How Genes are Expressed & How Meiosis Leads to New Organisms

Each chromosome is made up of many genes. A **gene** is a piece of a DNA molecule that gives us the instructions for making a protein. Different versions of the same gene are called **alleles**. Different alleles give the instructions for making different versions of a protein. Table 1 shows the alleles for two human genes. In the table, ***circle*** each symbol that represents part of a DNA molecule. ***Underline*** each word that is the name of a protein.

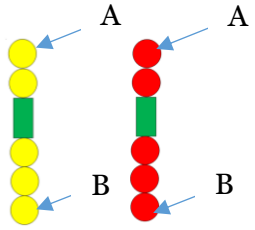
Table 1

Allele	→	**Protein**
A	→	Normal enzyme for producing melanin, a pigment molecule that gives color to our skin and hair
a	→	Defective enzyme that cannot make melanin
B	→	Normal hemoglobin
b	→	Sickle cell hemoglobin

In each pair of homologous chromosomes, both chromosomes have the same genes at the same locations. A gene may have different alleles on the two homologous chromosomes (**Aa**) or a gene may have the same alleles (**BB**). **Table 2** below shows how different **genotypes** (different combinations of alleles) result in the production in different proteins which in turn result in different **phenotypes** (different observable characteristics).

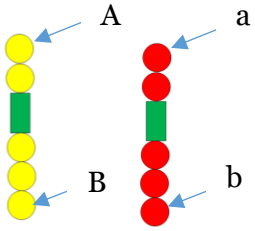
Table 2

Genotype	→	**Protein**	→	**Phenotype** (characteristics)
AA or **Aa**	→	Enough normal enzyme to make melanin in skin and hair	→	Average skin and hair color
aa	→	Defective enzyme for melanin production	→	Very pale skin and hair color; albino
BB or **Bb**	→	Enough normal hemoglobin to prevent sickle cell anemia	→	Healthy blood; no sickle cell anemia
bb	→	Sickle cell hemoglobin, which can cause red blood cells to become sickle shaped	→	Sickle shaped red blood cells can block blood flow in the smallest blood vessels, causing pain, etc.; sickle cell anemia



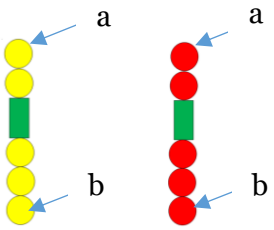
Traits Expressed
A/a locus _____

B/b locus _____



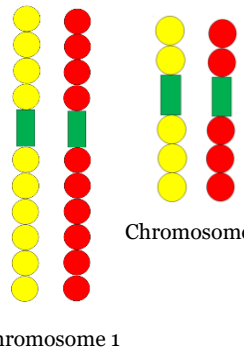
Traits Expressed
A/a locus _____

B/b locus _____



Traits Expressed
A/a locus _____

B/b locus _____



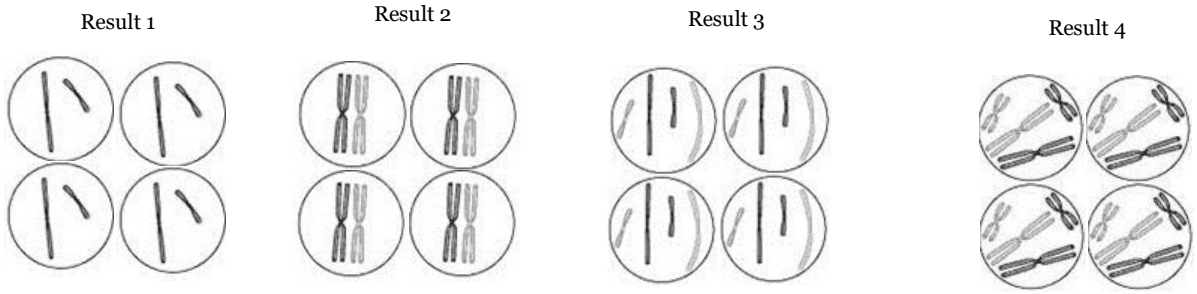
1. Each **homologous chromosome** pair (circle one): haploid diploid

2. The two colors represent: ♀ = _____ and ♂ = _____

3. The chromosome sets to the left are (circle one): heterozygous homozygous

4. The prefix "hetero" means _____, and "homo" means _____

5. Circle the option below that would be the correct result of meiosis. Remember: a **haploid cell** results…

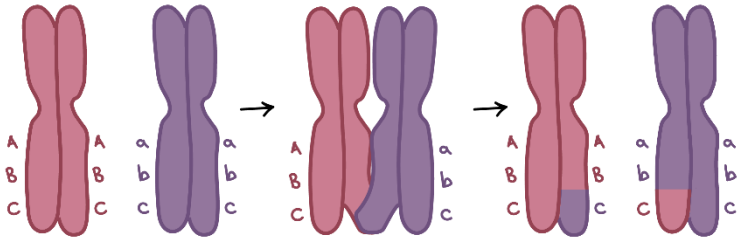


6. Explain your reasoning for choosing the result above. _____

_____

_____

Use the diagram below to answer questions 7-9.



