edexcel

# Moderators' Report/ Principal Moderator Feedback

## January 2014

## IAL Biology

### Unit: WBI04_01

The Natural Environment and Species Survival

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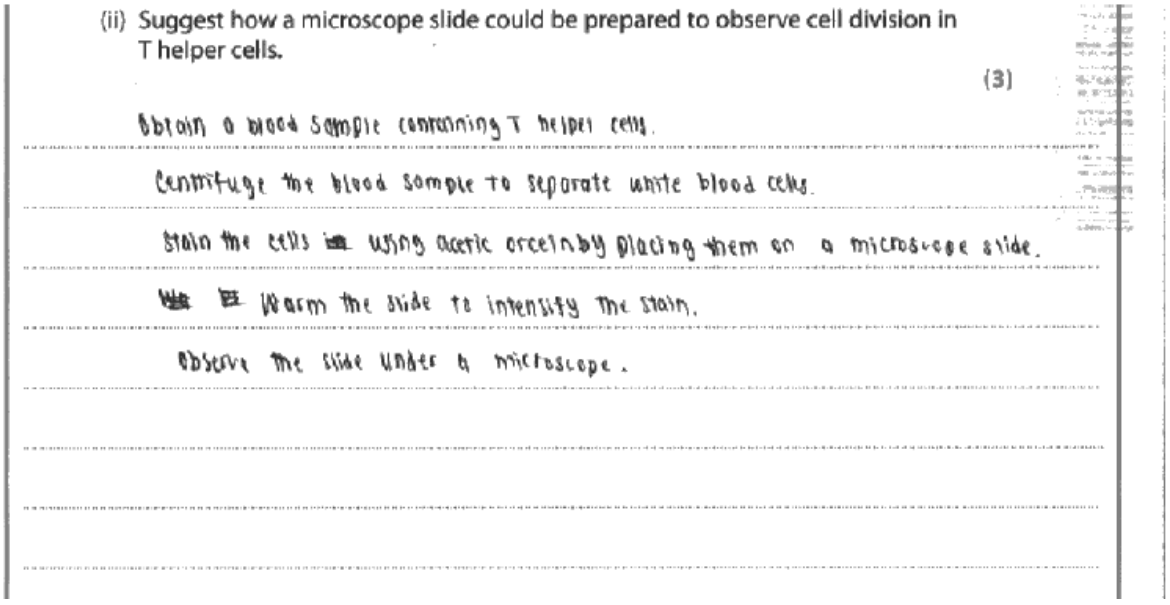
# General Introduction

Overall the paper performed well with the majority of students attempting to answer all the questions. The multiple choice questions scored well. It was clear that students have been prepared for the examination using past papers and their accompanying mark schemes. One or two questions were more challenging, especially where AS knowledge was being tested or BIO4 knowledge was being applied to unfamiliar scenarios.

**Question 1**
The majority of students could name the type of nuclear division as mitosis in 1(a)(i).

Applying a BIO2 core practical to a BIO4 context threw some of the weaker students in part (ii). However some of the more able students really thought the scenario through and even described ways of stimulating the T cells to ensure that mitosis was occurring; this was beyond the scope of our mark scheme but these students met three of the available mark points. Few students actually finished the story and described what would be looked for under the microscope. A clear response is given below:



(ii) Suggest how a microscope slide could be prepared to observe cell division in T helper cells.

(3)

Obtain a blood sample containing T helper cells.

Centrifuge the blood sample to separate white blood cells.

Stain the cells using acetic orcein by placing them on a microscope slide.

Warm the slide to intensify the stain.

Observe the slide under a microscope.

Part (b) scored well and students have clearly used past mark schemes to prepare for the examinations. There was a clear distinction between the more able students who described the activation of T killer cells and the less able who confined their responses to just the B cells. There is still some confusion over the cell type responsible for secreting antibody and the role of T killer cells. The response below illustrates all our mark points:

(b) Describe the role of T helper cells in the immune response.

