Cell Cycle Notes

Key Roles of Cell Division

1. Continuity of life is based on reproduction of cells, or _____
2. _____ of an entire organism; ex: an amoeba is a one celled organism.
3. Production of progeny from multicellular organisms. Ex: plant cuttings
4. Sexually reproducing organisms from single cell (fertilized egg → fetus → infant)
5. Renewal & _____ of damaged or worn out cells

Cell Division Roles

- Prokaryotic cells
  - _____ = reproduction
  - Origin of Replication = point where replication begins in bacteria DNA
- Eukaryotic cells
  - Development, growth, and repair

Cell Cycle – life of a cell from the time it is formed until its own division into _____

- Passes _____ to cellular offspring.

Cellular Organization - Genetic Material

- DNA – cell's _____, genetic material
  - Typical human has _____ of DNA
  - All new cells will have an _____ copy of the DNA
- Chromosomes – _____
  - Structure that contains all the cell's packaged DNA
  - Eukaryotic chromosomes made of _____ – complex of DNA and associated _____ that helps maintain the structure of the chromosome

Chromosome Numbers

- Each organism has a characteristic number of chromosomes.
- Human somatic cells (body cells) have _____ chromosomes
- _____ (reproductive cells – sperm / egg) have half the # of chromosomes (human eggs and sperm have 23 chromosomes).

Chromosome Structure

- Non-dividing cells' chromosomes are in the form of _____
- Following DNA replication chromosomes coil & condense
- Duplicated chromosomes have 2 halves = _____
- Chromatids are connected by a _____

Phases of the cell cycle

Interphase

- Accounts for ~ 90% of cell's cycle
- Cell grows and copies chromosomes
- Divided into 3 subphases:
    1. _____ (first gap) phase
    2. _____ phase (synthesis)
    3. _____ (second gap) phase
    4. During all 3 subphases cell grows by producing proteins & cytoplasmic organelles

Mitosis

- Mitosis - division of the _____
- Cytokinesis = division of the _____
    - Human body ~ 200 trillion somatic cells (we all started as one)
    - Mitosis _____ the chromosome number
        - If a cell begins with 46 chromosomes, the new cell will have 46 chromosomes.

Cytoskeleton – Role in Cell Cycle

- Microtubules
    - Hollow tubes that _____ chromosomes
    - _____ – 9 sets of triplet microtubules
    - Centrosome – microtubule-organizing center near the nucleus
- Microfilaments
    - Actin – 2 strands intertwined
    - Helps with _____ formation

Structures involved in cell division

1. Spindle fibers (mitotic spindle) – fibers made of _____ and associated proteins that move the chromosomes during division
2. Centrosome – non-membranous organelle that _____ and produce the spindle
    - Single centrosome replicates during interphase
    - _____ – radial arrays of microtubules forming from the centrosome
3. _____ – group of proteins associated with sections of chromosomal DNA at the _____
    - Place of microtubule _____

Mitosis and Cytokinesis

Prophase

- Chromatin _____ into chromosomes becoming visible under light microscope
- _____ disappear
- Duplicated chromosomes with 2 sister _____
- Mitotic _____ form
- Lengthening of spindles pushes _____ away from each other.

Prometaphase

- Nuclear envelop starts to _____
- _____ can now interact with chromosomes and attach to _____
- Each chromatid now has a _____
- Non-kinetochore microtubules interact with those on the _____

Metaphase

- Longest stage of mitosis ~ 20 minutes
- _____ to opposite ends
- Chromosomes line up at equator = _____; middle of the cell because of tugging from _____ microtubules
- Microtubules that originate from the centrosomes are attached to each side of the sister chromatid's kinetochore
- Microtubule = spindle because of shape.

Anaphase

- Shortest stage
- Sister chromatids are _____ by microtubules (spindle fibers)
  - Caused by action of motor proteins as they depolymerize the kinetochore microtubules at the _____
  - This action _____ the fibers
- Chromosomes move toward _____ ends of cell
- Cell _____ – due to _____ moving past one another also using motor proteins
- End of anaphase, two ends of cell have _____ and complete new set of chromosomes

Telophase

- Daughter cell _____ and nucleoli begin to form
- _____ forms around each set of chromosomes
- Chromosomes uncoil to _____ state
- Nuclear division is complete

Cytokinesis

- Animal cells
  - Cleavage – process that separates the two daughter cells
  - _____ – when a ring of actin forms on the cell surface and then interacts with myosin protein
    - It begins to contract until the cell is divided
- Plant Cells
  - _____ – forms from the fusion of membrane _____ made from the _____
  - Deposits of _____ material are collected in cell plate
  - Plasma membrane forms followed by cell wall from cell plate contents.

Cell Cycle Control

- The cell cycle is directed by internal controls or checkpoints. They provide _____ signs at each checkpoint
- There are 3 checkpoints throughout the cell cycle
  - G1, G2, and M

- _____ (Cdks) are proteins used in cell cycle control
- _____ increases in number in the _____ and then breaks down _____
- Cyclin binds to Cdks to activate them
  - The complex becomes a _____ - MPF

Cell Cycle regulation

- Growth factors = proteins released by certain cells that stimulates other cells to divide
  - _____ – PDGF
    - Released from platelets
    - Bind to _____ on cells called _____ (cells that aid in wound healing)
    - Triggers the fibroblasts to move past the G1 checkpoint
- Density-dependent inhibition = phenomenon where _____ _____
  - In the lab, cells will fill a space. When some cells are removed, mitosis is triggered and the cells divide to fill the space again
- _____ = to divide, cells must be attached to a substratum
- Cancer cells _____ exhibit density-dependent inhibition or anchorage dependence
  - Normally cells undergo _____ when an irreparable mistake occurs in DNA replication, but cancer cells bypass that normal control
  - Transformation – normal cell to cancer cell
    - Cancer cells result from a _____ in cell cycle controls
  - Tumors can be benign or malignant
  - _____ = spread of cancer cells to other areas