

BIOL 120 Genetics-Cell Cycle, Mitosis, Cancer

- **Somatic Cells**
 - body cells
 - mitosis**
 - for growth/repair
 - makes identical copies
- **Germ Cells**
 - sex cells
 - meiosis**
 - to make gametes (egg/sperm)
 - makes unique cells
 - $\frac{1}{2}$ chromosomes #
 - * one of each type of chromosome

Overview of Cell Division (somatic Cell)

1. Replication: DNA is duplicated
2. Mitosis: The two quantities of DNA are moved to opposite sides of the parent cell
3. Cytokinesis: The parent cell splits into two daughter cells

The Cell Cycle

1. Interphase: DNA is copied
2. Mitosis: DNA split equally into two daughter cells
3. Cytokinesis: Parent Cell is cleaved in half

Uncondensed/Condensed

During **Interphase**, the chromosomes are uncondensed or usable.

During **M Phase** (Mitosis), the chromosomes are condensed or movable.

Chromosomes and DNA Replication

Chromatin – a mass of genetic material composed of DNA and proteins that condense to form chromosomes.

Chromatid – one of the two identical copies of DNA making up a duplicated chromosome, which are joined at their centromeres.

DNA Replication

Precedes cell division.

A) The double-stranded DNA molecule is copied – first by splitting the molecule in half up the middle of the helix. New nucleotides are added to each side of the original parent molecule. Results in the production of 2 identical daughter DNA molecules from 1 parent molecule. Each daughter DNA molecule contains half of the parental DNA and half of the newly synthesized DNA.

B) The DNA polymerase enzyme moves along the unwound helix, tying together adjacent nucleotides on the daughter DNA strand.

The cell is now ready to divide.

Variations

- Brain and nerve cells form in the embryo and then never divide.
- Many leaf cells: divide as young leaves, stop dividing and simply increase in size by growing
- Bone marrow cells: divide rapidly; forming as many as 20,000 new cells per minute.

Cancer

- Two part failure in the cell cycle

Summary of Cancer

- Uncontrolled cell division
- Suppressor genes are unable to turn off growth, repair DNA, or cause cell suicide
- Metastasis causes cells to migrate
- They are immortal

Detecting Cancer

- Risk factors: chemical, sun exposure, nutrition & health, age
- Genetic testing: looking for mutations
- Detecting chemicals in the blood: certain cancer cells secrete proteins that are detectable in the blood
- Biopsy: take a portion of tumor and examine the cells

Treating Cancer

- Chemotherapy: highly toxic chemicals that will kill cells
- Cancer cells become resistant at 1 cell per million. Average tumor contains 1 billion cells, so ~1,000 are resistant

- Radiation therapy: high energy radiation pointed at tumor cells will destroy DNA, therefore destroying the cell

The Immune System's role in Cancer

- Cancer cells can sometimes be recognized by the immune system and T-cells can mount an attack and destroy cancerous cells.
- Immune system may become less effective at finding and destroying cancer cells as we age.
- Cancer cells are part of the body and sometimes do not cause a strong immune response.
- Many tumors secrete substances that suppress the immune system.

Caution

- Signs of Cancer
- See Your Doctor

- **C**hange in bowel or bladder habits
- **A** sore that does not heal
- **U**nusual bleeding or discharge
- **T**hickening or lump
- **I**ndigestion or difficulty swallowing
- **O**bvious change in wart or mole
- **N**agging cough or hoarseness