

الاسم :  
الرقم :مسابقة في الثقافة العلمية  
مادة " علوم الحياة"  
المدة ساعة واحدة**Answer the following exercises.****Exercise 1 (5pts)**

Studies were carried out in order to obtain tomatoes that ripe and rot slower than ordinary tomatoes. The document below reveals the results obtained.

Scientists obtained, by chance, a variety of super-tomatoes. In fact, they sought to produce fruits which can remain consumable for a time longer than in ordinary tomatoes. For that, they introduced a gene extracted from a bacterium into a tomato cell. This gene codes for the production of an enzyme that prevents cellular death. However, this manipulation had an unexpected effect at increasing the concentration of lycopene<sup>(\*)</sup>, known years ago, for its anti-oxidant properties. In fact, lycopene prevents certain components from attacking the cells. On the other hand, it is known that this attack favors the appearance of cancers or cardiovascular diseases within our body.

(\*) *Lycopene = pigment that gives the tomato its red color.*

- 1- Pose the problem at the origin of the studies performed.
- 2- Pick up, from the document, the origin of the extracted gene and the information it carries.
- 3- Are the obtained results consistent with the sought objective for producing these tomatoes? Justify the answer.
- 4- Justify the qualifications "transgenic" and "anti-cancer" attributed to this variety of tomato.

**Exercise 2 (5pts)**

The parathyroids are four small glands located at the base of the neck on both sides of the thyroid gland. They secrete a hormone, the parathyroid hormone (PTH), which plays a role in the regulation of the amount of calcium in the blood.

In order to determine this role, the following experiments were performed.

**Experiment 1:** A total ablation of the parathyroids of a dog is carried out, and then the amount of calcium in the blood is measured. This amount is noticed to be decreasing.

**Experiment 2:** Injecting this dog with parathyroid extracts increases the blood calcium amount. These extracts contain parathormone.

- 1- Interpret the experiments performed.
- 2- Justify that both experiments are insufficient for determining the role of PTH in the regulation of blood calcium amount. Indicate an additional experiment to be performed for determining this role.

**Experiment 3:** We vary the amount of blood calcium in this dog and the amount of PTH released by the parathyroids is measured throughout the experiment. The results are shown in the next document.

Amount of calcium in the blood ( x 10 <sup>2</sup> mg.L <sup>-1</sup> )	5	8	10	12	15	17
Quantity of PTH released (ng. kg <sup>-1</sup> . min <sup>-1</sup> )	5	3	0.5	0.2	0.2	0.2

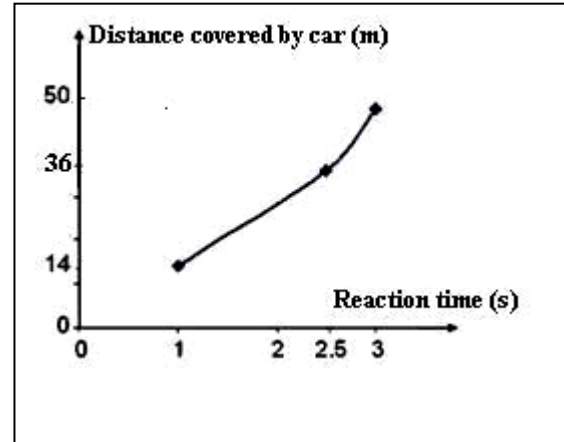
- 3- Analyze the results obtained. Draw out the relation between the amount of calcium in the blood and the PTH released in order to maintain the amount of blood calcium at a normal value.

### Exercise 3 (5pts)

Studies were carried out in order to show the effects of alcohol on car driving. The results are shown in document 1.

Alcoholemia (g/L)	Effects on car driving
0.3 to 0.5	- The driver takes risks while driving. - Wrong estimation of distances. - Reduced field of vision.
0.5 to 0.8	- Longer reaction time. -The driver has much difficulty in distinguishing road panels and the people crossing the road.
> 0.8	-Difficulties in taking decisions and adapting driving to different circumstances. -The coordination and synchronization of gestures are not totally controlled.

Document 1



Document 2

- Based on the analysis of document 1, draw out the relation between alcoholism and its effects on car driving.
- Justify that alcohol disturbs brain functioning.

The distance crossed by a car driver was measured during the reaction time\*. The results are shown in document 2.

- Draw up in a table the variation of the distances covered by car as a function of reaction time.
- In reference to document 2 and the information drawn out from document 1, show that alcohol increases the risk of car accidents.

\* **Reaction Time:** Time taken by the driver to brake and stop the car after the appearance of an obstacle.

### Exercise 4 (5pts)

Three stimulations of increased intensity are applied on a presynaptic neuron A. Microphotographies of synapse C are taken during each of these stimulations. The next document reveals the synapse and the microphotographies obtained.

- Compare the aspect of the synapse during these three stimulations. Draw out how the intensity of a stimulus is coded at the level of a synapse.
- How can the aspect of the synapse be explained if the used intensity was  $I_1$ ?
- Specify the mode of action of a neurotransmitter at the level of the postsynaptic neuron and its fate.

