

الاسم :  
الرقم :مسابقة في الثقافة العلمية  
مادة "علوم الحياة"  
المدة ساعة واحدة

Answer the following exercises:

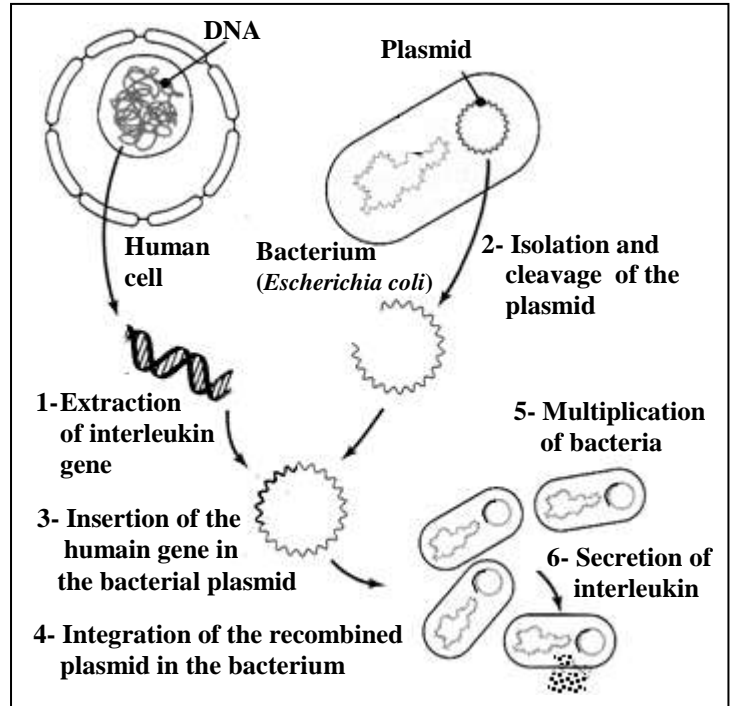
**Exercise 1 (5 points)****Interleukin**

Interleukin is a human molecule necessary for the stimulation of cells that destroy cancer cells.

We seek to obtain large quantities of this molecule by synthesizing it using bacteria (*Escherichia coli*).

The steps of this biotechnology method are presented in the adjacent document.

- 1- Write a short text describing the different steps of this technique.
- 2- Pick out from the document the donor gene and the recipient of the transferred gene.
- 3- Name the enzymes used in steps 1 and 3.
- 4- Explain why the manipulated bacterium is qualified as transgenic.
- 5- Draw out the medical application of this biotechnology method.

**Exercise 2 (5 points) Regulation of calcemia**

The parathyroid glands that are situated at the base of the neck are four in number. Their structure shows no excretory ducts, but they are richly irrigated by blood vessels. The parathyroid glands do not secrete calcium.

**Experiment 1**

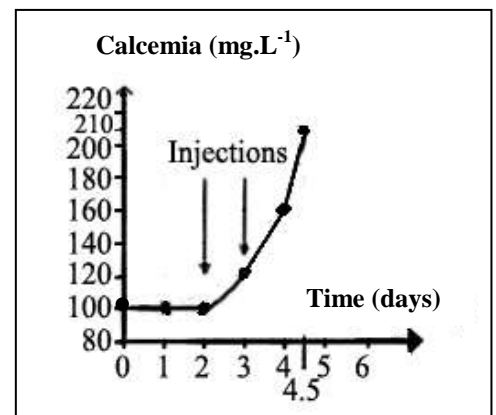
The ablation of the four parathyroid glands in a dog leads to tetany seizures (prolonged contractions) affecting all muscles and to a decrease in calcium blood concentration or calcemia. Death occurs within few days.

- 1- Interpret the above experiment.

**Experiment 2**

We inject a substance isolated from parathyroid extracts into a normal animal and we measure the evolution of calcemia. The obtained results are presented in the adjacent document.

- 2- Construct a table that presents the values provided by this document.
- 3- Analyze the obtained results. What can you draw out?
- 4- List three arguments showing that the parathyroid glands are endocrine glands.



