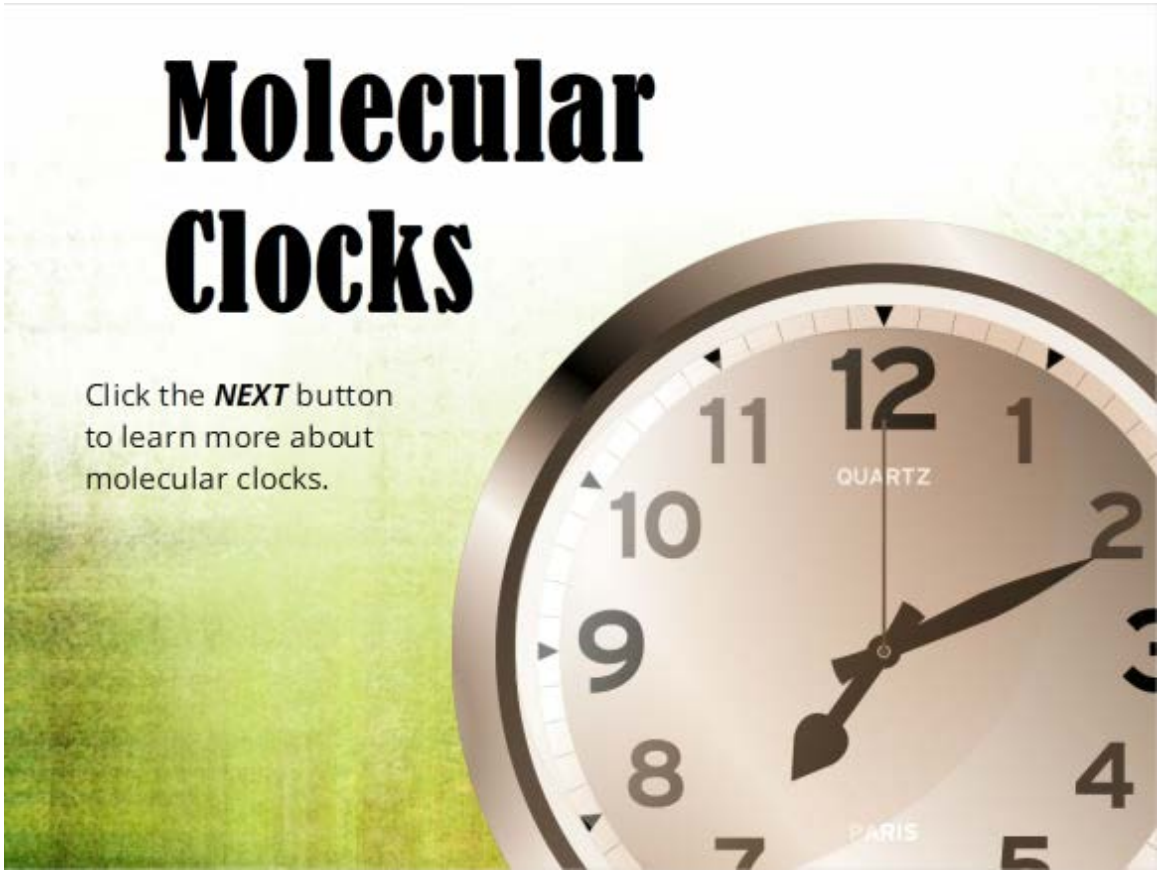
Module 9: Classification – The Basics
Topic 3 Content: Molecular Clocks

Introduction



Click the ***NEXT*** button to learn more about molecular clocks.

