

STUDY GUIDE - Ch. 13.4 - Genetic Variation Produced in Sexual Life Cycles
Contributes to (allows for) Evolution

NAME: _____

- **PHYSICALLY PRINT OUT** this PDF and **HANDWRITE** (with a black or blue pen) your answers directly on this PDF. Typed or digitally-written work is **not** accepted. Do **not** answer questions on separate paper.
- **Importantly, study guides are NOT GROUP PROJECTS!!!** You, and you alone, are to answer the questions as you **read** your assigned textbook. You are **not** to share answers with other students. You are **not** to copy any answers from any other source, including the internet.
- **Get in the habit of writing LEGIBLY, neatly, and in a medium-sized font.** AP essay readers and I will skip grading anything that cannot be easily read so start perfecting your handwriting, and don't write so large you can't add all the relevant details and key elaborations in the space provided.
- **SCAN** physical documents in color and with good resolution. Then, upload your final work as PDFs to Archie. Avoid uploading dark, shaded, washed-out, sideways, or upside-down scans of homework. Keep completed physical study guides organized in your biology binder to use as future study and review tools.
- **READ FOR UNDERSTANDING** and not merely to complete an assignment. **First**, read a section quickly to get an overview of the topic covered. Then, read it a **second** time slowly, paraphrasing each paragraph **out loud** and analyzing every figure. Finally, read it a **third** time as you answer the study guide questions if assigned and start building your memory. Try to write answers out in your own words, when possible, and try to purposefully and accurately use all new terminology introduced.

1. What is the **original source of genetic diversity (all new alleles) and why?**

(Check your answers by going to the **Ch.13.4 Concept Check Question #1** answers in Appendix A)

2. An important idea for you to understand is that **NEW** alleles (versions) of a gene arise by changes in the DNA (mutations), as you just stated in question 1, but genetic diversity in offspring **also** occurs when the **COMBINATION of alleles** for the different genes that end up in a newly resulting zygote are simply reshuffled. There are three ways that sexually reproducing organisms "shuffle alleles," generating genetic variation among offspring. What are the **three ways that sexual life cycles contribute to genetic variation?**

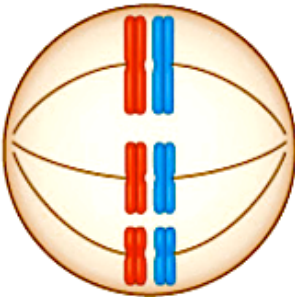
- 1.
- 2.
- 3.

3. Let's look more carefully at the ways meiosis and fertilization increase the genetic variation among offspring.

a. What exactly is meant by saying that **chromosomes assort independently?**

b. **How does the independent assortment of chromosomes increase genetic diversity** among the possible gametes that a particular diploid individual can produce?

- c. Below is a sample cell ($2n = 6$) in Metaphase I of Meiosis. Showcase three additional ways the chromosomes in this particular cell could orient themselves differently, by drawing three additional version of what this cell could look like in Metaphase 1. *Use a red and blue - different colored - pen or pencil to draw clearly your chromosomes.*

Possible Orientation of Chromosomes in Metaphase I	Possible Orientation of Chromosomes in Metaphase I	Possible Orientation of Chromosomes in Metaphase I	Possible Orientation of Chromosomes in Metaphase I
			

4. *Think:* The diploid number for fruit flies is 8 ($2n = 8$). The diploid number for grasshoppers is 46 ($2n = 46$). If no crossing over took place, would the genetic variation among the offspring from a given pair of parents be greater in the fruit flies or grasshoppers? **Explain your reasoning.**

(Check your answers by going to the [Ch.13.4 Concept Check Question #2](#) answers in Appendix A)

5. a. Study Figure 13.12. Explain why crossing over results in the creation of **recombinant chromosomes** in the daughter cells that form after a parent cell undergoes meiosis.
- b. **How does crossing over during late Prophase I (Prometaphase) of meiosis 1 increase genetic diversity?** Be very clear in your language. *Refer to earlier discussions on this topic in this Study Guide if you need to refresh exactly how to word your answer.*
6. *Think:* If maternal and paternal chromatids contain the **same alleles for every gene**, will crossing over lead to genetic variation? Explain. *(Check your answers by going to the [Ch.13.4 Concept Check Question #3](#) answers in Appendix A)*

7. How does random fertilization increase genetic diversity?

8. Here is a fun exercise to drive this point home. Pull out your calculator, and try your hand at this: When you were conceived, what were the odds that of the many possibilities, your parents would make you?

