

Examiners' Report
June 2018

IAL Biology WBI05 01

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Introduction

Candidates were able to demonstrate their knowledge and understanding by tackling the wide range of questions offered in this paper. It was clear that some candidates had studied the pre-release article and were able to relate their reading to the questions asked in a meaningful way. However, many appear to have struggled with aspects of the paper and, in particular, with the scientific article.

Some candidates attempted to “set the scene” before beginning their actual response, often merely repeating the words in the actual question. This wastes valuable time and gains no credit.

Incorrect interpretation of the wording of some questions was apparent in a number of questions and many candidates appeared to struggle to apply their knowledge to the unfamiliar scenarios that were presented.

Question 1 (a)

Most candidates are able to interpret and describe the results presented in a graphical form. Candidates gaining all 3 available marks described the general trend (MP1) and then picked out key features from the graph, the steepest increase (MP2) and the point at which the increase levels off (MP3). Some made no attempt to interpret the graph and simply described each change often calculating the percentage changes. This approach does not demonstrate an understanding of what the graph shows and did not score well.

(a) Using the information in the graph, describe the results of this investigation.

(3)

As the concentration of CO_2 increases, percentage increase in CO_2 volume of air breathed in per minute increases. The steepest increase was from 4 to 10% by 340%. The increase was less steep from 10 to 12% than from 0 to 4%.



This concise but complete response gained all three marks.



When asked to describe data make sure the main features are explained. Try to avoid describing individual changes with addressing the overall trends.

Question 1 (b)

Many candidates had a good understanding of how a change in carbon dioxide concentration in the blood would affect ventilation rate. Few candidates actually started the story with the concentration of carbon dioxide in the alveoli (MP1), instead they went straight into the increase in carbon dioxide concentration in the blood.

Some responses lacked sufficient detail to gain some marks. Chemoreceptors had to be located in a suitable structure in order to gain MP3. Some candidates described how heart rate could be affected rather than ventilation rate.

(b) Explain how changes in the concentration of CO₂ lead to changes in the ventilation rate of the kangaroo rat.

(4)

increased CO₂ concentration in lungs will increase CO₂ concentration in blood. This will decrease the pH of the blood and will be detected by chemoreceptors in the carotid arteries of the mouse. This will be detected by the ventilation center in the medulla oblongata that will send nerve impulses via the motor cortex to the ventilation muscles such as the intercostal muscles of the lungs causing increased contraction and therefore increased ventilation rate.



This response gained four marks for MP2, MP3, MP4 and MP5.

(b) Explain how changes in the concentration of CO_2 lead to changes in the ventilation rate of the kangaroo rat.

(4)

More CO_2 in the blood lowers the pH of the blood. This triggers the chemoreceptors to detect the drop and sends messages down the sympathetic nervous system to the medulla oblongata which sends impulses to the brain and cardiovascular centre to increase heart rate and increase ventilation rate. Thus, more CO_2 can diffuse out of the blood and oxygen can enter, allowing aerobic respiration.



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Examiner Comments

This response gained one mark, MP2. Reference to chemoreceptors by themselves was not sufficient for MP3. The response then goes astray and the candidate describes control of the heart rate which is not required.



ResultsPlus
Examiner Tip

Candidates should read questions carefully and check they have answered the questions that were asked.

Question 2 (a) (iii)

Most candidates recognised that phytochromes would be involved and correctly described the slow conversion of PFR to PR in the dark (MP1). Candidates generally struggled to convey the idea that a critical concentration of PFR is required for germination or alternatively that once a particular concentration of PR is reached germination is inhibited.

A number of candidates ignored the role of phytochromes and made other reasonable suggestions (MP3). Some candidates suggested the seeds would not be able to undertake photosynthesis in the dark. These responses did not gain MP3.

(iii) Suggest why the percentage of these seeds that germinate in no light gradually decreases over a period of time.

(2)
In no light, PFR is slowly converted to PR. As the time of darkness rises, the seeds contain a greater concentration of PR which inhibits germination in them and decreases the number of seeds that germinate.



ResultsPlus
Examiner Comments

Two marks awarded for marking points one and two.

(iii) Suggest why the percentage of these seeds that germinate in no light gradually decreases over a period of time.

(2)

~~Inade~~ Active form of P_r is converted to inactive form of P_r during night at a far red light at 720 nm.



Marking point one was awarded. Unfortunately, the candidate did not finish the response expected because they did not include why this is important.



Candidates should always check to make sure their answer is complete.

