##### Genetics

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*Genetics*, the science of heredity and variation, is a recent rapidly expanding discipline that has the potential to enhance the quality of human life. It has a dramatic impact on medicine, agriculture, archaeology, forensics, etc. A scientist that works in the field of genetics is a *geneticist*.

Johann Gregor Mendel, an Austrian Catholic monk and botanist, is widely recognized as the founder of genetics. While experimenting with pea plants in his garden, he discovered the fundamental laws of inheritance (the law of segregation, the law of independent assortment, and the law of dominance). According to Mendel’s model, physical traits are determined by heritable ‘factors’, now called *genes*, passed on by parents to offspring in a predictable pattern. Every individual has two copies of a given gene, and each pair of genes determines a specific trait. Parental genes are randomly sorted into gametes which have only one copy of the gene. Therefore, offspring inherit one genetic *allele*, a variant form of a gene, from each parent. What is more, the alleles of different genes are sorted into gametes independently of one another. Consequently, the inheritance of one trait is not dependent on the inheritance of another. While this was true for what Mendel saw in peas, we now know that genes can be inherited together when their genetic loci are close on the same chromosome. Moreover, parental genes appear in the offspring as *dominant* or *recessive* traits.

The segregation of gene variants and their corresponding traits was first observed by Gregor Mendel in 1865. However, the year 1900 marked the beginning of the modern era of genetics, when three scientists, Hugo DeVries, Carl Correns and Erich von Tschermak, independently rediscovered and confirmed Mendel’s work. In 1909, Wilhelm Johannsen, a Danish botanist and pharmacist, coined Mendel’s individual units of heredity, *genes*, a term derived from “*pangenesis”* (Charles Darwin’s developmental theory of heredity). Johannsen also coined the terms *genotype* and *phenotype*. The genotype, the set of alleles carried by an organism, determines the phenotype, the observable characteristics of an individual, like height, eye colour, blood type, etc. An organism displaying the usual phenotype for that species is called a *wild type*. The *Punnett square* is used to predict the genotypes and phenotypes of offspring from genetic crosses.

Logo

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A Punnett square showing a typical test cross

Genetic Material

The genetic information that controls the morphogenesis of an organism is stored in large macromolecules called nucleic acids, which are of two types: DNA (deoxyribonucleic acid) and RNA (ribonucleic acid). DNA constitutes the genetic material in all cellular organisms and most viruses. RNA is the information-carrying material in some viruses, but it is also found in all living cells, playing an important role in the production of proteins (the building blocks in each cell).

DNA is organized into thread-like structures called *chromosomes.* An individual’s collection of chromosomes is known as a *karyotype.* DNAacts as a blueprint for cells and is made up of two strands which intertwine to form a *double helix*. Watson, Crick, Wilkins, and Franklin are all credited with discovering the double-helix structure of DNA, which formed the basis for modern biotechnology.

A picture containing text

Description automatically generated

Human Male Karyotype

Each strand of the double helix is made up of many individual units called *nucleotides* which attach to each other in the DNA strand by phosphodiester bonds. A nucleotide has three components: a sugar molecule, a phosphate group, and one of four nitrogenous bases-*adenine (A)*, *guanine (G)*, *thymine (T)*, and *cytosine (C)*. There are four different DNA nucleotides, one type for each of the four different bases. Two of the bases (adenine and guanine) are *purines*, and the other two (cytosine and thymine) are *pyrimidines*. Purines pair with pyrimidines. More specifically, A with T and C with G. In RNA, the base *uracil (U)* takes the place of thymine. DNA *sequencing* is the process that determines the order of the nucleotides in DNA.

Diagram

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Nucleotides

*DNA replication* is the process of producing two identical DNA molecules from a double stranded DNA molecule.

The process of making an RNA copy of DNA is called *transcription*. This is performed by enzymes called *RNA polymerases*. The copy that emerges is referred to as a *messenger RNA (mRNA)* molecule.

