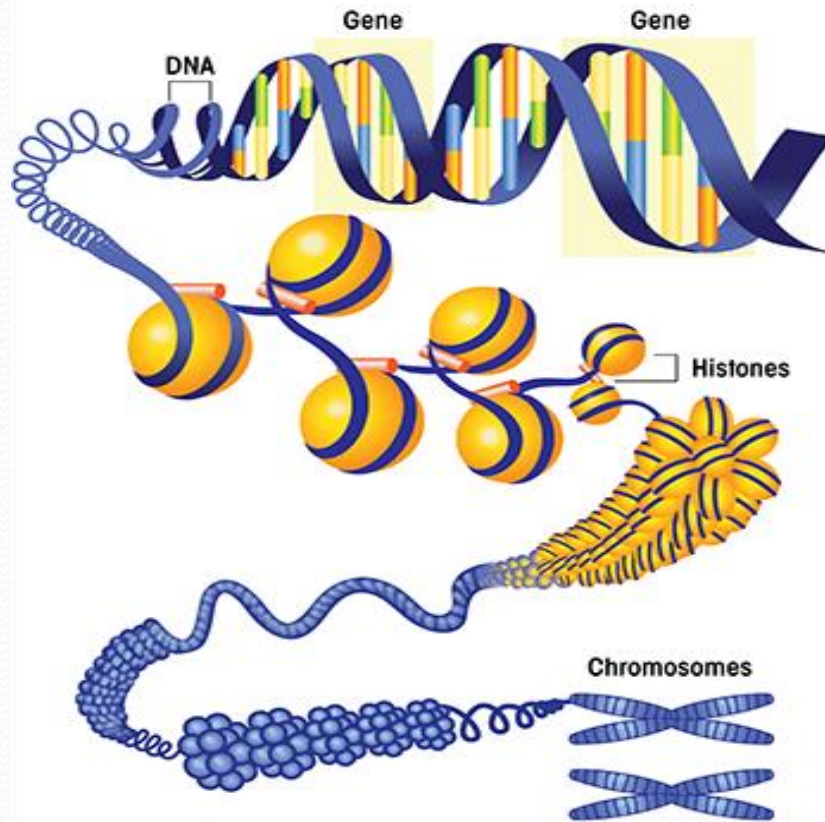


# Principals of Genetics (Zoo-352)



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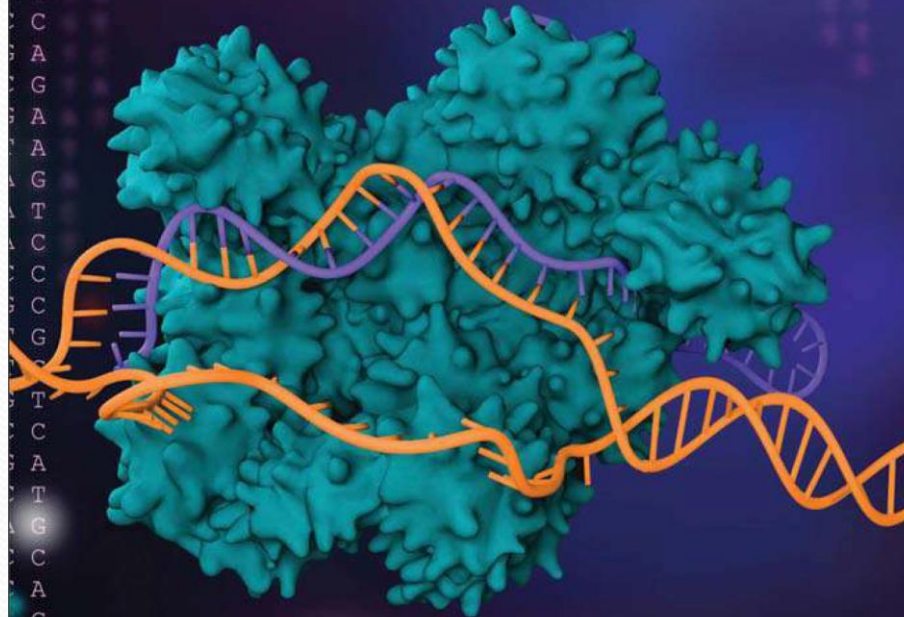
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Seventh Edition

# GENETICS

*Analysis & Principles*



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Robert J. Brooker

# Aims of genetics course

1. Understand the definition and branches of genetics.
2. Understand the key features of chromosome and gene.
3. Describe the key steps in the cell cycle.
4. Describe the relationship between mitosis and meiosis in both haploid and diploid cells.
5. Understand Mendel's first law of equal segregation.
6. Understand Mendel's second law of independent assortment.
7. Be able to apply the rules of probability to solve genetic questions.



