

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
ADVANCED SUBSIDIARY GCE
F222/ADVANCE NOTICE
HUMAN BIOLOGY

Growth, Development and Disease

TUESDAY 8 JUNE 2010: Morning

DURATION: 1 hour 45 minutes

For issue on or after:

13 MARCH 2010

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

INSTRUCTIONS TO EXAMINATION OFFICER/INVIGILATOR

Do not send this Insert for marking; it should be retained in the centre or destroyed.

READ INSTRUCTIONS OVERLEAF

NOTES FOR GUIDANCE (CANDIDATES)

- 1 This leaflet 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.**

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CASE STUDY 1

ASTHMA ON A SCHOOL TRIP

Faisal is at primary school and getting ready for a visit to the Yorkshire Dales. His mother has completed his parental consent form and included the information that Faisal has asthma. His medicine is listed as 'reliever', 'preventer' and 'spacer'.

The Head Teacher, Mr Gormley, is concerned that there is not enough information on the form about Faisal's asthma, and he has asked Faisal and his mother to meet with him. The school nurse has been asked to join them to discuss any issues.

Head Teacher:	Can I begin straight away by saying that there is no question of Faisal not taking part in the school trip. We have an asthma policy in school and we encourage pupils with asthma to achieve their potential in every aspect of school life. So there is no need to look so worried Faisal. (<i>Faisal smiles</i>) I have asked the school nurse to join us because she has 'asthma training' each year.
Nurse:	That's right. Now, I don't seem to have Faisal on my asthma register. Has the asthma been diagnosed recently?
Mum:	It was about three months ago but he has probably been struggling for a while. We thought it was just because he had a virus over the winter but then he had a really bad attack and then we knew. I should have recognised the symptoms.

<p>Nurse:</p>	<p>Oh, it's not always easy. So you went along to the asthma clinic and they carried out some tests Faisal – is that right? (<i>Faisal nods</i>) Well, I bet that was fun... did you have a go on one of these? (<i>She holds up a peak flow meter and Faisal nods again</i>)</p> <p>(<i>Nurse turns to Mum</i>) After the tests, they gave you lots of information on what to watch out for? (<i>Mum nods</i>) Did they give you a prescription for Faisal?</p>
<p>Mum:</p>	<p>Yes – Faisal has a reliever that he has to carry with him – do you have it now Faisal? The blue one? (<i>Faisal shows the Nurse his inhaler</i>) And can you use this by yourself? (<i>Faisal nods again</i>)</p>
<p>Nurse:</p>	<p>That's great! Do you need to use the spacer at all Faisal? (<i>She shows Faisal a spacer</i>)</p>
<p>Head Teacher:</p>	<p>Ah, so the spacer is not another kind of medicine then?</p>
<p>Nurse:</p>	<p>No, as you can see, the inhaler fits just here – can I borrow your inhaler Faisal just to show Mr Gormley? (<i>Faisal passes his inhaler to the Nurse</i>) Now, you deliver one 'puff' – I won't do that so as not to waste a dose – and then you just breathe through here. (<i>She demonstrates how to use the spacer</i>) A lot of children and adults find it easier to use their inhaler with a spacer – but there are other reasons for using one.</p>
<p>Mum:</p>	<p>But we don't use it with that inhaler – it's with the preventer that we need to use it.</p>

<p>Nurse:</p>	<p>That's what I thought. What I need to do is to give you this asthma card for you and your doctor or asthma nurse to fill in. This tells us exactly what medicine Faisal needs to take and when, and helps us to recognise the symptoms and the triggers – the things that might set off an attack. There's a section for emergency contact numbers as well. We keep this in school – but if anything changes then it will need to be updated.</p> <p>Do you have Faisal's preventer with you?</p>
<p>Mum:</p>	<p>Yes, do you want to see it?</p>
<p>Nurse:</p>	<p>I need to get the name for the record on the asthma card. Would you mind if I had a look?</p>
<p>Mum:</p>	<p>Not at all – are they not always the same?</p>
<p>Nurse:</p>	<p>No, and not all of the relievers are the same either– it's got something to do with different people having different genes apparently – but the follow up visits you have with the asthma clinic would soon pick that up. (<i>She looks at the preventer</i>) So is this the one that you need to use twice a day with the spacer Faisal? (<i>Faisal nods</i>)</p> <p>It might be a good idea if we keep a spacer in school. (<i>Nurse turns to Mum</i>) If Faisal does have an asthma attack, the spacer will make it much easier to use the reliever – I can sort that out for you. So, I think once the card is filled in we'll have everything we need to know. Just make sure that all the medicines you need with you have your name on – OK Faisal?</p>

Mum:	That's fine. And someone from school will look after the preventer?
Head Teacher:	That's right. Well, once we have the card done and we've briefed the staff again on the emergency procedures, we'll be ready to go. I'm really looking forward to all that fresh air – just what my lungs need Faisal!

CASE STUDY 2

APOPTOSIS – WHAT WE LEARNED FROM THE WORMS

In 2002, the Nobel Prize for Physiology and Medicine was awarded jointly to Sydney Brenner, H. Robert Horvitz and John Sulston. They had worked collaboratively for years on an organism called *Caenorhabditis elegans* – a nematode worm.

C. elegans has a life cycle of just over three days. It grows from a single fertilised egg cell to a multicellular adult organism in only 14 hours – growing from one cell to 1 090 cells. What is more, the worm is transparent and cell division can be followed using a microscope. However, 131 of these 1090 cells die. The death of these cells is not random but follows a pattern, and the pattern is consistent. It was Sydney Brenner who demonstrated that changes in the DNA of *C. elegans* could be linked to specific genes and that these, in turn, led to changes in organ development.

John Sulston went on to describe every cell division from the fertilised egg to the final 959 cells in the adult worm. It was Sulston who first described that specific cells always die – a phenomenon we call programmed cell death or apoptosis. He described the stages in this form of cell death.

Finally, H. Robert Horvitz investigated the genes controlling apoptosis and identified the first two ‘death genes’, which he called *ced-3* and *ced-4* (*ced* from cell death). But what is the significance for human physiology and medicine? The answer became obvious when researchers found a similar system of cell death genes acting in humans.

In early fetal development, human hands and feet look like ‘paddles’ – with the fingers and toes being linked by a ‘web’ of connective tissue. Between days 41 and 56 of fetal development, the cells of this connective tissue undergo apoptosis and the fingers and toes become ‘free’. The protein that stimulates apoptosis in humans is called a caspase, and is similar to the protein coded for by the gene *ced-3* in *C. elegans*. Surprisingly, humans and worms have similar genes controlling programmed cell death.

What are the ‘triggers’ that activate the death genes? Some triggers come from within the cell, such as damage to mitochondria or damage to DNA. Other signals come from outside the cell. Research into these triggers and signals is particularly important in the field of cancer. For some forms of cancer, the mechanisms are understood. One example of this is cervical cancer. Some forms of the Human Papilloma Virus (HPV) have been linked to cervical cancer. One form of the virus produces a protein that binds to an apoptosis promoter, p53, inactivating it. When p53 is inactivated, cells fail to undergo apoptosis and carry on dividing – out of control!

References:

- 1. <http://nobelprize.org> (accessed September 2009)**

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