(3)

T helper cells activates B cells and T killer cells. T helper cells secrete Cytokines. Cytokines stimulate mitosis of B cells into B effector cells and B memory cells. B effector cells differentiate into plasma cells needed to produce antibodies. Antibodies are needed for phagocytosis of bacteria. Cytokines produced by activated T helper cells stimulate mitosis of T-killer cells. T-killer cells are produced in large number of clones and T-killer cells bind to infected cell. T killer cells produces perforin that puncture the cell wall of infected cell causes it to lysis.

Part (d)(ii) is another example of where AS knowledge can be applied to a BIO4 context. There were some good descriptions of the role of golgi apparatus but students were required to link the proteins produced specifically to T cells. Mark point 2 naming cytokines was seen more frequently than mark point 3 for a reference to CD4 antigens.
A clear response is given below:

(ii) Describe the role of this organelle in T helper cells.

(3)

Golgi apparatus is involved in protein synthesis as proteins coming from ~~RER~~ rough endoplasmic reticulum goes to it inorder for the protein to be modified and packaged and it buds of from the golgi apparatus into a secretory vesicle that fuse at from the cell by exocytosis. and example of these ~~proteins~~ proteins are cytokines.

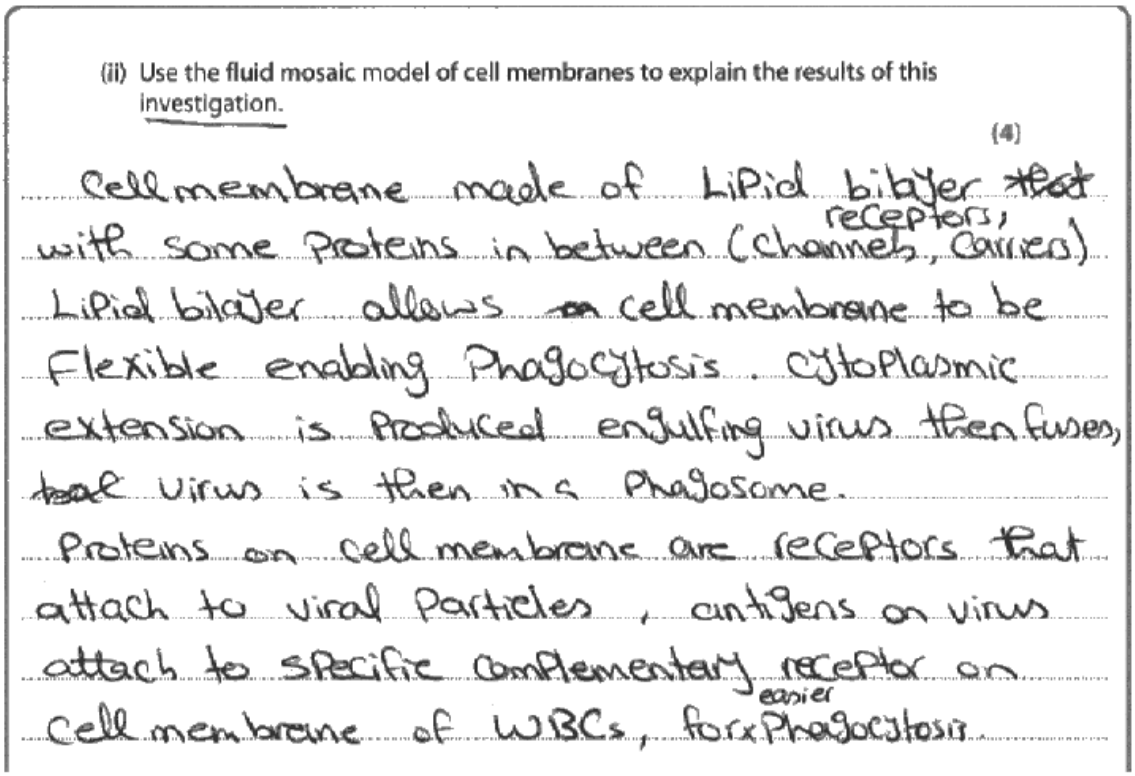
**(Total for Question 1 = 13 marks)**

**Question 2**

The responses to (b)(i) were very encouraging; many students knew what the length of the error bar represented and many actually answered the question by commenting on the reliability of the results shown in the graph.

