ژنتیک، جلسه پنجم

تفرق صفات

THE LAW OF SEGREGATION

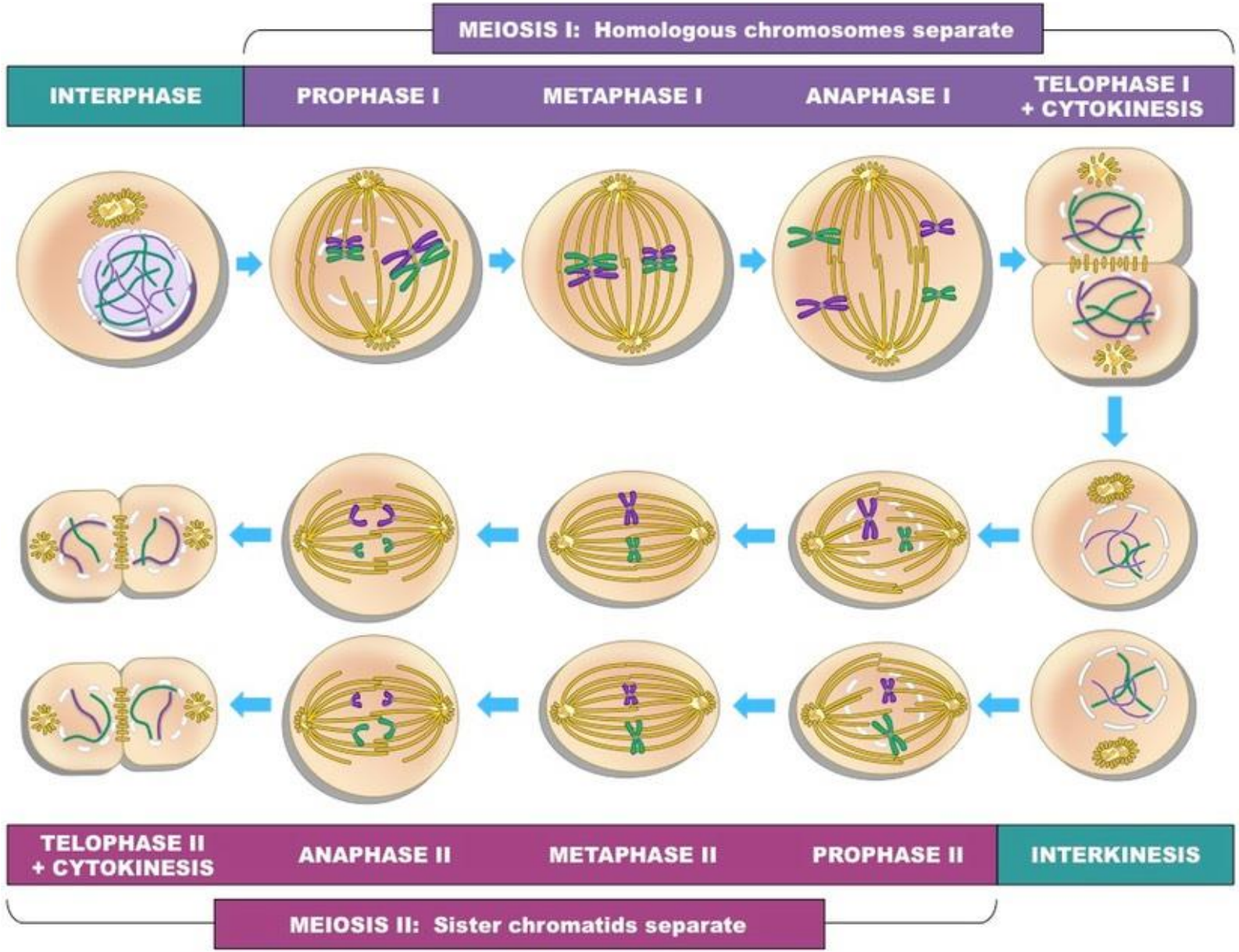
- During the formation of gametes (eggs or sperm), the two alleles responsible for a trait separate from each other. Alleles for a trait are then "recombined" at fertilization, producing the genotype for the traits of the offspring.

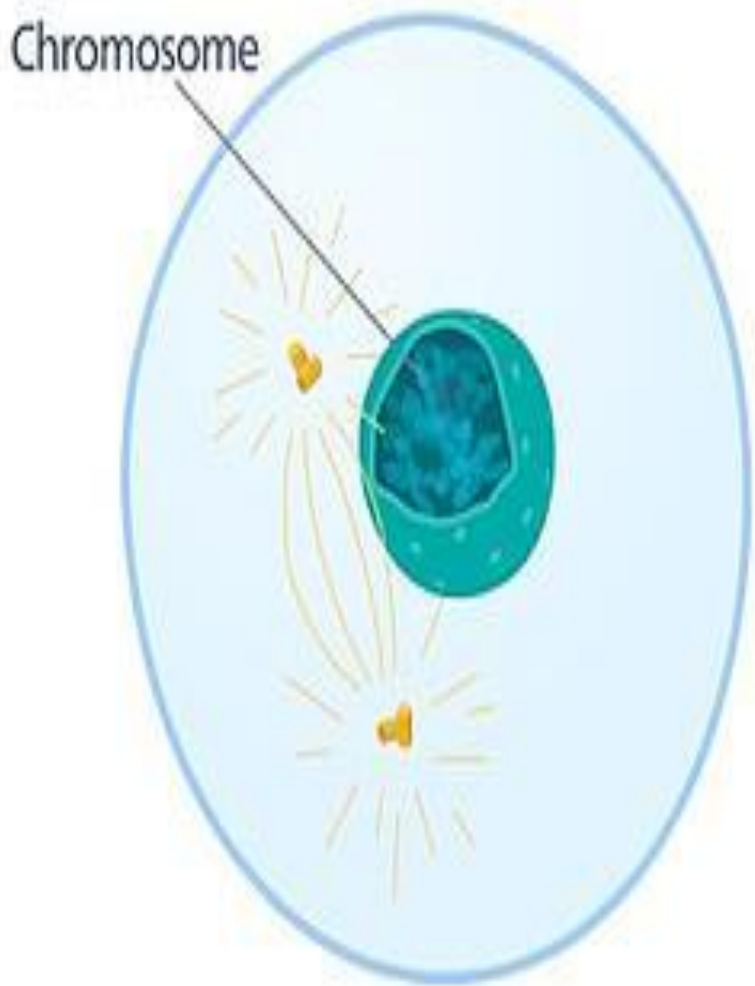
DEFINITION OF MEIOSIS:

- Meiosis is a special type of cell division in which chromosomes duplicate only once, but the cell divides twice. So one parental cell produces 4 daughter cells, each having half the chromosome number and DNA amount than the normal parental cell. So meiosis is called "Reductional Division."

OR

- A type of cell division that results in four daughter cells each with half the number of chromosomes of the parent cell, as in the production of gametes and plant spores.

