

Examiners' Report Summer 2008

GCE

GCE SNAB Biology (8048/9048)

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Maximum mark..... 60

Mean mark 32.1

Standard deviation 8.6

General comments

This examination required candidates to use and apply their knowledge of the specification in various different ways, in both familiar and unfamiliar contexts.

It was encouraging to see a number of considered, accurate and logically-tackled responses from candidates. However, some were hampered by either a lack of accurate knowledge or an insufficiently clear understanding of the principles and concepts. This was particularly evident when faced with unfamiliar situations. Further, the propensity of some candidates for not reading and, therefore, not interpreting the questions carefully enough hindered them from gaining credit for some questions.

Teachers are advised to help candidates to fill gaps in their knowledge and check their understanding of the principles and concepts covered in the specification, including practical skills, rather than just concentrating on the recall of factual knowledge of the course materials. Careful coaching to help candidates interpret the demands of different types of question, for example the difference between describe and explain, will also help many candidates.

Question 1

It was pleasing that most candidates were able to recognise successfully both arteries and veins from a section and a diagram in (a). There seemed to be much variation in the level of understanding of how blood moves in veins, particularly with reference to 'forward' movement. Most concentrated on the mechanism to stop backflow only. In (c), there seemed to be some confusion by candidates between capillaries and alveoli. A number also described non-structural features rather than the structural features requested.

Question 2

Generally most candidates tackled (a)(i) soundly, whilst in (a)(ii) transcription still remained a common error. A number of candidates found (b) challenging and a wide range of figures was seen. The majority of candidates gained marks in (c), though many felt they had to write an explanation as well as giving two named molecules. There was some confusion about the term molecule, with candidates naming an atom or an organelle.

Question 3

Many candidates adapted well to the alternative approach to the *Daphnia* core practical. Most candidates were able to read off the graph correctly on at least two occasions in (a). Generally, candidates grasped the idea in (b), but a number listed variables maintained by the student as described in the stem of the question at the beginning e.g. a constant number of heart beats. There were many anthropomorphic responses in (c) such as the *Daphnia* being "distressed".

Question 4

Few candidates gained both marks in (a)(i), as they failed to transpose correctly. The most common error was a lack of the H below carbon 5. There was a number of good descriptions of hydrolysis but some confused this with a condensation reaction, or incorrectly linked it to breaking hydrogen bonds. There were many full marks for (b)(i), but few seemed to have a clear understanding of the degenerate nature of the genetic code in (b)(ii). There were many vague answers that mixed up anticodons, amino acids and proteins. Many candidates tackled the ethical issues relating to genetic screening admirably, though answers often delved into designer babies and insurance companies, areas which were not relevant here. Also, a number failed to notice that the question asked for more than one issue to be outlined and concentrated on one area.

Question 5

Most candidates were able to recall the required facts for (a) and (b), but several seemed to have an incomplete understanding of risk and felt that the man described in (c) was guaranteed to have heart disease. Many answers for (d)(ii) lacked the detail and precision necessary to gain full credit. The majority of candidates only described the re-direction of blood around the blockage and did not follow this through with a description of how this restored normal heart function.

Question 6

A sizeable minority failed to gain the mark for (a)(i) whilst, in (a)(iii), tyrosine seemed to have been a more common incorrect answer than thiamine. Several found (b)(ii) hard with the most common error being sample 3.

Question 7

The whole range of marks was seen for each of the components of this question. Few gave sufficient detail in (a) to gain full credit whilst a minority of candidates tackled (b)(i) and (ii) interchangeably. Another common mistake in (b)(ii) was to write about the uptake at 10°C, ignoring the reference to rise (of 10°C) and the helpful hint in brackets (from 20°C to 30°C). Few gained both marks in (b)(iii) as they tended to write either about ions colliding with each other, rather than with the membrane (or a correct component of the membrane), or they described enzymes and the enzyme-substrate complexes.

Maximum mark 70

Mean mark 27.4

Standard deviation 11.0

General remarks

The examiners were pleased with the performance of many of the candidates. Many had a more accurate command of the factual knowledge outlined in the specification than has been the case in previous years and many were also able to take a thoughtful and perceptive approach to at least some of the context-driven questions requiring application of knowledge in unfamiliar contexts. Even where a candidate did not achieve a high overall score for the paper he or she often found the opportunity to display flashes of insight and an intelligent approach in the case of individual questions.

On the down side, there were some candidates who seemed to lack confidence and rely too much on rote learning instead of thinking for themselves. Some candidates would also be advised to spend longer in thinking through how to respond to a context question before starting to write. Short, well-focussed responses usually score higher marks than the long rambling approach which only reach the point on a supplementary sheet or in small writing at the bottom of the page.

Question 1

This quickly-answered question tested a considerable amount of knowledge, combining both plant versus animal cells, and prokaryote versus eukaryote; it proved quite discriminatory. A whole row (three boxes) had to be correct to gain a mark. The centriole (last row) provided the most difficulty. Candidates who had learnt the material accurately gained four or five marks. Those who lacked precision in their learning were caught out and gained only one or two.

Question 2

There were many very good answers gaining well-deserved high marks. Most recognised that this was a question about 'protein trafficking' but some started in the wrong place and spent two-thirds of the space available reproducing rote-learned material about DNA replication, translation and transcription, when the answer needed to start as the protein leaves the ribosome. Some had difficulty describing how the protein was enclosed in a vesicle by the endoplasmic reticulum which fused with the golgi body, releasing the protein which was then modified before being packaged into a second vesicle, this time by the golgi body to be transferred to the cell membrane. In some cases it was not clear whether it was the insulin molecule which was being enclosed in a vesicle by the endoplasmic reticulum or a ribosome.

Question 3

Many candidates lost marks in (a) for not making a direct comparison. It was necessary to state, for example, that 'cellulose molecules are unbranched *whereas* (some) starch molecules are branched' and that 'cellulose molecules were straight *whereas* starch molecules are coiled/spiral'. Confused responses, such as the common response 'starch molecules are branched whereas cellulose molecules are straight' were not credited since they lacked a comparison. This was a demanding question and underlying the difficulty in the use of words was a lack of accuracy in knowledge and understanding of the molecular structure of cellulose and starch. There was, for example, widespread confusion about 1-4 and 1-6 glycosidic bonds. Part (b) was about the aggregation of cellulose molecules into microfibrils in a way which accounted for the physical strength of cell walls and other materials composed of plant fibres. There was some confusion between molecules and microfibrils and many candidates did not gain the mark for observing that (in a microfibril) cellulose *molecules* are arranged in a parallel fashion. More candidates gained the second marking point for explaining that the molecules were joined by hydrogen bonding - although some spoilt it by referring to cellulose microfibrils rather than molecules. There were many good answers to (c). Many candidates understood that cohesion was about water molecules being joined by hydrogen bonds or as a result of the polar nature of water molecules. A minority confused cohesion with adhesion.

Question 4

Many candidates vaguely understood what (a) was about, but only the better ones were able to gain both marks by explaining clearly why the absence of melanin meant that DNA/nucleus/skin cells were unprotected from UV thus increasing the risk of mutation leading to cancer. Many candidates gained all three points in (b). A common error was to refer to uncontrollable cell *growth* exceeding cell death rather than uncontrollable cell *division*. There were some answers to (c) which gained both marks, but many candidates missed marking point 1 by referring to bits/pieces of a tumour, rather than tumour *cells* breaking free and being left behind following the operation to remove the primary tumour. Many candidates referred to bits/pieces/cells of the tumour spreading to other parts of the body, but only the better ones gained the second marking point for saying this took place *via* the blood or lymph. The use of the word 'metastasis' or reference to secondary tumours gained marking point 3. Many attempts to explain that the second tumour could have arisen independently were too ambiguous to be awarded marking point 4.

Question 5

Many candidates gained both marks in (a) by merely referring to haploid gametes joining to produce a diploid (zygote) or by writing about random assortment of *chromosomes/genes* giving rise to *genetic* variation. A substantial minority fell into the trap of writing about humans in terms of 23 and 46 chromosomes, instead of referring generically to haploid cells or halving of chromosome numbers. Again, many candidates gained both marks in (b) for reference to acrosomes releasing *digestive* enzymes. Some confused 'acrosome' with the enzymes it contains. Part (c)(i) was an apparently simple question which proved surprisingly discriminatory; the same was true of (c)(ii). Only a few candidates were able to explain that the new cells did not *grow* or increase in volume. Many candidates wrote about the whole of mitosis rather than *selecting relevant material* and *focussing on prophase*, as invited by the question in (c)(iii). In spite of this, many gained full marks. This could be achieved relatively simply, for example, by stating that chromosomes condense, nuclear membranes break down and that centrioles move to opposite ends of the cell. The mark scheme offers many other alternatives. Long-winded unfocussed answers about mitosis in general often failed to gain all three marks.

