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**Unit 6 Cell Division Review Packet**

**Topic #1: The Cell Cycle and Mitosis**

1. What events take place in the cell during interphase?
* **G1 phase** (first gap): the cell grows by producing proteins and organelles.
* **S phase** (synthesis): the cell makes a copy of its DNA
* **G2 phase** (second gap): the cell makes molecules / organelles needed for cell division
1. How does the length of interphase change when the rate of cell division increases? How does the length of interphase change when the rate of cell division decreases?

If cells are dividing rapidly the length of interphase decreases and the reverse would be true if they were not dividing. For example: G0 would take a longer amount of time.

1. What is the G0 stage? Why might a cell enter the G0 stage?

cell leaves the normal cell cycle and stops dividing Ex: liver cells (can reenter the cell cycle if the liver is injured

and damage cells must be replaced); muscle / nerve cells (never divide again once they are mature)

1. Compare and contrast the organization of DNA in a prokaryotic cell vs. an Eukaryotic Cell

The prokaryotic genome is typically a single, long DNA molecule. In prokaryotic cells, there are also small circles of DNA called plasmids that are separate from the main genome. A eukaryotic genome is much larger than a prokaryotic genome; a human cell generally contains much more DNA than a bacterial cell. In a human cell that is preparing for division or actively dividing, DNA is found as chromosomes, which are strings of chromatin that are super-coiled.

1. In what ways is prokaryotic binary fission different from eukaryotic mitosis?

Process is much simpler due to lack of nucleus – DNA is replicated, plasma membrane elongates, pinches and separates.

1. Why is cytokinesis necessary after mitosis?

Need cytokinesis in order for the cytoplasm to break apart. If it didn’t occur you would see one massive cell with many nuclei inside.

1. How is cytokinesis different in animal vs. plant cells?

The cleavage furrow splits animal cells (actin and myosin proteins interact to contract a ring around the membrane). The cell plate splits plant cells (cell wall materials are deposited by vesicles from the Golgi)

1. What are the purposes of mitosis in multicellular organisms?

Replacing cells that die from normal wear and tear

Growth and development from a single fertilized egg (zygote)

Reproduce asexually (ex: plants can grow by “grafting” / “cutting”)

1. What is the difference between diploid (2n) and haploid (n) cells?

Somatic cells are considered “diploid,” because they have two sets of chromosomes (Hint: “di” means two!). . Gamete cells are considered “haploid” because they have one set of chromosomes. Mitosis creates diploid daughter cells from parent diploid cells.

1. You should be able to describe the main processes that are occurring during each stage of the Cell Cycle and Mitosis.

**Topic #2: Meiosis**

1. How many daughter cells are created in meiosis? What types of cells (diploid or haploid) are these daughter cells?

4 daughter cells are created that are haploid

1. When do synapsis and crossing over occur during meiosis? What is the purpose of this process?

They both happen during Prophase I

* Synapsis = pairing of homologous chromosomes
* Allows for crossing over = exchange of DNA between homologous pairs
1. Describe the differences between metaphase I and metaphase II of meiosis.

Metaphase I - Homologous pairs line up at the metaphase plate

Metaphase II - Chromosomes line up SINGLE FILE along the metaphase plate

1. Describe the differences between anaphase I and anaphase II of meiosis.

Anaphase I - Homologous chromosomes separate (chromatids on a single chromosome DO NOT separate yet)

Anaphase II - Chromosomes separate into two sister chromatids that move to opposite ends of the dividing cell

1. How does the amount of DNA in a diploid cell that has just copied its DNA in preparation for meiosis compare to the amount of DNA in a haploid daughter cell at the end of meiosis II?

The amount of DNA at the beginning of Meiosis would be double the normal amount (46x2) and at the end of Meiosis II would be half the normal amount (23).

1. Why must gametes (eggs and sperm) be haploid cells?

Meiosis in humans produces sperm and egg cells with 23 chromosomes. During fertilization, one sperm meets up with one egg to create a zygote with 46 chromosomes. This zygote is considered diploid because it has two sets of chromosomes. This diploid zygote can divide by mitosis to create body cells in the new baby with 46 chromosomes each.

1. Why do populations of organisms that use meiosis and sexual reproduction have an evolutionary advantage over populations of organisms that use asexual reproduction?

Sexual reproduction produces offspring that are genetically different from the parents; this creates genetic variation within a population of organisms and makes the population less susceptible to environmental stressors (ex: a disease may only wipe out organisms with a particular gene).

* Variation from crossing over: mixing of genes between homologous chromosomes… creates an INFINITE variety of possible genetic combinations
* Variation from independent assortment of chromosomes: random alignment of homologous chromosomes along the metaphase plate during Metaphase I… independent assortment in humans produces 223 (8,388,608) different combinations in gametes
* Variation from independent assortment: which sperm fertilizes which egg?... any two parents will produce a zygote with over 70 trillion (223 x 223) possible diploid combinations (and this doesn’t even take into account crossing over!)

 **Topic #3: Cell Cycle Regulation**

1. How are cancer cells different from normal cells?

Cancer cells exhibit neither density-dependent inhibition nor anchorage dependency. Normal cells divide 20-50 times in culture conditions, then stop, age, and die; cancer cells are “immortal”

1. What is the difference between a benign and a malignant tumor?

If the abnormal cells remain at the original site, the lump is called a benign tumor. Cells from a different type of tumor—a malignant tumor—can break off and spread to other parts of the body and cause the growth of new tumors in other locations. An individual with a malignant tumor is said to have cancer.

1. What occurs at the M phase checkpoint?

The M phase checkpoint makes sure that all chromosomes are attached to the spindle at metaphase before anaphase

1. Why do most cancer treatments target rapidly dividing cells?

Because those cells are usually the ones with/susceptible to cancer