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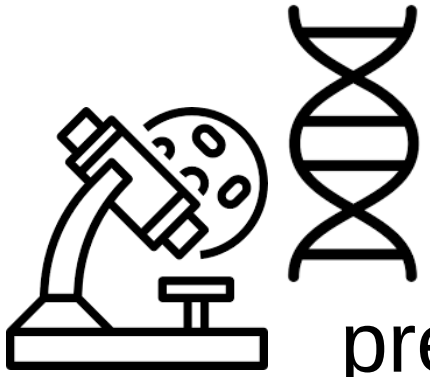


Biology

preparing students for exams

Ana Oliveira | June 6, 2023

Integrated Masters in Medicine
Model Exam | Access for International Students | 2023/2024

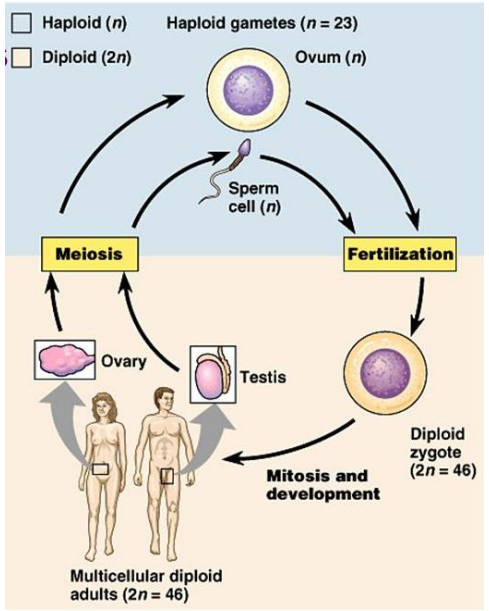
1. Sexual reproduction is based on a reductive nuclear division process of which some phases are represented in the schematic images below. Consider these cells with a karyotype of 2n = 4.

Put the letters in the correct sequence of events, starting with the letter C.

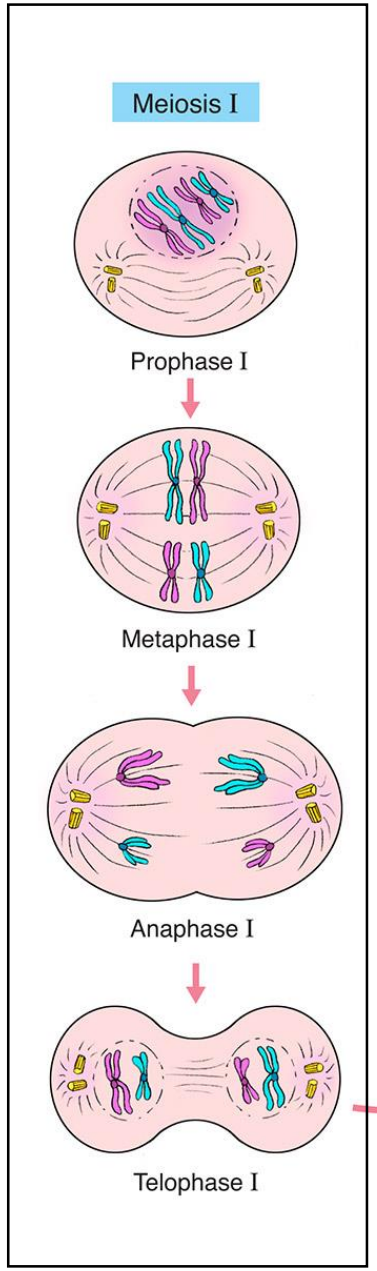
ANSWER:

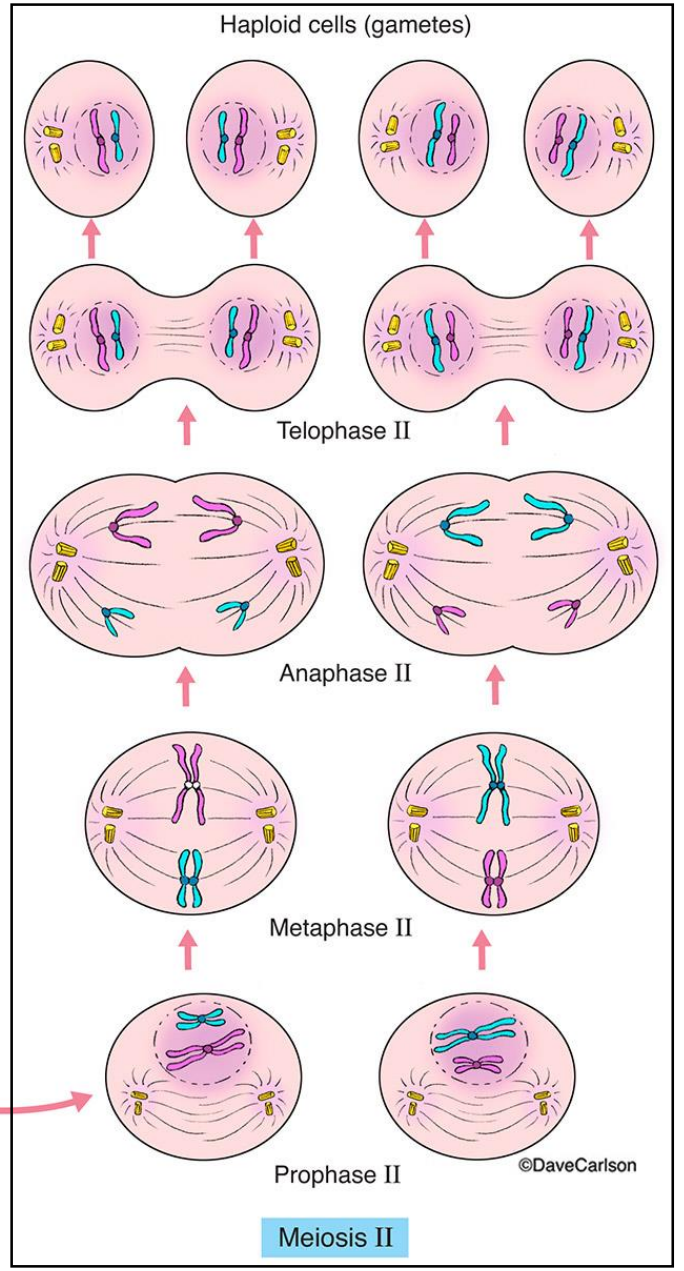
C – D – E – A – B

Sexual reproduction



Reductive division





Equation division

Meiosis

http://www.youtube.com/watch?v=jn-LfjZZMzg#at=31

https://www.youtube.com/watch?v=k2DBsovDXxE

2. The southern icefish (*Chaenocephalus aceratus*) inhabits the coldest marine environments on Earth. These animals have developed the ability to synthesize antifreeze proteins, which allows them to live in waters with temperatures below 0°C. This ability to live in waters with temperatures below 0 °C depends on….

(A) the presence of special proteins in their blood.

(B) its ability to regulate body temperature.

(C) the presence of proteins in the erythrocytes, which prevent ice formation.

(D) the increase in the number of cardiac chambers.

ANSWER:

The blackfin icefish (*Chaenocephalus aceratus*) belongs to the suborder Notothenioidei. Like most other Antarctic notothenioids, the blackfin icefish produces antifreeze glycoproteins in their blood and other body fluids. These proteins reduce the internal freezing temperature, preventing ice crystallization and thus allowing the fish to survive in water below 0°C.

3. Consider the following statements:

I. Biological molecules with energy reserve function.

II. Biological molecules that store the cell's genetic information.

III. Biological molecules with cellular structure and defense function.

IV. Biological molecules with immediate energetic function.

The molecules referred to in each sentence are:

(A) I - Proteins; II - Carbohydrates; III - Nucleic acids; IV - Lipids

(B) I - Carbohydrates; II - Proteins; III - Lipids; IV - Nucleic acids

(C) I - Lipids; II - Nucleic acids; III - Proteins; IV - Carbohydrates **ANSWER**

(D) I - Nucleic acids; II - Lipids; III - Carbohydrates; IV – Proteins

Four major types of biological macromolecules:

Type of Polymer	Monomers making up Polymer	Example
I. Carbohydrates (Polysaccharides)	Monosaccharides	Sugars, Starch, Cellulose
II. Lipids	Fatty acids and glycerol	Fats, steroids, cholesterol
III. Proteins	Amino acids	Enzymes, structural components
IV. Nucleic Acids	Nucleotides	DNA, RNA

4. Serra da Estrela (a mountain range in Portugal) is characterized by having a wide variety of habitats, which provides a high biodiversity, including some species that occur exclusively there (endemic species). Noteworthy is the plant *Silene foetida foetida*, which develops in fissures and small depressions in the rocks, with a distribution restricted to this mountain range, at altitudes above 1400 meters. River trout (*Salmo trutta fario*) and, due to the vulnerability of their populations, the Lusitanian salamander (*Chioglossa lusitanica*), an amphibian, are also mentioned.

Another plant found in the mountains, the wild thistle (*Cynara cardunculus*), is of great importance in the region's economy, as it is used in the manufacture of mountain cheese. This plant, characteristic of Mediterranean regions, grows up to 600 m altitude, has a deep root system and shows a good adaptation to environments characterized by high abiotic stress. The flower of this plant has several types of proteases (hydrolytic enzymes), such as cardosins, which accumulate in vacuoles, in the cell wall and in the extracellular space of Organs female organs of the flower.

4.1. In the plant *Silene foetida foetida*, the ions resulting from the

(A) erosion of rocks are transported in phloem vessels.

(B) weathering rocks are transported in the xylem vessels.

(C) weathering rocks are transported in the sieve vessels.

(D) erosion of rocks are transported in the woody vessels.

ANSWER:

"*(…) the plant Silene foetida foetida, which develops in fissures and small depressions in the rocks, with a distribution restricted to this mountain range, at altitudes above 1400 meters.*"

Weathering describes the breaking down or dissolving of rocks and minerals on the surface of the Earth

Erosion is the process where rocks are broken down by natural forces such as wind or water

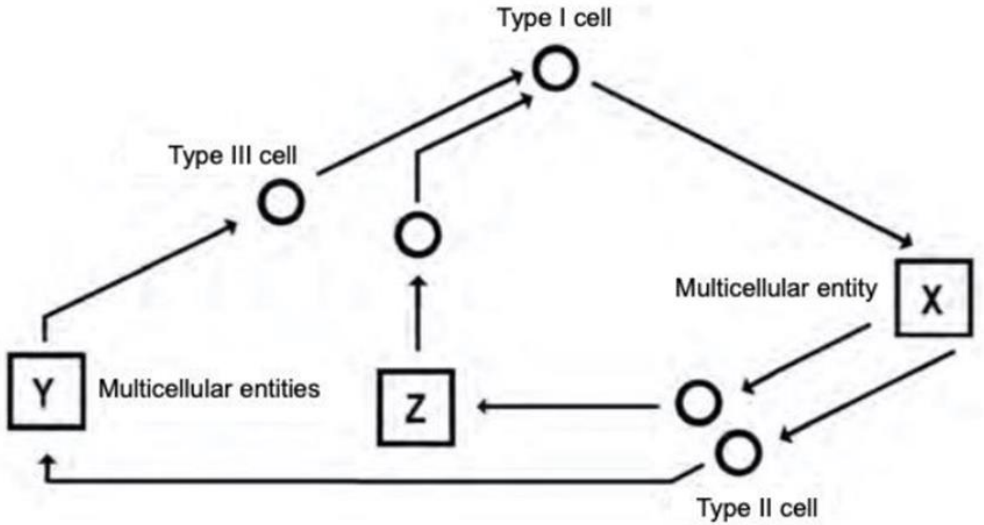
"*In the plant Silene foetida foetida, the ions resulting from the…*"

Xylem vessels transport water and minerals from roots to the upper parts of the plant

Sieve vessels conduit food (mostly sugar) from the leaves to the rest of the plant

Phloem vessels transport dissolved substances, such as sucrose and amino acids, from the leaves to the rest of the plant

4.2. The plant *Silene foetida foetida* has a life cycle similar to that represented in the following scheme:



In the above scheme, the adult plant is represented by the letter

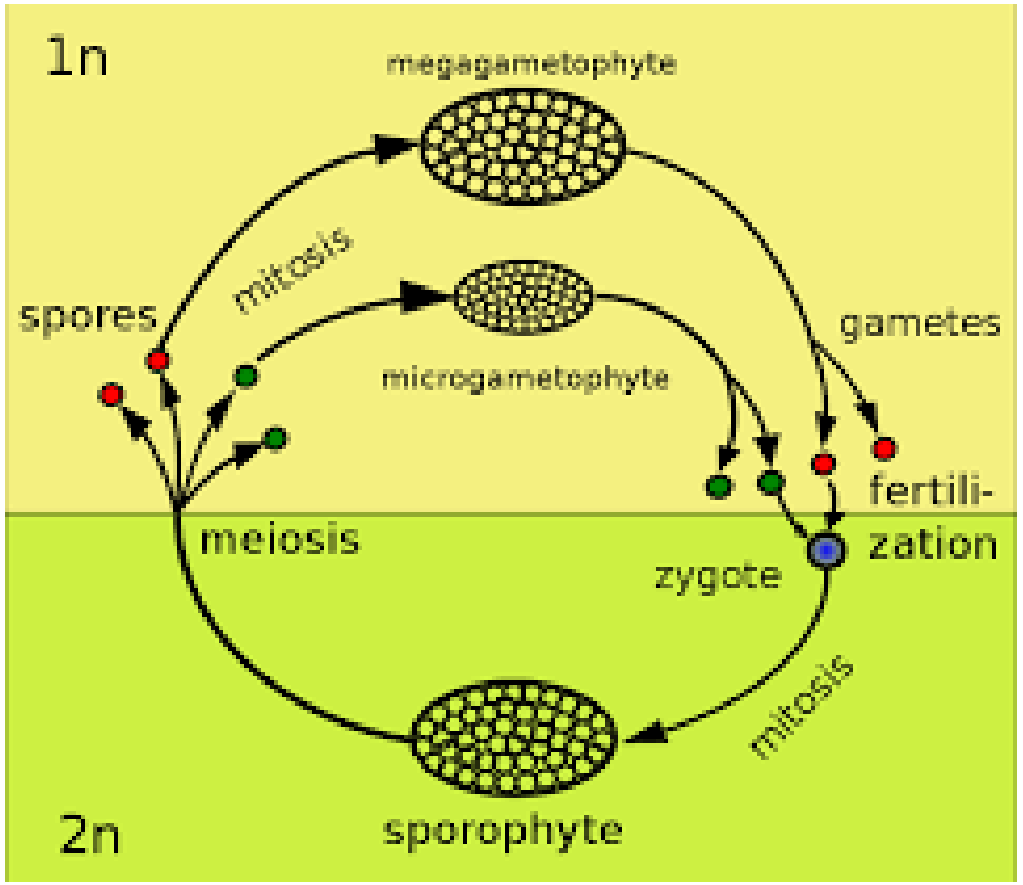
(A) X, and its cells have the same ploidy as type II cells.

