

AP Chapter 12 Study Guide: The Cell Cycle

(Rob Hamilton)

Teacher's Note: Chapter 12 builds on what you learned about the cell cycle in first year bio. It adds the mechanism of binary fission in prokaryotes, the chemical regulation of the cell cycle in eukaryotes and a brief overview of cancer. A solid understanding of mitosis will allow you to grasp the nuances of meiotic division in chapter 13 and prepare you to develop a rich understanding of Mendelian genetics. Read pgs 218 and 219.

1. List at least 3 reasons why cells divide?

- a) _____
- b) _____
- c) _____

Now read 219-221 as the authors discuss the cellular organization of genetic material.

2. What are the two components of chromatin? _____ and _____
3. Can chromatin function? i.e. Can enzymes, like DNA polymerase, bind to loose strands of DNA and copy it?
Yes or **No** In which portion of the cell cycle does this occur? _____
4. Can two copies of loose strands of DNA and protein be correctly divided up and distributed to daughter cells without being damaged? **Yes** or **No**
5. How do the chromatin fibers change as the cell prepares for division? _____

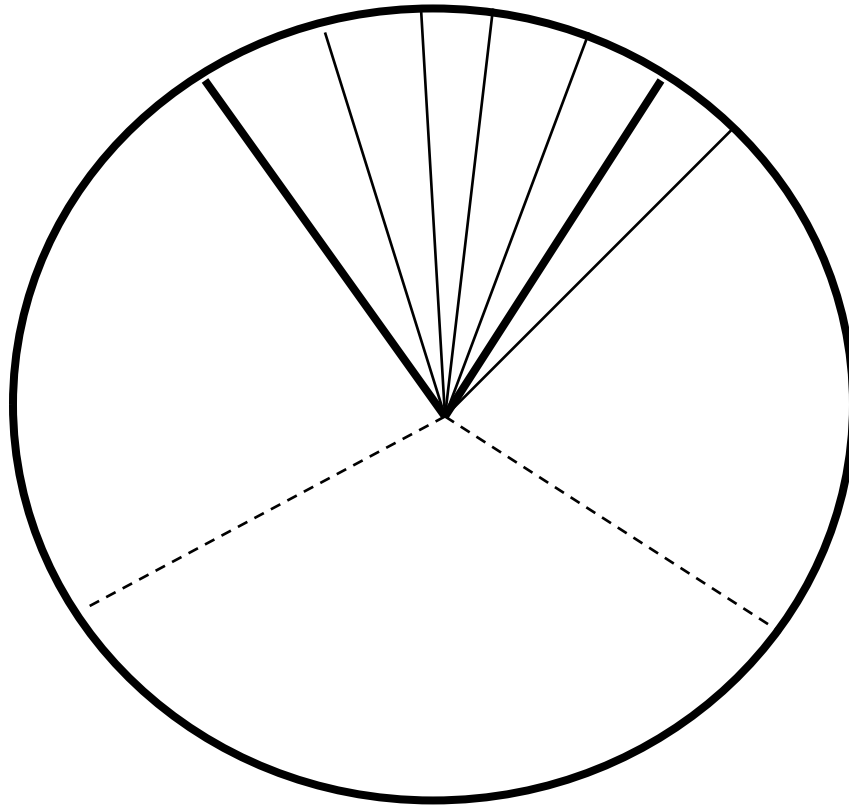
6. What is the densely coiled and folded chromatin now called? _____
7. How many exactly copied strands of DNA are in a chromosome after S? _____
8. What are these exactly copied strands of DNA called? _____ What structure unites them? _____

Supply the correct number

9. A chimpanzee somatic cell has 48 chromosomes. How many chromosomes does a chimp inherit from each parent? _____ How many chromosomes are in a chimpanzee egg or sperm? _____ How many chromatids would be in a somatic cell of a chimpanzee in G2? _____ How many chromosomes are in a set of chimpanzee chromosomes? _____

Read pgs 221-224 and then label the drawing of the cell cycle on the divided circle below:

The Cell Cycle



10. If you are looking at a slide of actively dividing cells, which stage of the cell cycle would you expect to find the most cells in? _____ Why? _____