Question 6

This question assumed that candidates had carried out a core practical on the effects of temperature on the development of organisms in the context of likely biological effects of climate change. Many candidates gained both marks in (a) for simply describing the pattern of rising hatching rate with temperature, peaking at 28°C. Further increase in temperature brought about a decline in hatching. A surprisingly large minority failed to recognise the importance of 28°C as the temperature at which most eggs hatch. Some even misread it as 30°C. Some tended to quote figures from the graph in a disorganised way without describing the overall pattern. Part (b) required candidates to suggest that the reason why there seemed to be a temperature optimum for hatching of 28°C was probably due to the temperature sensitivity of enzymes. Below 28°C the enzymes do not work at their maximum rate and above 28°C they are likely to become denatured. For (c), two of the available marking points were about the effect of temperature on hatching rates and were developed from (a) and (b). The examiners required candidates to suggest that *below* 28°C an increase in temperature would lead to an *increase* in population due to an increase in hatching rates. If temperature rose above 28°C, then the population would decrease due to decrease in hatching rate. Many gained neither of the marks because their answer was not explicit enough about whether they were writing about hatching above or below 28°C. Other marking points involved predation rate, changes in food supply and (linked to food supply) loss of synchrony with the seasonal cycles of other species. In each case they had to be specific as to whether the factor they described would increase or decrease the population. This question enabled the more able candidates to demonstrate clear thinking.

Question 7

This question explored further the biological effects of global warming. The performance of many candidates was particularly disappointing in this question, perhaps suggesting that many had dealt with this topic rather superficially. Many candidates gained the mark in (a)(i) with 'the deeper the peat layer the older it is' or a correct reference to carbon dating of the *peat* layer (not the pollen in it). Part (a)(ii) should have been easy to those who understood pollen analysis - we assume that a lot of alder pollen in an ancient peat layer indicates high rainfall because alder trees (today) occur in damp places/soil conditions. There were relatively few good responses to (b). It entailed taking an understanding of pollen analysis and transposing it onto an unfamiliar, yet entirely analogous one, involving insect exoskeletons. Responses suggested that 2008 SNAB candidates had a much poorer understanding of pollen analysis than their counterparts in the past. There were a few good responses to (c)(i) but many were disappointing. One expects candidates who have studied the SNAB specification to know that global warming can affect biodiversity by changing species distribution causing species to grow further north. Inspection of the map shows that in this situation there ***is no land further north*** for the arctic plant species to colonise, therefore it is particularly vulnerable to climate change. A frequently-encountered response which received no credit was that melting ice would raise the sea level. There is no indication on the map to suggest that the tundra area is near sea level. Part (c)(ii) proved to be highly discriminating. In addition to familiarity with the recurring climate change connection with enzyme activity, candidates were expected to recall that starch could be a plant's (particularly seeds) stored energy reserve used when it was not available from photosynthesis. The fact that plants use organic matter produced by photosynthesis for respiration is a feature of the carbon cycle. There were some very thoughtful responses which recognised that the increased temperature would mean stored carbohydrates were used up faster than they could be replaced and that this would prevent the plants from growing. Many other candidates were credited for advancing an alternative answer that the extra respiration would produce more CO₂ which would further enhance the greenhouse effect and exacerbate global warming even more.

Question 8

This context question started where the previous question left off, with climate change, and quickly moved on to the carbon cycle and the biology of biofuels before moving into the genetic manipulation of biofuel crops and associated ethical issues. It was a demanding question but there were several good responses and it allowed a wide range of candidates to demonstrate good thinking skills and perceptive application of knowledge. Most candidates were able to recognise that the use of biofuel was a question of carbon neutrality in (a) although only some were able to gain all three marks by explaining fully why burning biofuel was carbon neutral - because it was replacing CO₂ only *recently* absorbed through photosynthesis whilst burning fossil fuel was restoring carbon to the atmosphere that had been out of circulation for *millions* of years. Most candidates successfully carried out the calculation in (b)(i). Where the answer was correct, both marks were awarded whether or not calculations were presented. If, however, the second value (net energy yield as %) was given as 72% (instead of 72.6 or 73%) the mark was only awarded if there were sufficient calculations to show this was a rounding error. Most candidates gained one of the two marks in (b)(ii) for recognising that sunflower had the highest yield because it required less energy for downstream processing. The more thoughtful candidates gained a second mark for recognising this was despite having a lower gross yield (before processing) than sugar beet. The third (alternative) marking point required manipulation of figures (rather than just quoting data). There is an example to illustrate this on the mark scheme. Since (b)(iii) was devised, the issue of the use of land to produce biofuel has become widely discussed. Many candidates gained a mark suggesting that there was not enough farmland to produce enough biofuel to replace fossil fuel and many gained a second mark for adding that much more land was needed to grow food. Despite spiralling oil prices, a considerable number of candidates argued that biofuel would never catch on because it would always be too expensive. There were many good responses to (c)(i). Most candidates saw increased yield as a desirable outcome of GM and many also recognised the value of faster growth. Whilst many suggested making the plants resistant to pests or disease since the question was about reducing the price of biofuel, the mark was for reducing the need for pesticides or fertiliser (i.e. reducing costs). There were also good answers suggesting using GM to reduce down-stream processing costs or developing adaptations to enable crops to grow in different climatic conditions. Answers to (c)(ii) were disappointing. Many vaguely thought of GM genes contaminating other crops, weeds or wild plants but few recognised that the genes were spread through pollen. Many tended to cite stock out-of-context answers about 'superweeds' or unsubstantiated green propaganda claiming that GM crops were harmful or referred to unspecified religious objections. The better candidates recognised that people don't eat (or drink) biofuel and therefore it didn't matter unless the genes spread to food crops. Some tried to balance the environmental benefits of biofuel against the risks of GM.

Question 9

This question was about stem cells. Most candidates provided the correct answer in (a)(i), although some spelling mistakes made it difficult to decide whether the word was mitosis or meiosis. These did not get credit. Most candidates did not realise that (a)(ii) was about gene switching. Many candidates tried to answer (a)(iii) with stock answers. Only the better candidates placed their answer in the context of brain cells. Responses to (b)(i) were disappointing. Candidates had a vague idea about what it was about but were unable to explain it. The better candidates wrote about totipotent / pluripotent versus multipotent and degree of differentiation. Many candidates thought that adult stem cells were too difficult to obtain. Part (b)(ii) dealt with the ethics of stem cell research and applications. The quality of response was an improvement on previous years with less reliance on stock responses, although some candidates rambled around a single point.

Good answers could be brief, include at least three points from the appropriate list and also gained the fourth point for quality of argument, recognising the validity of the opposing

arguments but balancing and arguing the point of view that the candidate had adopted. Candidates who wrote at length and whose answer spilled over into the margins and onto supplementary sheets rarely gained more marks than those who wrote a concise, focussed and well-argued case within the space provided on the question paper. Many candidates still think that embryonic stem cells come from aborted fetuses.

Maximum mark..... 20

Mean mark 11.1

Standard deviation 3.2

General comments

Types of reports.

Out of a sample of 436 projects, 56% were Visit reports and 44% were reports on Issues. The increased *variety* of Issue reports and the number of Visits observed last year was maintained. There were very few unoriginal reports on Global Warming, far less on Cloning, Gene Therapy or Cystic Fibrosis but an increase in the number on stem cells. This is presumably because topics such as stem cells are 'safe' and covered in the SNAB books.

Breweries and zoos are still the most popular venues for a Visit with still far more schools going to a zoo compared to the pilot, but there has been no further increase in the variety of visits. The number of schools going on a Visit rather than looking at an Issue stayed roughly the same as last year.

Despite an improvement in the marks, there were still many centres that found section B difficult. As in previous years, giving an original discussion, speculating about the future and checking the validity of the source material proved especially difficult.

| Visit Topic | % |
|---|----|
| Zoo | 42 |
| Brewery | 17 |
| Sewage works | 7 |
| Kew Gardens | 6 |
| Leech Farm | 5 |
| Cheese Factory | 4 |
| West Lakes Science Park | 4 |
| Wildfowl & Wetlands Trust | 3 |
| Natural History Museum | 3 |
| VLA | 2 |
| Surrey University | 2 |
| Eli Lilly | 1 |
| Organic Farm | 1 |
| Syngenta | 1 |
| Southampton University | 1 |
| together with Hospital, INRA and Sparsholt College. | |

| Issue Topic | % |
|---|----|
| Stem cells | 26 |
| HIV | 4 |
| Sickle cell anaemia | 3 |
| Cancer | 3 |
| Down's Syndrome | 3 |
| Alzheimer's | 2 |
| Diabetes | 2 |
| Epilepsy | 2 |
| Huntingdon's disease | 2 |
| IVF | 2 |
| Alcohol | 1 |
| Blood doping | 1 |
| Breast Cancer | 1 |
| CVD | 1 |
| Cystic Fibrosis | 1 |
| Deforestation | 1 |
| Dementia | 1 |
| Genetic Engineering | 1 |
| H5N1 | 1 |
| Hypertrophic cardiomyopathy | 1 |
| Leukaemia | 1 |
| Malaria | 1 |
| Life Style diseases | 1 |
| together with Ageing, Albinism, Allergies, Anabolic steroids, Anthrax, Asbestos, Asthma, Autoimmune disease, Bear conservation, Bi polar disease, Chimaera, Chronobiology, Cloning, Club foot, Colour blindness, Cruciate ligaments, E Coli, Elephant conservation, Episiotomy, Eczema, Foot and mouth, FOP, Genetic diseases, Global Warming, Granulomatosis, Heart disease, Hepatitis, Horse ligaments, Human activity in Antarctica, Hypoxia, Infertility, Intensive Farming, Kiwi conservation, Lesch nyhan syndrome, Marfans syndrome, ME, Migraine, MMR, MRSA, Muscular dystrophy, Mutations, Nanotechnology, Nerve damage, Neutropenia, Obesity, Panic, Parkinson's, PGD, Phylloxera, PIGD, Rabies, Rainforests, Red Sage, SARS, Sex selection, Sharks, Snake venom, Spina bifida, Sponges, Taxonomy, TB, Tobacco, Tooth enamel, Trisomy 18, Twins, Wegeners syndrome, Wolves and Xenotransplantation. | |

Marks awarded.

