



## **General Certificate of Education**

# **Human Biology 1406**

**HBIO4      Bodies and cells in and out of  
control**

## **Report on the Examination**

*2010 examination - January series*

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## General comments

The paper produced a wide range of marks and correct responses were seen in all parts of all questions. However, no candidates obtained more than eighty percent of the raw marks. This may reflect the changes to the national criteria for A2, where application of knowledge (AO2) and How Science Works (AO3) now make up seventy percent of the marks available. It follows that factual recall alone cannot produce a good outcome for candidates. Centres should also note that what was *factual recall* (AO1) is now *factual recall with understanding*.

It was pleasing to note that many candidates did relatively well on parts of questions that involved descriptions of trends in tables and graphs. They also appeared to be quite well prepared for questions requiring explanations of these trends, or evaluation of decisions based upon data presented. The only exception to this was question 10(j).

Many candidates scored poorly on factual recall questions at the start of the paper. These were intended to allow E-grade candidates to obtain marks and work their way into the paper. In practice, these questions discriminated across the ability range. It was also evident that many candidates were not well prepared for the synoptic elements of questions. Centres should be aware that candidates are required to be familiar with the material in the Biological Principles at the end of Unit 1 and Unit 2 for all subsequent Unit assessments including Unit 4. Centres should also note that similar requirements apply to the Biological Principles at the end of Unit 4 for Units 5 and 6.

### Question 1

This question was intended to be a highly accessible start to the paper but proved challenging to many. In (a), only half of the candidates knew where spermatogenesis occurs. Despite the chromosome numbers being given on the diagram, only a third were able to correctly indicate the cell that divided by mitosis. In (b), over a third could not give one correct difference between oogenesis and spermatogenesis.

### Question 2

Some very good answers were seen to each part of this question. However, for a topic which has been a familiar part of A level for many years, it was disappointing to find over a third of candidates scoring no marks in (a) and (b). There was some evidence of over teaching of topics and some weaker candidates gave very confused accounts. The mark schemes for each part of the question show that candidates only require a few basic facts and ideas to obtain marks. For example in (c), the idea of antagonistic muscles both contracting to hold a joint in a given position.

### Question 3

Some 40 percent of candidates scored no marks in part (a). All that was required was the idea of insulin binding to receptors on membranes of target cells, the activation or recruitment of glucose-transporting proteins, more glucose entering cells and this resulting in more conversion of glucose to glycogen. Incorrect responses often began with the hypothalamus detecting blood glucose concentrations and telling the pancreas to excrete insulin. It was also common for candidates to state that insulin converts glucose into glycogen.

In (b)(i), very few candidates were able to calculate a ratio correctly. In (b)(ii), two thirds of candidates were unable to suggest a correct reason why undiagnosed diabetics had a higher death rate than diagnosed diabetics. This appeared to be a case where weaker candidates did not see that they were, effectively, being asked about harmful effects of diabetes; the use of factual recall with understanding.

#### **Question 4**

This question was answered well by many candidates. In (a), over two thirds obtained both marks for correctly describing the effects of age and life style. Part (a)(ii) discriminated rather more, with just over a quarter of candidates obtaining two marks and nearly a third failing to score. Many candidates made a suitable suggestion, such as a loss of neurones with age, but then failed to explain how this would slow reaction times. The examiners allowed a rather liberal interpretation of physiological functions in (c) and this resulted in nearly two thirds of candidates obtaining two marks. It was disappointing to find some candidates ignoring the wording of the question and giving declines in functions relating to the nervous system.

#### **Question 5**

In (a), the examiners allowed descriptions of depolarisation or the start of repolarisation of the membrane. Some candidates were confused between sodium, calcium, chloride and potassium ions. Others got the direction of movement of ions in the wrong direction, or by the wrong mechanism. It was not uncommon to see references to membrane potentials being due to sodium ions entering by facilitated diffusion, using energy from ATP. In (b), nearly two thirds of candidates correctly identified the refractory period. There were many good answers to (c)(i). It was pleasing to see that many candidates were able to predict the effect of the taser from the graph. Answers to (c)(ii) were often spoiled by a failure to state how high frequency tasers might be *too dangerous* to use. Many candidates wrote vaguely about damage to muscles, or it being very unpleasant. Better candidates suggested effects such as paralysis of breathing due to continuous contraction of muscles.

#### **Question 6**

In this question it was evident that many candidates were unfamiliar with correlation coefficients and what they show. Much of this Unit involves the interpretation of scientific data. Although a statistical analysis forms part of the ISA or EMPA that most candidates do after January, they should be familiar with certain basic statistical concepts for Unit 4. They should be aware that a correlation coefficient can be calculated to show the strength of correlation between two variables. Part (a) discriminated but only the very best candidates obtained three marks. In (a) and (b), only the better candidates were able to separate the concept of strength of correlation between twins from the total number of cases of asthma in the various types of twin. The weaker candidates tended to simply consider the number of cases.

