know what was meant by relative growth rate and went on to calculate mean weights and compare them to standard growth curves, which was not what the question asked for.

Q.3 Most candidates scored well on this question. Some candidates produced above the maximum marks and described all aspects of the factors involved in the prevention and control of HIV / AIDS in detail.

(a) Almost all candidates scored one mark for describing the use of blood tests. Some went on to state that the test checks for antibodies against HIV and a few referred to the HIV antigen test.

(b) (i) Most candidates correctly identified the region but a few did not look at the information and just stated Africa which was not specific enough to gain the mark.

(ii) It was pleasing to see that a increasing number of candidates understand that the population number is needed to make a comparison between regions and so gained this mark.

(c) This was well answered by most candidates.

The good answers included descriptions of biological, social and economic factors and linked these to how they may be involved in the prevention and control of HIV infection.

A few candidates focused their answers on just one of the three categories of factors and so restricted the number of marks they could be awarded.

Most candidates gained the QWC mark for quality of spelling, punctuation and grammar.

Teaching tip

Prepare cards each with a different statement about how HIV / AIDS may be prevented or controlled. Ask students what they understand by social, economic and biological factors and then ask them to sort the statements into these three categories. Follow this up by asking students to list 8 factors (at least two from each category) and explain in detail how each factor prevents or controls the spread of HIV / AIDS

4 This question was answered well across the ability range but very few candidates gained full marks.

A small number of candidates didn't read the question carefully and

(a) Almost all candidates correctly stated substitution as the type of mutation shown in Fig. 4.2.

(b) Almost all candidates correctly identified the amino acid as Leu(cine).

(c) Many candidates stated that type of mutation is called an insertion that it leads to a 'frame shift' and results in the second codon being changes to UAA which codes for stop. Some candidates went on to say that this would result in the polypeptide chain not being produced. A few candidates incorrectly stated that a different polypeptide chain would be produced.

A small number of candidates did not refer to Fig. 4.2 and gave a general description of the effect of mutations on the protein synthesis which did not gain any marks.

(a) There were some good answers to this part where candidates stated that the genetic code was degenerate and each amino acid may be coded for by more than one codon, so that a change in one base may result in a different codon that codes for the same amino acid. However many candidates

either used the term degenerate inaccurately, stating that the bases or amino acids were degenerate

or were confused and not able to describe the links between mutations and effect on the function of a protein.

Teaching tip

Improve students' examination technique by practising answering questions which have three or more marks. Let students work in twos or threes to answer questions and get them to feedback their answers to the class. Ask the class to say how many marks they should have for the answer and to suggest what they could add to the answer if they have not got full marks.

Q.5 Many candidates scored almost full marks on this question but some lost marks through lack of knowledge and understanding of the topic.

(a) Most candidates were able to state that an infectious disease is passed from person to person but many did not go on to state that it is caused by a pathogen (bacterium or virus).

(b) (i) Very few candidates gained marks on this part. Candidates confused the problem in controlling the disease tuberculosis with how drug resistant forms of the TB bacterium develop. Many candidates did not distinguish between the disease and the bacterium causing the disease.

Examiners expected candidates to state that MDR-TB cannot be cured because the usual antibiotics no longer kill the TB bacterium and therefore a lot of people die from it. A small number of candidates incorrectly thought TB was caused by a virus.

Teaching tip

Separate the teaching of how bacteria develop resistance to antibiotics from the problem with drug resistant forms of the disease. Give students sets of statements and ask them to say whether each statement is about the bacteria or about the disease.

(ii) Most candidates had little difficulty with this section and provided accurate answers.

(c) A pleasing number of candidates made the connection between plant

biodiversity in the rainforest and the potential for obtaining drugs / medicines. Some candidates linked this to the development of new vaccines and antibiotics.

(d) Some good answers which linked the need to use wood from trees or land for farming to the destruction of the rainforest with loss of habitats / biodiversity and possibly contributing to global warming. However, many candidates failed to gain marks by not reading the question carefully and either writing at length about the use plants for medicine or giving very vague answers about robbing the atmosphere of oxygen.

Q.6 This question was quite discriminating. Some A grade candidates gaining almost full marks whereas lower attaining candidates often only scored one or two marks.

(a) Most candidates showed a good understanding of the nature of stem cells and scored full marks on this section.

(b) Many candidates had difficulty in scoring three marks on this question. Examiners expected candidates to suggest that the donated adult bone marrow stem cells may enable bone growth by dividing and differentiating into new bone cells to replace damaged bone.

(c) (i) Hardly any candidates (including A grade candidates) gained this mark. Candidates didn't know that donated cells would be targeted specifically by T lymphocytes. Many candidates put B and T lymphocytes or gave a list of several different leucocytes.

Teaching tip

Recognise that this topic is difficult and complex. Take every opportunity to define and use key terms. At the end of the topic encourage students to present a summary of what they need to know by producing a poster to include antigen presentation, role of B cells, role of T cells and role of memory cells. Assess students' level of understanding internally and go over misconceptions.

(ii) Many candidates answered this well by stating that memory cells remain in the body for a long time and if the same antigen / pathogen enters the body a second time they create a faster immune response and antibodies are produced more quickly. However some candidates didn't gain any marks because they failed to use the correct scientific terms.

2858: Case Study

General Comments

Yet again, the examiners were impressed by the quality of some of the responses seen, particularly those which demonstrated evidence of additional research based on the case study. This was particularly evident in Question 2 – parts b and g. Candidates were obviously familiar with the technique of using the sphygmomanometer – although they were less confident with the spelling. The examiner recorded 19 different ways in which this was spelt. The question on bronchodilators elicited some excellent descriptions of named drugs and the mechanism whereby the nebuliser operates. There were also some excellent descriptions of the events leading to cancer formation and good candidates were able to describe the functioning of the immune system in the context of cancer cells rather than in terms of infectious diseases and pathogens.

However, those questions dealing with the more fundamental biological content proved difficult even for some otherwise good candidates. It was not unusual to see candidates who could only give 2 differences between plant and animal cells (Q1a) or who incorrectly identified structures such as mitochondria or even cytoplasm and nucleus as being present in one type of cell but absent from the other. Protein synthesis is a difficult area and this proved to be a very discriminating question as did the question on emphysema (Q2f). The examiners were surprised how few candidates answered in terms of loss of elasticity and its effect on recoil and good descriptions of the action of neutrophils and elastase tended to be centre specific with too many candidates referring to cilia damage and excess mucus production as the main problem. The examiners were intrigued by descriptions of the bronchodilator ‘smoothing the muscle’. Clearly candidates are being exposed to terms such as ‘smooth muscle’ but the relevance of this type of muscle as distinct to cardiac and skeletal muscle is not clear to them.

Teaching Tip

Students will come across all 3 muscle types in the Blood Circulation and Gas Exchange module. Encourage them to always stipulate which type of muscle they mean. An interesting discussion can be had on the diaphragm and intercostals muscles – why are they voluntary rather than involuntary?