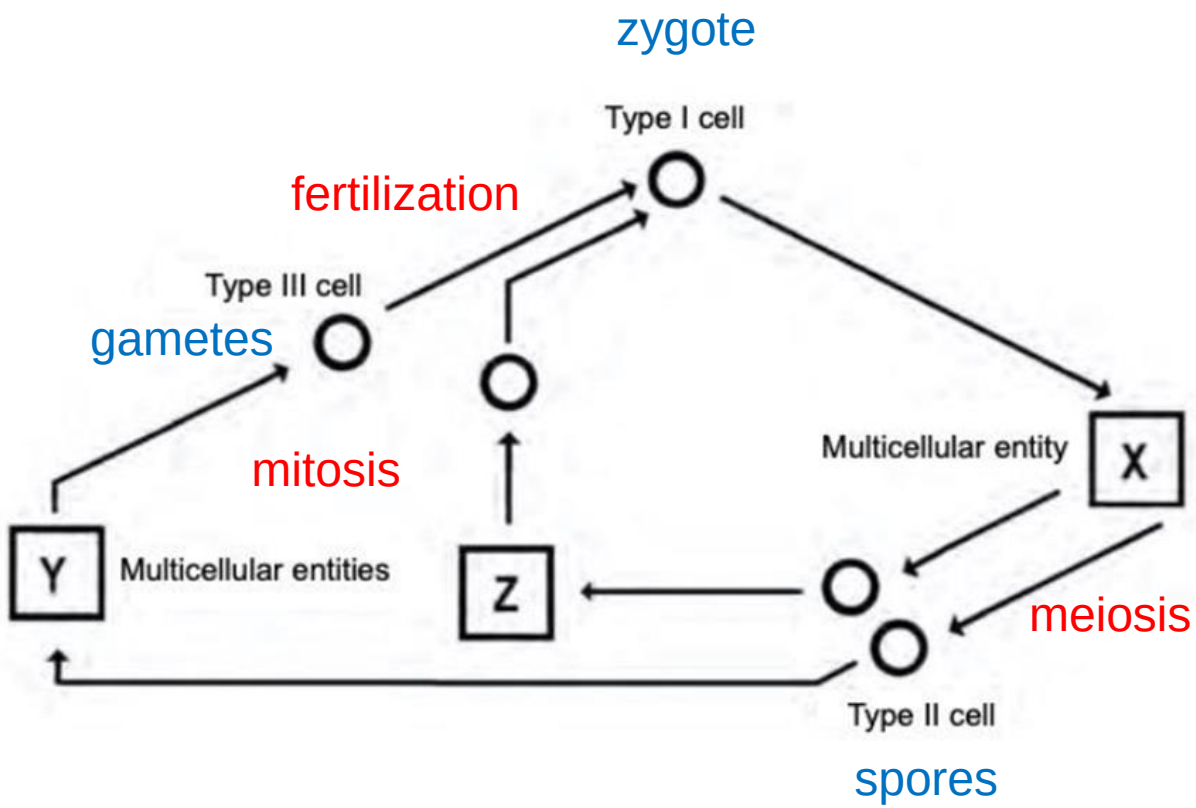
(B) Z, and its cells have the same ploidy as the type I cell.

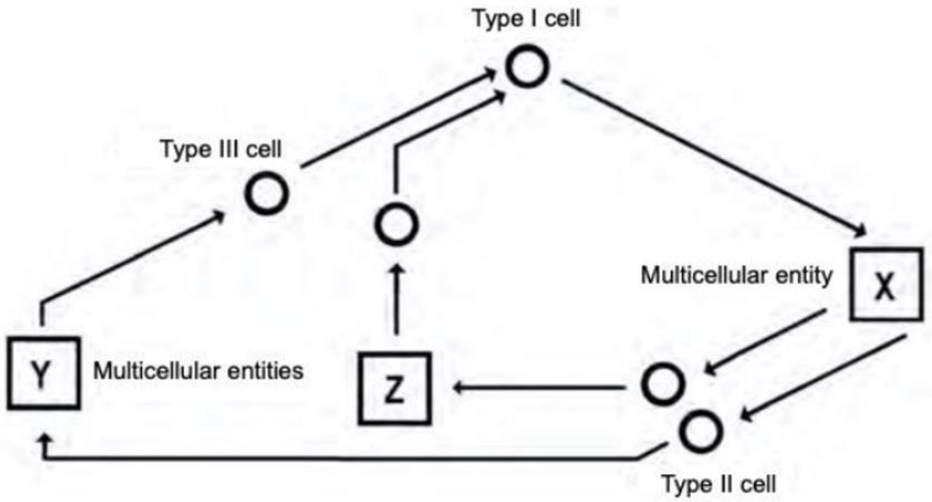
(C) X e results from the development of a zygote.

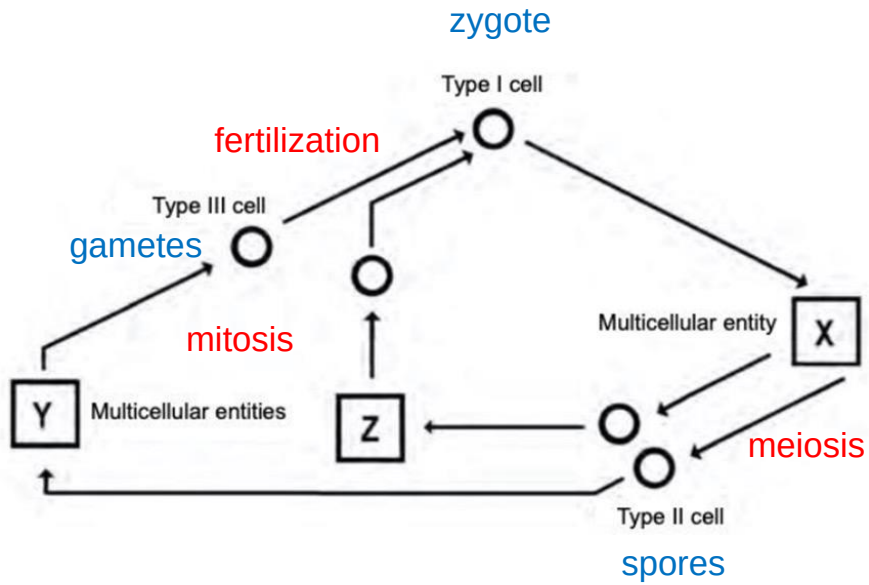
ANSWER

(D) Z e results from the germination of a spore.


1n
megagametophyte
mitosis
spores
gametes
microgametophyte
fertili-
zation
meiosis
zygote
mitosis
2n
sporophyte


zygote
Type I cell
fertilization
Type III cell
gametes
mitosis
Multicellular entity
X
Y
Multicellular entities
Z
meiosis
Type II cell
spores





4.3. In the above scheme, Type III cells are formed by a process of

(A) mitosis, in which homologous chromosomes separate.

(B) mitosis, in which the centromere of the chromosomes divides.

ANSWER

(C) meiosis, in which two haploid cells form.

(D) meiosis, in which chiasm formation occurs.

4.4. Make the association between the reproduction processes presented in Column I and the characteristics of Column II that may correspond to them. Each of the characteristics must be associated with only one letter and all characteristics must be used.

Write each letter in Column I on the answer sheet followed by the corresponding number or numbers (from 1 to 9).

Column I	Column II
(a) Asexual reproduction **(b) Sexual reproduction** **(c) Reproduction by both processes**	(1) Development of the adult individual by successive mitoses. (2) Production of reproductive cells by meiosis. (3) Formation of two cells similar to each other from a single-celled organism. (4) Occurrence of genetic recombination phenomena. (5) Formation of new organisms by the development of eggs without fertilization having taken place. (6) Favoring the rapid growth of a population. (7) Occurrence of mutations as a source of variability. (8) Formation of beings genetically equal to the parent. (9) Restoration of the number of chromosomes characteristic of the species.

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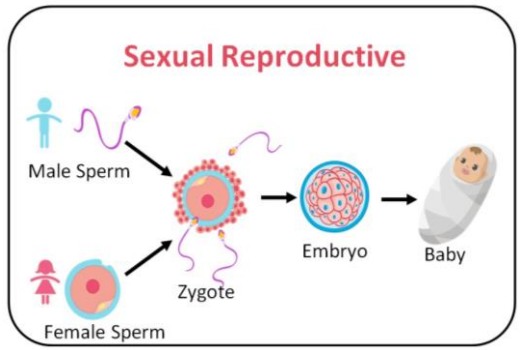
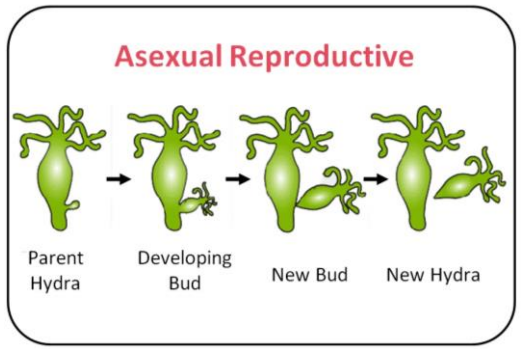
ANSWER:

(a) – (3), (5), (6), (8)

(b) – (2), (4), (9)

(c) – (1), (7)





Asexual Reproduction

One parent

Cells divide by fission, budding, or fragmentation

Very little chance of genetic variation

No formation of gametes

Found in lower organisms (i.e. bacteria)

Whole parent body or a bud/fragment/single somatic cell

Generally creates a minimum of two offsprings

Forms of reproduction

Involves plants, fungi and animals

Produces offspring

Sexual Reproduction

Two parents

Cells divide by meiosis

Genetic variation in offspring

Formation of gametes (haploid)

Found in higher/complex organisms (i.e. mammals)

Unit or reproduction is the gamete that results in fertilization (diploid zygote)

Creates a minimum of one offspring

https://www.youtube.com/watch?app=desktop&v=co5jZId0F-g

4.5. Order the expressions identified by the letters from A to E, in order to reconstruct the sequence of events that lead to the synthesis and incorporation of cardosines in the wall and in the extracellular space of female organs of the *Cynara cardunculus flower*.

A. Protein synthesis by ribosomes associated with the endoplasmic reticulum.

B. Fusion of Golgian vesicles with the cytoplasmic membrane.

C. Synthesis of a pre-messenger RNA molecule.

D. Post-translational modifications at the level of the Golgi complex.

E. Migration of a messenger RNA molecule into the cytoplasm.

ANSWER:

C, E, A, D, B

4.6. From a Darwinian perspective, the survival of *Cynara cardunculus* in the wild in Serra da Estrela is due to the

(A) differential reproduction of plants resistant to water stress.

(B) need for survival in regions with high precipitation.

(C) occurrence of mutations that allowed adaptation to granitic soils.

(D) natural selection of plants adapted to shallow soils.

ANSWER:

"*This plant, characteristic of Mediterranean regions, grows up to 600 m altitude, has a deep root system and shows a good adaptation to environments characterized by high abiotic stress. The flower of this plant has several types of proteases (hydrolytic enzymes), such as cardosins, which accumulate in vacuoles, in the cell wall and in the extracellular space of Organs female organs of the flower*."

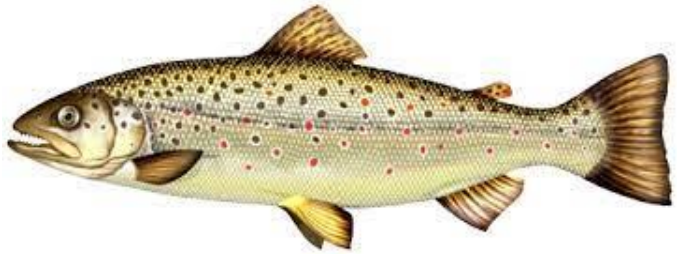
4.7. The fish *Salmo trutta fario* and the amphibian *Chioglossa lusitanica* have a digestive tract

(A) full and simple circulation.

(B) incomplete and double circulation.

(C) complete and closed circulatory system.

(D) incomplete and open circulatory system.



ANSWER:

Two types of digestive tracts: (1) incomplete - one opening, mouth, used for both entrance of food and an exit for wastes; (2) complete - as two openings, a mouth for entrance of food and an anus for waste elimination

Circulatory systems: (1) Open circulatory systems - common to most arthropods and mollusks; they have a heart that pumps blood into a hemocoel; (2) closed circulatory system, where the blood stays within blood vessels.

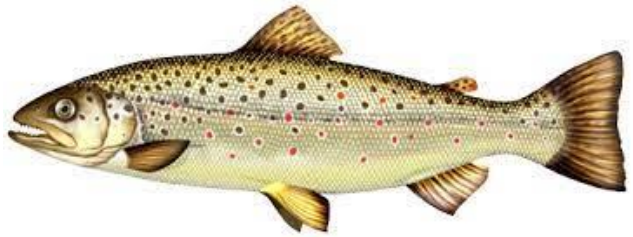
4.8. The river trout, *Salmo trutta fario*, and the rainbow trout, *Onchorhynchus mykiss*, the latter introduced in the dams and in some lagoons of Serra da Estrela,

(A) belong to the same genus.

(B) they can interbreed and produce fertile offspring.

(C) belong to the same population.

(D) have specific restrictive trutta and mykiss, respectively.



ANSWER:

The two trouts do not belong to the same genus nor to the same population; they are different species.

In general, different species are unable to interbreed and produce healthy, fertile offspring due to barriers called mechanisms of reproductive isolation.

4.9. The subspecies *Silene foetida foetida* is considered endangered in the wild, according to the International Union for Conservation of Nature (IUCN).

Match the endemism of *Silene foetida foetida* with the conservation category assigned by the IUCN.

In your answer, you should refer to the genetic variability of this plant.

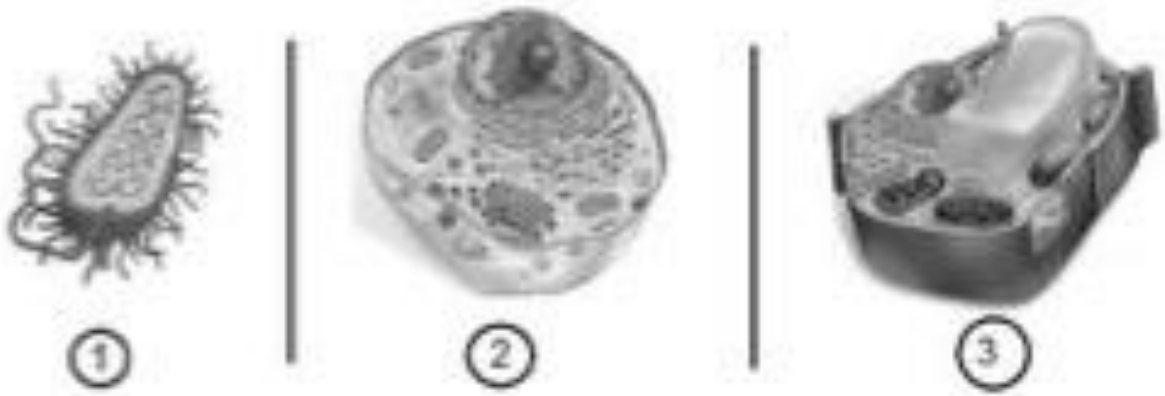
ANSWER:

It relates the restricted geographic distribution (endemism) of *Silene foetida foetida* with the reduced number of individuals that interbreed (A) and relates the reduced genetic variability with the low adaptability, which may affect the survival of the plant (danger of extinction) (B).

