

Tuesday 15 January 2013 – Afternoon

AS GCE HUMAN BIOLOGY

F222/01/ADVANCE NOTICE Growth, Development and Disease

For issue on or after:
17 NOVEMBER 2012

Duration: 1 hour 45 minutes



NOTES FOR GUIDANCE (CANDIDATES)

- 1** This document contains two case studies, which are needed in preparation for questions 1 and 2 in the externally assessed examination **F222/01**.
- 2** You will need to read the case studies carefully and also have covered the learning outcomes for Unit F222/01 (Growth, Development and Disease). The examination paper will contain questions on the two case studies. You will be expected to apply your knowledge and understanding of the work covered in F222/01 to answer these questions. There are 100 marks available on the paper.
- 3** You can seek advice from your teacher about the content of the case studies and you can discuss them with others in your class. You may also investigate the topics yourself using any resources available to you.
- 4** You will **not** be able to take your copy of the case studies, or other materials, into the examination. The examination paper will contain fresh copies of the two case studies as an insert.
- 5** You will not have time to read the case studies for the first time in the examination if you are to complete the examination paper within the specified time. However, you should refer to the case studies when answering the questions.

This document consists of **4** pages. Any blank pages are indicated.

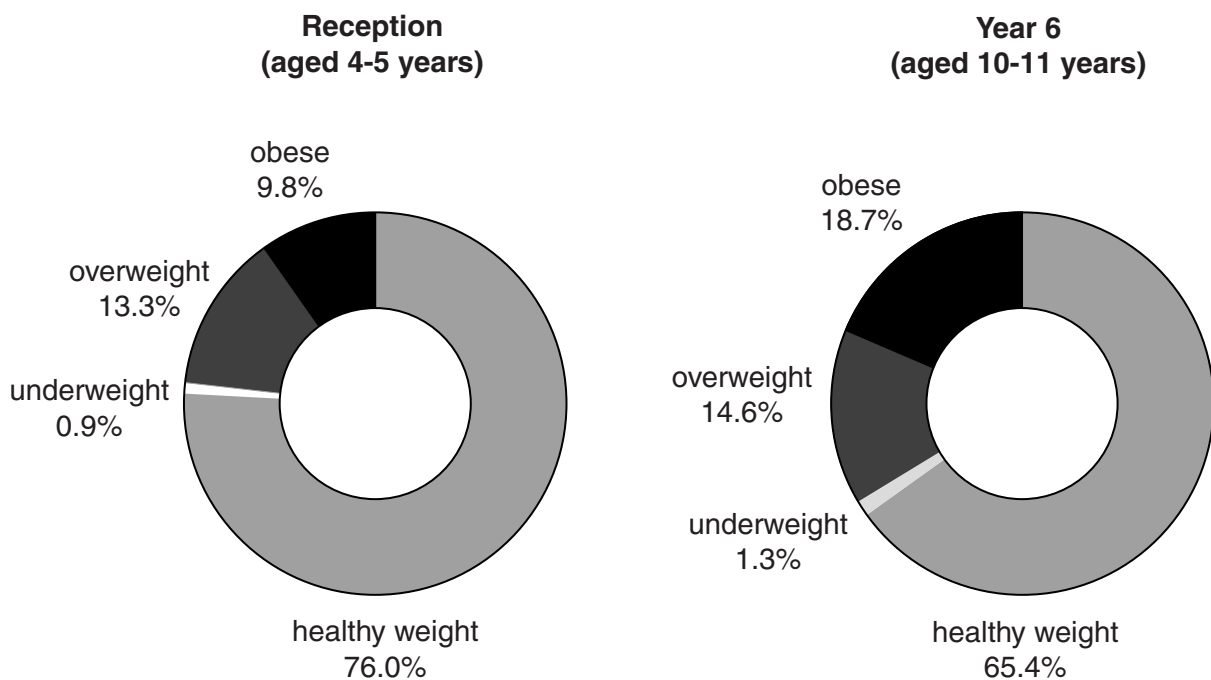
Case study 1

STORING UP TROUBLE

Childhood obesity is a growing problem in the United Kingdom (UK). Obese children are likely to stay obese into adulthood. As adults they are more likely to develop chronic diseases like type 2 diabetes at a younger age. Childhood obesity and the related diseases that develop in adulthood are largely preventable.

