Class notes 12.1

Vocabulary

**Nitrogen bases-** molecules that contain nitrogen and other elements.

**DNA replication-** Before a cell divides, the process in which DNA copies itself.

**What Forms the Genetic Code? Pg. 409**

**It took almost 100 years after the discovery of DNA for scientists to find out that it looks like a twisted ladder.**

James Watson and Francis Crick published the structure of DNA in 1953

DNA contains the genetic information for cells to make proteins. Proteins determine a variety

of traits, from hair color to an organism’s ability to digest food.

**The Structure of DNA pg. 409**

* **Parents pass traits to their offspring through chromosomes**.
* Chromosomes are composed mostly of DNA, which is shaped like a twisted ladder, or “double helix”. The sides of the double helix are made up of sugar molecules called deoxyribose, alternating with phosphate molecules.
* **DNA’s full name, deoxyribonucleic acid,** comes from this structure.

**The Structure of DNA pg. 409**

The rungs of DNA are made of nitrogen bases, molecules that contain nitrogen and other elements.

adenine (A)

thymine (T)

guanine (G)

cytosine (C).

A gene is a section of a DNA molecule that contains the code for one specific protein.

That code is a series of bases in a specific order—for example, ATGA CGTA C.

A single gene may contain several hundred to a million or more bases.

**Order of the Bases pg. 411**

The code each gene contains determines the structure of a protein.

**The order of the nitrogen bases along a gene forms a genetic code that specifies what type of protein will be produced.**

* Remember that proteins are long-chain molecules made of individual amino acids.
* In the genetic code, a group of three DNA bases codes for one specific amino acid.

For example, the three-base sequence CGT (cytosine- guanine-thymine) always codes for the amino acid alanine.

* **The order of the three-base code units determines the order in which amino acids are put together to form a protein.**

**How Does DNA Copy Itself? Pg. 412**

DNA replication begins when the two sides of a DNA molecule unwind and separate, like a zipper unzipping, between the nitrogen bases. Next, nitrogen bases in the nucleus pair up with the bases on each half of the DNA.

**Because of the way the nitrogen bases pair up, the order of the bases in each new DNA strand exactly matches the order in the original DNA strand.**

**A**denine **always** pairs with **T**hymine

**A T**

**G**uanine **always** pairs with **C**ytosine.

**G C**

**Class notes 12.4**

* Mendel’s work showed that genes exist (called them “factors”) but scientists in the early twentieth century did not know that structures in cells contained genes
* An American geneticist, **Walter Sutton**, studied the cells of grasshoppers at the start of the 1900s
  + He wanted to understand how the sex cells (sperm and eggs) form
  + Focused on how chromosomes moved within cells during the formation of sperm and eggs
  + Hypothesized that chromosomes are the key to learning how offspring have traits similar to those of their parents

**Sutton needed evidence to support his hypothesis (figure 1)**

* He discovered that grasshopper sex cells have exactly **½** the number of chromosomes found in grasshopper body cells

**Chromosome Pairs**

Sutton observed what happened when a sperm cell and an egg cell joined

* + The fertilized egg that formed had 24 chromosomes
  + It had the same number of chromosomes from each parent
  + The 24 chromosomes existed as 12 pairs
  + Each pair had one chromosome from each parent

**Chromosome theory of inheritance:**

**genes pass from parents to their offspring on chromosomes**

* **The body cells of humans contain 46 chromosomes that form 23 pairs**
* **Chromosomes are made up of many genes joined together like beads on a string**
* ***Each body cell contains between 20,000 and 25,000 genes***
  + - **Genes control traits**

**Figure 2 shows a pair of chromosomes from an organism**

* + **One chromosome from female parent, other from male parent**
  + **Each chromosome has the same genes**
  + **Genes are lined up in the same order on both**
  + **Alleles of some genes are not identical (heterozygous)**
* **Meiosis** is the process by which the number of chromosomes is reduced by half as sex cells form
* The chromosome pairs separate into two different cells
* The sex cells that form later on have only ½ as many chromosomes as the other cells in the organism
* A cell divides into two cells. Then, each of these cells divides again, forming a total of 4 cells
  + The chromosomes duplicate only before the first cell division
  + Each of the 4 sex cells receives 2 chromosomes, one from each pair in the original cell
  + When two sex cells join at fertilization, the new cell that forms has the total number of chromosomes (in this case four)
    - The organism that grows from this cell got two of its

chromosomes from one parent and two from the other

**Sexual reproduction**

Through the process of meiosis

* Two sex cells join (female egg and male sperm) to produce a new organism
* The joining of two cells with different DNA produces an offspring with a combination of physical characteristics from both parents
* Most animals, including mammals reproduce sexually

**Asexual reproduction:**

* One parent produces a new organism identical to itself
* A lot of time takes place through Mitosis
  + A parent cell divides into two new cells
  + No new genetic material is introduced (exact genetic copy)
* Includes animals such as sponges, jellyfish, and worms
* **asexual reproduction** 
  + An advantage is that one parent can quickly produce many identical offspring
  + A disadvantage is that the offspring have the same DNA – no variation and may not survive changes in the environment
* **Sexual reproduction**
  + An advantage is that it produces offspring with new combinations of DNA – offspring may have characteristics that help them survive under unfavorable conditions
  + A disadvantage is that it requires finding a mate and the development of the offspring

takes longer