

# Genetic Concepts & Terms

These notes are your ultimate revision weapon to revise Genetic Concepts & Terms. We've distilled years of previous exam questions (PYQs) into one powerful, concise resource. Everything you need to know, nothing you don't.

- **PYQs, Decoded:** All key concepts from past exams, organized and simplified.
- **Revise in Record Time:** Short, precise, and designed for last-minute review.
- **Focus on What Matters:** Master high-probability topics and boost your confidence.

## Foundational Figures & Theories

- **Gregor Johann Mendel**
  - Credited as the father of modern genetics.
  - Discovered the fundamental laws of inheritance through experiments on garden pea plants (*Pisum sativum*).
  - His principles are based on the mechanisms of sexual reproduction.
- **Sutton and Boveri**
  - Proposed the Chromosomal Theory of Inheritance (1902-1903).
  - Stated that chromosomes are the carriers of genetic material, providing a physical basis for Mendel's laws.
- **James Watson and Francis Crick**
  - First to propose the double-helix model of DNA (1953).
  - Awarded the Nobel Prize in Physiology or Medicine in 1962 for this discovery.
- **Waldeyer**
  - Coined the term "chromosome".

## DNA Structure and Discovery

- **Key Discoveries**
  - **Discovery of DNA:** Identified and isolated by Friedrich Miescher in 1869.
  - **Double-Helix Model:** Proposed by James Watson and Francis Crick in 1953.
- **DNA Composition**
  - **Sugar:** Deoxyribose.
  - **Nitrogenous Bases:** Adenine (A), Guanine (G), Cytosine (C), Thymine (T).
  - **Key Feature:** Complementary base pairing (A-T, G-C) ensures accurate storage and transmission of genetic information.
  - **Non-DNA Compound:** Tyrosine (an amino acid) is not a component of DNA.

## Basic Units of Heredity

- **Gene**
  - The basic unit of heredity.
  - Defined as a segment of DNA containing instructions for specific traits.
- **DNA (Deoxyribonucleic Acid)**
  - The primary hereditary material in most organisms.
  - Controls hereditary characteristics.
- **RNA (Ribonucleic Acid)**
  - Acts as a messenger, carrying instructions from DNA for protein synthesis.
- **Chromosome**
  - Structures located in the nucleus, made of DNA and proteins (nucleoproteins).
  - Carry hereditary traits from one generation to the next and contain genes.
  - **Constancy:** The chromosome number is constant for a species.

- **Human Chromosomes:** Human cells have 46 chromosomes, arranged in 23 pairs.

## Genetic Mechanisms & Concepts

- **Mendel's Laws of Inheritance**

- Derived from experiments on garden peas.
- The three laws are:
  - Law of Dominance
  - Law of Segregation
  - Law of Independent Assortment

- **The Genetic Code**

- A set of rules used by cells to translate genetic information (DNA/RNA) into proteins.
- **Key Features:** Universal, non-overlapping, non-ambiguous, and commaless.
- **Structure:** It is a triplet code (a codon is three nucleotide bases).
- **Codons:** There are 64 codons; 61 code for amino acids, and 3 are stop signals.
- **Nobel Prize (1968):** Awarded to Robert W. Holley, Har Gobind Khorana, and Marshall W. Nirenberg for interpreting the genetic code.

- **Gene and Protein Synthesis**

- Har Gobind Khorana is credited with the laboratory synthesis of a gene.

- **Mutation**

- A change in the base sequence within a gene.
- It is a source of genetic variation and a driving force of evolution.

- **Genetic Variation from Sexual Reproduction**
  - Caused by:
    - Blending of genes from two parents.
    - Chromosomal changes.
    - Shuffling of genes.
- **Genome Mapping**
  - A technique to map the location of genes on a chromosome and determine the distance between them using genetic markers.

## Chromosomes and Sex Determination

- **Sex Determination in Humans**
  - The 23rd chromosome pair determines sex.
  - **Females:** XX chromosomes.
  - **Males:** XY chromosomes.
  - The male (father) determines the sex of the offspring. A male child results from inheriting the Y chromosome from the father and the X from the mother.
- **Exception:** Some species (e.g., lizards in the genus *Sceloporus*) do not have distinguishable sex chromosomes.

## Other Genetic Elements

- **Jumping Genes (Transposons)**
  - **Discovery:** By Barbara McClintock.
  - **Principle:** Segments of DNA can move from one chromosome to another, affecting gene expression.
  - **Nobel Prize:** Awarded to McClintock in 1983 for this work.
- **Ribozymes**
  - **Nature:** RNA molecules.
  - **Function:** Catalytic molecules that speed up biochemical reactions, similar to enzymes.
  - **Discovery:** The catalytic property of RNA was discovered by Thomas R. Cech and Sidney Altman (Nobel Prize, 1989).

## DNA Damage and Mutagens

- **Agents Causing DNA Changes**
  - Professionals at risk of permanent DNA changes include:
    - **X-ray technicians:** Due to exposure to ionizing radiation.
    - **Researchers using Carbon-14 isotope:** Due to beta radiation.
    - **Dyers and painters:** Due to exposure to chemical carcinogens (e.g., benzene, formaldehyde).

### Know More About Genetic Concepts & Terms:

- [Genetic Concepts & Terms – Old Year Questions](#)
- [Genetic Concepts & Terms One Liner Questions & Answers](#)