The sample of scripts this summer suggests a slight improvement on last year (in brackets) with the Visit reports scoring the same as the Issues with a mean of 11.5 (11.1) compared to 11.5 (10.8).

The distribution of marks for the various criteria is shown below as percentages of possible total ie. 100% for Aa would mean that all students got the maximum of 2 marks.

| Criteria | Issue 2007 | Issue 2008 | Visit 2007 | Visit 2008 |
|-----------------|-------------------|-------------------|-------------------|-------------------|
| Aa | 83 | 91 | 90 | 88 |
| Ab | 79 | 76 | 79 | 79 |
| Ba | 53 | 50 | 56 | 51 |
| Bb | 33 | 37 | 34 | 40 |
| Bc | 34 | 41 | 37 | 40 |
| Ca | 68 | 68 | 68 | 73 |
| Cb | 75 | 85 | 76 | 76 |

The data seem to show little further improvement for Section A, but Section C has shown a small improvement overall. For most reports, the two aspects were clearly stated and discussed in reasonable detail and a consideration of the ethics, environment, economics and social aspects was given. Candidates are still much better at writing for an audience and giving a bibliography whose sources have been acknowledged in the text.

However, Ba is still much lower than one would like. Most candidates had no problem in providing biological background material but many accounts were still too descriptive as in previous years. There was not enough of a discussion to indicate full understanding.

Due to feedback last year, the weakest marks (Bb and Bc) have shown some further improvement. More candidates are managing to speculate about future developments with their own ideas and an increasing number not only looked at the validity of their source material but did give some evidence for their conclusions.

A - Purpose of Visit of Significance of Issue.

The data show that both the Visit and Issue reports are still scoring more highly than for the SNAB pilot indicating an overall greater awareness of the biological issues involved in the topic and for many centres this is still a strong point. In terms of being clear about what the report is about, some centres had their candidates summarise their aspects, main aspect and target audience in a box either at the beginning or end of the work, as they have in other years, and other centres' candidates had an introductory paragraph to do the same. However, some had many candidates whose stated aspects were not clear at all and didn't fit the text written. Some did not state a main aspect and some centres had many candidates who gave no aspects at all. Some of these may have had obvious headings, but others did not. Where there were no aspects and no subheadings it was often near impossible to create an area of the work to call the main aspect. There may have been a tendency to be over-generous here and cordon off a sizeable chunk that would gain the candidate the best mark. There appeared to be a wide variation in the quality of instructions given to candidates by centres and it still seems that some centres do not share the specification or the mark scheme guidance with their students. Overall performance in this part of the specification still seems very centre specific.

In quite a few instances the candidate had not covered their minor issue in sufficient detail and lost a mark. As in previous years, some used ethical, social, economic or environmental issues as their minor aspect which meant a lost mark for Ab. Nevertheless, Ab was often a strength for many centres, and candidates did make reference to these implications.

3.8% of students failed to identify clearly the two aspects of biological interest that they were looking at and as a result scored zero for Aa. However this was much better than the 9.3% in 2007. This loss of marks was roughly equal for Issue reports and Visit reports.

B - Biological principles.

Section B still poses the most problems and here students need to be clear about which of the two biological principles they are concentrating on and *must state it*. Some topics chosen for the main aspect were not very suitable because students found it difficult to find enough biology of a high enough level that could be discussed or its future speculated about. 'Enclosure design' in zoos and 'Recycling in Oxford' were two examples. Other reports often had accounts of procedures that left little scope for discussion of opinion e.g. PCR techniques. Nevertheless, there were far fewer 'environmental issue' reports, such as global warming, which did not contain much **biology** and which gained only 7 marks overall compared to the mean of 11.5.

Ba showed no signs of further improvement and many reports are still far too descriptive. In fact, one examiner felt that 'this section seemed to have gone down hill again since last year', in that a mark of four was very rare, as was one of three. The syllabus clearly asks for 'a clear discussion showing a thorough understanding of the biology'. Many reports had plenty of biological information which seemed to have been taken from the sources but was not used or discussed. In this case, it is almost impossible to work out whether the candidate has understood the biology behind the main aspect chosen. Overall, only 4% managed to score the maximum 4 marks for Ba but this was at least a slight improvement on last year. However, since the *overall* mark for Ba has not improved, it suggests that although some centres have made good progress on discussion, others have not and some have actually got slightly worse. It may be that new centres are finding this difficult at their first attempt.

Although there was another small improvement for Bb and Bc, these were still poorly done overall and remain the most problematic parts of the Visit / Issue report.

Bb - it is essential that candidates give a reasonable amount of detail on their speculations for the future. It is this that actually indicates a good understanding of the main aspect and its implications. It must be *their* speculations and not those of the scientists described in the main aspect. Perhaps the lack of improvement in Bb could be due to some centres' difficulty in promoting genuine discussion of ideas and concepts that seems to be at the root of Ba's disappointing marks. 42% of candidates gained zero or one mark here which is slightly better than last year. The majority of the rest gained two for speculating about future developments, but rarely did a candidate use a referenced source here to gain a third mark.

Bc - candidates must identify *at least three* of their sources and then have quite a detailed look at their validity. The best way is to compare the information with that obtained from another source. Many just vaguely said that their sources were reliable without stating which of the sources or giving any *evidence* for their opinion. If the sources are not actually checked and the evidence given, then three or four marks will not be given. Most centres didn't address this marking point at all and gained one mark for having three referenced sources numbered in their text. These were usually located in the main aspect text. Although these were usually identifiable from the main aspect text, in many instances they had to be 'weeded out' of the bibliography. Where a candidate did not have numbered sources from the bibliography in the text, their score here was difficult as looking at the bibliography alone did not usually reveal three obvious sources for B. They could have been used for the minor aspect instead. It was very rare for a candidate to question validity on all three sources and go any further. For many, the validation of source material was more like an afterthought and again not very detailed; although some candidates were making a token effort to comment on the sources, only a few validated one against any other. Although Wikipedia, Google and SNAB were very commonly used, some centres had certainly worked on this area and their candidates made very good attempts at validation.

NB. One important point as for last year is that candidates must make sure that the Bb and Bc discussions are about the same main aspect that the biology for Ba is. The easiest thing is for candidates to make sure that they identify the main aspect themselves rather than leave it for the examiner to try and work it out.

C - Communication.

There was a slight improvement on the good scores for Ca and Cb for last year. Students are finding it easier to write for a clearly defined audience and some excellent examples of magazine or newspaper styles were produced using either Word or Microsoft Publisher. Many centres had at least one of these marking points as a strength and one candidate even made a film! This is definitely in the spirit of SNAB and was a very nice original piece of work. However, some did not choose suitable graphs or diagrams to illustrate their point of view and make the report 'a good read' even though it was well presented. Most candidates had put in a bibliography and more often than not had three or more complete references plus references in their text. There were still many candidates who had not put references in the text and gained only one mark.

7.6% of students still failed to identify a target audience and as a result scored zero for Ca, this being roughly the same for both Visits and Issues but was at least an improvement on the 13% from 2007.

Only 0.9% of candidates failed to identify an audience as well as failing to identify the two biological aspects for Aa. This lost 4 marks but was much better than the 3.5% from 2007.

Although low, still a surprising number contained frequent spelling or grammatical errors and a significant number still failed to include references that had actually been *referred to* in the text. It is essential that as well as including a bibliography, candidates *use* the references in the text e.g. putting a website address next to a picture or diagram used. This then demonstrates that the candidates have read and understood the significance of the work they are referring to. There was a further decrease in the number that only used the SNAB texts as a source of reference material, which was very welcome. Candidates must have a bibliography with at least three sources that can be found easily and does not contain a SNAB text as one of them. Centres should note that www.google.co.uk does not count as a source in the bibliography! This was actually quite common yet again. Endless references to 'Wikipedia' are not acceptable as separate sources either!

General

The standard of 2007 seemed to have been improved on with the variety of the topics maintained and again some excellent, original work was seen. In fact, one examiner talked of learning 'lots of new and interesting things about biology' from some of this year's reports!