(A) *Silene foetida foetida* has a distribution restricted to Serra da Estrela, so crosses are established between a small number of individuals.

(B) The reduced genetic variability leads to a low ability to adapt to environmental changes, putting the plant in danger of extinction.

5. Analyze the figure below and choose the most correct option.



(A) 1. Plant cell; 2. Animal cell; 3. Bacterial cell

(B) 1. Animal cell; 2. Animal cell; 3. Plant cell

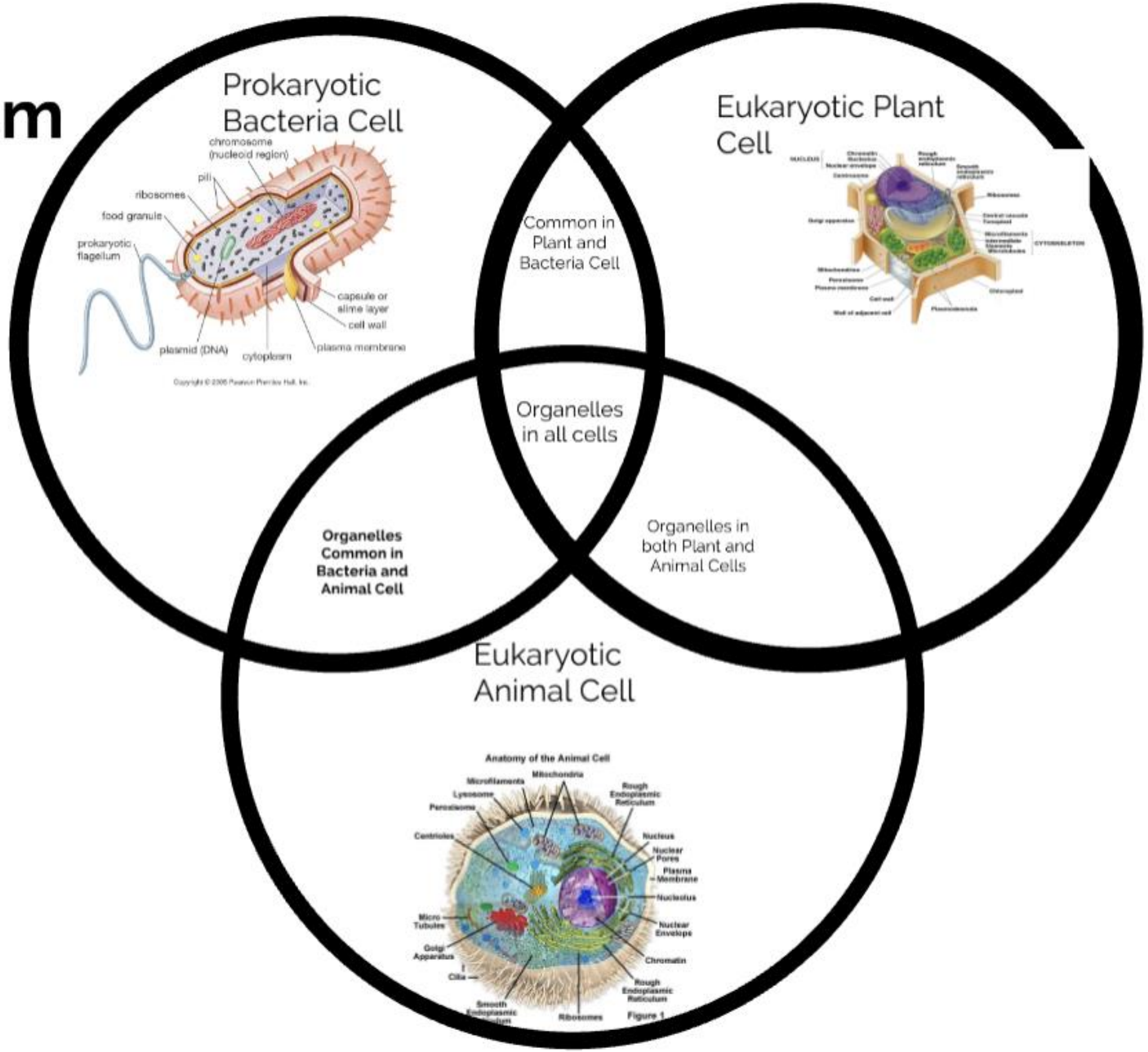
(C) 1. Bacterial cell; 2. Animal cell; 3. Plant cell

(D) 1. Bacterial cell; 2. Plant cell; 3. Animal cell

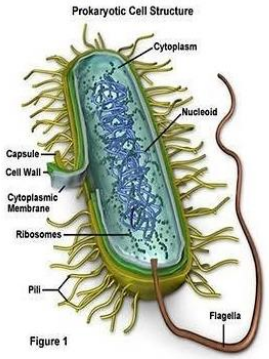
ANSWER

Cell Venn Diagram

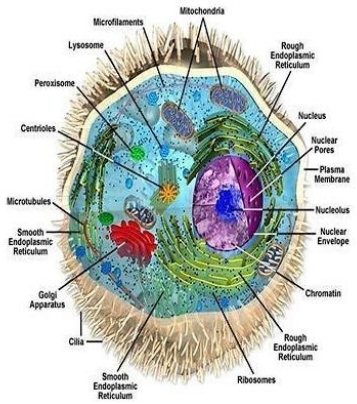
By: Helen Lin



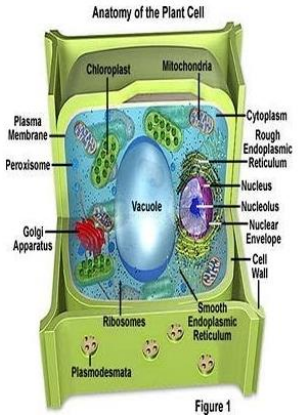
Bacterial cell



Animal cell



Plant cell



6. *Carefully read the following text:*

Some antibiotics work by activating cellular respiration, which leads to the production of free radicals (oxidizing toxic substances). These radicals can cause the death of bacteria through the destruction of proteins, lipids, and DNA.

In four unrelated bacterial species, *Bacillus anthracis*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Escherichia coli*, the enzymes of the hydrogen sulphide (H_2S) synthesis pathway were inactivated, either chemically or by mutation of their genes. In the bacteria that underwent these procedures, the production of H_2S was inhibited. These bacteria survived with great difficulty in the presence of antibiotics.

Subsequently, the mutated strain of *E.coli* (inhibited from the production of H_2S) and the wild strain of *E.coli* (non-mutated and producing H_2S) were subjected to the action of three different antibiotics. It was found that, in bacteria unable to produce hydrogen sulfide, the DNA was cut into fragments.

The recent sequencing of numerous bacterial genomes has changed the idea that H_2S would be an excretory product since this substance can block the formation of free radicals and can also stimulate the activity of antioxidant enzymes.

6.1. The hypothesis that we wanted to test with these experiments was that

(A) The free radicals produced cause the death of bacteria.

(B) hydrogen sulfide compromises the effectiveness of antibiotics.

(C) enzymes are necessary for the production of hydrogen sulfide.

(D) antibiotics prevent the production of hydrogen sulfide.

ANSWER:

"*Subsequently, the mutated strain of E.coli (inhibited from the production of H_2S) and the wild strain of E.coli (non-mutated and producing H_2S) were subjected to the action of three different antibiotics. It was found that, in bacteria unable to produce hydrogen sulfide, the DNA was cut into fragments.*"

6.2. According to the data, hydrogen sulphide can act

(A) increasing ATP production.

(B) inhibiting antioxidant enzymes, which activate cellular respiration.

(C) inhibiting cell multiplication.

(D) activating enzymes that facilitate the destruction of free radical.

ANSWER:

"*The recent sequencing of numerous bacterial genomes has changed the idea that H_2S would be an excretory product since this substance can block the formation of free radicals and can also stimulate the activity of antioxidant enzymes.*"

6.3. Antibiotics act on DNA, whose molecule has a

(A) (A + T) / (C + G) = 1, cutting it into fragments by an oxidation process.

(B) (A + T) / (C + G) = 1, cutting it into fragments by a reduction process.

(C) (A + C) / (T + G) = 1, cutting it into fragments by an oxidation process.

(D) (A + C) / (T + G) = 1, cutting it into fragments by a reduction process.

ANSWER

6.4. The bacteria that produce hydrogen sulphide have, in relation to those that do not produce this gas,

(A) lower respiratory activity.

(B) increased resistance to antibiotics.

(C) increased respiratory activity.

(D) less resistance to antibiotics.

ANSWER:

"*(…) the enzymes of the hydrogen sulphide (H_2S) synthesis pathway were inactivated, either chemically or by mutation of their genes. In the bacteria that underwent these procedures, the production of H_2S was inhibited. These bacteria survived with great difficulty in the presence of antibiotics.*"

6.5. Some antibiotics act on membrane proteins responsible for the active transport of Na^+ and K^+ ions, directly interfering

(A) in the diffusion of these ions through the phospholipid bilayer.

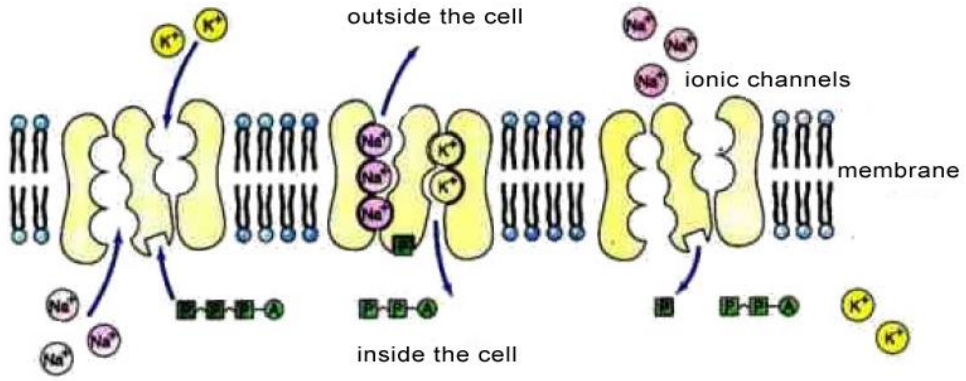
(B) in the diffusion of ions through proteins such as permeases.

(C) maintenance of the concentration difference between intra and extracellular media.

(D) in the maintenance of isotony that occurs between the intra and extracellular environments.

ANSWER:

If antibiotics act on membrane proteins responsible for the active transport of Na^+ and K^+ ions, they will directly interfere with the sodium-potassium pump.



6.6. The expression of the gene for the synthesis of the antioxidant enzymes referred to in the text

(A) implies the translation of mRNA in the rough endoplasmic reticulum.

(B) implies the transcription of DNA into pre-messenger RNA molecules.

(C) implies the transcription of DNA to deoxyribonucleotide molecules.

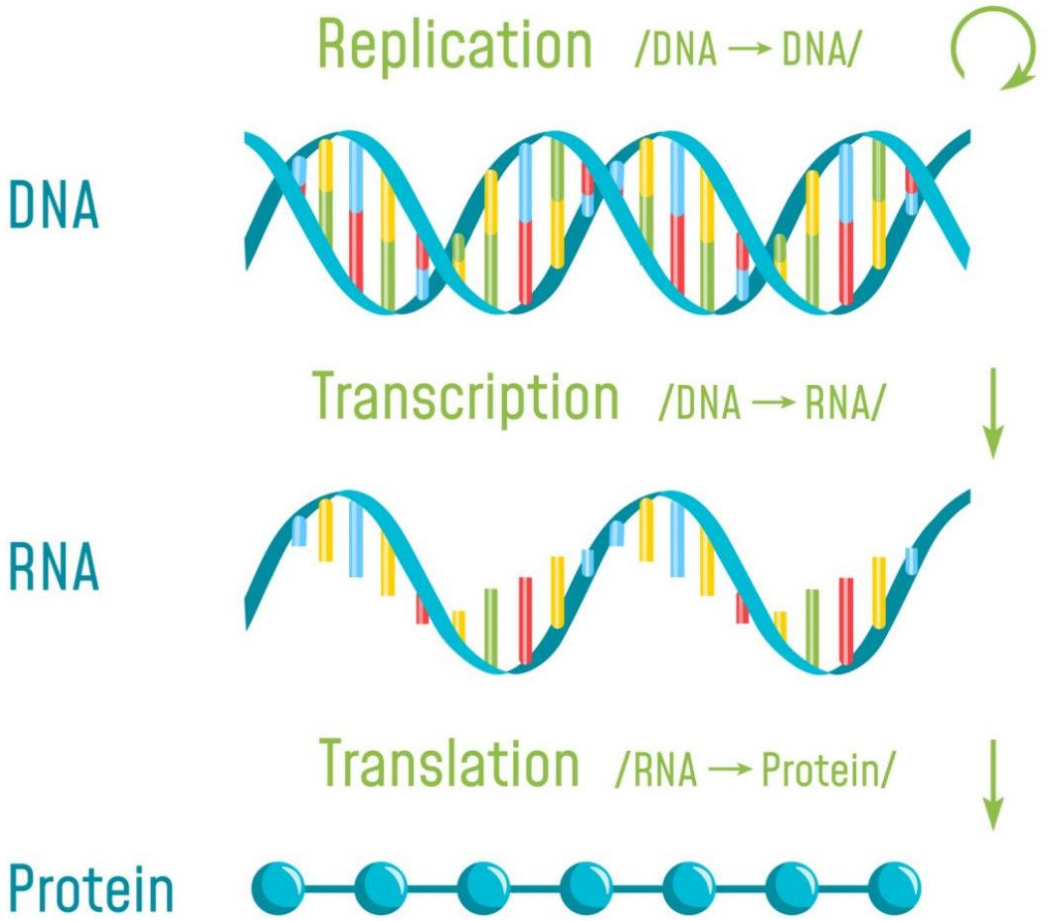
(D) implies the translation of the RNA codon sequence by ribosomes.

