Stem Cell Review Worksheet

Name:_____ **Date:** _____

As you listen to the presentation, fill in the definitions below.

Four main components of mammalian cells:

1. Nucleus: Center of the cell responsible for DNA storage, controls activity within the cell.

2. Membrane: Plasma membrane serves as the barrier between the cell and the outside environment. It is composed of a phospholipid bilayer that selectively allows for passage of small molecules (ex. water, oxygen).

3. Organelles: Specialized structures in the cell, which contribute numerous functions important for life. Examples are mitochondria, golgi apparatus, smooth endoplasmic reticulum, etc.

4. Cytoplasm: A water-like substance that fills the inside of the cell, provides support for organelles, as well as catalyzing reactions.

Levels of organization in the body:

DNA: Genetic information, stored in the nucleus of the cell.

Cell: Smallest unit of life in the body.

Tissue: Comprised of many cells, to form a functional unit.

Organ: Made of many tissues, to form a functional unit.

Organism: Comprised of many organs, to form a human.

What are Stem Cells: what does it mean to **differentiate** and **self-renew,** unlike other somatic cells?

Differentiate: The ability of the stem cell to develop into many different types of cells in the body.

Self-renewal: The ability of the stem cell to self-regenerate many times. This contributes to the stock of stem cells in the body.

What do stem-cells do?

The healing process:

1. Fibrosis: Initial reaction, the point where a clot is formed to stop the bleeding.
2. Inflammatory: Immune cells begin to fight any infection and get rid of debris.
3. Proliferation: New cells are formed and move to the site of healing.
4. Remodeling: New tissue continues to mature and increase strength.

Other examples of stem-cells in the body:

Broken bone: Stem cells help to regrow bone cells after a broken bone.

Heart attack: Stem cells can aid in healing and regrowth of heart muscle after this traumatic event.

Hair regrowth: Hair cells are regrown daily thanks to stem cells.

Intestinal lining: The lining of the intestines can be damaged when "bad" bacteria and viruses infect the body, and stem cells help to regenerate this lining each day.

Types of stem-cells:

EMBRYONIC stem cells:

What are they? Embryonic stem cells are pluripotent cells that can differentiate into any cell of the human body

Where do we find these cells? Embryonic stem cells are found in the blastocyst of a human embryo (4-7 days after fertilization)

Pros: Easy to find/isolate, pluripotent, immortal.

Cons: Potential of tumor formation, ethical concerns with where life begins.

ADULT stem cells:

What are they? These cells are multipotent and can be partially or fully differentiated. They are important in wound healing, maintaining cell populations, and renewing cells

Where do we find these cells? This is a specific region in the body where adult stem cells live and grow. Adult stem cells are isolated from these regions for research, treatment, etc.

Pros: Ethically sound method of stem cell use, multipotent.

Cons: Difficult to locate/isolate.

Adult stem cell types:

Neural: Become neurons & neural support cells. These stem cells are found in subventicular and subgranular zones.

Epithelial: Will become skin, intestinal gland and vessel lining. They are found in the niches of the skin, hair, etc

Hematopoietic: These will differentiate into the various cells of the blood. Found in the bone marrow and umbilical cord blood

Mesenchymal: Differentiate into cells of the cartilage, fat, muscle, etc. Found in bone marrow, adipose tissue, and umbilical cord blood.

Induced Pluripotent stem cells:

What are they? iPS cells are produced through transdifferentiation (reprogramming) of somatic cells

Where do we find these cells? iPS cells are taken from skin or blood cells

How are they reprogrammed? Transcription factors are introduced into the cell to change gene expression.

What cells can they become? Reprogrammed iPS cells are pluripotent and can differentiate into any cell type.

Pros: Pluripotent, immortal, easy to create.

Cons: Teratoma formation

Why do we care in medicine?

What do stem cells do in the body?

Stem cell therapies:

Alzheimer's: Stem cells can replace diseased neural cells with new neurons

Blindness: Replace dead retinal cells with new cells.

Cancer: Researchers can utilize regenerative ability to study cancer growth through stem cells

Diabetes: Stem cells can replace insulin pancreas cells.

Heart Attack: Regrow heart muscle cells with the help of stem cells.

Vascular Grafts: Creation of medical devices with stem cells reduces inflammatory response