{Ms. Carufel} **Mitosis Week Study Guide + Unit Review**
12/10/2020

This study guide will detail the topics and Learning Objectives that will be present on the unit exam:

1. Cell Organelles present during mitosis
2. Cell organelle functions during mitosis
3. Phases of the cell cycle
4. Phases of mitosis
5. What is mitosis?
6. What does mitosis help our cells to achieve?
7. DNA Replication during mitosis
8. DNA structure during mitosis
9. How long does it take to go through the process of mitosis?
10. During which stage of the cell cycle is the DNA copied?
11. Important mechanisms occurring during each cell phase of **mitosis.**
12. Important mechanisms occurring during each phase of the **cell cycle.**
13. The differences between cancerous cells and healthy cells.
14. What is cancer?

Review Activities:

https://www.playfactile.com/mitosisreviewgame : Mitosis Jeopardy Review Game (Can be played alone, as a class, or in small groups. Preferably it will be played as a class on review day, class can split into two or three groups, so fun and easy to use!!)

https://biomanbio.com/HTML5GamesandLabs/Genegames/mitosismoverpage.html (Mitosis Review game, can be played solo.)

Written Review of Mitosis Unit: Full Notes

Please do not hesitate to read pages 134-147 in your books “Biology” by Stephen Nowicki (Campbell Pearson) in addition to reading the full notes. All unit exam questions will be taken from your notes, and your book pages 134-147.

Key Vocab

A. Cell cycle
B. Mitosis
C. Cytokinesis

D. Synthesis
E. Checkpoint

5.1 The Cell Cycle (Pages 134-137 Holt McDougal Biology by Stephen Nowicki)

The cell cycle is the regular pattern of growth, DNA duplication, and cell division that occurs in eukaryotic cells.

There are four main stages in the cell cycle, gap 1, synthesis, gap 2, and mitosis.

Gap 1 (G1)

-is the first stage of the cell cycle. The cell carries out normal functions and continues to increase in cellular sizes and number of organelles.

A cell spends most of its time in this phase, although the exact length of time varies depending on cell type.

During G1, cells must pass a critical checkpoint before it can continue on into the synthesis phase. A checkpoint is a place along a road, border, etc., where travelers are stopped for inspection. a point or item, especially in a procedure, for notation, inspection, or confirmation.

Synthesis (S)

The second stage of the cell cycle. Synthesis means “the combining of parts to make a whole”. During the S stage, the cell makes a copy of its nuclear DNA.

In eukaryotes, DNA is located in the nucleus.

By the end of S phase, the cell contains two complete sets of DNA.

Gap 2 (G2)

Gap 2 is the third stage of the cell cycle. During G2, cells continue to carry out their normal functions and additional growth occurs.

Like G1, this stage includes a critical checkpoint. These ensure that the cell is prepared to undergo mitosis and division.

Mitosis (M)

Mitosis is the fourth stage of the cell cycle and includes two processes, Mitosis and cytokinesis.

Mitosis is the division of the cell's nucleus and its contents. During mitosis the nuclear membrane dissolves, the duplicated DNA condenses around proteins and separates, and two new nuclei form.

Cytokinesis is the process that divides the cell cytoplasm. The result is two daughter cells that are genetically identical to the original cell.

5.2 Mitosis and Cytokinesis (pages 138-143 in Holt McDougal Biology by Stephen Nowicki)

Key Vocab

A. **Chromosome**
B. **Histones**
C. **Chromatin**
D. **Chromatid**
E. **Centromere**
F. **Telomere**
G. **Prophase**
H. **Metaphase**
I. **Anaphase**
J. **Telophase**

DNA is a double-stranded molecule made of four different subunits called nucleotides. A chromosome is one long continuous thread of DNA that consists of numerous genes along with regulatory information. Each of your body cells have 46 chromosomes each.

If stretched out straight and laid end to end, the DNA in just one of your cells would be 10 feet long!

DNA wraps around proteins that help organize and condense it. During interphase, or when a cell is not dividing, DNA is loosely organized (Looks like spaghetti) During mitosis, however, your chromosomes are tightly condensed.