Most candidates completed the paper in the allocated time. Most scored better on Q1 than Q2.

Comments on Individual Questions

Q.1

- (a) This question was designed to be accessible to virtually all candidates and is covered at GCSE but a surprising number of candidates failed to gain full marks. Most answered in terms of chloroplast, cell wall and vacuole and there were some interesting observations such as the absence of lysosomes in plants.
- (b) As the question specified 'other than plant extracts', homeopathy was not accepted as an answer but the examiners were impressed by the range of complementary and alternative treatments suggested. Acupuncture and reflexology were the commonest correct answers with chemotherapy being the most frequent incorrect answer.
- (c) (i) The examiners were impressed by the number of correct responses to the calculation. The figures were taken straight from the case study which possibly indicates that this question was 'spotted' and rehearsed. However, a surprising number of candidates, having completed the calculation correctly, either did not round to the nearest whole number or rounded down to 312 despite the answer being 312.57. A number of candidates clearly did not have calculators.
(ii) Again, the examiners were impressed with the well considered responses to this question. Many picked up well on the concept of reliability and answered in terms of non standard methods, 'people use lots of different therapies and they might be using normal treatments as well', or lack of controlled trials, 'people might have different life styles'. Many students pointed out the 'placebo' effect might mean that people say they are better but.. this is difficult to measure scientifically'. Weaker candidates referred back to the case study, frequently quoting directly that only one trial had been found to be reliable or that only 453 people had tried the therapy and these answers were not accepted.
- (d) (i) Questions on the detail of protein synthesis are always demanding and this was no exception. There was much confusion between transcription and translation, codons and anti-codons, mRNA and tRNA. The examiners were looking for an indication that candidates were aware that the ribosome is where the tRNA/amino acid complex are held, that the ribosome structure allowed two molecules of tRNA at a time, that the amino acids were joined on the ribosome and that the ribosome 'reads' the mRNA molecule by moving along it and that this was translation. Other marks were available, for example, for an awareness of the role of complementary base pairing but, while the terminology was evident, only good candidates were able to give a coherent account. Weaker candidates contented themselves with repeating that this was where protein synthesis happens or, worse, where amino acids are made. There was some confusion apparent between the role of the golgi apparatus and the role of ribosomes.

- (d) (ii) This question was designed to be demanding and was probing the students understanding of the role of proteins in the cell and hence why, if they were missing, cells might die. The examiners were delighted by the quality of some responses. 'Carrier proteins on cell membranes help substances in and out of cells. If this doesn't happen the cell cannot survive.' Other candidates identified the inability to make enzymes or that the proteins were needed for a structural purpose with the cell. However, most candidates did not make the link between protein **role** and cell death and answered in terms of cells not having enough protein or not being able to divide.
- (e) (i) The majority of candidates gave bone marrow as the correct response. Some candidates gave a location for macrophages rather than the origin – a case of not reading the question. Some centres had clearly been taught in terms of red bone marrow and yellow bone marrow. Yellow or white bone marrow is mainly adipose tissue. It is the red bone marrow which contains the myeloid and lymphoid stem cells which give rise to all the blood cells.
- (ii) The structure of the answer space allocated for this question did not help students to structure a comparison of the two cell types which is what the examiners intended. Many candidates simply wrote four facts about the respective cell types. If these were correct, then full marks were given and good answers were seen which referred to their structure (bean shaped nucleus/large, round nucleus) or their function (phagocytic/produce antibodies/memory cells). Other correct responses made reference to antigen presentation (macrophages) or T and B cells (lymphocytes) or noted size differences. Some candidates clearly confused macrophages with neutrophils and it was not uncommon to see references to lobed nuclei.
- (iii) The examiners were pleased with the response to this question with the majority of candidates being able to give an excellent account of how cancer develops. With an internal maximum of 4 marks on this part of the question, many candidates scored maximum marks Weaker candidates referred to proto-oncogene and oncogene 'cells'. It was less common to see full marks on the role of lymphocytes in preventing the development of cancer. Weaker candidates described cancer cells as infective agents or oncogenes 'infecting' other cells and there were few good descriptions of recognition by the immune system of the antigens on cancer cells. Some candidates described the whole response in terms of a pathogen. Even here, some candidates referred to HPV and cervical cancer and were given credit. There were many excellent descriptions of the role of B cells, T killer cells and T helper cells and some candidates were credited for commenting on the effect of HIV with cancer being an 'opportunistic infection' in the case of Kaposi's sarcoma.

Q.2

- (a) The early warning chart was included in the pre-release material and most candidates used the chart and calculated the score correctly for part (i). Parts (ii) and (iii) were generally done well but see the comments on spelling in the general comments above. It was obvious from answers to part (iv) that many candidates had indeed taken a pulse and there were some excellent answers including those which explained why you had to use fingers and not the thumb. Weaker candidates described the measurement of blood pressure or simply said 'use a stethoscope' with no further amplification. None standard methods of obtaining a heart rate were credited if detail was correct. Some candidates described how heart rate is calculated from known cardiac output and stroke volume – again a case of not reading the question.
- (b) In part (i) the examiners were looking for the candidates to refer to the cuff pressure line on the graph to obtain the readings for systolic and diastolic pressure. Most candidates correctly gave the systolic reading as between 118 and 120 mmHg. The last sound would have been heard at 82mmHg. However, the examiners accepted any figure between 78 (the bottom of the peak) and 82mmHg. It is reasonable assume that the practioner would not know exactly when the last sound

occurred until no more further sounds were heard and hence allowing this range was justifiable.

(ii). This question proved to be the most difficult question on the paper. Many candidates failed to answer the question in terms of blood flow despite this being the question. Many contented themselves with description of the Korotkov sounds and even these were confused with the 'lub dup' sounds of the heart valve.

Marks were available for linking the sounds to blood flow, for correct figures from the graph and for commenting that the systolic pressure was due to ventricular contraction. Some candidates answered in terms of blood pressure decreasing with the sounds.