ANSWER

- The production of proteins is completed through two processes: transcription and translation

- Transcription and translation take the information in DNA and use it to produce proteins. Transcription uses a strand of DNA as a template to build a molecule called RNA

- The RNA molecule is the link between DNA and the production of proteins. During translation, the RNA molecule created in the transcription process delivers information from the DNA to the protein-building machines



6.7. Match each of the descriptions of enzyme synthesis in column I with the corresponding designation in column II.

Column I	Column II
(a) A molecule having a ribonucleotide sequence complementary to a codon. (b) Polyribonucleotide that contains information for the synthesis of a polypeptide. (c) Deoxyribonucleotide sequence that contains information for the synthesis of an enzyme.	(1) DNA polymerase (2) Gene (3) mRNA (4) tRNA (5) rRNA

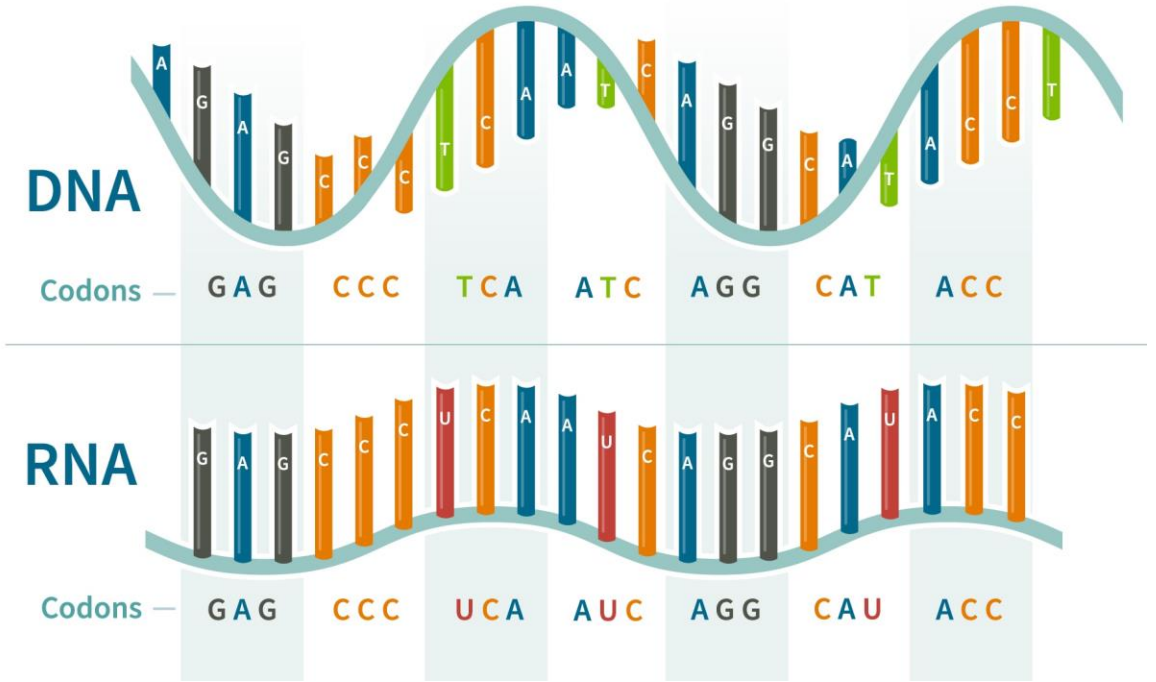
ANSWER:

(a) – (4) (b) – (3) (c) – (2)

- Deoxyribonucleic acid (**DNA**) is the molecule that carries genetic information for the development and functioning of an organism. DNA is made of two linked strands that wind around each other to resemble a twisted ladder - a shape known as a double helix.

- Ribonucleic acid (**RNA**) is a nucleic acid present in all living cells that has structural similarities to DNA. Unlike DNA, however, RNA is most often single-stranded.

- **Codon** is a DNA or RNA sequence of three nucleotides (a trinucleotide) that forms a unit of genomic information encoding a particular amino acid or signaling the termination of protein synthesis (stop signals). There are 64 different codons: 61 specify amino acids and 3 are used as stop signals.

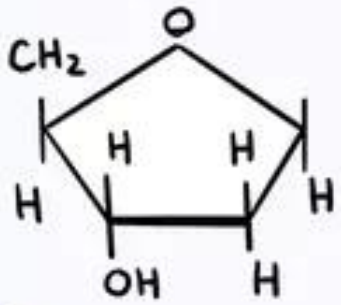


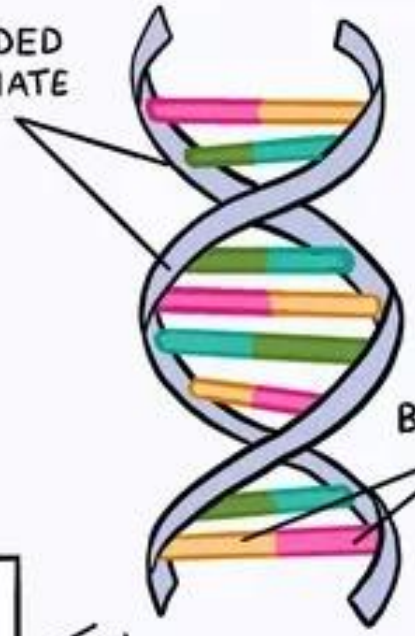
DNA vs. RNA

DEOXYRIBONUCLEIC ACID

DOUBLE-STRANDED SUGAR* PHOSPHATE

* DEOXYRIBOSE



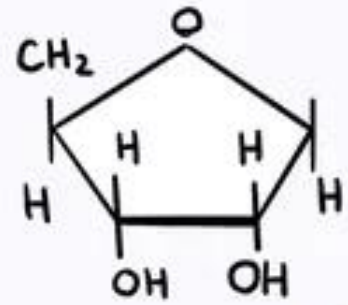


BASE PAIR

RIBONUCLEIC ACID

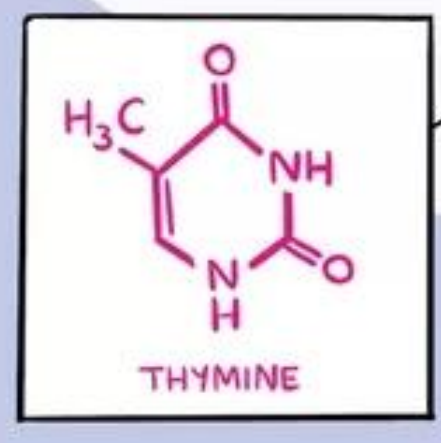
USUALLY SINGLE-STRANDED SUGAR* PHOSPHATE

★ RIBOSE

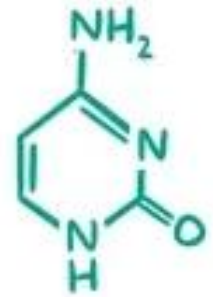


SINGLE NUCLEOBASE

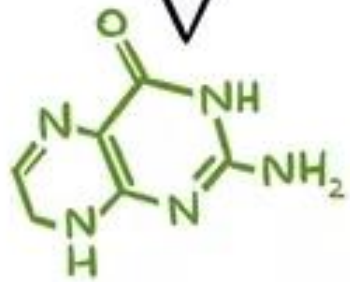
NUCLEOBASES



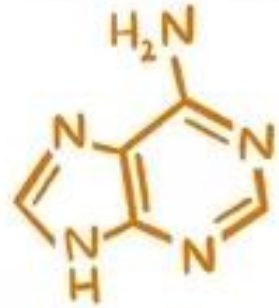
THYMINE



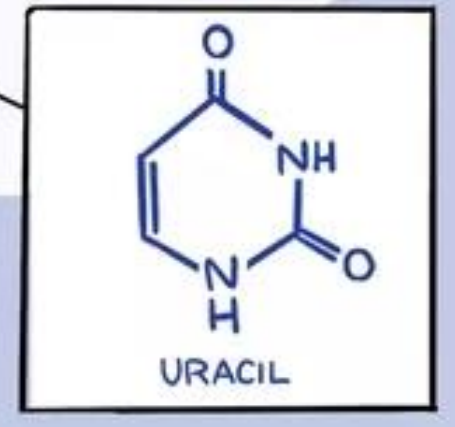
CYTOSINE



GUANINE



ADENINE



URACIL

ThoughtCo.

Types of RNA

mRNA

Processing

Messenger RNA (mRNA): responsible for carrying information from genes for the production of polypeptides in the cytoplasm.

tRNA

+ Amino acids

Transport RNA (tRNA): responsible for transporting amino acids to ribosomes for protein synthesis.

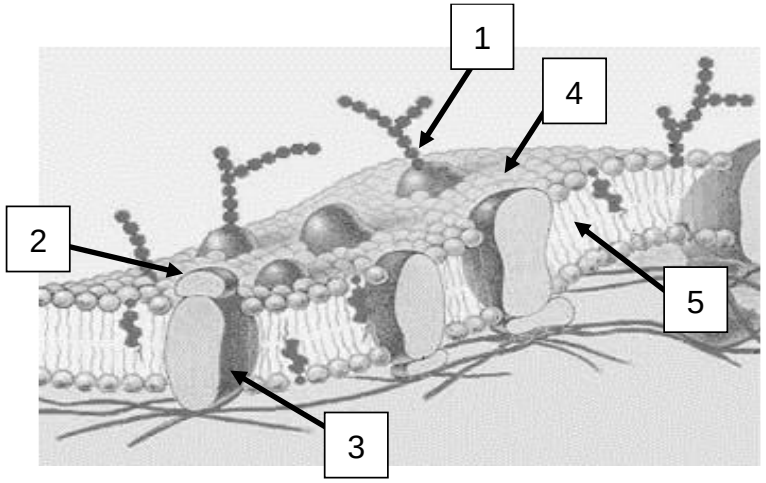
rRNA

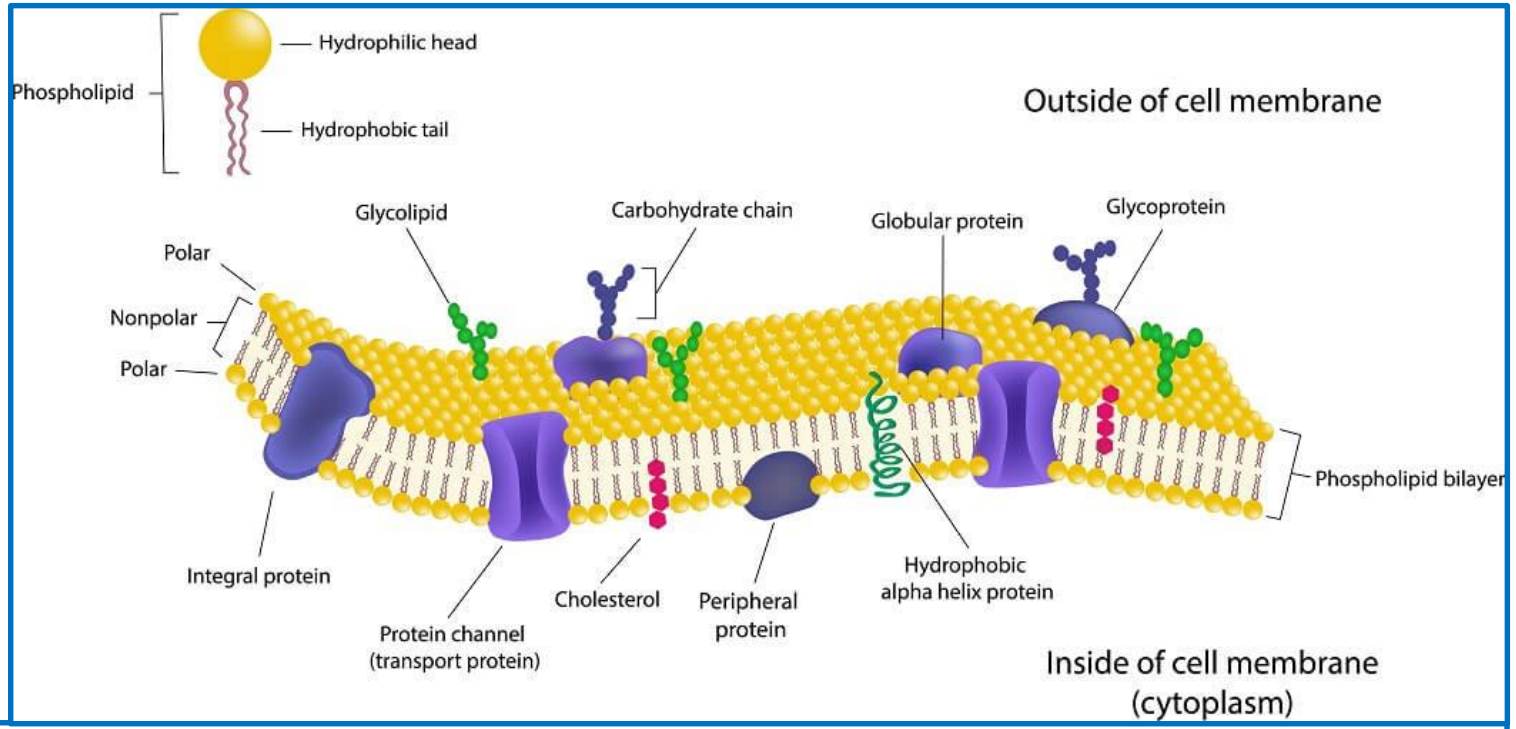
+ Ribosomal proteins

Ribosome

Ribosomal RNA (rRNA): associated with ribosomal proteins form ribosomes.

7. Consider the schematic representation of a cell membrane and make the corresponding legend.





ANSWER:

1 - glycoprotein

2 - extrinsic protein (peripheral proteins)

3 - intrinsic protein (integral protein)

4 - polar (head) phospholipid part

5 - nonpolar (tail) phospholipid part

8. *Carefully read the following text:*

(...) you enter the Noudar Nature Park (in Barrancos, Portugal). The narrow road, (…) holm oak forests, some scattered olive trees, pieces of dense and practically impenetrable vegetation, farmland, pasture areas and the first forms of animal life that abound in the wild – Mertolenga cows, black pigs scavenging for acorns, sheep and some stray horses (…) deer, wild boar, badgers and foxes.

Rate the statements as T (true) or F (false):

(A) All the species mentioned in the text, together with their habitat, characterize this ecosystem.

(B) In the ecosystem referred to in the text, we can consider olive trees as part of its abiotic component.

(C) Population of black pigs means the set of these beings and the acorns they consume.

(D) Horses existing at this location are considered to be of the same species if they have the potential to reproduce, resulting in genetically similar offspring.