The responses to part (ii) were more disappointing as relatively few students actually applied their knowledge of the fluid mosaic model to the mechanism of phagocytosis; this is a typical example of where AS knowledge can be used to explain a BIO4 topic. Students had clearly used previous mark schemes to accurately describe the process of phagocytosis. There were a number of students who did not appreciate that the question was about the entry of virus particles into phagocytes and describe the penetration of virus particles into host cells at the cell infection stage. Our mark scheme allowed for these students to score some marks.

A good response is shown below:



(ii) Use the fluid mosaic model of cell membranes to explain the results of this investigation.

(4)

Cell membrane made of Lipid bilayer ~~that~~ with some Proteins in between (channels, carriers, receptors) Lipid bilayer allows cell membrane to be flexible enabling Phagocytosis. Cytoplasmic extension is produced engulfing virus then fuses, ~~bad~~ virus is then in a Phagosome. Proteins on cell membrane are receptors that attach to viral particles, antigens on virus attach to specific complementary receptor on cell membrane of WBCs, for easier Phagocytosis.

Students did not pick up on the fact, in (c)(i), that we wanted to know that viruses are not living and therefore do not have the target sites of antibiotics, but did answer part (ii) very well. Again indicating that past paper mark schemes have been used by centres to prepare their students for the examination.

**Question 3**
Students are learning accurate definitions of the Biological terms used in the specification (part (a)(i)) but are struggling with calculations involving energy transfer between trophic levels (part(b)).

Part (a)(ii) was a good discriminator as the weaker students only described the relationship between NPP and the two factors whereas the more able students went on to explain the relationship.
This response is one of the many excellent responses that we saw:

(ii) Using the information in the graphs, describe and explain the relationship between NPP and each of these two environmental factors.

(5)

As mean ~~annual~~ annual temperature increases, NPP increases. Steepest increase is from 15°C to 25°C with increase of 950 Kg/m²/year. As temperature increases rate of enzyme activity increases in light independant reactions increases, so rate of photosynthesis increases, so NPP increases (RUBISCO ~~EN~~ enzyme). As annual rainfall increases, NPP increases. Steepest increase is from ~~0 to 1000 mm~~ mean rainfall of 0 to 1000 mm. As rainfall increases, water absorbed by plant increase, ~~more~~ & higher rate of photolysis and light dependant reactions, higher rate of photosynthesis.

Part (a)(iii) was a novel approach to examining students on the relationship between NPP and GPP. A number of students knew that the shape of the GPP line would be similar to that of NPP and a number knew that the position of the line would be higher. Some students chose to sketch the graph which yielded the marks.

**Question 4**

Students clearly have a good knowledge and understanding of the effect of temperature on enzymes; this question did not cause too many problems to students provided they wrote enough facts to earn them five marks in part (b). The commonest error, which we frequently see in the BIO1 paper as well, is that students tend to think that denaturation of enzymes only **starts** at temperatures above the optimum temperature.
This is illustrated in the response below:

(b) Describe and explain the effect of temperature on the activity of lipase R. (5)

from 30°C to 60°C as temperature increases, activity of lipase R increases as it gains more kinetic energy increases so collisions increases and more enzyme-substrate complexes are formed per unit time. Further increase in temperature from 60°C to 80°C, decreases the activity of lipase R as it begins to denature and the specific shape of its active site begins to change since enzymes are proteins in nature. H bonds holding the ~~shape~~ 3D shape of the active site begin to be broken so that the substrate no longer fits well in the active site

**Question 5**
A BIO4 paper can examine any AS topic, either as part of an item applied to a BIO4 topic or in the context of a question that is testing BIO4 content. This question is an example of the latter.

The first two parts of this question were testing entirely AS knowledge, but part (a)(ii) was trying to give the students some clues for specific details that would score them marks in part (b).

The responses to part (a)(i) were disappointing, primarily due to the poor expression of answers. We saw lots of comments about the pollen tube nucleus digesting the tissue of the style and there was lots of confusion over which nucleus was involved in the fertilisation of the female gamete. Disappointingly, very few students could actually state the actual function of pollen in transferring genetic material. Many students did not confine their responses to the question and described double fertilisation and the formation of the endosperm . . . very well! This did not penalyse them but would have wasted time.
Below is one of the better responses:

**5** Oak trees may be found growing in gardens and woods.

During sexual reproduction in oak trees, pollen is transferred between the flowers. The flowers then produce nuts called acorns. An acorn contains the embryo plant, as well as a store of starch.

