CARIBBEAN EXAMINATIONS COUNCIL

REPORT ON CANDIDATES' WORK IN THE SECONDARY EDUCATION CERTIFICATE EXAMINATION

MAY/JUNE 2008

BIOLOGY

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GENERAL COMMENTS

The June 2008 examination in Biology at the General Proficiency level was the 33rd sitting of this subject conducted by CXC. Biology continues to be offered at both the January and June sittings of the examinations. The biology examination is one of the more popular of the single sciences offered by the CXC at the CSEC level and assessed the performance of approximately 14 000 candidates this year. The examination comprises three papers: **Paper 01 – Multiple Choice; Paper 02 – Structured/Extended Essay paper; and Paper 03, the School-Based Assessment (SBA).** This examination marks the first sitting in which the structured and extended essay papers are combined and all questions are compulsory.

The overall performance of candidates this year is better than that of last year's even though there was a major change in the structure of the examination, including the elimination of choice of essay questions on the paper. Candidates were able to score across the range of marks for almost all questions. However, far too many demonstrated limited knowledge of fundamental biological concepts and principles and basic knowledge of biological phenomena. Generally, candidates performed inadequately on questions that required specific knowledge of familiar biological concepts, principles and processes. Candidates often indicate that they 'know' the material, but cannot recall the names and definitions. They are still unable to adequately display the skills they are supposed to acquire in pursuing practical work. These comments relate to teaching of the subject matter and calls for students having more opportunity to express for themselves the concepts, principles and processes – writing these down and checking for accuracy as well as for engaging in practical activity and not merely writing up experiments in note books. Further, there is insufficient attention paid to several suggestions which the Biology examiners have repeatedly made over the past years. These comments take on more meaning with the new format of the Biology examination that has eliminated choice. Particular attention must be paid to the comments reiterated below in preparing candidates, *if the desired improvement in performance is to be realized and sustained*. These comments relate both to test-taking techniques and means of addressing the content of questions:

- Teachers should remind their students that there is more to taking an examination than memorizing the content. When preparing students for an examination time should be spent practising *how to interpret* and answer questions clearly, concisely and to the point.

- Candidates also waste time providing information that is irrelevant to the question. This gains them no marks. This is particularly important for the extended essay component of the paper. Candidates ought to make better use of the time allotted for reading through the paper, selecting their questions and planning their responses *before* starting to write.

- Too many candidates still do not read questions well. They should be advised to take special note of the cues given in the questions and underline key words to draw attention to what the question requires. When the question asks for two items many candidates give one and lose marks unnecessarily through apparent carelessness.

- Also, many candidates have the tendency to select an obscure partially correct response instead of the obvious more familiar response to questions. This relates to both question writing technique and knowledge of the subject matter. It should be noted that more marks are awarded for the obvious responses to the questions.

- In papers where limited spaces are provided for short answers, candidates insist on repeating the questions asked, leaving insufficient room for responses and then writing their responses in the margins. This wastes valuable writing time.

- The first three questions required candidates to write their responses in spaces provided. However, several candidates re-wrote the questions in the extended response booklets instead. Apart from wasting time and running the risk of losing marks, this also shows the difficulty some students have in following examination instructions. The inability to follow instructions and guidelines is often disadvantageous to their performance.

- Candidates should also use the question numbering as a guide to link the different parts of the question. They should note that the numbering changes when there is a change in concept or context. They should also make every attempt to use the information given in the various parts of a question to help focus the context and content of their responses.

- Biological jargon should be used where appropriate and **spelling** of biological terms must be correct. Spelling of common biological terms continues to be atrocious. It is not possible to award marks for incorrectly spelt terms where they actually mean something different. Candidates far too often seemed unfamiliar with common terms used in Biology, for example, “distinguish”, “precaution”, “factor”, “implications” or “types”. Teachers should direct their students to the glossary of terms available in the CSEC Biology syllabus.

It should be noted that candidates at this level are expected to demonstrate understanding of fundamental principles and concepts such as *the relationship of structure to function; the relationship of living organisms to their environment; the cell as the fundamental unit of living organisms; genetics and variation and their role in perpetuating species, and the impact of disease on living organisms including social and economic effects on humans.* The Biology Team suggests that teachers should use more constructivist approaches in the teaching of Biology in which their students would be more involved in explaining their notions, clarifying the content and be more fully engaged in problem-solving activities.

Every effort must be made to encourage and facilitate the use of appropriate biological jargon including the correct spelling of terms. Candidates can lose marks for incorrect spelling as the badly spelt term might take on new meaning.

Some examples of biological terminology with which candidates were not familiar include:

- Annotated

- Adaptations

- Implications

- Biological control

- Genetic engineering
- Resistance
- Immunity

DETAILED COMMENTS

PAPER 01 – Multiple Choice

Paper 01, as is customary, consisted of 60 multiple-choice items. Performance on this paper was quite similar to that of last year's. The mean for the paper was 61% compared with 62% last year.