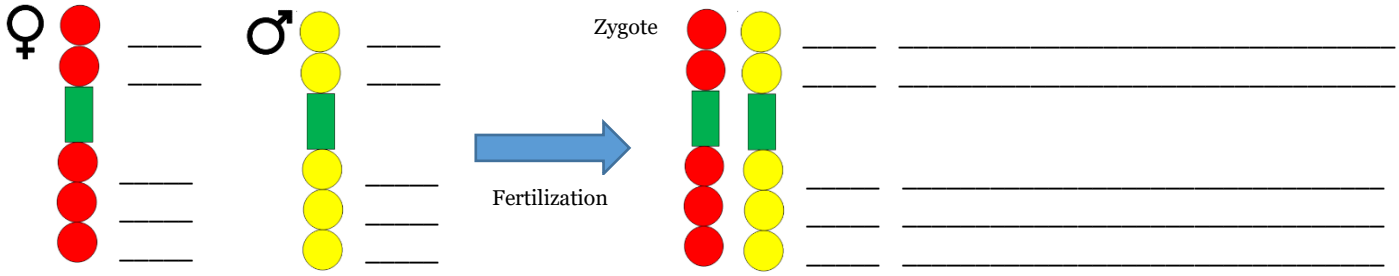
7. The event shown to the right is an example of _____ and only happens during _____.

8. This event serves to **increase the differences in the genomes of populations** is called _____.

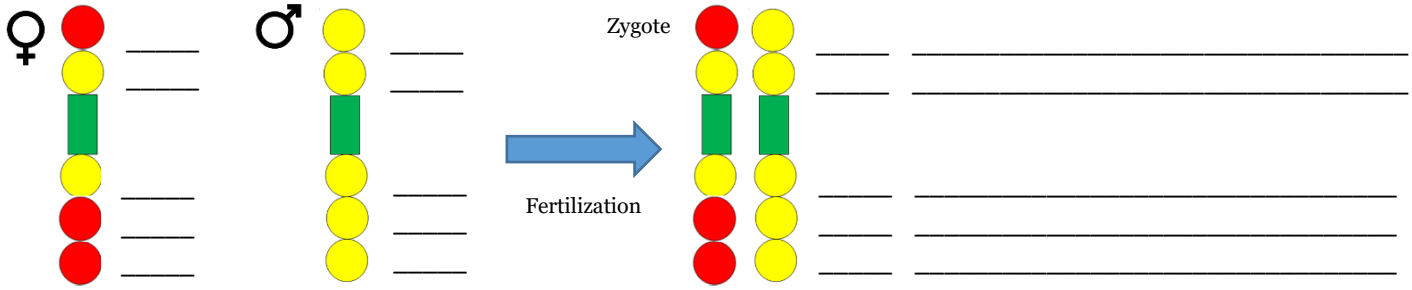
9. This event happens during (circle all that apply):

Meiosis I Meiosis II Metaphase I Prophase I Interphase

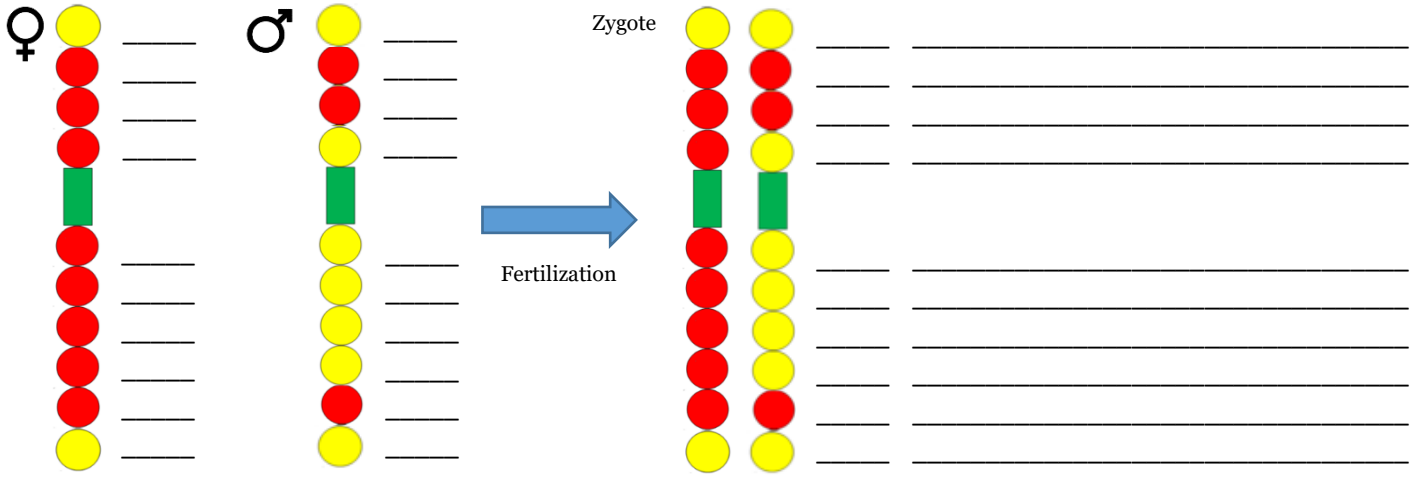
10. Below you will find a cross between two **pure bred parents** (either all homozygous dominant or all homozygous recessive gametes). Use the traits and the **alleles** (alternative versions of a gene) that represent them to complete this section. Add the single letter that represents the haploid allele for each parent gamete on the two lines to the left, write the diploid allele for the **zygote** (single-celled offspring) and the trait expressed on the longer line.



11. Below you will find gametes from two parents, use the traits in your Pop Bead Meiosis packets to determine what traits the zygote will have. Write the alleles of each chromosome, or pair, on the lines; and the traits last.



12. Below you will find gametes from two parents, use the traits in your Pop Bead Meiosis packets to determine what traits the zygote will have. Write the alleles of each chromosome, or pair, on the lines; and the traits last.



13. List a set of rules that you need to apply when you are combining alleles and determining the traits expressed by **diploid** (two full sets of chromosomes – one from each parent) organisms.

1. _____

2. _____

3. _____