

# Chapter 6: Inheritance

Comprehensive master notes covering chromosomal basis of heredity, Mendel's laws of inheritance, DNA structure, and gene expression.

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# 6.1 Basic Concepts of Inheritance



## Key Definitions

**Inheritance:** Transmission of characters from parents to offspring.

**Gene:** Basic unit of heredity made of DNA sequence.

**Allele:** Alternative or variant form of a gene.

## Genotype

The genetic constitution of an organism (e.g., TT, Tt, tt).

## Phenotype

The observable physical or biochemical characteristics of an organism.

# Mendel's Work on Pea Plants



## Why Garden Peas?

*Pisum sativum* offered distinct contrasting traits, easy controlled cross-pollination, and rapid life cycles.



## Contrasting Traits

Examined 7 pairs of traits including stem height (tall vs dwarf), seed color, and pod shape.



## Statistical Approach

Maintained meticulous numerical records of offspring generations (F1 and F2) establishing ratios.

# Mendel's Law of Segregation

## Principle Statement

Alleles of a gene separate during gamete formation so that each gamete carries only one allele for each gene.

**Monohybrid Cross:** Cross involving a single trait pair.

**F2 Phenotypic Ratio:** 3:1 dominant to recessive expression.

## Punnett Square Concept

A grid diagram used to predict the genotypes and phenotypes of a cross, demonstrating random fertilization of gametes.

# Law of Independent Assortment

## Principle Statement

Alleles of two or more different genes get sorted into gametes independently of one another.

**Dihybrid Cross:** Tracking two separate traits simultaneously.

**F2 Phenotypic Ratio:** Classic 9:3:3:1 ratio in dihybrid crosses.

## Biological Significance

Independent assortment during meiosis introduces immense genetic variation in gametes, driving biodiversity.

# Structure of DNA

## Double Helix Model

**Nucleotides:** Building blocks consisting of deoxyribose sugar, phosphate group, and nitrogenous base.

**Base Pairing:** Adenine (A) pairs with Thymine (T); Cytosine (C) pairs with Guanine (G).

**Backbone:** Alternating sugar and phosphate molecules form the structural rails.

## Watson & Crick Discovery

In 1953, James Watson and Francis Crick elucidated the 3D double helix structure of DNA, revolutionizing molecular biology.

# Chromosomes & Protein Synthesis

## Chromosomes

Thread-like structures composed of DNA coiled around histone proteins carrying numerous genes.

## Transcription (DNA to RNA)

Genetic code is copied from DNA strand onto messenger RNA (mRNA) inside the nucleus.

## Translation (RNA to Protein)

Ribosomes read mRNA codons to assemble specific amino acid chains forming functional proteins.

# Variations and Mutations

## What is a Mutation?

A permanent alteration in the DNA sequence that makes up a gene, which can be caused by environmental mutagens (radiation, chemicals).

**Continuous Variation:** Traits showing a complete gradated range (e.g., human height).

**Discontinuous Variation:** Distinct categorical traits (e.g., blood groups).

## Role in Evolution

Mutations introduce new alleles into populations, providing the raw material for natural selection and evolutionary adaptation.

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# Chapter 6 Summary

Master Notes Complete

## Mendelian Genetics

Covers monohybrid and dihybrid crosses, segregation, and independent assortment laws.

## DNA & Expression

Explains double helix structure, transcription, and translation into functional proteins.

## Variations & Mutagenesis

Highlights genetic variations, mutation causes, and significance in evolution.