Mendelin and cellular genetics

Health & Medicine

Mendelian and Cellular Genetics Mitosis Link: http www. emc. maricopa. edu/faculty/farabee/BIOBK/BioBookmito. html Eukaryotic cell division is a complex process involving replication, chromosomal segregation and splitting of the daughter cells (i. e., cytokinesis). Mitosis is the process of division of the diploid somatic cells in the eukaryotes to produce two identical daughter cells. It occurs in several stages namely prophase, metaphase, anaphase and telophase followed by cytokinesis.

Mitosis is initiated in the prophase when the nuclear envelope dissolves and the chromosomes condense and attach to the centrosome through the microtubules and kineticores. The spindle also forms at this stage. In the next phase i. e., the metaphase, the chromosomes, in the form of chromatids held together by a centromere, migrate to the equator, and line up in a " plate" between the two centrosomes. In the anaphase, the centrosomes separate, the spindles shorten and pull the chromosomes to the two opposite poles. The last phase that is, the telophase, is the physical division of the cell into daughter cells brought about by the re-formation of the nuclei and nuclear envelope around the chromosomes at the two poles. The two daughter cells formed are split apart by the process of cytokinesis.

2. Meiosis

Link: http://www. emc. maricopa. edu/faculty/farabee/BIOBK/BioBookmeiosis. html

The process, by which the germ cells or gametes are generated is called meiosis. Meiosis is made up by two subsequent processes, both of which resemble mitosis. During the formation of gametes, the number of chromosomes is reduced by half, and the number gets restored during fertilization. Unlike mitosis which produces two diploid cells, meiosis

produces four haploid cells. Meiosis occurs as two nuclear divisions, meiosis I and II. Meiosis I halves the ploidy level while meiosis II divides the chromosomes similar to mitosis. Meiosis also occurs in several stages.

3. DNA Structure and Chromosome Structure

Link: http://ghr. nlm. nih. gov/handbook/basics/dna

DNA bases pair up with each other, adenine (A) with thymine (T) and cytidine (C) with guanidine (G), to form units called base pairs. Each base is also attached to a sugar molecule and a phosphate molecule forming a nucleotide. Nucleotides are arranged in two long strands that form a spiral called a double helix. The double helix is like a ladder whose rungs are made up of the base pairs and the sides are formed by the sugar and phosphate molecules.

Chromosomes are thread-like structures but not visible in the cell’s nucleus—even under a microscope—until the cell starts dividing. During mitosis and meiosis, the DNA in the chromosomes becomes more tightly packed and becomes visible under a light microscope. Each chromosome has a constriction point called the centromere, which divides the chromosome into two sections, giving the chromosome its characteristic shape. The short arm is called the “ p arm” and the long arm is the “ q arm”.

4. Interphase Cell Cycle – G1, S, G2

Link: http://www. stanford. edu/group/Urchin/mitosis. html

The period in the cell cycle when the cell is resting and not dividing is known as the interphase. This phase is sub-divided as G1 (gap 1), S (synthesis), and G2 (gap 2) phases.

G1 is normally referred to as the " growth" phase in somatic cells when the DNA is not replicating but the cell is adding bulk, reproducing mitochondria

and other structures.

S is the time of synthesis when both DNA and centrosome syntheses occur.

G2 is the stage of interphase when the DNA synthesis is complete and the cell is waiting for the signal to start mitosis.

5. Monohybrid Inheritance

Link: http://www. absoluteastronomy. com/topics/Monohybrid_cross

Every physical characteristic of every living organism is controlled by different forms or alleles of the same gene. Monohybrid Inheritance is the inheritance of a single characteristic, and usually determined by the dominant gene. A monohybrid inheritance is best explained by Mendel’s pea experiments. When a true-breeding tall plant (T) was crossed with another true-breeding but short plant (t), all plants produced in the first generation were tall since the tall allele is the dominant allele and the cross was of the form TT x tt.

6. Sex Linked Inheritance (e. g. hemophilia)

Link: http://www. umm. edu/ency/article/002051. htm

Sex-linked diseases are inherited through either the X or Y chromosome. Dominant inheritance occurs when the abnormal gene dominates and the abnormal gene in one parent is able to produce disease even while the matching gene from the other parent is normal. Thus, in an X-linked dominant disorder, if the father carries an abnormal X chromosome, only the daughters are likely to inherit the disease tendency whereas if the mother has an abnormal X-chromosome, half of all her children irrespective of sex will inherit the disease tendency.

In contrast to this, in sex-linked recessive inheritance, also called X-linked recessive inheritance, the disease occurs only when both the matching

genes are abnormal. When only one gene is abnormal, disease is either absent or only mild. A person having one abnormal gene is known as a carrier and a carrier can pass the gene on to his/her off-spring. The recessive inheritance usually causes disease only in males because they have only one X chromosome. Females are carriers. Hemophilia is an example of a sex-linked recessive inheritance.