



Chapter 10 Exercises

Review Questions

- A diploid cell has _____ the number of chromosomes as a haploid cell.
 - one-fourth
 - half
 - twice
 - four times
- An organism's traits are determined by the specific combination of inherited _____.
 - cells
 - genes
 - proteins
 - chromatids
- The first level of DNA organization in a eukaryotic cell is maintained by which molecule?
 - cohesin
 - condensin
 - chromatin
 - histone
- Identical copies of chromatin held together by cohesin at the centromere are called _____.
 - histones
 - nucleosomes
 - chromatin
 - sister chromatids
- Chromosomes are duplicated during what stage of the cell cycle?
 - G₁ phase
 - S phase
 - prophase
 - prometaphase
- Which of the following events does *not* occur during some stages of interphase?
 - DNA duplication
 - organelle duplication
 - increase in cell size
 - separation of sister chromatids
- The mitotic spindles arise from which cell structure?
 - centromere
 - centrosome
 - kinetochore
 - cleavage furrow
- Attachment of the mitotic spindle fibers to the kinetochores is a characteristic of which stage of mitosis?
 - prophase
 - prometaphase
 - metaphase
 - anaphase
- Unpacking of chromosomes and the formation of a new nuclear envelope is a characteristic of which stage of mitosis?
 - prometaphase
 - metaphase
 - anaphase
 - telophase
- Separation of the sister chromatids is a characteristic of which stage of mitosis?
 - prometaphase
 - metaphase
 - anaphase
 - telophase
- The chromosomes become visible under a light microscope during which stage of mitosis?
 - prophase
 - prometaphase
 - metaphase
 - anaphase
- The fusing of Golgi vesicles at the metaphase plate of dividing plant cells forms what structure?
 - cell plate
 - actin ring
 - cleavage furrow
 - mitotic spindle
- At which of the cell cycle checkpoints do external forces have the greatest influence?
 - G₁ checkpoint
 - G₂ checkpoint
 - M checkpoint
 - G₀ checkpoint

14. What is the main prerequisite for clearance at the G₂ checkpoint?
 - a. cell has reached a sufficient size
 - b. an adequate stockpile of nucleotides
 - c. accurate and complete DNA replication
 - d. proper attachment of mitotic spindle fibers to kinetochores
15. If the M checkpoint is not cleared, what stage of mitosis will be blocked?
 - a. prophase
 - b. prometaphase
 - c. metaphase
 - d. anaphase
16. Which protein is a positive regulator that phosphorylates other proteins when activated?
 - a. p53
 - b. retinoblastoma protein (Rb)
 - c. cyclin
 - d. cyclin-dependent kinase (Cdk)
17. Many of the negative regulator proteins of the cell cycle were discovered in what type of cells?
 - a. gametes
 - b. cells in G₀
 - c. cancer cells
 - d. stem cells
18. Which negative regulatory molecule can trigger cell suicide (apoptosis) if vital cell cycle events do not occur?
 - a. p53
 - b. p21
 - c. retinoblastoma protein (Rb)
 - d. cyclin-dependent kinase (Cdk)
19. Which eukaryotic cell cycle event is missing in binary fission?
 - a. cell growth
 - b. DNA duplication
 - c. mitosis
 - d. cytokinesis
20. FtsZ proteins direct the formation of a _____ that will eventually form the new cell walls of the daughter cells.
 - a. contractile ring
 - b. cell plate
 - c. cytoskeleton
 - d. septum

Critical Thinking Questions

21. Compare and contrast a human somatic cell to a human gamete.
22. What is the relationship between a genome, chromosomes, and genes?
23. Eukaryotic chromosomes are thousands of times longer than a typical cell. Explain how chromosomes can fit inside a eukaryotic nucleus.
24. Briefly describe the events that occur in each phase of interphase.
25. Chemotherapy drugs such as *vincristine* (derived from Madagascar periwinkle plants) and *colchicine* (derived from autumn crocus plants) disrupt mitosis by binding to tubulin (the subunit of microtubules) and interfering with microtubule assembly and disassembly. Exactly what mitotic structure is targeted by these drugs and what effect would that have on cell division?
26. Describe the similarities and differences between the cytokinesis mechanisms found in animal cells versus those in plant cells.
27. List some reasons why a cell that has just completed cytokinesis might enter the G₀ phase instead of the G₁ phase.
28. What cell cycle events will be affected in a cell that produces mutated (nonfunctional) cohesin protein?
29. Describe the general conditions that must be met at each of the three main cell cycle checkpoints.
30. Compare and contrast the roles of the positive cell cycle regulators and the negative regulators.
31. What steps are necessary for Cdk to become fully active?

32. Rb is a negative regulator that blocks the cell cycle at the G₁ checkpoint until the cell achieves a requisite size. What molecular mechanism does Rb employ to halt the cell cycle?
33. Name the common components of eukaryotic cell division and binary fission.
34. Describe how the duplicated bacterial chromosomes are distributed into new daughter cells without the direction of the mitotic spindle.