- (c) This was answered well by the majority of candidates although answers of 'more than 100' or 'thousands' indicated a considerable amount of guessing. There was some confusion apparent with the term 'molecule' with this being confused with atoms. Some candidates correctly wrote 4 O₂ and then gave the answer as 8.
- (d) The most common mistake on this question was to confuse haemoglobin with red blood cells and talk about the 'sickling' effect. However, a pleasing number of candidates referred to bonds in the tertiary structure being broken. Ionic and hydrogen bonds were accepted but not disulphide and a number of candidates did list all the bonds in tertiary structure. The application of the word 'denature' to haemoglobin was very pleasing as this is normally covered in teaching in the context of enzymes. However, some candidates then switched into 'enzyme' mode and started talking about the active site changing shape which was rejected.
- (e) The examiners were surprised at the variable responses to the two abbreviations as both were in the case study. Most students were able to identify Chronic Obstructive Pulmonary Disease (or Disorder), although the word 'coronary' was a common error. Far fewer knew Peak Expiratory Flow Rate and there were some imaginative guesses; 'Police Eat Fried Rice' being one!
- (f) It was gratifying when candidates were able to describe the role of neutrophils and the production of elastase and subsequent destruction of the elastic fibres but detail such as this was very centre specific. However, surprisingly few candidates went on to explain the effect of elastic recoil and therefore that exhalation would become an effort. Far too many candidates answered in terms of excess mucus production and destruction of cilia.
- (g) The term 'bronchodilator' appeared in the case study and weaker candidates simply quoted from the study that this would 'get the airways back to normal'. The case study is a prompt and requires interpreting in terms of the contents of the specification and detailed knowledge of the structure of the gas exchange system is required in the specification. This was the level of response expected of the student. Marks were available for correctly used terminology such as 'lumen' and 'smooth' muscle (see introductory remarks). Some candidates referred to steroids and their effects in reducing inflammation. The role of the bronchodilator is to widen the lumen of the airways such that the steroid can get in. The examiners were pleased to see some excellent descriptions of a nebuliser and named bronchodilators and, as always on this paper, credit was given for evidence of further research.

2866 Energy, Control and Reproduction

General Comments

The examiners were pleased by some of the high quality responses seen on the examination paper for this session; it was evident that many of the candidates had engaged clearly with the subject material and a significant number of answers contained an exceptional level of detail. There is obviously first class teaching going on in some centers and these teachers are to be congratulated for the enthusiasm and interest they are generating in their students.

There was no evidence that candidates had struggled to complete the paper in the allotted time and it was pleasing to find very few questions that had not at least been attempted by candidates.

Unfortunately, it was noticeable that the level of literacy continues to cause very real problems for a number of candidates. Not only are these candidates forfeiting the marks for the Quality of their Written Communication, but they are also losing marks for poor wording and incorrect usage of scientific terminology. At A2 level, it is expected that a reasonable level of clarity should be achieved when explaining scientific ideas and phenomena.

Comments on Individual Questions

- Q.1** This question seemed to prove more challenging for some of the less able candidates than was anticipated. There was evidence of considerable confusion about the biology of twin pregnancies and even able students appeared to find it difficult to explain the value of epidemiological data in this context.
- (a) (i) Very few candidates failed to score the mark for this section. One or two scripts merely stated 'ultra-scan', which was not credited. A minority of candidates stated 'using an ultrasound scan, two heartbeats would be detected', which was an excellent response.
 - (a) (ii) Answers to this part of the question were relatively poor. Many candidates did not appear to understand the significance of there being twins initially *identified* (for example at an ultrasound scan), and answers frequently referred to a very early stage of pregnancy with the use of words/phrases such as two 'fertilized eggs' or 'zygotes'. The various incorrect reasons suggested for the subsequent disappearance of one of the twins ranged from 'not implanting' to 'vanishing' or 'dissolving'.
 - (a) (iii) A pleasing proportion of candidates scored both the marks for this section by citing the rarity of more than one oocyte/egg being released at once and the rarity of zygotic splitting. It was apparent from a number of answers that some candidates think twins arise by more than sperm fertilizing an egg. Some candidates opted to write about the idea of uterus is not being designed for multiple pregnancies, which is a perfectly valid point, but these responses were not credited if the wording was too vague e.g.; 'the womb isn't big enough' or the 'the uterus can't feed two babies'.
 - (a) (iv) Many candidates scored both the marks here for stating the increased use of fertility treatments such as IVF where more than

one embryo is inserted into the uterus. Some candidates failed to score the marks as they simply stated 'fertility treatments' or incorrectly state that 'more than one egg is inserted'.

A significant number of answers focused upon the idea that the gene for twins is becoming more common, which was not considered worthy of credit.

- (b) (i) Fewer candidates scored both marks for this section. The examiners were looking for understanding that identical twins are genetically identical, but that non-identical twins share some genes in common. Frequently candidates simply stated that 'identical twins have the same genes, but non-identical ones do not', thus only earning one mark.

The point about the allergy being (at least partly) genetically controlled was stated by very few candidates.

A significant number of responses stated reasons such as 'identical twins have weaker immune systems'.

- (b)(ii) A disappointingly small proportion of candidates scored marks on this section. Many candidates confused epidemiology with dermatology.

A large number of responses contained rather vague statements such as 'to get more reliable data' or 'to make the information more accurate'.

Q.2

This question was generally well answered. The extended writing question in particular showed evidence of detailed recall and understanding of the sliding filament theory by many candidates.

- (a) (i) There were some excellent responses to this part of the question. Some candidates described changes taking place in the *muscle*, rather than the fibres, so that points such as increased capillarisation were not relevant.
- (a) (ii) Most candidates scored two of the three marks here for explaining that these fibres respire anaerobically and produce lactate. A surprisingly few responses mentioned the resynthesis of ATP using CP.
- (b) Labelling the sarcomere was a straightforward task for many candidates. The most common errors were labelling zones rather than filaments (zones on a sarcomere would be indicated using a bracketed area rather than a single label line).
- (c) The examiners saw a pleasing number of full marks for this section, with a few outstanding answers that met 14 of the available marking points. Many candidates wasted time and space by describing events in the neurone and sarcolemma from the receipt of an action potential.

The mark here for the Quality of Written Communication was for the use of specialist terms in particular and was awarded more often than

Teaching Tip

There are many excellent animation of muscle contraction available freely on the internet. Try searching using <http://www.altavista.com/video/default> as this will search only for video clips.

- (d) It was rare for candidates to score full marks here. Most scored one for mentioning increased protein intake, but failed to qualify this statement in sufficient detail to earn another mark. The use of steroids was not credited as a marking point as these do not constitute part of a diet. Many candidates wrote about increased carbohydrate intake, but incorrectly referred to carbohydrate *loading*, which is associated with endurance events such as marathons rather than the weight training undertaken by body builders. Carbohydrate was credited if linked either to providing energy for muscle growth, or to allowing training to continue for longer.

Minerals such as iron and calcium were rarely mentioned or their importance qualified when they were.

Q.3

Some candidates clearly enjoyed answering this question and achieved high marks on all sections. Others really seemed to struggle to access even the easier parts and the examiners saw some very muddled responses. It seems that the nervous system is a topic less able students find disproportionately difficult.

- (a) Good responses here showed knowledge of uni-directional transmission and the passage of impulses from one neurone to another.

Weaker responses stated 'joining nerves' or 'allowing messages to cross from one neurone to the next'. A small number of candidates thought the function of the synapse was to speed up transmission of action potentials.

- (b) (i) This section was generally well answered.
(b) (ii) There were a large number of detailed, clearly written answers here.

Sadly a significant number of candidates wrote very muddled accounts, often wrongly stating that the vesicles move across the cleft, or that the vesicles contain the calcium ions.

Candidates should be encouraged to write *synaptic cleft*, rather than synapse, when this is what they are referring to.