Some of the topics that were *most* problematic for candidates were:

- Role of bacteria in the nitrogen cycle
- Respiration experiments
- Excretion in plants
- Water conservation in plants
- Identifying variables in an investigation
- Reflex arc and reflex action
- Bones – vertebrae and their functions
- Function of the skin in humans
- Reproduction in *Amoeba*
- Aspects of growth in plants and animals for example, role of auxins
- Menstrual cycle
- Distinction between natural and artificial selection
- Metabolic rate and effect on body temperature

PAPER 02 – Structured and Extended Essays

Paper 02 consisted of six questions, three of which were in the structured response format and three in the extended essay format. This paper tested all profile skill areas identified in the Biology syllabus. All questions were compulsory. Candidate performance on this paper was better than expected in that candidates were able to gain marks across the range for all questions and the mean for almost all the questions were quite close to the mid-point of the range. The mean overall score was 45 percent.

Since candidates were able to attain marks across the allotted range for all questions, it is evident that all marks on the paper were available. However, for more candidates to give their best performance attention must be paid to observations and suggestions the Biology examiners have repeatedly made. Observations and suggestions relate primarily to examination techniques which candidates should follow when writing this paper. In particular, candidate attention is drawn to the use of the stimulus material in responding to the questions and the guidance provided by the spaces allotted to each question where necessary. Candidates must note that they are not required to repeat the questions to begin their responses for the first three questions on the paper. Candidates also continue to display weak practical skills especially in planning and designing, manipulating and describing methods of experiments and in drawing conclusions from data. These observations suggest that teaching for developing practical skills *must include discussions, explanations and rationalizing of procedures and outcomes on the* part of students so that they become capable of developing and manipulating experiments and experimental data on their own. Simply having students write up experiments without orally communicating what they are doing and providing appropriate explanations for occurrences squanders the opportunity practicals provide for teaching and learning.

Question 1

This question dealt with an investigation of the water retention properties of two soil types, classification of soil organisms, some of their adaptations for feeding and also ways of investigating soil populations. Candidates were also required to demonstrate planning and designing skills, knowledge of data collection methods and ways of representing data as well as their ability to interpret data.

Candidate performance on this question was quite good. Most sections of the question was well done by the candidates. The mean was approximately 14 out of 25 and the mode 16 with just over the majority of candidates scoring more than half the marks allotted to the question.

Part (a) of the question required candidates to compare pie charts from an investigation of two soil samples. Candidates were required in Part (a) (i) to calculate the percentage of air in one of the samples, and in Part (a) (ii) to account for the difference in the proportion of air in the samples. These parts of the question were fairly well done by the candidates. The majority were able to calculate the percentage of air and provide a rationale for the differences based on the additional information that they derived. A good answer to Part (a) (ii) was:

> There is more air in Sample B since there is less clay (more air spaces), and there is less air in Sample A since there is more clay (less air spaces).

In Part (b) candidates were required to explore water retention properties in the two soil samples by reading the volumes in the measuring cylinders in responding to Part (b) (i) and identifying the cylinder that showed drainage of a selected soil sample in Part (b) (ii). These parts of the question were fairly well done although many candidates omitted the units in recording the volumes in Part (b) (i). Part (b) (iii), which asked candidates to estimate the volume of water retained by each soil sample, was also fairly well done. Part (iv), which asked candidates to identify a source of error in the investigation of the soil samples was well done by the better performing candidates. Candidates were expected to select responses form a range that included: *measuring of the volume of water/soil; drainage time; reading measuring cylinder* and so on. A noteworthy candidate response was:

> One sample of soil may already have water so that the calculation of the water retained may be made in error.

Part (b) (v) asked candidates to explain the importance of investigating water retention properties of soil. This part of the question was reasonably well done. Candidates were expected to make reference to: *the provision of plants with water held in the soil; different soils hold different amounts of water; can match soil type with plants that require different amounts of water.* A good response to this question read:

> So that one will know which soils are suitable for the growing of plants depending on their needs. One will know about the soil and so be able to take suitable measures to better equip them for a variety of needs, for example, low water retention causes leaching so one can add humus.

