Assessment Report

Scholarship, 2008

Biology

COMMENTARY

Overall, candidates showed better planning than in previous years. Answers were of higher quality with few answer booklets having questions that were not attempted. There were fewer low scoring answer booklets. Candidates appear to be becoming more confident with the demands and expectations of scholarship biology.

The best performing candidates most commonly demonstrated the following skills and/or knowledge:

- ability to attempt all three questions and to answer directly what was asked using clear biological terms
- ability to write coherent, logical paragraphs with a minimum of irrelevant material
- ability to define the concepts that were asked, to link the ideas that were given to them with well reasoned biological statements, and to fully answer the question
- ability to use the data presented and to integrate it with their own knowledge to produce clear succinct answers
- ability to answer with few contradictory statements
- ability to plan the answers in a logical manner, using the words asked in the question to head up the areas of the plan
- ability to address the question from an extensive pool of knowledge.

Candidates who did NOT achieve Scholarship lacked some or all of the skills and knowledge above and, in addition, they:

- did not address all aspects of the question, i.e. all the bullet points asked; they included irrelevant material in their answers - e.g. many candidates included evolutionary processes in their answers to all three questions but these were only relevant to Question 2; large amounts of descriptive detail was not relevant – e.g. protein synthesis and protein structure of haemoglobin (Hb) in Question 1, descriptive detail of specific biotechnology applications in Question 1 and lengthy descriptions of general evolutionary processes in Question 2
- did not answer all three questions
- had little biological knowledge on the questions that were asked
- were not able to link the data given to good biological reasoning for their answer
- had little knowledge on the latest biotechnological applications and instead gave much irrelevant data on the techniques that are used in biotechnology
- did not plan their answers and just down loaded much information, usually restating word for word what was given in the question paper
- were unable to decipher the difference between patterns and processes in evolution
- had little understanding of plant biology – e.g. they talked about the plants “moving”.

Question One

The best performing candidates most commonly demonstrated the following skills and/or knowledge:

- ability to address all four areas of the question in a logical sequential manner
- ability to answer the question that was asked without giving irrelevant information - e.g. they gave an in-depth discussion on protein structure
- ability to distinguish between gene mutation and chromosome mutation, codominance and incomplete dominance, and gene and allele

- clear understanding that frequency relates to the Hb^s allele and not the frequency of SCD in a population
- ability to make clear links between inheritance of the Hb^s allele, increased survival against malaria and increased frequency of the allele in the population
- ability to recognise that gene therapy would require that a correct copy of the Hb allele would need to be inserted into stem cells that gave rise to red blood cells not the red blood cells themselves. (note - not "replace" the Hb^s allele)
- ability to recognise that any therapeutic modification of the Hb gene via stem cells would only cure that individual and would not be inherited
- clear knowledge of biotechnological applications and realisation of their limitations
- ability to evaluate whether a cure was likely
- ability to use correct biological terms – e.g. gene flow, heterozygote, selection pressure
- ability to support their answer with relevant data from the resource material.

Candidates who did NOT achieve Scholarship lacked some or all of the skills and knowledge above and, in addition, they:

- did not address all four areas of the question
- did not make the link between the gene's position on chromosome 11 and therefore being autosomal; some candidates confused autosomal and somatic
- confused the terms "gene" and "allele"
- did not make the link between one amino acid difference and a substitution mutation and therefore suggested insertion or deletion mutations
- could not correctly interpret and apply the resource material supplied; they linked SCD occurrence with poor diet/health/hygiene/skin pigmentation (black) – e.g. "you can catch the disease by poor hygiene in third world countries"
- could not distinguish between allele frequency and SCD frequency
- were unable to fully discuss the frequency of the Hb^s allele, they could not relate the frequency of the Hb^s allele to the presence/absence of malaria in named regions of the world
- were side tracked into discussions based on irrelevant information – e.g. protein structure and economic and ethical aspects of either malaria, SCD or gene therapy
- misunderstood concepts like "dying before reproductive age"
- had limited knowledge of biotechnology applications; they discussed gene therapy in vague, fanciful terms and neglected to mention the key idea of inserting a normal Hb allele; many candidates thought it appropriate to insert DNA into a red blood cell or mix in genetically engineered haemoglobin, they lacked basic biological understanding of the blood cells and their origin
- included irrelevant discussion of ethics and costs in their biotechnological evaluations
- did not understand the requirements of an evaluation.