a. The **number of different gametes that can be formed because of independent assortment alone** is

2^n , where n = the number of homologous pairs

Therefore, since humans have 46 chromosomes or 23 homologous pairs, what is **the number of possible gametes that can be formed due to independent assortment of chromosomes per parent?** *Always show your work.*

b. The number above is the number of unique gametes your biological mom could have made. Your biological father could have made the same number of unique gametes too. To see the **effect of random fertilization** (the combination of one gamete from mom **AND** one gamete from dad), multiply the number of gametes one parent could make by the number of unique gametes the other parent could make. *Again, always show your work, even if not explicitly asked to do so.*

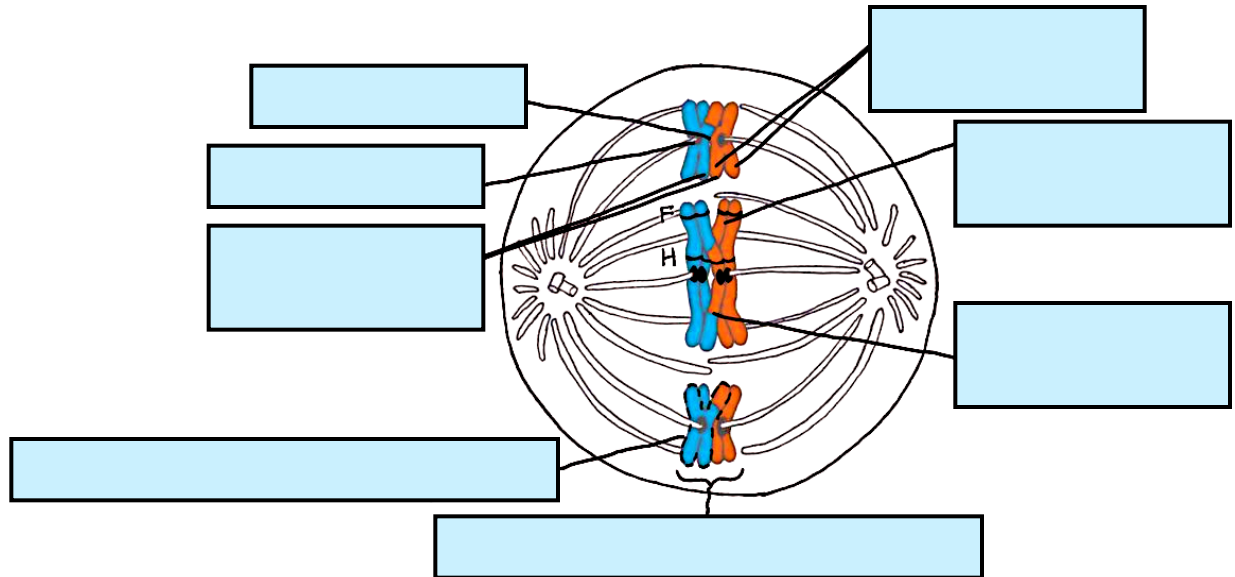
c. Your answer should be in the *trillions*, and all of this is *without* considering the enormous number of different ways crossing over could occur which drastically increases further the number of genetically different gametes each parent can produce!!! ***See how uniquely special you are!***

11. From an evolutionary perspective, why does **increasing the genetic variation among the offspring in a population benefit that species' survival?**

12. Proceed to the TEST YOUR UNDERSTANDING section at the end of the chapter. **Study your chapter sections and all Ch.13 study guides first!** Then, do your best to try to answer these from memory first in order to test how well you grasped the material before. If you are unsure, return to the relevant section of your chapter and restudy any pertinent material to refresh your memory. (Check some of your answers by going to the Ch.13 Test Your Understanding answers in Appendix A)

1. _____ 2. _____ 3. _____ 4. _____ 5. _____

6.



The chromosomes of one color make up a haploid set.
All red and blue chromosomes together make up a diploid set.

7.

8. A rewording of this question could be as follows: "Why is being able to switch to sexual reproduction instead of asexual reproduction an **ADAPTATION** in some species." So, explain how it helps organisms - including offspring - in that population better survive & reproduce!)

11. a.

b.

9. *(This is critical to know how to determine for the AP exam. Label the alleles clearly in your drawings)*

Prediction: Gametes based on chromosomes as drawn in question 6.

Prediction: Alternative gametes that could be produced if crossing over altered the combination of alleles on the chromosome drawn in question 6.