Candidates performed reasonably well on Part (c) of the question that assessed candidates' knowledge about investigating soil organisms. In Part (c) (i), candidates were asked to identify a couple of features that they observed on the diagrams of soil organisms presented in Figure 3. In Part (c) (ii), they were to identify a group of soil organisms that is important in recycling soil nutrients. Far too many candidates identified earthworms as organisms that recycle nutrients. Thus, the expected response was *bacteria* or *fungi.* Candidates were generally able to earn the marks allocated to Part (c) (iii), which asked for reasons why certain of the organisms were to be found under stones or leaf litter. Candidates generally recognised that this would allow for*: protection from predators; prevention of desiccation; not adapted for dry conditions, need moist habitat.* Part (c) (iv) was one of the most badly done sections of the question and shows quite clearly the lack of attention paid to practical skill in Biology. The majority of candidates had little clue about how to carry out an investigation of soil organisms, incorrectly making reference to the use of quadrats along with the absence of evidence of data collection and recording methods. Candidates were expected to suggest the use of *bottles/traps* to catch organisms and to refer to *choice of location and timing*; *placement of bottles/traps*; *use of Tullgren funnel*, *identifying* and *counting organisms* and *recording relevant data*. Two good responses were:

- In the habitat dig holes and place bottles covered with leaves to produce pitfall traps to trap Organism 5.
- Distribute the bottles in the entire area
- Collect the bottles after one day
- Count the number of the population

And

- Select and name a suitable habitat
- Dig holes at regular intervals and bury bottles leaving the mouths at the surface of the ground
- Lightly cover with grass and leave overnight
- Take bottles to the lab, observe the results by counting the organisms

- Tabulate observations

Part (c) (v) asked candidate to define the term 'carnivore' and give two adaptations a carnivore in the soil sample should have. This question was fairly well done, even though quite a few candidates held some misconceptions about carnivores. Some candidates believe that carnivores feed on herbivores only or that they are living things with backbones. With respect to the adaptations, most candidates were able to access one of the two available marks. Candidates were expected in their responses to refer to: *locomotory structures, fast movement; mouth parts for trapping, biting, piercing; cutting, developed sensory system for detecting prey.* Examples of good responses were:

> Two adaptations are sharp teeth or stingers and poison or venom to stun and kill prey … mouth parts to trap and kill animals and should be able to move quickly or to be well camouflaged to catch them. Therefore, have a great number of legs or be colored to match the colour of the habitat.

Misconceptions

- Quadrats or nets can be used to determine the population of organisms in a leaf litter.
- Carnivores eat 'organisms'. They should note that the term 'organism' refers to both plants and animals.
- Carnivores are living things without backbones.
- All invertebrates are insects.
- Earthworms recycle soil nutrients.
- Recycling of nutrients only involved organisms which physically break down the material, for example, earthworms.

Question 2

This question tested candidates' knowledge of parts of the appendicular (joint) and axial (vertebrae) skeleton in humans. Candidate performance on this question was disappointingly weak although not entirely unexpected. The mean was five and the mode was three.

In Part (a), candidates were to label the parts identified by numbers on diagram of the mammalian joint illustrated in Figure 4 (Part (a) (i)) and state the function of two parts selected from the diagram (Part (a) (ii)). Part (a) (i) was very poorly done. Candidates were expected to label as follows: *1 – synovial membrane; 2 – synovial fluid; 3 – cartilage; 4 - bone*. Since these are commonly known parts of a joint, it is quite surprising that many candidates failed to provide accurate labels, and too often interchanged the names or incorrectly spelt the names. Performance on Part (a) (ii) was somewhat better in that many candidates were able to relate *the synovial fluid to lubrication of the joint to reduce friction* and *the bone with providing attachment for muscle, its role in movement, support or red blood cell production*.

Part (b) also proved challenging for a large number of candidates. They were required in Part (b) (i) to name a partially movable joint. Few candidates knew that the *wrist*, *ankle* (*gliding/sliding*), *atlas* and *axis* (*pivot*) are classed as partially movable. Part (b) (ii) was fairly well done since a fairly large number of candidates recognised the elbow as *a hinge joint which allows gross movement – flexing and extending the lower arm, over a wide area*. Many, however, were vague in referring to the *limited or restricted movement in the partially movable joint* in making the comparison between movement at the two types of joints which Part (b) (ii) of the question asked.

Part (c) required candidates to complete a diagram of a human forelimb to illustrate how antagonistic muscles are aligned. This part of the question was fairly well done in that while candidates knew that antagonistic muscles, in this case, the biceps and triceps are on opposite sides of the humerus, many had little knowledge of how they were attached to the radius/ulna.

In Part (d), candidates were asked to explain how in older persons the hip bone can lose its locomotory function. This part of the question was also fairly well done. Candidates were expected to include in their responses ideas such as: *the hip bone carries the weight of the torso; loss of bone mass/erosion of cartilage at joint possible; reduction of synovial fluid; increased friction at joint; physical damage to the hip bone through injury possible.* Thus, in general candidates recognised that locomotion could be impaired through a loss of effectiveness at the joint. A good response to this part of the question was:

> Cartilage around the ball and socket joint may wear away causing frequent rubbing of bones. Older persons may lack calcium in their diet giving rise to brittle bones especially those of the hips. Both cause pain during walking or movement of the hip joint.