#### **Question 7**

This question was answered well by many candidates. It was pleasing to see that most were able to interpret the information presented in the diagrams. In (a), about a fifth of candidates obtained all three marks and three fifths obtained one or two marks. Weaker candidates appeared not to have read the stem of the question carefully and some seemed to think that the

transporter protein was an enzyme that made dopamine. Others thought that cocaine entered the cell instead of dopamine and produced the same effect as dopamine inside the cell. Part (c) was particularly well answered and over a third of candidates obtained all three marks.

### **Question 8**

Part (a) tested the powers of expression of weaker candidates and they often failed to score marks because of vague statements along the lines of, 'DNA in an organism'. On the other hand, most candidates knew and could express a reasonable explanation in (b).

Answers to part (c) were very often vague and failed to describe the main features of the relationship shown in the graph. On reflection, a grid should have been printed on the graph to prompt the candidates to quote numbers from the graph. The commonest mark awarded was for the observation of a negative correlation.

Two of the marks in (d) were aimed at A-grade candidates and only good candidates were able to follow the logic in the question and get two or three marks. Many candidates obtained one mark for stating that the humans would produce antibody in response to the vaccine.

### **Question 9**

The examiners allowed candidates to interpret the pedigree as a genetic diagram, or as a series of observations of known cases of cancer. Obviously, individuals such as E might be too young to have developed cancer yet.

Parts (a) and (b) discriminated across the ability range. Weaker candidates attempted to answer by just referring to the frequency of cancer in the generations. This was particularly evident in (b), where many made no attempt to follow the inheritance of X chromosomes. In fact, there was a significant minority who did not know that men are XY and women XX. In (b), only the best candidates looked at the inheritance of X chromosomes from father to daughter.

In 9(c), many candidates made no attempt to use the information in the question and wrote in general terms about what a genetic counsellor might say to help anyone reduce their risk of cancer. This question was aimed at A-grade candidates.

Part (d) discriminated well across the ability range. Some well-prepared candidates produced excellent answers about how a non-functional protein could lead to a failure of cell death (apoptosis) of potentially cancerous cells and the uncontrolled division and metastasis of these cells.

### **Question 10**

This question contains a lot of AO3 and this proved too challenging for many candidates. To be successful with these sorts of questions, candidates require the skills to evaluate methodology, interpret results, extract information and evaluate conclusions. These skills should be developed in conjunction with their practical work. Most of the answers they need are in the information given in the question, or can be deduced from it.

In (a), most candidates obtained one mark for the idea that there would be less chance of a sperm reaching an egg. Very few related sperm count to the number of sperm surviving transit through the female reproductive tract.

The calculation in (b) was poorly done by almost two thirds of candidates. Many appeared to be unable to deal with powers of ten.

Part (c) was well done by many. It was pleasing to see that the best answers began with noting the information in the stem of the question about the actual number of beads per centimetre cubed. Many candidates also related the differences in standard deviation to accuracy. In (d), nearly two thirds of candidates related inaccuracy of method B to the higher dilution factor. Only a minority were able to clearly explain how this could adversely affect counting.

Part (e) proved too challenging for the majority of candidates. The problem appeared to be a failure to appreciate that sperm counts are counts of living sperm cells. The sperm were left in the solutions and apparatus to see whether this affected survival of the sperm.

In part (f), the vast majority failed to obtain the mark. As observed in question 6, candidates should know that a probability value of 0.05 or less is significant for most scientific purposes. This does not require the detailed teaching of statistics.

Many good answers were seen for (g). It was pleasing to see that most candidates could extract relevant information and deduce the basic idea of how oestrogen in beef could get into baby boys before birth and affect future sperm production. Weak answers stated, or implied, that oestrogen was still getting into boys during puberty, or that men were eating this beef.

Nearly two thirds of candidates failed to score in (h). The mark scheme was looking for the idea of taking sperm samples from many men, doing sperm counts and looking for counts at the lower end of the range. Many candidates failed to score because of vague references to doing sperm counts and seeing which were low. There were some very good answers that made reference to many samples and looking for counts (statistically) significantly below the mean, or outside of the 95% range. Another approach that was seen was to suggest taking samples from men who are fathers and finding the lowest sperm count of this group as the limit below which a count is low.

Part (i) discriminated across the range. Many candidates were able to suggest reasons why the results of this investigation might not be reliable. The commonest was the use of method B, which gives less accurate sperm counts. The examiners only accepted reasons relating to why the methodology used in this investigation might not be reliable, not what other investigations might have added to the story.

There were few good answers to (j). Many candidates wrote at length about one reason why women should, or should not, be advised to eat beef from these countries. As a general point, candidates should be advised to look at both sides of the proposal in this sort of question.