Teaching ideas for Option C, *Cells and energy*

Some students find biochemistry challenging, particularly if they are not studying Chemistry with HL Biology. A sound knowledge of the basics learnt in Chapter 3, *The chemistry of life*, is required. Modelling the protein structure can be beneficial, and experimental work can help develop understanding of the key concepts of respiration and photosynthesis.

Practical activities

- Protein structure provides an excellent opportunity for 3D modelling of structure, either using commercially available kits or as computer simulations. Students can distinguish visually between globular and fibrous proteins.
- Practical work involving enzymes can be used in conjunction with Chapter 3, *The chemistry of life*. This could include the use of catalase from vegetable or animal sources (such as liver) to catalyse the breakdown of hydrogen peroxide. Alternatively students could investigate the enzymes involved in photosynthesis by studying the rate of photosynthesis in different conditions (see Chapter 3 and Chapter 8). The breakdown of starch by amylase also provides a good reaction with a clearly observable endpoint.
- Encourage students to investigate aerobic and anaerobic respiration of yeast. Provide basic apparatus such as boiling tubes, yeast suspension and glucose solution, bungs, delivery tubes and a means of excluding air (liquid paraffin) and an indicator such as Janus Green to show the presence or absence of oxygen. The investigation can be extended by using different substrates or temperatures.
- Invite students to make their own (non-alcoholic) ginger beer using yeast and explain why alcohol is not produced. A recipe can be found on the following site: http://www.scienceinschool.org/2008/issue8/gingerbeer
- Make models of chloroplasts and mitochondria to highlight the similarities and differences in their structure and clearly locate the sites of the various reactions.
- Chromatography of pigments from different plants at different times of the year can be carried out to demonstrate how pigments vary in different species and how they are broken down at the end of the growing season.
- Students can investigate the distribution of accessory pigments in different parts of plants, such as copper beech trees, which are exposed to different intensities of light.
- Supply students with algal balls (algae embedded in agar) and ask them to investigate the rate of photosynthesis in different conditions. The SAPS website provides useful guidance: http://www.saps.org.uk/secondary/teaching-resources/235
  Colour or intensity of light and pH of the water in which the balls are kept can be used as variables. Continuous data can be collected or pH change in water can be measured at intervals. Student-designed investigations can be used for assessment.
- Students can research or visit (if appropriate) glasshouses where crops such as tomatoes are grown and find out about achieving optimum conditions for maximum photosynthesis and plant growth by controlling limiting factors. Some producers have novel methods of generating heat through solar panels, recycling water and minimizing pesticide use in huge glasshouses. See, for example, www.thanetearth.com.

Links to TOK

- Students can discuss the relationship between the lock-and-key hypothesis and the induced fit hypothesis for enzyme action and consider why there was such a long time period between the proposals of the two.
- When students consider large-scale production of crops in glasshouses, they could consider the necessity and desirability of such systems. Are they required to supply human needs or do they satisfy the desire for seasonal crops to be available all year round in developed countries?

Copyright Cambridge University Press 2011. All rights reserved.

Links to ICT

- Students can model the 3D structure of proteins using computer simulations.
- Enzyme practical work could involve the use of pH probes, temperature sensors and other continuously recording data loggers.
- Data loggers can be used in investigations of both yeast respiration and photosynthesis.

Copyright Cambridge University Press 2011. All rights reserved.