ANSWER:

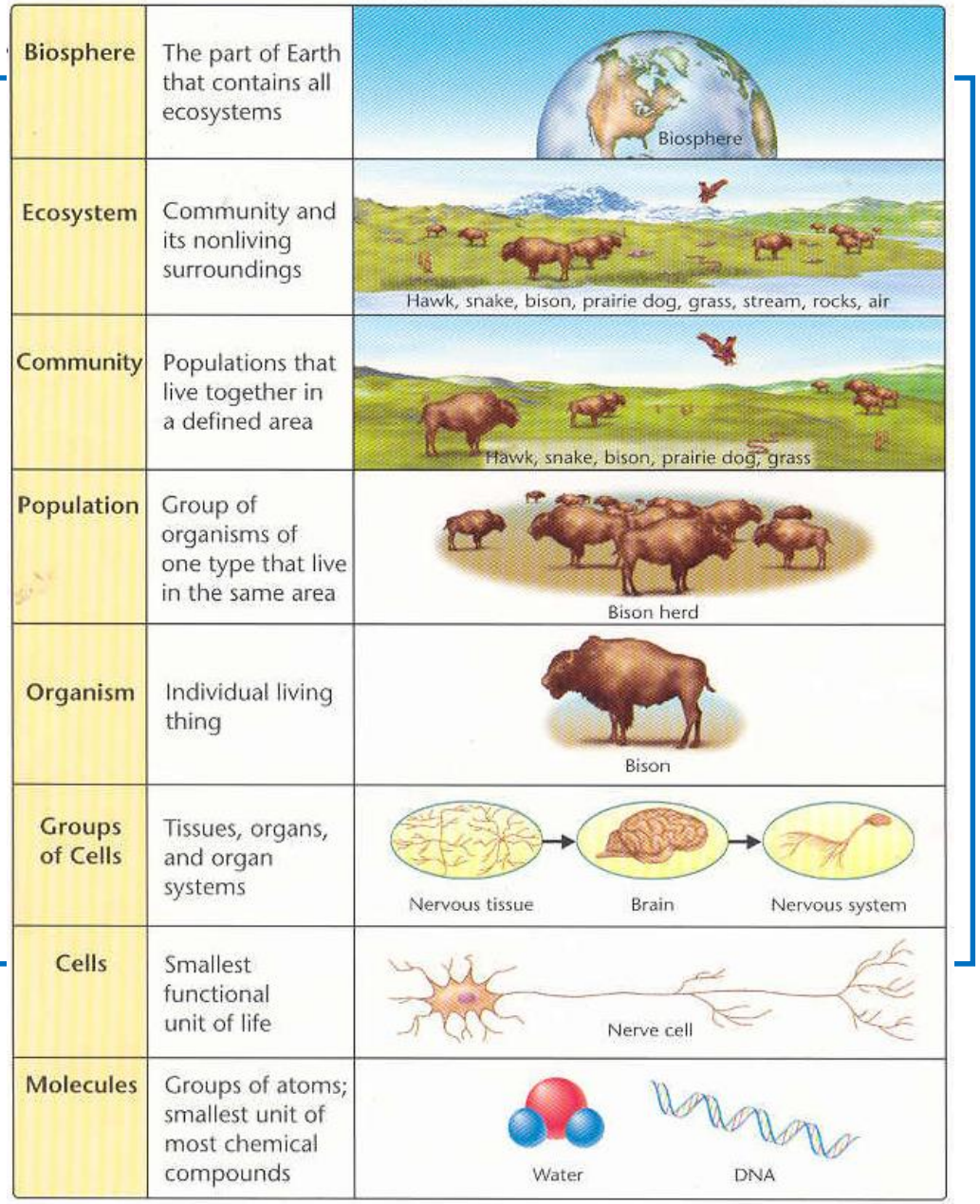
(A) All the species mentioned in the text, together with their habitat, characterize this ecosystem. **TRUE**

(B) In the ecosystem referred to in the text, we can consider olive trees as part of its abiotic component. **FALSE**

(C) Population of black pigs means the set of these beings and the acorns they consume. **FALSE**

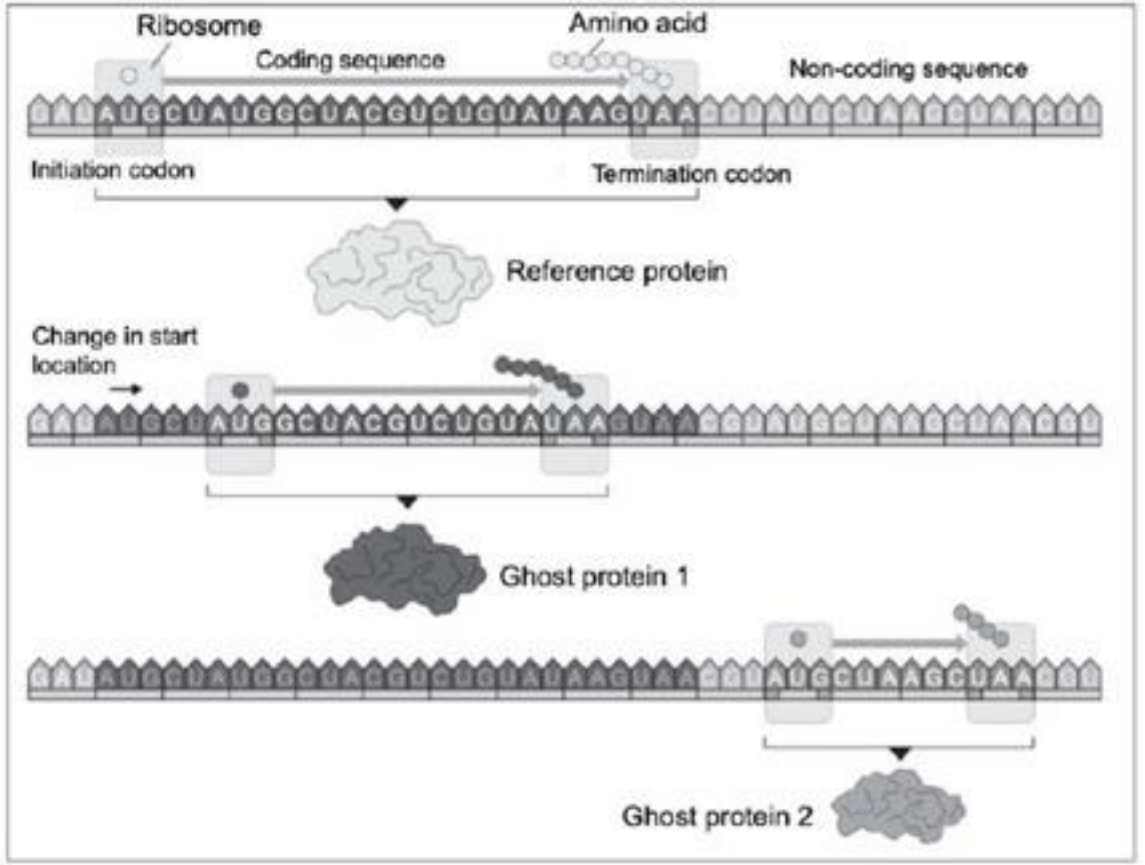
(D) Horses existing at this location are considered to be of the same species if they have the potential to reproduce, resulting in genetically similar offspring. **TRUE**

levels of organization

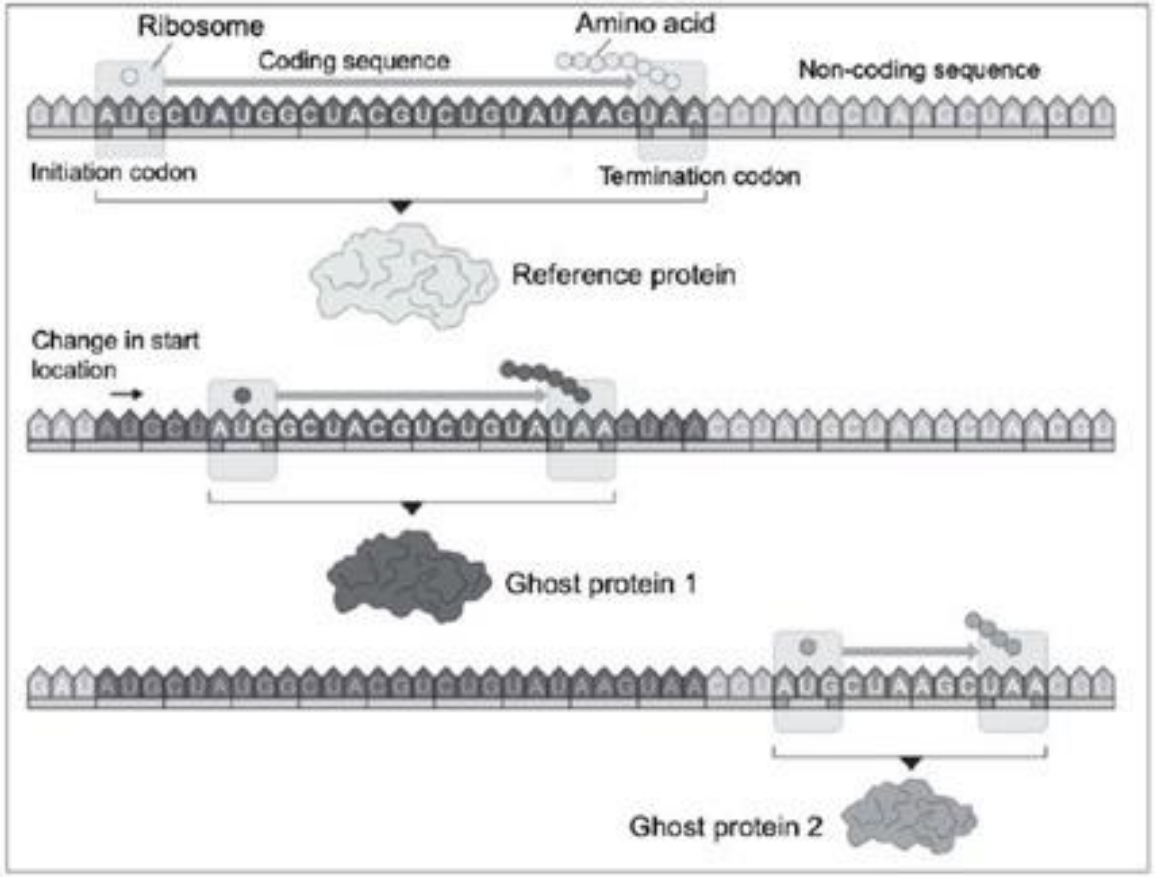


9. *Carefully read the following text:*

Some investigations indicate that, in a DNA sequence, there may be two or more coding pieces of information, a main one and others that lead to the production of one or more alternative proteins (ghost proteins 1 and 2; see figure below). It was discovered that each mRNA can be read in different ways, giving rise to different proteins that coexist in the cell. In mouse stem cells, more than half of the sites where ribosomes bind do not correspond to known initiation sites. All mouse neuron mRNAs were sequenced, and, among the 250 new proteins, some resulted from alternative coding sequences. Recently, an mRNA resulting from an intergenic region, which was identified as non-coding, was also identified in mice. The new gene has three exons and is only expressed in post-meiotic cells.



9.1. Justify why the rat's blood circulation is called “double and complete”.

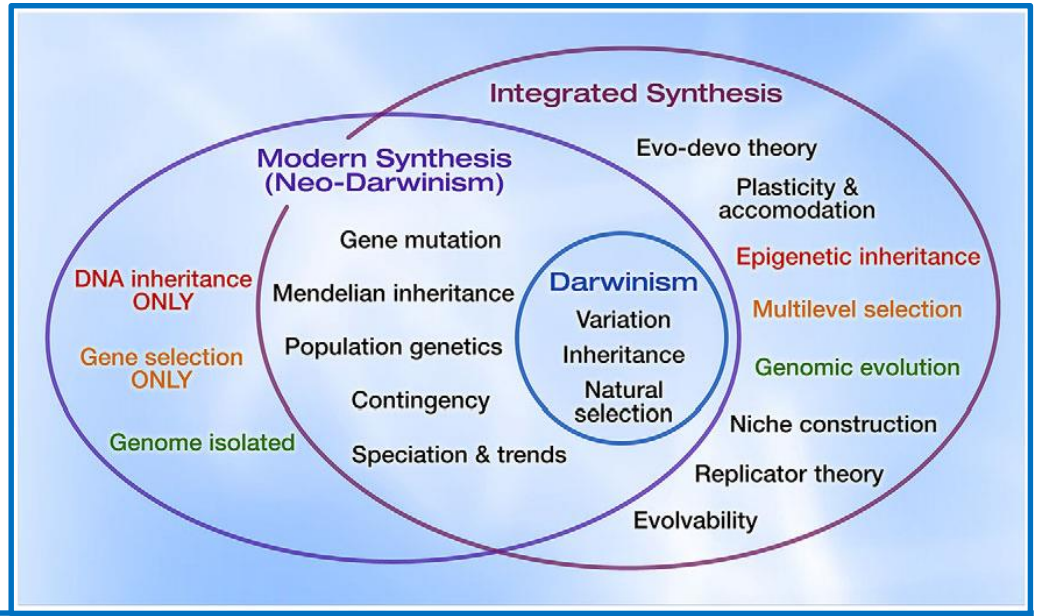


ANSWER:

Answer topics:

- the circulation is dual as there is a systemic circulation and a pulmonary circulation;
- circulation is complete because there is no mixing of arterial blood with venous blood.

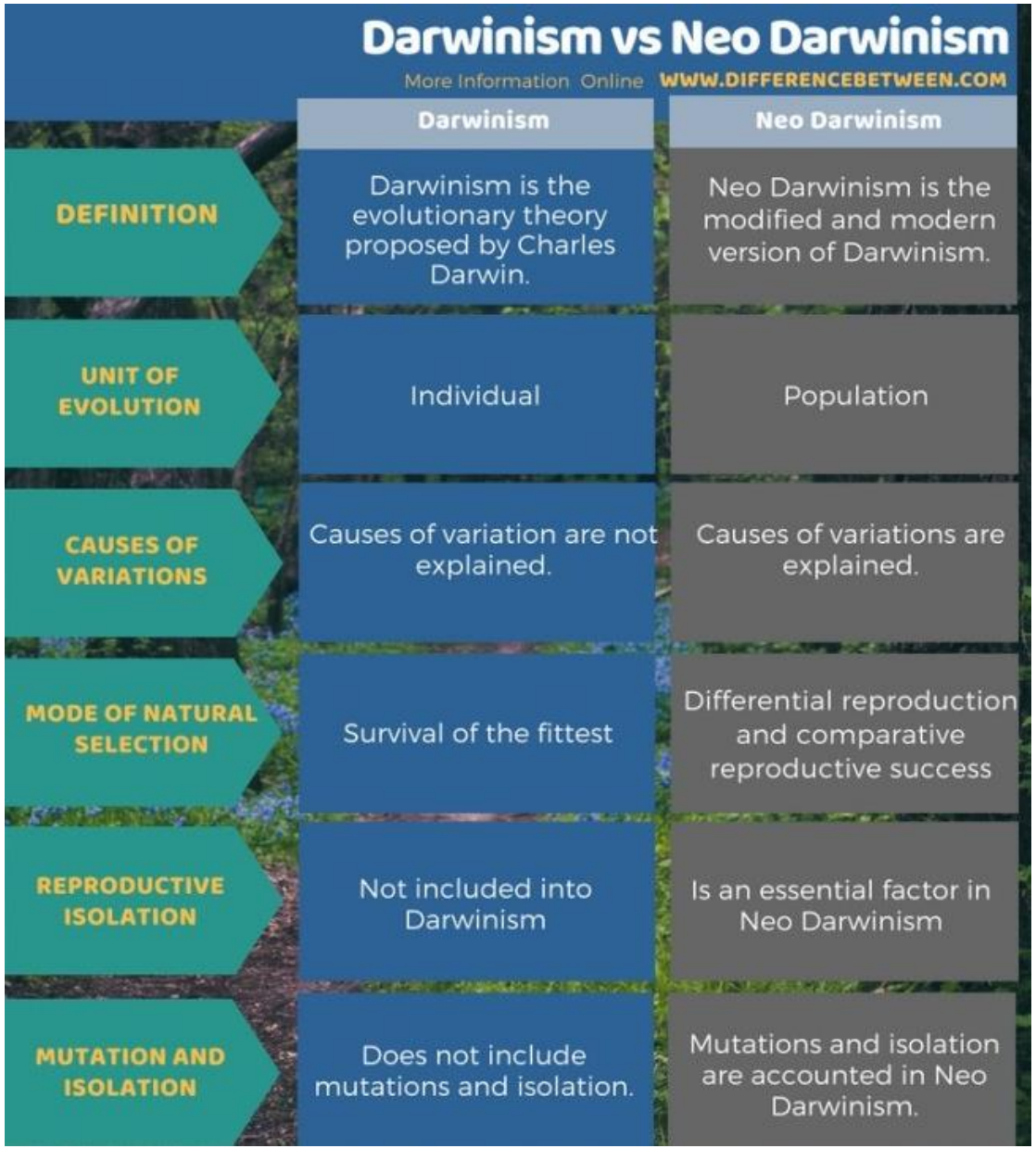
9.2. Explain how the processes that give rise to ghost proteins can contribute to greater adaptive capacity of living beings, constituting a complementary mechanism to those considered by the neo-Darwinian theory.



