

Genes and gene action :

1. Development of the DNA concept .
2. Development of gene theory .

The gene is a sequence specific to the rules of nitrogen , and relay a message shows the instructions required for the synthesis of different proteins that are the body's tissue in an organism .

Gene is the basic units of heredity in a living organism cells pass genetic traits to offspring or from parents to children .

Genetics : is the science study gene , and genetic traits transmitted from parents to children through genes (genome) .

DNA : a molecule that composed of a huge number of nucleotides . that provides the information for the construction of proteins and RNA , DNA can replicate itself and carries genetic information between cells and between generations .

Nitrogen bases : it's held the two strands of DNA together that are attached to each other via hydrogen bonds , there are two hydrogen bases .

I. Control of action :

- 1- Definition of genes .
- 2- the genetic code .

Gene : is the basic units of heredity in a living organism cells and pass genetic traits to offspring .

Genetic code : is the set of rules by which a gene is translated into a functional protein .

Gene : is a sequence of DNA nucleotides that encodes a molecule of RNA .

The gene may contain instructions for making an individual protein , or it may have a regulatory function . gene contains both coding sequences and non-coding sequences .

Allele : one of the alternative forms of a single gene . in pea plants , a single gene codes for seed color , and it comes into other for green seeds .

RNA can synthesis protein via the genetic code .

Terminology

- 1- **Cell division**: in volves nuclear division and cytokinesis to produce two new cells.
- 2- **Cytokinesis** : which is division of cytoplasm.
- 3- **Somatic cell**: is the body cell.
- 4- **Mitosis**: is nuclear division in which the chromosome number stays constant. Mitosis is the types of nuclear division that occurs in growth and repair of the body.
- 5- **Diploid cell (2n)**: Cell that Which has full number of chromosomes and occurs in all cells of the body.
- 6- **Haploid Cell (n)**: Cell that has hair number of diploid chromosomes and occurs in sex cells.

- 7- **Chromosome:** A Cellular structure carrying genetic material, found in the nucleus of eukaryotic cells. Each chromosomes consists of one very long DNA molecule and associated with proteins.
- 8- **Chromatin:** the complex of DNA and proteins that makes up eukaryotic chromosomes.
- 9- **Kinetochores:** A structure of proteins attached to the centromere that links [binds] each sister chromatid to the mitotic spindle.

Q:What happens to the cell when it enters in the mitosis and interphase?

During the G₁,S,G₂ occurs the following:

- 1- The cell grows in their size.
- 2- The cellular organelles increase in number.
- 3- Matabolic activates occurred.
- 4- Chromosomes (DNA) replication.
- 5- Chromatin is condensing into chromosomes and centrosomes have duplicated in preparation for mitosis.

1. Pnephase

- 1- Chromosomes are duplicated.
- 2- Centrosomes begin moving apart.
- 3- Nuclear envelope is fragmenting and nucleolus will disappear.
- 4- Spindle is in process of forming, and centromere of chromosomes are attaching to centromere spindle fibers.

2. Metaphase:

- 1- Fully formed spindle consists of poles, asters, and fibers.

- 2- The chromosomes attached to centromeric, spindle fibers are aligned at the metaphase plate [also called the equator] of the spindle.

3. **Anaphase:**

- 1- The centromeres divide.
- 2- The sister chromatids separate, becoming two daughter chromosomes move toward the opposite poles of the spindle, the daughter chromosomes have a centromere and single chromatid.
- 3- What accounts (How) for the movement of the daughter chromatids?

First, The centromeric spindle fibers disassemble at the region of the kinetochore, and this pulls the daughter chromosomes to the poles,

Second, the polar spindle fibers lengthen as they slide past one another.

4. **Telophase:**

- 1- The spindle disappears
- 2- The nuclear envelope forms or nuclear envelope components reassemble around the daughter chromosomes.
- 3- Each daughter nucleus contains the same number of kinds of chromosomes as the original parental Cell.

DNA Replication

- 1- The process of transcription begins as enzymes unzip the molecule of DNA in the region of the gene to be transcribed.

- 2- Free RNA nucleotides form base pairs with their complementary nucleotides on the DNA strand. The mRNA strand is complete when the RNA nucleotides bond together.
- 3- The mRNA strand breaks away, and the DNA strands rejoin, the mRNA strand leaves nucleus and enters the cytoplasm.

***During** Which stage of cell cycle does DNA Replication occur? Interphase

Interphase: The period between divisions is called interphase.

Mitosis: Is a type of cell division occur in all cells or the process of sorting and distributing the chromosomes is called mitosis.