There were a lot of zoo/wildlife park visits, leading to large numbers doing captive breeding. One group had visited a 'pick your own' farm leading to food-related topics such as pesticide use, another had been to a lecture at the Natural History Museum about blowflies leading to a collection of reports on the use of insects in determining time of death, which provided some very graphic images. Others had visited a herbarium. Another group visited a pharmaceutical company leading to many medical topics. Centres that had not been on a visit provided a wide range of issues, with many of these being medical in nature. However unless there was a personal aspect e.g. family member affected, they tended to be very much a description of the disease/syndrome and its treatment without any discussion.

A strength for many centres has been the ability to state their two aspects of biology more clearly and then deal with them effectively. In addition, another strength was the ability to consider the ethical, environmental, social or economic issues associated with their report. Generally the reports were well presented and planned appropriately to the target audience (mainly AS or A level students) and there was evidence of thorough research and good use of internet sites.

However, Section B still poses the most problems in that far too many reports tend to be descriptive rather than analytical. Once again, there was a big difference between centres that knew the criteria and those that clearly did not, since it seemed that some centres had not read the Examiner's report at the end of each year. In fact, still only 4.0% gained the maximum four marks for Ba for either Visits or Issues suggesting that students still find it very difficult indeed to write an original, analytical discussion. Finding the information proves relatively easy but actually using it effectively does not.

Once again, some centres that had organised a visit included some sort of 'talk' where the information had been taken verbatim and then 'written up' with hardly any biology for a discussion. In cases such as this, it is useful for the students to produce some sort of questionnaire before the visit. This will make it easier for them to produce an original piece of work. For Bb and Bc again, very few candidates gained more than one or two marks but this sample does at least show an improvement on last year, 1.4% gaining four marks for Bb compared to 1.1% last year. Bc stayed roughly the same with 2.4% gaining four marks compared to 2.7% in 2007. These small improvements are very welcome.

Centres should remind their students that source material used in their work must be properly acknowledged. This applies as much to material taken from websites as to printed matter.

Once again, the examining team were almost unanimous in observing that the Visit / Issue report is very centre specific indeed. Some centres have clearly taken previous feedback and reports on board and their candidates were producing excellent work. However, a large number still do not seem to understand fully the specification's requirements. It cannot be stressed too highly that this is not an essay! It is an original, analytical piece of work.

It is important that centres carrying on with the Visit / Issue as part of the Edexcel 2008 syllabus note that the specification has a slightly different emphasis. The reports must first identify a biological problem that is being solved and then discuss the details of this *solution*, their implications and any alternatives that can be considered. Centres need to check the Edexcel website for further support material and exemplars.

Maximum mark..... 20

Mean mark 12.1

Standard deviation 3.6

General comments

As is frequently the case with this paper, many candidates gave little evidence of having thoroughly thought through the choice of practical during the pre-release week. To be discussing such simple safety issues as long hair and trip hazards caused by bags not being tucked away shows a misunderstanding of the level of answer required at AS level. Similarly, when candidates are discussing the way in which they drew conclusions from a graph in an experiment that did not involve the plotting of one, it shows that far too little thought had been given to the preparation of this paper.

On a positive note, most did seem able to identify the various kinds of variable in specific experiments and could discuss the source of errors and their remedies. This suggests that much of the focus of GCSE level experimental skills are well understood, but overall the level of answer indicates a somewhat worrying lack of progression beyond this during the first year of A level.

Question 1

Part (a) was well answered by many, but there was a tendency on the part of weaker candidates to be non-specific and not to relate the point to a practical carried out, or not to state clearly what they had done. A simple statement that repeating it was important would not gain the marks, whereas the idea of collecting all the class data in the beetroot membrane experiment would. A significant number of candidates just gave three examples of one aspect of validity and only gained one mark. Part (b) was not well answered by many. It showed up the weakest of candidates who gave generic safety rules such as “tying back hair” or even more common “taking care when...”. Specific safety issues, related to actual practical work carried out, were required. Many still think that all bacteria are harmful and thus lost marks for not specifying when and/or how a problem might arise if appropriate procedures were not carried out. In addition, even when appropriate situations were identified, a simple statement that “aseptic” technique was used, without saying what they actually did, was made.

Question 2

Many candidates made a reasonable attempt at (a). However, a significant number did not recognise that the question asked for errors in *measuring* the dependent variable and not aspects of the practical which might affect the value of the dependent variable. Part (b) was marked in relation to the answer given in (a). Thus, if candidates had not recognised that the dependent variable measurement was being asked for, it was still possible for them to get full marks here, and most did. Part (c) was very well answered by the majority; when marks were lost it was usually due to vagueness, such as the use of the word amount. Rarely did candidates confuse the dependent variable and independent variable and they usually could come up with a credible controlled variable.

Question 3

Part (a) was surprisingly poorly done. Many gave a general answer as to how to use a graph and/or how to draw one, but did not say how they used it to reach a specific conclusion. Often they did not specify what type of graph they used and some chose an experiment for which they had not drawn a graph at all! If all these faults were not made, then the next common mistake was an inability to describe what the graph actually did. For example, many chose the beetroot membrane practical and did not recognise that a linear relation was not expected, nor was it obtained; they missed the fact that the gradient changed with temperature as the membrane was destroyed. They did not seem to understand what the practical was trying to show and often tried to explain away the actual point of the experiment as anomalous to this imagined, non-existent, straight line. Considering they are given time to choose a practical with a well-understood graph it is surprising that so few actually understood the graph they were trying to discuss. Most candidates could think of ways to extend their investigation in (b), but many wanted to go and do something different such as using different organisms, different enzymes or looking at the effect of some other factor on the process which had been investigated.

Maximum mark..... 60

Mean mark 35.6

Standard deviation 9.4

General comments

The overall standard of responses was similar to recent papers, with a slightly higher mean score than the last session. The best candidates showed the high level of understanding that has become typical; the ability to recall information appropriate to the question was often good. Some of the data interpretation required was quite demanding and responses here were not as impressive as hoped. There was a lack of precision in reading graphs and data tables and candidates should be warned that this can lose credit.

Question 1

It was intended that this would be a more straightforward test on the immune system than in recent papers and there were many answers showing a clear understanding of active immunity. It was encouraging that most gave the description required by the question although some responses revealed a degree of confusion in (a), particularly with respect to the interactions between lymphocytes. Part (b) provided most candidates with several marks and was generally very well done.

Question 2

A disappointing number of candidates answered this question poorly, choosing to describe DNA analysis, often in impressive detail, rather than address the issue of DNA testing paternity reliably. It was sometimes possible to give some credit to these attempts, but it was necessary to interpret the question correctly to score highly. There were good responses that were spoiled by confusion about the differences between several genetic terms such as chromosome, allele, gene and genotype. Most candidates found the calculation straightforward although a significant number misunderstood the question and calculated a separate percentage for each population. This was given one mark where correct, but two marks were reserved for correct answers rounded appropriately. Part (b)(ii) generated a wide range of responses, most worthy of both marks, with the majority scoring a mark for pointing out the prevalence of mating within the same population. It was disappointing that a large number of candidates seemed to use 'population' and 'species' interchangeably, particularly when responses to (c) suggested a good understanding of the concept of a species. There were many good descriptions of how speciation might occur for (c), although it was not common to see sufficient detail for full marks and there were a number of examples of candidates hoping to score more marks by repeating a point.

Question 3

Candidates were allowed to demonstrate their understanding of photosynthesis in this question and the majority scored highly. It was pleasing to see candidates responding to the direction to be precise in (a), perhaps because of the mark allocation, and most were able to provide the missing products of the light-dependent reactions. Photolysis was also known by almost all candidates.

Part (d) prompted weaker candidates to give a detailed description of glucose production, but the mark scheme allowed this to score well. Better candidates addressed the question itself, saving themselves considerable time and effort. Competition from weeds was recognised as a factor affecting crop yield and most candidates were able to make a sensible suggestion about how atrazine might be used.

Question 4

This question broke with tradition a little in that it tested forensic science but scored poorly. It was surprising to see candidates struggling with data interpretation and in particular failing to give answers with sufficient precision. Part (a) followed form in being well answered and (a)(ii) was usually recognised as a question about succession, although full marks for detailed answers were less common than in the recent past. There was quite a lot of data to use in (b), although where candidates understood the principle they were able to give some sensible answers. The most common error was to fail to recognise that there were two possible values for days since death for 45mm flesh fly larvae. This was disappointing, as it had been hoped that the inherent lack of precision in this method would be well known. Part (b)(ii) was very difficult to answer fully, partly because of the decision to insist upon a recognition that a range of values were possible for the time of death, and the need to say that the deaths could have been within a day of each other, rather than restating the question's suggestion that they were at about the same time. Most candidates scored one mark and with hindsight it would have helped candidates if a little more direction had been given.

Question 5

Part (a) provided little discrimination as almost all candidates recognised the different antibiotics and were able to point out their characteristics. Answers to (b) were generally pleasing, although, in many answers, bacteria were given an immune system, suggesting a lack of understanding of terminology. The core practical was generally well known for (c), although candidates should be warned that detailed descriptions of methods will be expected in straightforward questions such as this. Lawned agar plates were not well described, for example, where it is not enough to describe growing bacteria in a Petri dish. Some indication of suitable incubation duration and temperature should be possible for candidates who have carried out the procedure and in particular unsafe incubation temperatures, such as human body temperature, were not allowed. Other vague descriptions that were not credited included methods unlikely to work, such as putting antibiotic solutions on the agar. It seems likely that the impracticality of such techniques would have been obvious had they been carried out.

Question 6

It was expected that the final question on the paper would be less taxing than was the case. The first two marks on offer for (a) required simple statements about how allele frequencies can increase, but a large number of responses discussed how the allele might have originally arisen. The third mark was awarded only occasionally as it required thinking more deeply as to how the allele could provide an advantage. Most candidates were fully aware of the controversy caused by the teaching of evolution and stated some conflict between religious teachings and evolution. A very large number of answers suggested that evolution should not be taught since it cannot be proved. This was not allowed credit as such a notion would impact significantly on a number of areas of the curriculum. Part (b)(ii) was pleasing as many candidates were able to show that they understood the difference between evolution as a theory and natural selection as a mechanism for change that can be demonstrated.

Maximum mark..... 40

Mean mark 21.7

Standard deviation 7.7

General comments

The paper provided a wide range of marks, with some requiring straightforward answers and others requiring careful processing. There was evidence in the questions about neurotransmitters and the electron transport chain that candidates could provide clear descriptions of the steps involved. Those parts of the questions which required candidates to apply their scientific knowledge were discriminating as some candidates could not do this. Answers to some questions showed that at times candidates were not reading the question carefully and following the instructions given. Care must be taken to use correct scientific vocabulary and avoid vague, superficial answers.

Question 1

Overall, marks were lost due to a failure to use correct scientific terminology or by simply repeating parts of the question. A surprising number of candidates failed to score in (a). Many did not refer to the diagrams and gave explanations rather than the description asked for. Marks were lost for descriptions of the visual cortex rather than naming the individual parts. There were many responses that referred to fewer neurones. In (b), the majority of candidates scored a mark for reference to the critical window. Many vague references to connections failed to score any marks. Most candidates gained the mark in (c), with the majority describing cataract removal or bandaging of young children's eyes. Some, however, named experiments without any description.

Question 2

This question was well answered by candidates who showed familiarity with the content of the specification. Many candidates gained the first two marks in (a). Some candidates were unable to relate the changes in size of the parts of the brain to changes in activity in those areas and so lost marks. Others failed to make any comparative statements. Fewer candidates gave details of the changes in brain activity with very few able to make the link between the activity of the motor cortex with the drug treatment. Part (b) was answered very well by the majority of candidates. Most set out their answer clearly and logically, often gaining maximum marks. Some candidates confused calcium and sodium ions, some referred to release of vesicles. Marks were also lost when it was not clear which membrane was being referred to. Few candidates referred to diffusion across the synaptic cleft. In (c), some candidates gave good coherent answers and gained all four marks. Many candidates scored one or two marks for reference to L-Dopa but then lost marks from lack of clarity. Some did not make it clear that it was dopamine which could not cross the blood brain barrier. The term agonist was used without explanation. Many stated that drugs could be used which 'act in a similar way to dopamine' without reference to shape or structure or how the drug might act.

Question 3

Parts of this question allowed all candidates to score some marks but only really good candidates scored highly overall. In (a), many candidates were able to describe the decrease in oxygen concentration but fewer were able to explain this. Parts (a)(ii) and (a)(iii) were generally well answered. For those who had revised, (a)(iv) proved to be a straightforward question with many candidates scoring full marks. Some candidates failed to make the direction of movement of the protons clear and some muddled electrons and protons. Few correct references to chemiosmosis or oxidative phosphorylation were seen. Part (b) scored evenly across all the marks. For (b)(i) and (b)(ii), the most frequent answer was for reference to the sodium-potassium pump. Few candidates got the mark for the restoration of resting potential in (b)(i). In (b)(ii), many candidates lost marks by referring to rod cell or cell membrane rather than inner segment.

Question 4

Parts (b) and (c) proved difficult for all but the best candidates, as both parts required answers to specific questions rather than a learned sequence of responses. Part (a) was generally answered well but a minority of candidates lost marks by giving long lists with no comparative statements. Typically only the best candidates scored all the marks in (b). Marks were lost by candidates giving a vague answer mentioning oxygen debt. Many also described why the lactic acid needed to be removed. A large number of candidates lost marks by stating that oxygen was used to convert lactate to pyruvate. Many correct references were given about what happened once pyruvate was formed. Few stated that the lactate had to be removed from the muscle. Simply using the terms homeostasis or negative feedback without the correct context did not gain credit in (c): many candidates lost marks for this. Whereas many correct references to the hypothalamus were seen, some were accompanied by incorrect statements e.g. references to ventilation centre. Vasodilation was a well understood term but marks were often lost by reference to arteries or capillaries dilating or vessels moving closer to the skin. Marks were also lost as it was often not clear that the vasodilation increased the flow of blood to the skin which in turn meant that more heat was lost from the skin. Weaker candidates often did not just discuss blood circulation changes but made reference to other heat loss mechanisms.

Maximum mark..... 40

Mean mark 28.7

Standard deviation 6.1

General comments

The Moderators were again pleased to see a wide variety of individual investigations had been carried out. As was the case last year, many of the best investigations stemmed from candidates' individual ideas rather than formulaic investigations such as variations on the theme of sheltered versus exposed shore investigations or the effect of trampling on grassland. If candidates do not have the opportunity to be genuinely individual in their research and development they are not being allowed to follow the SNAB approach to Biology A level.

There are still instances of candidates having worked quite hard on data capture and processing yet failing to address some aspects of the criteria. If these omissions were not reflected in the Centre marking then the Moderators had to reduce the marks awarded. Teachers in some Centres submitted carefully considered comments for each section of the electronic record sheet, greatly assisting the moderation process. This is especially important when larger Centres are submitting work marked by more than one teacher, where there should be some evidence that internal moderation has taken place.

There is still a minority of Centres which submit only very brief comments to support their awarding of marks. Centres are reminded that Moderators appreciate thoughtful and helpful comments, as these assist them in the moderation process.

A Research and rationale

Generally, the candidates gave more emphasis to this section than last year and future candidates should be encouraged to pay careful attention to this opening section: good research before work begins improves the quality of the whole investigation.

As was the case last year, many candidates stated an aim or hypothesis and gave some biological background, although they must have used sources they were often not referenced in the text. Many candidates seemed content with only three or four sources, one of which was a SNAB textbook. Candidates are expected to spend some time finding good sources if they are to be awarded higher marks for this section. Unless some sources are incorporated into the conclusion, Ab cannot be given more than 4 marks. A significant number of candidates failed to place their investigation into a context or explain their interest in doing the work.

B Planning

The plan was usually given its own subsection and the variables were clearly measured or controlled. Trial experiments were carried out by most candidates and they often led to useful changes to the plan. This allowed Centres to give candidates higher marks as a consequence.

The Moderators were pleased to see that only a very small number of candidates claimed a core practical from the previous year or a different type of group ecological study as a trial experiment. The moderators did not regard this as meeting the criteria.

At least some potential safety hazards were identified by nearly all the candidates. The best examples were set out in a table and all reasonable risks considered. Laboratory-based experiments should be encouraged to use Hazcard data. This aspect could have easily been improved by many candidates.

C Implementing

Candidates were usually able to carry out techniques carefully and methodically. Candidates often stated that they had reviewed their plan in the light of their trial experiment and either made modifications or confirmed their original plan did not need any modification. To justify the award of high marks, there must be further written evidence of review as the data collection proceeds.

D Observing and recording

Many candidates collected sufficient data with repeats to allow meaningful interpretations to be made. However it seemed to the Moderators that many candidates had not given any thought to the possibility of anomalous results, or perhaps these results were overlooked. If anomalous results were noted they were often not discussed or investigated. When these details are missing from a report the higher marks for strand b cannot be justified.

E Interpreting and evaluating

Very few candidates had major problems with statistical analysis. However statements about confidence limits and the justification for accepting or rejecting a hypothesis sometimes lacked clarity. Biological principles were still often only referred to in too a superficial manner to interpret the results, as has been the case in previous years. The Moderators are still concerned that a greater emphasis needs to be placed on using biological principles to interpret the findings of the investigation.

Some graphs were inappropriate for the data gathered and this did not help the candidates consider the biological principles involved.

The limitations were often carefully discussed but though sometimes modifications were not considered or suggested.

F Communicating

As was the case last year, there were many excellent reports that used suitable images, graphs, tables and diagrams. An abstract is not strictly required but it does lend weight to scientific style. Many of the best reports were significantly less than 3000 words. A small number of reports were well beyond the word limit but the candidates had thought the penalty worth taking as all the other sections were worth high marks.

Some otherwise good reports did not present well-chosen graphs or a properly constructed bibliography. This latter point has been less of a problem this year: web sites details should be given in full, ideally with date accessed. However details of books used were often incomplete; including the SNAB books! The author(s), title, date, edition and publisher (ISBN) should be given.

Most candidates used sources of information when writing their reports, unfortunately these sources were often not referenced in the text. This can be done by several methods, if it is not then 6 marks cannot be awarded for this section.

