**Structure & Organization of Genetic Material in Prokaryotes and Eukaryotes**

How is DNA organized in the cell?

Genome: complete genetic makeup of an organism

Gene: functional unit of DNA. These sequences code for the production of specific proteins or RNA.

Prokaryotic DNA:

* Circular, double-stranded DNA
* May have multiple copies of that circular chromosome
* Location: nucleoid region
* Supercoiling of DNA occurs-amount of supercoiling controlled by two enzymes:
  + Topoisomerase I & Topoisomerase II
  + Antibacterial drugs will target these two enzymes
* Some prokaryotes have one or more small, circular or linear DNA molecules=PLASMID-not part of nucleoid, can be copied or transmitted between cells, or incorporated into the chromosomal DNA and reproduced during cell division.
* Haploid organisms-carry only one copy of each gene
* Very small amount of non-essential DNA
* Some DNA are **regulatory sequences**, which determine when certain genes & associate cell functions are activated.

Eukaryotic DNA:

* Lots more DNA compared to prokaryotic organisms, however much is non-coding
* Contained within nucleus
* Mitochondria & chloroplasts also contain DNA
* All DNA in single human nucleus =~2m. Therefore DNA must be compacted significantly
* Histones: family of 8 proteins that a segment (146 base pairs) of DNA wraps around. Together called “Nucleosome”
* P216 Fig. 5.12
* Most eukaryotes are DIPLOID (two copies of each gene), some ferns or algae may be HAPLOID, while some specially bred organism may have three or more copies of each gene. E.g. seedless watermelons are TRIPLOID.
* Genes are not evenly spaced along a chromosome and are not equally divided among the chromosomes. E.g. human chromosome #19 has 72 million b.p. with ~1450 genes, while chrom #4 has ~1.3 billion b.p. but only ~200 genes
* There is NO correlation between an organism’s complexity and genome size or number of protein-coding genes. E.g. p217 Lungfish has 40X’s more DNA/cell than a human cell. Rice has ~51000 protein-coding genes, while human have between ~20000-25000 coding genes
* Some genes encode for RNA molecules required for cellular processes.

HMK:

Read: 214-217

* P218 #10-14