OCR
RECOGNISING ACHIEVEMENT

Wednesday 18 January 2012 – Afternoon

AS GCE HUMAN BIOLOGY

F222/ADVANCE NOTICE Growth, Development and Disease

For issue on or after:
17 NOVEMBER 2011

Duration: 1 hour 45 minutes

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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**.

2 You will need to read the case studies carefully and also have covered the learning outcomes for Unit F222 (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 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

NEW WAYS OF TREATING HEART DISEASE

A recent study by the British Heart Foundation has shown that the estimated cost of coronary heart disease (CHD) in the United Kingdom (UK) is over 7 billion pounds. This new figure is more than seven times higher than previous estimates, which focused only on the cost to the NHS of providing direct healthcare. This study takes into account the cost of the 'informal' care provided by family and friends and also the lost earnings to the economy. This research, based on 1999 figures, concludes that CHD is the most costly disease in the UK, followed by back pain, rheumatoid arthritis and Alzheimer's disease. The results indicate that the inclusion of informal care and productivity loss is essential to gain an accurate picture of the economic impact of a major illness in the UK in the future. These findings highlight the need to continue to research and develop new treatments for CHD which is not only a health problem but also an economic problem.

Nanotechnology offers a new way of treating heart disease. Researchers at Harvard University have built a nanoparticle that can cling to artery walls and slowly release drugs to prevent the growth of scar tissue. The nanoparticles, called 'nanoburrs' are coated with peptides (protein fragments) that allow the particles to bind to target proteins on the basement membrane of the endothelial cells which line the wall of the artery. The basement membrane is only exposed when an artery is damaged. Once the nanoburrs have bound to the walls of damaged arteries they are programmed to release small quantities of drugs over several weeks or months to treat patients with CHD. This prevents other parts of their body from being exposed to doses of potentially toxic drugs. This advance could provide an alternative to drug-release stents which are currently used to treat some patients with CHD.

Another area of research carried out at the Institute for Child Health, has revealed how damaged hearts may be able to heal themselves. Treating a damaged heart following a heart attack is difficult because a section of the heart muscle dies and the tissue has limited ability to respond to stimulation. The research team have found that the cells in the outer layer of the heart are similar to stem cells and have the capacity to develop into any kind of new tissue in the heart depending on the signals they receive from the body. These cells are called progenitor cells. They can be stimulated by a protein, called thymosin-beta4, to move into the heart muscle and form new blood vessels. With new blood vessels now able to carry oxygen and nutrients to the heart muscle, the damaged heart muscle can grow new cells and repair itself. Finding out how thymosin-beta4 helps to heal the heart offers enormous potential for a therapy that would eliminate the risk associated with using donated stem cells. This is another excellent example of how research at a molecular level, may lead to the development of innovative treatments that should help patients improve their lives. This will reduce the economic burden of treating CHD.

References:

1. www.heartstats.org

2. http://www.understandingnano.com/nanomedicine-nanoparticles-nanoburrs-targeted-drug-release-artery.html

3. http://www.independent.co.uk/life-style/health-and-families/health-news/revealed-how-damaged-hearts-may-learn-to-heal-themselves-436699.html

All web references correct at the time of production.

Other references should be researched.

Case Study 2

EFFECTIVE PRACTICE IN BLOOD TRANSFUSION

After leaving university, Tom trained as a biomedical scientist and worked in the haematology laboratory in a large hospital. He was always particularly interested in Transfusion Medicine and had recently been promoted to lead a team of Transfusion Practitioners. Transfusion Practitioners work with consultants and also with the local blood bank managers to support clinical teams in the safe and effective use of blood in transfusions.

Tom has just bumped into Florence, an old friend from school, and she is asking him about his work with the blood transfusion service.

Florence:	Hi Tom – it's good to see you. I heard that you've just got a new job as a Transfusion Practitioner. I don't really know much about blood transfusion – you sort of take it for granted. Why do people need a blood transfusion?
Tom:	You have about 5 litres of blood in your body and you can lose up to 1.5 litres without developing too many symptoms. If larger amounts of blood are lost, a blood transfusion may be needed to immediately replace the blood lost.
Florence:	..... and what would happen if I needed a blood transfusion during an operation?
Tom:	Well.... before you had the transfusion you would be told the risks and benefits of receiving donated blood and asked to sign a consent form. Then you would have a blood sample taken to find out what blood group or blood type you have. Your blood will also be cross-matched with donor blood in the laboratory. Also, your surgeon would ask you to stop taking any medicines such as aspirin before the operation.
Florence:	Why do people have different blood groups?
Tom:	Your red blood cells carry hundreds of different markers on their cell surface membranes. These markers are called antigens. Your blood group depends on which antigens are present on your red blood cells. The two blood grouping systems that are most important for matching blood are the ABO system and the Rhesus system. There are other blood group systems but they are usually less important for blood transfusion.
Florence:	So, what happens in an emergency if there isn't time for cross-matching?
Tom:	Good question Florence…..if you are blood group O, your blood can be given safely to any patient but we only use this in a real emergency because it can cause problems. The blood group that is often in short supply is blood group O. I was just reading about some exciting new research where scientists have developed a way of converting one blood group to another.
Florence:	Wow – that's amazing! How do they do that?

Tom:	The process uses bacterial enzymes to cut the A and B antigens from the surface of red blood cells. This technique enables red blood cells from groups A, B and AB to be converted into group O red blood cells. In the future this may help to relieve shortages of blood for transfusions.
Florence:	But how is blood actually transfused?
Tom:	A cannula is inserted into a vein. The cannula is attached to a 0.5 litre bag of blood, which hangs on a stand. It usually takes two to four hours to receive one unit of blood. While having a transfusion, the patient will be closely monitored by a nurse who will regularly check blood pressure, temperature and heart rate.
Florence:	Is the blood bank the only place where you can get blood?
Tom:	No, there are other methods. Cell salvage can be used. This is where blood lost during or after an operation can be collected, processed and given back to you .....and also, we can carry out autologous pre-donation for a planned operation where you donate a few units of blood in advance and then it can be given back to you during or after the operation. Not all patients or operations are suitable for these procedures.
Florence:	I'm beginning to get some idea of what an important job you do. Do many problems arise during blood transfusions?
Tom:	Blood transfusion is a commonly used procedure and generally very safe. Serious complications are very rare but can include an immediate reaction to the donor blood if the wrong blood is given accidentally. You can also get fluid collecting on the lung or get an infectious disease from the donor blood. It's part of my job to implement procedures that make sure mistakes don't occur and that all blood transfusions are successful. Now that's enough about me. What about you……..?

References:

1. http://news.bbc.co.uk/1/hi/health/6517137.stm
2. http://hcd2.bupa.co.uk/fact_sheets/html/blood_transfusion.html

All web references correct at the time of production.

Other references should be researched.

END OF ADVANCE NOTICE