Purpose

To provide information about this year’s Biology examination.

Information

Information about the format of Paper One and Paper Two was provided in the subject notice published in April 2011.

Each paper will contain:
- short-response questions that will assess *Understanding biology* (UB) and *Investigating biology* (IB)
- extended-response questions that will assess *Evaluating biological issues* (EBI).

The EBI question topics are listed below to allow candidates to research each topic prior to the examination. Selected resources relating to two of the topics are attached. The resources will not be provided during the examination.

Candidates can bring their EBI topic research material (for all five topics) into the examination room on one double-sided sheet of A4 paper. It may be handwritten or typed. Although the research material itself will not be assessed by markers, it must be handed to the supervisor at the end of the Paper Two examination session.

**Paper One EBI topics**

**Part A — Cell structure and function**
- The effects of drugs on cellular processes.

**Part B — Physiology of organisms**
- The long-term impact of government policy on healthy lifestyles.

**Part C — Organisms and ecosystems**
- The impact of intensive horticultural practices on global biodiversity.

**Paper Two EBI topics**

**Part A — Continuity of life**
- The development of cattle-breeding technologies such as cloning and embryo-splitting.

**Part B — Evolution and diversity**
- The regulation of human intervention in evolutionary processes.
Enquiries

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Smart Choices — Healthy Food and Drink Supply Strategy for Queensland Schools

Smart Choices is all about supplying healthy food and drink choices to students in Queensland schools.

School food and drink supply includes all situations where food and drink is supplied in the school environment — tuckshops, vending machines, school excursions, school camps, fundraising, classroom rewards, school events such as celebrations and sports days, and food used in curriculum activities.

Reflecting the Australian Dietary Guidelines for Children and Adolescents and The Australian Guide to Healthy Eating, Smart Choices categorises foods and drinks into three groups:

**GREEN — Have Plenty**

*Encourage and promote these foods and drinks in the school.*

**GREEN** foods and drinks are drawn from the five basic food groups and are low in saturated fat, sugar and/or salt and rich in nutrients. These foods should feature prominently in the school environment.

Foods and drinks that fit into the **GREEN** category include fruit, vegetables, wholegrain or high fibre bread and cereals, reduced-fat milks, cheese and yoghurt, lean meat, fish and poultry, eggs, nuts and water.

**AMBER — Select Carefully**

*Do not let these foods and drinks dominate choices and avoid large serve sizes.*

**AMBER** foods and drinks are mainly processed and have had some sugar, salt or fat added to them. These products should not dominate at the expense of healthier choices. A selection that consists mostly of **AMBER** foods and drinks will provide students with choices containing too many kilojoules at the expense of fresh choices.

**RED — Occasionally**

*Limit the availability of these foods and drinks to no more than two occasions per term.*

The “occasional” foods and drinks that make up the **RED** category are based on the “extra” foods as defined in The Australian Guide to Healthy Eating. These foods and drinks should only be consumed occasionally because they lack adequate nutritional value, are high in saturated fat, and/or added sugar and/or salt, can create excess energy and can contribute to tooth decay and erosion.

*Source:* Adapted from Fact Sheet No. 1: Smart Choices — Healthy Food and Drink Supply Strategy for Queensland Schools, Department of Education and Training, Queensland Government
Health survey shows one in five Queensland kids are overweight

A survey carried out by the Children's Nutrition Research Centre and School of Human Movement Studies at The University of Queensland has found more than one in five Queensland children are overweight or obese.

The Healthy Kids Queensland Nutrition and Physical Activity Survey was conducted for Queensland Health and measured the nutrition, physical activity and weight among school-aged children in 2006.

Queensland Health Minister, Stephen Robertson, released details of the study this week. He said the survey was the first state-wide study of child nutrition in Queensland since a national survey in 1995.

"The survey shows that Queensland - like the rest of Australia – is experiencing an epidemic of unhealthy weight and obesity among children," he said.

"Overall, 21% of Queensland children aged 5 – 17 years are overweight or obese; including 19.5% of boys and 22.7% of girls.

"However, generally obesity rates in Queensland children were about 3% lower than in kids in New South Wales and Western Australia where comparable surveys have been done."

Mr Robertson said he was concerned by the rates of obesity in children and the impact on their future health.

"We know that excess weight is now the main cause of preventable chronic disease in Queensland," he said.

"Overweight and obesity contributes to the development of type 2 diabetes, heart disease, kidney disease, stroke, arthritis and some mental health problems."

The survey's key findings included:

- There are more severely obese children and young people today than 20 years ago.
- Children are not eating enough fruit and vegetables with half of the sample consuming less than one serve of vegetables a day.
- Fewer than one in six boys, and one in 15 girls, reported doing at least one hour of moderate physical activity every day in the week.
- Many children had inadequate intakes of iron and calcium; too many weren't drinking enough milk, too many drank soft drink; and too many ate fatty and sugary snack foods.
- Average intakes of saturated fat were 45% higher than levels recommended by the National Health and Medical Research Council.

