Version 1.0

General Certificate of Education (A-level)
June 2011

Biology BIOL5

(Specification 2410)

Unit 5: Control in Cells and in Organisms

Report on the Examination

Further copies of this Report on the Examination are available from: aqa.org.uk

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334).
Registered address: AQA, Devas Street, Manchester M15 6EX.

General Comments

The range of responses to the questions in this unit test was extremely wide. There were many candidates who were able to demonstrate a sound grasp of factual detail, not only of many of the topics tested in this unit, but also of relevant sections of other units. Such candidates also demonstrated their ability to apply their knowledge to questions set in unfamiliar contexts and to handle data with the competence that comes from practice of the skills concerned. Candidates who were less successful frequently demonstrated very limited understanding of underlying principles. They often appeared to have taken little note of the material provided in the question, responding to key terms with what appeared to have been answers based on previous mark schemes, correct in detail but irrelevant in context. Quality of Written Communication proved a problem for some and it was not uncommon to encounter poor or non-existent use of technical language or to see arguments presented in answers requiring longer responses that lacked all coherence. Examiners are aware of the pressures on candidates in examinations and do everything they can to interpret what has been written. However, a significant number of candidates failed to gain marks because their handwriting simply could not be read.

Question 1

(a) Most candidates named the two substances required in answer to part (i) correctly, although there were responses such as sugar and pentose that lacked the necessary precision. Part (ii) was answered correctly by most candidates.

(b) In part (i), a few candidates attributed the properties of DNA in containing thymine being double stranded to one or other of the specified forms of RNA. Most, however, were able to explain that tRNA was folded and contained hydrogen bonds. Part (ii) was also answered well with only occasional confusion between exons and introns.

(c) Although part (i) was answered well, less able candidates experienced considerable difficulty with part (ii). There was much confusion between chromosomes and genes and there were frequent references to stop codons being found at only the end of chromosomes. Equally worrying was the number who considered that as the base sequence on DNA was random, then the percentage of bases was also random.

Question 2

(a) Although better candidates answered part (i) well, others had less success in assembling a relevant response. There was uncertainty over the nature of local chemical mediators and some candidates chose to explain why hormones affected cells in a different way from the nervous system. There was widespread knowledge in part (ii) that hormones are transported in the blood but fewer were aware that chemical mediators have a local effect and diffuse directly to their target cells. Many candidates failed to access the full range of marking points by starting their answers with the word, “they”. Inevitably this led to comments that were not relevant to one or other of the substances involved.

(b) Those candidates who focused clearly on the relevant aspects of synaptic transmission produced excellent answers. Others, however, produced lengthy accounts that included much that was of, at best, marginal relevance.

(c) Although candidates encountered few problems in extracting the relevant information from the graph in part (i), they experienced much greater difficulty in expressing 8 as a percentage of 10 despite, in some cases, identifying clearly on the graph the relevant numbers.

Question 3

(a) Although diffusion of auxin from the growing regions of a shoot is included in the specification, a considerable number of candidates failed to gain what should have been a readily accessible mark. Incorrect answers were broadly spread between inappropriate processes such as osmosis and behavioural responses such as tropism and kinesis.

(b) Those candidates who recognised that a growth response was involved recognised that the shoot would gain light for photosynthesis. There were, however, many vague answers that simply referred back to the favourable environment mentioned in the question.

(c) Most of the candidates who attempted to explain rather than describe the data appreciated that a rise in temperature would result in an increase in the rate of diffusion. Few, however, related this to an increase in kinetic energy or to faster movement. Many phrased their answers in terms of stomatal closure at higher temperatures, contradicting information supplied in the graph.

(d) Many of the candidates answering part (i) failed to heed the information given in the question stem and attributed the difference in rates of uptake to the absence of a cuticle on the upper surface. Of those who did take note of this information, a significant few confused cuticle and stomata, often writing of fewer cuticles being present through which water could pass. However, there were some excellent responses which attributed the difference in rate of uptake to either a thicker cuticle on the upper surface of the leaf or fewer stomata. Most candidates recognised that features and characteristics differed between species and offered realistic answers to part (ii).

Question 4

(a) Most candidates identified the correct part of the graph in their answers to part (i) and offered an appropriate comment about the concentration of progesterone in part (ii).

(b) The term positive feedback was misinterpreted by a substantial number of candidates who took the phrase to mean a situation where an increase from the resting level led to events which returned the factor concerned to the norm. This is negative feedback. Others identified the term correctly by offering a general answer relating to further departure from the resting level, but then failed to follow the instructions in the question and relate this to the required example of oestrogen and LH.

