**Cell Growth and Division Chapter 10 Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**10.1 Cell Growth and Division**

* Limits to Cell Size
	+ 1) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ – as size increases, DNA is not able to provide information for all the needs of the cell. (Library analogy)
	+ 2) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- If a cell gets too large, the surface area of the cell is not large enough to get oxygen and nutrients in and waste out

 -surface area to volume ratio

 -traffic analogy

* **Cell Division** = the process in which a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **\_\_\_\_\_\_\_\_\_\_ Reproduction** = the production of genetically identical offspring from a single parent
* **\_\_\_\_\_\_\_\_\_\_ Reproduction** = offspring inherit some of their genetic information from each parent

**10.2 The process of Cell Division**

* **Chromosomes** – threadlike structures of DNA and protein that contains genetic information
	+ Prokaryotes – chromosomes are in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Eukaryotes – chromosomes (chromatin) are in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- Many eukaryotes have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ which make it possible to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Steps of the Cell Cycle

* Interphase (G1 Phase, S Phase, G2 Phase)
* Cell Division
	+ Mitosis (Prophase, Metaphase, Anaphase, Telophase)
	+ Cytokinesis

 

Important Cell Structures Involved in Mitosis

* **Chromatid** – each strand of a **duplicated** chromosome
* **Centromere** – the area where each pair of chromatids is joined
* **Centrioles** – tiny structures located in the cytoplasm of animal cells that help organize the spindle
* **Spindle** – a fanlike microtubule structure that helps separate the chromatids

Phases in the Cell Cycle

* **Interphase** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ **\_\_\_\_\_\_\_\_\_\_G1 Phase** = cell growth, make new proteins and organelles
	+ **\_\_\_\_ Phase** = New DNA is made (doubles)
	+ **\_\_\_\_\_\_\_\_\_\_ Phase** = Organelles needed for cell division are made
* **Mitosis** = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ **Prophase**
		- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (Chromosomes become visible)
		- Centrioles separate
		- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ starts to form
	+ **Metaphase**
		- Chromosomes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ across the center of the cell.
		- Spindle fibers connect the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of each chromosome

to the two poles of the spindle.

* + **Anaphase**
		- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- Individual chromosomes are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on spindle fibers
	+ **Telophase**
		- Chromosomes are at \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ends of the cell
		- Chromosomes spread out into \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ reforms
		- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ breaks apart



 \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_

* **Cytokinesis** = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ pinches in half
	+ Each of the two daughter cells has an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ set of chromosomes

**10.3 Regulating the cell cycle**

* How do cells know when to divide?????
	+ Some cells don’t divide once they are formed (muscle and nerve)
	+ Cells in the bone marrow that make blood cells and digestive tract divide as fast as every few hours
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** = a family of proteins that regulates the cell cycle in eukaryotes
* **Regulatory proteins** instruct the cells when to divide
	+ Internal regulatory proteins make sure that steps in the cell cycle are completed before the next step occurs
	+ External regulatory proteins direct the cell to speed up or slow down the cycle
		- Ex. Growth factors – stimulate the division of the cell (embryonic development and wound healing)
* **Apoptosis** = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Cells either are damaged and die or they have programmed cell death
	+ In apoptosis the cell and chromatin shrink, cell membrane breaks and other cells recycle it
	+ Ex – mouse foot, human hand

Cancer

* **Cancer** = occurs when some of the body’s cells \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Cancer cells do not respond to the signals that regulate growth and divide uncontrollably
	+ Cancer cells absorb nutrients needed by other cells, block nerve connections, and prevent organs from functioning.
* **Tumor** = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ **\_\_\_\_\_\_\_\_\_\_\_\_\_\_ tumors** = noncancerous tumors that do not spread to other tissue
	+ **\_\_\_\_\_\_\_\_\_\_\_\_\_\_ tumor** = cancerous tumor that invade and destroy surrounding tissue
	+ **Metastasis** = the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Causes of cancer
	+ Caused by defects in the genes that regulate cell growth and development
		- Sources of gene defects include
			* Tobacco, radiation exposure, defective genes, viral infection
		- Many cancers have a defective p53 gene which halts the cell cycle until chromosomes have been replicated
* Treatment of cancer
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ – chemical compounds that kill cancer
		- Targets rapidly dividing cells and also interferes with cell division in normal cells (side effects)

**10.4 Cell Differentiation**

* During the development of an organism, cells differentiate into many types of cells.

Stem Cells

* **Stem cells** = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cells**= can develop into any type of cell in the body
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** = can develop into most (but not all) of the body’s cell types
	+ Inner cells in the early embryo (a hollow ball called a blastocyst)

**Embryonic Stem Cells**

* + Found in the inner cells mass of the early embryo.
	+ Embryonic stem cells are pluripotent. (cells have the capacity to produce most cell types in the human body)

**Adult Stem Cells**

* + Adult stem cells are **multipotent.** They can produce many types of differentiated cells
	+ Adult stem cells of a given organ or tissue typically produce only the types of cells that are unique to that tissue.

**Stem Cell Research**

* + Repair or replace badly damaged cells and tissues.
		- heart attack
		- stroke
		- spinal cord injuries.

**Stem Cells – the ethical concerns**

* + Embryonic stem cells are harvested from early embryos
		- Most methods \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the embryo
		- In the past, US limited funding for the embryonic cell lines used for research - NIH has 136 embryonic stem lines in the US that are currently being used for research
		- Research is being done to
			* harvest embryonic stem cells without destroying the embryo
			* turning adult stem cells into pluripotent cells
			* Embryonic stem cells out of umbilical cord blood