Question 2 (b) (ii)

Many candidates recognised that blue light caused more curvature of the coleoptiles than red light (MP2). Some candidates also described the general trend, that increasing the intensity of either blue or red light increased the angle of curvature of the coleoptiles.

(ii) Using the information in the graph, compare the effect of red light and blue light on the curvature of the coleoptiles.

(2)

Both red and blue light cause an increase in the mean angle of curvature with increasing light intensity. ^{Blue} Red light causes a greater mean increase in the mean angle of curvature than ^{red} blue light. At low light intensities, red light has a greater effect. At 0.5 au light intensity both colours cause an equal mean angle of curvature.



ResultsPlus
Examiner Comments

Both marking points were awarded for this response.

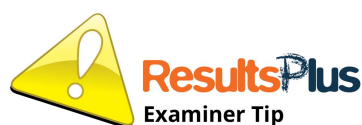
(ii) Using the information in the graph, compare the effect of red light and blue light on the curvature of the coleoptiles.

(2)

Both blue and Red light effect curvature of the coleoptiles. Red however has a much greater effect and as intensity increases, ~~so does~~ so does mean curvature all the way up to 85°. At max intensity on graph, Red light produces about 112% more curvature than blue light.



In this response the candidate did not describe the relationship between light intensity and the degree of curvature. This meant MP1 was not awarded. The candidate also mixed up the effect of blue and red light so did not get MP2.



When describing a graph candidates should make sure they use both the y-axis and the x-axis labels in their description.

Question 2 (b) (iii)

Most candidates made a sensible suggestion and gained the mark for this question. A number of candidates made more than one suggestion. When a candidate does this an incorrect response can negate the mark that would be awarded for the correct response. Candidates cannot provide a list of alternatives and leave the examiner to select the correct one.

Question 2 (b) (iv)

Many candidates provided complete answers to this question. Care needs to be taken with the way some ideas are conveyed.

For MP2 it needed to be clear that it was the bonds between and not in cellulose that were being broken.

For MP5 candidates needed to describe the coleoptiles bending or growing towards the light. Coleoptiles moving towards the light was not sufficiently clear.

(iv) Explain the role of IAA in the effect of light on these coleoptiles.

(4)

IAA is one types of growth hormone. IAA locates at the tip of the shoot. When there is light, it diffuses down the shoot to the side without exposure of light. The cells at area without exposure of light will elongate. Auxin-active pumps pump H^+ ions out of the cell so the pH decreases. Auxin will bind to ~~se~~ receptors on cell membrane to produce ~~secondarge~~ secondary message molecules. The bonds between cellulose microfibrils will be broken and cell wall expand. Water osmosis into the cell forming vacuoles. Then bonds between cellulose microfibrils will reform and cell elongate. The cells at area without exposure of light are larger so the shoot bends towards the light.



ResultsPlus
Examiner Comments

This comprehensive response gained four marks from MP1, MP2, MP4, MP3 and MP5.

(iv) Explain the role of IAA in the effect of light on these coleoptiles.

(4)

IAA is a hormone that is a photoreceptor and is sensitive to light intensity. As light intensity increases, the IAA ~~grow~~ results in the growth of the plant part (tip of shoot) where the light is directly hitting the shoot. It accumulates away from the light and so the shaded part of the shoot tip will grow resulting in a curvature / bend.



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Examiner Comments

This slightly confused account only gained one mark, MP1.

Question 3 (b) (i)

Many candidates struggled with this question. Often candidates implied that ATP was being used in the immediate response to light by rod cells.

MP1 was often not seen as candidates just ignored the basic idea that ATP provides energy for many cellular processes.

'Providing', 'making available' and 'releasing' were acceptable terms for MP1, but ATP 'produces' energy was not accepted for this marking point.

(b) Rod cells contain large numbers of mitochondria.

(i) Describe the role of ATP in the response of rod cells to light.

(3)

As light enters the rod cells, ATP is used to convert rhodopsin into opsin and retinal and also converts cis-retinal into trans-retinal.



ResultsPlus
Examiner Comments

This candidate has missed the point of the question and is describing the events that occur when light hits rhodopsin. No marks were awarded.



ResultsPlus
Examiner Tip

Candidates need to read questions carefully and answer the question that is asked.

(b) Rod cells contain large numbers of mitochondria.

(i) Describe the role of ATP in the response of rod cells to light.

(3)

Mitochondria is the source of ATP synthesis.

ATP is source of energy.

ATP is used in the rod cells to actively pump sodium ions outside the cell.

ATP is also used to bind opsin and ~~and~~ cis-retinal ~~to~~ back together into rhodopsin when there is no light.