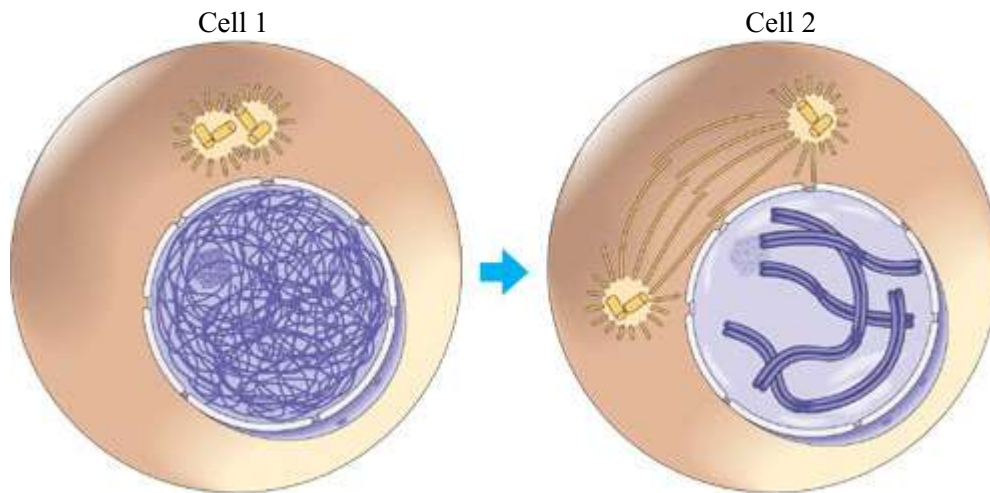
11. What are the main events of G1 and G2? _____

12. When does DNA replication occur? _____

Jump ahead to chapter 13 and read page 240 and then answer the following question by entering the correct number

13. Human somatic cells contain 46 chromosomes. During metaphase of mitosis a human somatic cell would contain how many _____ diploid chromosomes. _____ pairs of homologous chromosomes. _____ sister chromatids and _____ centromeres

Examine the pictures below:



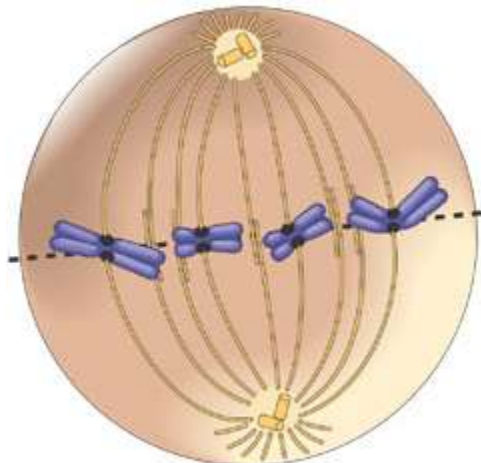
13. In what stage of the cell cycle is cell 1? _____.

14. What stage of the cell cycle is cell 2 in? _____.

15. Compare the pictures and list the changes that have occurred from cell 1 to cell 2.

- a) _____
- b) _____
- c) _____
- d) _____

16. In what stage of the cell cycle is the cell below? _____



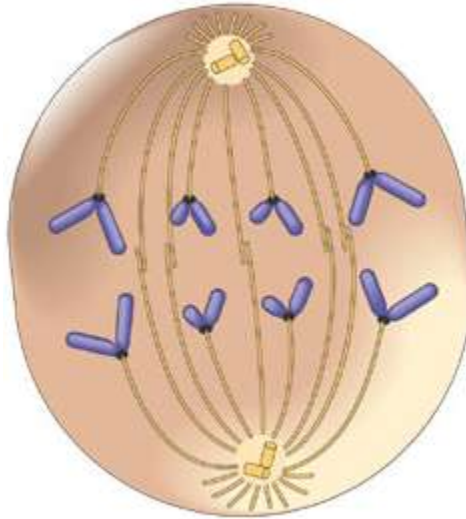
17. How have the positions of the chromosomes changed? _____

18. Where do the spindle fibers attach to the chromosomes? _____

19. Do all of the spindle fibers attach to chromosomes? **Yes** on **No**

20. How do non-kinetochore spindle fibers affect the shape of the cell? _____

21. In what stage of the cell cycle is the cell below? _____



22. How have the positions of the chromosomes changed? _____

Examine figure 12.8

23. Describe the evidence that supports the hypothesis that motor proteins within the kinetochore move the chromosomes down the spindle fiber to the centrioles and refute the idea that spindle fiber pull chromosomes to the centrioles _____

24. Describe how the chromosomes change once they reach opposite ends of the cell _____
_____ What reforms around them? _____ What is the
name of this last stage of the cell cycle? _____

25. (*Supply the correct number*) In human somatic cell following mitosis, there are _____ nuclei present
in _____ cell(s) containing _____ chromosomes and _____ pairs of homologous chromosomes

Read about animal and plant cell cytokinesis on pages 224-226.

26. What is the role of the motor proteins actin and myosin in animal cell cytokinesis? _____

27. Why can't plant cells use the same cytokinetic mechanism? _____

Then how do plant cells divide? _____

Read about prokaryotic cell division on pages 226-227.

28. Prokaryotic chromosomes differ from eukaryotic chromosomes in three major respects. Prokaryotic chromosomes are _____ in shape and eukaryotic chromosomes are _____.

