

CHAPTER 8: CELLULAR REPRODUCTION AND INHERITANCE PART I

Honors Biology 2012

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TYPES OF REPRODUCTION

- ☼ Asexual Reproduction - offspring are identical to parent cell or organism (inherits genes from only one parent)
- ☼ Sexual Reproduction - offspring are similar to parents but show a variation of traits (inherits genes from two parents)

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CELL DIVISION

- ☼ Virchow's principle - every cell must come from a preexisting cell
- ☼ Unicellular organisms - cell division can reproduce an entire organism
- ☼ Multicellular organisms
 - ☼ Some can reproduce asexually (plants that can grow from cuttings)
 - ☼ Development and growth
 - ☼ Repair and regeneration

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PROKARYOTE DIVISION

- Binary Fission - dividing in half
- Chromosome duplicates and copies separate
- Cell elongates
- Cell divides into two

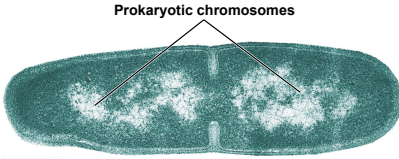
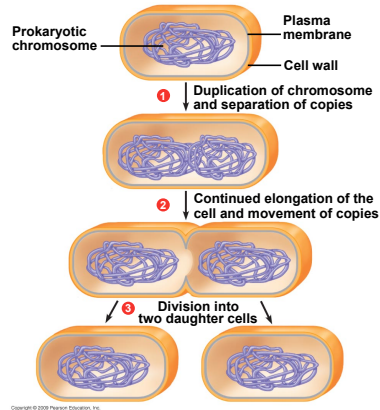


Fig. 8.3

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EUKARYOTIC DIVISION

- Chromosomes
- Contain the cell's DNA
- Found in the nucleus
- Most often as long fibers of chromatin (combination of DNA and protein)
- When a cell divides, the chromatin coils up forming chromosomes.
- Before a cell can divide, each chromosome must be copied. The copies are now called sister chromatids.
- Chromatids are joined at the centromere

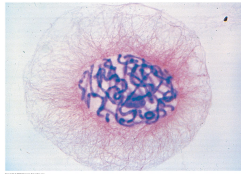
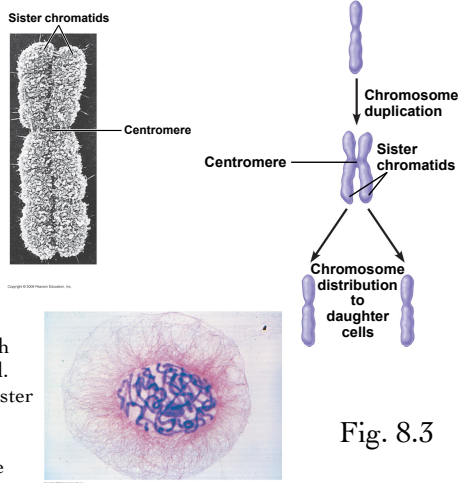


Fig. 8.3

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CELL CYCLE

- Cell cycle - ordered sequence of events for cell division
- Two stages:
 - Interphase - duplication of cell contents
 - G₁ - growth (increase cytoplasm)
 - S - duplication of chromosomes
 - G₂ - growth (prepare for division)
 - Mitotic phase (M-phase) - division
 - Mitosis - division of nucleus
 - Cytokinesis - division of cytoplasm

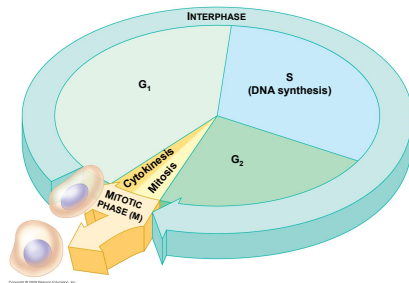


Fig. 8.5

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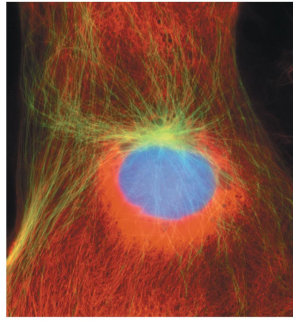
INTERPHASE

