Teaching ideas for Option D: Human physiology

This option is for HL students only and provides a good opportunity to extend the concepts taught in Topic **6**, *Human physiology*. It is a good choice for students who are planning to study medicine or related disciplines at university and there are opportunities for practical work involving dissection and physiology.

Ideas for the lesson

- Students of this age may well know of the psychological issues associated with anorexia so it is useful to discuss the physiological aspects associated with the lack of sufficient nutrients. This can be used to begin discussion about nutrition and diet generally, in particular the difference between malnutrition and starvation.
- Students can revise aspects of diffusion, active transport and endocytosis here and refresh their knowledge of membranes from Topic **1**, *Cell biology*.
- Ask students to research the wider implications of excessive alcohol consumption, not only on the liver but also in economic and social terms, and to discuss their findings.
- Students can research the incidence of coronary heart disease and asthma now and in the past, as a health-centred activity, and relate this to geographical occurrence of the conditions. It is useful to ask them to find data to support statements they may make. Good data is available from the World Health Organization website (**www.who.int**) and other local health information sites.
- Ask students to collect newspaper and other reports on the abuse of performance-enhancing substances, including anabolic steroids and erythropoietin (EPO). These can be used to discuss the ethics as well as risks and benefits of such substances. The World Anti-Doping Agency (**www.wada-ama.org**) publishes the Prohibited List, which details these substances.
- Requirements for a balanced diet can be addressed by inviting students to bring in food packaging and consider nutritional labelling from manufacturers. Students can keep a diary of their own food intake and decide whether they are eating a balanced diet.

Practical activities

- Practical work using vitamin C tablets and 2,6-dichlorophenolindophenol (DCPIP) can be carried out by students to construct a standard graph against which they can compare the vitamin C content of different foods. An assessable investigation could be to consider the effect of cooking or aging on the vitamin C content of a particular food or fruit juice. Wider issues concerning vitamin and mineral intake can be discussed here. Many sources provide information on the value of vitamins and minerals, for example, iodine (**www.iccidd.org**) and vitamin B (**www.bbc.co.uk/news/health**, search for 'vitamin B and Alzheimer's').
- Students can investigate enzymes and their investigations can be used for assessment. They can consider the optimum pH for enzyme activity using amylase/starch or trypsin. A link can be made between the secretion of hydrochloric acid in the stomach and the tolerance of *Helicobacter pylori* to stomach acid.
- Simple demonstrations of the effect of detergent on lipids can help students visualise the problems of lipid digestion.
- Supply students with microscopes and slides to study the lining of the small intestine.
- Practical work using small pieces of liver (as a source of catalase) to break down hydrogen peroxide can be used to emphasise the role of the liver in detoxification. Comparison between different sources of catalase can be a useful exercise. Potato and other vegetables are more manageable sources of the enzyme. A useful summary of the functions of the liver can be found at **www.bbc.co.uk/science/humanbody/body** (select 'organs' and then 'liver').
- Supply students with data-logging equipment to monitor heart and breathing rates so that they can investigate how these change with stress or exercise (for example, see Practical **2**). If a gym is available, the exercise can be carefully controlled. Care should be taken to ensure that any students with relevant medical conditions do not undertake unsuitable exercises.

- If students have not seen and or dissected a heart prior to this, it is useful to demonstrate the chambers and associated structures here.

ICT

- Databases of nutritional content of foods and software to calculate intakes of essential nutrients from a daily diet can be used.
- Students can use data-loggers to monitor heart and breathing rates in investigations.
- Electrocardiograms can be used if suitable monitors are available.

Common problems

- Some students require extra help with understanding dissociation curves. It is helpful to consider the respiratory pigments of species such as annelids and *Chironomus* larvae (midges), which live in low-oxygen conditions, and to examine their dissociation curves.

Theory of knowledge (TOK)

- The work of Warren and Marshall in elucidating the cause of stomach ulcers and cancers provides an excellent introduction to the paradigm shift. Other scientists who used themselves in their experiments led to discoveries about the transmission of yellow fever, syphilis and hookworm.
- The link between cause and effect can be applied to the case of coronary heart disease and the many interrelated factors that lead to a high risk of the disease. Students can discuss how it is impossible in many cases to identify a single cause.
- Discussion of the reduction of risk in the light of knowledge of causes for coronary heart disease is also of interest.

International mindedness

- The occurrence of coronary heart disease varies in different regions and students can consider the reasons for this.
- Excessive alcohol consumption is a problem in certain countries and students could examine the social pressures such as advertising and peer group pressure that may lead to this.
- The role of high-altitude training for international athletic events could be discussed.