At almost all times during the cell cycle, each of your chromosomes is associated with a group of proteins called histones.

DNA wraps around histones at regular intervals, similar to beads on a string. Parts of the histones interact with each other, further compacting the DNA.

At the spaghetti stage, the loose combination of DNA and proteins is called chromatin.

One half of a duplicated chromosome is called a chromatid.

Together, the two identical chromatids are called sister chromatids. Sister chromatids are held together at the centromere, a region of the condensed chromosome that looks pinched. In addition, the ends of DNA molecules form structures called telomeres, which are made of repeating nucleotides that do not form genes. They prevent the ends of chromosomes from accidentally attaching to each other, and they help prevent the loss of genes.

The combined processes of mitosis and cytokinesis produce two genetically identical daughter cells.

Interphase

Interphase plays an important role in preparing the cell to divide. It provides critical time for the duplication of organelles and for DNA replication . By the end of interphase , an individual cell has two full sets of DNA, or chromosomes, and is large enough to divide.

Mitosis

1. During prophase, chromatin condenses into tightly coiled chromosomes. Each consists of two identical sister chromatids. The nuclear envelope breaks down, the nucleolus disappears, and the centrosomes and centrioles begin to migrate to opposite sides of the cell.

   Organized microtubules called spindle fibers grow from the centrioles and radiate toward the center of the cell.

2. In metaphase, the spindle fibers attach to a protein structure on the centromere of each chromosome and align the chromosomes along the cell equator, around the middle of the cell.
3. During anaphase, sister chromatids separate from each other. The spindle fibers begin to shorten, which pulls the sister chromatids away from each other and toward opposite sides of the cell.
4. In telophase, a complete set of identical chromosomes is positioned at each pole of the cell. The nuclear membranes start to form, the chromosomes begin to uncoil, and the spindle fibers fall apart.

Cytokinesis

Cytokinesis divides the cytoplasm into two cells and completes a full stage of the cell cycle. Cytokinesis differs in animal and plant cells. In animal cells, the membrane forms a furrow, or trench, that is pulled inward by tiny filaments, like a drawstring. Gradually the membrane pinches closed, forming a separate cell around each nucleus.

<u>5.3 Regulation of the Cell Cycle</u> (pages 144-147 in Holt McDougal Biology by Stephen Nowicki)

Key Vocab:

A. **Growth Factor**
B. **Apoptosis**
C. **Cancer**
D. **Benign**
E. **Malignant**
F. **Metastasize**
G. **Carcinogen**

Both external and internal factors regulate the cell cycle in eukaryotic cells. External factors come from outside the cell. They include messages from nearby cells and from nearby cells of the organism's body. Internal factors come from inside the cell and include several types of molecules found in the cytoplasm.

Many cells also release chemical signals that tell other cells to grow. For example, growth factors are a broad group of proteins that stimulate cell division.

Growth factors bind to receptors that activate specific genes to trigger cell growth.

Just as some cells need to grow and divide, other cells need to die. Apoptosis is the name of programmed cell death. It occurs when internal or external signals activate genes that help produce self-destructive enzymes. Cancer is the common name for a class of diseases characterized by uncontrolled cell division. It arises when regulation of the cell cycle breaks down. Cancer cells can also continue to divide in the absence of many of the growth factors required for division in healthy cells. As a result, they divide much more often than do healthy cells.

Cancer cells form disorganized clumps called tumors. In a benign tumor, the cancer cells typically remain clustered together. This means the tumor may be relatively harmless and can probably be cured by removing it.

However if a tumor is malignant, some of the cancer cells can break away, or metastasize, from the tumor. These breakaway cells can be carried in the bloodstream or lymph system to other parts of the body, where they can form more tumors, called metastases. Cancerous cells are harmful, because they do not perform their assigned task in the body. They cannot transmit messages, like neurons, or exchange oxygen like cells in the lung. They are taking up space, energy, and nutrients and not performing their jobs. Cancer cells come from normal cells that have suffered damage to the genes that help make proteins involved in cell-cycle regulation. Substances known to produce or promote the development of cancer are called carcinogens. These include tobacco smoke and certain air pollutants, which are both associated with lung cancer.