

Answer the following exercises :

**Exercise 1 (7 points)**

**Transgenic Tomato NHX1**

Farmers complain from the low yield of tomato plants cultivated in salty soil in their region. The excessive salts ( $\text{Na}^+$ ) provoke the dehydration of tomato plants and lead to their death.

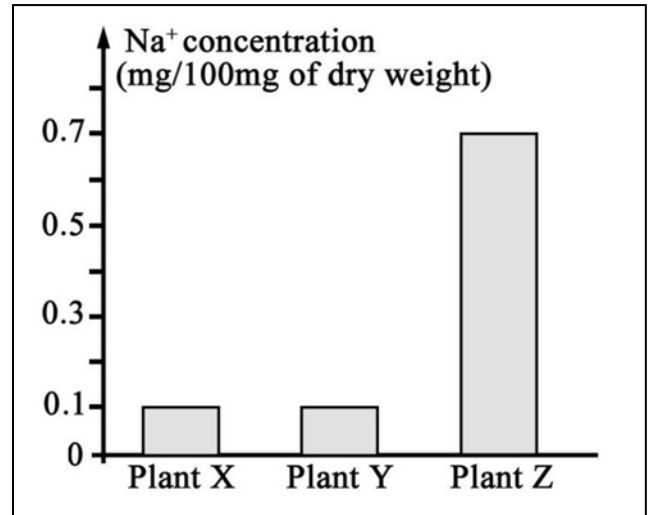
Certain plants, other than tomatoes, are adapted to this kind of soil; they accumulate  $\text{Na}^+$  ions which inhibits the exit of water and consequently their dehydration.

In these plants, a gene NHX1 has been identified. This gene codes for a protein responsible for the accumulation of  $\text{Na}^+$  ions. This gene was cloned and integrated by transgenesis in the genetic material of tomato.

- 1- Pick out from the text :
  - 1.1- The characteristic of the plants that are adapted to salty soil.
  - 1.2- The role of the gene NHX1.

The adjacent document shows the concentration of  $\text{Na}^+$  in different plants where we introduced the gene. These plants are cultivated in salty soils.

- 2- Draw a table which represents the variation of the concentration of  $\text{Na}^+$  in the different plants.
- 3- Specify the plant X, Y or Z where transgenesis is successful.
- 4- Justify the benefit of these transgenic tomatoes NHX1 for these farmers.



**Exercise 2 (6 points)**

**Alcohol and the Brain**

In Lebanon, the laws related to road safety, which have been applied since April 2015, impose sanctions that vary between a penalty of 350 000 LL for an alcoholemia of 0.3g/L, up to the withdrawal of the driving license. Alcoholemia is the amount of alcohol in blood.

The consumption of alcohol affects the person at the physical, psychological and even physiological level. Alcohol consumed in high doses attenuates hearing and attention and it provokes vision troubles.

- 1- Pick out from the text:
  - 1-1- Two effects of alcohol consumption in high doses.
  - 1-2- The sanction imposed by the Lebanese laws.

Alcohol acts at the level of inhibitory GABA synapses, and this inhibits the transmission of the nervous message. Studies performed on car drivers who consumed alcohol showed that their capacity to stop the car when facing a danger decreases, and the car can only be stopped at a later time at a distance of 100 meters ahead.

- 2- List the steps of the transmission of the nervous message at the level of a synapse.
- 3- Pick out the statement that shows that alcohol slows down reflexes.
- 4- Justify the measures taken by the government to limit car accidents.

**Exercise 3 (7 points) Multiple Sclerosis**

Multiple sclerosis is a disease manifested by vision troubles and difficulties in movement. It is characterized by the appearance of plaques around the nerve fibers.

Researchers measure the speed of conduction of the nervous message along the myelinated nerve fibers of the optic nerve, in a healthy individual and in another one suffering from multiple sclerosis. The results are shown in document 1.

<b>Fibers of the optic nerve</b>	<b>Speed of the conduction of the nervous message (in m/s)</b>
<b>Healthy Individual</b>	100
<b>Individual suffering from sclerosis</b>	1

*Document 1*

They also measure the speed of conduction of nervous message in different types of fibers. Document 2 shows the conditions and the obtained results.