Overall, many candidates made a genuine attempt to carry out an individual investigation at GCE standard, their marks were usually limited more by omissions rather than failing to carry out suitable investigations. The Centre marking was well matched to most of the criteria.

The Moderators hope that the comments in this report will be brought to the attention of future candidates.

Maximum mark 60

Mean mark 28.6

Standard deviation 8.4

General comments

The almost 100% question completion rate and the volume of, mostly, relevant material written by candidates on this paper indicate that the vast majority of candidates found this paper accessible and generally understood the context of the questions and were able to complete the paper within the allocated time. However, difficulties lay in the exam technique of some candidates as they often write at length rather than targeting the question clearly. The best answers - those which gain the highest marks - are usually concise and carefully worded. Extra space was provided on the question paper this year, but some candidates appear to view this as no indication of how much they need to write, sometimes even going on to use additional sheets, or writing extensions to their answers in the margins of the paper. This should not be necessary and candidates should be made aware that responses written in the margins may be difficult for the examiners to mark due to the nature of the electronic scanning of the papers. Candidates should be reminded that if additional sheets are used, or the candidate continues their answer elsewhere on the paper they should indicate this clearly on their paper in the area provided for the answer.

The mean mark was lower but the range of marks was similar to last year's paper, ranging from candidates struggling to reach double figures and those scoring more than 50 of the available 60 marks. Each individual question achieved the full range of marks with a good spread of easily accessible marks and some challenging points for the more able candidates. The examiners are satisfied that this paper manages to assess a range of intellectual skills and abilities drawing on information which could be taken from every unit of the A level specification.

Question 1

In general, most candidates demonstrated a strong knowledge and understanding of the pre-release article, quoting (usually) relevant information from the text. Many candidates, however, had difficulty in synthesising an answer with the correct scientific detail, or link it to their knowledge and understanding of the rest of the specification. Some candidates continue to attempt to present quotations from the scientific article in an undigested way but the questions and the mark scheme were successful in rewarding responses which demonstrated understanding. Poorer candidates would simply quote the text without explanation, better candidates were able to explain the quotation or, better still, to use the idea and explain the biology behind the answer. To help prepare candidates for this part of the paper, teachers should act as a mentor to help candidates to get inside the passage, explaining difficult ideas in the passage if they are a barrier to their comprehension. It is worth encouraging candidates to identify aspects of the specification which are woven into the passage to help target some of their revision.

Candidates used quotations from the text well in (a) to illustrate the large number of bacteria and the range of habitats available. However, they were less able to explain these ideas in their own words. Many candidates commented on the 'fast reproduction rate' of bacteria rather than a large population size, which do not always coincide. In spite of this, most were able to select an appropriate example from the text to illustrate the large number of bacteria. A few candidates referred to bacteria living in 'many different habitats' or a 'variety of niches'. Many candidates did not make it clear that bacteria can live in a wide range of habitats and instead used phrases such as 'they live in harsh / extreme conditions' or 'they can survive where humans cannot'. Most candidates correctly chose an example from the text to illustrate the variety of habitats available to bacteria. Students were more likely to comment on the usefulness of bacteria to humans, for example in providing clean water, rather than their influence on many other living organisms.

The majority of candidates correctly commented on differences in lipids / peptidoglycan or 'molecular differences' in (b)(i). Whilst many candidates pointed out that Woese used 'genes' or 'looked at the genes' in his classification, few stated clearly that genetic *differences* were an important factor in grouping organisms. A lot of candidates misinterpreted the meaning of the question, giving responses more suitable for (b)(ii): an error that could have been avoided if the candidates read all parts of the question before tackling the individual sections. Another common error was for candidates simply to list lots of examples of each of the classification groups.

In (b)(ii), most candidates correctly selected from the text the comment that Woese's classification was 'too heavily weighted towards the microbial'. Most candidates, however, found it hard to gain a further mark. Many referred to the large number of species in Eukaryota, but did not link this clearly to their being placed into a small section of the classification system. There were many emotive phrases taken from the text, such as 'biologists would not like their subject being placed in one group' or 'biologists found it hard to understand his system'. Several responses were very opinion-led with little biological detail, with many favouring some of the *ad hominem* arguments against Woese.

Most candidates scored both of the marks in (c) for a simple comparison, although a significant minority failed to make clearly comparative statements e.g. 'Eukaryotes have a distinct nucleus but Prokaryotes do not'. Surprising numbers of candidates thought prokaryotes were plants and eukaryotes animals. Many talked about the organism - failing to read that the question referred to cells.

In (d), most candidates communicated the idea that genes / alleles are shared between bacteria. The best answers also referred to conjugation or sharing plasmids as a mechanism. Most candidates did not make it clear that genes were shared 'between species / types' of bacteria and talked about sharing 'in the population' or with other bacteria. Many referred to horizontal evolution without explaining how this happened. Some candidates incorrectly stated that 'all bacteria have the same genes' or 'there is a lack of genetic diversity' because they divide by mitosis / asexual reproduction.

Many answers in (e) were of a very general nature based on GCSE levels of knowledge. A level knowledge was not evident in those answers which referred to destroying or damaging "critical tissues" without explaining how they are damaged (a common feature), or "scouts" looking for pathogens. Others used language that was not appropriate for A level Biology e.g. "troops swing into action". This is an example of where candidates may rely too heavily on the language of the article than the biology they have learnt through the teaching of the specification. Some candidates wrote at length all about the specific immune system without any reference to how this might make someone feel ill.

Some candidates gained all four marks in (f) for just saying, for example, that bacteria had a high reproductive rate, that they existed in huge populations, that MRSA arose because of unsatisfactory hygiene in hospitals and misuse of antibiotics; whilst others wrote a lot about natural selection without being sufficiently specific and in context to gain more than two marks. Some hospital references tended to be vague or bordering on the libellous. Other candidates explained how a pool of people with suppressed immune systems, intravenous procedures and possibly poor hygiene may contribute to infection rate. Some candidates misread the question and described how it is spread from person to person - usually by sneezing!

Good candidates gained the mark in (g) with a few words. The rest rambled but failed to be specific enough, often referring to effective vaccines and immune systems. Others think that antibiotics are effective against this virus.

Question 2

This question was intended to weave together a number of ecological strands and general biology from the specification, each one simple enough in itself, in order to understand what would be for most candidates an unfamiliar and complex ecosystem, the North Sea. It also assessed skills in the use of data to recognise and analyse patterns, and to suggest alternative explanations for these patterns in terms of causality. In terms of data analysis, candidates were generally able to use data from a graph, with some minor errors. Manipulation of data was rare and candidates often failed to appreciate that other factors that are not named or investigated can still exert an effect on the data presented. Candidates who scored well followed the story line through the data and drew on the many interactions taking place. Other candidates lost marks by not reading the questions carefully.

Part (a)(i) was intended to be an accessible question to serve as a gentle introduction to the more complex themes of the rest of the question. Some candidates picked up three marks easily. For many others their understanding of food webs seemed not to have progressed since Key Stage 3. Some used pyramids instead of a web, some drew the arrows pointing in the wrong direction and many were confused about the use of terms such as 'primary consumers'. Many candidates failed to gain the third mark (making the food chain into a web) due to lack of clarity of the trophic level the extra organisms occupied.

Despite being in the specification many candidates were unable to gain the two marks available in (a)(ii) by explaining energy transfer between trophic levels and thus why only a small proportion of the energy was passed on. Many gained one mark by referring to over-fishing or observing that there were many more sandeels than cod.

The data sheet explained that phytoplankton were essentially plant-like and most candidates recognised, in (b)(i), that they would benefit from more light available near the sea surface. Many went on to suggest a second advantage such as a higher temperature (in summer), more carbon dioxide or less zooplankton/ *Calanus*. There were some interesting responses including, "the predators can't see the phytoplankton because the sun shines in their eyes more at the surface".

The simple piece of basic biology in (b)(ii) was quite discriminatory. Many candidates recognised that what they knew about phosphate in cells, in phospholipid membranes, ATP and DNA would apply to phytoplankton. Others were unable to make this simple item of knowledge transfer and just tended to think of it as a general mineral needed for photosynthesis, chlorophyll or protein production.

Part (c)(i) was another remarkably simple question which proved discriminatory tested students understanding of SI units and scientific notation. Good A level candidates took it in their stride but other candidates revealed a surprising lack of understanding. Common errors included missing off grams, referring to centimetres, or meters to the power of -2.

The idea of (c)(ii) was to test data analysis skills and causality which occur in the specification in the context of global warming. Many candidates had a good go at it and gained two of the three marks, although it was disappointing not to see more gaining all three marks. Most candidates recognised that temperature and productivity did follow a similar pattern and hinted that the relationship was not a perfect one. Few candidates used the term 'correlation' to describe the relationship. Again, few went on to suggest what the other factors might be controlling productivity. It was disappointing that so few realised that increase in productivity in spring and early summer preceded the rise in temperature implying that the relationship was not a causal one. Many candidates were convinced that enzymes denatured at 16°C, hence a fall in productivity, rather than looking at the overall trend (in terms of earlier changes in productivity cf. temperature) and suggesting reasons for that. A significant minority of candidates made basic errors in identifying months from the graph, confusing April/August and January/June.

