Year: 11

Topic 4.4 VARIATION AND EVOLUTION

Knowledge and Understanding to be developed

The characteristics of a living organism are influenced by its genes and its interaction with the environment. Living organisms are interdependent and show adaptations to their environment. These adaptations are a result of evolution. Evolution occurs by a process of natural selection and accounts both for biodiversity and how organisms are all related to varying degrees. Learners will acquire an understanding of evolution and how it has resulted in the biodiversity seen on Earth.

The discussion of the potential for the human genome gives opportunities to explain the technological applications of science and also to evaluate the risks and ethics of such information being more widely available. The study of the work of Charles Darwin and Alfred Wallace allows learners to understand how scientific theories develop over time and also the importance of peer review and communicating results. The investigation into the variation in organisms will allow many practical skills to be developed.

Key Terms to be learned this topic:

Variation continuous discontinuous clones asexual reproduction mutation ionising cystic fibrosis evolution natural selection resistance

Learning Objectives and Outcomes: Students should be able to :

(a) the variation in individuals of the same species having environmental or genetic causes; **variation being continuous or discontinuous**
(b) sexual reproduction leading to offspring being genetically different from the parents, unlike asexual reproduction where genetically identical offspring called clones are produced from a single parent; sexual reproduction therefore giving rise to variation
(c) the facts that new genes result from changes, mutations, in existing genes; mutations occur at random; most mutations have no effect but some can be beneficial or harmful; mutation rates can be increased by ionising radiation
(d) some mutations causing conditions which may be passed on in families, as is shown by the mechanism of inheritance of cystic fibrosis; the development and use of gene therapy in cystic fibrosis sufferers
(e) heritable variation as the basis of evolution
(f) how individuals with characteristics adapted to their environment are more likely to survive and breed successfully; the use and limitations of a model to illustrate the effect of camouflage colouring in predator and prey relationships
(g) how the genes which have enabled these better adapted individuals to survive are then passed on to the next generation; natural selection as proposed by Alfred Russell Wallace and Charles Darwin; how the process of natural selection is sometimes too slow for organisms to adapt to new environmental conditions and so organisms may become extinct
(h) how evolution is ongoing as illustrated by antibiotic resistance in bacteria, pesticide resistance and warfarin resistance in rats
(i) the potential importance for medicine of our increasing understanding of the human genome