ResultsPlus
Examiner Comments

This response starts by explaining the role of ATP in providing energy and then gives two good examples of how the ATP is used. All three marks were awarded MP1, MP3 and MP5.

Question 3 (b) (ii)

This was a QWC question with the emphasis on clarity of expression. Many candidates produced detailed responses that scored highly. In many responses the candidates described everything from the start of glycolysis through to oxidative phosphorylation. It was not clear if this is because they do not know the location of the different stages of respiration or if they did not read the question carefully.

(ii) Describe how ATP is produced in mitochondria.

(6)

By the process called oxidative phosphorylation. reduced NAD and reduced FAD release Hydrogen atoms. Hydrogen atoms are split into protons and electrons. The electrons are transported along the electron transport chain (ETC) losing energy at each carrier. The ETC is located in the inner membrane of the mitochondria. The electron carriers use that energy to pump protons from the mitochondrial matrix to the intermembrane space. The protons accumulate in the intermembrane space and form an electrochemical gradient. The protons move back down the concentration gradient and into the mitochondrial matrix through proton channels. This is the energy produced causes the proton channel to with ATPase property to convert ADP and inorganic phosphate to ATP. ($ADP + P_i \rightarrow ATP$). The movement of H^+ hydrogen ions across the membrane is called chemiosmosis.



ResultsPlus
Examiner Comments

A good response that gained six marks.

*(ii) Describe how ATP is produced in mitochondria.

(6)

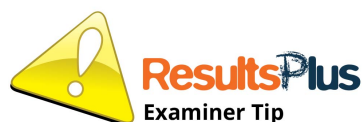
Oxidative phosphorylation in mitochondria, electrons to
Electron transport chain, losing energy used to pump H^+ ,
from matrix to inter membrane.

Energy released so H^+ moves back to matrix to form ATP



This response gained two marks, MP2 for correctly making reference to oxidative phosphorylation. The candidate then also described the release of energy by electrons moving along the electron transport chain MP4.

Unfortunately, the candidate describes pumping of protons 'to the' inner membrane. To get MP5 it has to be 'across' or 'through' the inner membrane not 'to it'. Similarly, to get MP 6 there must be a clear reference to protons being pumped into the intermembrane space.



Candidates should not describe ions, protons etc as diffusing or being pumped 'into' membranes. Generally, this is not credited with marks. They should be described as moving 'across' or 'through' the membrane.

Question 4 (a) (i)

Most candidates provided a suitable answer for this question. However, as in Q2(b)(iii) some provided more than one alternative and sometimes this resulted in them losing the mark.

Question 4 (a) (ii)

This question proved straightforward for most candidates. MP1 was generally seen. Some candidates did not explain how they would obtain a rate and did not divide the distance measured by a time taken so did not achieve MP2.

(ii) Describe how this apparatus could be used to calculate the rate of respiration of the sand lizard.

(2)

Measure the length of the oil drop moved in the capillary tube as the sand lizard ~~bre respire~~ breaths.



In this response the candidate has started the answer but has not remembered that to calculate a rate you need to divide by time. Only MP1 was awarded.



Candidates need to read answers carefully to check they are complete.

Question 4 (b) (i)

This calculation was accessible to many candidates. Both marks were awarded for the correct percentage increase. Some candidates calculated a percentage decrease. If candidates showed, in their working, the correct values from the graph they gained the working mark.

Question 4 (b) (ii)

Many candidates recognised that anaerobic respiration was taking place (MP2) and linked this to the conversion of pyruvate to lactate (MP3). Very few candidates explained why anaerobic respiration was taking place (MP1) or linked the oxidation of reduced NAD with the conversion of pyruvate to lactate (MP4).

(ii) Explain the change in mean muscle lactate concentration during the exercise.

(3)

During the exercise the muscles need rapid energy supply for rapid contraction. So mostly fast-twitch anaerobic respiration occurs through and respiration is limited to glycolysis ^{in cytoplasm} where 2 ATP molecules are formed and pyruvate ~~acts as~~ is converted to lactate, increasing lactate concentration. After exercise lactate passes through the liver where it's oxidised to pyruvate that can be stored as glycogen or enters link reaction and kreb's cycle by diffusing into mitochondria. This decreases the concentration of lactate.



This response gained two marks, MP2 and MP3.



Candidates should think about the reason for something happening. In this example why is anaerobic respiration required? It is more than just the need for a rapid energy supply.

Question 4 (c)

A number of good responses were seen to this question. However, many candidates did not recognise that there were two parts to the graph; an initial increase in oxygen consumption followed by a decrease in oxygen consumption. These candidates generally gave incomplete responses.