<u>Some misspelt words included:</u>

Cartilage – "cartalage", "cartillage"
Synovial – "sinoval", "cernovial"
Wrist – "rist", "wrisk"

<u>Misconception</u>

- Cranium is a partially movable joint
- Hinge joints move in two planes, back and forth

<u>Question 3</u>

This question required knowledge of the process of meiosis and its implications, as well as the processes involved in genetic engineering. The question was reasonably well done given that the topic is among the more challenging aspects of the CSEC Biology syllabus. The mean was 4.5 out of 15 with a mode of three. Very well prepared candidates were able to attain marks across the full range available for the question.

Part (a) of the question dealt with aspects of meiosis based on the representation on a diagram showing chromosomes in a dividing cell that was labelled Figure 6. Candidates generally provided accurate labels of the chromatids and centromere respectively which were required in Part (a) (i) and were able to identify the process as meiosis which was asked in Part (a) (ii). While several candidates were able explain why the process was indeed meiosis required in Part (a) (iii), many more were

unable to articulate their reasoning. Candidates were expected to refer to: *pairs of homologous chromosomes separating; centromere intact; evidence of crossing over in homologues.* An excellent response was:

> …pieces of chromosomes have been exchanged. This only occurs in meiosis. The chromosomes are being separated and are still composed of 2 chromatids joined at the centromere….

Part (a) (iv) asked candidates to indicate the number of chromosomes in the daughter cells produced in the cell division illustrated. A majority of candidates obtained the mark allocated to the question, but far too many ignored the stimulus material and gave the number of chromosome in a human gamete, which was not asked for. For Part (a) (v), candidates were to give two advantages of meiotic cell division. Candidates were expected to refer to concepts such as: *maintenance of the genetic number through successive generations; gametes different/offspring show variation; increase chances of survival as environmental conditions change.* A good response was:

> It can produce genetically different offspring which may be of better quality. The organisms' offspring which are genetically different may be able to survive environmental conditions if they change drastically.

Part (b) of the question assessed candidate knowledge of genetic engineering and its implications. In Part (b) (i), candidates were to define the term 'genetic engineering'. Candidates for the most part did not draw on the significance of manipulating genes and that the process was done at the sub cellular level. They were expected to indicate that: *genetic engineering involved the transfer; human manipulation; across species; at the sub-cellular level; not limited to or by species*. A good definition was:

> Genetic engineering is the insertion of genes into the DNA of one organism from another by humans.

In Part (b) (ii), candidates were to give an advantage of genetic engineering. This part of the question was well done. Candidates were expected to refer to: *faster change in trait; targeted traits involved; any trait can be manipulated/changed; any organism can be affected/changed.* In the following example this candidate illustrated how genetic engineering might be used to help find a cure for systemic, difficult-to-cure diseases:

> Diseases such as cystic fibrosis may be cured by inserting new healthy genes in place of genes carrying the disease.

However, challenging for candidates was Part (b) (iii) in which they were to identify possible problems that could arise with genetically modified organisms. Candidates were expected to refer to the unknowns about modified traits and their impact on the environment: *the new trait may cause organism to impact the environment differently and negatively; change in role in food chain, web; ability/inability to switch genes on and off.*

Part (c) of the question asked candidates to explain why gene transfer between species is successful even though those species cannot normally interbreed. This part of the question was not well done by candidates. Candidates were expected to indicate that *in general, organisms similar at the genetic level; gene structure is the same in all living things; transfer of genes possible between vastly*

different species; interbreeding is a complex of activities – involving many structures and processes, gametes different. A response that gained full marks was:

> This is possible because humans are controlling the gene transfer by inserting the genes directly into the DNA of an organism … normally, species do not interbreed as they cannot easily fertilise eggs of another species

Misconceptions/misconstructions:

- Lack of understanding that genetic engineering occurs at the sub-cellular level
- Lack of understanding that genes of all living organisms have a universal structure

Question 4

This question assessed the depth of candidates' understanding of the energy flow in ecosystems and their ability to evaluate the principles and implications of biological control. Approximately half of the candidates obtained over half the available marks for this question. The performance was thus quite good. The mean was almost seven out of 15 and the mode was eight.

Part (a) (i) of the question dealt with energy flow to and within ecosystems. The concept of plants as producers for the system because of their unique light- absorbing and energy conversion characteristic was widely understood. A good response was:

> They are the only organisms that can readily make use of the sun's energy. They use it to perform photosynthesis by which they make their food; herbivores eat these plants to gain energy and carnivores eat the herbivores and other carnivores for energy.