***What are the stages** of cell division? What are the kinds of nuclear division?

***Sister chromatids:** Two copies of each chromosome made during the S phase are called sister chromatid.

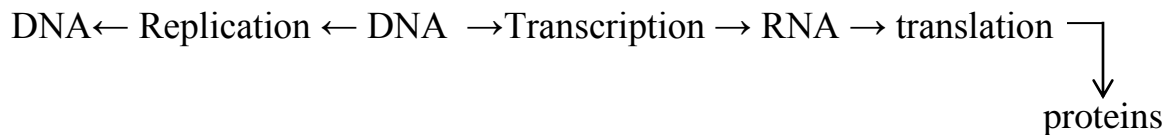
***What are the differences between DNA and RNA?**

- 1- An RNA molecule usually consists of a single strand of nucleotides, not a double strand The single stranded structure is closely related to its function.
- 2- Ribose is the sugar in RNA, rather than the deoxyribose sugar in DNA.
- 3- The nitrogenous base Uracil (U) replaces thymine (T) in RNA, Uracil forms base pairs with adenine (A) just as thymine dose in DNA.
- 4- There are three types of RNA, molecules [1- m RNA 2- r RNA 3- t RNA]

5- RNA synthesized protein [protein synthesis].

***What are the differences between transcription and DNA replication?**

Transcription results in the formation of one single- stranded RNA molecule rather than a double- stranded DNA molecule



The three major parts of DNA replication

- 1- Enzymes and other proteins bind to the DNA at a replication origin, forming a replisome at (a).
- 2- Enzymes use energy from ATP to unwind [unzip] the DNA double helix at (b).
- 3- DNA polymer catalyzes formation of a new matching strand for each old DNA strand at (c).

This occurs as one fast, continuous process on the leading strand and in discontinuous sections on the lagging strand. [the lagging strand occurs in short segments in the direction opposite to movement of the replisome].

Summary of DNA replication:

- 1- Binding of enzymes to existing DNA,
- 2- Un winding of the double helix, and
- 3- Synthesis of a new matching strand for each existing (old) strand.

Mitosis : the cell pass into four phases of the following.

Prophase:

- 1- The individual chromosomes become visible.
- 2- Chromatids are becoming visible because they become more coil and dense [thickness].
- 3- The two identical chromatids are attached at a genetic region called centromere.
- 4- Centrioles begin to separate and move to opposite poles of the cell.
- 5- A series of fibers known as the spindle will shortly begin to form.

Metaphase:

- 1- The chromosomes align at the equatorial plane.
- 2- The nucleus is not visible.
- 3- Spindle fibers are completed and the centriole are at the poles.
- 4- Each chromosome still consists of two chromatids attached at a centromere.
- 5- Chromosomes or chromatid aligned at the cells equatorial plane during this phase.
- 6- Each chromosomes divides [splits] as the centromeres replicate and the cell enters the next phase, Anaphase.

Anaphase:

- 1- The pair chromatids separate after the centromeres replicate.
- 2- Daughter chromosomes, are separating and moving toward the poles and the cell will begin cytokinesis.

Telophase:

- 1- The spindle disassemble and the nucleus, nucleolus and nuclear membrane form [reappear].
- 2- Daughter cell are formed as a result of the division of the cytoplasm.
- 3- Each of the newly formed daughter cells then enters at the G₁ stage of interphase.

Q1: What is the purpose of mitosis or what is the importance of cell division?

Q2: What is the purpose of mitosis or what is the importance of cell division?

Q3: During which stage of cells cycle dose DNA replication occur.

Meiosis:

- **Sexual reproduction:** Is the formation of new individual by the union of two sex cells. Before sexual reproduction can occur, the two sets of genetic information must be reduced to one set.
- **Centromere:** Two chromatids are attached to each other at a point called the centromere.
- **Homologous chromosomes:** A pair of chromosomes of similar size and shape that have genes for the same traits are said to be homologous. But the genes may not be identical.
- **Haploid and diploid cells:** Both plants and animals produce cells with a haploid number of chromosomes. The male anther in plants and

the testes in animals produce haploid male cells, sperm in both plants and animals, the ovaries produce haploid female cells, eggs.

- **Crossing- over:** Is the exchange of equivalent sections of DNA on homologous chromosomes.
- **Synapsis:** Process that which the homologous chromosomes recognize one another by their centromere, move through the cell toward one another, and come to lie next to each other in a process called synapsis.
- **Nucleotide:** Is basic structural unit of all nucleic acid molecules. Ex:
A/ Thymine (T) nucleotide of DNA is comprised of phosphate, deoxyribose sugar and the thymine nitrogenous base thymine (T). B/
The RNA uracil nucleotides is comprised of a phosphate, ribose sugar, and the nitrogenous base, uracil [4].

