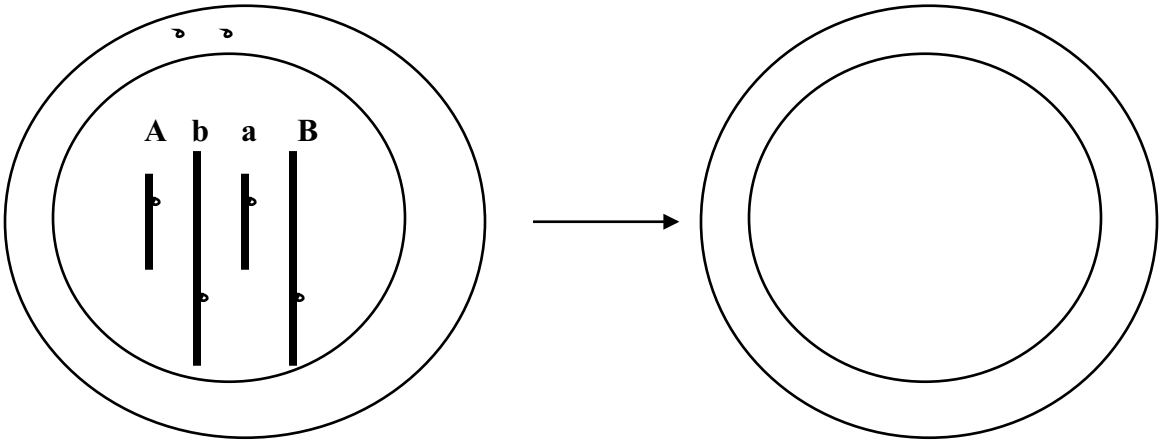
AP Chapter 13 Study Guide: The Meiosis and Sexual Life Cycles

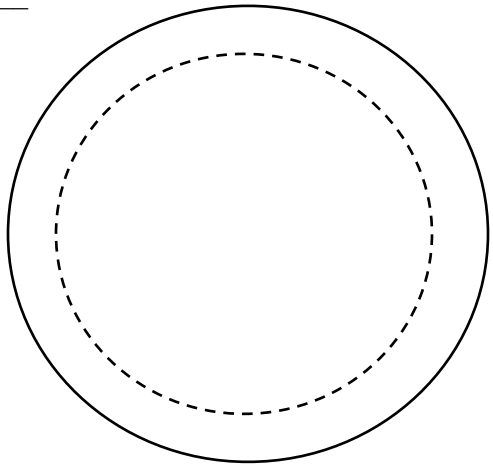
(Rob Hamilton)

Teacher's Note: *Chapter 13 builds on the cell cycle and leads you to a rich understanding of Mendelian genetics. Read pgs 238-242 for some background on genetic inheritance and sexual lifecycles. There is some important vocabulary, but nothing that requires a tremendous amount of thought. The important part of this chapter begins in section 13.3 on page 243. As you read pgs 243-247, it is critical that you learn how the process of meiosis provides for genetic variation. You must also be able to compare mitotic and meiotic cell division. Finally, you will come to appreciate the genius of Gregor Mendel as you gain an understanding of how he used mathematics to predict the existence of meiosis without ever knowing that chromosomes existed!*

1. Shown below is the cell of an organism that is heterozygous at two genetic loci on different chromosomes. Draw the arrangement of the chromosomes and other pertinent cell structures (centioles & spindle) as the cell goes through meiotic division. Place the chromosomal status (n, 2n, 4n) in the slot to the right of the stage name. In addition, answer any questions below the diagrams.