In Part (a) (ii), candidates were required to show how a plant or animal may belong to more than one food chain. While many candidates were able to draw reasonable diagrams with multiple food webs, they should note that normally labels, annotations and peripheral writings should be used to explain concepts and ideas presented in illustrations. In Part (a) (iii), candidates were required to explain why the number of organisms decreases at successive trophic levels. This part of the question was poorly done by several candidates, because they were unable to relate the decrease in number of organisms to energy loss to the environment. Further, simply stating that energy is lost is an inadequate response. Candidates were expected to include in their responses the ways in which energy decreases up the food chain, as it is used up by organisms for metabolic processes, through heat loss in physiological processes, for example, respiration, excretion or in ejestion. The following are examples of good responses. The first is succinct and to the point, while the latter illustrates how a good explanation is developed:

> The number of organisms decreases at successive trophic levels because as we go up trophic levels, the energy passed on becomes less and less. In fact 90% of the energy is used, lost by heat etcetera because of the low energy being passed on, the trophic levels can only support fewer organisms…
>
> … because at each level the amount of energy decreases. Energy is highest at the first trophic level because the sun's energy is abundant and only plants can make use of it for food. As herbivores consume plants they use some of the energy and store the rest, but

> to get enough energy one herbivore may eat a lot of plants, therefore the number of herbivores is less than the number of plants …

Part (b) of the question assessed candidates' knowledge of biological control and its implications. This part of the question was quite well done by able candidates, but presented a challenge to less able ones. For example, those candidates who were unable to identify a relationship that is important in biological control, which was one of the requirements of Part (b) (i) of the question, found great difficulty in explaining how the relationship functions in biological control, which was the other requirement of this part of the question. Candidates were expected to identify a predator /prey relationship or parasite/host relationship in their responses. In Part (b) (ii), candidates were to suggest reasons for a preference of biological control over the use of pesticides. Candidate response varied from coherent, well articulated arguments to the citation of totally irrelevant reasons such as "global warming" and "eutrophication". Candidates were expected to refer to biological control as *not likely to pollute the environment, contaminate food and drinking water* and that *pesticides had the potential to harm organisms not targeted*. Many candidates made reference to the development of resistance to pesticides, which, while valid, was too often poorly explained. Or they used terms vaguely, for example, "environmentally friendly" with insufficient explanation. Good responses to Part (b) (ii) were:

> Firstly the use of pesticides poses the risk of bio-accumulation. This happens as a result of the chemicals accumulating in the bodies of organisms as we go up trophic levels. It usually affects the organism at the last trophic level most.
>
> … chemicals could begin to accumulate in the soil and plants, poisoning and killing other organisms that feed on them and those connected in food chains. Extreme cases could cause mass destruction or even species extinction. The water in the soil could get affected … overuse of pesticide may also cause the pest to become resistant to it …

<u>Misconception:</u>

- Candidates often misinterpreted the use of pesticides in biological control making incorrect inferences to crops and plants.
- Pests become "used" to pesticides by antibody production.
- Organisms develop "immunity" to pesticides.

<u>Question 5</u>

This question required knowledge of the structure and function of the respiratory system in humans, factors that affect respiratory surfaces and the negative impact of human activity (factory emissions, cigarette smoke) on the environment. Candidate performance on this question was also good with a mean of 6.5 out of 15 and a mode of four.

Part (a) of the question tested candidates' knowledge of the structure of the human lung and how it is adapted for oxygen absorption. In Part (a) (i), they were to explain with the aid of a diagram how air reaches the lungs and oxygen absorbed into the blood stream. While the majority of candidates were able to provide an adequate explanation, the accompanying diagrams were indeed poor. This reflects a lack of appropriate drawing skill and is consistent with poor illustrations in SBA books. More

attention must be paid to developing candidates' drawing skill. Candidates were expected to include in their responses reference to *air passing through the nasal passage, bronchi/bronchioles, lung/alveoli* and then *to the capillaries surrounding the alveoli; the functioning of the ribcage* and *diaphragm in inspiration; oxygen dissolving in the moisture of the alveoli lining* and *diffusion of oxygen into the capillaries.* Several candidates were confused about where oxygenation of the blood took place and how the oxygen in the alveoli actually got into the blood stream. Part (a) (ii) asked candidates to suggest why it is important for human blood to have a specialized cell for oxygen absorption. This part of the question was not very well done. They sometimes referred to "surface area to volume ratio" but were generally vague in their explanations. They also tended to focus on what were the specializations of the red blood cells rather than the reasons for the special characteristics. Candidates were expected to include in their responses ideas such as: *oxygen is required by all cells; blood is the only means of supplying oxygen to all cells; many more cells requiring oxygen than cells of respiratory (absorptive) surface; specialized cells adapted to take up large quantities of oxygen and give up same to the cells that require oxygen.*

Part (b) required candidates to suggest why comparing the effects of smoke emissions from factories on leaves with the effect of smoking cigarettes on human lungs is appropriate. This question was challenging for many candidates. While they recognised that the leaves and lungs were indeed respiratory surfaces they could not rationalise the comparison. Candidates were expected to refer to the following facts*: smoke contains tar/solid particles; particles block stomata/ clog alveoli; reduction of gaseous exchange surface area, reduction of availability of gases in both humans and plants.*

Part (c) asked candidates to explain why governments should consider it their responsibility to reduce smoking in public. This part of the question was well done with most candidates gaining the marks allotted. A good response was:

> They (the government) should consider it their responsibility because smoking causes lung cancer, chronic bronchitis and other diseases. The number of persons with these diseases can be increased if the public is exposed to second-hand smoke and thus can cause a strain on the country's health services. Also, most smokers are young men and women and when they become sick there are fewer working people in the population to provide income for the country.