ANSWER:

Answer topics:

- mutations and genetic recombination are causes of genetic variability (proposals by neo-Darwinism);
- the synthesis of new proteins from different mRNA readings is a source of new features;
- the greater variability can lead to a greater adaptive capacity of living beings.



Darwinism vs. Lamarckism

Darwinism suggests that all species of organisms arise and develop through the concept of natural selection	Lamarckism suggests that there is an internal vital force in all organisms
Does not accept the internal vital force concept	Does not accept Darwin's natural selection theory
Struggle for existence and survival of the fittest are two major factors	Struggle for existence and survival of the fittest are not accepted
Proposes that only useful variations will be transferred over successive generations	Proposes that all the acquired characters are inherited by the next generation

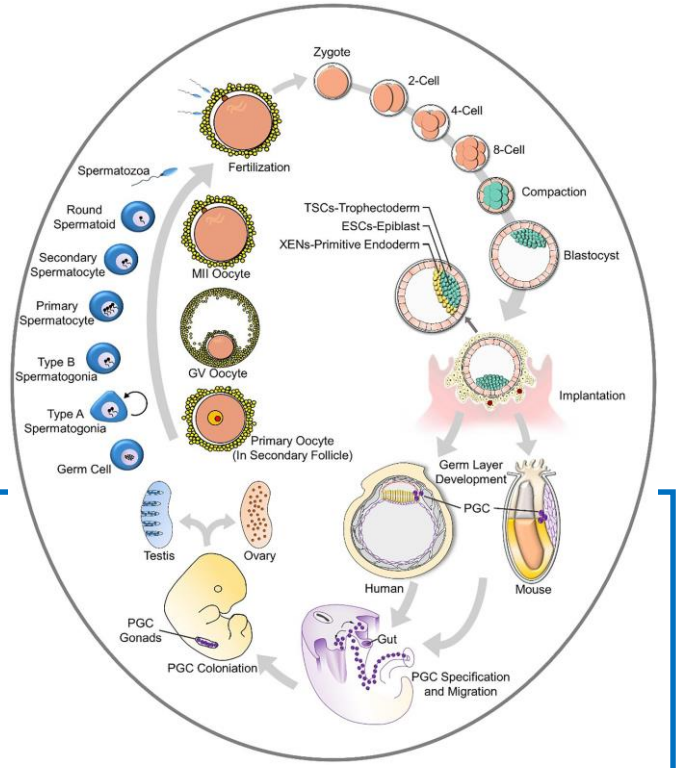
9.3. The new gene identified in mice is expressed in cells

(A) somatic and has three coding regions.

(B) somatic and has three non-coding regions.

(C) germline and has three coding regions.

(D) germline and has three non-coding regions.

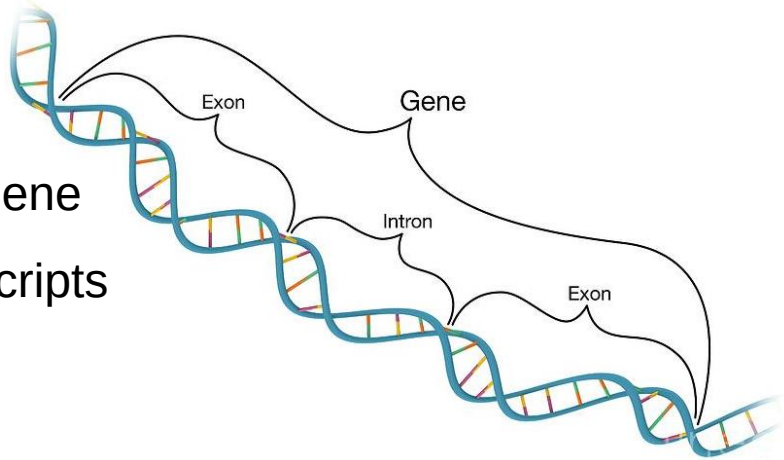


ANSWER:

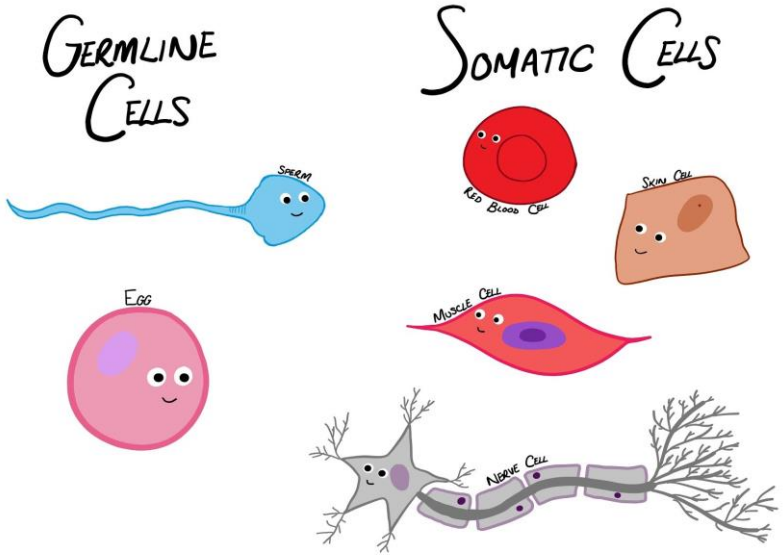
"*The new gene has <u>three exons</u> and is only expressed in <u>post-meiotic cells</u>.*"

↓ three coding regions

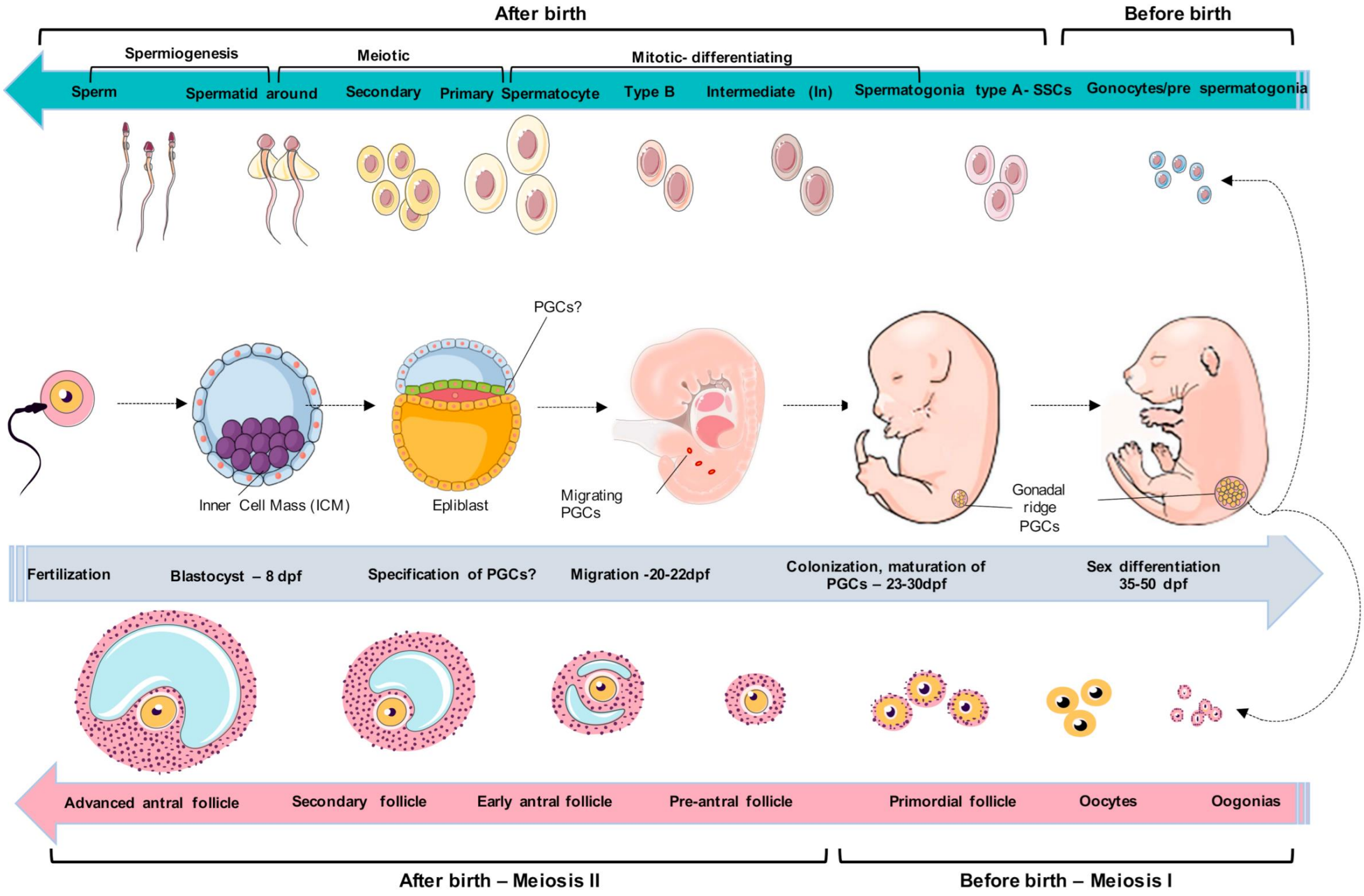
↓ germline cells



Exon refers to both the DNA sequence within a gene and to the corresponding sequence in RNA transcripts



Somatic cells are the cells in the body other than sperm and egg cells (which are called **germ cells**)


After birth
Before birth
Spermiogenesis
Meiotic
Mitotic- differentiating
Sperm
Spermatid
around
Secondary
Primary
Spermatocyte
Type B
Intermediate (In)
Spermatogonia
type A- SSCs
Gonocytes/pre spermatogonia
PGCs?
Inner Cell Mass (ICM)
Epiblast
Migrating PGCs
Gonadal ridge PGCs
Fertilization
Blastocyst – 8 dpf
Specification of PGCs?
Migration -20-22dpf
Colonization, maturation of PGCs – 23-30dpf
Sex differentiation 35-50 dpf
Advanced antral follicle
Secondary follicle
Early antral follicle
Pre-antral follicle
Primordial follicle
Oocytes
Oogonias
After birth – Meiosis II
Before birth – Meiosis I

9.4. The nucleotide sequence of DNA that gave rise to ghost protein 2 was

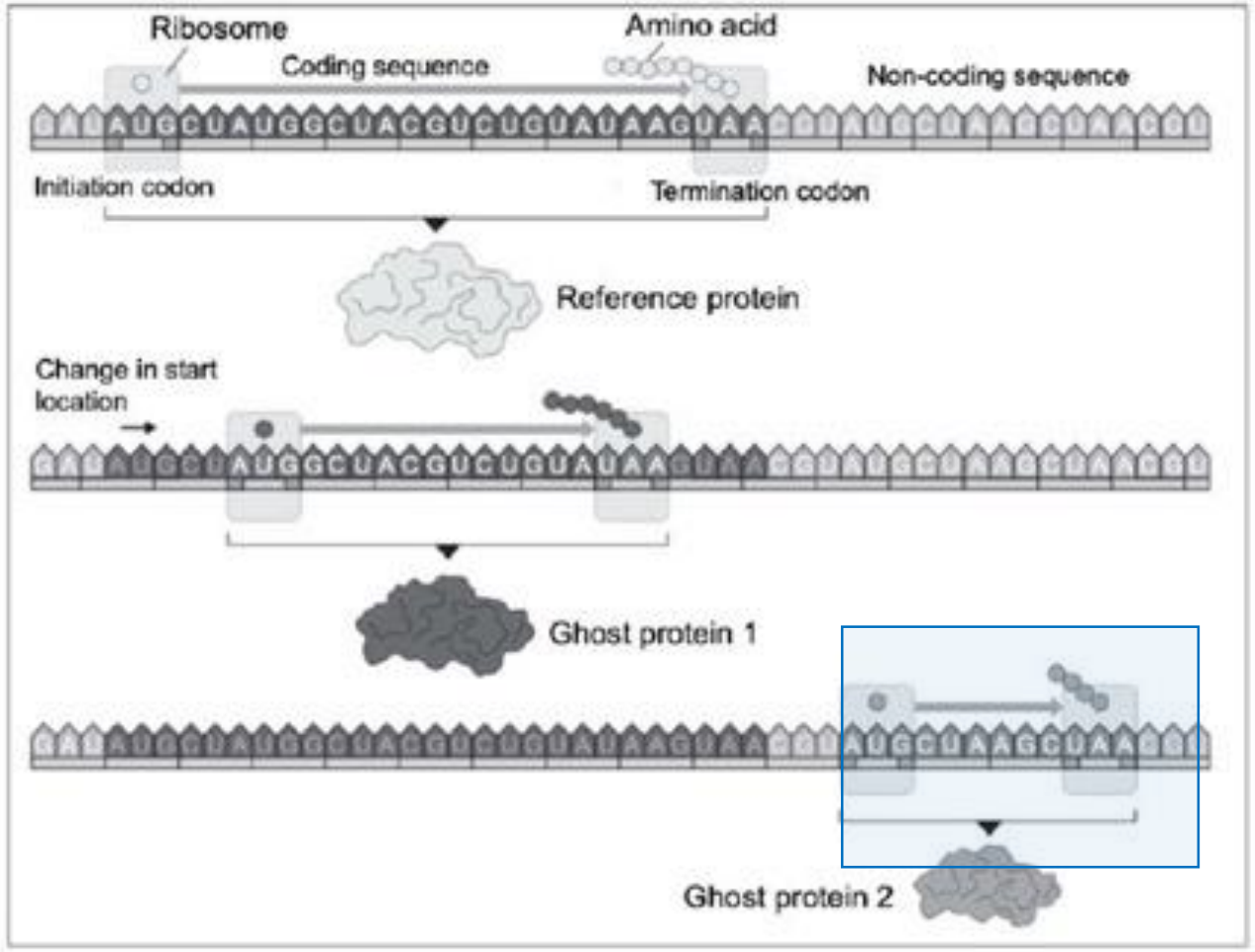
(A) 5' UACGAUUCGAUU 3'.