- (c) (i) Some candidates thought acetylcholinesterase was the neurotransmitter and thus did not gain credit for explaining its importance at synapses. Those candidates that recognised its role as an enzyme to break down the neurotransmitter tended to score well, but a common error was to state that acetylcholine was broken down into *acetyl* and choline.
(c) (ii) This was intended to be a more challenging question, but the examiners were surprised how difficult the majority of candidates appeared to find it. Of the candidates who suggested some form of enzyme inhibition, many lost opportunities for marks by using vague language to describe the mechanism of enzyme inhibition. Candidates continue to state incorrectly that a competitive inhibitor has the *same* shape as the normal substrate.
(d) (i) Few candidates failed to score the mark here.
(d) (ii) The target grades for this part of the question were high ones and it was pleasing therefore that so many candidates scored at least one of the available marks. The mechanism of pain relief by diamorphine is a complex one and teachers are to be congratulated on the clear way in which some of their students have understood this process

and were able to use the information in the question to suggest a plausible explanation.

Q.4

Many candidates scored poorly on this question, achieving marks only on the final part.

- (a) (i) About half of candidates achieved the mark here for mentioning diffusion, but relatively few went on to give detail about the formation and dissociation of carbonic acid. A significant number of responses attempted to give an outline of the entire biochemistry of respiration.
- (a) (ii) Very few candidates managed an adequate definition of the term receptor to earn the mark for this section. Teachers are reminded that terms in italics in the specification are required learning and are likely to be tested in this manner.
- (a) (iii) This part of the question was intended to be more demanding and it was thus not surprising that most candidates found it difficult. The responses generally indicated a lack of understanding of the term *inhibition* (as read from Fig. 4.1) in this kind of feedback system.
- (b) This part was surprisingly poorly answered by many candidates. The majority of answers focused upon the effect of excess hydrogen ions attaching to haemoglobin, thus preventing it from carrying oxygen, instead of upon the increase in acidity of the blood and the effect of this upon enzymes.
- (c) A pleasing number of candidates scored full marks for this section.

Q.5

The majority of candidates seemed to enjoy this question and find the material it contained quite accessible.

- (a) (i) Most candidates read correctly from the graph to produce the correct response for this part of the question. A few incorrect responses arose due to candidates reading the data for the UK rather than for the Philippines, or from failing to add the word million (or requisite number of noughts) after the number 26.
- (a) (ii) The majority of candidates could correctly calculate the percentage requested, although a significant number failed to round up to the nearest whole number as demanded by the question and thus lost one of the marks.

A few candidates had clearly been expecting to calculate a percentage change and tried to answer the question in this way.

- (b) The examiners saw a large number of high quality responses to this very accessible extended writing question. Given the straightforward nature of the question it was a shame that so many candidates merely described the pattern of the data from the graph without attempting an explanation for the differences seen between the UK and the Philippines.

The mark for the Quality of Written Communication here focused upon spelling, punctuation and grammar and the examiners found it difficult to justify awarding this in many cases. Commonly candidates spelt Philippines incorrectly, failed to begin new sentences with capital letters or to indicate punctuation of any kind.

- (c) It was evident from some of the answers to this section that candidates had some understanding of the two agricultural systems, but marks were commonly lost as comparative points were not made.
- (d) This section was very straightforward and nearly all candidates scored both the available marks.

Q.6

Most candidates were able to access parts of this question and the examiners say some very detailed answers indeed.

- (a) (i) The Graafian follicle was generally correctly identified as structure B. The germinal epithelium was correctly identified as structure A by about half of candidates.
- (a) (ii) A large number of candidates confused the Graafian follicle with the oocyte and wrote about its release and travel along the oviduct after ovulation.

There were, however, some very clear explanations of the formation and role of the corpus luteum also seen.

- (b) (i) Candidates often had the right idea about cancer having something to do with cell division, but failed to earn the mark as they simply stated that cells in the ovary 'divide'. This is true of most cells in the human body and the examiners were looking for the idea of much or frequent division taking place in the ovarian tissue.
- (b) (ii) This section was answered very well by nearly every candidate, despite the fact that it was using applied knowledge.

Credit was not given to explanations of thermography as an appropriate method of detecting ovarian cancer as the ovaries are too deep within the body core to give a differential temperature reading of a tumour within them.

A significant number of candidates wrote of treatment consisting of a hysterectomy, without qualification and the examiners did not consider this worthy of credit.

- (c) Many candidates scored one of the three available marks here, frequently for stating that cancer has many causes or that there are many different types of cancer. Relatively few responses mentioned the ethical impossibility of human experimentation to establish causation or showed an appreciation of correlation over cause and effect relationships.

2867 Genetics, Homeostasis and Ageing

General Comments

There was a much wider range of marks for this paper, at both ends of the distribution range, when compared with the June 2005 paper. It was pleasing to see that even where candidates were struggling, there was good evidence of knowledge and understanding which indicated an interest in the subject.

The Examiners are hopeful that each candidate was able to demonstrate some positive achievement. There were fewer blank spaces on the paper this year, which made it possible to credit positive achievement more effectively. However, a worrying number of candidates had handwriting which was very difficult to read.

Any science paper will involve dealing with data. Understanding the difference between the words 'describe' and 'explain' is a problem for many candidates. Many candidates also struggle with the calculations.

Teaching tip

Candidates should be encouraged to practise a wide range of calculations including calculations on magnification, actual size, percentages and percentage increase.

Sixty marks on this paper are available for synoptic questions. These questions include over-reaching skills such as calculations and statistics, as well as questions using facts, principles and concepts from Modules 2856, 2857 and 2866. Candidates are expected to apply these facts in the context of the content for Module 2867.

Teaching tip

Whilst studying module 2867, candidates should be encouraged to access relevant material from previous modules and to make a note of it. It is easier to do this if either summaries have been made of previous modules as the learning outcomes are covered, or if candidates are encouraged to use spider diagrams to indicate the synoptic knowledge applied to the topic from 2867.

The topics included in this module are themselves 'over-reaching' and cannot be adequately understood without using material learnt in previous modules. However, candidates frequently fail to spot questions which require synoptic knowledge or to be adequately familiar with the relevant synoptic topic.

Teaching tip

Another useful technique is to encourage candidates to go through previous papers and to flag up questions where they think that synoptic material is required. They can then be given access to the mark scheme to check for themselves the information that could be included in the answer.