**The Human Genome Project (HGP)**

All the genetic information of an organism constitutes its *genome*. The study of the structure and function of entire genomes is called *genomics*. The Human Genome Project (HGP) was an international research effort to map the entire human genome. Scientists attempted to determine the sequence of the human genome and identify all the genes in human DNA. They estimated that humans have approximately 20,500 genes. The project lasted thirteen years and was completed in 2003.

Alterations in the Genetic Material

Mutations

Although genetic information is replicated and transmitted from one generation to the next with considerable accuracy, mistakes do occasionally occur. A *mutation* is an alteration in a DNA sequence. Mutations that occur in gametes and can be passed onto offspring are classified as *germline mutations*. Mutations that occur in any of the cells of the body apart from germ cells and therefore are not passed onto offspring are classified as *somatic mutations*. If a mutation does not have an observable effect on the organism’s phenotype, it is a *silent mutation*. An organism whose phenotype has been altered by mutation is referred to as a *mutant*. An environmental agent, either physical or chemical, that can induce a mutation is called a *mutagen*.

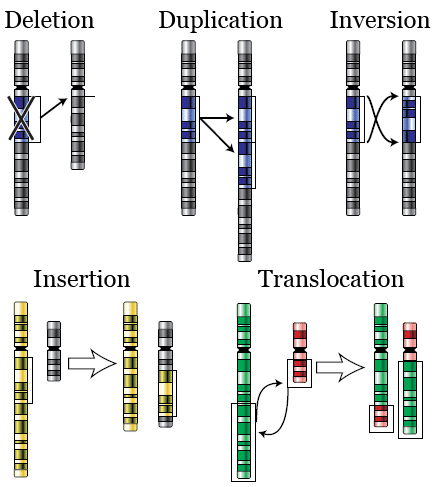
**Point Mutations**

A large category of mutations that describe a change in a single nucleotide of DNA are *point mutations*. A point mutation is classified as a *transition* when it is a purine to purine (A ↔ G) or a pyrimidine to pyrimidine (C ↔ T). If the alteration occurs from a purine to a pyrimidine or vice versa (A or G ↔ T or C) it is classified as a *transversion*.

**Chromosomal Alterations**

*Chromosomal alterations* are mutations that change chromosome structure and can be classified as:

* An *insertion* (addition of genetic material ranging from a single extra DNA base pair to a piece of a chromosome)
* A *deletion* (the removal of genetic material ranging from a single missing DNA base pair to a piece of chromosome)
* An *inversion* (the excision of a portion of the double helix followed by its reinsertion at the same position but in the reverse orientation)
* A *duplication* (the production of one or more copies of a gene or region of a chromosome)
* A *translocation* (when a chromosome breaks and a portion of it reattaches to a different chromosomal location)



Chromosomal alterations

Larger scale alterations occur through *recombination* that may involve the exchange of segments of polynucleotides between different DNA molecules, and the *transposition* of a piece of DNA from one position to another in a DNA molecule.

**DNA Repair Mechanisms**

DNA stability is maintained through multiple *DNA repair mechanisms* including nucleotide excision repair (NER), base excision repair (BER), mismatch repair (MR), homologous recombination (HR), and non-homologous end joining (NHEJ).

Genetic Disorders

A *genetic disorder* is a disease caused by an abnormality in the genetic makeup of an individual. Some diseases are due to inherited mutations and are present at birth, while others are caused by acquired mutations, in a gene or group of genes, that occur either randomly or are linked to environmental factors. The main types of genetic disorders are:

* single gene inheritance
* multifactorial inheritance
* chromosomal abnormalities
* mitochondrial inheritance

Single Gene Inheritance

*Single gene inheritance* is also called *Mendelian* or *monogenic inheritance*. This type of disorder is caused by a mutation that affects only one gene. Single gene inheritance has different patterns of inheritance, including:

* *autosomal dominant* that usually occurs in every generation (e.g., Huntington’s disease)
* *autosomal recessive* that is not typically seen in every generation (e.g., sickle cell anaemia)
* *X-linked dominant* that more commonly affects females (e.g., X-linked hypophosphatemic rickets)
* *X-linked recessive* that more commonly affects males (e.g., Duchenne’s muscular dystrophy)

Mitochondrial Inheritance

*Mitochondrial inheritance* is quite rare and is strictly maternal.