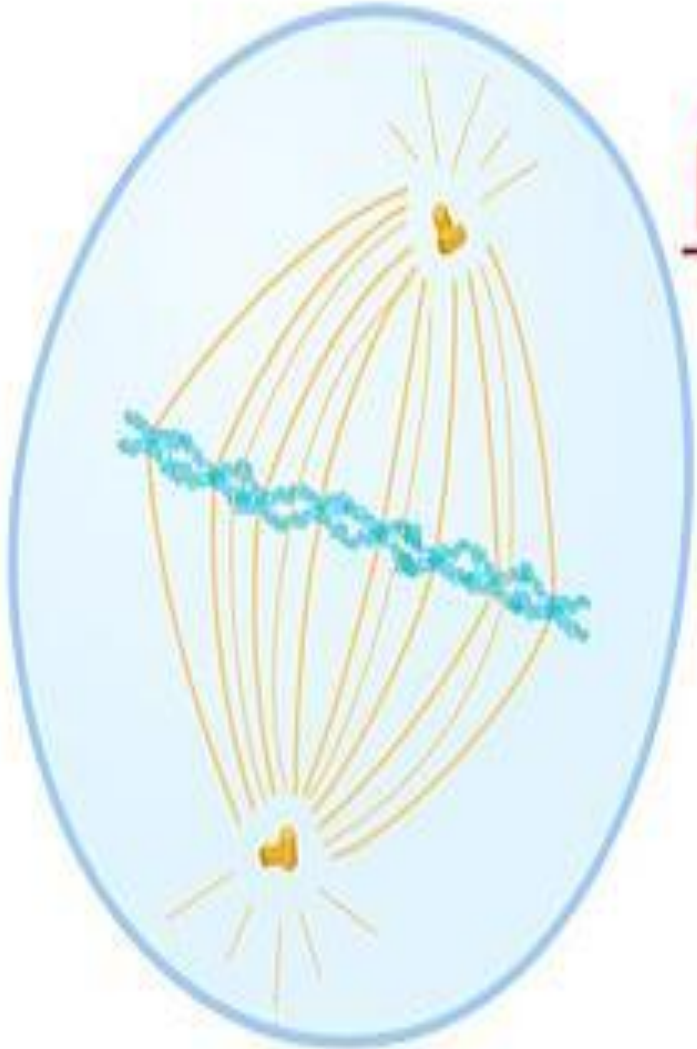

MEIOSIS I: Homologous chromosomes separate
INTERPHASE
PROPHASE I
METAPHASE I
ANAPHASE I
TELOPHASE I + CYTOKINESIS
INTERKINESIS
PROPHASE II
METAPHASE II
ANAPHASE II
TELOPHASE II + CYTOKINESIS
MEIOSIS II: Sister chromatids separate



Prophase

Chromatin condenses into **chromosomes**

Nucleolus disappears

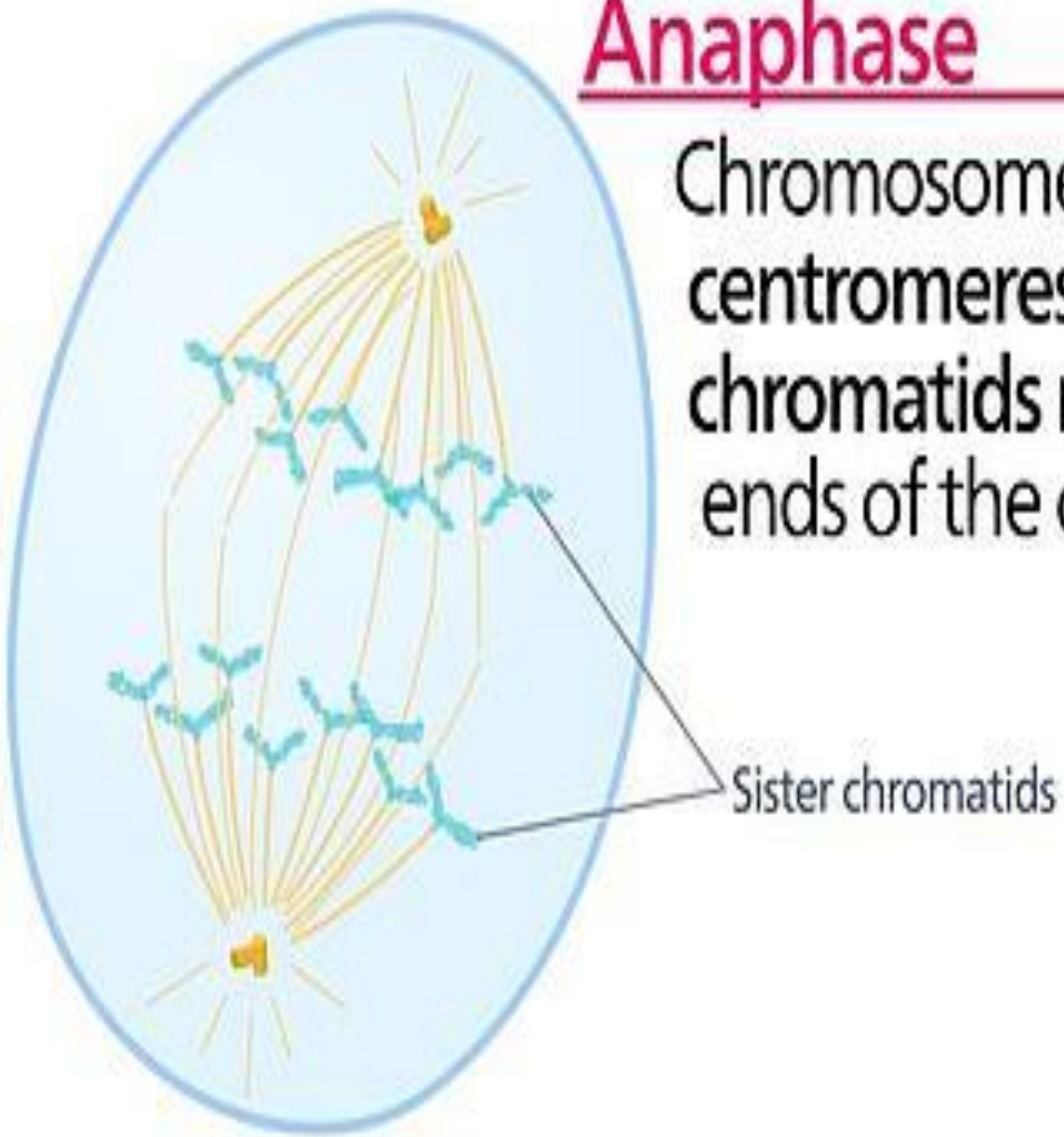


Metaphase

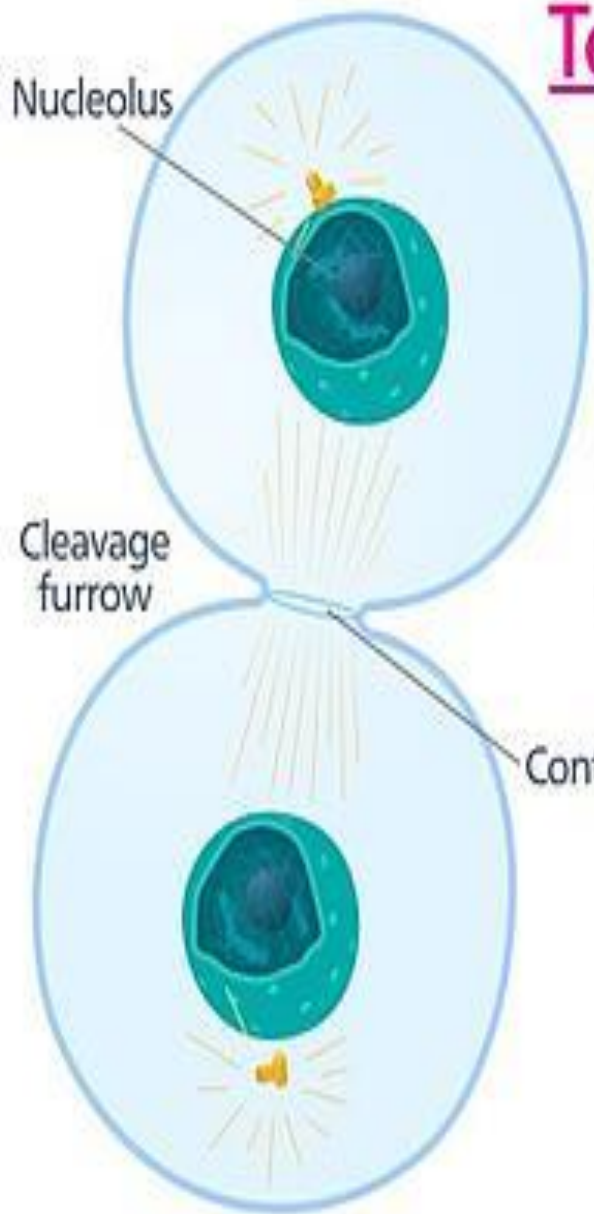
Chromosomes line up along metaphase plate (imaginary plane)