$I_1$

$I_2 > I_1$

$I_3 > I_2$

1: Presynaptic neuron  
2: Postsynaptic neuron  
3: Synaptic cleft

4: Exocytosis  
5: Vesicles of neurotransmitters  
6: Released neurotransmitters

الاسم :  
الرقم :مسابقة في الثقافة العلمية  
مادة "علوم الحياة"  
اسس التصحيح**Exercise 1 (5pts)**

- 1- Problem: How to obtain tomatoes that ripe and rot slower than ordinary tomatoes?  
**OR** How to obtain tomatoes that remain consumable for a time longer than in ordinary tomatoes? **(1pt)**
- 2- The gene is extracted from a bacterium.**(0.5pt)** It codes for the production of an enzyme that prevents cellular death. **(0.5pt)**
- 3- Yes. Thanks to the enzyme coded by the gene of the bacterium, the obtained tomatoes reveal a high amount of lycopene that protects against certain components that attack their cells. Therefore, tomatoes ripe and rot slower than ordinary tomatoes. **(1pt)**
- 4- The obtained tomatoes are qualified as transgenic because they accept a foreign gene that translates the information it carries. **(1pt)**  
They are qualified as anti-cancer tomatoes because they have a high amount of lycopene that will protect the body against cancer. **(1pt)**

**Exercise 2 (5pts)**

- 1- The ablation of the parathyroids decreases the amount of calcium in the blood while the injection of the parathyroids extracts increases this amount. This implies that the parathyroids act by secreting substances via blood pathway in order to increase the amount of calcium in the blood. **(1pt)**
- 2- The 1<sup>st</sup> experiment reveals that the ablation of the parathyroid decreases the amount of calcium in the blood. The 2<sup>nd</sup> experiment reveals that the parathyroid extract increases the amount of calcium in the blood. These experiments do not prove whether the parathormone or another molecule present in the parathyroid extract is at the origin of the increase or the decrease observed. **(1pt)**  
The additional experiment: the injection of the parathyroid extracts deprived of PTH then measurement of the amount of calcium in the blood.  
**OR** injecting PTH then measuring the amount of calcium in the blood. **(1pt)**
- 3- For a low amount of calcium in the blood equal to  $5 \times 10^2 \text{ mg.L}^{-1}$ , the amount of the released PTH is high ( $5 \text{ ng.kg}^{-1} \text{ min}^{-1}$ ). As the amount of calcium in the blood increases, the amount of the released PTH decreases. Starting from a certain value ( $12 \times 10^2 \text{ mg.L}^{-1}$ ) no matter how much the increase in calcium is, the amount of released PTH remains constant and equal to  $0.2 \text{ ng.kg}^{-1} \text{ min}^{-1}$ . This implies that PTH increases the amount of calcium in the blood and that the amount secreted depends on the amount of calcium in the blood: high for a low blood calcium amount, and low for a high calcium blood amount. Therefore, this variation in the release of PTH maintains the amount of calcium in the blood at a normal value. **(2pts)**

### Exercise 3 (5pts)

- 1- For alcoholemia between 0.3 and 0.5g/L, the driver does not estimate distances correctly and visual field is reduced. As alcoholemia increases to overcome 0.8g/L, the coordination and synchronization of gestures for adapting driving to different circumstances are not totally controlled. This shows that disturbances increase with alcohol consumption. **(1pt)**
- 2- Coordination and synchronization of movements, vision, and reaction time.... All these functions depend on the brain. Therefore, alcohol disturbs brain functioning. **(1pt)**
- 3- **(2pts)**

<b>Reaction time (seconds)</b>	<b>1</b>	<b>2.5</b>	<b>3</b>
<b>Distance covered by car during reaction time (m)</b>	<b>14</b>	<b>36</b>	<b>50</b>

*Variation of the distance traveled by car as a function of reaction time*

- 4- Document 2 reveals that as the reaction time taken for the car to stop when an obstacle appears increases from 1 to 3 seconds, the distance traveled increases from 14m to 50m. Document 1 reveals that the consumption of alcohol increases the reaction time. Therefore, a driver who consumed alcohol increases his reaction time which prevents the car to stop at the required time, increasing the risks of car accidents. **(1pt)**

### Exercise 4 (5pts)

- 1- At intensity  $I_1$ , the vesicles containing the neurotransmitters are many and intact within the presynaptic nerve endings of the presynaptic neuron, there is no exocytosis and none of the neurotransmitters is found in the synaptic cleft. At intensity  $I_2$ , few vesicles containing the neurotransmitters were subjected to exocytosis. The others are close to the plasma membrane of the presynaptic neuron and we find in the synaptic cleft some released neurotransmitters. At intensity  $I_3$ , the number of vesicles that are subjected to exocytosis is higher than that with intensity  $I_2$ , the number of vesicles of the presynaptic neuron is less than before and the quantity of neurotransmitter released is very high.  
This means that as the intensity of stimulation increases the quantity of released neurotransmitter increases. Thus, the intensity of stimulation is coded by the concentration of the neurotransmitter released in the synaptic cleft. **(2pts)**
- 2- Intensity  $I_1$  is below the threshold of stimulation. This is because no nerve message propagated along the presynaptic neuron. It did not reach the vesicles and thus did not allow exocytosis. **(1pt)**
- 3- The neurotransmitter fixes on its specific postsynaptic receptors, triggering PSP. **(1pt)**  
The neurotransmitter is degraded by an enzyme. **(1pt)**