Explain the changes in the oxygen consumption of this sand lizard.

(4)

The oxygen consumption increases until 30 minutes after exercise. This is because ~~oxygen debt~~ there's oxygen debt, ^{since anaerobic respiration takes place} so the muscle sand lizard need to breath deeply to obtain oxygen to pay off the debt.

* Oxygen is required to oxidise the lactate back to the pyruvate and reduce NAD back to reduced NAD.

Therefore, the oxygen consumption increases.

However, ~~the after 30 minutes after~~ beyond 30 minutes after exercise, ^{to 120 minutes after exercise} the oxygen consumption decreases by $9.6 \text{ dm}^3 \text{ kg}^{-1} \text{ day}^{-1}$.

This is because all the oxygen debt has been paid off and aerobic respiration takes place.

Pyruvate will enter the link reaction to produce more reduced \downarrow NAD and ~~the~~ all the lactate have been removed.



In this response the candidate has clearly gained MP1, MP2 and MP4. MP3 was awarded, just because of the comment about aerobic respiration in line 11 when taken together with the comment about anaerobic respiration in line 2. By itself a simple statement that 'aerobic respiration takes place' would not be sufficient for this marking point.

Explain the changes in the oxygen consumption of this sand lizard.

(4)

Oxygen consumption increases during the first 20 minutes after exercise. This is due to ~~excess post~~ ^{oxygen debt} that is needed to be repayed. ~~due to~~ ^{accumulated} lactate back into pyruvate or glucose in the liver. The oxygen consumption then levels off for ~~ab~~ 10 minutes. This is when the rate of conversion of lactate reaches maximum. After 30 minutes, all lactate have been converted so oxygen consumption drops back to normal after 120 minutes. The drop is not sudden as respiration rate is still high due to the ~~high~~ high heart and ventilation rate.



In this response the candidate gained MP2 (lines 1 and 2) and MP4 (lines 5 and 6).

Question 5 (b) (ii)

Candidates generally provided complete responses to this question. Where marks were not awarded it was generally because candidates were incorrectly recalling details of the process.

(ii) Describe the role of calcium ions in the sliding filament theory of muscle contraction.

(3)

When the sarcolemma is depolarised, the sarcoplasmic reticulum is stimulated to release calcium ions into the sarcomere, then calcium ions bind to troponin causing it to change shape and pulling on tropomyosin to expose the myosin head binding site, then myosin head binds and forms actin-myosin bridge and releasing ADP and Pi thus moving actin filament in a 'power stroke'. When muscle is not stimulated, ATP binds with the myosin head and ATP synthase with the help of calcium ions changes ATP to ADP and Pi so actin-myosin bridge is broken and myosin head changes shape and returns to its original position.



A complete response that gained all three available marks.

Question 5 (c) (i)

This question proved difficult for most candidates. When asked about data, candidates need to think carefully about the data provided and the question they are being asked.

In this table candidates were given the number of people with osteoarthritis and the number of individuals in each group. Looking carefully at the data shows that with increasing physical activity the frequency of osteoarthritis increases. The number of cases decreases but the size of the group decreases by a greater extent. Most candidates ignored the reference to frequency in the question and did not get the available mark.

Question 5 (c) (ii)

This question proved accessible to most candidates. Most candidates gained MP1 and many also gained MP2

(ii) Explain why the scientists were able to suggest that BMI does not affect the frequency of cases of osteoarthritis in this study.

(2)

The range was overlap and BMI for all were quite similar.
There is not much difference in the BMI of individuals doing
0 hours of heavy physical activity and 4 hours of physical
activity.



This response gained both marks.

(ii) Explain why the scientists were able to suggest that BMI does not affect the frequency of cases of osteoarthritis in this study.

(2)

Even though the mean body mass index (BMI) was at 26.2 ± 3.9 , the number of cases of osteoarthritis was at 2 meaning it has decreased not increased but there is no effect.



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Examiner Comments

This response does not address the question asked and gained no marks.

Question 5 (c) (iii)

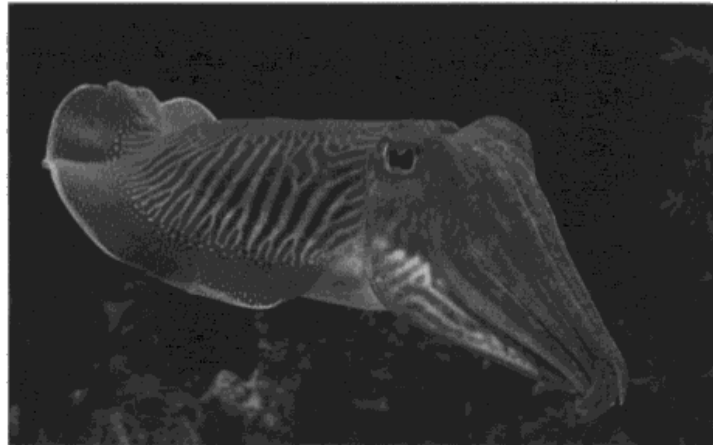
This was another familiar question and many candidates gained both marks.

