**Topic 5.4: Cladistics**

**Essential Idea: The ancestry of groups of species can be deduced by comparing their base or amino acid sequences.**

**Statements & Objectives:**

**5.4.U1 A clade is a group of organisms that have evolved from a common ancestor.**

Define clade and cladistics.

(**Define:** Give the precise meaning of a word, phrase, or physical quantity.)

**5.4.U2 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.**

Outline the relationship between time, evolutionary relationships and biological sequences (nitrogenous base or amino acid).

**(Outline**: Give a brief account or summary)

**5.4.U3 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.​**

Outline the use of a “molecular clock” to determine time since divergence between two species.

**(Outline**: Give a brief account or summary)

State the source of differences between biological sequences (nitrogenous base or amino acid).

(**State:** Give a specific name, value or other brief answer without explanation or calculation.)

**5.4.U4 Traits can be analogous or homologous.​**

Contrast analogous and homologous traits.

**(Compare**: Give an account of similarities and differences between two (or more) items or situations, referring **and** **contrast** to both (all) of them throughout.)

State an example of analogous and homologous traits.

(**State:** Give a specific name, value or other brief answer without explanation or calculation.)

**5.4.U5 Cladograms are tree diagrams that show the most probable sequence of divergence in clades.​**

Define cladogram and node.

(**Define:** Give the precise meaning of a word, phrase, or physical quantity.)

Outline how computer programs analyze biological sequence data to create cladograms.

**(Outline**: Give a brief account or summary)

Identify members of clades given a cladogram.

(**Identify:** Find an answer from a given number of possibilities.)

**5.4.U6 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.​**

Outline the role of technological advancements in the development of cladistics.

**(Outline**: Give a brief account or summary)

Explain why the development of cladistics lead to the reclassification of some species.

(**Explain**: Give a detailed account including reasons or causes)

**5.4.A1 Cladograms including human and other primates.**

Interpret a cladogram depicting primate species. ​

**5.4.A2 Reclassification of the figwort family using evidence from cladistics.**

Outline the reason and evidence for the reclassification of the figwort family.

**(Outline**: Give a brief account or summary)

**5.4.S1 Analysis of cladograms to deduce evolutionary relationships.​**

Analyze a cladogram to explain the evolutionary relationship between species.

(**Analyze:** Interpret data to reach conclusions)

Discuss the use of cladograms as hypotheses of evolutionary relationships.

(**Discuss:** Give an account including , where possible, a range of arguments for and against the relative importance of various factors, or comparisons of alternative hypotheses.)

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

Outline the reason why biological theories may change with time.

**(Outline**: Give a brief account or summary)

**Key Terms**

Clades

​DNA sequence

​hybridization

​node

variation

DNA

evolutionary clock

​analogous

phylogenetic relationships

analogous characteristics

amino acids

​polypeptide

​cladistics

​common ancestry

variation

​homologous

​reclassification

​characteristics

​cladogram

phylogeny

mutation

​outgroup

​morphology