**Exercise 3 (5 points)**

**Tobacco dependency**

**“Dopamine is a neurotransmitter implicated in the control of movement and pleasure. In depressed people, the concentration of dopamine is low. MAOI\* are used as antidepressants; they increase the concentration of dopamine especially by preventing its degradation by specific enzymes. Acetaldehyde is a MAOI that is present in alcohol as well as in tobacco”.**

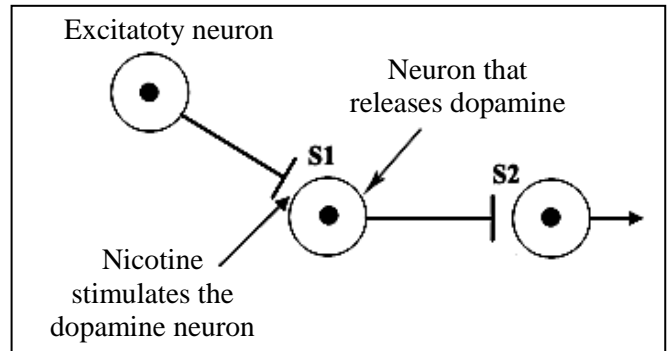
*\*MAOI : Mono Amine Oxydase Inhibitors, inhibit the enzymes responsible for dopamine degradation.*

*Document 1*

1- Pick out from the text, the mode of action of MAOI as antidepressants as well as the role of dopamine.

Document 2 represents the action of nicotine present in tobacco on the secretion of dopamine at the level of the cerebrum.

- 2- Draw out from document 2 the mode of action of nicotine.
- 3- Justify by referring to documents 1 and 2 why depressed people seek excessive tobacco consumption.
- 4- Explain why nicotine present in tobacco is considered as a drug.



*Document 2*

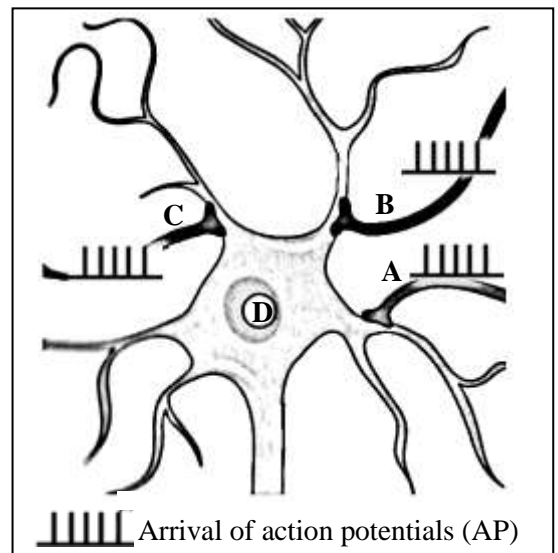
**Exercise 4 (5 points)**

**Response of a neuron to stimulations**

Document 1 presents synaptic junctions of three afferent neurons (A, B, C) with a motorneuron (D). We seek to study the response of neuron D following independent stimulations or simultaneous stimulations of different neurons.

Document 2 shows the obtained results.

- 1- Specify in each of the cases 1, 2 and 3 whether neuron D is excited or inhibited. Justify the answer.
- 2- Determine whether the synapse between C and D is excitatory or inhibitory.
- 3- Specify the role of neuron D that is revealed in this experiment.
- 4- List the steps of the transmission of nerve message at the level of synapse A.



*Document 1*

Case	1	2	3
Stimulated neurons	A	A + B	A + B + C
Results in D	+	-	+
+ = presence of action potentials                      - = absence of action potentials			

*Document 2*

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Part of the Ex	Answer key	Mark
<b>Exercice1 (5 points)</b>		
1	We extract the interleukin gene from the DNA of a human cell. We isolate the plasmid of a bacterium (Escherichia coli), and cleave it. Then we insert the human gene into the bacterial plasmid. The recombined plasmid integrates in the bacterium that multiplies. The obtained bacteria secrete interleukin.	2
2	Donor : human cell Recipient : bacterium (Escherichia coli)	0.5
3	Step 1 : restriction enzyme Step 3 : DNA ligase enzyme	1
4	The bacterium is qualified as transgenic since it has integrated a new gene belonging to a different species (human), and has expressed the new character (secretion of interleukin).	1
5	This method permits the production of huge quantities of interleukin to fight cancer.	0.5