Anaphase

Chromosomes break at **centromeres**, and **sister chromatids** move to opposite ends of the cell



Telophase and Cytokinesis



Nuclear membrane reforms, nucleoli reappear, chromosomes unwind into chromatin

Myosin II and **actin** filament ring contract to cleave cell in two

ژنتیک، جلسه ششم

آمیزش منوهیبرید

GENETIC CROSSES

- THE MONOHYBRID CROSS
- THE DIHYBRID CROSS

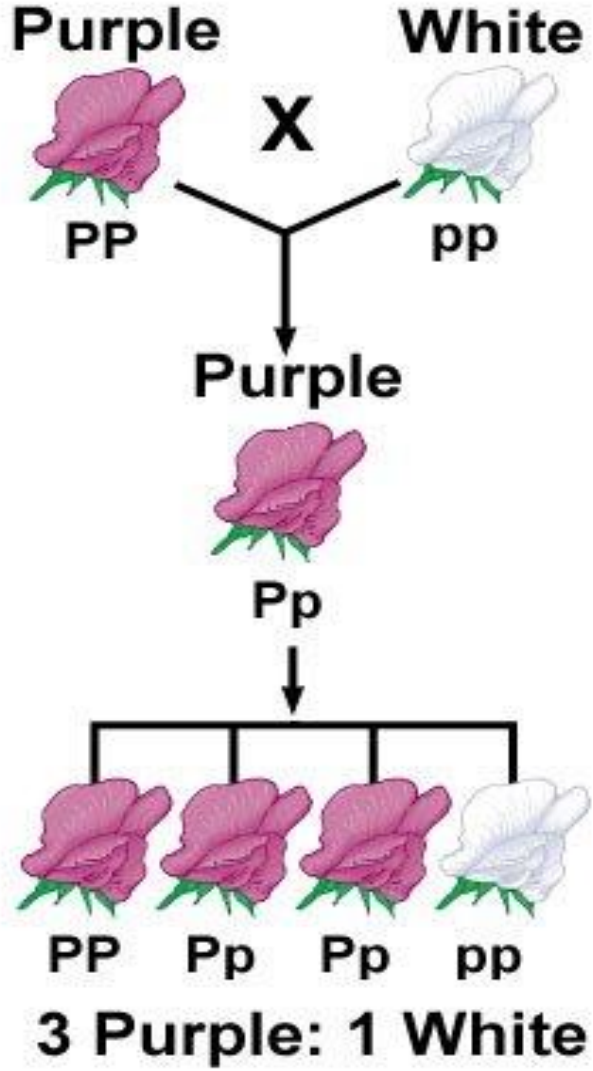
Mono vs. Dihybrid Crosses

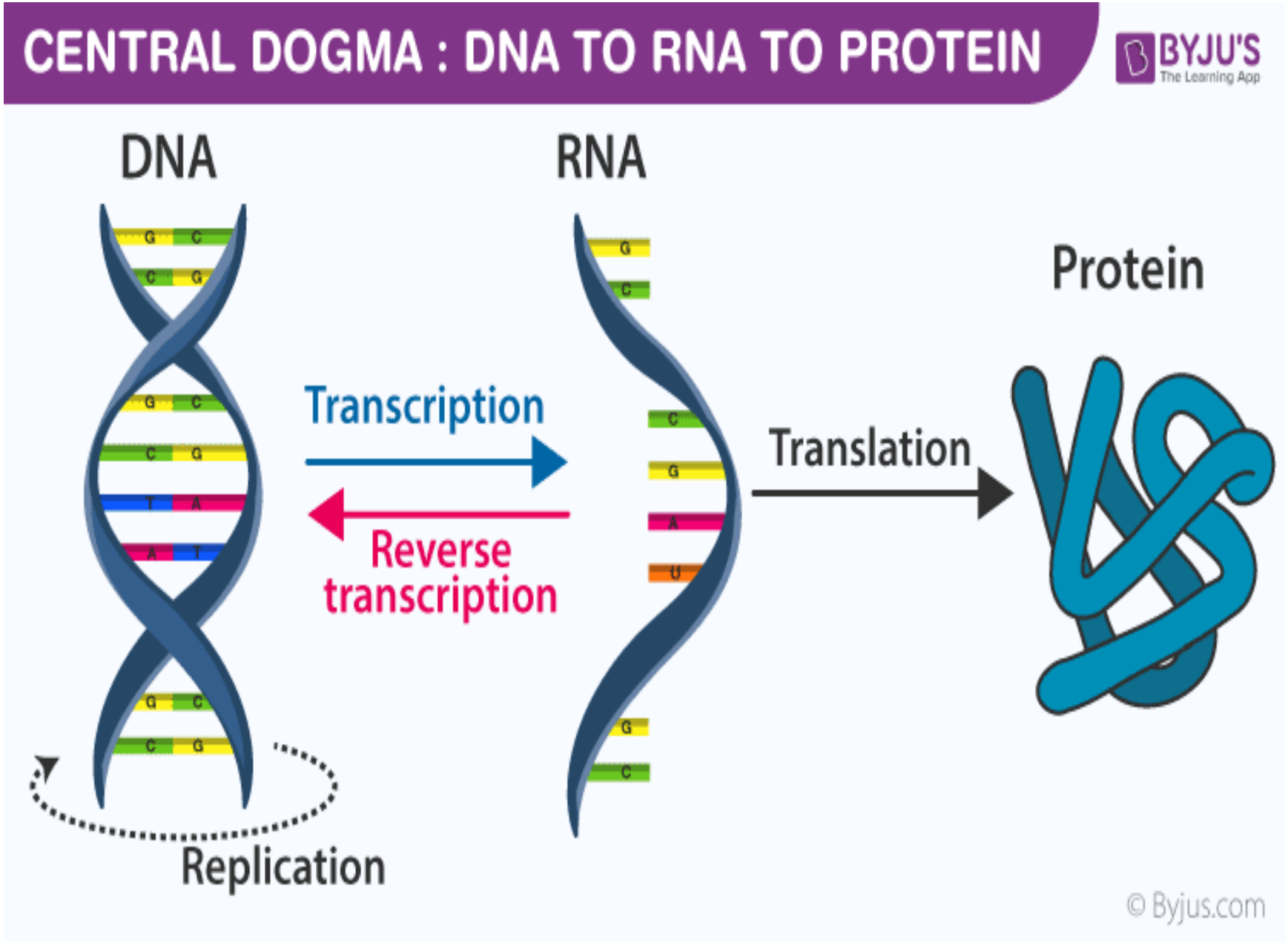
- **Monohybrid Cross**: predicts the offspring of a cross for **one trait** (ex. plant height).
- **Dihybrid Cross**: predicts the offspring of a cross for **two traits** (ex. plant height and seed shape).

PARENTAL GENERATION (P)

FIRST FILIAL GENERATION (F1)

SECOND FILIAL GENERATION (F2)




CENTRAL DOGMA : DNA TO RNA TO PROTEIN
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DNA
RNA
Protein
Transcription
Reverse
transcription
Translation
Replication
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ژنتیک، جلسه هفتم

ترتیب مستقل صفات

Law of independent assortment

Mendel's second for different law states that genes for different traits-for example, seed shape and seed color- are inherited independently of each other. This conclusion is known as **law of independent assortment**.