Q1: What are the differences between DNA and RNA?

Q2: List are the differences between mitosis and meiosis?

Q3: What are the differences between an interphase cell and a cell in mitosis?

Mendelion Genetics:

Mendel developed a model to explain the 3:1 inheritance pattern that consistently observed among the F₂ offspring in his pea experiments.

First, alternative versions of genes account for variations in herited characters.

The alternative versions of a gene are called alleles.

Second, for each character, an organism inherits two alleles, one from each parent.

Dominant allele :		Sperm from F1 (Pp) plant	
		P	p
Eggs from	P	PP	Pp
F1 (Pp) plant	p	Pp	pp

Recessive allele :

3= Dominants gametes

1= Recessives gametes

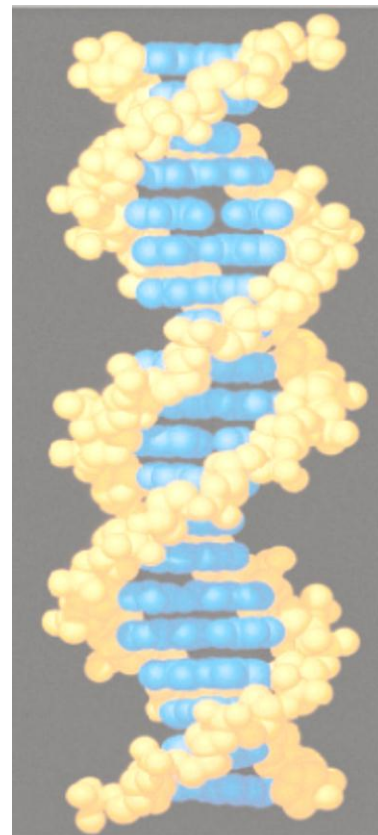
Genotype: A structure of Homologous chromosome and their genes which consists alleles.

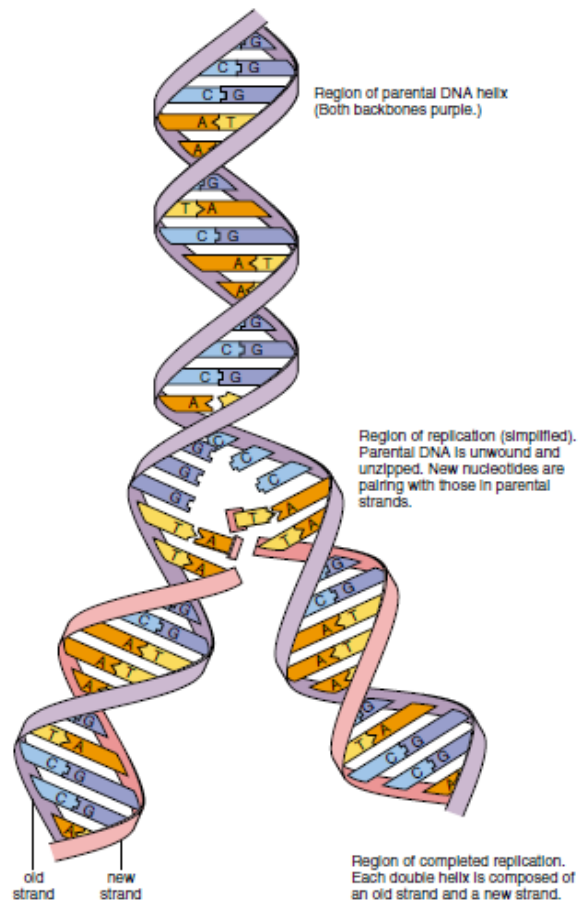
Phenotype: The characteristics of the organism which produces by the activities of genotypes (alleles).