Question 6 (a)

Candidates were provided with some information about an experiment, carried out using a single cuttlefish, and then asked to suggest improvements.

Many candidates suggested using more cuttlefish (MP1). Some candidates also looked at the data provided and suggested that sound intensities above 165 a.u. (MP2) or that smaller increments of sound intensity or frequency could be investigated (MP3). A number of candidates made suggestions about controlling conditions or controlling the age and gender of the cuttlefish etc which did not gain any credit. When asked to suggest improvements to an experiment, candidates should limit their suggestions to improvements around the information that is provided.

6 The photograph below shows the common cuttlefish, *Sepia officinalis*, a marine invertebrate.



Magnification $\times 0.2$

When in danger, cuttlefish can exhibit a flight response that includes squirting water containing a dark ink.

In an experiment, one cuttlefish was exposed to sounds of different intensity and frequency. The cuttlefish was observed for a flight response.

The results are shown in the table below.

Sound intensity / a.u.	Frequency / cycles per second							
	80	100	150	200	250	300	400	500
165		■	■	■				
160		■	■	■				
155			■	■				
150			■	■	■			
140				■				
130								
120								

Flight response ■

(a) Give **two** ways in which this experiment could be improved.

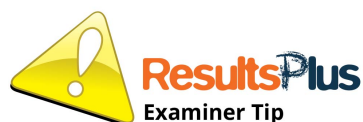
(2)

- Increase the sample size

- Control variables ex: temperature, species of fish, type and volume of sound.



One mark for the idea of repeats, MP1.



When candidates are asked to suggest how an experiment could be improved, they need to use the information provided to help answer the question. General comments about controlling variables are not going to get marks.

(a) Give **two** ways in which this experiment could be improved.

(2)

Smaller intervals of sound intensity / frequencies used.
Larger sample size / repeat & find average to increase reliability.
Make sure control variables e.g. temperature / pH / Same parent to minimise genetic difference is controlled to improve validity.



Both marks were awarded for MP1 and MP3.

Question 6 (b)

In this question candidates were asked to suggest how habituation of cuttlefish to a sound could be investigated. MPs 1 and 2 were awarded for selecting information from the table about sounds cuttlefish respond to. Few candidates actually made reference to this information and did not get either MP1 or 2. Relatively few candidates made any reference to the idea of exposing the cuttlefish to the same sound at regular time intervals MP4. MPs 3, 5 and 6 were frequently seen.

(b) Cuttlefish can become habituated to sound.

Using the information in the table and your own knowledge, explain how it could be shown that cuttlefish can become habituated to sound.

(4)

Stimulate a cuttlefish with ^{same} repeated sound in the level which it can receive, like 165 a.u. of sound intensity and 100 cycles/s.

Stimulate the same cuttlefish every 5 minutes

Measure the time for ^{mobile} ink water to ~~turn~~ turn clean. It represents amount of ink released and the level of flight response

As times of sound increases, time for ink water to turn ~~set~~ clean decreases.

Repeat on other cuttlefish to calculate mean time.



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Examiner Comments

This candidate recognised that the question was asking how habituation could be demonstrated. The candidate then went on to use information from the table to help design an experiment. Four marks were awarded from, MP 2, 1, 4, 5 and 3.



ResultsPlus
Examiner Tip

Many candidates tried to argue that the data given as part of the question showed habituation, but this was incorrect. It is important that questions are read carefully.

Question 7 (a)

Many candidates produced a reasonably complete account of how mammals can maintain a core body temperature. However, few candidates linked this to the Star nosed mole. As a consequence, MPs 1, 2 and 3 were rarely seen.

7 The scientific article you have studied is from Scientific American.

Use the information from this article and your own knowledge to answer the following questions.

(a) The star-nosed mole needs to 'survive cold northern winters' (paragraph 2).

Suggest how this mammal maintains a steady core body temperature in a cold climate.

