

### Exercise 1 (6 points)

### The origin of Goiter

Hypothyroidism, an insufficient secretion of the thyroid gland, is either due to dysfunction of the thyroid gland or due to malnutrition. In infants, this disease is manifested by severe mental retardation, dwarfism and retarded puberty. The adults show weak muscles, hypothermia, as well as goiter. The goiter is the swelling of the anterior part of the neck due to the increase in the volume of the thyroid gland.

1. Pick out from the text :
  - 1.1. two symptoms observed in infants affected by hypothyroidism.
  - 1.2. the definition of goiter.
  - 1.3. the possible causes of hypothyroidism.

In order to determine the origin of this disease, the percentage of individuals showing goiter are assessed as a function of the average concentration of iodine in their urine. This concentration reveals the quantity of ingested iodine. The results are shown in the adjacent document.

The average concentration of Iodine in urine ( $\mu\text{g/liter}$ )	50	20	5
Individuals showing goiter (%)	5	40	60

2. Draw the curve which shows the variation of the percentage of individuals presenting goiter as a function of the average concentration of iodine in urine.
3. Determine the origin of goiter.

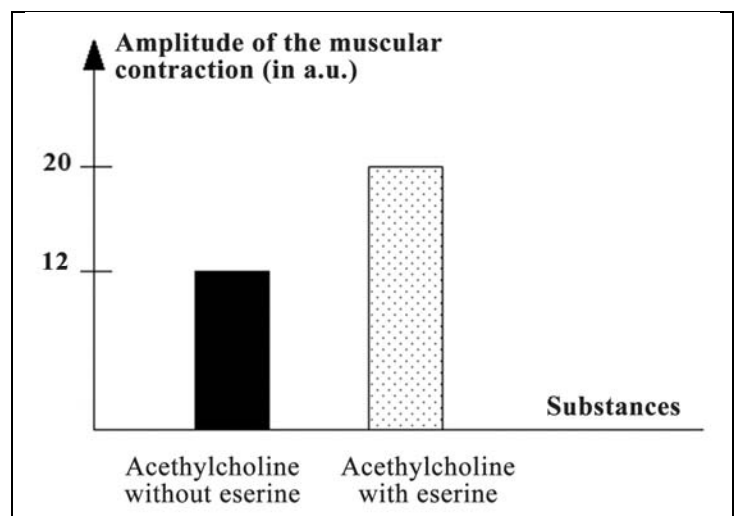
### Exercise 2 (7 points)

### Eserine and Acetylcholine

In the framework of studying the action of eserine, a substance extracted from plants, on the function of acetylcholine synapses, the following experiment is performed:

The muscle innervated by a nerve is placed in a physiological liquid containing acetylcholine in the absence or presence of eserine. After that, the amplitude of muscular contraction in each of the two cases is measured. The obtained results are shown in document 1.

1. List the steps of the transmission of nerve message at the level of a synapse.
2. Draw a table which shows the amplitude of muscular contraction in each of the cases.
- 3.1. Compare the results in document 1.
- 3.2. What can you draw out from this comparison?
4. Formulate one hypothesis explaining the mode of action of eserine.



Document 1

In another experiment, acetylcholinesterase enzyme, an enzyme responsible for the degradation of acetylcholine in the synaptic cleft, is added in the absence or presence of eserine.

The activity of acetylcholinesterase enzyme is measured and the obtained results are shown in document 2.

	Activity of Acetylcholinesterase (%)
without eserine	100
with eserine	52

**Document 2**

5. Deduce the mode of action of eserine.
6. Explain the variation of the amplitude of muscular contraction in the presence and in the absence of eserine.

### Exercise 3 (7 points)

### Omega-3 and Health

Patients suffering from atherosclerosis follow a Mediterranean type food diet. This food diet is characterized by the low intake of lipids. These lipids are poor in saturated fats, in cholesterol and in omega-6. In addition, these lipids are rich in oleic acid and in omega-3, with a ratio omega 6/omega 3 equal to 2.

After following up for 27 months two groups of patients one consuming Mediterranean type of food diet and the other consuming a classical food diet, a decrease of 73% of the relative risk of death of cardiac origin is observed in patients following the Mediterranean type of food diet.


1. Define : atherosclerosis
2. Name the type of lipoprotein which contributes to the development of atherosclerosis.
3. Indicate the elements which the Mediterranean type food diet is rich in.
4. Draw out from the text the consequence of following the Mediterranean type food diet on the health of patients.