Multifactorial Inheritance

*Multifactorial inheritance* is also called *complex inheritance* or *polygenic inheritance*. This type of disorder is caused by mutations in multiple genes. Lifestyle and environment are contributory factors, as well. Examples of multifactorial inheritance disorders include diabetes, cardiovascular disease, colon cancer, etc.

Chromosomal Abnormalities

*Chromosomal abnormalities* can be categorized as *numerical* or *structural* depending on whether the changes are in the number or structure of entire chromosomes. A numerical disorder occurs when an individual is either missing one of the chromosomes from a pair or has more than two chromosomes instead of a pair. Examples of numerical disorders include trisomy, monosomy, etc. A well-known numerical disorder is Down syndrome. An abnormal chromosome number due to an extra or missing chromosome is called *aneuploidy*, the most common type of chromosomal abnormality. A structural abnormality involves an alteration in the structure of the chromosome in one of several ways. A part of an individual chromosome may be missing or extra, turned upside down, or switched to another chromosome. An example of a genetic syndrome caused by a structural abnormality is Pallister Killian mosaic syndrome.

Genetic counselling

*Genetic counselling* is a process of communication in which specially trained professionals in both genetics and counselling, meet with individuals and families affected by or possibly at risk of developing a genetic disorder. Genetic counsellors help people understand and adapt to the medical, psychological, and familial implications of genetic diseases.

Gene Editing

Since the late 1900’s scientists began to develop techniques known as *genome editing* or *gene editing* (a type of *genetic engineering*) to directly target and modify genomic sequences. Three major genome editing technologies are zinc-finger nucleases (ZFNS), transcription activator-like effector nucleases (TALENs) and clustered regularly interspaced short palindromic repeat (CRISPR).

Map

Description automatically generated with medium confidence

CRISPR

CRISPR/Cas9 has generated the most excitement, because it is efficient and easy to use. It is described by scientists as a pair of ‘genetic scissors’ as it can ‘perform surgery’ on genes, allowing genetic material to be added, removed, or altered at particular target sites in the genome. Genes that are faulty are replaced with healthy ones, so genetic diseases like muscular dystrophy, cystic fibrosis, sickle cell disease, even cancer can be treated. The use of genetic technologies to produce a therapeutic effect or prevent disease is called *gene therapy*.

Emmanuelle Charpentier and Jennifer Doudna invented CRISPR-Cas9 while studying how bacteria protect themselves from viruses, and were awarded the Nobel Prize in 2020. The technique was modified for humans and some scientists suggest that CRISPR could be used on early embryos, as well. However, genetic changes on germ-line cells are permanent and are passed onto future generations. Moreover, there is always a risk that an edit could cause a mutation in the genome with unpredictable side effects. In 2018, He Jianku, a Chinese scientist, announced the birth of the world’s first CRISPR-modified babies, two twin girls, known as Lulu and Nana. He altered a gene while the girls were in a petri dish, in order to protect them from HIV since their father had contracted AIDS. He Jianku was banned from working on reproductive medicine for life and was sentenced to three years in prison.

Gene editing is quite controversial because of the ethical, legal, and social issues that may arise. There is also a danger of a potential misuse of this technique. One example of a potential misuse is planned breeding (the selection of desired heritable traits for the improvement of the human race).

**Practice Exercises**

Practice with Word Parts

**Exercise 1:** Scan the text for terms which contain the following word parts.

1. *gen/o* (originate;origin)  
   ……………………………………………………………………………………………………………………………….
2. *-gen* (one that generates)

……………………………………………………………………………………………………………………………….