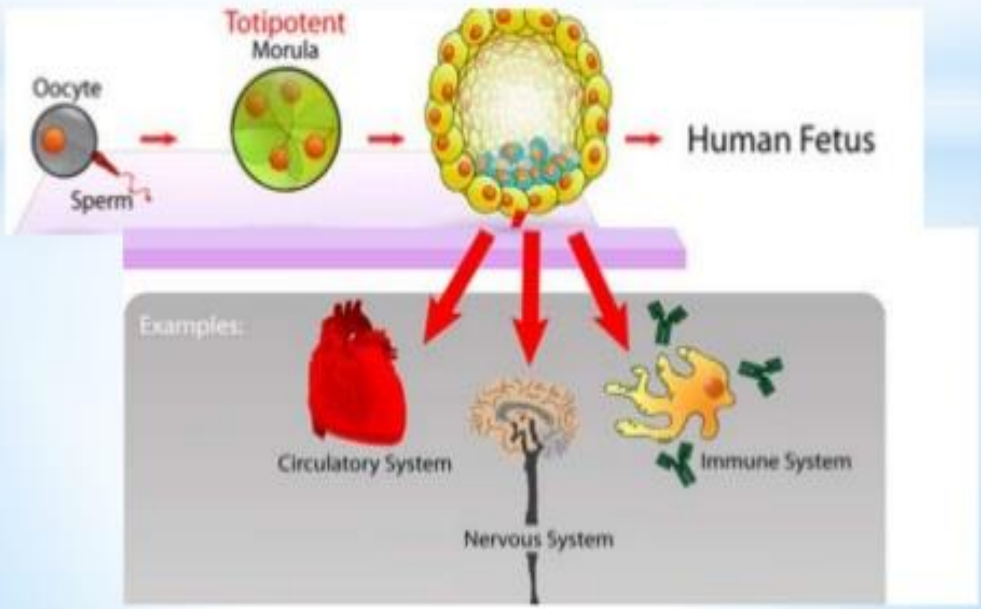
Genotype RrYy- the alleles R and r will separate from each other as well as from the alleles Y and y.

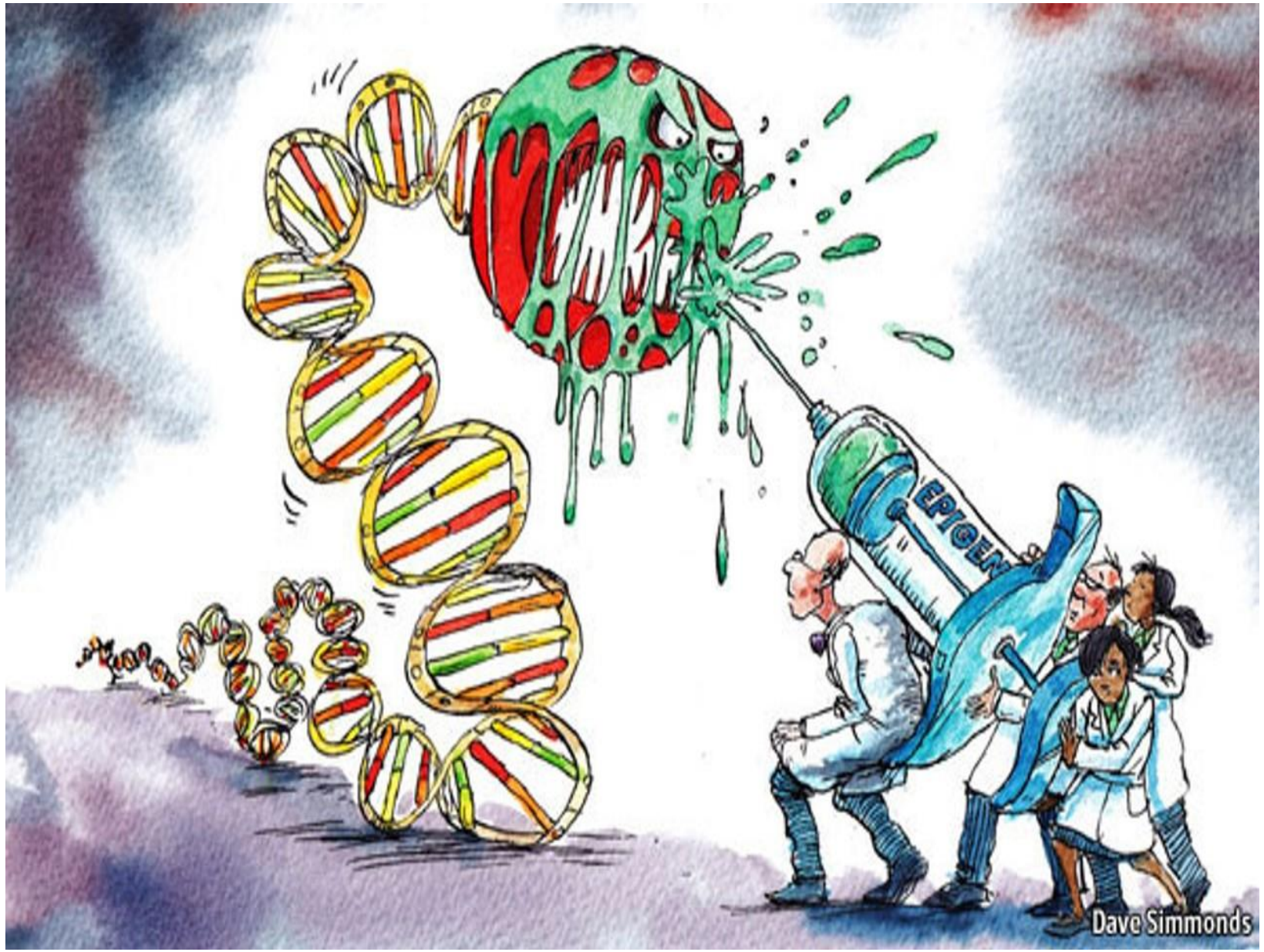
Epigenetics

*Changes in gene expression or phenotype that don't involve changes to the DNA sequence[1]

*Its defined as heritable changes in gene activity and expression that occur without alteration in DNA sequence

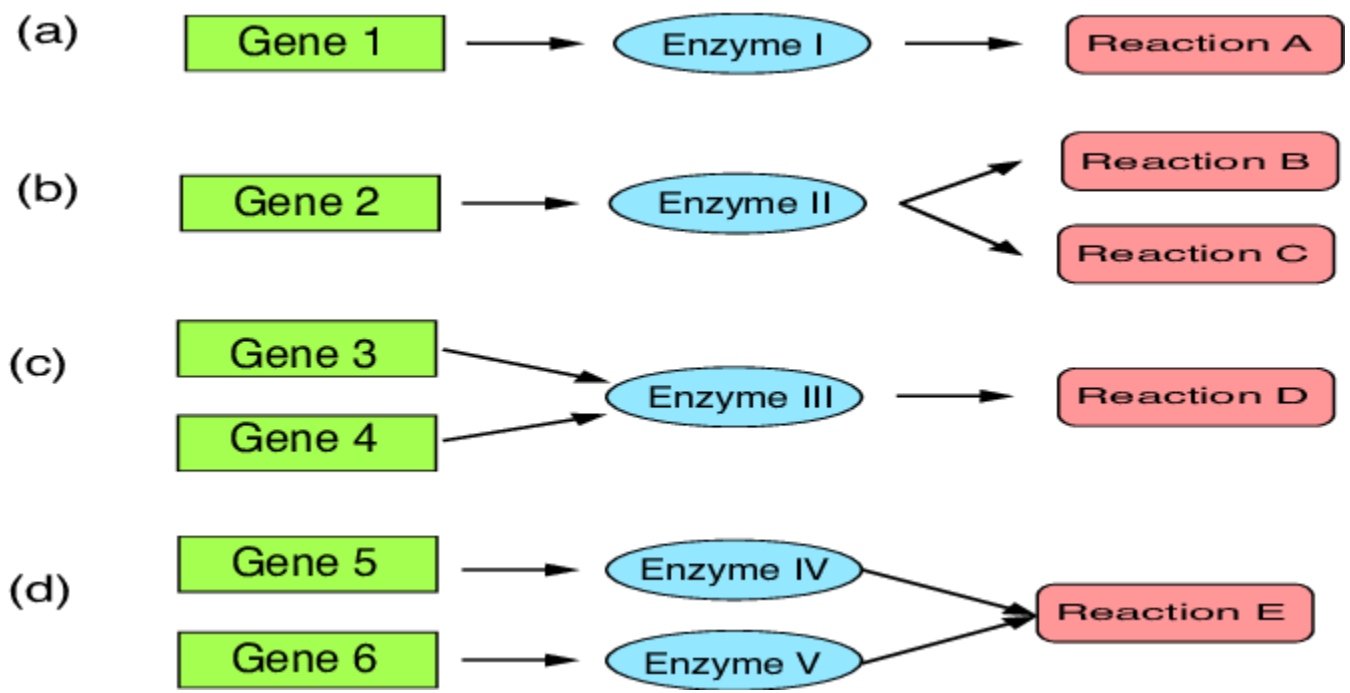
*Modern definition is non-sequence dependent inheritance.