Part (c)(iii) further explores the decline in productivity in July and August at a time when temperatures were continuing to rise. The actual reasons why this happens in the North Sea is due to an increase in zooplankton responding to an earlier peak in phytoplankton and to depletion of mineral nutrients such as phosphate in the surface layer. Candidates were not expected to know this and so a variety of suggestions were acceptable. These included temperature limitation in May, grazing by zooplankton (*Calanus*) in July and depletion of mineral salts or carbon dioxide in the surface layers. This proved a discriminatory question which allowed thoughtful candidates to display good thinking. Most candidates referred to light intensity despite the phrasing of the question directing them away from this. A number referred to other limiting factors but were unable to suggest what they were or that temperature was limiting in May. Few students seem to realise that phytoplankton are *grazed* or were aware of the difference between zooplankton and phytoplankton.

By the time candidates reached (d), the data sheet has made *Calanus* an old friend. The question is another 'suggest' one and the two marks allocated invite more than one suggestion. There were many good answers suggesting a decline in food (phytoplankton) or an increase in predation (by sand eels). Another valid point included enzyme sensitivity to temperature in *Calanus* (although it was a pity to see so many candidates who expected enzymes to be denatured by such modest temperature increases). It was also good to see suggestions that *Calanus* population may increase too early out of synchrony with the increase in food supply. Some weak candidates did not seem to appreciate that *Calanus* were living in the sea: comments were made about streams, water availability and even soils. Geography was also not well understood: one candidate suggested that the North Sea is near the equator (hence warmer waters). Also the sea really won't evaporate and dry up!

There were some good answers to (e)(i) and most candidates scored at least one of the two marks. To get the first marking point, it was necessary to say that the population of herrings was declining until the ban started. To get the second mark, a candidate had to emphasise that the population began to increase rapidly or dramatically as soon as the ban started. Some thoughtful candidates gained the second mark by emphasising that what really strengthened the argument was that cod, which was not subject to the ban, continued to decline. A rare alternative for a mark was to use figures: these had to be manipulated, not merely quoted, e.g. 'herring stocks recovered to over half of the 1963 level in less than ten years'. A significant number of candidates made some simple data interpretation errors, for example stating that the herring ban 'started in 1982', or confusing cod and herring graphs.

Most candidates recognised (e)(ii) as a question about natural selection and that the disadvantage of the large net size (intended as a conservation measure) would result in a decline in size of (adult) cod, whereas fewer pointed out that cod may mature earlier. There were a number of very good descriptions of how this might occur, including a description of how genes for smallness were passed on to the next generation. However, a significant minority lost marks here as they referred only to 'genes' or 'alleles' rather than 'genes for smallness'.

The Essays

There was a fairly even split of choice of essay this year and both essays had a full spread of marks, although there were fewer essays at the two extremes of marks than in previous years. Question 4 was a little more popular than question 3. The responses marked demonstrated that the vast majority of candidates had no difficulty tackling at least one of the essay choices and most wrote at significant length on their chosen theme. (A few candidates managed to fill 11 pages for their responses). On the whole, the standard of essay writing has improved each year. It was clear that candidates had been preparing for these questions by reviewing previous essays from this paper. Unfortunately, this resulted in a number of candidates trying to fit prepared essays from previous papers into their answers - this was not generally successful.

The essays assess synopticity at a range of levels. The weaker candidate with synoptic skills are able to demonstrate such skills in terms of breadth (A marking points) and reasonable writing skills (D). Most candidates with more knowledge were able to explore relevant biological points in depth (B marking points). But candidates who could recall a great deal of knowledge were subject to a ceiling of 14 marks for content (six A and eight B points). To go beyond this, they had to use mature synoptic writing skills and develop some deeper themes in their essay (C marking points). The system rewards positive (synoptic) achievement throughout the range but is very discriminatory at the top end. Only exceptionally good candidates interpreted the more subtle nuances of the question enough to gain the 19th and 20th mark.

Candidates frequently did not go beyond recall type essays - i.e. there was a distinct lack of personal opinion and joined up thinking. Few demonstrated that different areas of biology are very closely related if not dependent upon each other e.g. nervous/ endocrine systems, or gene therapy and production of new medicines.

In skill area D, most candidates were able to operate at the level of two marks, but not many were able to weave ideas together in a seamless way. Some of the better candidates who managed to stick to the main points of the question were getting three but very few candidates scored four. Candidates should be encouraged to write essay plans before commencing the essay as it is difficult to achieve more than two marks for D without a clear structure and logical sequence of information.

There are still a total of 24 points, of which 20 are needed to gain full marks, but this year we gave very few essay marks of 20. The better candidates tended to score 17 or 18, mostly due to a failure to meet many of the expected C points.

Question 3

Many candidates scored well in this essay on control and coordination. Most were able to discuss a broad range of examples, in particular thermoregulation and control of heart and breathing. Candidates gained the majority of marks for depth also in these areas. However, it was pleasing to see a significant number of candidates ranging over a large number of topics, including response to infection and control of the cell cycle.

A disappointingly small number of candidates referred to 'homeostasis', and fewer gave a good definition or explanation of a control mechanism or negative feedback. Very few candidates included reference to other examples of homeostasis such as osmoregulation. Many appeared to be convinced that homeostasis is concerned with thermoregulation, and no other control process. There were other misuses of scientific terms in this context: negative and positive feedback were often confused, as were para / sympathetic nervous systems and autonomic / somatic nervous systems. Other common mistakes were concerned with the basic biology and often cost the candidate B marks, for example getting regions of the brain confused.

The C points - the deeper themes - of Q3 required candidates to explain why thermoregulation or good coordination, or good regulation of respiration in response to energy requirements related to activity (allowing us to escape danger or obtain food), or rapid reflexes enabled us to survive in a range of habitats. Few candidates gained many C marks in this essay as many gave good descriptions of the processes but did not go on to discuss the consequences of these for the body, nor to give an impression of how the systems work together. In the scripts I marked, I did not see a single good comparison between the nervous and endocrine systems despite their clear presence on the specification.

Several candidates started to write all they know about muscle contraction, respiration and atherosclerosis, but the majority of essays tended to remain focussed on discussion of relevant topics for the essay.

Question 4

Most candidates were able to give broad descriptions of a variety of applications and a significant number gave good descriptions for isolating and separating fragments of DNA. There were some good discussions of the implications of each new technology, clearly stating the benefits and drawbacks to come to a considered position.

In Q4 the deeper themes for C points were related to ethical and social issues. Most candidates referred to the ethical implications such as rights of the embryo and insurance issues, although these did not tend to be in sufficient depth to award C points (A and B points were awarded). Few candidates considered the dangers from infectious viruses or mutation. A great deal of ethical concerns were expressed in naturalistic or religious terms and almost never with any grounding in biology. This matters because much of the 'horror science' candidates alluded to was downright implausible! Contemporary medicine raises sufficient pressing ethical questions that answers need not resort to master races, humans harvested for organs, Brave New World, Frankenstein clones, adult human bovine hybrids, genetic weapons, deletion of the gay gene, etc. There was also commonly an attitude that might be called hand-wringing without particulars; candidates who wrote that all this genetics is troubling stuff and where will it end, without ever couching the problem in terms of personal or social responses to current biology.

Good answers in the discussion of ethics included (on the negative side) coercive treatment after screening, false hopes of therapy, experimental therapies in infants and over-interpretation of risk factors; and (on the positive side) foreknowledge of the genetic burden of society, personalised and more effective medicine, fewer abortions after PIGD and a realisation that genes are not destiny.

A number of candidates included a large amount of irrelevant material, especially in their discussions of genetically modified organisms and stem cells. Some candidates prefaced their essays with accounts of DNA replication, and the structure and function of proteins. This work, sometimes amounting to one-half of the essay, gained no marks as it was not tied in to the focus of the essay title. Many did not refer to 'human DNA' or the 'human genome project' in their descriptions, making it difficult to see how this answered the question. For example, some candidates wrote about genetic modification - but not in the context of human genes.

Some wrote at great length about cloning or stem cells without gaining many marks. Too many candidates embarked on long accounts of cloning Dolly the sheep without linking it to the question of genes or gene expression, or cell programming at all. Dolly occurred well before the publication of the human genome (and anyway, she's a sheep). The potential for human therapeutic cloning and matching replacement tissue was appreciated by some students, but the prospects for basic research into disease using somatic nuclear transfer from patients was not grasped; a sheet of 'Parkinson' neurons could be a useful model system for screening drugs, for example. Few candidates explored understanding cell development and differentiation (gene switching, transcription, gene induction and control of cell division/cancer).

Most candidates got one element of genetic screening into their answer, although many did not differentiate between A1, A2 and A3 i.e. a loss of breadth again. The processes of obtaining DNA, electrophoresis and Southern blotting were generally well described (better candidates would obtain all relevant B marks, weaker candidates simply used key words).