(5)

They maintain a steady core body temperature through thermoregulation through the hypothalamus, including mechanisms such as vasoconstriction, which slows down blood flow and prevent heat loss. This is done through a negative feedback system back to a norm value, and any changes in the ^{body} temperature ~~above~~ below the norm value is detected by thermoreceptors in the hypothalamus. Stimulates responses including speeding up liver activity for high metabolism, (if already has high metabolism regardless), and through obtaining sufficient energy through preys. It has a voracious appetite and the biomolecules broken down from food could be used ~~to~~ in metaboliz reactions which releases heat.



In this response the candidate gained five marks. MP6 line 2, MP1 lines 2 and 3, MP4 inside the smooth brackets on lines 7 and 8, MP1 and 5 in the last three lines.



This is a good example of how candidates can link their biological knowledge to the circumstances of a particular organism.

7 The scientific article you have studied is from Scientific American.

Use the information from this article and your own knowledge to answer the following questions.

(a) The star-nosed mole needs to 'survive cold northern winters' (paragraph 2).

Suggest how this mammal maintains a steady core body temperature in a cold climate.

(5)

Control of temperature is thermoregulation which is controlled in the hypothalamus. Temperature receptors in aortic and carotid bodies in the body of the mole will send an impulse to the hypothalamus if the temperature is too ~~hot~~ cold. Nerve impulses will then be sent along motor neurone to effectors. Process is called negative feedback. Impulses are sent to surface cells so they twitch, so the body begins to shiver, increasing respiration and metabolic process, increasing the body temperature. Vasoconstriction also occurs, where blood vessels near the surface become smaller and narrower, so less heat is lost from the surface.



ResultsPlus
Examiner Comments

This response gained two marks. MP6 for reference to the hypothalamus and MP8 for vasoconstriction reducing heat loss. MP4 was not awarded for 'increasing metabolic processes'. A response for MP4 should be in the context of this particular animal and increasing metabolic rate was not seen to mean the same as having a high rate metabolic rate to begin with.



If a question is in the context of a particular organism, especially if it is from the scientific article, candidates should link their response to the context, as it is likely some of the marks will be linked to the specific example or context.

Question 7 (b)

A pleasing number of candidates were able to give a good explanation of why a structure can be described as an organ. MP1 had to be about different tissues or cell types. Simple reference to 'different cells' was not enough for this marking point.

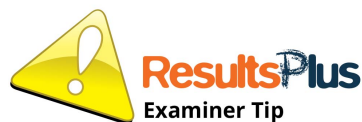
(b) Explain why the papillae that surround the nose of the star-nosed mole are described as organs (paragraphs 3 and 4).

(2)

The papillae is made of different specialized tissues (e.g. lamellae, Merkel cell) and they work together to carry a specific function of signalling different aspects of touch.



An excellent response that describes what an organ is in the context of papillae of the star-nosed mole. Both marks were awarded.



This response shows candidates how it is possible to answer questions in the context of the question.

(b) Explain why the papillae that surround the nose of the star-nosed mole are described as organs (paragraphs 3 and 4).

(2)

Eimer's organ consists of various types of tissues, including Schwann cell, lamellae and Merkel cell, which work together to perform more specialised functions.



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Examiner Comments

In this response the candidate has gained MP1 only. Working together to perform 'more specialised functions' was not accepted for MP2.

Question 7 (c)

Candidates generally described the initiation of an action potential beginning with sodium ion channels opening. However, many gave their response in the context of a synapse so gave several details that were not required. Relatively few candidates attempted to explain how a nerve impulse could begin in a nerve ending (MP1).

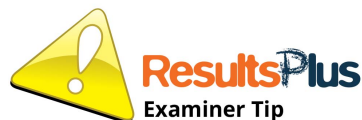
(c) Suggest how a nerve impulse can be initiated in the 'single nerve ending' of a 'lamellated receptor' (paragraph 4).

(3)

a stimulus activates a nerve impulse from the nerve ending of a lamellated receptor. This causes an action potential that causes depolarisation and repolarisation along the axons, which help the nerve impulse to travel to the brain.



Only MP4 was awarded.



When candidates check their answer to a question they should notice the number of marks available. Then ask themselves, have I included the relevant number of points in my answer?

(c) Suggest how a nerve impulse can be initiated in the 'single nerve ending' of a 'lamellated receptor' (paragraph 4).

(3)

When ~~the~~ an eimer's organ detects an object, pressure is exerted in the lamellated receptors, on every single nerve ending. This change in pressure stimulates ~~the~~ Na⁺ channels to ~~off~~ open. Na⁺ ions diffuse into the cell, and if ^{the} enough stimulus is large enough to open enough Na⁺ channels to reach ~~the~~ threshold, then a generator potential will be started in the lamellated receptor. This ~~action~~ ^{action} potential will be directed ^{towards} ~~to~~ a sensory neurone which will transmit the impulse to the brain.