EPIGEN
Dave Simmonds

ژنتیک، جلسه هشتم:

همکاری ژن ها


(a)
Gene 1
Enzyme I
Reaction A
(b)
Gene 2
Enzyme II
Reaction B
Reaction C
(c)
Gene 3
Gene 4
Enzyme III
Reaction D
(d)
Gene 5
Gene 6
Enzyme IV
Enzyme V
Reaction E

14.1 What Is the Evidence that Genes Code for Proteins?

One-gene, one-enzyme has since been revised to the **one-gene, one-polypeptide relationship**.

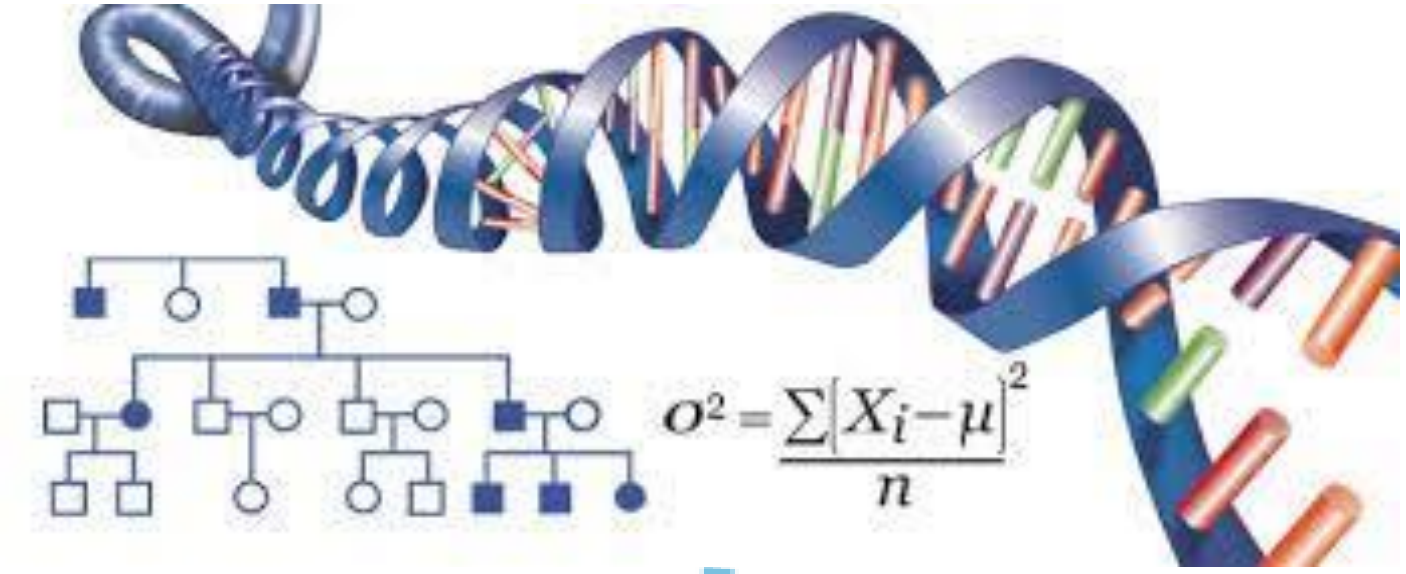
Many proteins have several polypeptides chains, or subunits.

Example: Hemoglobin has four subunits, each specified by a separate gene.

Not all genes code for polypeptides.

ژنتیک، جلسه نهم

روش های آماری در ژنتیک


$\sigma^2 = \frac{\sum[X_i - \mu]^2}{n}$


Statistics
Genetics
TTCGGAGTTACG
AAGCCTCAATGC
TCACTGGTCTGG
AGTGACCAGACC

What Is Statistics?

- "The mathematics of the collection, organization, and interpretation of numerical data, especially the analysis of population characteristics by inference from sampling."

- Statisticians collect and analyze data, then calculate results using a specific design. They draw conclusions and make decisions in the face of uncertainty.

BIOSTATISTICS

When the data being analyzed are derived from biological and medical sciences, the term “ Biostatistics” is used.

2.2 PROBABILITY AND STATISTICS

- The laws of inheritance can be used to predict the outcomes of genetic crosses
- For example
  - Animal and plant breeders are concerned with the types of offspring produced from their crosses
  - Parents are interested in predicting the traits that their children may have
    - This is particularly important in the case of families with genetic diseases