# Time table for weekly planning for principles of genetics

Lectures	Syllabus view
1	Genetics overview
2	Chromosomes
3	The cell cycle and its checkpoint
4	Mitosis
5	Meiosis
6	Exam 1 and collection of the first homework (16-8-1446 H)
7	Saudi Founding Day holiday (24-8-1446 H)
8	Mendelian genetics
9	The law of segregation
10	Testing the law of segregation
11	Law of independent assortment
12	Testing the law of independent assortment
13	Genetics of the human blood group
14	Exam 2 and collection of the second homework (6-11-1446 H)

# Assessment

## ❑ Lecture:

- 2 lecture exams (20%)
- Attendance, participation and homework (10%)
- Final exam (40%)
- 70% of total grade

## ❑ Laboratory:

- 30% of total grade

# Genetics:

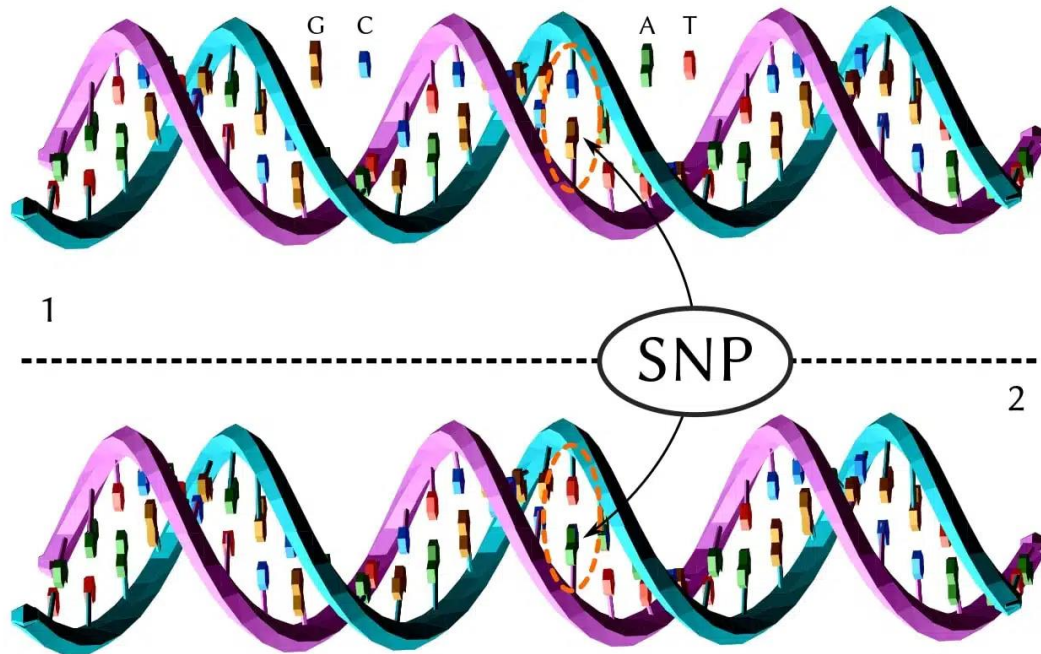
**Genetics** is the study of **genes**, **heredity**, and **genetic variation** in living organisms.

- **A gene** is a portion (or sequence) of DNA that codes for a specific protein (function).
- **Heredity** is the transmission of genetic traits from parents to their offspring, either through asexual reproduction or sexual reproduction.
- **Genetic variation**, variation in alleles of genes, occurs between individuals or between populations.