ResultsPlus
Examiner Comments

This response demonstrates that the candidate has studied the pre-release article and has prepared well for the examination. All four marking points are present in the response and a maximum score of three was awarded.



ResultsPlus
Examiner Tip

Candidates should make sure they use the pre-release material to help them prepare for the exam.

Question 7 (d)

Most candidates gained either MP1 or 3. Very few seem to have considered how the structures described in the article work.

Question 7 (e)

Many candidates demonstrated an understanding of the ideas of differentiation. However, they often did not sufficiently express their understanding to gain marks. Many mentioned differentiation, but did not say 'from a stem cell', so did not gain MP1. Candidates often described the activation and deactivation of genes but did not mention transcription factors and did not gain MP3. Candidates often made reference to genes specific to Schwann cells but did not link these to the production of myelin and did not achieve MP4. A small number of candidates described the myelin gene; As myelin itself is not a protein, this was not accepted for MP4.

(e) Explain how a Schwann cell becomes specialised during its development (paragraph 4).

(3)

When a Schwann cell is differentiated it is a stem cell. There is stimuli and a which causes the transcription factors to switch on and switch off genes which would differentiate it into a Schwann cell. produce specific proteins, mRNA is made and transcribed in the ribosomes making proteins which would produce myelin sheath and sodium channel potassium channels etc and differentiate the cell into a Schwann cell.



ResultsPlus
Examiner Comments

This is an example of a good response. Three marks were for MP1 in lines 1 and 2, MP2 in line 2, MP3 in line 3 and MP4 in lines 5 to 7.

(e) Explain how a Schwann cell becomes specialised during its development (paragraph 4).

(3)

The some genes in a non-specialized cells are exposed to ~~chemi~~ stimuli. Some genes are activated and some aren't. The activated genes are transcribed and translated forming proteins and therefore giving the cell a specific role causing it to become specialized.



ResultsPlus
Examiner Comments

In this response the candidate has not adequately expressed relevant ideas clearly. It was just sufficient to award MP2. For MP3 the term transcription factors had to be used.

Question 7 (f)

Many candidates produced reasonable explanations and scored well. However, a large number of candidates simply repeated information from the article and did not gain many marks.

- (f) Suggest how 'sensory neurons collecting information from the 11th appendage are granted far more cortical territory ... than other appendages' (paragraph 20).

(3)

The area ~~rep~~ representing the ~~#~~ neurone from the 11th appendage in the brain is ~~great~~ has a greater size than other areas ~~re~~ representing the other appendage as there are more neurones and the 11th appendage is more developed. There are more stimulus from the 11th appendage, more nerve impulse travel to the area, more neurotransmitter release, more ~~synapse~~ synapse formed, thus there are more neurones in the area.



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Examiner Comments

This response gained MPs 1, 2 and 3 in the last four lines.

(f) Suggest how 'sensory neurons collecting information from the 11th appendage are granted far more cortical territory ... than other appendages' (paragraph 20).

(3)

The 11th appendage contains the most free sensory receptors so more action potentials can be generated. This causes more development to take place. Hence the 11th appendage is granted more cortical territory in order to cause greater growth.



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Examiner Comments

More action potentials generated by the 11th appendage was accepted for MP1. No other marking points were seen.

Question 7 (g)

For MP1 candidates needed to include the idea of time and not just 'period'. MP2 was expressed in several different ways and was frequently seen. Relatively few candidates discussed the idea of unresponsiveness before and after the critical period (MP3).

(g) State what is meant by the term 'critical periods of development' (paragraph 23). (2)

(first years of life)
critical period where brain reconnects and arranges
synapses ~~to be~~ in the cortex where they develop.



This response was too vague and did not gain any marks.

(g) State what is meant by the term 'critical periods of development' (paragraph 23). (2)

Critical periods are periods of time in which
a specific environmental stimulus is needed to
result in the successful development of
a part of the brain.



This clear and concise response gained both available marks. It could have been improved by linking the response to the context of the question i.e. the star-nosed mole.

Question 7 (h)

This question was on a familiar topic for candidates and many good responses were seen. The QWC mark was for logical sequence and generally no penalty was applied. The main reason candidates did not gain particular marks was because they referred to 'metals' rather than 'metal ions'. Candidates should be describing sodium or calcium ions and channels for sodium or calcium ions.

*(h) Explain how the nerve impulses generated in the sensory neurones of the 11th appendage are transmitted across synapses (paragraph 26).