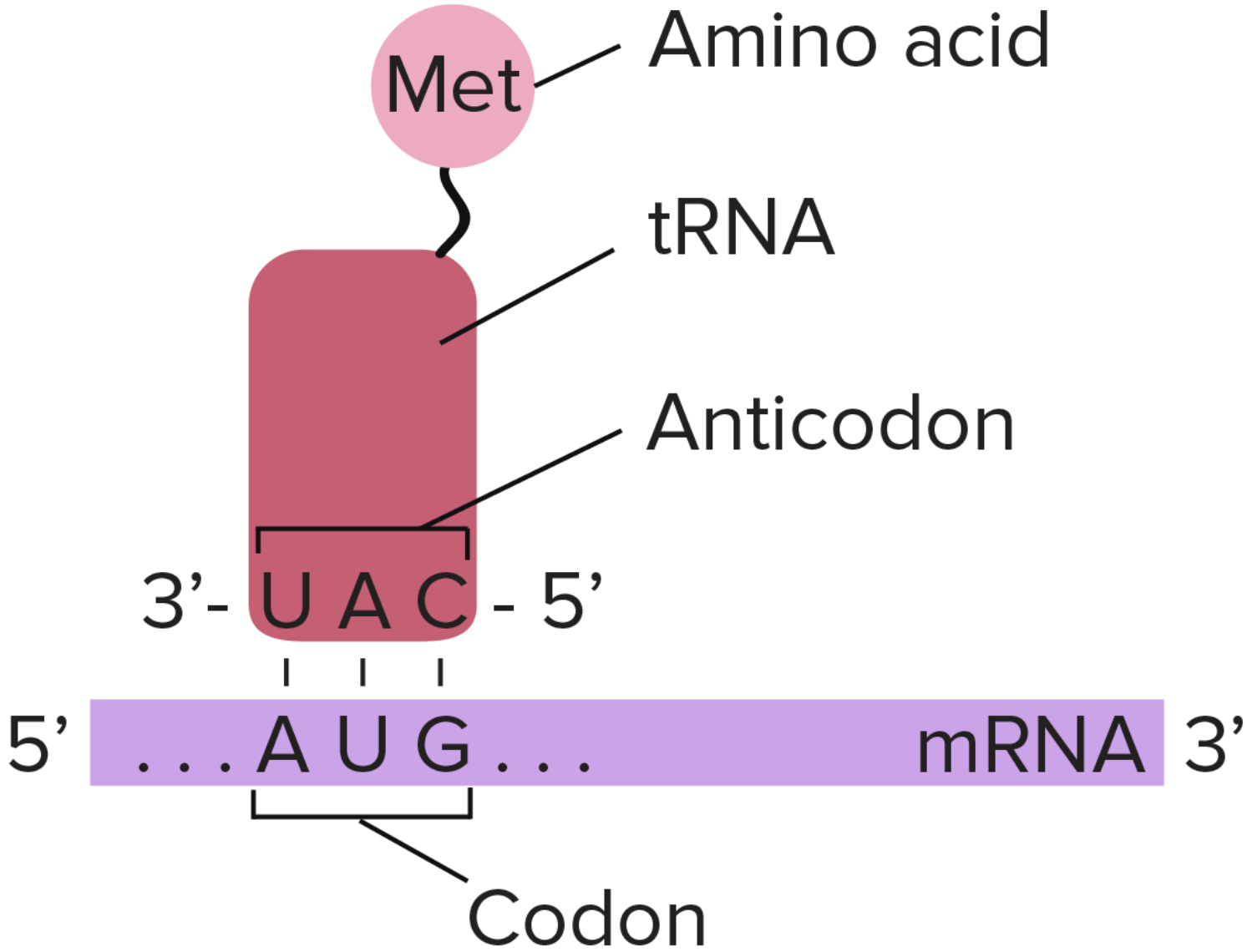
(B) 3' TACGATTCGATT 5'.

(C) 5' TACGATTCGATT 3'.

(D) 3' UACGAUUCGAUU 5'.

ANSWER




Met
Amino acid
tRNA
Anticodon
3'- U A C - 5'
5'
. . . A U G . . .
mRNA
3'
Codon

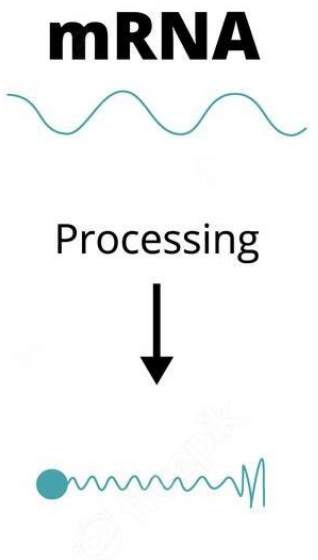
9.5. The resting potential of mouse neurons is a consequence of

(A) active transport of ions, against the concentration gradient.

(B) facilitated diffusion of ions through carrier proteins.

(C) facilitated diffusion of ions across the phospholipid bilayer.

(D) active transport of ions without energy consumption.



Messenger RNA (mRNA): responsible for carrying information from genes for the production of polypeptides in the cytoplasm.

ANSWER:

"*All mouse neuron mRNAs were sequenced, and, among the 250 new proteins, some resulted from alternative coding sequences.*"

mRNA vs tRNA vs rRNA

mRNA	tRNA	rRNA
mRNA is a subtype of RNA molecule which carries a portion of the DNA code to other parts of the cell for processing	tRNA molecule is a small RNA molecule, which is clover-leaf shaped and transfers a specific amino acid in the cytoplasm to the ribosome	rRNA molecule is a component of the ribosome and serves as the organelle of translation
Linear in shape	Clover-leaf shaped molecule	Sphere shaped molecule
Carries the message of transcript DNA codes of polypeptides from the nucleus to the ribosomes	Carries specific amino acids to the ribosome, aiding the translation	Associated with specific proteins to form ribosomes
Consists of codons	Consists of anticodons	Lacks codon or anticodon sequences
Size of the molecule is typically 400 to 12,000 nt in mammals	Size of the molecule is 76 to 90 nt	Size can be either 30S, 40S, 50S, and 60S

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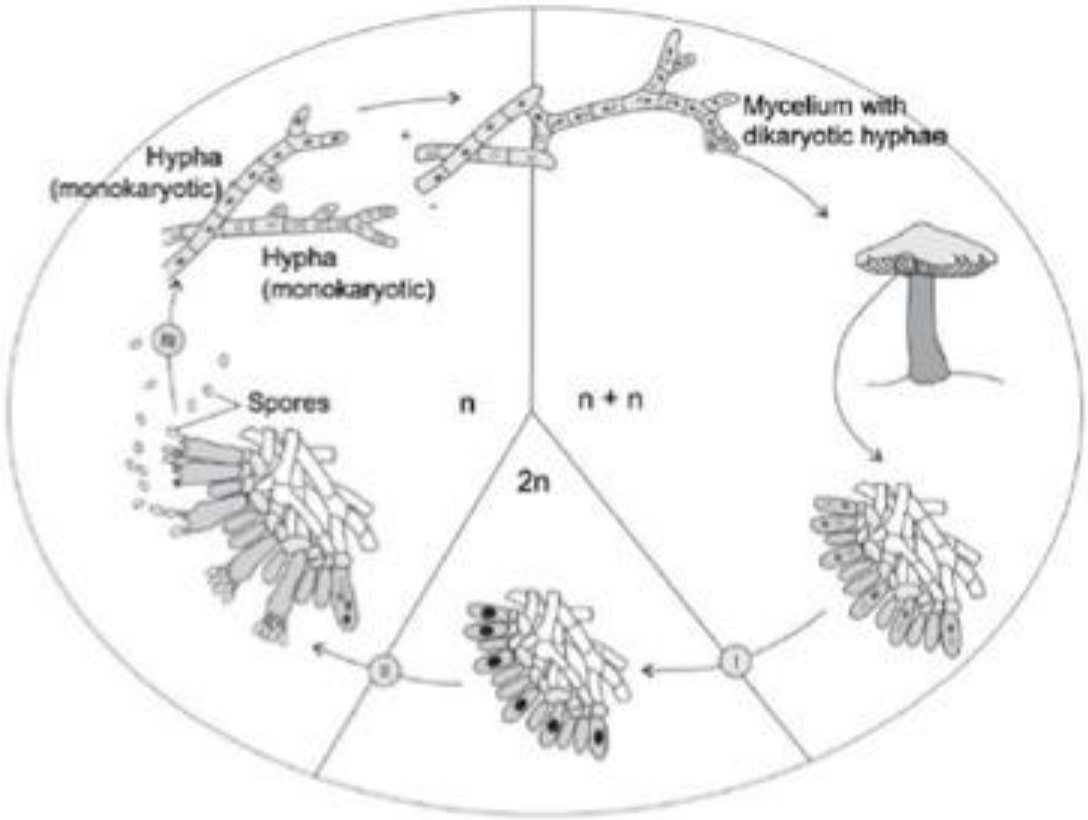
10. *Carefully read the following text:*

Under favorable conditions, in mushrooms, as in most fungi, every day some spores mature and are released into the air. There are, however, fungi that fruit underground – truffles.

The occurrence of mutations in truffles, over millions of years, allowed the formation of aromatic compounds that attract animals. When an animal eats a truffle, most of the pulp is digested, but the spores are not.

Many species of fungi live associated with the roots of woody plants, producing a network of filaments, or hyphae, that grow between the roots of plants, forming a shared organ of absorption known as an ectomycorrhiza.

The figure shows the life cycle of a mushroom, a multicellular fungus made up of hyphae, which together form a mycelium.



10.1. Explain how, over the generations, the mutations mentioned in the text have contributed to the reproductive success of truffles.

ANSWER:

Answer topics:

- relationship between the truffles' fruiting location and the difficulty of spore dispersion;
- relationship between mutations and the formation of aromatic compounds that attract animals;
- relationship between non-digestibility of truffle spores by animals and spore dispersion.

10.2. The life cycle shown in the figure is

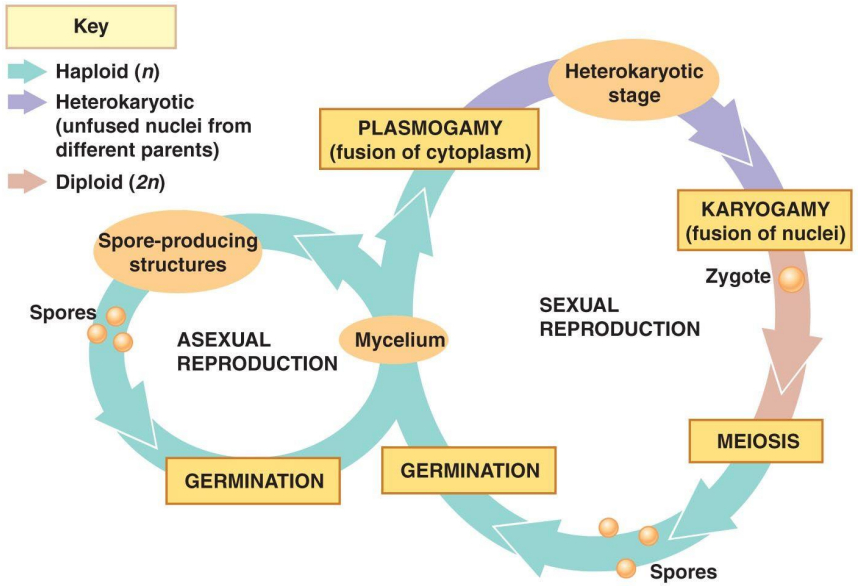
(A) haplodiplontic, with post-zygotic meiosis.

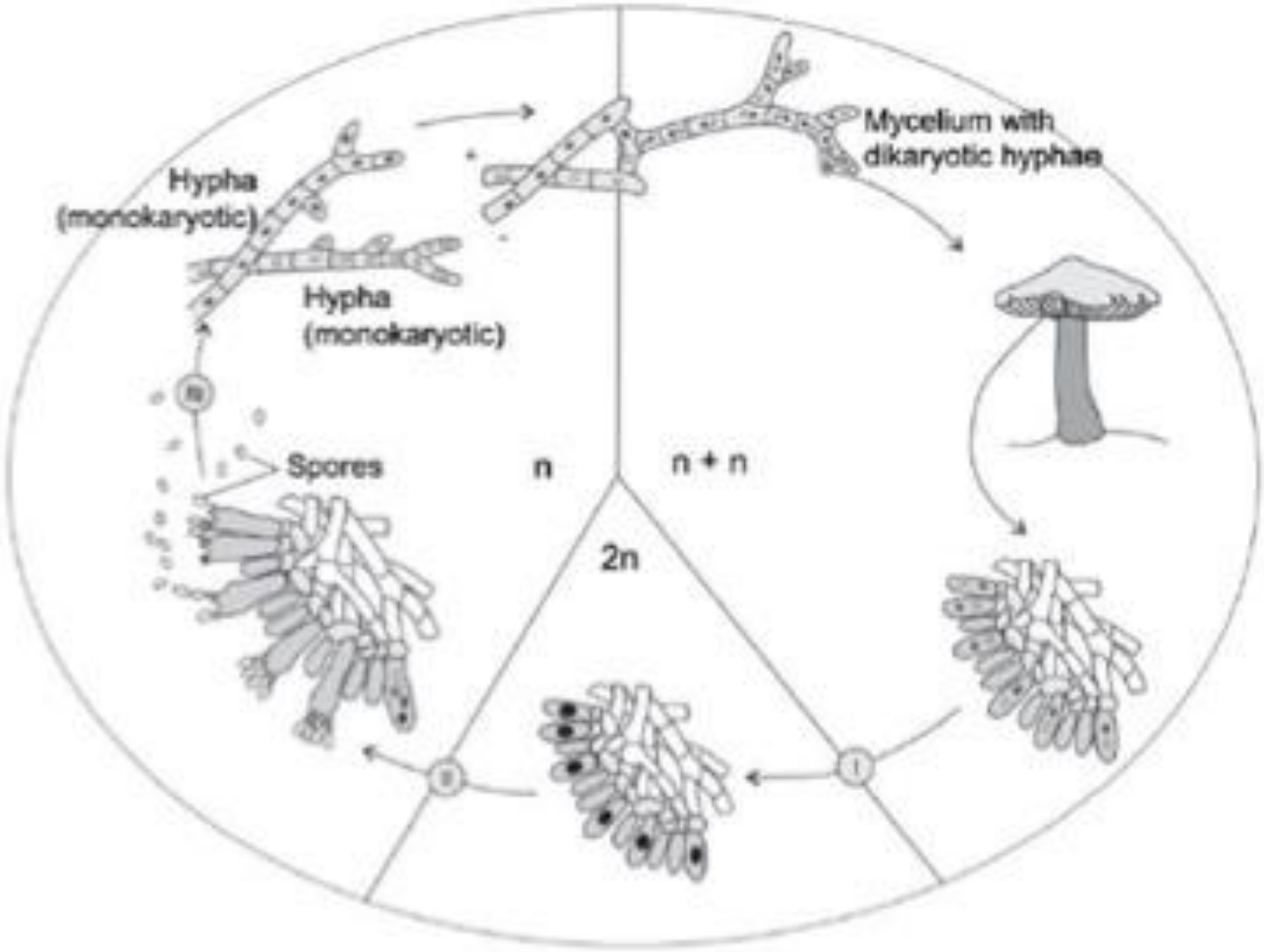
(B) haplodiplontic, with presporic meiosis.