(c) The hormonal control of the oestrous cycle was well understood and there were some excellent answers to this part of the question.

Question 5

(a) The restriction site was described in a number of ways, most of them acceptable, but statements such as that “there was an active site on the plasmid” or that “the amino acids on the unknown DNA corresponded to those on the restriction enzyme” clearly could not be awarded credit. Many candidates, however, were able to indicate in their answers to part (i) that the sequence of bases concerned occurred on the unknown DNA. Unfortunately they were often defeated by the logic behind the argument that getting two fragments from a circular plasmid would require two cuts in the sequence and since one was on the original plasmid, the other must have been in the unknown piece of DNA. Better candidates answered part (a)(ii) well and were able to explain clearly what was represented by the large fragment. They often clarified the situation with simple diagrams.

(b) Most candidates correctly identified the number of BamH1 restriction sites as two. Although three proved to be a fairly popular alternative, the examiners were at something of a loss to explain the significant number of candidates who wrote a letter instead of a number in the answer box.

(c) In part (a), most candidates appreciated that electrophoresis would separate DNA fragments according to size and that the smaller fragments would travel further. Many offered considerable extra detail but only the best recognised the need for reference markers. Part (ii) was targeted at the more able candidates and it was encouraging to be able to record that these candidates were able to predict that when added together, the total size would be greater if digestion were incomplete. Weaker candidates usually concluded that the length would be less than the original and often attempted to support this with much illogical and tortuous argument.

Question 6

(a) Most candidates were able to explain that totipotent cells were able to differentiate but could not link this satisfactorily to the evidence in the table. Many of the less able candidates either attempted to link totipotency to callus, or considered callus, leaves and plantlets to be different sorts of cells.

(b) Simple numbers and a generous mark scheme should have enabled most candidates to gain full credit for their answers to this question. The fact that only just over half did so emphasises the difficulty candidates have in working with ratios.

(c) Part (i) was answered very poorly and many candidates ignored the reference to reproducing sexually in the question to write about mutation and environmental factors. Many of those who did approach the question appropriately demonstrated confusion between seeds and gametes and between mitosis and meiosis. The answers to part (ii) were rather better with many pointing out that plants derived from tissue culture would be clones or would be genetically identical. However, there were inappropriate responses relating to the procedure being “quicker” or “less expensive”.

Question 7

(a) Part (i) was generally well answered and most candidates appeared to appreciate that an increase in temperature would increase the rate of metabolic reactions and could link respiration and oxygen. Part (ii) proved to be more demanding and it was apparent from the answers that few candidates could interpret the units used here. The reference to cm^3 was frequently taken as referring to the volume of the iguana, g^{-1} was occasionally related to the mass of oxygen consumed and h^{-1} was even considered to be the symbol for hectare. Denied the opportunity to suggest that the units allowed comparison by the wording of the question, many of the less able candidates struggled to offer an appropriate explanation.

(b) Part (i) required candidates to describe the pattern of movement displayed in the graph. This proved straightforward for those who read the axes carefully and took time to appreciate what the bars represented. There were many, however, who attempted an explanation rather than the required description or failed to present a suitable overview of the trends displayed. Part (ii) generated a number of descriptions while many of the answers offered explanations based inappropriately on taxes, kineses or, in a few instances, tropisms.

(c) Stronger candidates linked evaporation of water from the tongue with heat loss; weaker candidates suggested that panting would cool an iguana by bringing in cooler air. A disturbingly large proportion of candidates invoked endothermic responses and wrote of vasodilation and sweating.

Question 8

(a) There were some comprehensive and accurate answers to this question from the better candidates but those who were less able clearly confused transcription and translation when discussing the impact of transcription factors on tRNA or on ribosomes.

(b) In part (i), the principle of complementarity was understood by most, but less able candidates were not always sure as to what was complementary to what. Consequently, there were numerous inappropriate references to DNA , genes and even "double-stranded" mRNA. Many candidates interpreted the information provided in the flow diagram correctly and clearly understood the role of the siRNA-protein complex on the structural integrity of mRNA. The result was that there were some excellent answers to part (ii). It was also clear, however, that some of the weaker candidates experienced considerable difficulties over the interpretation of the information contained in this flow chart. Such candidates were reluctant to make use of the information in the third box and sought explanations involving the breaking of genes or the proteins resulting from translation. Answers to this part of the question also reinforced the view that many candidates were uncertain of the difference between transcription and translation.