The photograph below shows oak leaves and acorns.


Magnification ×1

(a) (i) Describe how the pollen is involved in the production of the embryo plant.

(4)

The pollen contains the male gamete. The pollen travels by wind or insects reaching the Stigma of the female parts. The pollen then releases enzymes forming a pollen tube down the style reaching the ovary of the plant. The male gamete then enters the ovary and fuses with the female gamete forming a zygot which then divides forming the embryo, which later develops into the seed.

Responses to part (a)(ii) were variable, but not so different to what we see in BIO1 papers: students can describe the structure of starch but not relate it specifically to its significance as an energy storage molecule. Students clearly do not understand the difference between easy hydrolysis and fast hydrolysis.

We had hoped for some good descriptions of decomposition in part (b) but some students wrote detailed descriptions of the evolution of tannin-resistant microorganisms. Mark points were stand-alone and awarded where applicable. Other students did not look at the mark allocation and as a result did not give sufficient facts to be awarded four marks.
A good response is shown below:

(b) Some oak trees lose their leaves each year. The leaves remain on the ground because they take a long time to decompose.

The leaves contain high levels of tannins that are poisonous to many animals and microorganisms.

Explain why oak tree leaves take a long time to decompose.

(4)

As ~~detrit~~ detritivores that attempt to eat the leaves will be poisoned from the tannis, so process won't be completed. Decomposers like saprophitic bacteria and fungi decompose the ~~leafe~~ leaves by external digestion and producing enzymes that break down the complex organic mater in the leaves. After the process of breaking the matter down, the decomposers absorb the soluble simple matter to utilise it in respiration and other processes. ~~Sein~~ Since one of the products absorbed is tannis, which is poisonous, bacteria will be killed. So process will stop, therefore it will take long time for leaves to be fully decomposed

**(Total for Question 5 = 12 marks)**

**Question 6**

This was probably the most challenging question on the paper, as there were three graphs illustrating some very complicated data. Students coped very well with all the information and again, the use of past papers in preparing students for a BIO4 paper was evident.

Part (a) was probably the most challenging question on the whole paper, but the majority of students made an attempt at answering the question. The commonest errors were to either describe the peaks and troughs and not the changes or to quote inaccurate data points from the graph. The mark scheme was deliberately open so that any correct description of a change in each of the three decades could be credited.

This is illustrated in the responses below:

(a) Describe the changes in the size of the 'red area' from 1970 to 2000.

(3)

There is no overall trend in the size of 'red area', it shows fluctuations in which it sometimes decreases and then increases and vice versa. From 1970 to 1980 it showed an overall decrease in the size of 'red area' and then an increase from 1980 to [redacted] mid-1990s where it reached its highest size of 'red area' which was 190/ $10^3$ ha. In 1995 and 1996 both sizes of 'red area' were the same and that was the maximum size. Between [redacted] 1975 and 1979, there was no size of 'red area' at all.

(a) Describe the changes in the size of the 'red area' from 1970 to 2000.

(3)

There is a fluctuation in size of 'red area' from 1971 to 1974. From 1975 to 1979, there is no 'red area'. There is a fluctuation in size of 'red area' from 1980 to 1987. From 1988 onwards, size of 'red area' increases. However, this is only until 1996. From 1997 to 2000, size of 'red area' decreases. The largest size of 'red area' is in 1995 and 1996, which is 190 $10^3$ ha. There is a slight fluctuation in size of 'red area' from 1993 to 1995.