ژنتیک، جلسه دهم

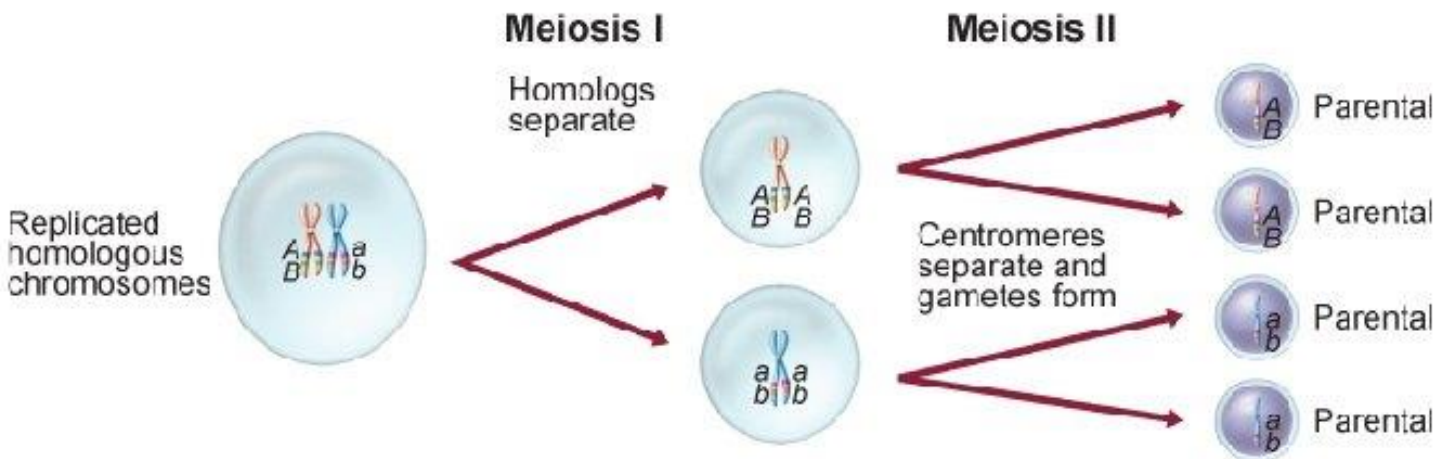
تعیین و تمایز جنسیت

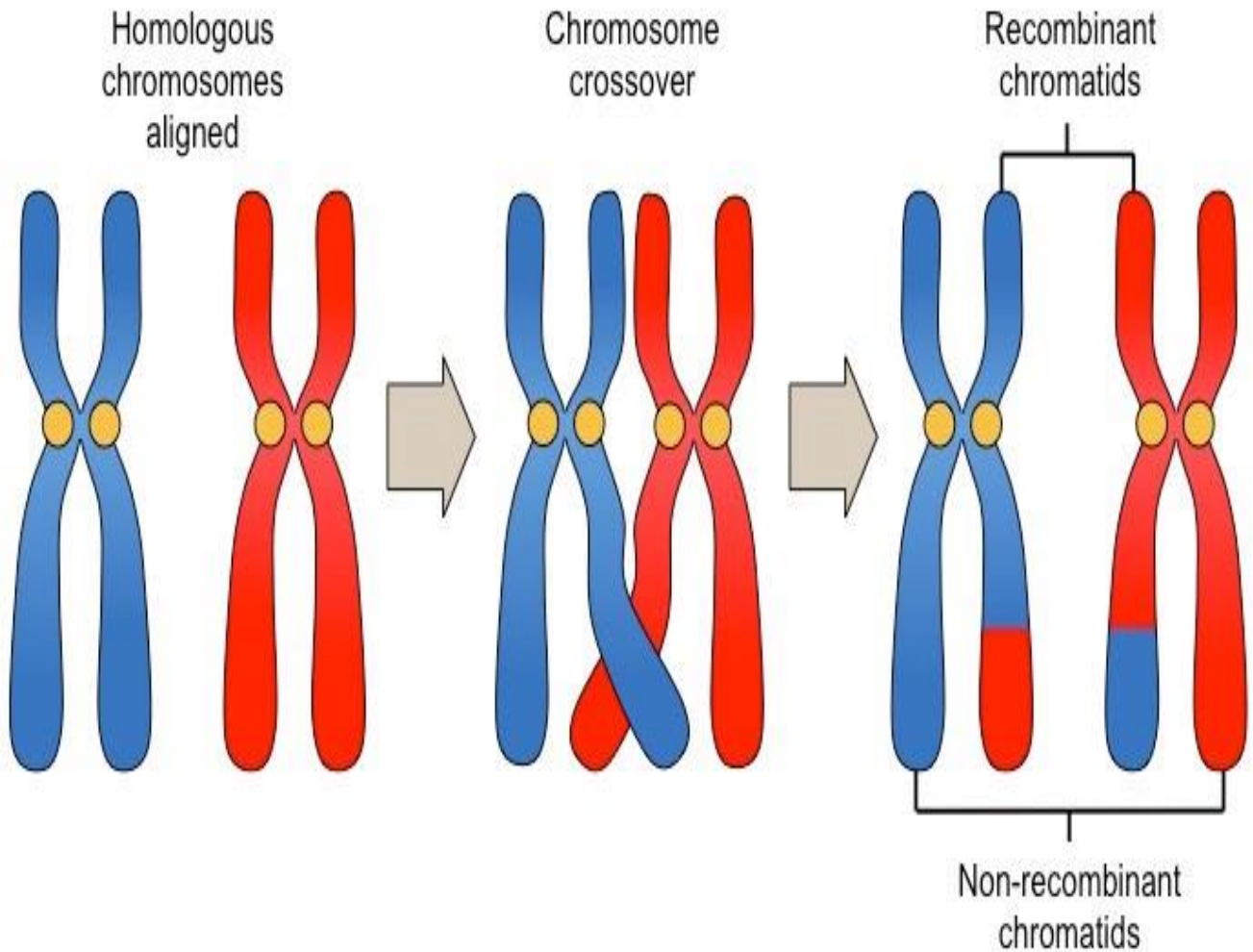
ژنتیک، جلسه یازدهم

پیوستگی ژن ها و Crossing over

Gene Linkage

- Genes located close to each other on the same chromosome are said to be linked.
- They usually travel together during gamete formation.
- Gene linkage results in an exception to Mendel's law of independent assortment.




Homologous chromosomes aligned
Chromosome crossover
Recombinant chromatids
Non-recombinant chromatids