Part of the Ex	Answer key	Mark														
<b>Exercise 2 (5 points)</b>																
1	Tetany seizures affecting all the muscles with a decrease in calcemia followed by death occur after the ablation of the four parathyroid glands. This means that the parathyroid glands are indispensable for the maintenance of normal calcemia and survival.	1.5														
2	<p style="text-align: center;">Injections ↓      ↓</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Time (days)</th> <th>0</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>4.5</th> </tr> </thead> <tbody> <tr> <td>Calcemia (mg.L<sup>-1</sup>)</td> <td>100</td> <td>100</td> <td>100</td> <td>120</td> <td>160</td> <td>210</td> </tr> </tbody> </table> <p>Variations of calcemia in function of time following injections of parathyroid extracts</p>	Time (days)	0	1	2	3	4	4.5	Calcemia (mg.L <sup>-1</sup> )	100	100	100	120	160	210	2
Time (days)	0	1	2	3	4	4.5										
Calcemia (mg.L <sup>-1</sup> )	100	100	100	120	160	210										
3	From day 0 till day 2, calcemia remains constant at 100 mg.L <sup>-1</sup> . Then it increases from 100mg. L <sup>-1</sup> to 210 mg. L <sup>-1</sup> between D2 and D4.5 after two successive injections of parathyroid extracts at D2 and D3. <b>(0.5pt)</b> This means that the parathyroid glands release a substance into blood which is responsible for hypercalcemia. <b>(0.5pt)</b>	1														
4	The parathyroid glands are endocrine glands because they do not show excretory ducts <b>(0.5pt)</b> , they are richly irrigated by blood vessels <b>(0.5pt)</b> and act via blood <b>(0.5pt)</b> .	0.5														

<b>Part of the Ex</b>	<b>Answer key</b>	<b>Mark</b>
	<b>Exercise 3 (5 points)</b>	
<b>1</b>	-MAOI increases the concentration of dopamine, especially by preventing its degradation by specific enzymes. <b>(0.75 pt)</b> -Dopamine is a neurotransmitter implicated in the control of movement and pleasure. <b>(0.75 pt)</b>	<b>1.5</b>
<b>2</b>	Nicotine stimulates dopamine neuron at the level of S1 to increase the liberation of dopamine at the level of S 2.	<b>1</b>
<b>3</b>	Depressed people have low concentration of dopamine. Tobacco contains acetaldehyde which is a MAOI that increases the amount of dopamine, especially by preventing its degradation by specific enzymes; and it contains nicotine that also increases the liberation of dopamine. Therefore, smoking tobacco increases the concentration of dopamine and corrects the effect of depression.	<b>1.5</b>
<b>4</b>	Nicotine is considered as drug because it acts at the level of the synapse and modifies its function in addition to inducing physical and psychic dependence and tolerance.	<b>1</b>

<b>Part of the Ex</b>	<b>Answer key</b>	<b>Mark</b>
	<b>Exercise 4 (5 points)</b>	
<b>1</b>	In the case of the stimulation of neurons(A+ B), neuron D is inhibited <b>(0.5 pt)</b> because there is absence of AP in neuron D. <b>(0.5 pt)</b> However, in the case of the stimulation of neuron A or neurons (A+B+C), neuron D is excited <b>(0.5 pt)</b> because APs appear in neuron D. <b>(0.5 pt)</b>	<b>2</b>
<b>2</b>	The synapse between C and D is excitatory <b>(0.5 pt)</b> because the stimulation of neurons (A+B) does not result in the generation of any AP; however, the stimulation of the same neurons (A+B) simultaneously with neuron C leads to the generation of AP in neuron D <b>(1pt)</b> .	<b>1</b>
<b>3</b>	The role revealed at the level of neuron D is an integrating role of the nerve messages coming from different afferent neurons (A, B and C).	<b>0.5</b>
<b>4</b>	The afferent nerve message reaches the terminal buds of the presynaptic neuron. It triggers, by exocytosis, the liberation of the neurotransmitter to the synaptic cleft. The liberated neurotransmitters fix on specific receptors on postsynaptic membrane and trigger an excitatory postsynaptic potential. The neurotransmitters are degraded by specific enzymes and/or are recaptured by the presynaptic membrane.	<b>1.5</b>