Comments on Individual Questions

- Q.1** Marks on this question ranged from zero to full marks. This, as usual, was intended to be a question on a familiar topic which was accessible to the candidate. However, candidates found some sections on this question very difficult, particularly those which contained calculations and biochemistry. The question on the symptoms of diabetes mellitus scored most marks.
- (a) (i) Many candidates found the calculation of magnification very difficult. Of those with the correct method, many got the decimal point in the wrong place whilst a few did not obey the instruction to give the answer as a whole number.
- (ii) This question was answered correctly by many. The most common incorrect answer was to refer to *enzymes*, (which were shown on the diagram), or to use imprecise language e.g. stating that hormones were secreted into the blood without indicating *directly* into the blood or without a duct.
- (iii) Many candidates scored full marks for this part of the question and all marking points were seen. There were some incorrect answers implying the involvement of the hypothalamus. As the terms are very similar, accurate spelling of the words 'glucagon' and 'glycogen' was essential to earn the marks.
- (b) Many candidates scored two or three marks. A significant number however, concentrated on the structure of the glucose molecule rather than why it is suitable to **convert** into a storage molecule. Many candidates lost marks by referring to hydrogen bonds as an apparently universal type of bonding whilst others mentioned bonds found in proteins.
- (c) Most candidates managed to score marks on this question, although four marks rather than six was more common. The most common marking point credited was glucose in the urine. There were some good answers which referred to the lowering of the water potential of the blood which then followed on to explain why the symptoms occurred. However, marking points which referred to the long term effects of diabetes such as CHD, cataract and macular degeneration (learning outcome 5.4.2.2. (c) and (d)) were hardly seen at all.
- Q.2** Most parts of this question were answered well, and scored highly, though (b) (ii) was answered poorly and showed a lack of understanding of the role of twin studies, and many candidates showed a lack of detailed knowledge of the differences between cyclic and continuous HRT.
- (a) (i) Most candidates correctly interpreted the graph, stating that female fertility dropped more sharply than male fertility, and women became infertile at 50. Fewer candidates noticed that women were most fertile at 20, whilst males reached maximum fertility at 30. Marks were also lost by inaccurate reading of the graph scale or by failing to quote figures at all.

(ii) Many candidates correctly linked the approach of the menopause to a drop in female fertility, and the fact that males continue to produce sperm throughout their life as a reason for higher male fertility at 40. Higher scoring candidates also referred to the fact that a woman's body may become too old to support a foetus, or the fact that oocytes are older. A common error was the use of the term eggs or ova instead of oocytes, which gained no credit.

(b) (i) The majority of candidates correctly stated that the increased likelihood of twins could be due to two oocytes being released per cycle or the fact that the zygote may divide into two. Some candidates mentioned the increased need for IVF and this was also credited.

(ii) Few candidates scored well on this synoptic question, with many showing a lack of understanding of the differences between identical and non-identical twins. Many candidates discussed the use of these studies to help gain information for organ transplants which gained no credit in the context of this question. Examiners were expecting candidates to state that identical twins are genetically identical, whilst non-identical twins are not. It was pleasing to see that some candidates referred to the degree of concordance or similarity within each group, in order to determine if differences are due to genetics or the environment.

(c) (i) Most candidates correctly gave three symptoms of the menopause, though 'irrational behaviour' was not accepted.

(ii) Many candidates correctly stated that HRT replaces oestrogen in the body for one mark, but few stated the importance of this in preventing the mobilisation of bone calcium to prevent osteoporosis. Credit was not given for repeating answers given in (c) (i)

(iii) This question was synoptic and was answered poorly by many candidates who stated that active transport or even osmosis was the method of transport used to cross the cell membrane. Higher scoring candidates correctly identified that the hormones were steroids and therefore fat soluble and so could pass through the phospholipid bilayer of the cell membrane by diffusion.

(iv) Many candidates knew that HRT involved the use of oestrogen and progesterone, but could not describe the differences between cyclic and continuous methods of HRT. Examiners hoped to see answers describing cyclic HRT as taking tablets of various combinations of the hormones for 3 weeks, followed by withdrawal bleeding, or the taking of oestrogen continuously and progestin for 10-14 days. The use of the term 'withdrawal bleeding' was credited as was 'period' in inverted commas but references to a period or menstruation were not credited. Many candidates gained credit for knowing that continuous HRT involved the use of skin patches or implants or the taking of oestrogen and progesterone tablets, but few knew that they needed to replace patches or implants, or the timescale involved.

Q.3 This was possibly the most testing question on the examination paper, with marks aimed at the A/B candidate.

(a) (i) Most candidates managed to score two marks for this question by stating that a species can interbreed to produce fertile young. Fewer candidates accessed the third mark which could have been scored for commenting on named similarities e.g. structure, physiology, genetics etc

(ii) Only a minority of candidates scored full marks on this classification which is learning outcome 5.4.1.4 (c). The most difficult term of the classification sequence was already given and the rest should have been simple for those candidates who had learnt the work. The anglicised version of the classification was accepted.

(b) (i) Most candidates scored only one mark for the observation that similarities in the albumin indicated similarities in genes or relationships. Any references to concentrations, amounts or levels of albumin were not credited. Only a few candidates made the link between the protein and the similarity of the DNA or the codons.

(ii) Candidates could have scored two easy marks by observing that the gorilla was most closely related and the gibbon the least closely related. However, some candidates lost these marks by using vague statements about 'being linked' to humans. Some candidates provided comprehensive answers on the variation of the complementary relationship between the antibodies and the similar binding site on the albumin from the primates. It is pleasing to see the increased use of figures to illustrate the point. Accurate comparative figures with appropriate units are always credited. Some candidates simply described the data rather than explaining it.

Q.4 Most candidates achieved some good marks on this question and the genetics presented little difficulty. However, candidates found the need to apply the information given to the QWC question rather more challenging.

(a) (i) The Examiners were encouraged to see a lot of correct answers to this question. However, some candidates did not realise that they needed two alleles for each of the two characteristics. The mark allocation is a good guide to the number of facts required to answer the question. Some tried to make the condition sex-linked whilst others wrote the N/n locus as a superscript on the ABO locus. Where possible, the Examiners credited the genotype for the female if the error was carried forward from the genotype of the male (ecf), providing the alleles were correct. Some gave alternative genotypes for the male with nail patella syndrome assuming that the condition was recessive and failing to follow the inheritance given on Fig. 4.1.

(ii) Many candidates realised that this was autosomal linkage, linked to blood group A and scored three easy marks. Many determined that the allele was dominant but this often only appeared in part b). A significant number thought that it was recessive.

- (b) The Examiners had expected that the topic of genetic counselling would appeal to Human Biology candidates to give a mark yielding QWC question. However, very few candidates scored full marks for this question. There was generally a lack of detail in their answers. Very few candidates explained the genetic information that the counsellor would give the couple and few seemed familiar with the nature of the condition itself. Most students were aware that the genetic counsellor would only advise the couple, leaving them to make their own informed decision. Most knew that they would discuss the probability of the couple having a child with nail patella syndrome, but did not work out or quote the probability figure. Very few suggested testing for Blood group A even though they had identified the link with nail patella syndrome. Many students discussed the use of IVF and amniocentesis, but few realised you couldn't test for nail patella syndrome and that there was no cure. Many students stated that the genetic counsellor would advise on how to cope with the condition but only a very few recognised that the mother would know this as she had the condition. Many candidates used the term 'carrier' inappropriately. There was a marked improvement in the accuracy of the spelling but a number of candidates had handwriting that was very hard to read. The disadvantages of this are obvious. Although Examiners will use a magnifying glass where necessary, such measures are likely to lose the QWC mark, which also assesses legibility.