<u>Misconceptions</u>

- No difference between the trachea and oesophagus.
- Oxygenation of blood took place in the heart.
- Carbon monoxide is interchangeable with carbon dioxide.
- How acid rain is formed.
- Low availability when carbon monoxide is present.

<u>Question 6</u>

This question investigated candidates' knowledge of diseases and how the body is able to defend itself against diseases, antibiotics and implications of improper use as well as the impact of alcohol

abuse. Performance on this question was good with a mean of seven out of 15 and a mode of seven, giving a classically normal distribution curve. Candidates were able to access marks across the full range allotted to the question.

In Part (a) candidates were asked about the body's disease defence system and its effectiveness. In Part (a) (i), candidates were asked to explain how the body defends itself against disease. Candidates often did not provide a comprehensive enough account of the functioning of the immune system. Candidates were expected to include among other concepts: *clot formation; role of white blood cells, immune system response* including *production of antibodies, destruction and removal of antigens, memory cells and their role.* For Part (a) (ii), of the question candidates were required to identify diseases against which the body could not effectively defend itself. Most candidates were able to give at least one relevant disease which was often a viral disease such as HIV and AIDS. Too many candidates named obscure diseases when the obvious *hereditary*, for example, *sickle-cell anaemia*, *physiological*, for example, *diabetes* or *hypertension* and *viral diseases* were the expected responses. In Part (a) (iii), candidates were expected to indicate why it is difficult for the body to defend itself from one of the diseases identified in the previous section. Candidates were expected to indicate that these diseases were generally not caused by pathogens or antigens that *trigger the immune system* or that they *attacked and or destroyed the immune system itself or that the disease manifested at a sub cellular level that the immune system could not easily detect.* A good response from a candidate who indicated that the body has difficulty defending itself against a hereditary disease was:

> It is difficult for the body to defend itself against hereditary diseases because these diseases are transferred in the genes of the parent to the offspring. They are not caused by pathogens and so cannot be acted upon by antibodies or phagocytes and must be treated differently for example, gene therapy

Part (b) asked candidates for two biological and two social implications of the improper use of antibiotics. This part of the question was not generally well done as candidates had to recognise that antibiotics are drugs that are used to *treat diseases caused by bacteria* and their actions are rather *specific to bacteria.* Thus, candidates were expected to refer to: a*ntibiotics used to treat bacterial diseases; development of resistance of bacteria to antibiotics when dosage not adhered to; increased chances of new strains of bacteria developing when antibiotics improperly used; lack of effectiveness of treatment.* With respect to the social implications of the improper use of antibiotics, candidates performed reasonably well and many alluded to the financial burden on the community/country. They were expected to include in their answers: *cost of health care/treatment of diseases; increased incidence of disease; susceptibility to epidemics; burden on families.* A good response to this part of the question with respect to biological and social implications of the improper use of antibiotics was as follows:

Two biological implications of the improper use of antibiotics are:

1. The bacteria will become resistant to antibiotics and will remain unharmed in the body.

2. The surviving bacteria will be stronger than its predecessor and will need an even stronger antibiotic prescription to be killed.

Two social implications of the improper use of antibiotics are:

1. The cost of extra doses of antibiotics and relevant research.

2. If the disease is communicable, the resistant strain of bacteria may infect other persons increasing cost for research and medication.

Part (c) of the question required candidates to offer an explanation for sometimes describing alcohol as an abused drug. This question was fairly well done by candidates. Many focused their responses on the effect on the nervous system including the feeling of euphoria and change of behaviour including addiction in those who consume excessive amounts. Candidates were indeed expected to develop their responses around the ideas of: *alcohol is a depressant of the nervous system; alters normal functioning of the body; addictive for some people/increase dependence; drinker becoming more sociable and self-confident/feeling of euphoria/less social responsibility; need to drink excessive amount to maintain euphoria; need to be treated as any other disease that must be controlled.*

Misconceptions

- Antibiotics are used to treat any or every type of disease.
- Antibiotics can be used to treat viral disease.
- One can overdose on antibiotics in the same way one can overdose on alcohol or illegal drugs.

