

CORNELL NOTES

Directions: You must create a minimum of 5 questions in this column per page (average). Use these to study your notes and prepare for tests and quizzes. Notes will be stamped after each assigned sections (if completed) and turned in to your teacher at the end of the Unit for scoring.

UNIT 2: CELLS

Chapter 5: Cell Growth and Division

I. The Cell Cycle has _____ main stages (5.1)

A. The _____ **cycle** is a regular pattern of **growth, DNA replication, and cell division in eukaryotic cells**

1. Originally divided into _____ stages (observations were limited by microscopes at the time)

a. Interphase- cell appeared to be at _____

b. _____ - cell dividing

2. Improved techniques and tools later allowed scientist to identify _____ distinct stages

a. **Gap 1 (G₁)** - cell carries out _____ functions

1). **Cell increases** in _____

2). **Organelles increase** in _____

b. **Synthesis (S)** - Cell makes copy of its nuclear _____.

1). **Synthesis** means "the combining of _____ to make a _____."

2). By end of S stage, cell nucleus contains _____ complete **sets of DNA**

c. **Gap 2 (G₂)** - Cells continue to carry out normal functions

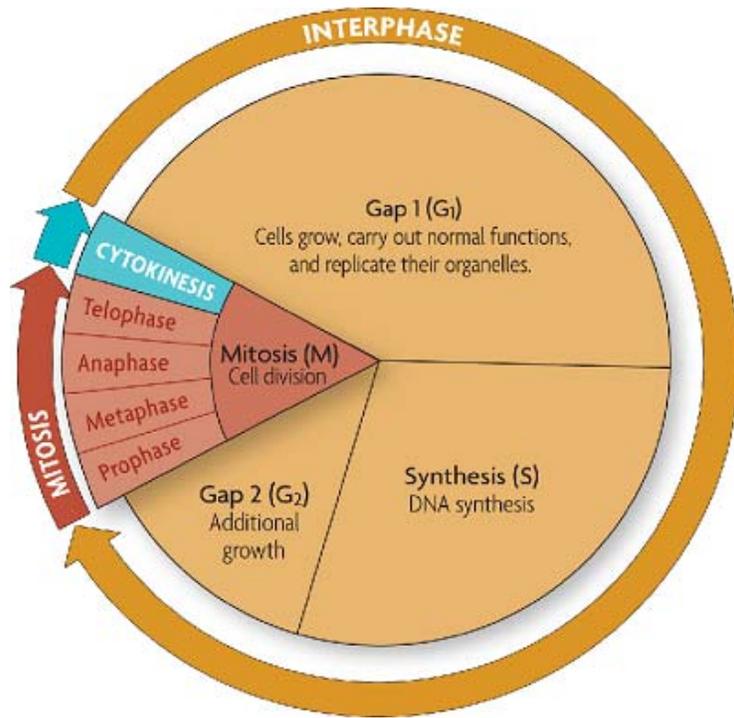
1). Additional _____ occurs

2). **Critical checkpoint** (before cell goes through _____ cell must be adequate size, undamaged DNA)

d. **Mitosis (M)** - Includes _____ processes

1). **Mitosis - Division** of cell _____ and its _____

2). **Cytokinesis** - Process that _____ the **cell** _____. Two identical _____ cells produced



B. Cells divide at different rates

1. _____ of cell division **vary widely**
 - a. _____ cells typically divide much _____ than **eukaryotic** cells
 - b. Rate at which cells divide linked to body's _____ for those cells.

2. In **human cells**, **S**, **G₂**, and **M** stages together usually take about _____ **hours**
 - a. Length of **G₁** stage _____ most for different cell types
 - b. Rate of cell division greater in _____ and _____

FIGURE 5.2 CELL DIVISION	
CELL TYPE	APPROXIMATE LIFE SPAN
Skin cell	2 weeks
Red blood cell	4 months
Liver cell	300–500 days
Intestine—internal lining	4–5 days
Intestine—muscle and other tissues	16 years

C. Cell size is limited

1. Cells have **upper** and **lower** _____ limits

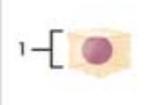
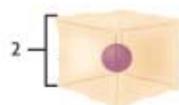
a. Must be **big** enough to “hold” everything

b. Upper limit due to ratio of cell _____ **area** to _____

1). Oxygen, nutrients, and wastes move across the **cell** _____ (surface of cell)

2). As cell grows, its surface area (cell membrane) does not grow as fast as _____ - too **small** for **adequate exchange of** _____

2. To maintain suitable cell size, **growth** and **cell division** must be _____.

Relative size			
Surface area (length × width × number of sides)	6	24	54
Volume (length × width × height)	1	8	27
Ratio of surface area to volume	$\frac{6}{1} = 6:1$	$\frac{24}{8} = 3:1$	$\frac{54}{27} = 2:1$

