

الاسم:
الرقم:مسابقة في الثقافة العلمية (علوم الحياة)
المدّة: ساعة واحدة

Answer the following questions.

Question I (3 pts)

Potatoes that Shine in Darkness

Scottish researchers developed genetically modified potatoes that shine in fluorescent light in absence of water. They introduced in these potatoes a gene that codes for a fluorescent protein found in jellyfish. These new “smart” potatoes are distributed between the other potatoes and serve as indicators of dehydration (these potatoes are not edible). Researchers wish to double or even triple the potato crop.

L ‘Agence Science Press, 25 December 2000

- a- Pick up from the text the use of these potatoes and their economic interest.
b- What is the significance of “genetically modified organisms (GMO)”? Justify that these potatoes are GMO.

Question II (4 pts)

Multiple Sclerosis

“Multiple sclerosis is a neurological disease, which reveals the critical role of myelin in the transmission of information at the level of the nervous system. Persons who suffer from multiple sclerosis complain mainly of weakness, lack of coordination, discomfort in vision and language... Although the exact origin of this disease is not really known, the cause of motor and sensory troubles is very clear since multiple sclerosis affects the myelin sheath of a group of axons of the cerebrum, the medulla oblongata, and the optic nerves. The word sclerosis is of Greek origin that means to become hard, which corresponds to the effect of lesions that develop on the groups of axons, and we talk about multiple sclerosis because the disease affects several sites of the nervous system simultaneously.”

Neurosciences, Pradel 1999

- a- Pick up from the text the cause of sensory and motor troubles and the symptoms of the disease.
b- Knowing that in this disease the speed of a nervous message considerably decreases, explain in reference to the text and acquired knowledge how the structure of the nervous fiber intervenes in the conduction of the nervous message.

Question III (6 pts)

We inject, with a micropipette a certain quantity of the neurotransmitter acetylcholine, at the level of two categories of neurons A and B that are in different activity. We measure, at the same time, the frequency of action potentials of these neurons. The results are presented in the table below.

Time (in seconds)	10	15	20	30	50
Frequency of AP					
Neurons A	3	10	14	14	3
Neurons B	40	30	20	20	40

← Injection of acetylcholine →

- a- Analyze the obtained results. What can you deduce concerning the action of acetylcholine?
- b- How can you explain, ionically, the action of acetylcholine at the level of neurons A?
- c- Explain the fate of acetylcholine after its release in a synaptic cleft.

Question IV (7 pts)

Two dogs, A and B, are kept at a temperature of -4°C show an increase in the volume of the thyroid gland, yet their body temperature remains constant at 38°C .

Dog A is the control. Two days later, dog B is subjected to the ablation of the thyroid gland followed by the injection of two of iodine molecules T_3 and T_4 , isolated from the thyroid extract. The adjacent document shows the variation of body temperature of these two dogs.

- a- Construct, in the same table, the variations of body temperature of these two dogs as a function of time.
- b- Analyze the obtained results. What informations can you draw out?
- c- Explain how the thyroid gland maintains constant body temperature.

الاسم :

أسس التصحيح

الرقم :

المادة : علوم الحياة

المدة : ساعة واحدة

Question I (3 pts)

- a- Use: these potatoes are indicators of dehydration. (1/2 pt)
Economic interest: they permit the doubling and the tripling of potato crop. (1/2 pt)

- b- A genetically modified organism is an organism whose genes are modified by the introduction of a strange gene. (1 pt)
The potatoes are genetically modified organisms because we transfer the gene that codes for a jellyfish protein, of a different species, and they accept this gene and produce the jelly fish protein coded by this gene. (1 pt)

Question II (4 pts)

- a- The cause of motor and sensory troubles: Multiple sclerosis affects the myelin sheath of a group of axons of the cerebrum, the medulla oblongata, and the optic nerves. (1 pt)
The symptoms of the disease: weakness, lack of coordination, discomfort in vision and language, motor and sensory troubles. (1 pt)
- b- Myelin sheath facilitates and accelerates the propagation of nervous messages. Since multiple sclerosis is a disease due to the demyelination of the nerve fibers, this explains the slowing down of the propagation of the nervous message. (2 pts)

Question III (6 pts)

- a- At time 10 seconds the frequency of AP is 3 at the level of neurons A and 40 at the level of neurons B. After the injection of acetylcholine at time 15 seconds, the frequency of AP has increased at the level of neurons A to become 14. On the other hand, it has decreased at neurons B to become 20 at time 20 seconds. Frequencies at the level of these two categories of neurons remain constant as long as the injection continues till 30 seconds. Later, the frequency at the level of each of these groups of neurons returned to their initial states: 3 for neurons A and 40 for neurons B. (2 pts)

This implies that acetylcholine has an excitatory action on neurons A and an inhibitory action on neurons B. Thus, acetylcholine has a double effect: excitatory and inhibitory. (1 pt)

- b- Acetylcholine provokes a depolarization at the level of the membrane of neurons A, which is due to the massive entry of Na^+ ions. (1 pt)

- c- Acetylcholine, once liberated in the synaptic cleft, fixes on their specific receptors on the postsynaptic membrane. Then this neurotransmitter is degraded by specific enzymes and is reabsorbed by the axon terminals, stopping the transmission of a nervous message. (2 pts)

Question IV (7 pts)

a- (3pts)

Time (in days)	1	2	2.5	3	4	5
Body temperature (in °C)						
Dog A (control)	38	38	38	38	38	38
Dog B	38	38	32	34	38	38

Variation of body temperature in function of time in the two dogs

b- The body temperature of the 2 dogs is 38°C. This temperature remains constant till the 5th day in the control dog A. on the contrary, dog B, submitted to the ablation of its thyroid two days later, we observe a rapid decrease of body temperature until 32°C after 2.5 days. The injection of T₃ and T₄ (thyroid extract) at time 2.5 days increases the body temperature to 38°C at day 4. This temperature remains constant until day 5. **(1 pt)**

The thyroid is responsible to maintain the body temperature (**½ pt**) The thyroid acts by blood pathway by means of the two hormones T₃ and T₄ to maintain constant body temperature.

(½ pt)

c- The thyroid is an endocrine gland that elaborates the two hormones T₃ and T₄ that are released in blood. These hormones act on certain target cells that possess specific receptors for these hormones. The binding of the hormone-receptor modifies the activity of the cells and maintain constant body temperature. **(2 pts)**