PAPER 03 – School-Based Assessment

GENERAL COMMENTS

Performance on the School-Based Assessment was reasonable. The syllabus coverage for centres was generally good and it was evident that there was some attempt to conduct practical activities for most skills. However, while the skill of Observation, Recording and Reporting (ORR) was generally well done, Analysis and Interpretation (AI) and Planning and Designing (PD) continue to present candidates with the most difficulty. It is recommended that more practical work, and work providing opportunity for developing these specific skills, form a greater part of the Biology course. In general, practical work should have an experimental approach that facilitates the development of critical experimental skills which is a major goal of the SBA. Efforts must also be made to include fieldwork for each batch of candidates.

A review of previous school reports will provide further suggestions for developing practical skills. Further suggestions are reiterated in this report and each teacher is alerted to the specific strengths and weaknesses displayed by their candidates in the Moderation Feedback Form sent to schools from CXC, after moderation. Teachers should also review the 2002 School's report to obtain an overview of the moderation processes and the expectations of the moderators.

While the quality of the books submitted from several centres was good, there are still some centres that submitted books without the requisite information. The CXC Biology syllabus provides guidelines for the preparation of practical books for submission. Some of the requirements include: a Table of Contents with aims of the practical activities, page numbers, dates, and a clear indication of the skills being assessed. In addition, the marks awarded for each practical activity must be placed

aside the practical and not listed at the front or back of the books. There must also be clear and specific indication of the activities that are used for the SBA.

The moderation exercise is too often hampered by poor mark schemes. These must be prepared and submitted with due care and attention. Mark schemes must be legible and preferably bound together instead of on loose sheets of paper. There must be a clear and direct relationship between the marks awarded to the appropriate activities in the practical books and to the marks on the tally sheets. It should also be noted that no more than two skills should be assessed in a practical activity.

The following is a list of criteria which teachers should follow in marking SBA activities.

- Marks should be awarded for each skill separately. It is noted that in some cases, marks were given for each skill, then tallied to give a composite score.

- Marks awarded to students' work should be a fair indication of its quality. Too many students received high marks for work that obviously fall short of the CXC standard. This was particularly noticeable for Planning and Designing, Analysis and Interpretation, and Drawing. When the CXC standard is not observed there is great disparity between the teacher's score and that of the moderator. This circumstance is usually **disadvantageous** to the students.

- Marks submitted on the moderation sheet should reflect the candidates' marks in each of the samples. Consistency of marking and submission of marks relate to the reliability of the process and thus acceptability of marks submitted.

- Teachers are once again reminded that body fluids such as saliva, blood and urine are not to be used for practical work. These can be sources of infection and may have serious legal implications should a student become infected while conducting practical work. Plant materials must be removed from books before they are submitted to CXC, since these are also potential agents of infection when moved from place to place.

- Fieldwork, both quantitative and qualitative aspects, is critical to the study of Biology and must be included in the SBA submissions

The moderation feedback form, which is sent to each centre, provides constructive and useful information relevant to the particular teacher(s). This form offers specific recommendations and is intended to assist teachers in the planning, conducting and assessing practical work – in the laboratory and field. Improvement of students' practical skills will have a direct influence on candidate overall performance in the Biology examination, since certain questions, notably Question 1 on Paper 02, are based on knowledge and application of these practical skills.

SPECIFIC COMMENTS ON THE ASSESSMENT OF SKILLS

Observation, Recording, Reporting (ORR)

These skills appear to have been mastered at most centres. For most of the work observed, the method was clearly described with logical sequence of activities. The tables and graphs were clear and provided adequate details which allowed for clear description and discussion of the experiment. It

was also observed that except for a few centre, the past tense was correctly used in the presentation of the report on the practical activity.

The importance of fieldwork is reiterated here. At some centres, little or none is being done. Many centres that attempted fieldwork frequently neglected quantitative or qualitative investigations. Both aspects of fieldwork are expected. Investigations need not be elaborate but students should be given the opportunity to explore the environment and make observations about the relationships among living organisms and their environment.

Drawing (Dr)

The number of drawings included in candidates' practical books, as well as the quality of the drawings, continue to be of concern to the Biology Examining team. At too many centres poor drawings were awarded high marks. Drawings are not expected to be works of art, but they should demonstrate an adherence to the guidelines for accuracy, clarity, labeling and magnification. Students have to be given several opportunities to develop drawing skills. The larger the number of drawings students have to produce, the more opportunity they have to practise, and develop the skill. It is also emphasized that drawings must be practised from actual specimens and not from textbooks. This comment has been stressed in several school reports.

Teachers must ensure that their students draw samples of **flowers, fruits, storage organs and bones**. Additional examples may be included in practical books. However, **microscope drawings should not be used for SBA**. It is very useful for students to see and attempt to record what they do see under the microscope but at this level these drawings should not be used for SBA. Similarly, dissections may help students to understand structures such as the digestive system but they are too complex to be drawn accurately at this level. These difficult drawings do not provide a fair test of ability at this level.