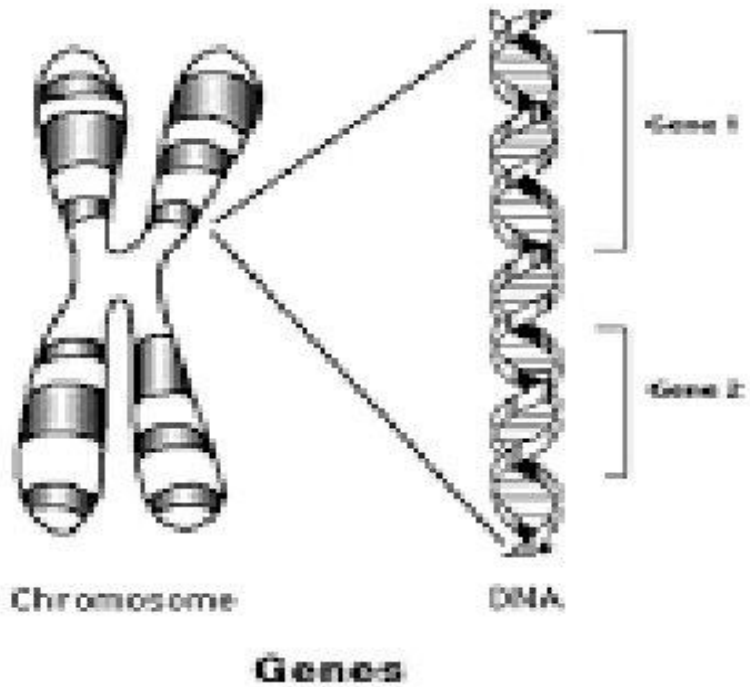
ژنتیک، جلسه دوازدهم

اختلالات کروموزومی

Mutations

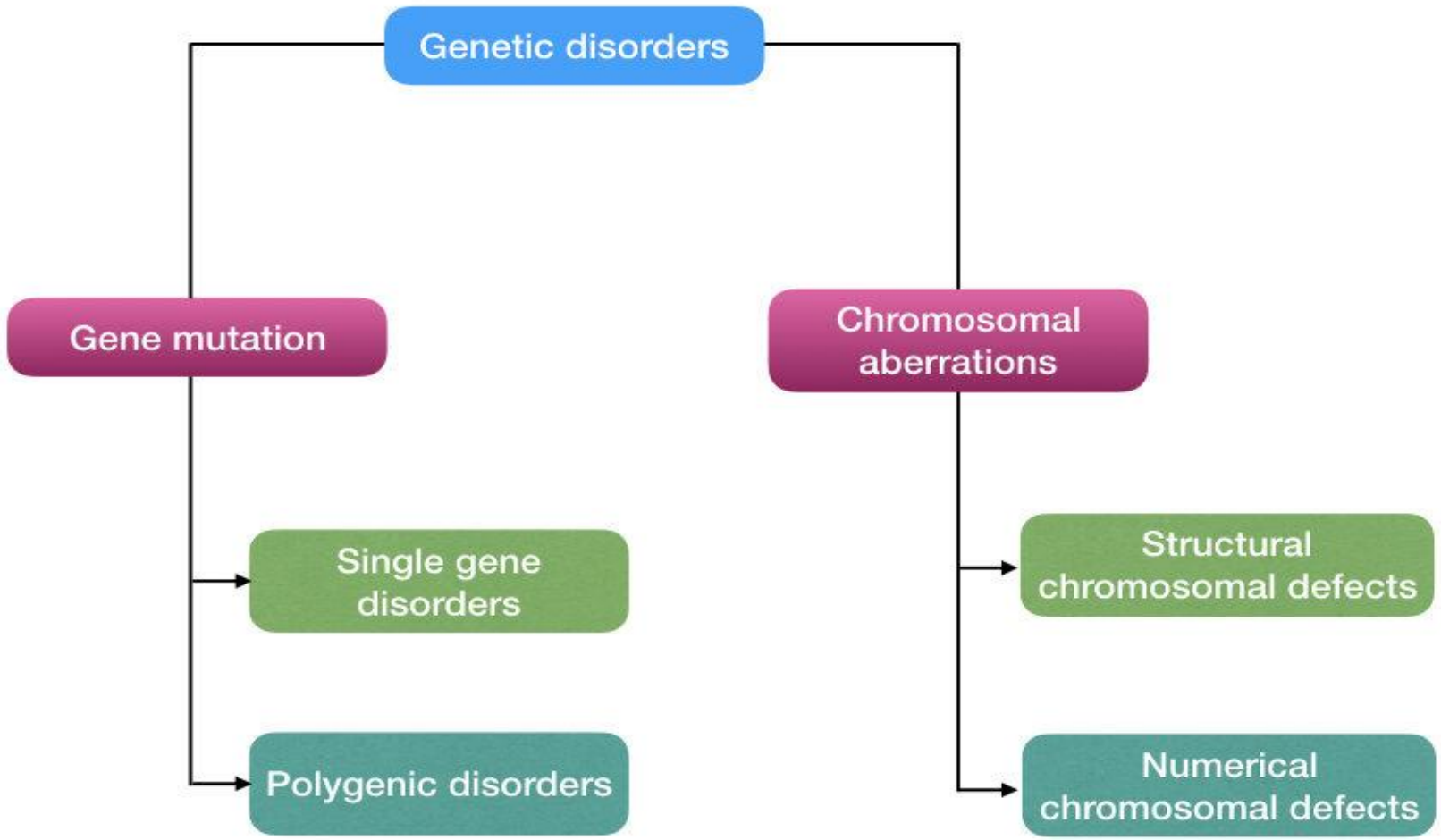
- **Mutations** are defined as "a sudden genetic change in the DNA sequence that affects genetic information".
- They can occur at the molecular level (genes) and change a single gene, or at the chromosome level and affect many genes.

Types of mutations



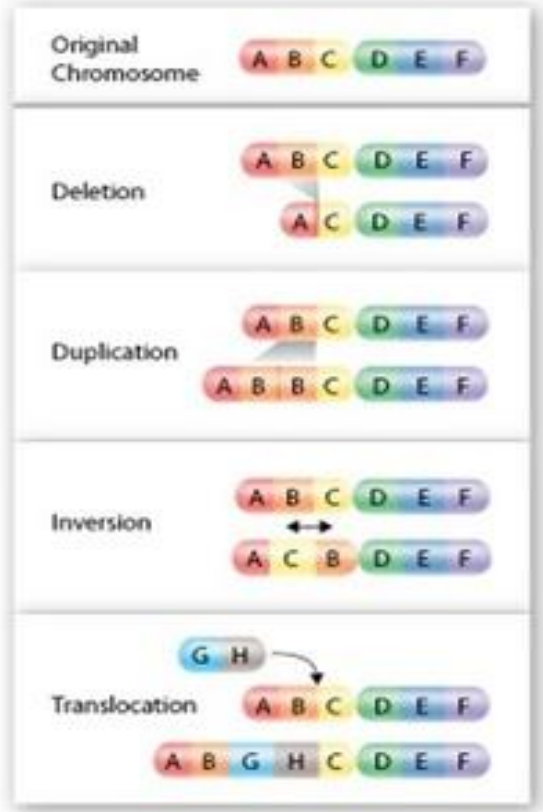
Chromosomal mutation: affects whole or part of a chromosome

Gene mutation: Changes to the bases in the DNA of ONE gene


Genetic disorders
Gene mutation
Chromosomal aberrations
Single gene disorders
Polygenic disorders
Structural chromosomal defects
Numerical chromosomal defects

4 Types of Chromosomal Mutations

- Deletion- loss of part of chromosome
- Duplication- extra copy made of part of chromosome
- Inversion- reverses direction of part of chromosome
- Translocation- part of one attaches to another chromosome

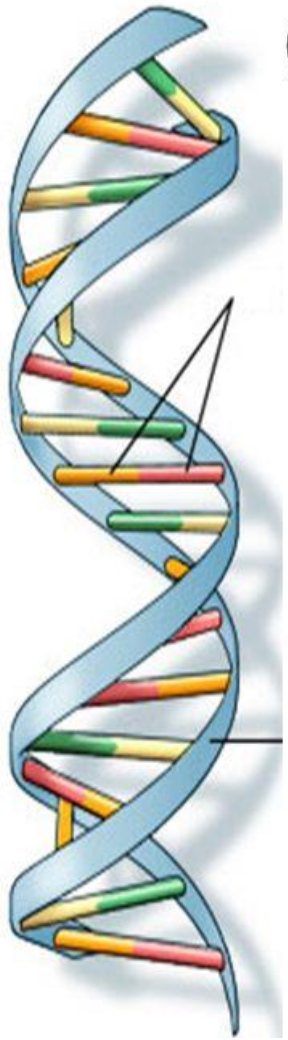


ژنتیک، جلسه سیزدهم

جهش های ژنی

Types of Gene Mutations:

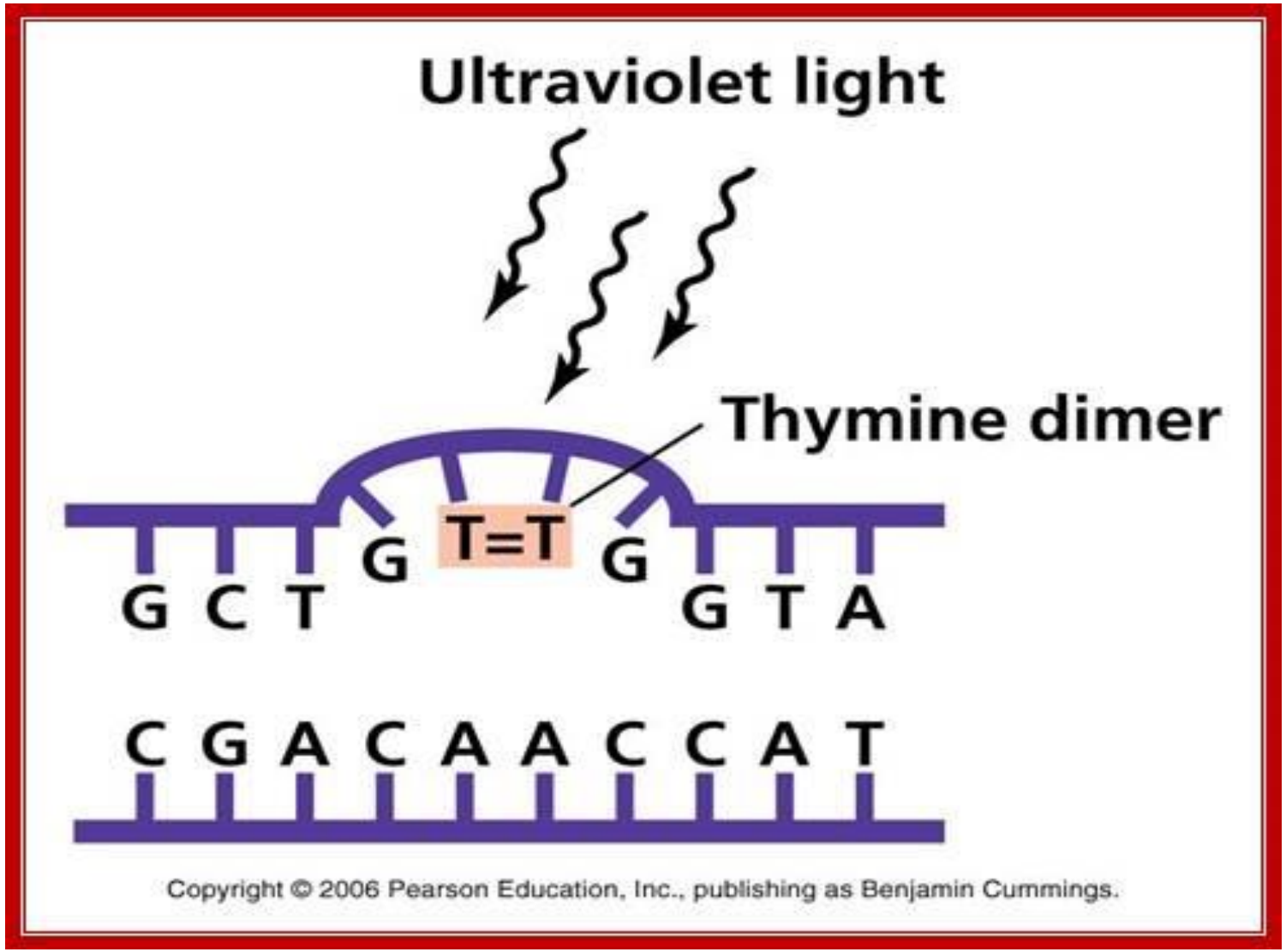
1. **point/substitution** – a single nucleotide changes**; or** the wrong amino acid is placed during protein synthesis
2. **insertion** – a sizable length of DNA is inserted into a gene
3. **deletion** – segments of a gene are lost



