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General Genetics Course

Dr. DAHDOUH Amel

Preamble

Mendelian genetics, pioneered by Gregor Mendel, aims to elucidate the principles governing trait determination and inheritance through the analysis of offspring resulting from controlled crosses between individuals of different genotypes.

Following the discovery of deoxyribonucleic acid (DNA) as the carrier of genetic information, molecular genetics has continued to investigate the intricate mechanisms underlying the determination, expression, and transmission of traits.

A comprehensive understanding of trait determination and transmission also requires studying individuals under natural conditions, where each is genetically unique and capable of reproducing with any conspecific. This aspect of genetics, which examines the interactions between individuals and their environment, is encompassed within the field of population genetics.

This course, designed for second-year students in the Natural and Life Sciences Common Core, provides a foundational overview of genetics. The curriculum encompasses topics ranging from the structure of DNA and its variations to protein synthesis, culminating in formal genetics with an emphasis on diploid organisms. Although the chapters are not exhaustive, they have been curated to include all the essential components of a basic genetics curriculum.

The course structure has been reorganized into two main sections: the first section covers molecular genetics, while the second section is devoted to fundamental genetics.

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Molecular Genetics

1 Genetic Material

1.1 Nucleic Acids

A nucleic acid is a polymer composed of monomeric units called nucleotides, which are linked together by phosphodiester bonds. These nucleic acids are of fundamental importance in all living organisms, as they serve as the carriers of genetic information.

1.2 Types of Nucleic Acids

There are two primary types of nucleic acids: deoxyribonucleic acid (DNA) and ribonucleic acid (RNA):

- **DNA (Deoxyribonucleic Acid)**: DNA is a long molecule with a helical structure composed of two strands. These strands are linear and consist of repeating units of nucleotides, which are connected by phosphodiester bonds.
- **RNA (Ribonucleic Acid)**: RNA, similar to DNA, is a polymer of nucleotides linked by phosphodiester bonds. However, RNA is typically single-stranded and plays a key role in the expression of genetic information.

Both DNA and RNA are essential for the synthesis of proteins and the functioning of cells, contributing to the development, function, and reproduction of living organisms. While DNA primarily stores genetic information, RNA is involved in gene expression. Table 1 below compares RNA and DNA based on their structure and composition: