# Teaching ideas for Topic 5: Evolution and biodiversity

Evolution and biodiversity are key to our understanding of relationships and interactions between species. Links between this topic and Topic **10**, *Genetics and evolution (HL)*, can be made and this topic is also important for understanding of concepts in both Option **B**, *Biotechnology and bioinformatics*, and Option **C**, *Ecology and conservation*.

## Ideas for the lesson

• A starter activity for this topic could be a ‘courtroom-style’ consideration of the evidence for evolution from the fossil record, selective breeding, homologous structures such as pentadactyl limbs, embryology and adaptive radiation. Only ‘evidence’, not doctrine, should be included.

• Lead a class discussion on the development of resistance to antibiotics. This is a good opportunity to discuss how previous generations have died of diseases that were not treatable before the discovery of antibiotics. The use and over-use of antibiotics and the development of resistance is a good example of rapid evolution as a result of environmental change. Students could consider why a hospital is a likely source of newly evolving bacteria, why failing to take a complete course of antibiotics is dangerous and why bacteria evolve so quickly.

• Ask students to come up with the best mnemonic to remember the classification of organisms from domain to species level.

• The Smithsonian National Museum of Natural History has useful supporting material on human origins and the construction of cladograms: [**http://humanorigins.si.edu**](http://humanorigins.si.edu)

• The Smithsonian National Museum of Natural History ([**www.mnh.si.edu**](http://www.mnh.si.edu)) and the Natural History Museum ([**www.nhm.ac.uk**](http://www.nhm.ac.uk)) have further material on biodiversity and genomics, which can be used here or in Option **C**.

## Practical activities

• Construction of a dichotomous key is described in the student’s book, Figure **5.21**. To consolidate understanding of this concept, provide students with ten leaves from different local plant species (or students could collect the leaves themselves) and ask them to construct a key to distinguish them. Provide a large and a small leaf from the same plant in the sample and ask students to make a list of observable features that are not suitable for use in classification, explaining why they are not. (This exercise could also be done with suitable small, slow-moving animals, such as snails.)

• If fieldwork is undertaken for Topic **4**, *Ecology*, samples of different organisms can be used to identify and recognise the key features of the taxonomic groups suggested in the syllabus: Porifera, Platyhelminthes, Mollusca and so on. Alternatively, suitable samples can be ordered from biological suppliers. Examination and careful handling of real organisms is preferable and students can also discuss the ethical issues involved in removing organisms from their habitats.

• Protocols describing the construction of a cladogram are available on many websites (for example, [**www.biologycorner.com/worksheets/cladogram\_construction.html**](http://www.biologycorner.com/worksheets/cladogram_construction.html)) but care should be taken that features other than structural differences are used as these are not always the most objective method of comparing species.

## ICT

• Simulations of natural selection are available online, for example, [**www.nhm.ac.uk**](http://www.nhm.ac.uk) (search for ‘evolution experience game’) or [**http://phet.colorado.edu/en/simulation/natural-selection**](http://phet.colorado.edu/en/simulation/natural-selection).

• Cladograms can also be constructed using ICT and data from the internet (see above).

## Common problems

• Students often think that antibiotic resistance occurs as a result of poor hygiene in hospitals. This is not entirely true and can be discussed in the light of other evidence about the development of new characteristics in bacteria and other species.

## Theory of knowledge (TOK)

• Can evolution be studied using experiments? Is it possible to establish beyond reasonable doubt that evolution has occurred?

• Discuss the difference between a scientific theory, such as natural selection, and a doctrine such as a religious belief.

• Species are renamed in the light of new evidence. How important is knowledge from the past in informing our current ideas?

## International mindedness

• How important is international agreement in taxonomy? Why is Latin a useful language to use for naming species? These are both useful aspects to consider and discuss.