1. *-genesis* (birth, origin, creation)

……………………………………………………………………………………………………………………………….

1. Can you think of more terms that include the word parts mentioned above?

gen/o ………………………………………………………………………………………………………..

-gen …………………………………………………………………………………………………………

-genesis ………………………………………………………………………………………………………..

Practice with Adjectives

**Exercise 2:** Complete the table with the missing noun or adjective.

|  |  |
| --- | --- |
| **Noun** | **Adjective** |
| heredity | ………………………… |
| genome | ………………………… |
| chromosome | ………………………… |
| ………………………… | recessive |
| structure | ………………………… |
| ………………………… | abnormal |
| analysis | ………………………… |
| anaemia | ………………………… |
| ………………………… | molecular |
| technology | ………………………… |
| contribution | ………………………… |
| ………………………… | additional |
| ………………………… | extensive |
| therapy | ………………………… |

**Exercise 3:** Complete the table with the missing verb or noun.

|  |  |  |  |
| --- | --- | --- | --- |
| Verb | Noun | Verb | Noun |
| ………………………… | transcription | ………………………… | editing |
| ………………………… | inversion | ………………………… | alteration |
| inherit | ………………………… | attach | ………………………… |
| translocate | ………………………… | ………………………… | process |
| ………………………… | deletion | ………………………… | modification |
| enhance | ………………………… | occur | ………………………… |
| ………………………… | duplication | observe | ………………………… |

**Exercise 4:** Scan the text for terms that mean:

|  |  |
| --- | --- |
| **Definition** | **Term** |
| 1. a microscopic thread like structure that carries genetic information | ……………………………………… |
| 1. an abnormal chromosome number due to an extra or missing chromosome | ……………………………………… |
| 1. an alternate form of a gene | ……………………………………… |
| 1. an organism's complete set of DNA including all of each genes | ……………………………………… |
| 1. the presence of an extra segment of chromosome | ……………………………………… |
| 1. the genetic constitution of an organism | ……………………………………… |
| 1. the movement of a genetic element from one location to another in a DNA molecule | ……………………………………… |
| 1. the basic unit of heredity | ……………………………………… |
| 1. an organism displaying the usual phenotype for that species | ……………………………………… |
| 1. the process by which DNA makes a copy of itself during cell division | ……………………………………… |
| 1. the addition of one or more nucleotides to a chromosome | ……………………………………… |
| 1. the chromosomal constitution of the cell nucleus | ……………………………………… |
| 1. the removal of genetic material ranging from a single missing DNA base pair to a piece of a chromosome | ……………………………………… |
| 1. the set of observable characteristics of an organism | ……………………………………… |
| 1. an alteration in the nucleotide sequence of a DNA molecule | ……………………………………… |

**Exercise 5:** Think of noun phrases that include the word *gene.* Enter them in the diagram below.

**Exercise 6**: Are you familiar with the following terms which refer to genetic disorders? Match the terms with their definition.

*achondroplasia, cri-du-chat syndrome, cystic fibrosis (CF), fragile X syndrome (FXS), myoclonic epilepsy with ragged-red fibers (MERRF), sickle cell anaemia, X-linked hypophosphatemic rickets*