(c) Part (c) proved the saving grace to some who attempted essay (a) where they described the idea presented here to established medical practice. Most candidates were able to establish a link between disease and synthesised proteins, but only the more able recognised that the use of siRNA would be most appropriate when treating genetic disease.

Question 9

This question was intended to be synoptic and as such required a basic understanding of principles established in other units. There were some outstanding answers but it was also disappointing to note that there were many candidates who clearly had little idea of the functions of cell organelles or of the role of ribosomes and RNA in protein synthesis.

(a) There were, perhaps inevitably, candidates who confused condensation and hydrolysis but most were able used the terms appropriately in the context of protein digestion and synthesis.

(b) Those who understood protein structure usually gained credit, but almost two-thirds of all candidates made no progress here. While the most frequent problems stemmed from confusing amino acids with bases, others appeared uncertain that proteins could be digested.

(c) Most, but by no means all, candidates identified the overall trend of decrease, increase, decrease but rather fewer supported this with data from the table relating to the age of the pupa. Where the age was quoted, it was not uncommon to see it given in days or years. A little common sense might have excluded the latter.

(d) Answers to part (i) might have been better had more candidates distinguished between the roles of lysosomes and ribosomes. There were many responses associating an increase in lysosomes with increased protein synthesis towards the end of the time spent as a pupa.

Others linked lysosomes with disease and answered in terms of increased exposure to bacterial infection. A major misconception in the answers to part (ii) was that protein synthesis would decrease RNA concentration as it was "used up" in the process.

(e) Although some of the candidates answering this part of the question were unable to identify the trend in the table, most recognised that tissue formation involved protein synthesis and hence the increase in RNA.

(f) This question discriminated very effectively over the range of available marks but, at all levels of ability, candidates appeared to find difficulty with spelling the words aerobic and anaerobic. Examiners try to avoid being unnecessarily pedantic over the spelling of technical terms but the onus is on candidates to make their intentions clear, particularly when the words concerned are closely similar. A considerable number of candidates failed to equate tracheae with insect gas exchange and wrote of breathing and the lungs.

Question 10

There was a noticeable improvement in the overall standard of the essays this year with much more evidence of planning. The best work was a pleasure to read. It was expertly crafted and often incorporated clear evidence of wider reading which allowed the incorporation of cogent examples that were clearly relevant to the title. There were still essays, however, that were of poor quality. The following comments could often be applied to these essays.

- They were frequently based on content that was superficial and rarely reflected the detail expected at the end of an A-level course. This was particularly true of essay (b) in discussions of the cardiac cycle. Some candidates felt bound by style and produced lengthy introductions and conclusions that were no more than synopses of what was going to be or had been written. Clearly this wastes time that would better be spent providing appropriate detail.

- There were many fundamental errors and misconceptions. The relationships, for example, between amino acids and proteins, photosynthesis and respiration were frequently confused.

- Much of the content was clearly irrelevant. Candidates not infrequently targeted an appropriate topic but ignored the focus of the question, leaving the examiner to identify the relevant points.

- The plans revealed that some candidates felt that they had to include something from every unit. This led to the occasional incorporation of odd topics which resulted in the withholding of marks for relevance.

10 (a) Using DNA in science and technology

The very best essays from candidates who selected this option were outstanding. They reviewed, often in great detail, the relevant aspects of the specification although not always incorporating the role of DNA in the classification of organisms. Considering that much of the content of this essay could be drawn from this unit, it was surprising how poor many answers were. Understanding of techniques was often extremely limited, particularly *in vivo* gene cloning and the use of markers. Many essays presented no more than a broad overview either emphasising ethical issues at the expense of biological detail or failing to distinguish established practice from wishful thinking.

10 (b*) Cycles in biology

Most of the candidates who attempted this essay were able to write about appropriate biochemical, physiological and ecological cycles. Despite the help given in the title, some of the less able candidates sought to redefine a cycle as any process that leads to another process and hence justified the inclusion of much irrelevant discussion of such topics as protein synthesis. Accounts were, on the whole, sound but there was much confusion

between the detail of the Krebs and Calvin cycles, while the nitrogen cycle produced some extremely confused accounts often resulting from the need to “start” and “end” the cycle with nitrogen gas. The cardiac cycle was often introduced as an example of a physiological cycle but descriptions seldom reflected the detail of control that is a key feature of the relevant part of this specification.

UMS conversion calculator www.aqa.org.uk/umsconversion