G_1 _____ S _____

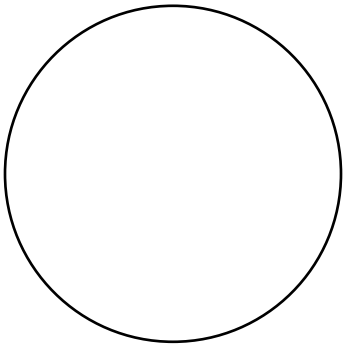


Prohase I _____

2. Describe the events that occur in prophase I of meiosis that do not occur in prophase of mitosis? _____

_____

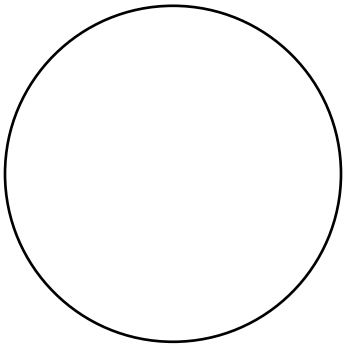
_____



Metaphase I _____

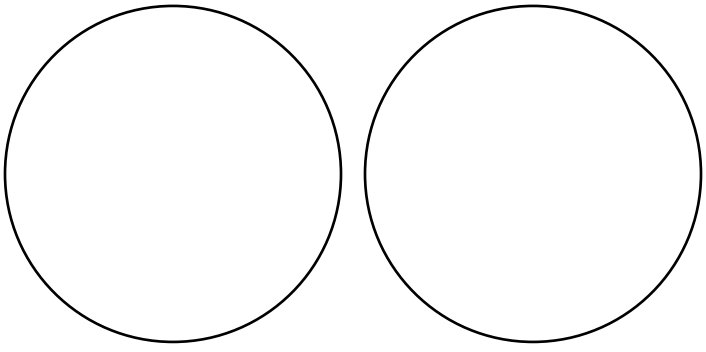
3. How is the alignment of chromosomes on the metaphase plate in metaphase I of meiosis different than the alignment of chromosomes during metaphase of mitosis? _____

_____



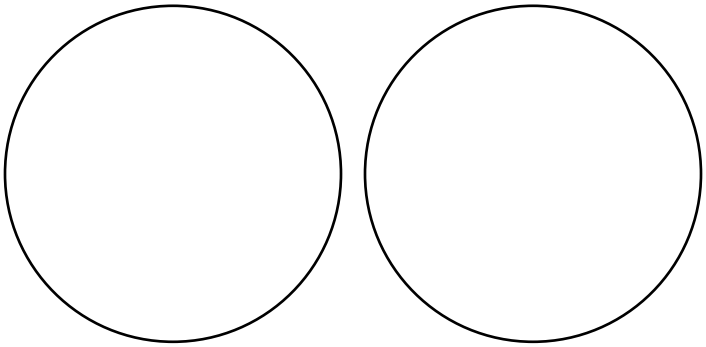
Anaphase I _____

4. **Homologs** or **sister chromatids** separate during anaphase I of meiosis.
5. **Homologs** or **sister chromatids** separate during anaphase of mitosis.

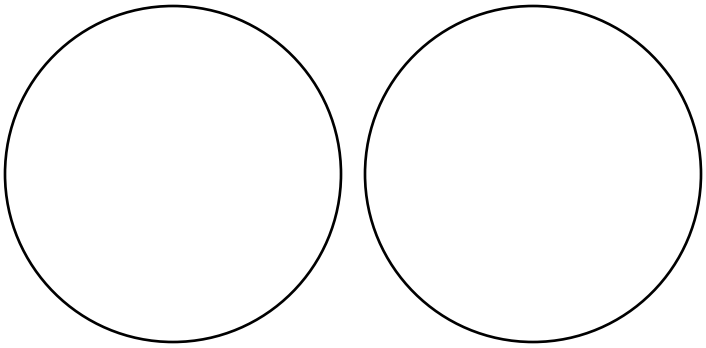


Telophase I & cytokinesis I _____

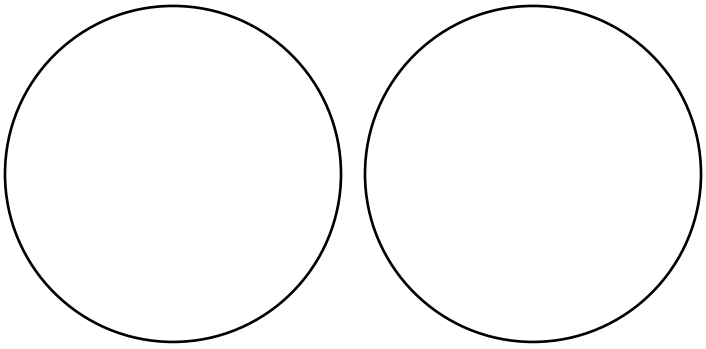
6. These cells have **the same amount** or **twice as much** or **half as much** genetic material as the parent cell
7. These cells are genetically **the same** or **different** than the parent cell



