

## Genetics Notes Chapter 1

### Intro.

- Genetics is the study of all aspects of genes.
- Genes are the fundamental units of biological information.
- **Molecular Genetics**-the study of one gene at a time.
- **Genomics**-the study of a genome as a whole.

### 1.1

- DNA is made up of nucleotides.
- 4 different bases adenine, guanine, thymine, cytosine. Hydrogen bonded together.
- An organism's complete set of genetic information, encoded in DNA, is its genome.
- When nuclei contain two complete sets of genes they are **diploid**.
- Humans have **pairs of 23 chromosomes** (46 in total)
- Two members of a chromosomal pair are called **homologous chromosomes** or **homologs**.
- Genetic code contains many sections of DNA that do not code for proteins called **introns**.
- Homologous chromosomes contain the same genes in the same relative position, forming a gene pair
- DNA is efficiently packaged into chromosomal form by wrapping around molecular spools called **nucleosomes**.
- Nucleosomes are composed of eight proteins called **histones**.
- The coiled DNA and proteins together make up **chromatin**.
- A region on the chromosome called the **centromere** acts as an attachment point for the chromosome during cell division.
- Tips of the chromosomes are called **telomeres** they do not code for anything but prevent genes from being damaged.
- DNA found outside of the nucleus like in the mitochondria or chloroplasts is called **extranuclear DNA**.
- Prokaryotes have no nucleus so their DNA is in one long often circular coil.
- They also usually contain smaller circular chromosomes called **plasmids**.

### 1.2

- Three main types of proteins: **structural proteins**, contribute to the makeup of physical structure; **enzymatic proteins**, catalyze reactions; **regulatory proteins**, turn genes on and off at the appropriate times.
- **Transcription** is the conversion of DNA to RNA.
- **RNA** is single-stranded instead of double, uses the sugar ribose instead of deoxyribose, and uses the base uracil instead of thymine.
- After the RNA is transcribed proteins modify it by cutting out the introns.
- RNA destined for **translation** into protein synthesis is called **messenger RNA** or mRNA.
- Proteins are made up of a chain of **amino acids** called a **polypeptide**.
- Groups of three nucleotides called **codons** code for a specific amino acid.
- Hereditary change is caused mostly by mutation in DNA. This leads to variation.
- Some DNA can also be influenced by the environment and is called **epigenetic**.

### 1.3

- Natural Selection is the process whereby individuals with a particular characteristic that may reproduce better than others given the environment.
- Since these individuals will reproduce more the abundance of this characteristic will increase.
- Similarity due to shared ancestry is called **homology**.

### 1.4

- **Forward genetics** starts with a phenotype of interest and then attempts to look at what genes control it.
- **Reverse genetics** starts with a DNA sequence (gene) of interest and attempts to see what phenotype it controls.
- By showing how a gene goes wrong we can deduce its normal function.
- DNA manipulation is usually done on the level of a single gene.
- This is done through DNA cloning which replicates a DNA fragment over and over again until it becomes "amplified."
- Specific sequences of DNA, RNA, or protein can be found using probing. These probes take advantage of the specific affinity certain macromolecules have and then binds to them with a fluorescent mark to display the desired section.
- Cloned genes can be used to probe for its homologous sections of genes because complements of gene sections have a special affinity for each other.
- **Polymerase Chain Reaction** if a specific segment of DNA including primers is exposed to an unknown sample and the DNA replicates it means that a homolog in the unknown sample exists which tells us that that segment of DNA exists in the sample.
- **Blots?**
- Proteins can be detected by using antibodies that have strong affinities for the antigens (specific proteins)

### 1.5

- Species that are used commonly in scientific research are called **model organisms**.
- They are often cheap, come in large quantity, reproduce quickly, and often because of their homology learned information can be applied to humans.

### 1.6

- The introduction of a foreign gene into a host organism is called a transgene and it relies on **transgenetics**.
- Correcting genetic disease at the DNA level is **gene therapy**.