<b>Nerve fibers of mammals</b>	<b>Diameter of the fiber (in μm)</b>	<b>Speed of the conduction of the nervous message (in m/s)</b>
<b>Fibers with myelin</b>	2	12
<b>Fibers without myelin</b>	2	2

*Document 2*

- 1- What can you draw out from document 1?
  - 2-1- Analyze the results shown in document 2.
  - 2-2- What can you conclude?
- 3- Indicate the chemical nature of myelin and its location at the level of a neuron.
- 4- Justify, based on what precedes, the following statement: “The cause of multiple sclerosis is the destruction of myelin sheath”.
- 5- Name two other diseases that affect the nervous system.

Part of the ex	Exercise 1 Transgenic Tomato	Mark 7 pts								
1-1	The plants accumulate Na <sup>+</sup> ions and this inhibits the exit of water and consequently their dehydration.	1								
1-2	The gene NHX1 codes for a protein responsible for the accumulation of Na <sup>+</sup> .	1								
2	Table showing the variation of Na <sup>+</sup> concentration in different plants X, Y and Z. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Plant</th> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>Concentration of Na<sup>+</sup> (mg/100 mg of dry weight)</td> <td>0.1</td> <td>0.1</td> <td>0.7</td> </tr> </tbody> </table>	Plant	X	Y	Z	Concentration of Na <sup>+</sup> (mg/100 mg of dry weight)	0.1	0.1	0.7	2
Plant	X	Y	Z							
Concentration of Na <sup>+</sup> (mg/100 mg of dry weight)	0.1	0.1	0.7							
3	Plant Z Since the concentration of Na <sup>+</sup> is 0.7 mg/100mg of dry weight, which is 7 times higher than that of the plants X and Y where the concentration in each is 0.1 mg/100mg of dry weight, then plant Z becomes capable of accumulating sodium which means that it has integrated the new gene.	2								
4	Transgenic tomatoes become capable of accumulating sodium which enables them to grow in salty soil. Thus, the problem of farmers concerning the fact that the salty soil is inappropriate for the growth of tomatoes is solved.	1								

Part of the ex	Exercise 2 Alcohol and Brain	Mark 6 pts
1-1	Alcohol consumed in high doses attenuates hearing and attention and it provokes vision troubles.	1
1-2	The sanction varies from a penalty of 350 000 LL for an alcohol blood level of 0.3g/L, up to the withdrawal of the driving license.	1
2	<ul style="list-style-type: none"> <li>- The afferent nervous message (AP) arrives at the level of the terminal buds of the presynaptic neuron.</li> <li>- This provokes the liberation of neurotransmitters by exocytosis into the synaptic cleft.</li> <li>- The liberated neurotransmitters bind to receptors on the postsynaptic membrane.</li> <li>- This fixation leads to post-synaptic membrane potential.</li> <li>- The liberated neurotransmitters are either degraded and/or recaptured by the presynaptic membrane.</li> </ul>	11/4
3	Alcohol acts at the level of inhibitory GABA synapses, and this inhibits the transmission of the nervous message. This shows that alcohol slows down reflexes.	1
4	Alcohol attenuates the capacity of the driver to stop the car when facing a danger, so this increases the risk of car accidents. This is why imposing sanctions on drivers whose alcoholemia exceeds the threshold (0.3g/L) can prevent them from driving after consuming alcohol. This can decrease car accidents.	1 3/4

<b>Part of the ex.</b>	<b>Exercise 3 Multiple Sclerosis</b>	<b>Mark 7 pts</b>
<b>1</b>	The speed of conduction of the nervous message slows down in the person suffering from MS.	<b>1</b>
<b>2.1</b>	Document 2 shows that the velocity of the conduction of the nervous message in none myelinated fibers is 2m/s, slower than that, 12m/s, in the myelinated ones that have the same diameter, 2 $\mu$ m.	<b>1</b>
<b>2.2</b>	Myelin accelerates the conduction of the nervous messages.	<b>1</b>
<b>3</b>	Myelin is of phospholipid nature. It is located around the nerve fibers.	<b>1 1/2</b>
<b>4</b>	The fibers of the person suffering from multiple sclerosis behave like none myelinated ones. This implies that these fibers have lost their myelin sheaths and this slows down the conduction of the nervous message. Therefore, multiple sclerosis disease is due to the destruction of myelin sheaths around nerve fibers.	<b>11/2</b>
<b>5</b>	Parkinson – Alzheimer	<b>1</b>