Prophase II _____

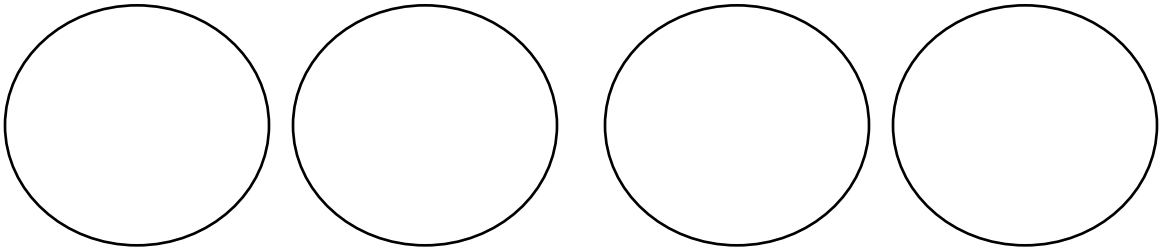


Metaphase II _____



Anaphase II _____

8. **Homologs** or **sister chromatids** separate during anaphase II of meiosis.



Telophase & Cytokenisis II _____

9. These cells have **the same amount** or **twice as much** or **half as much** genetic material as the parent cell.

10. All the daughter cells have **the same** or **different** number of chromosomes.

11. The daughter cells are **the same** or **different** genetically

Grab your chapter 12 study guide and answer the following questions concerning the fundamental difference between meiotic and mitotic cell division:

12. How many times does the cell divide during mitosis? _____

13. How many times does the cell divide during meiosis? _____

14. How many daughter cells are produced in mitosis? _____

15. How many daughter cells are produced in meiosis? _____

16. How do the daughter cells produced in mitosis compare genetically to the parent cell? _____

_____

17. How do the daughter cells produced in meiosis compare genetically to the parent cell? _____

_____

18. What type of cells are produced in mitosis? **Somatic cells** or **Gametes**

19. What type of cells are produced in meiosis? **Somatic cells** or **Gametes**

20. How does prophase I of meiosis differ from prophase in mitosis? _____

_____

21. How does metaphase I of meiosis differ from metaphase in mitosis? _____

_____

22. How does anaphase I of meiosis differ from anaphase in mitosis? _____

_____

Read pgs 247-249 then jump ahead to chapter 14 and read about the work of Gregor Mendel on pages 251-258.

ARE YOU AWAKE AND ALERT??? WHAT FOLLOWS IS <u>CRITIAL</u>!!!

23. What does it mean to segregate? _____ Write Mendel's Law of Segregation _____

_____

_____

24. During what stage of meiosis are the alleles (various gene forms) found on the maternal and paternal chromosome segregated? _____

25. What structures physically cause segregation? _____

26. What tetrad event (during metaphase I) determines which allele is distributed into any given gamete? _____

_____

27. Does segregation create genetic variation upon which natural selection (described on pages 443-445) can act?

_____ Explain _____

_____

28. Write Mendel's Law of Independent Assortment. _____

_____

29. During what stage of meiosis are the alleles independently assorted from one another? _____

30. What tetrad event determines how chromosomes assortment? _____

31. Does independent assortment create genetic variation upon which natural selection can act? _____

Explain _____

_____

A little bit of Math!

32. Every human has 46 chromosomes (23 maternal chromosomes and 23 paternal chromosomes.) Since you have one maternal #1 chromosome and one paternal #1 chromosomes, what are the chances of passing on the maternal #1 in any given gamete? _____

33. What would be the probability of passing on the maternal #1 and maternal #2 in any given gamete? *(Hint: you might wish to read about probability on pages 258-259)* _____

34. Assuming no crossing over, admittedly very improbable, what are the chances of a human being producing two gametes with exactly the same chromosomes? _____ **WOW!**

*Now when you consider that all 23 pairs of chromosome **can and do** exchange maternal and paternal alleles during crossing over, having two gametes that are genetic clones becomes impossible!* **DOUBLE WOW!!**

35. 99.9% of non-bacterial species carry on some type of sexual reproduction. What is the great adaptive value of sex? _____

_____

Conversely, why is it possible to view meiosis, crossing over and recombination as destructive processes? __

_____