Mitosis

Mitosis is the type of cell division that occurs for ______________________ & _______________________.

It results in two daughter cells that have ______________________ & _______________________.

Almost every cell in the human body has an identical set of ____ chromosomes, produced through the process of mitosis.
During most of a cell’s life cycle, the DNA strands are so ________________ that they are not visible. The loose DNA is called _________________.

Prior to cell division, the DNA coil around ________________(histones) to form ________________ that are visible under a microscope.
Interphase (between cell divisions): G1, S and G2. Chromosomes are ____________.

Cell Cycle Animation

During G1: __________________________.

During S: Synthesis of new ________
Each chromosome is ______________, forming 2 identical copies of each.

During G2: Final preparations for cell division.
G1: cells grow, carry out their normal functions and replicate their organelles.

Synthesis: cells make a copy of nuclear DNA (at the end of this phase there are 2 sets of DNA).

G2: cells continue to carry out normal functions and additional growth occurs.
Sister Chromatids

The two identical copies of each chromosome produced in the S phase are attached together by ________________.
Each strand is called a ________________.
Phases of Mitosis

Prophase:

- Chromosomes ___________ and become ___________
- Nuclear membrane ________________
- Centrioles start to ___________________
Metaphase:

- Each chromosome (with 2 sister chromatids) line up along the __________ of the “__________”.

- _________________attach to the _________________ of each chromosome.
Anaphase:

- Centromeres separate (______________) and sister _________________________ (now each a chromosome) move to _________________.

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[Diagram of cell showing separation of sister chromatids during anaphase.]
Telophase/ Cytokinesis:
New __________ form, chromosomes unwind back to ________________.
Cell divides into two ________________.

In plant cells, a cell plate forms between the two cells.

In animal cells, a cleavage furrow forms as the parent cell is pinched into two cells.
Telophase/Cytokinesis:

Telophase has to do with the nuclei forming around the two sets of chromosomes (which are uncoiling), at opposite poles of the cell.

Cytokinesis is the process by which the ________________ divides to form two new cells.
Actively growing tissue, such as the tip of a plant root, will have cells undergoing mitosis.

- Identify as many stages as you can in the picture below.
Cancer

Cancer is caused by ____________________ in which cells don’t respond to ________cell cycle ____________, such as contact inhibition.

- **Benign growth:**
  ____________________.

- **Malignant growth:**
  ____________________.

- **Metastasis:**
  ________ of cancer in the ____________
Why Cancer Kills

• Since cancer cells are always undergoing cell division (mitosis) they do not ___________________.
  • ________________________________________________________________________.
• They deprive surrounding normal tissue of ____________________________.
• Eventually, there are not enough healthy, normal cells in the organ to allow it to _______________.
  • ________________________________________________________________________.
Hyperplasia: proliferation of cells (many cells being produced)
Dysplasia: abnormality in maturation of cells, expansion of immature cells
In Situ Cancer: the tumor is found in the tissue it began in.
Invasive Cancer: the tumor has spread into neighboring tissues.
How does a cell become cancerous?

- Certain genes (genetic codes) are ________________(altered) and no longer ________________properly.

- Two types of genes that regulate the cell cycle:
  1. Proto-oncogenes: ________________cell division (______________)
  2. Tumor Suppressor Genes: ________________cell division (the______________)
Loss of Normal Growth Control

Normal cell division

Cell damage—no repair

Cell Suicide or Apoptosis

Cancer cell division

First mutation

Second mutation

Third mutation

Fourth or later mutation

Uncontrolled growth
Proto-oncogenes

- ________________________ cell division

- Produce proteins that

  __________________________________________________________

  - _______________________: Mutated form of the gene that ________the ________protein

  - The gas pedal is “____________________________.”
Abnormal Cell Growth: Oncogenes

Normal genes (regulate cell growth)

1st mutation (leads to accelerated cell division)

Proto-oncogene to oncogene
Tumor Suppressor Genes

- They inhibit cell division
- They produce an ________________ protein for cell division
  - Mutated genes may not ________________ the protein
  - The brakes “______________”.
Mutations in Tumor Suppressor Genes

- Normal genes (regulate cell growth)
- Tumor suppressor genes
- 1st mutation (susceptible carrier)
- 2nd mutation or loss (leads to cancer)
- Active oncogene
- No brakes!
Cancer Tends to Involve Multiple Mutations

Benign tumor cells grow only locally and cannot spread by invasion or metastasis.

Malignant cells invade neighboring tissues, enter blood vessels, and metastasize to different sites.

Mutation inactivates suppressor gene
Cells proliferate
Mutations inactivate DNA repair genes
Proto-oncogenes mutate to oncogenes
More mutations, more genetic instability, metastatic disease