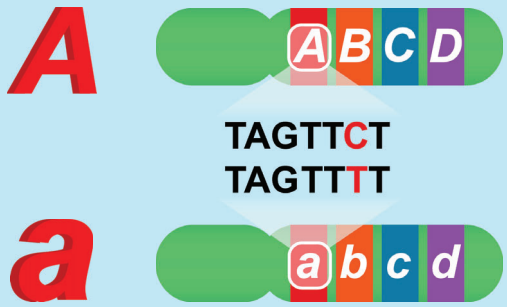
TOPIC: GENETIC VARIATION

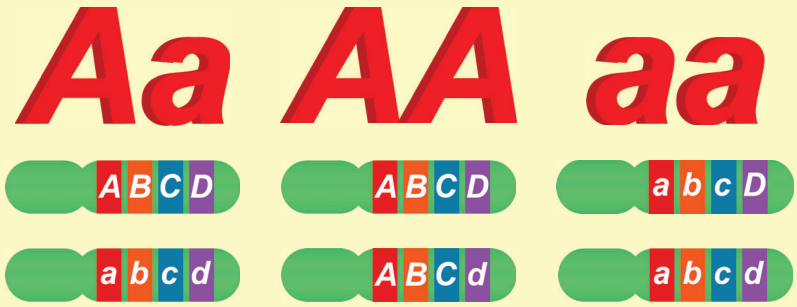
Sources of Genetic Variation

- *Recall*: evolution requires _____ variation.
- Two ways to talk about genetic variation in a population:

1. **New alleles:** from _____ to the ____ sequence.



2. **New combinations of alleles** (_____): from sexual reproduction and recombination (_____).



PRACTICE

Which process ensures that alleles are always found in new combinations?

a) Natural selection.

b) Sexual reproduction.

c) Genetic drift.

d) Mutation.

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Mutations

- **Mutations:** changes in the DNA introduce _____ variation → _____ & _____.
  - **Beneficial:** ___ fitness
  - **Neutral:** ___ fitness
  - **Harmful** (_____): ___ fitness
- Mutations can introduce both new _____ & new _____.

New Alleles

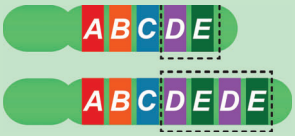
Changes to DNA sequence: may affect coding regions or _____ regions.

- **Point mutation:** change in a _____ DNA nucleotide.

New Genes

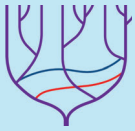
Chromosome Level Mutation: change in the _____ or _____ of chromosomes.

- Gene duplications can lead to the evolution of _____ genes.



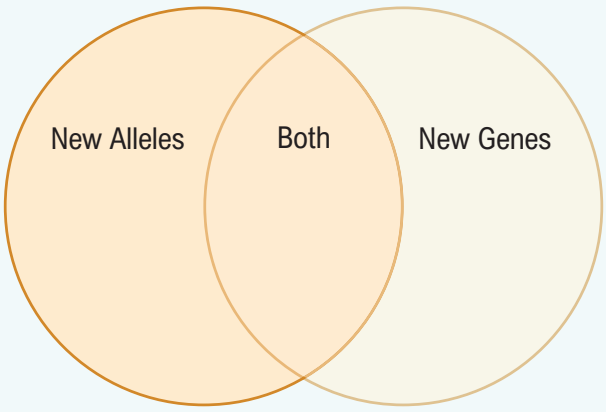
Horizontal (_____) gene transfer: movement of alleles from one _____ to another.

- Most common in _____ and archaea, but also happens in eukaryotes.



EXAMPLE

Fill in the Venn Diagram below with the statements from the box. If a statement applies to mutations that create both new alleles and new genes, place it in the overlapping section of the two circles.



a) Can come from a change in the composition of chromosomes.
b) Can be created from changes to a small number of base pairs in the DNA sequence.
c) Increase genetic variability.
d) Can introduce DNA from a different species.
e) Can be created by gene duplications.

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PRACTICE

Mutations that don't impact the fitness of an allele can be called?

a) Neutral mutations.

b) Point mutations.

c) Beneficial mutations.

d) Deleterious mutations.

PRACTICE

Which of the following statements about mutations is correct?

a) Lateral gene transfer is most common in eukaryotes.

b) Mutations are more common in populations with low fitness.

c) Many mutations do not affect the fitness of an organism.

d) Most mutations increase the fitness of an organism.

PRACTICE

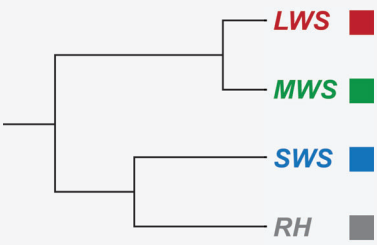
Gene trees are evolutionary trees that show the evolutionary lineages of specific genes separate from organisms. Below is a gene tree for the genes that code for opsins in humans. Opsins are the light sensitive proteins in the eyes. Humans have four opsins that are active in visual perception: long-wavelength sensitive (LWS or red-sensitive), medium-wavelength sensitive (MWS or green sensitive), short-wavelength sensitive (SWS or blue sensitive), and rhodopsin (RH, not color sensitive). Which mutational process would be most likely to create a gene tree like this?

a) Point mutations.

b) Deletion events.

c) Horizontal gene transfer.

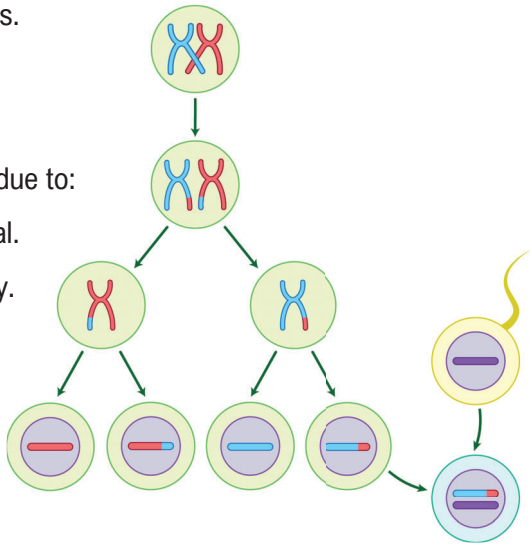
d) Gene duplication events.



TOPIC: GENETIC VARIATION

Sexual Reproduction and Recombination

- Genetic variation comes from new alleles and new _____ of alleles.
- **Sexual reproduction:** Offspring contain _____ alleles than parents.
  - _____ each carry ___ of the parent's ___ alleles.



- Alleles from different _____ are inherited in different combinations due to:
  1. Recombination (crossing over): chromosomes _____ material.
  2. Independent assortment: chromosomes are _____ separately.
  - Allows different genes to evolve _____.
  - Allows NS to work on different _____ of genes.

PRACTICE

Natural selection is able to work independently on different genes that are found on the *same* chromosome because of which process?

a) Mutation.
b) Recombination.
c) Independent assortment.
d) Fertilization.

PRACTICE

Over short time periods, what would you expect to be responsible for creating the most genetic variation in humans?

a) Horizontal gene transfer.
b) Natural selection.
c) Mutation.
d) Sexual reproduction.