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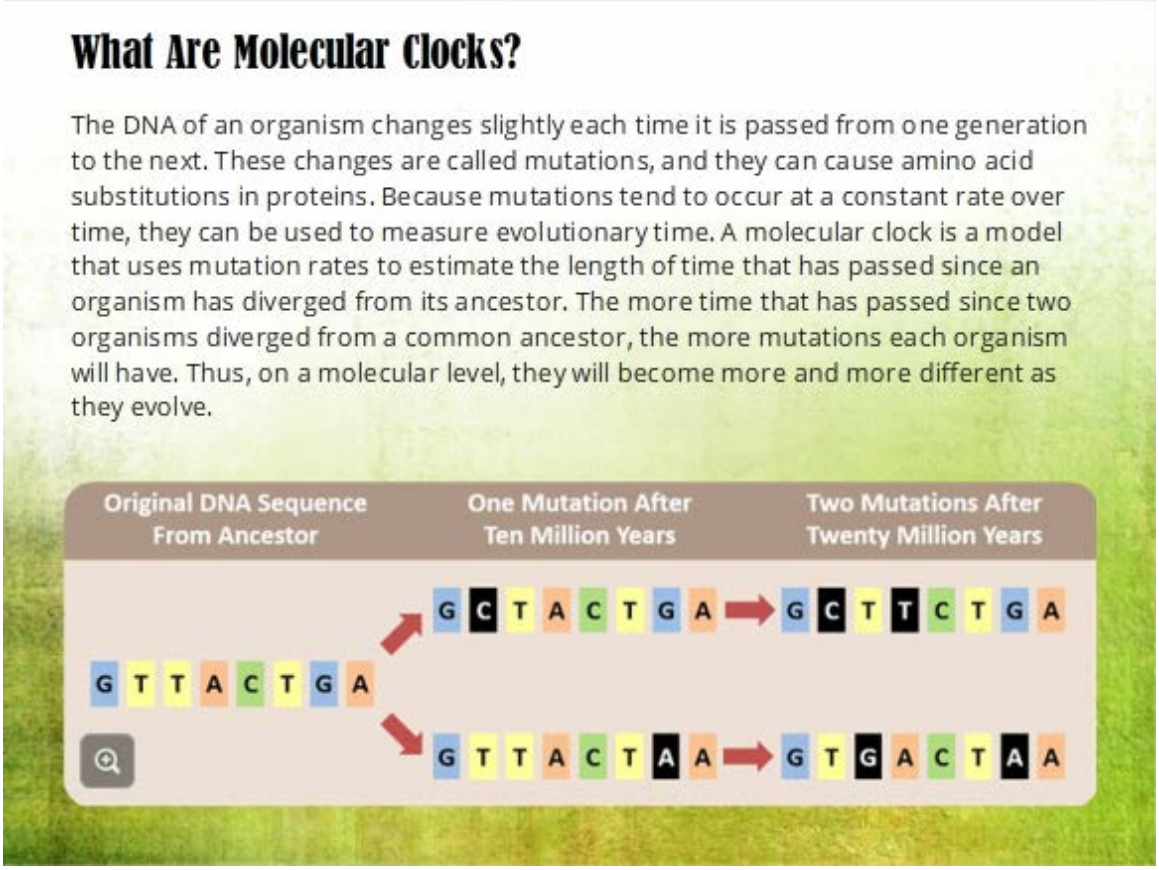
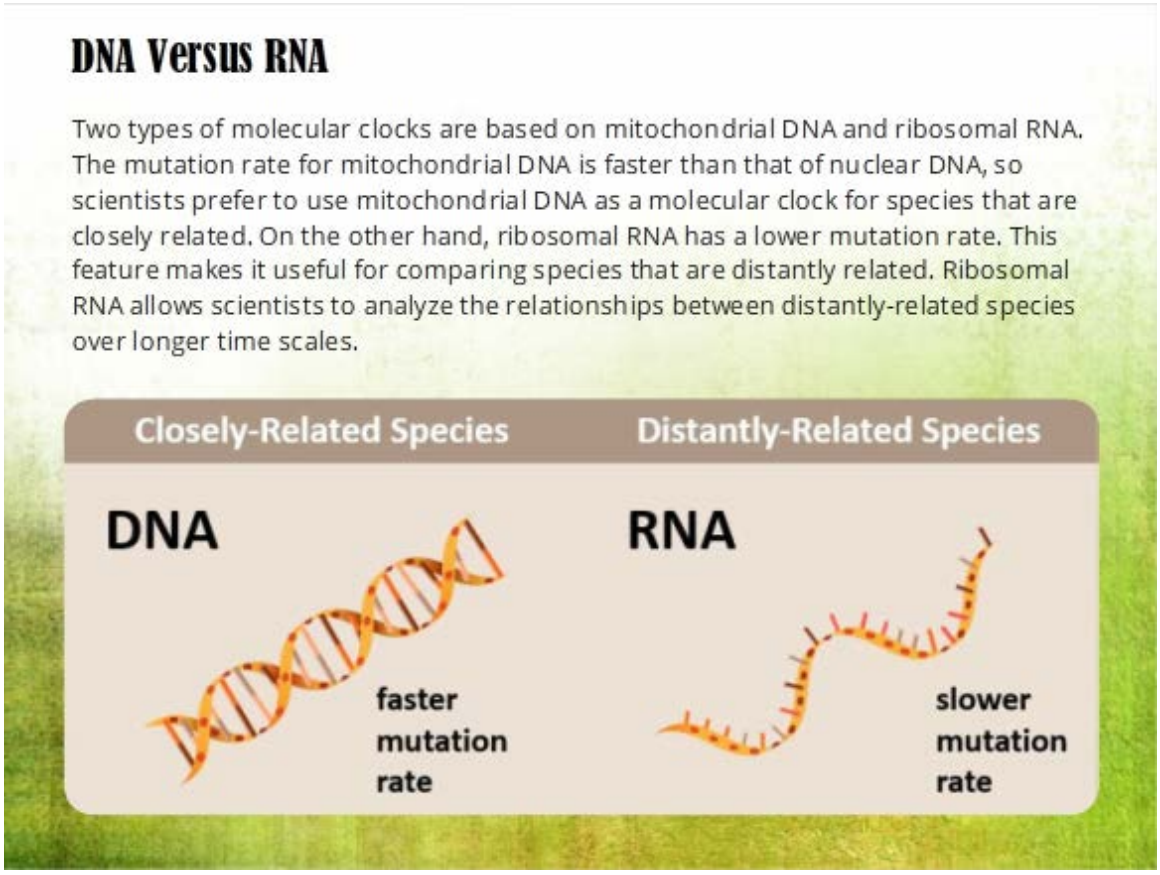
What Are Molecular Clocks?