(5)

When a nerve impulse travels along the sensory neurone and reaches ~~to~~ the synaptic knob, it stimulates calcium ions to enter the synaptic knob. The entry of calcium ions causes vesicles containing neurotransmitters to ~~bind to~~ ^{fuse with} the membrane of the synaptic knob and release their contents ^{by exocytosis.} into the synaptic cleft. The neurotransmitters then diffuse across the synaptic cleft and bind to specific receptors on the ~~membrane~~ post synaptic membrane. This causes sodium ions to enter the post synaptic neurone. If the threshold potential is reached, an action potential is generated in the post synaptic neurone and propagated along ~~to~~ it.



This is an example of a well written response that covers all the MPs. A maximum of five marks were awarded.

* (h) Explain how the nerve impulses generated in the sensory neurones of the 11th appendage are transmitted across synapses (paragraph 26).

(5)

~~Calcium ions help the vesicles with neurotransmitters to be released by exocytosis from~~

Calcium ions make vesicles move towards the membrane and release neurotransmitters by exocytosis from presynaptic cleft into post synaptic cleft receptors. Which this then opens sodium ion channels and depolarises the cell causing the transfer of nerve impulses.



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Examiner Comments

Two marks were awarded for this response, MP3 and MP6. MP7 was not awarded for depolarisation of the cell or transfer of nerve impulses. Candidates had to describe the membrane being depolarised or the initiation of impulses in the post synaptic neurone.

Question 7 (i)

This question was accessible to candidates. Many were able to describe the experiments used to demonstrate critical windows associated with the development of sight. Frequently, these responses contained significant detail.

- (i) The article states that 'early behavioural patterns in star-nosed moles—which use the 11th appendage to suckle—contribute to activity-dependent expansion of the fovea in the cortical maps' (paragraph 26).

Describe how the role of the critical period in the development of the visual cortex has been demonstrated in other mammals.

(3)

Mammals such as kittens have been used to show role of critical period of development. In the Hubel and Wiesel's experiment, new born kittens were had one of their eyes shut and the other remained open. The opened eye developed perfectly and they were able to see. After 6 months when the closed eye was opened and the other eye was closed, the kitten was blind which showed a period of critical development where the eye needs to be stimulated. If this is repeated four months after kitten's birth, it has no effect. The window was 6-8 weeks.



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Examiner Comments

This response gained three marks for MPs 2, 3 and 4.

- (i) The article states that 'early behavioural patterns in star-nosed moles—which use the 11th appendage to suckle—contribute to activity-dependent expansion of the fovea in the cortical maps' (paragraph 26).

Describe how the role of the critical period in the development of the visual cortex has been demonstrated in other mammals.

(3)

- Experiments done by Crowley and Katz on ferrets, and experiments on kittens and monkeys by Hubel and Wiesel show the role of the critical period.



One mark was awarded for this response MP1.

Question 7 (j)

Candidates often demonstrated a good understanding of the speciation. Although not essential on this occasion, candidates frequently ignored the context and gave a general description of speciation.

- (j) Explain how the star-nosed mole could have evolved as a different species from the coast mole and Townsend's mole (paragraph 28).

(3)

The ancestral species of these moles could have grown in population size and spread to different areas with different environmental factors and selection pressure ^{such as different food sources.} They soon became geographically isolated. In each area occupied they would be exposed to different mutation changing their alleles frequency. Species with the beneficial alleles in each area will survive and pass on their alleles changing the allele frequency this is natural selection, by time reproductive isolation will occur leading to speciation the evolving of new species that ~~eat~~ can't breed to produce a fertile offspring.



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Examiner Comments

A good account of speciation that gained all three available marks.



ResultsPlus
Examiner Tip

The candidate has linked an account of speciation to the star-nosed mole. The only way to improve this response would be to link advantageous alleles to the star-nosed mole.

Paper Summary

Based on their performance on this paper, candidates are offered the following advice:

- Look closely at the number of marks allocated to each question and equate this to the number of ideas or points presented.
- Use precise, scientific terminology of an A level standard.
- Read the stem of the question closely before committing an answer to paper.
- Understand that simply repeating the stem is unlikely to gain any credit.
- Show workings in calculation questions to avoid losing marks.
- Understand that the command word 'explain' requires a biological rationale in the answer and not simply a description.
- Show how data has been manipulated where required instead of simply quoting figures from a graph or table.
- Use time management sensibly.
- Have a greater appreciation of the scientific method, in particular the design of experiments.
- Understand that the command word explain expects candidates to offer biological rationale in their response and not solely description.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

<http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx>

