



ADVANCED SUBSIDIARY GCE
HUMAN BIOLOGY
Growth, Development and Disease

F222/ADVANCE NOTICE

For issue on or after:
17 NOVEMBER 2009

Tuesday 12 January 2010
Morning

Duration: 1 hour 45 minutes



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.

This document consists of **8** pages. Any blank pages are indicated.

Case Study 1

SIR AUSTIN BRADFORD HILL – THE FATHER OF EPIDEMIOLOGY

Epidemiology is the study of diseases within populations. As a science, epidemiology depends on collecting data, but the data is not usually obtained from experimental research. For example, one of the largest epidemiological studies ever undertaken is the 'Million Death Study'. This is a prospective study being carried out in India between 1998 and 2014, in which 14 million people will be questioned. During this time period, approximately 1 million of those involved in the study will die. By establishing the cause of death it is hoped that key 'risk factors' will be identified – although this is only one aspect of the study.

One of the most famous epidemiological studies ever carried out was also linked to causes of death. In 1948, Austin Bradford Hill invited a young doctor, Richard Doll, to join his team. The team was investigating the reason for the dramatic increase in deaths due to lung cancer. Why 1948? Deaths from lung cancer had been increasing every decade since the beginning of the century, but with two world wars and a global depression it was not until 1948 that the figures started to look alarming. While death rates from other causes such as TB were declining, death rates from lung cancer were still increasing and no one was certain of the cause.

In an interview published in the British Medical Journal in March 1997, Sir Richard Doll made the following observation:

'At first, I thought it (*deaths from lung cancer*) was more likely to have something to do with motor cars. But I used to go round the wards, checking the notes after discharge to see whether the diagnosis was confirmed or not, and what immediately struck me was that if a person was a non-smoker, the diagnosis was practically never confirmed, but if he or she was a smoker, then it was almost always lung cancer.'

In their first study, Hill and Doll designed a questionnaire that was given, by social workers, to 650 male patients in London hospitals. The interviewees were patients with suspected lung, liver or bowel cancers. The social workers were not told the suspected diagnosis, and they also interviewed other male patients with other diagnoses. As Hill and Doll suspected, those whose lung cancer was confirmed were smokers. This seemed to show what Hill termed a '**strength of association**'. This is the first of a set of criteria that are now called the 'Bradford Hill' criteria. These criteria form the basis of any epidemiological study carried out to this day.

However, Hill and Doll's results might have been a feature of living in London. It was time to apply more of the criteria. For **consistency** there has to be more than one observation of the connection. Hill and Doll carried out a similar study using 750 similar patients in hospitals throughout England.

To further establish strength of association, a prospective study was set up in 1951 interviewing 40 000 doctors about their smoking habits. In the first 29 months of the study, there were 36 lung cancer deaths. After four years there were 200 lung cancer deaths, and almost all of them were heavy smokers. This supported another criterion – a **dose response relationship**. Hill and Doll began publishing their results in 1954, and the results from the study were still being published in 2004. This long-term study used more of the Bradford Hill criteria to evaluate the evidence. The findings were supported by **experimental evidence** establishing the presence of carcinogens in tar from tobacco. There was now a scientific basis to the link between smoking and lung cancer – a **theoretical plausibility**.

In Hill's own words:

'None of these (criteria) can bring indisputable evidence for or against a cause and effect hypothesis. What they can do... is to help answer the fundamental question – is there any other way of explaining the facts before us? Is there any other answer equally or more likely than cause and effect?'

References:

Doll, R., 1991, Sir Austin Bradford Hill and the progress of medical science. *British Medical Journal*, volume **305**, pages 1521 – 1526.

Bower, H., 1997, No sign of slowing down (Sir Richard Doll interviewed). *British Medical Journal*, volume **314**, page 695.

Case Study 2

GETTING TO THE HEART OF THE MYSTERY – AN ANALYTICAL TOXICOLOGIST TAKES THE STAGE

Krystina is a biomedical scientist who specialises in analytical toxicology. She has been approached by a friend who is organising a 'Crime Writers Workshop'. Krystina has agreed to be part of a panel of 'experts' and answer questions from aspiring crime writers. She has not had much to contribute until the topic of poisons is brought up.

Alistair:	My story is set in Ancient Greece – I don't want to give too much away – but I need to know about what kind of poisons would have been easily available.
Krystina:	I think I can help you out a bit on this one. It's ironic really, the word 'toxicology' comes from the Greek words 'toxon' and 'toxicos'. It refers to the poisons they put on their arrows. It would certainly have made them a much more lethal weapon.
Alistair:	But what poisons would they have used?
Krystina:	Well, they would know about arsenic. It's really a question of whether your murderer would have had access to it or not I suppose.
Alistair:	I'm not sure I can work that one into the storyline. Incidentally, I know what the symptoms are – stomach pains, vomiting and so on, but I've never really known how it works – can you tell us?
Krystina:	Without going into too much detail, arsenic pretty much leads to multiple organ failure. But if it helps anyone with a story – there is some evidence that eating garlic can act as an antidote. Garlic has always been useful as a medicinal plant. <i>(some members of the audience take notes)</i> It can act like an antibiotic you know, so pretty useful for infections too... <i>(Krystina is interrupted)</i>
Claire:	So do you have any other suggestions? Let's suppose arsenic isn't an option – what else would have been around and easy to get hold of?
Krystina:	Well, I suppose one of the oldest poisons around is lead. This has been mined for years but I'm afraid I have no idea if it was mined in Greece, although the Romans certainly used it.
Alistair:	So what would lead poisoning symptoms be?
Krystina:	Strangely enough, the symptoms can look like heart problems – chest pain for example. <i>(some audience members nod)</i>
Alistair:	Now that sounds interesting – you mean it could look like natural causes?

Krystina:	Well, not to a good toxicologist! <i>(the audience laughs)</i> But if you really want to follow that up, you should consider a plant like wolfsbane.
Claire:	I like the sound of that one – a really chilling name! What’s its proper name?
Krystina:	<i>Aconite</i> – again from a Greek word, so they probably would have known about it and it is certainly common enough. The symptoms include tingling in the fingers and fatigue, but feeling restless at the same time. Chest pains again, of course, and irregular heart beat.
Alistair:	Now that does sound promising! Any more ideas?
Krystina:	Well, maybe this is a bit obvious, but what about hemlock? In ancient Athens it was used as a method of execution. <i>(several members of the audience mutter the name ‘Socrates’)</i> Socrates, that’s the name I was trying to remember! So it was certainly used by the Greeks – maybe that is your best bet. Just remember though, sometimes cooking will destroy toxic compounds so be careful how you introduce it to your victim – I mean in your story of course! <i>(the audience laughs)</i>

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