Analysis and Interpretation (AI)

This skill continues to present problems for the majority of candidates. The processes involved in demonstrating this skill are reiterated here.

Discussions are expected to provide some background information or the general principles on which an investigation is based. Results should then be explained. When a control is used it provides a point of comparison for the experimental set up in which a particular variable has been omitted. This comparison should be included in the discussion as it is the key to drawing the conclusion. Conclusions should relate directly to the aim of the investigation. Students should also be reminded to discuss at least one limitation of the investigation. It is important for them to recognise that the conditions present in a school laboratory are rarely ideal.

Many teachers continue to use questions to stimulate discussion. This device is good for helping students to develop their AI skills. However, they should not be used excessively, nor should they be the <u>only</u> means of assessment. These questions must guide students to provide the required background information, give explanations for the results, draw conclusions and show an awareness of possible limitations. The information provided in this way should then be written up as a paragraph of continuous prose as is normally done for the discussion/ conclusion. In many cases, candidates seem to have learnt a formula for writing up the discussion but showed no real understanding of how to interpret their own results. As a learning strategy teachers may ask their students to orally explain

the results to obtain a clearer view of their understanding and to help them develop their analytical skills.

It should be noted that food tests on their own are not appropriate for assessing AI. Simple investigations can be designed in which food tests are used. For example, students can be given unknown mixtures and asked to find out which food would be most suitable for an infant. Food tests can be used also to determine the presence of a particular food before and after digestion by an enzyme. These types of exercises will allow students to develop the necessary skills. Knowledge of the food tests and the nutritional requirements can then provide the background information on which they will base their conclusions.

Moderators were also concerned about the narrow range of investigations assessed for AI. With the exception of patterns of growth in seedlings, very few candidates seemed to have been exposed to investigations other than experiments. Investigations that require collecting observations over a period of time are ideal for discussing limitations as they lack controls and so many variables may change. These limitations can then be used as the basis for planning and design exercises. For example, students can be asked to find out which of the flowers in a garden butterflies prefer or what types of moths a house lizard eats by completing a table of observations over a period of days or weeks. They can then use the observations to develop a hypothesis and design an investigation that would test it.

Manipulation and Measurement (MM)

As in previous years, the marks for this skill were good. However, as was stated in previous reports, in many cases there was reason to believe that these marks were not the result of rigorous marking. If virtually all students in a class gain full marks on an activity, perhaps the task is not demanding enough or the criteria not detailed enough to allow the necessary discrimination between different levels of performance. It is important that students be exposed to a wide range of apparatus and their use in collecting data. This would help to ensure the development of the skill and give a fairer assessment of student competence in MM. Teachers are reminded that marks for MM must be written down in the laboratory books next to the laboratory practical for which they were awarded and mark schemes and detailed criteria submitted as done for all other skills.

Planning and Designing (PD)

Performance on this skill was fair. Most experiments designed by the students indicated that there was some understanding of the procedures involved in planning and conducting an experiment. There are still a few areas of difficulty where candidates were unable to state their hypotheses clearly and relate the aim to the hypothesis. In some instances, there were no replicates in the investigations.

There is room for more creative experiments. Teachers should take examples from their environment that would challenge the ability of their students. It is also important that development of the skill start with the commencement of the teaching of the syllabus. In many cases it was obvious that practical activities targeting the development of the Planning and Designing skill was among the last set of activities in which the candidates engaged prior to the examinations. Figure 1 is a noteworthy submission from 2005 SBA which clearly illustrates how a planning and designing activity might be effectively developed.

Example:

This Planning and Designing activity submitted by a centre was based on the observation that "*A boy notices that all the trees around his yard except the grapefruit tree were infested with 'duck' ants".* The students were required to plan and design an experiment to determine what was responsible for the difference in infestation. An example of an appropriate hypothesis and a relevant aim for investigating the hypothesis was:

> ***Hypothesis****: 'Duck' ants will appear on some trees but will not be present on grapefruit trees because the leaves contain a chemical that repels the ants*
> ***Aim****: To investigate whether 'duck' ants are repelled by a chemical from the leaves of the grapefruit tree.*

There was a clear description of the materials and method. Students planned to extract the substance from the leaves of the grapefruit tree, which may be responsible for the repellant effect, along with extracts from the leaves of other trees as an appropriate control. The 'duck' ants would then be placed near drops of each of the extracts in petri dishes. The measurable variable would be the number of 'duck' ants that leave or remain in each dish. Results would then be tabulated and subsequently discussed.

As stated by the candidates, one limitation may be that 'the chemical in the leaves that cause the effect on the 'duck' ants may be affected by the extraction'. Appropriate marks were awarded for the various aspects of the experiment.

Figure 1. Example of a good Planning and Designing activity