☼ In the cytoplasm:

☼ contents of the cytoplasm doubles (G₁ and G₂ phases)

☼ In the nucleus:

☼ chromosomes duplicate (S phase)



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STAGES OF MITOSIS

☼ Prophase

☼ (Prometaphase)

☼ Metaphase

☼ Anaphase

☼ Telophase (and Cytokinesis)

☼ In order for any of this to happen the mitotic spindle must form

☼ Spindle is made from microtubules and is directed by the centrioles (centrosomes)

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PROPHASE

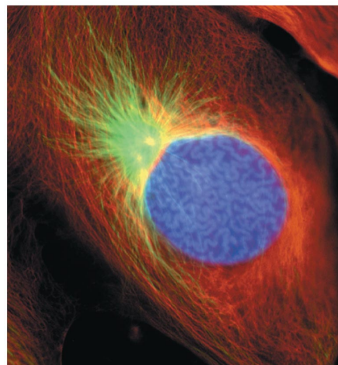
☼ In the cytoplasm:

☼ Microtubules begin to emerge from centrosomes to form the spindle

☼ In the nucleus:

☼ Chromosomes coil

☼ Nuclear envelope begins to disappear

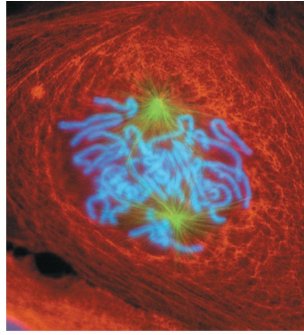


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PROMETAPHASE

- ☼ Spindle microtubules reach chromosomes and attach at the centromere (kinetochore)
- ☼ Spindle moves the chromosomes toward the center
- ☼ Other microtubules meet those from the other side
- ☼ Nuclear envelope disappears

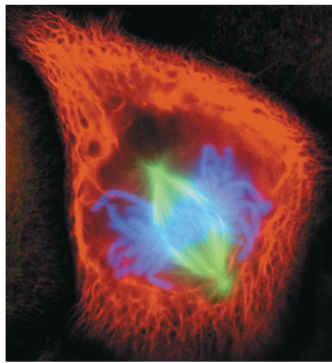


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METAPHASE

- ☼ Spindle completely formed
- ☼ Chromosomes align at the cell equator

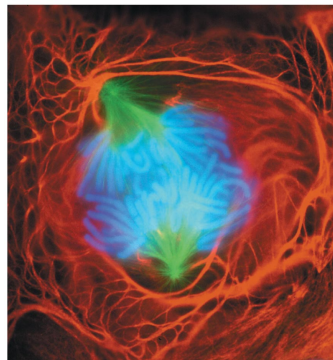


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ANAPHASE

- ☼ Sister chromatids separate at the centromeres
- ☼ Daughter chromosomes are moved to the opposite poles of the cell
- ☼ Cell elongates

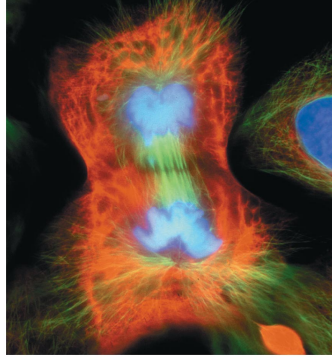


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TELOPHASE

- Cell continues to elongate
- Nuclear envelope reforms around the daughter nuclei
- Chromosomes uncoil
- Nucleoli reappear
- Spindle disappears



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CYTOKINESIS

- Cytoplasm divided into separate cells
- In animal cells:
 - Cleavage furrow forms
- In plant cells
 - Cell plate forms
 - Formed from vesicles containing cellulose

