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|  | Statement | Guidance |
| 5.4.U1 | A clade is a group of organisms that have evolved from a common ancestor. |  |
| 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. |  |
| 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. |  |
| 5.4.U4 | Traits can be analogous or homologous. |  |
| 5.4.U5 | Cladograms are tree diagrams that show the most probable sequence of divergence in clades. |  |
| 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. |  |
| 5.4.A1 | Cladograms including humans and other primates. |  |
| 5.4.A2 | Reclassification of the figwort family using evidence from cladistics. |  |
| 5.4.S1 | Analysis of cladograms to deduce evolutionary relationships. |  |

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

1. A **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  is a tree diagram showing the similarities and differences between different species.
2. The branching points on cladograms are called **n\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
3. Cladograms are mostly based on **D\_\_\_\_\_\_\_\_ b \_\_\_\_\_\_\_\_\_\_\_\_ s\_\_\_\_\_\_\_\_\_\_\_\_\_\_** or the **a\_\_\_\_\_\_\_\_\_ a\_\_\_\_\_\_\_\_\_\_\_ s\_\_\_\_\_\_\_\_\_\_\_\_** in a protein

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

1. Species may evolve over time to form a new species. Consequently there are **g\_\_\_\_\_\_\_\_ of s\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** derived from a **c\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
   1. Such groups are called **c\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
   2. Note all members of a clade may exist today
   3. Common ancestors often do not exist, they have evolved into modern species or have become **e\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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

1. DNA evidence can be used to build a CLADOGRAM OF PRIMATES
   1. Humans are included
   2. Used to estimate when species **d\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** and hence when the **c\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a\_\_\_\_\_\_\_\_\_\_\_\_\_\_ e\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

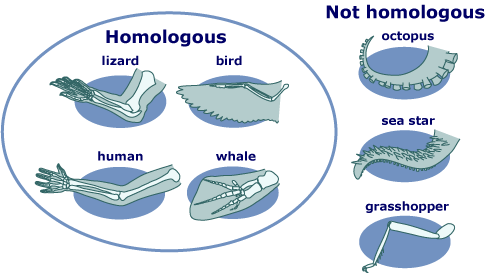
5.4.U2 Evidence for which species are part of a clade can be obtained from the base sequences of a gene or the corresponding amino acid sequence of a protein.   
5.4.U3 Sequence differences accumulate gradually so there is a positive correlation between the number of differences between two species and the time since they diverged from a common ancestor.

1. **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** in the **\_\_\_\_\_\_\_\_\_\_\_** that persist and are inherited occur at a **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.** 
   1. For example: **MITOCHONDRIAL DNA** from humans and primates has been completely sequenced and used to construct cladograms between them.
   2. The **rate at which mutations occurred** at can be used as a **molecular clock** to calculate how long ago the species diverged.
   3. If the DNA base sequences or two species are similar….
      1. ….then **FEW mutations** have occurred….
      2. ...therefore the species only diverged relatively recently.

5.4.U4 Traits can be analogous or homologous.

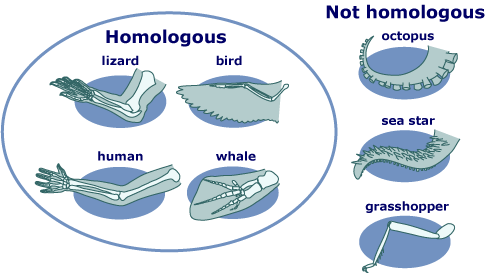
1. **H\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ S\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** are similar because of **COMMON ANCESTRY**

For example:



1. **A\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ S\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** are similar because of **CONVERGENT EVOLUTION**

For example:



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

1. **DNA EVIDENCE** identified the different **common ancestors**

Practice: Use pg 275 of your textbook to complete the reclassification of the figwort family

**HOMEWORK: Use the Tree of Life interactive** <http://www.wellcometreeoflife.org/interactive/>

* Look up points of evolution for
  + Chordata