In total, 3691 children attending Years 1, 5 and 10 from 72 government and non-government schools across Queensland participated in the survey.

The health consequences of being overweight or obese

For adults, the health problems and consequences of obesity are many and varied, including musculo-skeletal problems, cardiovascular disease, some cancers, sleep apnoea, type 2 diabetes, and hypertension to name a few. Many of these health problems are preventable though a healthy and active lifestyle. In particular, regular physical activity reduces cardiovascular risk in its own right and also improves levels of cardiovascular risk factors such as overweight, high blood pressure, and type 2 diabetes.

With respect to children, the most important long-term consequence of childhood obesity is its persistence into adulthood. Once a child is overweight or obese it is unlikely that they will spontaneously revert to a healthy weight, predisposing them to the health concerns listed above for adults. Obese children and adolescents also suffer from an increase in medical conditions. For example, the prevalence of type 2 diabetes is increasing in children and adolescents. Other problems associated with excess weight in children and adolescence includes the development of sleep apnoea, heat intolerance, breathlessness on exertion, tiredness and flat feet. Some research suggests that obese children (particularly older girls) also tend to exhibit decreased self-esteem and a significant proportion of children use unhealthy dietary practices for weight control.

PAPER TWO EBI TOPICS

PART A — CONTINUITY OF LIFE

APPLICATION OF REPRODUCTIVE TECHNOLOGY TO THE AUSTRALIAN LIVESTOCK INDUSTRIES

Abstract

Current use of reproductive technology in the Australian livestock industries is limited, though it increased in line with higher prices for beef and wool through the 1980s. The required techniques, many of which were developed in Australia, are available and the level of expertise is comparable to the best in the world. However, the extensive pastoral industries do not readily lend themselves to these procedures. Only in the dairy industry is artificial insemination used to a significant degree. On the other hand, application of the technology in the pastoral industries is confined largely to studs and breeding cooperatives which provide breeding animals for producer flocks and herds. Hence the impact of applied technology may be more widespread than first appears.

Until recently, little regard was paid to application of the technology along sound breeding principles. Artificial insemination and multiple ovulation and embryo transfer (MOET) have not been used so much in planned breeding programmes aimed at local improvement of stock, but more to proliferate genes of reputedly superior stock, imported either from overseas or elsewhere in Australia. This is particularly true of MOET, where the incentive to use it is commonly a short term cash gain made from proliferating breeding stock of a particularly valuable and usually novel strain or breed.

Recent technological improvements which render the use of reproductive technology cheaper and more effective will lead to its more widespread use in commercial practice. Techniques for embryo freezing and splitting have been greatly simplified and quickly put into practice. The novel livestock technologies of in vitro oocyte maturation and fertilisation have already found commercial application overseas. Fecundity-enhancing products have also been adopted by the livestock industries. There is potential value for greater use of reproductive technology in the livestock industries provided it is implemented according to sound breeding principles and that associated management practices are applied simultaneously.

What is the difference between nuclear transfer and embryo splitting?

**Embryo splitting**

Livestock breeders have used embryo splitting since the 1980s to create cloned animals, in order to preserve desired traits of a certain animal. It entails the artificial division of a single embryo, which replicates the natural process which can give rise to identical twins. In this case, both the nuclear genes and the small number of mitochondrial genes would be identical. This is done by separating the embryonic cells (ESCs) at a very early stage of development before they have had a chance to differentiate (while they are still totipotent). However, there are very few cells at this stage — usually less than eight — so this method can only give rise to a few clones.

The disadvantage of embryo splitting is that the clones are made from embryonic material so it is not possible to clone an adult animal from which its cells have already differentiated.

**Nuclear transfer**

This process involves the introduction of genetic material (in the form of an individual cell nucleus removed from either an embryonic, foetal or adult cell) into the cytoplasm of an unfertilised egg or embryo, whose own genetic material (nucleus) has been removed. The nuclear genes of clones produced by this technique would be identical, although the mitochondrial DNA of such clones would be different. However, unlike the embryo splitting technique, nuclear transfer has the potential to create a clone of an adult organism, as well as the potential to produce many more clones.

The nuclear transfer technique to clone animals is relatively new. The first evidence that it was possible to clone vertebrate animals using nuclear transfer was in 1952, using frogs. The more recent developments of nuclear transfer technology have brought with them the potential to contribute towards the genetic improvement of livestock. Dolly the sheep was created in this way.

*Source: ThinkQuest, Oracle Educational Foundation, http://library.thinkquest.org/C0121981/pages/s_nucleembr.htm*
Brandy breakthrough in cattle cloning

Cattle producers are one step closer at being able to clone their prize stud bulls, with Australian scientists claiming a world first by successfully cloning a cow using new methods. “Brandy” the cow was cloned by researchers at the Institute of Medical Research at Monash University in Melbourne. The cells used to create Brandy underwent two rounds of nuclear transfer, rather than one round that was used in cloning Dolly the sheep. Researchers say other cows have been cloned, but this is the first using new technology. Scientists say the type of cloning is much cheaper and easier to use, making it far more accessible to farmers.