Q.5 Candidates appear to find questions on excretion and water balance difficult. An attempt was made to make this information more accessible.

- (a) (i) The majority of candidates were able to label the medulla and pelvis accurately.
- (ii) Marks were lost in this section by failure to distinguish between the arterial or oxygenated blood and the venous or deoxygenated blood. 'Clean' or 'dirty' blood are not adequate descriptions at full Advanced Level standard. There was also much confusion as to what each fluid contained. Urine was more accurately described, although some candidates thought that it was the glomerular filtrate. Loose statements such as 'removed' were not accepted as adequate for this simple description as the examiners were looking for the excretion of nitrogenous waste. For these reasons very few candidates scored six, although this approach to the topic improved performance.
- (b) (i) The most common answer to this question was to refer to the wider diameter of the afferent arteriole compared to the efferent. However, few candidates scored two marks by referring to the origin of the pressure with the contraction of the left ventricle or the large number of capillaries in the glomerulus in the confined space of the Bowman's capsule.
- (ii) Most candidates scored two marks for this question.
- (c) (i) This was intended to be a very accessible synoptic question as all the information needed for the answer was on Fig. 5.2. Many

candidates scored well over maximum marks for this answer but a number failed to spot the help that they had been given. The words 'message' and 'signal' are not acceptable substitutes for 'nerve impulse' or 'action potential'

(ii) The role of learning or training in inhibiting the reflex did not occur to many candidates. Marks could also have been scored by referring accurately to the nerve pathway to the brain.

Q.6 This question was high scoring largely due to the excellent answers to the QWC question.

- (a) The Examiners were delighted to find that candidates had learnt the material for this potentially difficult topic extremely well. Very few candidates were unable to score at least four marks with many scoring a maximum. The specialist terms were also well understood, with the restriction enzyme and the plasmid accurately identified by name in many cases. Errors included finding the hGH rather than the gene. Fortunately only a few candidates thought that the transgenic bacterium should be injected into the patient.
- (b) (i) Few candidates had a good understanding of the meaning of the term '*below the height of the tenth centile*'. Many candidates thought that this was the average height for his age and therefore only scored one mark for noting that it was related to his age. Only a few candidates accessed the synoptic material and described the term as 'shorter than 90% of children in his age group'.
- (ii) Marks were lost in this question by a lack of detailed information. E.g. that short height could run in the family or that it could be a genetic disease. An extra mark was available for a candidate who named an alternative genetic disease such as Achondroplasia. Reference was frequently made to the 'right' foods without saying which or to named vitamins or minerals without saying how they contribute to height. '*Malnutrition can retard growth*' was not accepted as malnutrition also includes too much food or the wrong kinds of food. A few candidates referred to the **anterior** pituitary gland and its role in hGH production, which was credited. Those who mentioned the effect of a tumour often did not qualify it by stating that it might interfere with hGH production. Two marks were available for each section to ensure that candidates answered all three sections.
- (iii) Most candidates noted that there was a growth spurt at puberty but many lost marks by confining their answer to the development of the reproductive organs. There is some confusion between the terms growth and development.

Q.7 Once again, the synoptic material on vaccines created difficulty for some candidates. It was targeted at the A/B candidate, and only the higher scoring candidates achieved full marks on the synoptic material.. However, most candidates were able to score well on the questions on ageing.

- (a) (i) Some candidates had a sound grasp of the immune response and

easily scored maximum marks. However, a significant number had little idea of how it worked. Many did not mention the term 'immune response' whilst others implied that the *vaccine* destroyed the plaques rather than the antibodies produced in response to the vaccine. Statements such as 'the antibodies eat or kill the plaque' were not credited.

(ii) The most common answers included the destruction of normal tau, some candidates using the term autoimmunity, unexpected side effects and the statement that mice did not necessarily react like humans. There were very few references to the fact that the vaccine may be destroyed by the patient's immune system or that the patient may be allergic to the vaccine and very few candidates produced three valid answers as might be expected for a question targeted at grade A or B.

Teaching tip

The Target series produced by the ABPI is extremely useful for the study of topics such as Alzheimer's disease. They also have booklets on osteoporosis and diabetes to mention but a few. These may be obtained from:

The Association of the British Pharmaceutical Industry
12 Whitehall
London SW1A 2DY
Tel 02079303477
www.abpi.org.uk or www.abpischools.org.uk

- (b) Most candidates scored two marks without difficulty although an indirect cause such as CHD was not credited.
- (c) (i) Answers to this question were both detailed and accurate. However, some candidates lose marks by using the word 'affects' without saying how. Ageing affects the eye, ear etc would not be credited.
- (ii) Answers to this question were full and direct. The Examiners were somewhat alarmed by the unsympathetic references to the taxation burden on the young and the impact this would have on their working life and pensions, with no recognition of the taxation contribution paid by retirees. Some even went so far as to say that prolonging the life of the elderly was not such a good idea. Whilst many of the points on the dependency ratio were credited, topics such as this should be approached in an ethical and compassionate manner. The Examiners were relieved to see some references to the value of the ageing population in terms of their experience, their ability to care for children and their desire to contribute to society.

Principal Moderator's Report

Once again the number of candidates that entered at both AS and A2 showed a significant increase. The number of centres increased by one-third at AS (with a 50% increase in candidate entry) and by over 100% (with a 150% increase in candidate entry) at A2. The work submitted showed evidence of tremendous hard work on behalf of the teachers and the candidates. The standard of work submitted reflected a wide range of ability which had, on the whole, been recognised in the marking by teachers. Whilst there remains an overlap with some investigations at AS with those submitted for Biology there was evidence of an increasing number of centres developing investigations specific to the Human Biology specification. At A2 there appeared to be an equal division between centres submitting laboratory based investigations and those submitting Human Physiology investigations.

General summary

Whilst there was some evidence that Centres from the previous session had on the whole taken on board the comments and advice made in their moderator's report this was not always the case, especially at A2. Investigations that had been discussed at INSET and in last year's Principal Moderator's report showed some improvement in standard across the cohort but some misinterpretations were still clearly evident. It was encouraging to see Teacher's applying the hierarchical mark scheme more confidently as well as a general improvement in the understanding of the sub descriptors.

As with last year, the majority of adjustments were for the following reasons:

- Misapplication of the hierarchical mark scheme.
- Failure to credit a descriptor in the candidates' work.
- Use of inappropriate task(s).

At AS, the key areas that led to the mark being supported by the Moderator differing from that being awarded by the centre were in Skills A and E. Concern still exists that the subtleties of the generic mark scheme are inadvertently overlooked in some Centres which impacts on the marks such as P5ai and P7aai or E3a and E5ai.