Prokaryotic chromosomes are in a single copy and are called **haploid** or **diploid**. While eukaryotic chromosomes occur in pairs and are said to be **haploid** or **diploid**. Finally, while prokaryotic DNA is loosely associated with protein, a eukaryotic chromosome is 60% protein and only 40% DNA.

29. What is the name of the place prokaryotic DNA replication begins? _____

30. As replication of DNA continues, the bacterium doubles its length. Do microbiologist believe that bacterial DNA floats free in the cytoplasm or is it thought to be attached to proteins within the plasma membrane?

What evidence supports this? _____

31. Following DNA replication the plasma membrane pinches in and a new cell wall forms. This type of prokaryotic cell division is called _____

Jump to pages 229-231 and read about the control system of the cell cycle.

32. The two kinds of proteins that regulate the cell cycle are _____ & _____

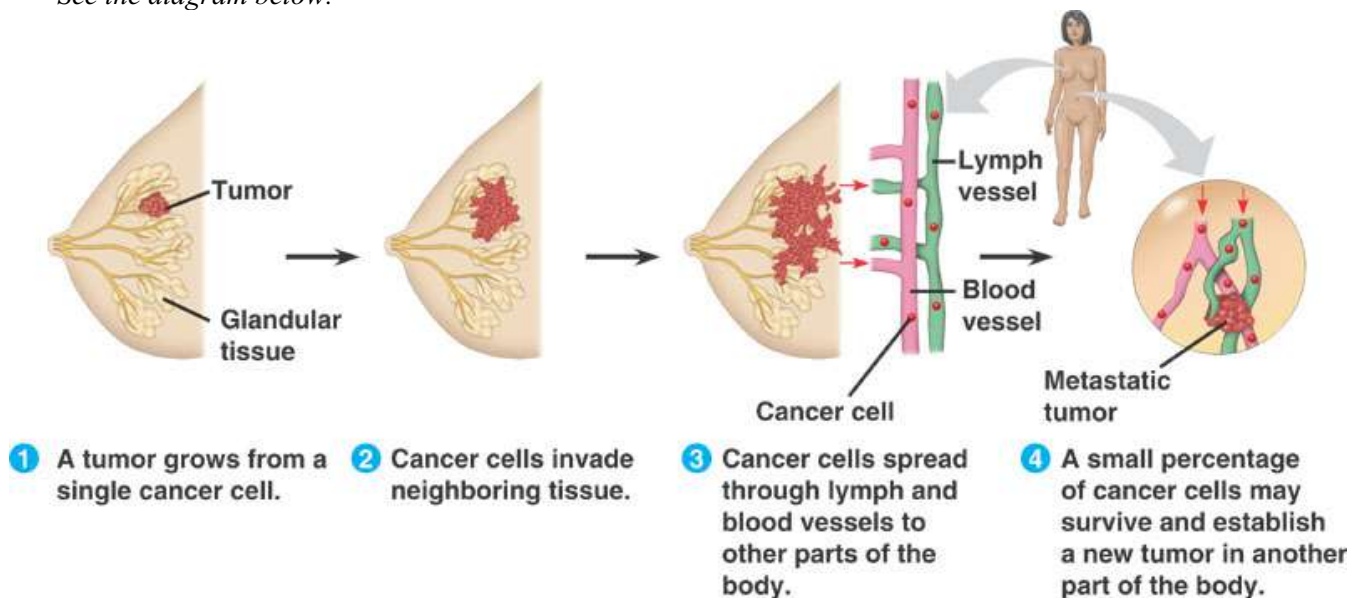
33. The synthesis of _____ begins in S and continues through G2. As it accumulates it binds with cyclin dependent kinases or _____. The resulting complex is called _____ or maturation promoting factor. High levels of MPF _____ mitosis. During anaphase, _____ is degraded lowering the levels of MPF and sending the cell into G1.

34. At critical times in the cell cycle called _____ the cell will receives a stop or go signal. If the cell does not receive the go signal, it will switch to a non-dividing state, the _____ phase.

Read pages 232-233 which contain a brief overview of cancer.

35. When a single cell undergoes _____ a normal cell is converted into a cancer cell.
36. Cancer cells carry on continuous cell division and the resulting mass of cells is called a _____
37. If the tumor stops growing, it is called a _____ tumor and if the tumor is actively growing and interfering with the functioning of the organ, it is called a _____ tumor.
38. Malignant tumors can break off and spread through the body in a process called _____.

See the diagram below:



39. A tumor that is localized can be treated with _____ because a dividing cell's DNA is more easily damaged by this high energy. However, to treat cancers that are known or suspected of producing metastatic tumors, _____ must be used, in which drugs that are toxic to dividing cells are administered through the blood stream.