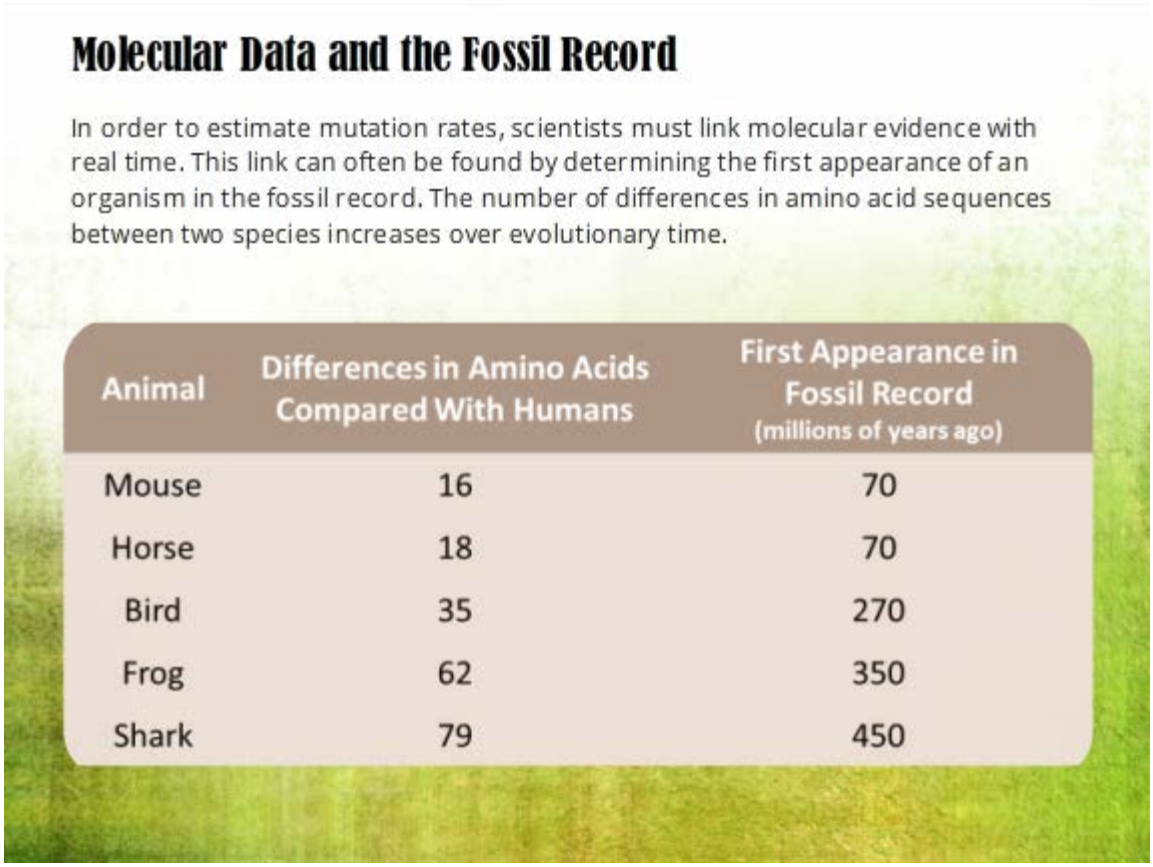
The DNA of an organism changes slightly each time it is passed from one generation to the next. These changes are called mutations, and they can cause amino acid substitutions in proteins. Because mutations tend to occur at a constant rate over time, they can be used to measure evolutionary time. A molecular clock is a model that uses mutation rates to estimate the length of time that has passed since an organism has diverged from its ancestor. The more time that has passed since two organisms diverged from a common ancestor, the more mutations each organism will have. Thus, on a molecular level, they will become more and more different as they evolve.

DNA Versus RNA



Two types of molecular clocks are based on mitochondrial DNA and ribosomal RNA. The mutation rate for mitochondrial DNA is faster than that of nuclear DNA, so scientists prefer to use mitochondrial DNA as a molecular clock for species that are closely related. On the other hand, ribosomal RNA has a lower mutation rate. This feature makes it useful for comparing species that are distantly related. Ribosomal RNA allows scientists to analyze the relationships between distantly-related species over longer time scales.

Molecular Data and the Fossil Record



Molecular Data and the Fossil Record

In order to estimate mutation rates, scientists must link molecular evidence with real time. This link can often be found by determining the first appearance of an organism in the fossil record. The number of differences in amino acid sequences between two species increases over evolutionary time.

Animal	Differences in Amino Acids Compared With Humans	First Appearance in Fossil Record (millions of years ago)
Mouse	16	70
Horse	18	70
Bird	35	270
Frog	62	350
Shark	79	450

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