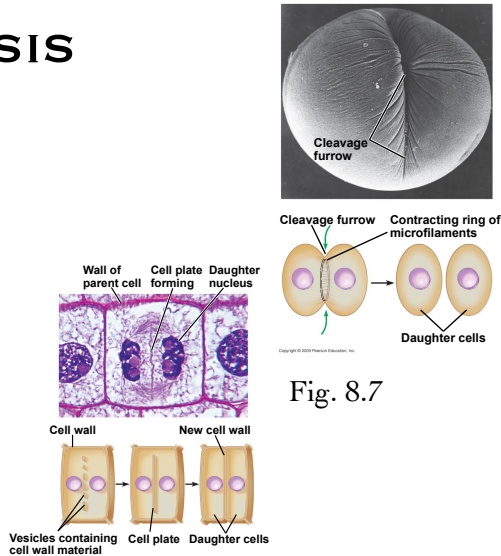


Fig. 8.7

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CONTROLLING CELL DIVISION

- Essential nutrients must be present
- Growth factors - proteins that stimulate division
- Density-dependent inhibition - crowded cells stop dividing
- Anchorage dependence - cells that must be in contact with a solid surface

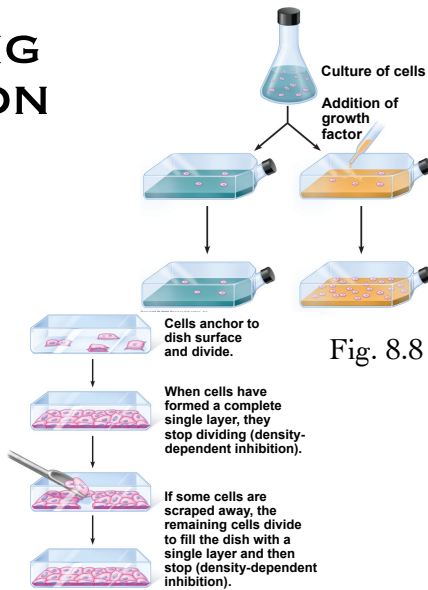


Fig. 8.8

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CELL CYCLE CONTROL

☉ Checkpoints

- ☉ G₁ checkpoint - allows entry into S phase or causes the cell to end the cell cycle
- ☉ G₂ checkpoint - ensures DNA was copied correctly
- ☉ M checkpoint - ensures cell has divided

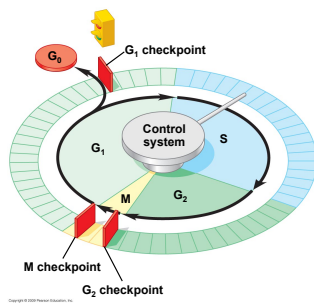
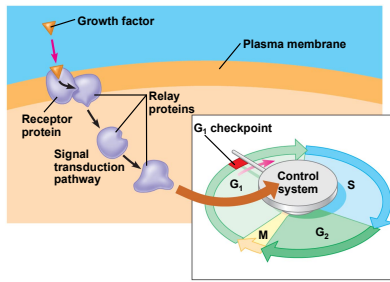


Fig. 8.9



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CANCER

- ☉ Cancer cells escape the controls of the cell cycle
 - ☉ Cancer cells divide rapidly even in the absence of growth factors
 - ☉ Cancer cells spread to other tissues through the circulatory system
 - ☉ Growth is not inhibited by other cells which forms tumors
 - ☉ Benign tumors - remain at the original site
 - ☉ Malignant tumors - spread to other locations
- ☉ Cancer treatment (radiation and chemotherapy)

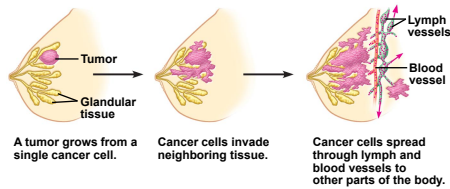


Fig. 8.10

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