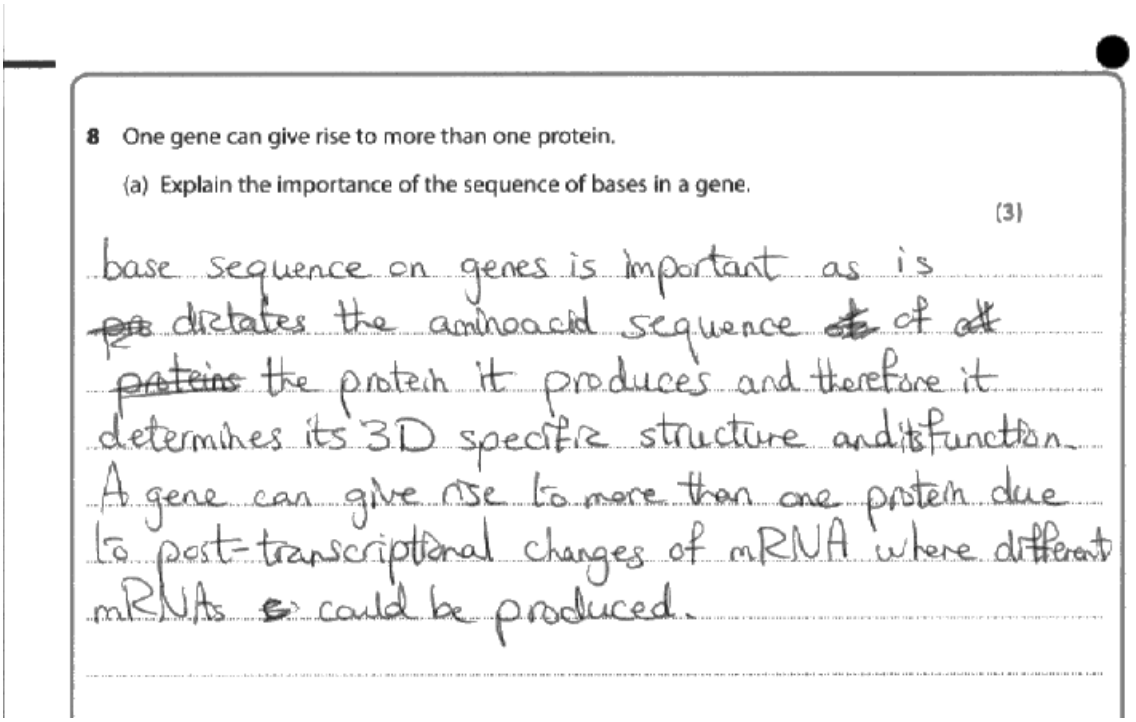
Parts (b), (c) and (e) caused few problems, provided the students considered the marks allocated to each question and made sufficient points in their answers.

Part (d) was more challenging as many students only wrote about the data post 1970 and did not consider the long-term means given on the graphs and their significance.

**Question 7**

Parts (a) and (b) were coped with reasonably well. The calculation did cause the weaker students problems as they struggled with interpreting the graph. Very few students actually stated the effect of their named factor on the estimate in part (iii) so only scored one of the two marks.

The responses to part (c) were variable. The weaker students described the brine shrimp core practical. Middle ability students went on auto pilot and used past mark schemes to answer the question without really thinking about the actual context of the question.
Below are a couple of good responses:

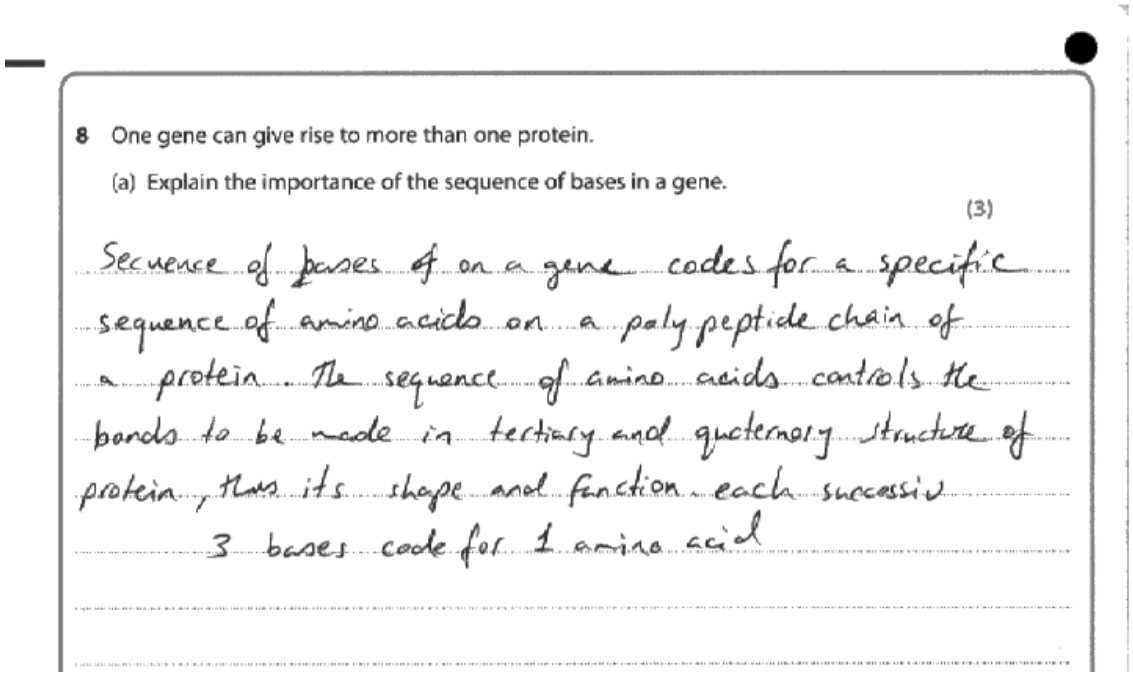


8 One gene can give rise to more than one protein.

(a) Explain the importance of the sequence of bases in a gene.

(3)

base sequence on genes is important as is ~~pa~~ dictates the aminoacid sequence ~~of~~ of ~~at~~ ~~proteins~~ the protein it produces and therefore it determines its 3D specific structure and its function. A gene can give rise to more than one protein due to post-transcriptional changes of mRNA where different mRNAs could be produced.



8 One gene can give rise to more than one protein.

(a) Explain the importance of the sequence of bases in a gene.

(3)

Secuence of bases of on a gene codes for a specific sequence of amino acids on a polypeptide chain of a protein. The sequence of amino acids controls the bonds to be made in tertiary and quaternary structure of protein, thus its shape and function. each successive 3 bases code for 1 amino acid

**Question 8**

In part (a) we saw reference to the codons coding for amino acids and the idea that the sequence of bases determined the sequence of amino acids and hence the three-dimensional structure if the protein. Disappointingly there were few references to the start sequences and stop codons.

We were extremely pleased with how well part (b) was answered, with many students being awarded five or six marks for their response.
Below is an example of the high quality of responses that we saw:

*(b) The cochlea in a chicken's inner ear is lined with hair cells that can detect different frequencies of sound. The frequency detected depends on the type of BK channel protein present in the cell membrane.

One report suggests that there are 48 different BK channel proteins in these hair cells.

The *cSlo* gene codes for all of these BK channel proteins.

Explain how one *cSlo* gene can give rise to different BK channel proteins in these hair cells.

**(6)**

When the sClo gene is transcribed, it gives a sequence of pre-mRNA. This pre-mRNA ~~gives~~ has to go through a phase called post-transcriptional change before it's ready for translation. In this process, splicing occurs of pre-mRNA by enzymes called splicosomes. Those cut the introns out leaving the exons (coding regions). ~~Different~~ Exons may be arranged in many ways resulting in a different variety on mRNA. When translated into an amino acid sequence. They're different. So different amino acid sequence is primary structure, means different bonds formed at different places. Bonds could be Hydrogen, ionic or disulphide bridges. Resulting into a different secondary and tertiary structure and a different 3D shape for different proteins.

**(Total for Question 8 = 9 marks)**

## Summary

From the responses to the questions on this paper the following points would help improve student performance:

- Be prepared for any AS topic to be tested on this paper by revising the BIO1 and BIO2 specification thoroughly.
- Read the question carefully to identify the command words; if there are two command words then the answer must address both, if full marks are to be accessed.
- Check the mark allocation for each question and ensure that at least as many facts are given in the answer.
- In QWC questions always check the answer to ensure that it is clear and that there are no spelling mistakes, particularly of the scientific terms.

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