Gene: Is the basic unit of heredity

Is the basic unit of DNA (chromosome)

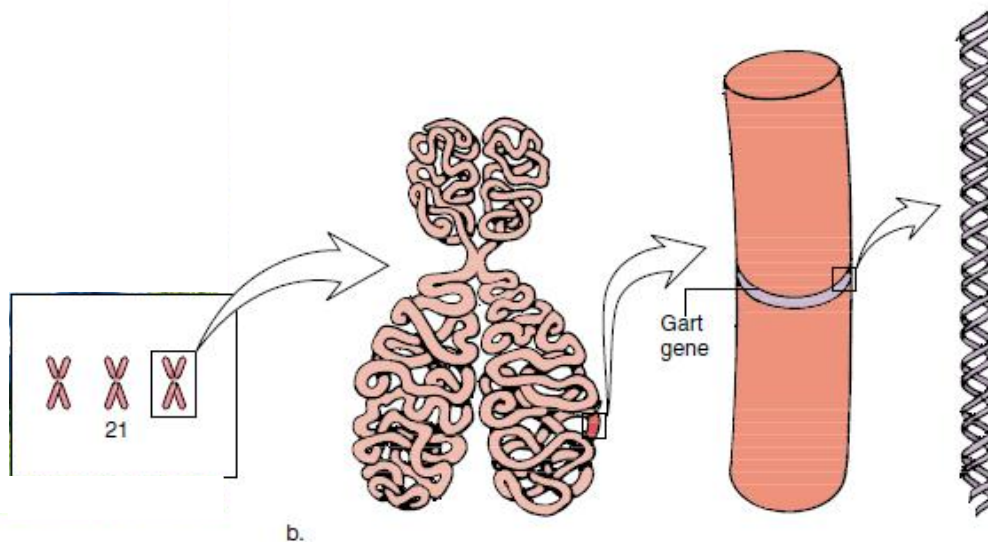
Alleles: Alternative versions of a gene.

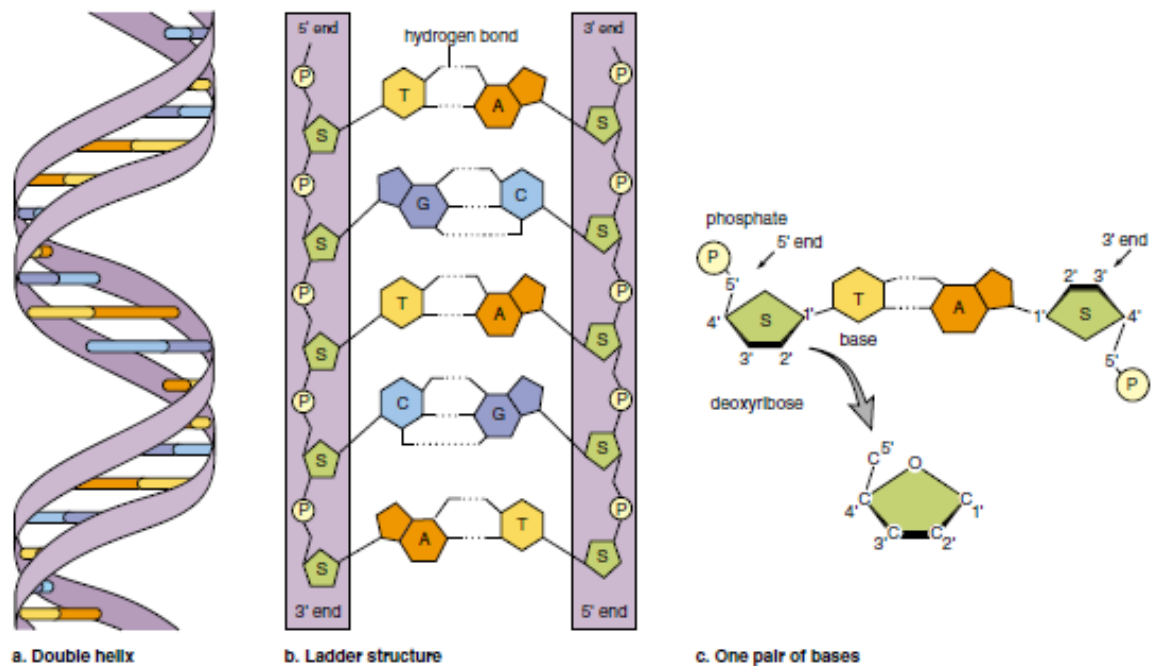




DNA replication.

