Summary

Unit 5 - Evolution and Biodiversity

Subject	Year	Start date	Duration
Biology	IB1	Week 1, May	3 weeks 12 hours

Course Part

Core

Curriculum

Aims

Appreciate scientific study and creativity within a global context through stimulating and challenging opportunities

Acquire a body of knowledge, methods and techniques that characterize science and technology

Apply and use a body of knowledge, methods and techniques that characterize science and technology

Develop an ability to analyse, evaluate and synthesize scientific information

Develop a critical awareness of the need for, and the value of, effective collaboration and communication during scientific activities

Develop experimental and investigative scientific skills including the use of current technologies

Develop and apply 21st century communication skills in the study of science

Become critically aware, as global citizens, of the ethical implications of using science and technology

Develop an appreciation of the possibilities and limitations of science and technology

Develop an understanding of the relationships between scientific disciplines and their influence on other areas of knowledge

Objectives

Demonstrate knowledge and understanding of

- facts, concepts, and terminology
- methodologies and techniques
- communicating scientific information

Apply

- facts, concepts, and terminology
- methodologies and techniques
- methods of communicating scientific information

Syllabus Content

Core

5. Evolution and biodiversity

5.1 Evidence for evolution

Nature of science:

Looking for patterns, trends and discrepancies - there are common features in the bone structure of vertebrate limbs despite their varied use.

Understandings:

Evolution occurs when heritable characteristics of a species change.

The fossil record provides evidence for evolution.

Selective breeding of domesticated animals shows that artificial selection can cause evolution.

Evolution of homologous structures by adaptive radiation explains similarities in structure when there are differences in function.

Populations of a species can gradually diverge into separate species by evolution.

Continuous variation across the geographical range of related populations matches the concept of gradual divergence.

Applications and skills:

Application: Development of melanistic insects in polluted areas.

Application: Comparison of the pentadactyl limb of mammals, birds, amphibians and reptiles with different methods of locomotion.

5.2 Natural selection

Nature of science:

Use theories to explain natural phenomena - the theory of evolution by natural selection can explain the development of antibiotic resistance in bacteria.

Understandings:

Natural selection can only occur if there is variation among members of the same species.

Mutation, meiosis and sexual reproduction cause variation between individuals in a species.

Adaptations are characteristics that make an individual suited to its environment and way of life.

Species tend to produce more offspring than the environment can support.

Individuals that are better adapted tend to survive and produce more offspring while the less well adapted tend to die or produce fewer offspring.

Individuals that reproduce pass on characteristics to their offspring.

Natural selection increases the frequency of characteristics that make individuals better adapted and decreases the frequency of other characteristics leading to changes within the species.

Applications and skills:

Application: Changes in beaks of finches on Daphne Major.

Application: Evolution of antibiotic resistance in bacteria.

5.3 Classification of biodiversity

Nature of science:

Cooperation and collaboration between groups of scientists - scientists use the binomial system to identify a species rather than the many different local names.

Understandings:

The binomial system of names for species is universal among biologists and has been agreed and developed at a series of congresses.

When species are discovered they are given scientific names using the binomial system.

Taxonomists classify species using a hierarchy of taxa.

All organisms are classified into three domains.

The principal taxa for classifying eukaryotes are kingdom, phylum, class, order, family, genus and species.

In a natural classification, the genus and accompanying higher taxa consist of all the species that have evolved from one common ancestral species.

Taxonomists sometimes reclassify groups of species when new evidence shows that a previous taxon contains species that have evolved from different ancestral species.

Natural classifications help in identification of species and allow the prediction of characteristics shared by species within a group.

Applications and skills:

Application: Classification of one plant and one animal species from domain to species level.

Application: Recognition features of bryophyta, filicinophyta, coniferophyta and angiospermophyta.

Application: Recognition features of porifera, cnidaria, platyhelmintha, annelida, mollusca, arthropoda and chordata.

Application: Recognition of features of birds, mammals, amphibians, reptiles and fish.

Skill: Construction of dichotomous keys for use in identifying specimens.

5.4 Cladistics

Nature of science:

Falsification of theories with one theory being superseded by another - plant families have been reclassified as a result of evidence from cladistics.

Understandings:

A clade is a group of organisms that have evolved from a common ancestor.

Evidence for which species are part of a clade can be obtained from the base sequences of a gene or the

corresponding amino acid sequence of a protein.

Sequence differences accumulate gradually so there is a positive correlation between the number of differences between two species and the time since they diverged from a common ancestor.

Traits can be analogous or homologous.

Cladograms are tree diagrams that show the most probable sequence of divergence in clades.

Evidence from cladistics has shown that classifications of some groups based on structure did not correspond with the evolutionary origins of a group or species.

Applications and skills:

Application: Cladograms including humans and other primates.

Application: Reclassification of the figwort family using evidence from cladistics.

Skill: Analysis of cladograms to deduce evolutionary relationships.

ATL Skills

Approaches to Learning

Thinking

- In this unit, we will

ask students to formulate a reasoned argument to support their opinion or conclusion

give students time to think through their answers before asking them for a response

reward a new personal understanding, solution or approach to an issue

ask open questions

set students a task which required higher-order thinking skills (such as analysis or evaluation)

build on a specific prior task

help students to make their thinking more visible (for example, by using a strategy such as a thinking routine)

require students to take an unfamiliar viewpoint into account when formulating arguments

ask questions that required the use of knowledge from a different subject from the one you are teaching

include a reflection activity

make a link to TOK

Social

- In this unit, we will

  have students work in small groups

  allocate, or ask students to allocate among themselves, different roles in a classroom discussion or activity

  have students peer assess their group performance or process

  support students in resolving a conflict in a team

  give a group assessment task

  give students feedback on how they worked as a group

  have students discuss their understanding of a text or idea among themselves and come up with a shared understanding

  provide an opportunity for students to analyse the impact of their behaviour on the class or on a group performance

  encourage students to consider alternative points of view or to take the perspective of others

  provide opportunities for students to make decisions

Developing IB Learners

Learner Profile

Inquirers

Knowledgeable

Thinkers

Reflective