NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Assessment Report

Scholarship, 2006

Biology

Commentary:

The 2006 Scholarship examination provided three questions for candidates. All three questions allowed candidates to provide evidence towards outstanding performance (eight marks). The three questions gave a wide coverage of the ecological and evolutionary aspects of the core content areas, and also challenged the more able candidates.

The overall quality of the answers submitted by candidates was higher than in previous years. Evidence of planning of answers by candidates was more common. However, a significant number of candidates still demonstrated only a superficial knowledge of the concepts they were trying to explain. Candidates often failed to achieve high marks for their answers because they did not give specific examples or explanations in sufficient detail. Repetitive statements and generalisations were common; concise, well-reasoned answers were needed. As in previous years, a significant number of students were out of their depth in attempting to answer scholarship questions.

Success in scholarship biology demands high literacy skills, a wide general knowledge, and the ability to see the complexities involved in biology.

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

- sound, comprehensive and accurate knowledge of biological concepts and processes; their answers demonstrated a depth and breadth of biological understanding
- critical thinking skills; candidates were discerning when analysing the question and the resource information provided, and in selecting appropriate biological knowledge to answer the question
- ability to write coherent, logical and precise answers that got straight to the point without restating the question or including irrelevant or superfluous information
- ability to thoroughly plan their answers
- use of appropriate terminology, avoiding irrelevancies and generalisations
- addressed the question asked and did not “dump” any irrelevant material.

Specific Questions

In Question 1, candidates could:

- link the purpose of the migration to the inability of the Godwit to survive the Alaskan winter, and present a discussion that identified issues that would drive the continuation of the migratory behaviour, irrespective of the high energy expenditure and significant risk factors
- link advantages of migration to survival and link this to potential ways in which this behaviour may have evolved.
- discuss the interactions between environmental cues, sensory perception, and hormonal responses that feature in migration
- explain potential methods of navigation used by the Godwit and discuss reasons why there would be a need for multiple navigational methods
- explain that the length of light period caused the birds to congregate prior to migrating in both NZ and Alaska
- identify several changes in environment as the season changes from summer to autumn, and explain why it would be the reduction in day length rather than change in mean daily temperature that would be used as an environmental cue
- explain and link coherently the biological concepts for the:
    - preparation **and** the start of migration
    - successful migration of the godwits to and from Alaska
    - benefits to the birds of migrating as against not migrating
    - risks involved in migrating
    - evolution of the migratory behaviour as seen in the godwit.

In addition, better candidates could qualify statements, eg if the predator was prey specific then migrating would be an advantage for the prey (godwit) because the predator numbers would reduce to very low levels or none at all when the godwit was gone.

In Question 2, candidates:

- recognised that mutations:
    - occurred in the DNA of the germ cell/gametes
    - were not always harmful
    - created new alleles that entered the gene pool
- identified the inheritance pattern as "co-dominant" and realised that it was not sex-linked
- explained the current frequency of the allele using specific examples of selective breeding / pleiotropy / linkage; recognised that farms are managed so natural selection no longer applies; could explain how genetic drift / founder effect could act
- wrote comprehensive answers linking ideas into discussions.

In Question 3, candidates:

- could use biological terms accurately to explain their understanding of all three processes: genetic drift, natural selection, cultural evolution
- wrote coherent, legible, well-structured answers that showed evidence of planning, and linked each concept back to the biological evolution of a named hominin species
- fully discussed the contribution of each factor to biological evolution
- understood the difference between genetic drift, the founder effect and a bottleneck
- explained the significance of a small population and demonstrated an understanding of the chance / random removal of alleles from the gene pool, clearly distinguishing this from an environmental selection pressure
- clearly explained how the selection pressures acted on the variation in the phenotypes of a hominin species resulting in different reproductive successes, which caused changes in the allele frequencies over time
- identified that cultural evolution is a change in the information that is taught / learned, whereas biological evolution is a change in genetically inherited information; this allowed candidates to make a clear explanation of how cultural evolution contributed to biological evolution
- displayed very accurate and up-to-date information of the hominin groups.

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

In Question 1, candidates:

- limited their answer to descriptions only
- made generalisations, eg giving photo-periodism as the stimulus for the birds to congregate without stating that it was the shortening of the period of light (day-length)
- misused the terms exogenous, endogenous and zeitgeiber
- made anthropomorphic statements regarding the migratory behaviour of the birds
- used vague or general descriptions rather than biological terminology
- used incorrect concepts such as: 'young birds were born'; 'pregnant females'
- did not understand that it would have been the cold winter conditions in Alaska that would have caused the original godwit population to seek warmer conditions during the Alaskan winter and not the evolution from NZ
- were confused about breeding seasons, stating that they would not breed in NZ because it was wintertime; if they were going to breed in NZ then they would breed in our spring / summer
- misused the prefix 'circ' which cannot be used in conditions where the biological clock is being influenced by environmental conditions; this prefix is used in a free-running situation
- failed to recognise that it was not individuals that evolved (Lamarkian), but specific phenotypes within a population that were selected for and hence changed allele frequencies in that population.

In Question 2, candidates:

- did not expand ideas into comprehensive answers
- identified protein synthesis as the site of the mutation
- used a lot of prepared material that did not relate to the question, eg described the process of protein synthesis in detail
- attempted to perform calculations to explain the frequency of the allele; attempted to apply Hardy-Weinberg in their explanations
- explained the inheritance pattern in terms of how common the allele was, eg the more common allele is the dominant one, the less common allele is the recessive one
- explained the current frequency of the A1 allele in terms of selection of the A2 allele because of health benefits, which are possible future benefits and not current
- assumed that the artificial selection of the A2 milk was already occurring.

In Question 3, candidates:

- misread the question relating the three factors to biological evolution and consequently did not answer the question asked
- were unable to provide evidence to support the three factors asked
- had a poor understanding of the three factors, particularly genetic drift; candidates confused bottlenecks, founder effect and genetic drift, using them interchangeably and could not describe / define genetic drift accurately
- did not understand what random / chance removal of alleles actually means and confused this with the environmental pressures
- focussed on cultural evolution of humans, rather than how cultural evolution contributed to the biological evolution of humans
- did not relate their knowledge of natural selection / genetic drift / cultural evolution to the biological evolution of hominins
- made anthropomorphic statements
- showed no evidence of planning in their answers.