Causes of Gene Mutations

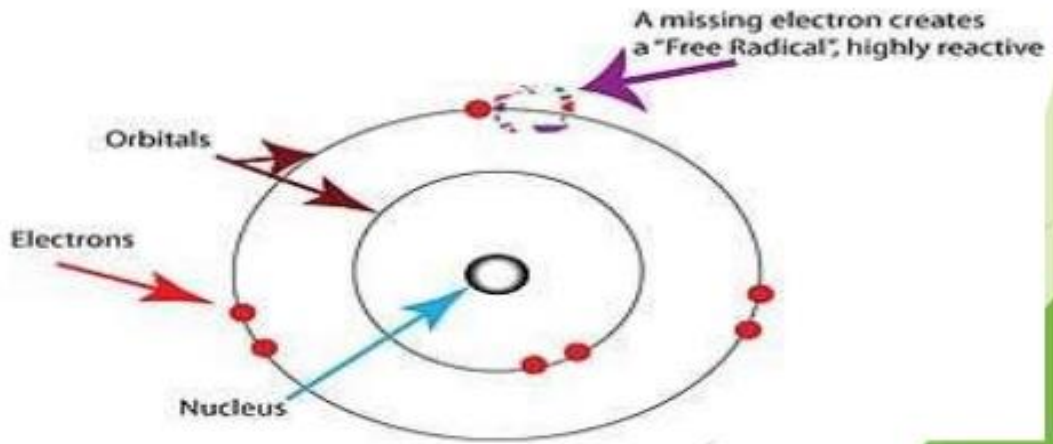
- Mutations can occur spontaneously during DNA replication
- Many mutations occur as a result of exposure to mutagens, or mutation causing agents in the environment

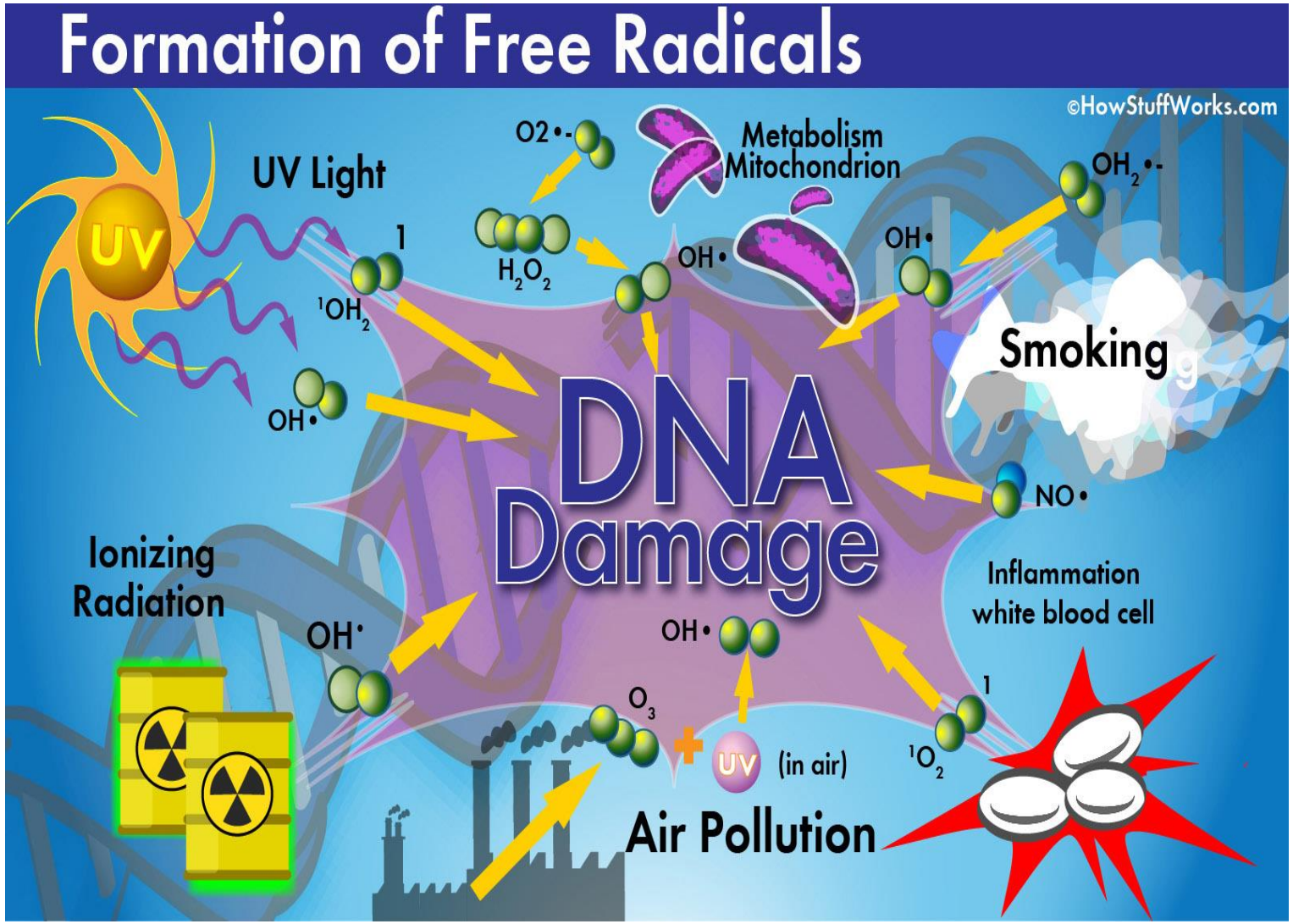

Types of mutagens
1
•Physical
2
•Chemical
3
•Biological



Definition:

- Molecule or molecular fragment containing one or more unpaired electrons in its outermost atoms or molecular orbital and are capable of independent existence.




Formation of Free Radicals
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UV Light
UV
Metabolism
Mitochondrion
O2•-
H_2O_2
OH•
$^1OH_2$
OH_2•-
Smoking
NO•
DNA
Damage
Ionizing
Radiation
Inflammation
white blood cell
O_3
UV
(in air)
$^1O_2$
Air Pollution

ژنتیک، جلسه چهاردهم

نگرشی بر مهندسی ژنتیک