|  |  |
| --- | --- |
| **Definition** | **Term** |
| 1. a progressive genetic disorder that causes sticky mucus to build up in the lungs and digestive system, but also affects other parts of the body such as the kidneys | …………………………………………………..  ………………………………………………….. |
| 1. a chromosomal disorder causing infants to produce a high-pitched cry that sounds like that of a cat, also known as *cat’s cry* or *5p- syndrome* | …………………………………………………..  ………………………………………………….. |
| 1. an extremely rare mitochondrial disease that affects many parts of the body, particularly the muscles and the nervous system, symptoms of which include myoclonus, spasticity, ataxia, recurrent seizures and slow deterioration of intellectual function | …………………………………………………..  ………………………………………………….. |
| 1. a genetic condition resulting from mutations in a gene on the X chromosome, that is characterized by a range of intellectual and developmental problems and affects males more severely than females | …………………………………………………..  ………………………………………………….. |
| 1. a heritable disorder of bone mineralization caused by defects in the renal handling of phosphorus leading to growth retardation and bone deformities | …………………………………………………..  ………………………………………………….. |
| 1. a rare genetic condition that is the most common cause of disproportionate short stature, where the arms and legs are particularly short, the most common type of *dwarfism* | …………………………………………………..  ………………………………………………….. |
| 1. an inherited disorder that affects haemoglobin, causing red blood cells to become rigid and crescent-shaped | …………………………………………………..  ………………………………………………….. |

**Exercise 7:** Match the terms used to name the instruments and pieces of equipment found in a laboratory with the images below. Write your answers in the lines provided.

*beaker, centrifuge tube, centrifuge machine, cover glass, glass microscope slide, microcentifuge tube, optical microscope, stereo microscope, Pasteur pipette, Petri dish, pipette, scalpel, syringe, volumetric flask, vortex machine*

|  |  |  |
| --- | --- | --- |
| A close-up of a knife  Description automatically generated with low confidence   1. .................................... | A picture containing floor, knife  Description automatically generated   1. ………………………………….. | A close-up of a syringe  Description automatically generated with medium confidence   1. ..................................... |
| A picture containing floor, Petri dish, indoor, dishware  Description automatically generated   1. ........................................ | 1. ……………………………………. | A picture containing text  Description automatically generated   1. …………………………………….. |
| A picture containing text  Description automatically generated   1. ………………………………. | A picture containing bathroom  Description automatically generated   1. …………………………………… | A picture containing indoor, bathroom, sink  Description automatically generated   1. …………………………………. |
| A picture containing cup, jar, glass  Description automatically generated   1. …………………………………… | A close-up of a camera  Description automatically generated with medium confidence   1. …………………………………. | A picture containing indoor  Description automatically generated   1. …………………………………… |
| A picture containing floor, indoor, old  Description automatically generated   1. …………………………………. | A white frame on a purple surface  Description automatically generated with low confidence   1. …………………………………. | A picture containing purple, cloth, knife  Description automatically generated   1. ……………………………….. |

**Exercise 8:** Below are the names of some prominent figures in the history of biology and genetics. Can you match them with the main concepts of their theories?

|  |  |
| --- | --- |
| 1. Jean Batist Lamarck  (1744-1829) | …………. the theory of *the continuity of germplasm* |
| Άουγκουστ Βάισμαν - Βικιπαίδεια  2. August Weismann  (1834 –1914) | …………. the theory of *punctuated eqilibrium* |
| 3. Hugo de Vries  (1848 –1935) | …………. the theory of *evolution by natural selection* |
| 4. Charles Robert Darwin  (1809-1882) | …………. the theory of *use and disuse* or theory of *inheritance of acquired characteristics* |
| 1972 Stephen Jay Gould and Niles Eldredge propose... | Sutori  5. Stephen Jay Gould  (1941-2002)  Niles Eldredge  (1943- ) | …………. the *mutation theory* |