II. Mitosis and Cytokinesis (5.2)

A. Chromosomes _____ at start of mitosis

1. _____ - one long continuous thread of **DNA**

a. Consists of numerous _____

b. You have _____ **chromosomes**

c. Must be _____ to fit into cell nucleus

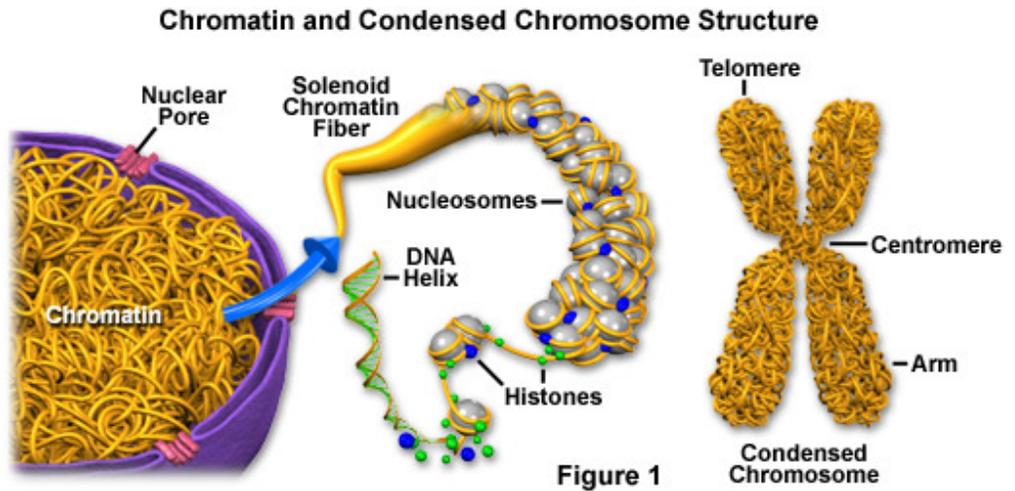
1). **DNA wraps around** _____ called _____

2). When loosely condensed called _____

d. Chromosome looks like “**X**” (each half is identical DNA- called a _____)

e. **Sister chromatids** held together by _____

f. _____ - found at ends of DNA molecules and prevent _____ from coming apart



B. Mitosis and cytokinesis produce two genetically _____ daughter cells

1. **Interphase** - important role in preparing cell to divide (____ sets of _____ and are _____ enough)

2. **Mitosis** - divides cell's _____ into **two genetically identical nuclei**, each with its own single, full set of _____

3. ____ main phases of Mitosis

a. **Prophase** - DNA _____ into tightly coiled **chromosomes**. **Nuclear envelope** breaks down. _____ move to poles and _____ **fibers** form

b. **Metaphase** - **Spindle fibers** attach to each _____. Chromosomes align along cell _____ (middle)

c. **Anaphase** - _____ separate to _____ sides of cell

d. **Telophase** - _____ starts to form. **Chromosomes** begin to uncoil and **spindle fibers** fall apart

4. **Cytokinesis** - division of _____. Different in animal and plant cells.

III. Regulation of Cell Cycle (5.3)

A. **Internal** and **external** factors _____ cell division

1. External factors

- Include _____ and _____ factors
- Once a cell _____ another cell it stops dividing
- Many cells release chemical signals (**growth factors**) that trigger _____

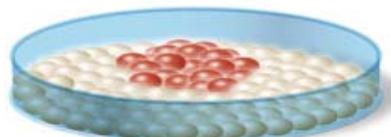
2. Internal factors

- External** factors trigger _____ factors that affect _____ cycle
- Two of the most important internal factors are _____ and _____

Normal cell growth



Cancerous cell growth



- _____ - programmed **cell death** (signals activate genes producing **self-destructive enzymes**)

B. **Cell division** is uncontrolled in _____.

1. **Cancer** - common name for class or diseases characterized by _____ **cell division**

- Form from disorganized clumps called _____
- _____ types of tumors
 - 1). **Benign** - cancer cells typically remain _____ together.
 - 2). **Malignant** - Some cell break away (or _____) from the tumor and spread through body

2. **Cancer cells** come from normal cells that have suffered _____ to genes that make proteins

involved in cell division

a. damage from **radiation, inherited, chemicals, ultraviolet radiation**

b. _____ - Substances known to cause cancer

c. **Cancer** can be treated with both _____ and _____. (these typically kill both cancerous and healthy cells)

IV. Asexual Reproduction (5.4)

A. _____ **fission** is similar in function to mitosis

1. **Reproduction** occurs in _____ ways (_____ and _____ reproduction)

a. **Sexual reproduction** - joining of two specialized cells (_____ - egg and sperm), one from each parent

1). Offspring are _____ unique

2). Mixture of _____ from both parents

b. **Asexual reproduction** - creation of offspring from a single parent. **Offspring genetically**

2. **Binary fission** - _____ reproduction of single-celled organism

a. Occurs in _____

b. **binary fission** and _____ have similar results

B. **Advantages** and **Disadvantages** of **Asexual reproduction**

1. In environments that _____, **asexual** may be better. If they are well suited to environment may be more efficient

2. In changing environments _____ reproduction produces genetic diversity which raises chances for survival

V. Multicellular Life (5.5)

A. **Multicellular** organisms depend on interactions among different _____ types.

1. Cells _____ and work together in groups that form increasingly large, more complex structures

a. _____ → _____ → _____ → _____

b. **Tissue** - **group** or **cells** that _____ **together** to perform a **particular** _____

c. **Organ** - **group** of _____ that **work together** to perform **specific function** or related functions

d. **Organ system** - _____ that carry out **similar** _____

1). Organ systems work together to maintain _____

2). Occurs in _____ and _____

B. Specialized cells perform specific functions

1. **Cell differentiation** - process by which unspecialized cells develop into their mature _____ and _____

a. Every cell in body has full set of _____

b. Cells only use certain _____ and become specific (ie. : bone cells, muscle cells, nerve cells, etc.)

C. Stem cells can develop into different cell types

1. **Stem cells** - _____ type of body cell

a. Can divide and renew themselves for _____ periods of time

b. Remain _____ in form

c. Develop into a variety of _____ cell types

2. Stem cells can be categorized by their _____ or potential to develop into _____ cell types and different _____.

3. _____ **Stem Cells** - partially undifferentiated cells located among the specialized cells or many organs and tissues

4. _____ **Stem Cells** - come from donated embryos grown in a clinic

5. Research and Treatment Hope

a. Stem cells have long been used to treat _____ and _____

b. Might be used to repair damaged _____

c. Used to cure _____ (i.e. diabetes)