Genetic fingerprinting was commonly referred to by candidates, as was gene therapy. PCR, when mentioned, was rarely described successfully. There was some confusion re germ and somatic cell therapy with students either failing to clarify the difference and alluding to germ therapy being routinely undertaken, for example in treating cystic fibrosis. Many candidates still appear to think that gene therapy involves removing and replacing the defective gene from cells. A substantial minority of candidates believed that gene therapy calls for *lysosome* and even *lysozyme* complexes.

Only one candidate noted that the lung is not the only site of cystic fibrosis pathology and that therapy targeted to the lung could not bring general relief. A single candidate referred to SCID, and named Ashanthi, the 1990 recipient of the pioneering ada-SCID therapy, though without describing the retroviral transfer of the normal ADA allele into her T cells. The case of SCID gene therapy deserves wider renown, both for the lasting benefit that can follow modified bone marrow implants, and for the dangers of off-target transcriptional activations.

UNIT GRADE BOUNDARIES AND UNIFORM MARKS

The raw mark obtained in each unit is converted into a standardised mark on a uniform mark scale, and the uniform marks are then aggregated into a total for the subject. Details of the method of aggregation are given in Appendix A.

For the AS examinations Units 1 and 3 have a weighting of 30% and Unit 2 has a weighting of 40%, and the maximum raw marks and maximum UMS marks are shown in the table below.

| Unit code | Maximum raw marks | Maximum UMS marks |
|-----------|-------------------|-------------------|
| 6131 | 60 | 90 |
| 6132 | 80 | 120 |
| 6133 | 40 | 90 |

For the A level, Units 1, 3, 4 and 6 have a weighting of 15% and Units 2 and 5 have a weighting of 20%, and the maximum raw marks and maximum UMS marks for the A2 units are shown below.

| Unit code | Maximum raw marks | Maximum UMS marks |
|-----------|-------------------|-------------------|
| 6134 | 60 | 90 |
| 6135 | 80 | 120 |
| 6136 | 60 | 90 |

The table on the next page shows the boundaries at which raw marks were converted into uniform marks in this examination. The A and E grade boundaries are determined by inspection of the quality of the candidates' work. The other grade boundaries are determined by dividing the range of marks between A and E. Marks within each grade are scaled appropriately within the equivalent range of uniform marks.

In Unit 3 the A and E boundaries are determined separately on the two components of the unit, paper 01 (visit or issue report) and paper 02 (practical work review). These marks are then added together to find the A and E boundaries for the unit as a whole, and the other grade boundaries for the Unit are then found as described above. Boundaries for the B, C and D grades for each component can be calculated in the same way, but please note that these are not simply added together to obtain the B, C and D boundaries for the unit as a whole.

Unit grade boundaries

Please refer to the notes on the previous page.

| Unit | Maximum mark | Grade | | | | |
|--|----------------------|-------|----|----|----|----|
| | | A | B | C | D | E |
| | <i>Uniform marks</i> | | | | | |
| | 90 | 72 | 63 | 54 | 45 | 36 |
| | <i>Raw marks</i> | | | | | |
| 6131 Unit SN1 | 60 | 40 | 36 | 33 | 30 | 27 |
| 6133 Unit SN3 | 40 | 29 | 25 | 22 | 19 | 16 |
| <i>Paper 01 Visit/Issue Report</i> | 20 | 15 | 12 | 10 | 8 | 6 |
| <i>Paper 02 Practical Review</i> | 20 | 14 | 13 | 12 | 11 | 10 |
| 6134 Unit SN4 | 60 | 45 | 40 | 36 | 32 | 28 |
| 6136 Unit SN6 | 60 | 36 | 32 | 28 | 24 | 21 |

| Unit | Maximum mark | Grade | | | | |
|----------------------------------|----------------------|-------|----|----|----|----|
| | | A | B | C | D | E |
| | <i>Uniform marks</i> | | | | | |
| | 120 | 96 | 84 | 72 | 60 | 48 |
| | <i>Raw marks</i> | | | | | |
| 6132 Unit SN2 | 70 | 37 | 32 | 28 | 24 | 20 |
| 6135 Unit SN5 | 80 | 62 | 56 | 50 | 44 | 38 |
| <i>Paper 01 Written test</i> | 40 | 28 | 25 | 22 | 19 | 17 |
| <i>Paper 02 Coursework</i> | 40 | 34 | 30 | 27 | 24 | 21 |

PROVISIONAL STATISTICS

The provisional percentages of candidates obtaining at least the indicated grade are given below.

| Unit | Entry | Cumulative percentage of candidates | | | | |
|---------------|-------|-------------------------------------|------|------|------|------|
| | | A | B | C | D | E |
| 6131 Unit SN1 | 4 724 | 20.2 | 34.3 | 48.4 | 62.3 | 73.9 |
| 6132 Unit SN2 | 7 928 | 22.8 | 38.0 | 50.4 | 62.5 | 73.4 |
| 6133 Unit SN3 | 7 083 | 17.7 | 44.1 | 63.5 | 79.7 | 89.5 |
| 6134 Unit SN4 | 2 465 | 18.6 | 37.0 | 54.0 | 68.7 | 79.9 |
| 6135 Unit SN5 | 3 838 | 19.2 | 37.6 | 55.7 | 71.1 | 83.4 |
| 6136 Unit SN6 | 3 829 | 22.4 | 37.9 | 55.6 | 72.3 | 82.7 |

| AS cash in | Entry | A | B | C | D | E |
|------------|-------|------|------|------|------|------|
| 8048 | 5 608 | 16.7 | 34.6 | 53.2 | 69.7 | 83.3 |
| 9048 | 3 720 | 24.2 | 47.4 | 69.0 | 85.2 | 95.5 |

APPENDIX A

The Uniform Mark System for AS and A level Unit Schemes

The result for each unit will be issued as a standardised mark on a uniform mark scale. AS subjects have a total of 300 uniform marks and A level subjects have a total of 600 uniform marks.

Tables 1 and 2 show the numbers of uniform marks required to gain each subject grade in AS and A level examinations. They also indicate the number of uniform marks in units with various weightings that will aggregate into the appropriate subject grade. These provide a guide to the level of performance in each unit.

The uniform marks shown for each unit do not necessarily represent the actual mark range used for marking the module. Grade boundaries for units are set at Awarding meetings on the basis of candidate performance on the actual mark range used. These boundaries are then converted to the uniform marks shown in the tables, with intermediate values calculated accordingly.

Table 1 - Advanced Subsidiary Subjects

| Subject | | Unit Weighting | | | | | |
|----------|------------|----------------|-----------|----------------------------------|------------|-----|-----|
| Grade | UM | 20% | 30% | 33 ¹ / ₃ % | 40% | 50% | 60% |
| Max mark | 300 | 60 | 90 | 100 | 120 | 150 | 180 |
| A | 240 | 48 | 72 | 80 | 96 | 120 | 144 |
| B | 210 | 42 | 63 | 70 | 84 | 105 | 126 |
| C | 180 | 36 | 54 | 60 | 72 | 90 | 108 |
| D | 150 | 30 | 45 | 50 | 60 | 75 | 90 |
| E | 120 | 24 | 36 | 40 | 48 | 60 | 72 |

For example, a candidate for AS Salters-Nuffield Biology must take three units, Unit 1 and Unit 3 are weighted at 30% and Unit 2 is weighted at 40%

| | Uniform mark obtained | Approximate level of performance |
|----------------------|-----------------------|----------------------------------|
| Unit 1 | 65 | B |
| Unit 2 | 73 | C |
| Unit 3 | 80 | A |
| Subject Total | 218 | Subject Grade = B |

Table 2 - Advanced Level Subjects

| Subject | | Unit Weighting | | | | |
|----------|-----|----------------|----------------------------------|-----|-----|-----|
| Grade | UM | 15% | 16 ² / ₃ % | 20% | 25% | 30% |
| Max mark | 600 | 90 | 100 | 120 | 150 | 180 |
| A | 480 | 72 | 80 | 96 | 120 | 144 |
| B | 420 | 63 | 70 | 84 | 105 | 126 |
| C | 360 | 54 | 60 | 72 | 90 | 108 |
| D | 300 | 45 | 50 | 60 | 75 | 90 |
| E | 240 | 36 | 40 | 48 | 60 | 72 |

For example, a candidate for A level Salters-Nuffield Biology must take six units, Units 1, 3, 4 and 6 are weighted at 15% and Units 2 and 5 are weighted at 20%. The candidate in this example has four units in the bank.

| | Uniform Mark Obtained | Approximate level of performance |
|------------------------------------|-----------------------|----------------------------------|
| Unit 1 | 59 | C |
| Unit 2 | 73 | C |
| Unit 3 | 69 | B |
| Unit 4 | 82 | A |
| Unit 5 | * | |
| Unit 6 | * | |
| Partial Total in Bank = 283 | | |

The candidate already has 283 uniform marks in the bank. If a Grade B is required in the subject, the candidate must obtain at least 137 marks from the remaining two (e.g. 70+67) in order to gain the minimum uniform mark of 420 for a Grade B (283 + 137 = 420).

There is no rule requiring candidates to take units amounting to 30% of the examination at the time of cashing in, nor do candidates have to take all papers with synoptic assessment at the same time at their first cash in.

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