## **Abbreviations**

## **Exercise 9:** What do the following abbreviations stand for?

DNA ………………………………………………………………………………………

RNA ………………………………………………………………………………………

HGP ………………………………………………………………………………………

mRNA ………………………………………………………………………………………

Rdna ………………………………………………………………………………………

NER ………………………………………………………………………………………

BER ………………………………………………………………………………………

MR ………………………………………………………………………………………

NHEJ ………………………………………………………………………………………

ZFNS ………………………………………………………………………………………

MFS ………………………………………………………………………………………

FXS ………………………………………………………………………………………

CF ………………………………………………………………………………………

TALENs ………………………………………………………………………………………

MERRF ………………………………………………………………………………………

A ………………………………………………………………………………………

G ………………………………………………………………………………………

T ………………………………………………………………………………………

C ………………………………………………………………………………………

|  |  |
| --- | --- |
| Acronyms |  |
| Term | Meaning |
| CRISPR | clustered regularly interspaced short palindromic repeat |
| MELAS syndrome | Mitochondrial Encephalopathy Lactic Acidosis Stroke-like episodes |

|  |  |
| --- | --- |
| Eponyms |  |
| Term | Meaning |
| Punnett square | A chart that shows all the possible ways alleles can combine in a genetic cross.  It is named after Reginald C. Punnett, a British geneticist, who devised the approach in 1905. |
| Petri dish | A shallow dish on which biological cultures may be grown and/or viewed.  The device was named after Julius Richard Petri, a German microbiologist, who invented it in 1887. |
| Down syndrome | A genetic disorder caused by the presence of all or part of a third copy of chromosome 21, also known as *trisomy 21*.  Down syndrome is named after the British physician, John Langdon Down (1828 – 1896), who was the first to categorize the common features of people with the condition. |
| **Huntington disease** | A rare, hereditary disease that causes the progressive degeneration of nerve cells in the brain, and uncontrolledmovements, also known as Huntington's chorea.  It is named after George Huntington (1850 – 1916), an American physician, who first described the disease. |
| Marfan syndrome (MFS) | A rare multi-systemic genetic disorder that affects the connective tissue, caused by mutations in the FBN1 gene.  It was named after Antoine Bernard-Jean Marfan (1858 –1942), a French paediatrician, who first described the condition in 1896. |

**Mythonyms**

|  |  |  |
| --- | --- | --- |
| chimera - Wiktionary | **Chimaera**, in Greek mythology, was a fire-breathing creature with physical traits of more than one animal, including the lion, goat, and snake as one.  *Chimera* is someone who has two completely different sets of DNA in their body. | What is a chimera? | New Scientist |
| Cyclopes | Cyclops | **Cyclops** in Greek mythology were giants, with a single eye in the centre of their forehead.  *Cyclopia*,also known as *cyclocephaly* or *synophthalmia* is a rare congenital defect characterized by a single eye, often resulting in a miscarriage or stillbirth. | Cyclopia - Simple English Wikipedia, the free encyclopedia |
| Giant - Wikipedia | **Giants** were huge, aggressive creatures of great strength.  *Gigantism*isa rare condition caused by overproduction of the growth hormone in childhood, characterized by excessive growth. | Gigantism - Wikipedia |
| Proteus in popular culture - Wikipedia | **Proteus** was a Greek sea-God capable of changing his shape at will.  *Proteus syndrome* isa rare condition associated with overgrowth of bones, skin, and other tissues. | Σύνδρομο του Πρωτέα - Βικιπαίδεια |
|  | The **Satyrs** were male creatures with pointy ears and horns. *Satyr ear* or *Stahl ear* is a rare congenital deformity of the pinna resulting in an elf-like appearance. |  |
|  | **Klotho/Clotho** was one of Three Fates, the goddesses who controlled the length of human life. She was responsible for spinning the thread of human life.  *Klotho protein* isa membrane protein whose overexpression is associated with life extension and anti-aging. | Klotho (biology) - Wikipedia |