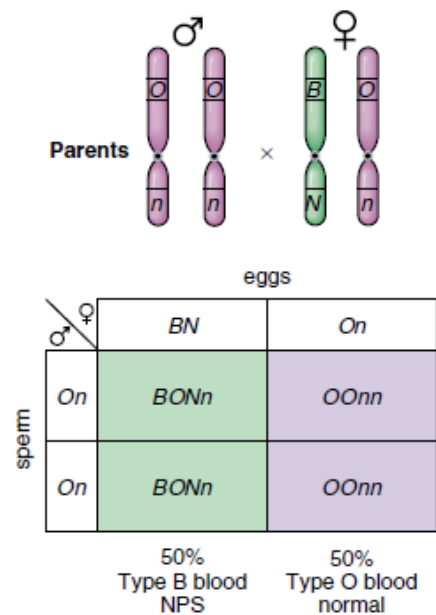
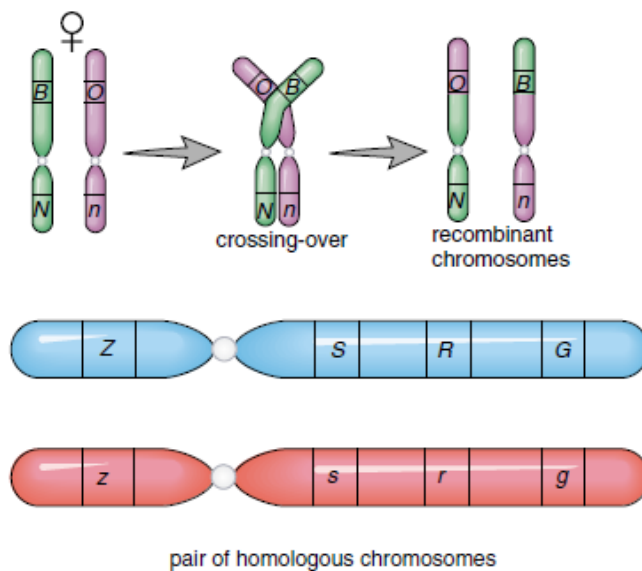
After the DNA molecule unwinds, each old strand serves as a template for the formation of the new strand. Complementary nucleotides available in the cell pair with those of the old strand and then are joined together to form a daughter strand. After replication is complete, there are two daughter strands. Replication is called semiconservative because each new double helix is composed of an old (parental) strand and a new (daughter) strand. Each molecule has the same sequence of base pairs as the parent molecule had before unwinding occurred.

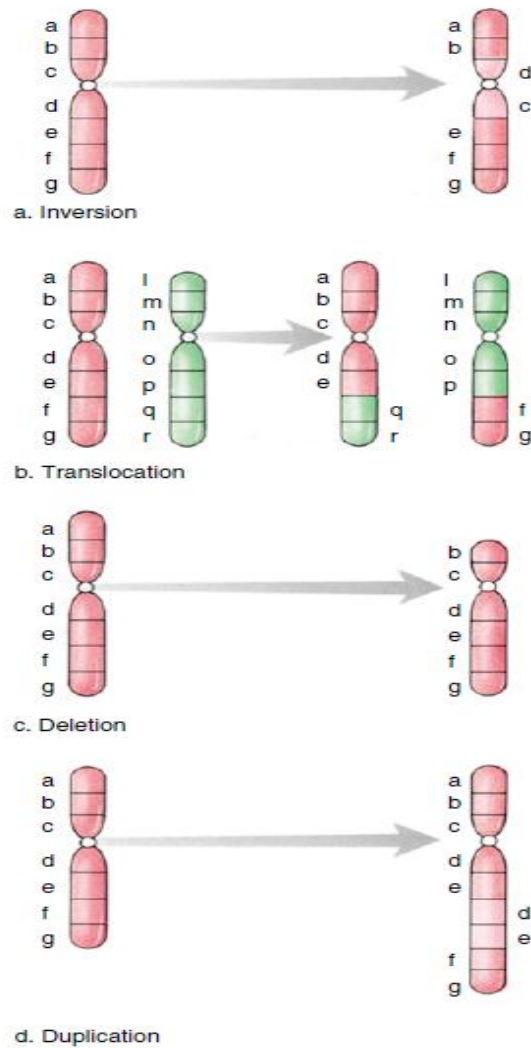




Overview of DNA structure.

a. DNA double helix. **b.** When the helix is unwound, a ladder configuration shows that the uprights are composed of sugar and phosphate molecules and the rungs are complementary bases. Notice the bases in DNA pair in such a way that the phosphate-sugar groups are oriented in different directions. This means that the strands of DNA end up running antiparallel to one another, with the 3' end of one strand opposite the 5' end of the other strand. **c.** When you examine one pair of bases, you see that 3' and 5' refer to a numbering system for the carbon atoms.





Types of chromosomal mutations.

- a. Inversion occurs when a chromosomal segment breaks apart and then rejoins in reversed direction.
- b. Translocation is the exchange of chromosomal segments between nonhomologous chromosomes.
- c. Deletion is the loss of a chromosomal segment.
- d. Duplication occurs when the same segment is repeated within the chromosome.

The End