At A2 the main area of discrepancy arose in Skill S, with several candidates, and on occasions whole centres, failing to submit a separate report. In some cases evidence was not provided for Skill R which meant that no marks could be supported by the Moderator.

Any centres who wish to gain more detailed feedback regarding this year's moderation, or proposals for next year, via the coursework consultancy service, available free of charge, via the Subject Officer.

Starting in September 2006 is a series Human Biology specific INSET meetings where more detailed and specific guidance and advice will be provided. Centres who were new to AS this academic year and are embarking on the A2 course in September are strongly advised to attend before embarking on the A2 coursework.

Administration

On the whole Centres submitted the correct forms completed in an appropriate manner. It is important to note that the three additional skills at A2 (S, R and M) should be recorded on the 'Additional Skills' form for each candidate and submitted with the work.

Centres are encouraged to note that a Centre Authentication Form (CCS160) must be submitted for both AS and A2 entries. Failure to do so will mean that this has to be requested at a later date and could potentially delay the publication of results.

Most forms that will be required for any particular session can be found on the OCR website (www.ocr.org.uk)

Annotation, in the main, was clear and accurate. However, some Centres failed to annotate appropriately both in quantity and in style. The aim of moderation is to support the marks awarded by the Centre. This is far easier if it is clear to the Moderator why a particular sub descriptor (for example P5ai) was awarded.

It is preferable that teachers annotate in the style of:

P5ai ✓ to indicate a full match

I5bii x to indicate the sub descriptor is not met

(E5bi) to indicate a partial match

Adjustment of candidates' marks

Candidates in a Centre will have their marks increased or decreased as a result of the centre falling outside tolerance. This will occur if:

- all the candidates entered have been uniformly over or under-assessed in which case a single adjustment will be applied to the whole Centre.
- candidates towards the top of the Centre's rank order have been over or under-assessed more than the rest of the sample then a tapering scaling will have been applied. This will mean that the top candidates were adjusted to a greater extent than those candidates at the bottom of the rank order.

In either case the rank order of the candidates from a Centre will remain unaltered, but there may be a compression of the mark range.

In some cases this session when work had been moderated it led to the rank order of candidates being changed. Due to this work had to be returned to centres for remarking, with direction given by the Moderator as to the areas of concern. The reason for this is to lessen the adjustment to some candidates. OCR policy is that the rank order submitted by the Centre must be maintained, but on occasions when an adjustment has to be made it could mean that some candidates have to be adjusted more than necessary to maintain the rank order. By the work being remarked by the Centre, hence producing a new rank order, this should hopefully be avoided and hence a fairer adjustment to all the candidates in the centre.

Where Centres were found to be significantly outside of tolerance a second sample was requested from the Centre. This sample was moderated and the evidence used to support or modify the initial moderation.

Context of the investigation(s)

To enable the Moderator to have an understanding of the background of the investigation it is very helpful if Centres provide Moderators with sufficient information about the context in which the work was set and the limitations on apparatus and

materials within the Centre. This is vital if Moderators are to be able to take into account the apparatus available to the candidates and therefore make allowances for the precision and accuracy of the data collected.

Information for each investigation might include:

- details of the theory taught prior to the investigation
- preliminary work undertaken by candidates
- apparatus availability/restrictions
- precision of apparatus available is also invaluable e.g. balances, gas syringes and colorimeters
- time allocation provided.

Mark Schemes

Whilst the moderation process utilises to the OCR generic descriptors it is beneficial for moderators to be aware of the Centre's expectation for each sub descriptor by the inclusion of any customised mark schemes.

Centres should note that it is a requirement to provide evidence for the 'a' strand subdescriptors in Skill I. This may be in the form of a tick list for all the candidates, or the subdescriptors can be annotated next to the single, raw data table that is used to assess the Skill. If this evidence is not submitted, work can be moderated back to zero for this skill.

Hierarchical nature of the mark scheme

For each skill, the scheme allows the award of intermediary marks 2, 4 and 6 that are between the defined mark levels. An intermediate mark may be awarded when the meets **all** the descriptors for one level e.g. level 3 in planning and also meets half of the subdescriptors for the next level, for example

- i) **all** of P5a (P5ai, P5aii and P5aiii) **or**
- ii) **all** of P5b (P5bi and P5bii) **or**
- iii) **half** of the P5a and P5b (for example P5ai, P5aiii and P5bii).

The award of 8 marks for the Skills P and A has caused some difficulties again this session. This mark should only be awarded if the level 1, 3, 5 and 7 descriptors were awarded easily **and** if the work shows '*originality, depth or flair*'..

It is not necessary for a candidate to go beyond the specification to gain 8 marks. Also candidates who write excessively in an attempt to score 8 are unlikely to be awarded P7aii due to irrelevance or A7bi on the grounds of failing to be concise.

Nature of tasks

Common tasks included enzyme investigations (the effect of temperature, enzyme concentration, substrate concentration and pH), membrane permeability with changing temperature, and osmosis. These investigations were suitable for all four skills and allowed access to the higher descriptors.

Please remember that there is no requirement in the OCR specification for each candidate to carry out a different investigation.

a) Human Physiology investigations

The main area of concern and cause for adjustment this session was due to the failure to meet 3 key sub descriptors. The details given below are meant as amplification of the sub descriptors and in is in no way an alteration to the specification.

- P3aai In the case of Human physiology investigations it is paramount that the candidates recognise the vast range of factors which should be **considered** when dealing with Human subjects.
- P3b For P3b candidates should **plan** to study **at least ten subjects** in each of five (or more) categories.
- We realise that this is rarely always possible to **implement** a study of this size, so we would expect to see data collected from a minimum of **ten subjects** in **two** or more categories.
- P5bi Candidates are required to give a description of their data collection strategy, in enough detail that it could be repeated by another student. Candidates should be encouraged to ask '*can my method be followed by another student?*'.

b) Secondary data investigations

Though the descriptors are written to allow this type of investigation, we have found that weaker candidates find it hard to score well. This is due to the areas of concern discussed in the 'Principal Moderator's report to Centres, 2005'. Far fewer of this type of investigation were seen this year. We strongly advise Centres thinking of using a secondary data investigation to contact the Subject Officer at OCR for advice and guidance before starting work.

c) Inappropriate tasks for A2

It is essential that A2 investigations are centred clearly on one or more learning outcomes from the A2 specification. But, there must also be opportunities to use scientific knowledge and understanding from one or more AS learning outcomes to support the A2-level work.

We strongly advise Centres to submit proposals for A2 investigations to the Subject Officer for advice and guidance.

Skill I

Some Centres incorrectly marked tables of processed data for this skill. Only tables of raw data should be used to assess this skill. If no raw data is submitted the Moderator will be unable to support any mark for Skill I.

All raw data should be displayed in a single table, with the independent variable in the first column. SI units for both the dependent and independent variable should be in the appropriate row/column heading(s). Failure to do so will limit the mark to 4 for this skill. On some occasions it was evident that Centres had provided blank tables to their candidates which encouraged students to submit the data in split tables, thus limiting their marks to a maximum of 4.