Question Two

The best performing candidates most commonly demonstrated the following skills and/or knowledge:

- ability to identify and explain the evolution of Antarctic fish in terms of divergent/adaptive radiation and Arctic fish in terms of convergent/parallel evolution and expanded on their discussion using relevant detail
- ability to clearly identify cold water as a selection pressure

- ability to recognise that antifreeze glycoprotein (AFGP) arose through a mutation before the water cooled down
- ability to discuss how and why the adaptive radiation of notothenioids developed in relation to the information given in the question
- ability to recognise that a discussion of parallel evolution starts with two unrelated species (in the context of the genetics under discussion)
- ability to recognise that the AFGP allele not only arose in the ancestral species of notothenioids but was passed down to offspring which fixed the allele in subsequent generations
- ability to identify and explain the evolutionary processes of mutation, selection pressures, changes in allele frequency, vacant niches, and speciation in the evolution of modern day notothenioids, and support their answer with resource data.

Candidates who did NOT achieve Scholarship lacked some or all of the skills and knowledge above and, in addition, they:

- wrote lengthy descriptions of evolutionary processes in general and did not relate them to polar fish
- incorrectly assumed a relatedness between notothenioids and the Arctic cod despite the opposite clearly being stated in the question
- did not identify mutation in ancestral species as the source of the AFGP protein
- did not clearly state that cold water was a selection pressure - the language used was vague and generalised
- did not explain the passing on of the alleles to the offspring, nor were they able to talk about how the frequency of the allele increased in the gene pool
- talked about "genetic drift", which was incorrect in this example as it is not the random fixing of the AGFP allele, rather selection for this allele
- mentioned that new niches were available but were unable to link this idea to the extinction of the other fish species
- made a generalised statement regarding the adaptive radiation of the notothenioids without linking to and expanding on material from the text describing the different niches the fish exploited
- did not explain how isolating mechanisms could have led to the development of the numerous notothenioid species
- relied too heavily on definitions to support an idea and did not link evidence from the question to the concept they were discussing
- did not use data from the resource material to support their answers e.g. named species of Antarctic fish
- did not deal with each idea independently and completely, or establish clear links within their answer
- stated a pattern or a process and quoted relevant information directly from the question but then failed to make an argument or statement that clearly linked the two together
- had a deterministic approach to evolution – e.g. "they evolved the gene".

Question Three

The best performing candidates most commonly demonstrated the following skills and/or knowledge:

- ability to clearly identify juglone-intolerant trees as being those affected by the toxic chemical juglone and vice versa

- ability to make clear statements as to whether a concept referred to juglone tolerant or juglone intolerant plants
- ability to clearly identify and explain the adaptations of black walnut for allelopathy and the effects on the juglone intolerant plants and to link this to the competitive advantage (positive outcomes) for the black walnut
- ability to evaluate the affects of black walnut trees on their community as being limited to mature black walnut trees but not juveniles, to juglone intolerant trees but not tolerant trees, and the biotic but not the abiotic environment
- clear understanding of the meaning of the concept "biological diversity" (not genetic biodiversity but community biodiversity)
- realisation that the reduction in biodiversity in the forest community extended beyond the effect on the numbers of juglone tolerant and intolerant plants but would also have flow on effects to their associated fauna that depend on them; they could specify which organisms would decrease in number and which would increase; they also understood that biodiversity was about number of species, not whether various plants or other organisms "thrived or grew"
- ability to write answers that directly addressed the question with a minimum of irrelevant information and generalisations
- ability to elaborate on the resource material provided and not just repeat it.

Candidates who did NOT achieve Scholarship lacked some or all of the skills and knowledge above and, in addition, they:

- were unable to evaluate the effects of black walnut on the community; they relied too heavily on simple restatements of information provided in the question and did not make links between adaptations and the subsequent effects on Black Walnut success or biodiversity
- did not specify that the effects of juglone were only on intolerant plants; many talked about the effects of juglone on other species without recognising that some were juglone tolerant
- did not clearly state that the allelopathic effect of Black Walnut only reduces competition from juglone intolerant plants - instead they used vague terms such as "certain", "some" and "other" when discussing the impact of juglone
- did not read the information in the question that clearly stated that allelopathy is the production of chemicals by plants to inhibit the growth of other plants, so in their answers talked about the juglone being toxic to animals eating the black walnut
- did not identify that biodiversity in the community would be reduced; they used vague descriptors when discussing biodiversity and failed to simply state whether it increased or decreased
- used language that was too generalised when discussing biological ideas; correct terms were not used or were used in an incorrect or loose way that detracted from their answer
- did not recognise that the evaluation required a discussion about the extent of control – not whether control existed or not
- did not elaborate on the resource data provided.