**Glossary**

|  |  |  |  |
| --- | --- | --- | --- |
| **English** | **Greek** | **English** | **Greek** |
| **achondroplasia** | αχονδροπλασία | **karyotype** | καρυότυπος |
| **adenine (A)** | αδενίνη | **messenger RNA (mRNA)** | αγγελιοφόρο RNA |
| **allele** | αλληλόμορφο | **microscope slides** | αντικειμενοφόρες πλάκες |
| **aneuploidy** | ανευπλοειδία | **mitochondrial inheritance** | μιτοχονδριακή κληρονομικότητα |
| **beaker** | ποτήρι ζέσεως | **monogenic inheritance/ single gene inheritance / Mendelian inheritance** | μονογονιδιακή ή Μενδελική κληρονομικότητα |
| **centrifuge tube** | σωλήνας φυγοκέντρησης | **multifactorial inheritance/ complex inheritance/ polygenic inheritance** | πολυγονιδιακή κληρονομικότητα |
| **chimera** | χίμαιρα | **mutagen** | μεταλλαξιογόνος παράγοντας |
| **chromosomal abnormality** | χρωμοσωμική ανωμαλία | **mutant** | μεταλλαγμένος |
| **chromosomal alteration** | χρωμοσωμική μεταβολή | **mutation** | μετάλλαξη |
| **chromosome** | χρωμόσωμα | **myoclonic epilepsy with ragged-red fibers (MERRF)** | μυοκλονική επιληψία με τραχιές κόκκινες ίνες |
| **cri-du-chat syndrome** | σύνδρομο κλάματος γαλής | **nucleotides** | νουκλεοτίδιο |
| **cyclopia** | κυκλωπία | **numerical abnormality** | αριθμητική χρωμοσωμική ανωμαλία |
| **cystic fibrosis (CF)** | κυστική ίνωση | **Petri dish** | τρυβλίο Petri |
| **cytosine (C)** | κυτοκίνη | **phenotype** | φαινότυπος |
| **deletion** | αποκοπή | **pipette** | πιπέτα |
| **DNA repair mechanisms** | μηχανισμός επιδιόρθωσης DNA | **point mutations** | σημειακή μετάλλαξη |
| **DNA replication** | αντιγραφή του DNA | **Punnett square** | τετράγωνο Punnett |
| **DNA sequencing** | αλληλουχία DNA | **purines** | πουρίνη |
| **dominant** | επικρατές | **pyrimidines** | πυριμιδίνη |
| **double helix** | διπλή έλικα | **recessive** | υπολειπόμενο |
| **duplication** | διπλασιασμός | **recombination** | ανασυνδυασμός |
| **fragile X syndrome (FXS)** | σύνδρομο εύθραυστου Χ | **RNA polymerase** | RNA πολυμεράση |
| **gene editing/ genome editing** | τροποποίηση γονιδιώματος | **scalpel** | νυστέρι |
| **gene therapy** | γονιδιακή θεραπεία | **sickle cell anaemia** | δρεπανοκυτταρική αναιμία |
| **gene** | γονίδιο | **silent mutation** | σιωπηρή μετάλλαξη |
| **genetic counselling** | γενετική συμβουλευτική | **somatic mutation** | σωματική μετάλλαξη |
| **genetic disorder** | γενετική διαταραχή | **structural abnormality** | δομική χρωμοσωμική ανωμαλία |
| **genetic engineering** | γενετική μηχανική | **syringe** | σύριγγα |
| **geneticist** | γενετιστής | **thymine (T)** | θυμίνη |
| **genetics** | γενετική | **transcription** | μεταγραφή |
| **genome** | γονιδίωμα | **transition** | μετάβαση |
| **genomics** | γονιδιωματική | **translocation** | μετατόπιση |
| **genotype** | γονότυπος | **transposition** | μεταφορά |
| **germline mutation** | μετάλλαξη βλαστικής σειράς | **transversion** | μεταστροφή |
| **gigantism** | γιγαντισμός | **uracil (U)** | ουρασίλη |
| **guanine (G)** | γουανίνη | **volumetric flask** | ογκομετρική φιάλη |
| **insertion** | ένθεση/εισαγωγή | **wild type** | άγριος τύπος |
| **inversion** | αναστροφή | **X-linked hypophosphatemic rickets** | Χ-φυλοσύνδετη υποφωσφαταιμική ραχίτιδα |