

Assessment Report

Scholarship, 2007

Biology

COMMENTARY

- The best students were able to write coherent logical paragraphs with a minimum of irrelevant material. Students needed to revisit the question when answering it to ensure they were still on the topic. Failure to do this led to pages of irrelevant information being presented.
- Students need to attempt all three questions, and fully read the question asked so that they answer all aspects of the question.
- The vast majority of students had a limited understanding of the significance of standard deviation in regard to validity of data.
- Students struggled to answer unfamiliar resource-based questions and apply their knowledge to the question asked.
- Students were good at quoting data from the resource material, but were less able to draw trends from the data.
- Students need to be able to link statements and justify their answers.
- Students made basic errors in their biology, and did not define a concept with sufficient accuracy, or explained a concept while omitting to define it first, eg confusion between autosomes and sex chromosomes, and the inheritance of these chromosomes.
- Many students showed a limited understanding of the link between allele frequency and evolution.
- Students need to reread their final answer for contradictory statements.

Question One

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

- recognised the similarities in the abiotic factors and biotic factors contributing to the fundamental niche of both spp (The FL and FU ideas):
 - could explain the upper limits to niches in terms of physiological tolerance to desiccation. [OP]. Neither species could survive above the high tide mark because of extreme desiccation; water was also needed for feeding and for reproduction
 - could describe the process of filter feeding and realized that the barnacles did not compete with each other for food in this process
 - neither species was found below the low tide mark because of competition with seaweed for space and predation by starfish, which occupy the below low tide region.
- recognised that because the two species of barnacles occupy the same habitat, inter-specific competition between them was occurring, and could then link this to Gause's Exclusion Principle to explain that *Balanus* must be out-competing *Chthamalus* because the fundamental and realised niche of *Balanus* was the same whereas *Chthamalus* had a different fundamental and realised niche
- explained the factors determining the differences in the niches of the 2 barnacles and related these to Gause's Exclusion Principle:
 - able to identify the key abiotic factor that restricted *Balanus* to the lower part of the intertidal zone – a lower tolerance to desiccation than *Chthamalus*
 - clearly explained the roles of competition in determining the realized niches of the barnacles. Knew that the “algae” were photosynthetic seaweeds that would be competitors with barnacles for space [not food!].

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

- assumed that because *Chthamalus* was “forced” to inhabit the upper tidal zone or because it has a wider fundamental niche, it wasn’t as well adapted as *Balanus*
- demonstrated a superficial understanding of how abiotic factors change in the intertidal zone such as assuming that salinity increases as you get closer to the high tide mark
- focused on irrelevant factors such as humans, wave action
- had general ideas about what factors affect barnacles but missed the important ideas, eg they talked about exposure to sunlight rather than lack of submersion in water
- assumed that barnacles need sunlight to stay alive
- misunderstood the concept of surface area: volume, and confused rate of water loss and volume of water loss, eg as *Chthamalus* was smaller it must have a smaller surface area: volume, therefore, lost less water
- did not understand that filter feeders do not compete for food.

Question Two

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

- carefully and logically proceeded to analyse the data and summarise their conclusions into clear statements
- identified the inheritance of HD as being autosomal and therefore not on the sex chromosomes, with the HD allele being dominant as it was expressed when present in the genotype / heterozygotes
- could describe trends in the data presented in tables and graphs and support this with relevant figures from the table / graph [the evidence]
- were able to interpret the different types of statistical significance and adjust their conclusions accordingly, eg recognised that there was no significant difference between age of onset in homozygotes and heterozygotes (Table 3)
- identified apparent contradictions such as the information that the gene was autosomal but that the data in Table 4 appeared to indicate some connection between inheritance and the sex of the offspring
- realized that small sample sizes [Fig 1, Table 4] cast doubt on the validity of the data / findings
- did not get side tracked into describing [at length] the process of protein synthesis and the functioning of proteins.

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

- found it difficult to identify key trends / draw conclusions from the different sources. Instead they just quoted data
- tried to explain the mechanisms involved in the inheritance, although this was not asked for in the question
- mis-used the term “lethal” allele
- made superficial conclusions that often missed key information such as statistical significance or small sample size, eg stating that HD is more lethal for homozygotes as more of them had died by the end of Stage 4 (4/6 compared with 10/13)
- misunderstood the difference between autosomal and sex chromosomes with statements such as “autosomal chromosomes are not inherited” or “Huntington’s disease is autosomal so that it is carried on the sex chromosomes X and Y”

Question Three

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

- gave clear, accurate definitions / explanations of four biotechnological applications, and avoided unnecessary detail of actual processes involved in the application, eg detail of the PCR process
- clearly explained the impact of each biotechnological application on the gene pool
- recognised that a key factor affecting impact on the gene pool was whether or not the application affected germ line cells:
 - that gene therapy, stem cell therapy, and xeno-transplantation at present act on only somatic cells so will not be passed on
 - that stem cell therapy and xeno-transplantation act at cellular or tissue / organ level and, therefore, have no affect on DNA
- recognised limitations in the current use of these bio-technologies, and the difficulty of predicting future development and impact
- could link the impact on the gene pool to evolutionary processes and make reasoned, logical, and specific predictions of the effect on future biological evolution of *Homo sapiens*, eg:
 - that the numbers of individuals involved in these procedures world wide is small / would be available to only developed countries, so that the impact on the gene pool will be minimal and is unlikely to result in any major change in biological evolution of *Homo sapiens*
 - the impact of gene flow between populations reducing the chance of major change in allele frequency in different gene pools, and so reducing the chance of speciation
 - the possible consequence / impact of natural selection on evolution as a result of, eg:
 - reduction in genetic variation / diversity in the gene pool due to genetic testing
 - maintenance of detrimental alleles within the gene pool
 - unforeseen consequences due to removal of alleles from the gene pool
 - avoided, eg:
 - describing possible consequences as a current fact
 - emotive language and sweeping generalisations, eg “the catastrophic effect on the gene pool”
 - inappropriate detail not required by the question, eg ethical issues.

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

- failed to appreciate that gene therapy, stem cell therapy and xeno-transplantation at present only act on somatic cells so will not be passed on
- didn't recognise that stem cell therapy and xeno-transplantation act at cellular or tissue / organ level and therefore have no affect on DNA
- assumed that the disorders being treated by stem cell therapy and xeno-transplantation were genetic in origin and therefore the disorder could be passed on to offspring
- some recognised that gene therapy, stem cell therapy and xeno-transplantation allow people to survive and therefore reproduce, but then said future generations would be affected by the disorder (see previous comment about the incorrect assumption here) and would die. Did not consider other current treatments that allowed the survival of these people in the first place
- assumed that all these technologies were beyond research stage and in widespread use.