

**Chapter 9 Reading Guide: The Cell Cycle**

How to use this reading guide: Look over the entire reading guide—read each question to prepare yourself for reading the chapter. Read the chapter carefully and thoroughly. Make sure to look at all of the figures and pictures and read their captions. Then...answer the questions posed below.

**The Key Roles of Cell Division**

1. What are the important roles that cell division play in the life of an organism? Study figure 9.2.
  
  
  
  
  
  
  
  
  
  
2. What is the cell cycle?

**Cell division results in genetically identical daughter cells**

3. What is a genome?
  - a. Contrast prokaryotic with eukaryotic genomes. How are they different?
  
  
  
  
  
  
  
  
  
  
4. For each pair of terms listed below, explain what each is and how they are related to each other.
  - a. Chromosomes & chromatin
  
  
  
  
  
  
  
  
  
  
  - b. somatic cells & gametes

5. Study figure 9.4 (and of course read the info) and draw a picture of a replicated chromosome in the space below. On the picture label the: centromere and the sister chromatids.
  - a. Beside each label, explain what these are (include any special information about purpose, etc...).
  
6. Contrast the terms mitosis and cytokinesis.
  
7. A chicken has 78 chromosomes in its somatic cells, how many chromosomes did the chicken inherit from each parent?
  - a. What process produced the cells that each parent provided? Why is this process necessary?
  - b. How many chromosomes are in each of the chicken's gametes?
  - c. How many chromosomes will be in each somatic cell of the chicken's offspring?

**The mitotic phase alternates with interphase in the cell cycle**

8. Diagram the cell cycle in the space below. For each stage of the cycle, describe what happens.
  - a. Describe the timing of cell division—how long does it typically take? How do each of the stages of the cell cycle compare with respect to time? Which stage takes the longest? Why?

9. Study figure 9.7 carefully and read the captions thoroughly. Use this information to complete the chart below.

Stage	What part of the cell cycle (Interphase? Mitosis?)	Significant/unique events that distinguish this phase from others.	Picture of the stage/phase
G <sub>2</sub>			
Prophase			
Prometaphase			
Metaphase			
Anaphase			
Telophase & Cytokinesis			

10. What is the mitotic spindle? When does it begin to form? What is its function?  
 a. How is its formation related to the centrosome? The centriole?

11. Describe the movement and location of the centrosomes and spindle microtubules in each of the following phases.  
 a. Interphase

b. prophase

c. prometaphase

12. Draw a picture which shows what the mitotic spindle would look like at metaphase. In your picture, label the aster, centromere, chromosome, kinetochore, spindle fiber.
13. Contrast kinetochore microtubules with nonkinetochore microtubules. What are their functions?
14. What is the current hypothesis for how chromosomes are moved apart during anaphase?
- Study figure 9.9 and briefly describe the experiment that supports the current hypothesis.
15. CLEAVAGE- Contrast cytokinesis in animal cells and plant cells.
- What is responsible for the movement of the cleavage furrow?
  - Where do the materials for the cell plate come from?
16. Binary fission is special type of cell division which accounts for how prokaryotes reproduce. Briefly explain...
- How the chromosome replicates and what problems this presents.
  - The steps through which the prokaryote proceeds.

17. Study figure 9.13 and of course, read...and then describe how mitosis might have evolved?

18. During which stages of the cell cycle and mitosis would a chromosome consist of two identical chromatids?

**The cell cycle is regulated by a molecular control system**

19. How does the timing of cell division differ for different cells? Why is an understanding of this timing important (not just cancer—think about stem cells and others...).

20. Study figure 9.14. What is the support for the presence of cytoplasmic signals that control the cell cycle?

21. What is the cell cycle control system?

22. What are checkpoints? How are “checkpoints” involved in the control system? Why are they important?

- a. Draw a picture of the cell cycle control system and label the checkpoints.
  - i. Why is the G1 checkpoint considered the “restriction point?”

23. Distinguish between kinases and cyclins.

- a. Compare their relative concentrations throughout the cell cycle.
- b. How are kinases influenced by cyclins? What are these called?
- c. How are they related to the MPF?

24. Explain how the MPF initiates mitosis (what does it actually do) and is subsequently turned off.

25. There are both internal factors and external factors that serve as “stop” and “go” signals for cell division.

- a. Explain how kinetochore binding regulates the cell cycle. Is it internal or external? Why is it important?

b. Nutrient mix also regulates the cell cycle. Is it internal or external? What happens in this case?

- c. Explain how growth factors affect the cell cycle. Are these internal or external signals?
  - i. PDGF is an example. Explain how this works.

d. Density-dependent inhibition is an external signal. How does this affect the cell cycle?

e. What is anchorage dependence? How is it signaled?

26. How do cancer cells differ from normal cells? Describe ALL the ways they differ!

27. What is transformation? How does the immune system normally respond to this?

28. Compare and contrast a benign tumor with a malignant tumor?

a. What is so abnormal about malignant tumors?

29. What is metastasis? Why do metastatic cancers pose such problems for treatment?

30. Contrast the treatments for local tumors and metastatic tumors.

a. Describe what the metastatic treatments do in relation to the cell cycle. Use Taxol as an example.

b. Why are there side effects to the treatments? Explain why hair loss and nausea often occur.