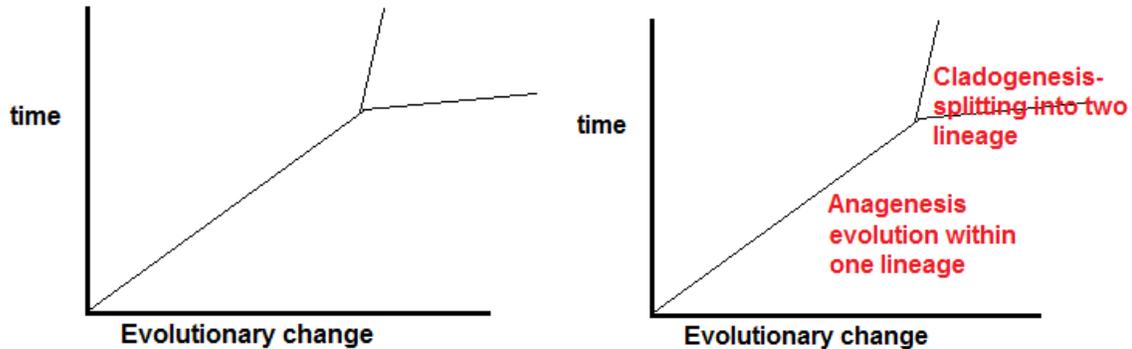


1. Label on the chart the point in time that **Anagenesis** and **Cladogenesis** would occur.



2. What must be present for evolution to take place? **Genetic Variation**
3. How do you measure **genetic variation**?
- Proportion of polymorphic loci**= # of loci with variation/ total # loci studied X 100= %
 - Expected heterozygosity**= # of loci with (2pq)/ total # loci studied X 100 = %
4. There are different hypothesis that explain the genetic variation of proteins. What is the difference between the two hypotheses stated below?
- Neutral-mutation hypothesis**- **individuals with different molecular variants have equal fitness.**
 - **Protein variants function equally. Natural selection does not differentiate between them.**
 - **Evolution is shaped by genetic drift and mutation **not** by natural selection.**
 - Balance hypothesis**- **genetic variation in populations is maintained by selection that favors variation (balanced selection).**
 - **Alleles with higher fitness will survive/ natural selection.**
 - **Molecular variants are not physically or functionally equivalent.**
5. Explain the following concepts that allow for genetic variation of DNA sequences.
- Restriction-site variation**- **restriction fragment length polymorphisms have been used to study population structure and gene flow among different populations.**
 - Microsatellite variation**- **short DNA sequences that exist in multiple copies repeated in tandem (repeated sequence motifs). Variation in # of repeats is common. Can be detected using PCR.**
 - DNA Sequencing**- **PCRing DNA can allow for observation of trends that could lead to conclusions of evolution.**

6. What defines a species? What does the **Biological Species Concept** tell you?
A group of organisms whose members are capable of interbreeding with one another but are reproductively isolated from the members of other species.
7. Explain the following **Modes of Speciation**.
Speciation- the process by which new species arise. Mechanism that prevents the exchange of genes between groups of organisms.
 - a. Allopatric speciation- arises when a geographic barrier first splits a population into two groups and blocks exchange of genes between them.
 - b. Sympatric speciation- arises in absence of any external barrier to gene flow; reproductive isolating mechanisms evolve within a single population. Genetic differentiation. Most likely due to strong disruptive selection.
8. Phylogeny is typically studied using a gene tree.
 - a. What does phylogeny mean? Evolutionary relationship among a group of organisms.
 - b. What do the nodes and branches represent? Nodes= species and branches= relationship
 - c. When constructing a phylogeny tree what do you look at to determine the relationships? Alignment of homologous species- phylogenetic trees are often constructed from DNA sequence data. Typically use DNA sequences of multiple genes NOT just one.
9. What is the molecular clock?
Date evolutionary events over time.
Measure the rate at which a protein evolves is roughly constant over time, the amount of molecular change that a protein has undergone can be used as a clock.