Skill A

Again this year Moderators had to adjust some Centres downwards as no evidence of processing of data could be found. In these cases the candidates mark was reduced to zero.

A3a should be awarded for the presentation of processed data. Whilst the use of software for plotting graphs is to be encouraged, candidates must ensure they can

use the packages at a suitable standard to produce a graph of suitable quality. There should be sufficient horizontal and vertical grid lines to allow new intermediate data to be extracted accurately. Often, graphs produced using the default 'wizards' in software packages such as Microsoft Excel® do not produce suitable graphs. All graphs should also have an informative title, axis labels, appropriate units on both axes and an appropriate line drawn. Some examples of suitable and unsuitable graphs are provided in the 'Principal Moderator's report to Centres, 2005'.

In some cases candidates were incorrectly awarded A5a for a graph. This is not appropriate. A5a requires detailed numerical processing e.g. the calculation of the standard deviation (this can be used to aid the progression through the Evaluation skill), deduction of an intercept or appropriate use of statistical testing. Centres should note that plotting range bars does not meet A5a as no further numerical processing has been undertaken.

Confusion appears to exist regarding the difference between range bars and error bars in some centres:

- Range bars – produced by plotting the highest and lowest value of data above and below the average. As this requires no mathematical processing it can not be used for A5a but may be discussed in detail to help provide evidence for E5bi.
- Error bars – produced by calculating the standard deviation of the data and plotting a bar from the mean ± 1 SD. The calculation of the SD can be used to credit A5a, and again the discussion of the error bars can be used to provide evidence for E5bi. Centres should note that the SD can be determined for assessment purposes even if there are only 3 sets of data as it is the skill that is being assessed not the numerical answer.

A5bi requires conclusions to be linked with detailed scientific knowledge and understanding of an AS (or A2 as appropriate) standard and linked coherently, comprehensively yet concisely for A7bi.

Skill E

The increased use of writing frames was encouraging this session.

There remains confusion in some Centres as to the difference between errors and limitations:

- A limitation is a fault that lies within the method and will potentially affect each trial/run of the method such as the fluctuation of the temperature in a waterbath or the parallax error when reading a meniscus.
- An error is a fault that occurs at random and affects an intermittent set of data/one point such as the failure to measure out a chemical incorrectly for one run.

Confusion also remains regarding the difference between accuracy and precision.

Accuracy is how close a measured value is to the 'true' value of the measurement.

A measuring device is **precise** if it records the same value for a measurement repeatedly. It is not possible to assess the precision of a measurement if the measurement is only made once – unless the degree of precision of the measuring device is known.

To be awarded E5bii, candidates must explain what impact the main error(s) have had on the raw data collected. Have the errors caused the measured values to be under- or overestimates of the 'true' values?

A2 specific skills only

Skill S

As with the June 2005 series, the main area of concern in this skill was that some Centres had failed to realise that this report was separate from the Plan and so rarely scored higher than 3 marks out of 5. Candidates are expected to submit a concise report of 500 to 1000 words on the information gained from the resources stated in their bibliography (S1b). It is important to stress that the report is about the resources used in the planning and not about the whole investigation.

To be awarded S5a, candidates should explain the choice of diagrams, charts, data selected from the sources, in terms of their usefulness to the investigation and in terms of the validity of the information presented in the source.

To be awarded S5b, the report produced should coherently integrate the information gained from the sources with evidence of a variety of presentational techniques such as tables, graphs and pictures.

Skill R

In order to be awarded any marks for this Skill, candidates must have listed a minimum of **ten** questions.

Whilst almost all candidates asked ten appropriate key questions (R1a) several candidates failed to show evidence of asking two or more supplementary questions to partly meet R3b. This subdescriptor also requires candidates to suggest simple improvements to their questions.

To gain R5b the supplementary questions must be asked and evaluated in terms of their usefulness to the investigation.

Skill M

Some Centres sent photographs of models/posters or printouts of PowerPoint presentation and/or OHP slides as evidence for this skill. Whilst this is not a requirement, this evidence was appreciated by the Moderators.

For each of these 3 skills teachers are required to complete, as a minimum, the tick list for S, R and M which is available from the Subject Officer at OCR.

Suggested writing frames/tables

These tables can be used to help candidates, without unfair assistance, to provide evidence for various subdescriptors. Depending on the depth and detail of the content within the table the subdescriptor(s) may be partially or full met.

Apparatus list:

item [P1b]	quantity of the item	concentration and volume required [Possibly P3b]	what is the item being used for	reason for choice of the item [P5bi/P7b]

Table to show how concentrations of working solutions will be made [P7b]:

required concentration	volume of stock solution	volume of solvent

Table to show key variables:

variable [P3aii]	type of variable (dependent / independent / 'controlled')	why the variable must be controlled [P7b]	how it will be controlled [P5bi]

Table to evaluate the investigation:

rank order of limitation [E5ai]	limitation [E3a]	error caused as a result of the limitation i.e. effect on the data collected [E5bii]	suggestion for removing / reducing the effect of the limitation [E5aii]	justification of the improvement [E7a]
first				
second				
third				

Centres and teachers new to the OCR specification, or starting the A2 course for the first time are strongly advised to attend a Human Biology specific INSET meeting. Details are available on the OCR web site.

**Advanced GCE (Human Biology) (7886/3886)
June 2006 Assessment Series**

Unit Threshold Marks

Unit		Maximum Mark	a	b	c	d	e	u	Entry
2856	Raw	60	39	33	27	21	15	0	1407
	UMS	90	72	63	54	45	36	0	
2857	Raw	60	45	39	33	27	22	0	1380
	UMS	90	72	63	54	45	36	0	
2858A	Raw	120	95	83	71	59	47	0	1782
	UMS	120	96	84	72	60	48	0	
2858B	Raw	120	95	83	71	59	47	0	24
	UMS	120	96	84	72	60	48	0	
2866	Raw	90	65	56	47	39	31	0	358
	UMS	90	72	63	54	45	36	0	
2867	Raw	120	82	72	62	52	43	0	663
	UMS	120	96	84	72	60	48	0	
2868	Raw	90	72	64	56	48	40	0	663
	UMS	90	72	63	54	45	36	0	

Specification Aggregation Results

Overall threshold marks in UMS (i.e. after conversion of raw marks to uniform marks)

	Maximum Mark	A	B	C	D	E	U
3886	300	240	210	180	150	120	0
7886	600	480	420	360	300	240	0

The cumulative percentage of candidates awarded each grade was as follows:

	A	B	C	D	E	U	Total Number of Candidates
3886	3.8	13.3	32.0	56.8	79.8	100.0	1472
7886	6.4	20.5	47.8	75.3	94.5	100.0	655

For a description of how UMS marks are calculated see;
www.ocr.org.uk/OCR/WebSite/docroot/understand/ums.jsp

Statistics are correct at the time of publication

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