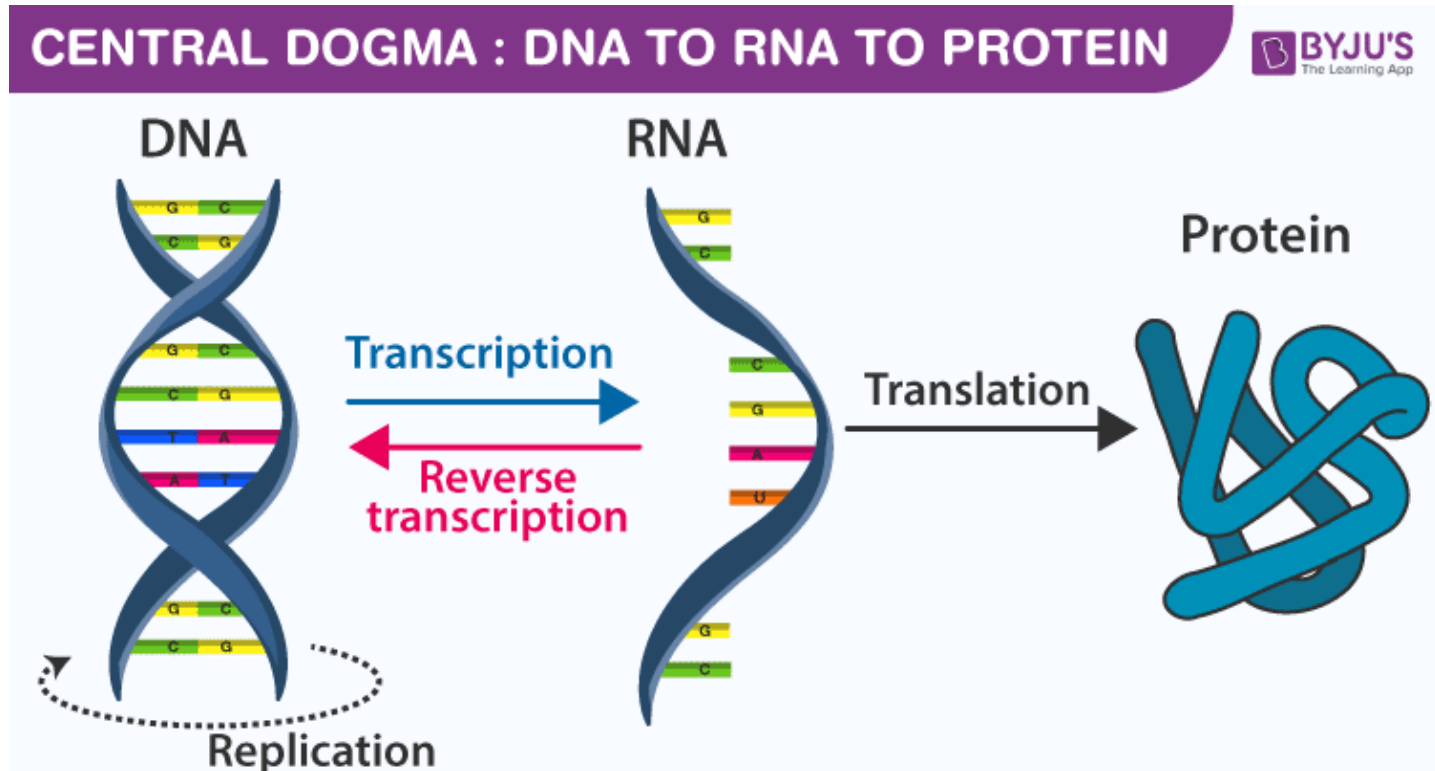
# Genetic variation:



