

Teaching ideas for Chapter 4, *Genetics I*

This topic covers both the basics of theoretical genetics and also up-to-date aspects of genetic engineering and biotechnology. There is ample scope for addressing ethical issues surrounding GM food, use of DNA technology in forensic science and the use of gene transfer techniques for human benefit. Some students find theoretical genetics difficult and require lots of practice to become proficient in genetic problems. It is important that HL students can do this in preparation for more advanced genetics in Chapter 10.

Practical activities

- Having reviewed the structure of DNA and introduced the relevant terms, it is useful to address the idea of what happens when mutations occur. This is well covered at the following website, where there are a number of video clips:
www.brightstorm.com/science/biology/molecular-biology/genetic-mutation
- Meiosis can be confusing for students to follow and any practical work is helpful. Students can be encouraged to model meiosis using pipe cleaners, modelling clay or paper models. A novel way of doing so using LEGO® is shown at:
<http://www.sciencebuilders.com/legoanimations.html>
Development of trisomies and crossing over can be demonstrated well in this way.
- Supply students with a series of karyotypes so they become familiar with interpreting them for abnormalities. A discussion of the techniques used to obtain them and the ethical issues involved is very useful.
- Although it is possible to carry out simple gel electrophoresis in the lab, there are many good video demonstrations on the internet for students to view. For example:
www.dnatube.com/video/702/Dna-Fingerprinting
- Invite students to research the outcomes of the human genome project. They might consider who ‘owns’ the information that has been discovered and whether companies have the right to use it for commercial gain, such as to develop medical treatments to which they hold the copyright.
- Provide students with a range of views on genetically modified crop plants, including maize, tomatoes, oranges, and animals such as sheep, which produce milk containing human proteins for medical treatment. A positive view on the techniques and benefits can be viewed at:
www.uctv.tv/search-details.aspx?showID=8709
Other sites, such as Greenpeace, give an opposing view.
<http://www.greenpeace.org.uk/media/press-releases/gm-trials-are-genetic-tyranny-says-greenpeace>
Ask students to compile a ‘balance sheet’ of benefits and disadvantages from a scientific point of view.

Links to TOK

- The mutation causing sickle-cell anemia is a good example of a correlation and a cause that are clearly linked.
- Comparison of the risks associated with amniocentesis and CVS provides a useful way to introduce a discussion on the right to choose such a test and the rights of an unborn child. Also, students might ask to what extent it is right to define a ‘normal’ person.
- DNA profiling has helped solve many crimes and bring criminals to justice but there are ethical issues to consider in retaining DNA from people who have never been convicted. A video clip providing a good starting point for discussion can be found at:
www.planet-scicast.com/view_clip.cfm?cit_id=2684
- Reproductive and therapeutic cloning are topics that can be discussed from an ethical standpoint. Which, if either, produce the greater good?



Links to ICT

- ICT can be used to trace the occurrence of a particular gene or allele in different parts of the world. Blood groups, and lactose intolerance, provide good examples of variation between ethnic groups caused by genetics.

Aspects of internationalism

- Sickle-cell anemia is a condition that used to be prevalent in areas where malaria is common. With the increased mobility of people throughout the world, many countries now face the challenge of treating people with the condition. It is important to raise awareness of the symptoms and problems sufferers face.
- Some cultures favour the birth of one sex over another and karyotyping can be used to determine the sex of an unborn child. What are the ethical issues involved in different countries?
- The economic benefits of GM crops may be different in different countries. Students can consider who will benefit and who will not, and why.