(C) haplont, with presporic meiosis.

(D) haplont, with post-zygotic meiosis.

ANSWER





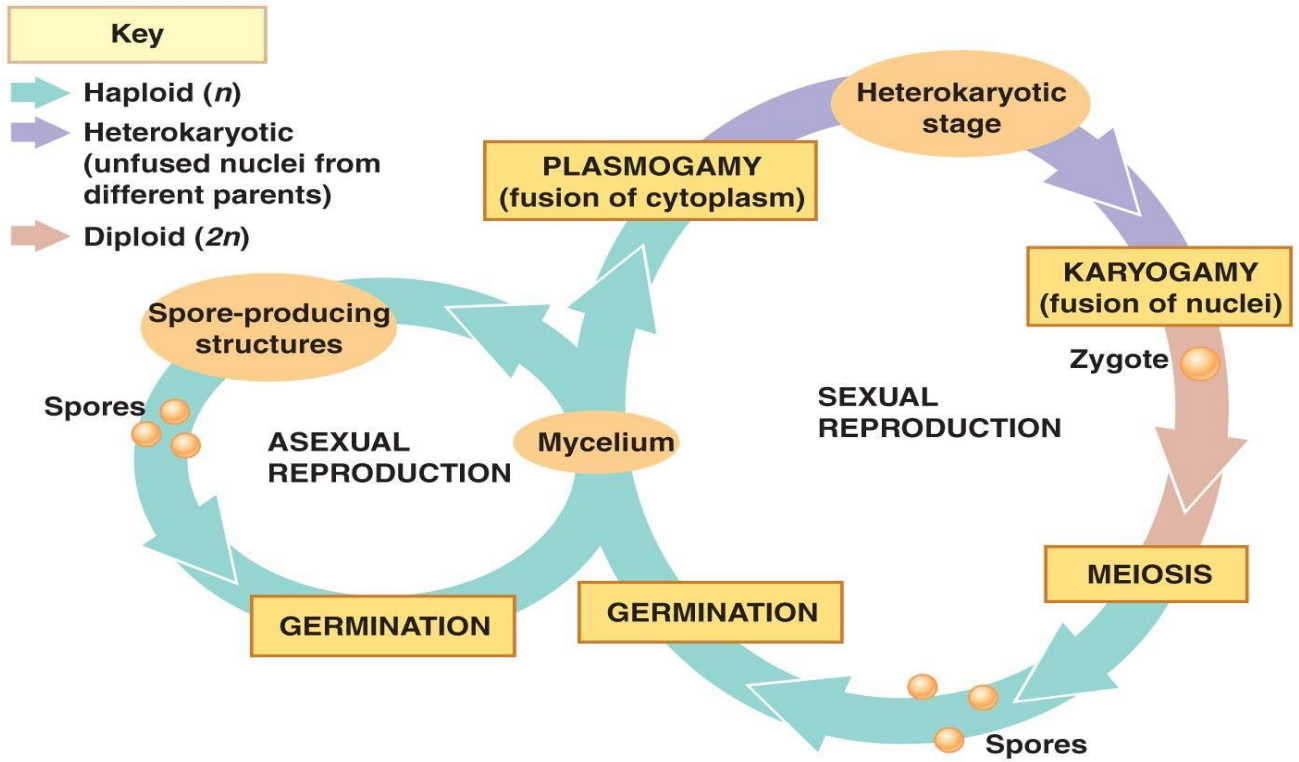
Life cycles that include sexual reproduction involve alternating haploid (n) and diploid (2n) stages, i.e., a change of ploidy is involved. To return from a diploid stage to a haploid stage, meiosis must occur. In regard to changes of ploidy, there are three types of cycles:

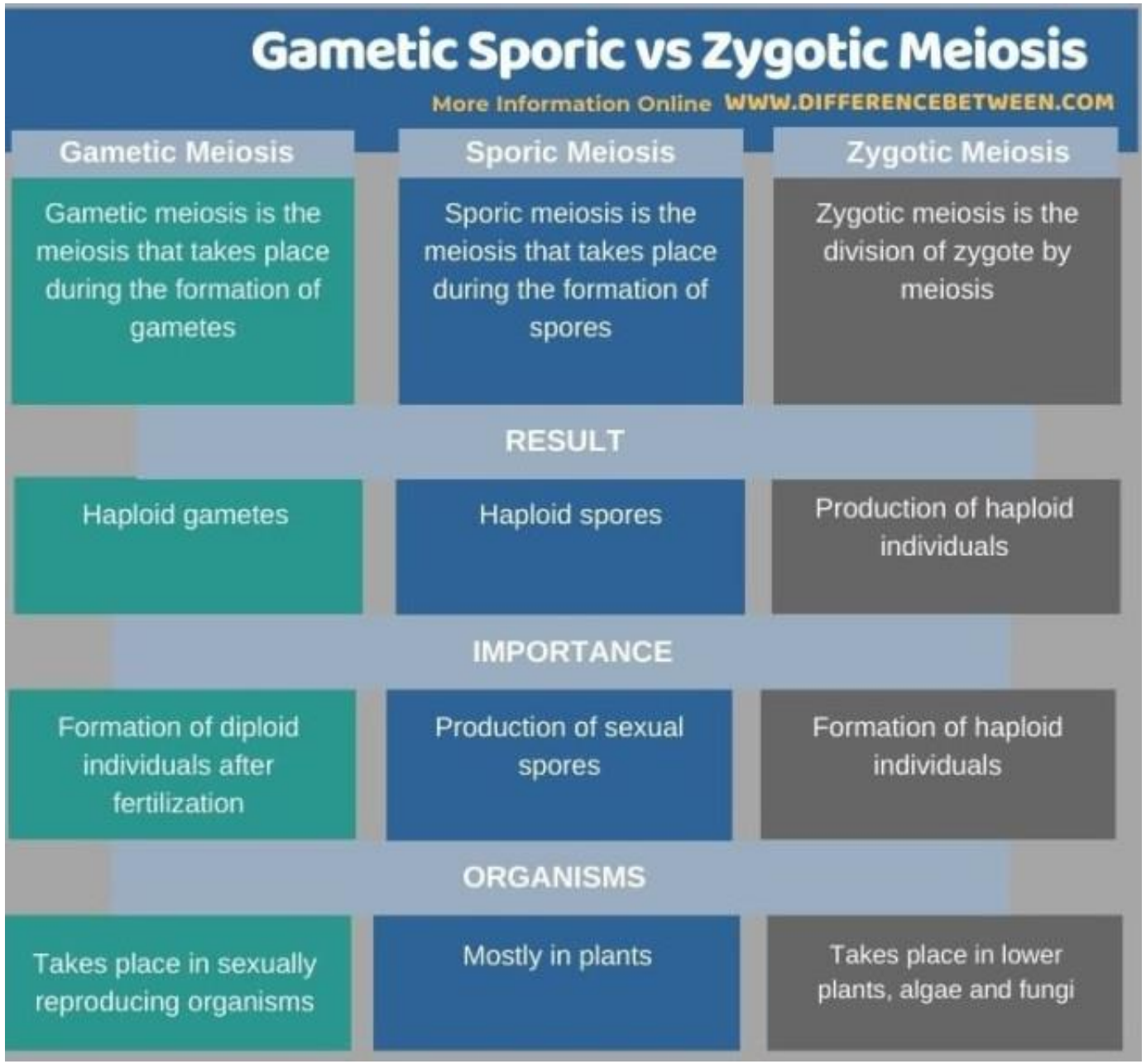
1) haplontic life cycle - the haploid stage is multicellular and the diploid stage is a single cell, meiosis is "zygotic";

2) diplontic life cycle - the diploid stage is multicellular and haploid gametes are formed, meiosis is "gametic";

3) haplodiplontic life cycle

(also referred to as diplohaplontic, diplobiontic, or dibiontic life cycle) - multicellular diploid and haploid stages occur, meiosis is "sporic".




Gametic Sporic vs Zygotic Meiosis
More Information Online WWW.DIFFERENCEBETWEEN.COM
Gametic Meiosis
Sporic Meiosis
Zygotic Meiosis
Gametic meiosis is the meiosis that takes place during the formation of gametes
Sporic meiosis is the meiosis that takes place during the formation of spores
Zygotic meiosis is the division of zygote by meiosis
RESULT
Haploid gametes
Haploid spores
Production of haploid individuals
IMPORTANCE
Formation of diploid individuals after fertilization
Production of sexual spores
Formation of haploid individuals
ORGANISMS
Takes place in sexually reproducing organisms
Mostly in plants
Takes place in lower plants, algae and fungi

11. Put in order the letters that identify the following statements, in order to reconstruct the temporal sequence of some of the events that, according to Lamarck, explain the evolution of the dolphin from the terrestrial ancestral mammal.

A. By changing the environment, the terrestrial ancestral species colonizes the aquatic environment.

B. Atrophy of the hind limbs is transmitted by each individual to his offspring.

C. Individuals occupying the new environment do not use hind limbs.

D. Failure to use the hind limbs leads to their atrophy.

E. In the ancestral species, the hind limbs are used for locomotion on land.

ANSWER:

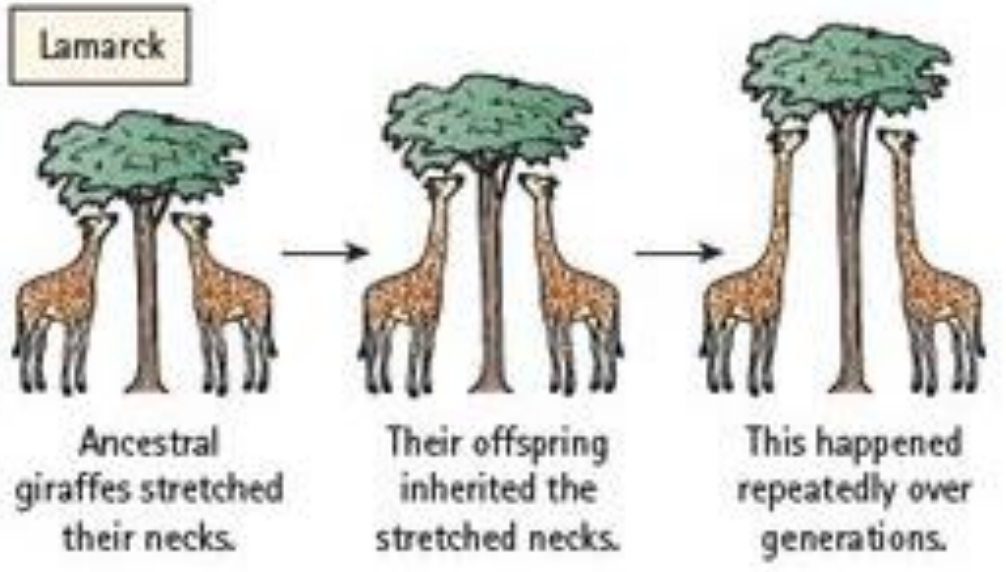
E – A – C – D – B

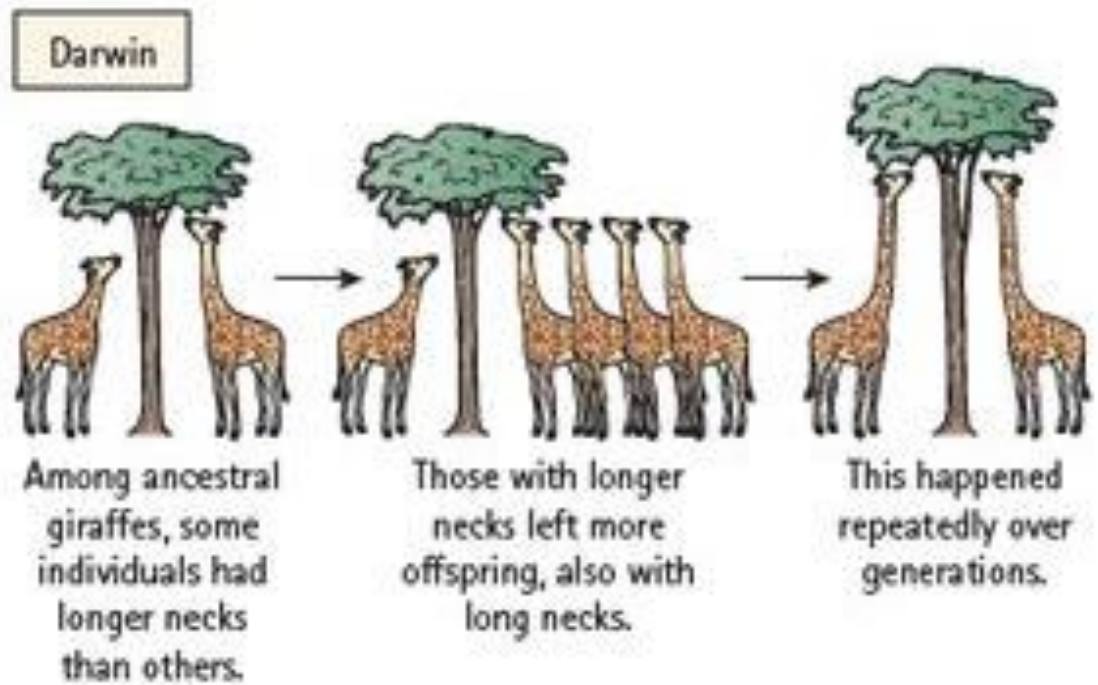
Lamarckism suggests that there is an internal vital force in all organisms

Does not accept Darwin's natural selection theory

Struggle for existence and survival of the fittest are not accepted

Proposes that all the acquired characters are inherited by the next generation





Good study!