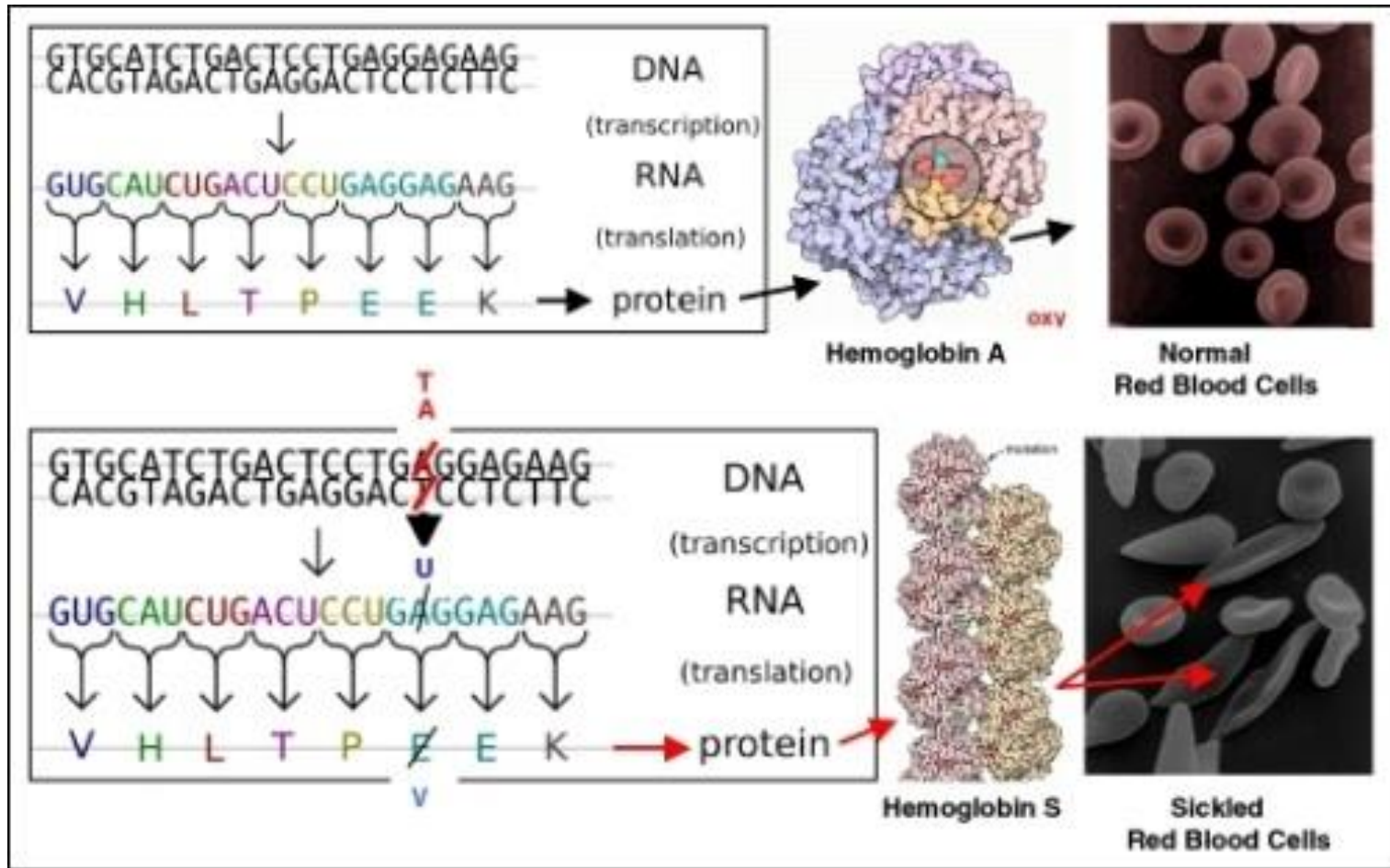
- ❑ Single-nucleotide polymorphisms (SNPs) in populations and single-nucleotide variations (SNVs) in individuals.
- ❑ SNP and SNV variants are simply exchanges of one nucleotide base pair for another.



# Central Dogma



- A segment of **DNA** is converted to **RNA** (**transcription**), followed by translation process that turns the **RNA** to **protein** (**translation**).