Obesity is a condition where weight gain has led to an excess of body fat which poses a threat to health. The most common measure of obesity is the Body Mass Index (BMI). A BMI of 30 or above means that an adult is considered to be obese. In children and adolescents the BMI values for obesity vary according to their age and sex and are related to the UK 1990 BMI growth reference charts.

The National Child Measurement Programme (NCMP) was established in 2005 as part of the government's strategy to tackle the continuing rise in excess weight in children. The NCMP has measured the weight of children in primary schools in England each year since 2005. The measurements are carried out in both reception class (aged 4–5 years) and year 6 (aged 10–11 years). Parents have to give permission for their children to be measured and between 2005 and 2010 the participation rate in the programme increased from 48% to 91%. The National Health Service Information Centre coordinates the collection and analysis of the information and uses it to support its efforts to increase the numbers of children with a healthy weight. Results from the analysis of the 2010 NCMP can be seen in the diagram below.



These results show the extent of the obesity problem facing an entire generation of children.

Complications of obesity, previously only seen in adults, are beginning to appear in children. In Bristol, a clinic established for children with obesity has diagnosed four children with type 2 diabetes. This is the first description of type 2 diabetes in UK Caucasian children and it has led to fears that this is the 'calm before the storm' in terms of an epidemic of obesity-related type 2 diabetes.

Children who have developed type 2 diabetes can be prescribed the drug metformin, a drug that lowers blood glucose levels. This drug is suitable for treating children because, unlike some other drugs, it does not pose a risk of hypoglycaemia and therefore blood glucose levels do not need to be monitored as frequently.

Many aspects of modern society have contributed to the increasing prevalence of childhood obesity. Tackling this problem in the UK will therefore require the involvement of several agencies including government bodies, food manufacturers, the health service, schools, parents and the media. Families will need to take responsibility for making lifestyle changes. Without these changes our children will not only be building up a store of fat but also building up an increased risk of developing health problems that could blight their future.

Case study 2

PERSONALISED MEDICINE

Our increasing ability to understand the scope and nature of human biological variation is allowing medical treatments, such as drug or cell therapies, to be tailored to a patient's medical history, genes and immunology.

'Personalised medicine has been an aim for years but now we are really starting to see results coming out of it,' says Nell Barrie, Cancer Research UK's Science Information Officer. When it comes to cancer, the basic idea of personalised medicine is to categorise tumours in terms of their molecular and genetic defects rather than according to where they are found in the body. This allows treatment to be selected for the individual tumour, instead of just prescribing a cocktail of cancer drugs.

The DNA of cancerous cells codes for tumour specific proteins not coded for by the DNA of healthy cells. A person's immune system normally detects these tumour specific proteins and destroys the cancerous cells. This does not appear to happen in people with cancer.

Herceptin[®] is the brand name for a drug that targets a type of protein (HER2) found in the cell surface membranes of the cancerous cells in roughly one in four breast cancer patients. So, whilst many breast cancer patients display similar clinical symptoms, only a subset of patients may benefit from the drug Herceptin[®]. The drug label advises health professionals to test patients for the protein (HER2) to identify those most likely to benefit from treatment with Herceptin[®].

Therapies that use whole cells can also be tailored to an individual. These therapies can be divided into two types:

- Autologous – when a patient's own cells are used to regenerate their organs or tissues. Researchers at Imperial College London have been using autologous therapy to treat patients with severe alcoholic cirrhosis of the liver. For each of the nine patients treated, the individual's blood stem cells were isolated, cultured and then injected back into the main artery serving the liver. Significant improvements in liver function were found in seven out of the nine patients.
- Allogenic – when a patient is treated with cells or tissues from a different person. Researchers with the London Project to Cure Blindness are developing a treatment for age-related macular degeneration (AMD) which uses embryonic stem cells to regenerate damaged cells in the retina of the eye.

Genetic variation means that responses to medication can vary. Research has involved correlating observed drug responses in people, with specific genetic markers which they carry on their genome. In the future it may be possible to design drugs to interact with specific genes. Drugs could also be targeted to specific metabolic processes.

Developments in personalised medicine owe a lot to the advances in human genome sequencing. Furthermore, the study of an individual's proteins and metabolites means that patient-generated data are being produced at an unprecedented rate and this has the potential to revolutionise medical treatments.

END OF ADVANCE NOTICE

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