

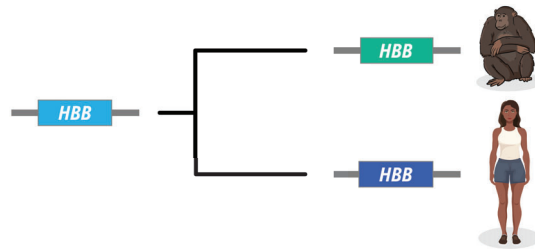
## TOPIC: PHYLOGENETICS AND GENOME EVOLUTION


### Homologs: Orthologs & Paralogs

◆ **Homologs:** genes that are descended from the same \_\_\_\_\_ gene.

▪ **Orthologs:** homologous genes in related \_\_\_\_\_.

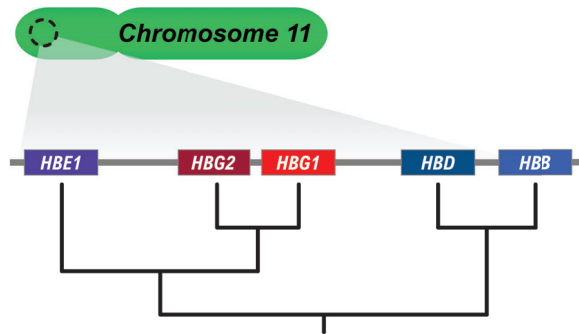
- Arise through \_\_\_\_\_.
- E.g., Human and \_\_\_\_\_  $\beta$ -hemoglobin.



 **Orthologs** are in **Other** species.

▪ **Paralogs:** homologous genes in the \_\_\_\_\_ genome.

- Arise through gene \_\_\_\_\_.
- Gene \_\_\_\_\_: group of paralogs in a genome.
- E.g., The 5 \_\_\_\_\_ in  $\beta$ -hemoglobin gene family.



 **Paralogs** are **Peas** in a **Pod**.

## PRACTICE

Which of the following statements about homologs are true?

- Phylogenetic trees of different taxa can be made using orthologs but not paralogs.
- A gene family is a group of paralogs within a genome.
- Orthologs are homologs that are found in different species.

a) I & II.

b) I & III.

c) II & III.

d) I, II, & III.

## **TOPIC: PHYLOGENETICS AND GENOME EVOLUTION**

### **PRACTICE**

The different genes that code for the photoreceptive proteins that function in the vertebrate eye are all believed to be paralogs. Which statement below is most consistent with this idea?

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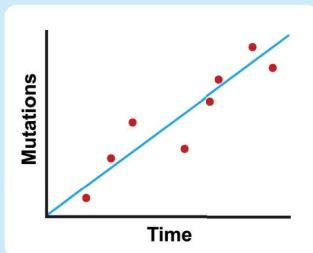
- a) The ability to detect light evolved repeatedly in different vertebrate lineages.
- b) Different photoreceptor genes are found in different species of vertebrates.
- c) Gene duplication events in photoreceptor genes have occurred whenever there has been a speciation event.
- d) The genes that code different photoreceptors all arose through gene duplication events.

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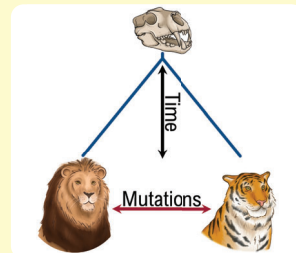
### The Molecular Clock

◆ Number of mutations between \_\_\_\_\_ can estimate a date of divergence.

- **Why it works:** \_\_\_\_\_ tend to enter populations at a relatively \_\_\_\_\_ rate.
  - Especially true for \_\_\_\_\_ mutations.



- **Calculating mutation rate:** Compare DNA sequences of related species with known dates from the \_\_\_\_\_ record.



◆ Molecular clocks are only estimates:

- Mutation rates can \_\_\_\_\_ in different lineages.
- Can't calibrate beyond the time of good \_\_\_\_\_ record.
- \_\_\_\_\_ selection can influence the clock.

## PRACTICE

What is one challenge to trying to date a speciation event using a molecular clock?

- a) If natural selection acts on a sequence, it can affect the rate that new mutations become fixed in a population.
- b) Because mutations are random, in some lineages, mutations do not occur.
- c) New mutations are more likely to occur in non-neutral genes.
- d) Molecular clocks can only be calibrated if the gene used has a known effect on fossils.