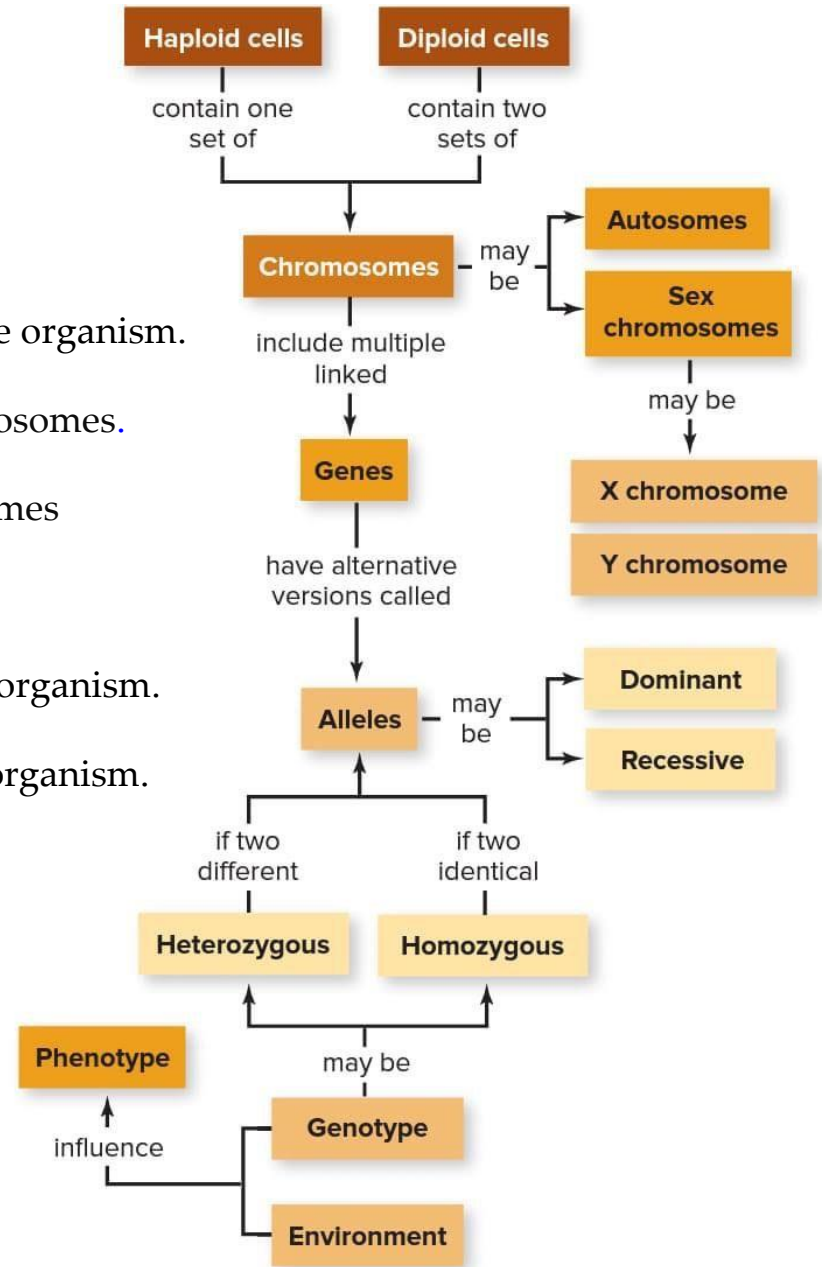


# Branches of Genetics:

1. **Classical Genetics:** It is the **oldest discipline** in the field of genetics, going back to the experiments of **Gregor Mendel**. The study of the transmission of genotype from parent to offspring.
2. **Human genetics:** is the study of heredity and variation in the humans.
3. **Cytogenetics:** is the study of chromosomes and chromosome abnormalities
4. **Population genetics:** The genetics of the different populations of animal and plant species.
5. **Molecular genetics:** is the study of the structure and function of genes at the molecular level.
6. **Genetic engineering:** or the manipulation of an organism's genome, changes or adds genes to an organism's sequence of DNA in order to create new traits or remove unwanted ones

# Genetics Terms:

- ❑ **Genome:** All genetics material (DNA) present in one organism.
- ❑ **Haploid cells:** The presence of a single set of chromosomes.
- ❑ **Diploid cells:** The presence of two sets of chromosomes
- ❑ **Allele:** Different version of one gene.
- ❑ **Genotype:** The combination of alleles present in an organism.
- ❑ **Phenotype:** Characteristics that are observed in an organism.
- ❑ **Homozygous:** Alleles are the same.
- ❑ **Heterozygous:** Two different alleles.





# Differences between Prokaryotic and Eukaryotic cells

	Prokaryotic cells	Eukaryotic cells
<b>Taxonomic groups</b>	Bacteria, Cyanobacteria	Protists, Fungi, Plants, and Animals
<b>Size</b>	Usually <5 $\mu\text{m}$ (less than)	Usually >5 $\mu\text{m}$ (grater than)
<b>Nucleus</b>	No true nucleus, no nuclear membrane	True nucleus, nuclear membrane
<b>Chromosomes</b>	Single circular chromosome	Multiple linear chromosome
	Chromosomes are condensed in the nucleoid via DNA supercoiling and the binding of proteins	Chromosomes are condensed in a membrane-bound nucleus via histones
	Contain little amount of repetitive DNA	Contain large amount of noncoding and repetitive DNA
	Contain one copy of each gene (they are haploid)	Contain two copies of each gene (they are diploid)
<b>Mitosis and Meiosis</b>	Absent	Present

- ❑ Eukaryotic cells contain many different organelles that perform specific functions. Such as, mitochondria, chloroplasts contain genomes.
- ❑ The eukaryotic cell possesses some structures that are critical for mitosis and meiosis: **centrosomes** and **microtubules/spindle fibers**.