Document 1 specifies the inscriptions recommended by a food health security agency concerning the labeling of food containing omega 3 as a function of the composition of the product.

recommended inscriptions (written on the label)	The Relative Composition
« Source of omega 3 fatty acids »	If omega3 is at least 2g in 100g of food
« Participating in reinsuring the equilibrium of the supply of omega 3 fatty acids »	If the ratio $\frac{\text{omega 6}}{\text{omega 3}}$ is less than or equal to 5.

**Document 1**

Document 2 presents the elements on a label on the cover of myonnaise.

	Mayonnaise :
	<div>THE AVERAGE NUTRITIONAL VALUES IN 100g :</div> <div> Food Fibers : 0g      Sodium : 0.65g  Protein : 1.6g      Glucose : 2.4g  Lipids : 73g part of which :  Omega 6 fatty acids: 28.5g and Omega 3 fatty acids: 3g </div>

**Document 2**

5. Justify the inscription “source of omega 3” on the label of the myonnaise.
6. Show that the inscription « Participating in reinsuring the equilibrium of the supply of omega 3 fatty acids » should not be present on the label of this myonnaise.
7. Determine if this myonnaise can be recommended for patients suffering from atherosclerosis.

مسابقة في الثقافة العلمية: مادة علوم الحياة  
أسس التصحيح

Q.	Exercise 1 (6 points) The Origin of Goiter	Mark
1.1	Severe mental retardation, dwarfism and retarded puberty	0.75
1.2	The goiter is the swelling of the anterior part of the neck due to the increase in the volume of the thyroid gland.	0.75
1.3	Hypothyroidism is either due to the dysfunction of the thyroid gland or due to malnutrition.	0.75
2	<p>Title: The variation of the individuals showing goiter as a function of the average concentration of iodine in urine</p> <p>Scale: on x-axis: 1 cm for 10 µg/L on y-axis: 1 cm for 10%</p>	2
3	Since the quantity of iodine in urine reveals the quantity of ingested iodine, this indicates that the people with the lowest average concentration of Iodine in urine consume the least quantity of iodine. Moreover, The percentage of individuals showing goiter increases from 5% to 60% as the concentration of iodine in urine decreases from 50 to 20 (µg/litre) meanwhile, the concentration of ingested iodine decreases. Consequently the low intake of iodine is the origin of goiter.	1.75

Q.	Exercise 2 (7 points)	Eserine and Acetylcholine	Mark						
1	The steps of the synaptic transmission: 1. Arrival of nerve message to the presynaptic terminal bud. 2. Liberation of neurotransmitters into the synaptic cleft by exocytosis. 3. Fixation of neurotransmitters on the specific receptor on the postsynaptic membrane. 4. Generation of nerve message at the level of postsynaptic neuron 5. Recapture and/or degradation of neurotransmitters.		2						
2	<table><tr><td>Substances</td><td>Amplitude of muscle contraction (a.u)</td></tr><tr><td>Acetylcholine without eserine</td><td>12</td></tr><tr><td>Acetylcholine with eserine</td><td>20</td></tr></table> <p>Amplitude of muscular contraction without or with eserine.</p>		Substances	Amplitude of muscle contraction (a.u)	Acetylcholine without eserine	12	Acetylcholine with eserine	20	1
Substances	Amplitude of muscle contraction (a.u)								
Acetylcholine without eserine	12								
Acetylcholine with eserine	20								

<b>3.1</b>	After the injection of eserine in the presence of acetylcholine, the amplitude of muscle contraction is 20 a.u, a value 1.6 times greater than 12 a.u, which is a value obtained in the absence of eserine.	<b>0.5</b>
<b>3.2</b>	Eserine amplifies the action of acetylcholine	<b>0.5</b>
<b>4</b>	Hypotheses : <ul style="list-style-type: none"> <li>- Eserine inhibits the hydrolysis of acetylcholine by acetylcholinesterase at the level of neuromuscular synapse.</li> <li>- Eserine facilitates the fixation of acetylcholine on their receptors.</li> <li>- Eserine favors the exocytosis of acetylcholine at the level of neuromuscular synapse.</li> </ul>	<b>1</b>
<b>5</b>	Document 3 shows that the activity of acetylcholinesterase decreases approximately to half from 100% to 52 % in the presence of eserine. Thus, eserine inhibits the action of acetylcholinesterase, an enzyme which normally degrades acetylcholine in the synaptic cleft.	<b>1</b>
<b>6</b>	The amplitude of muscular contraction is more amplified in the presence of eserine. This substance inhibits the enzyme acetylcholinesterase (document 3) which normally degrades Acetylcholine in the synaptic cleft. Consequently, the concentration of acetylcholine, a neurotransmitter responsible of the muscular contraction increases. This leads to the fixation of Acetylcholine on a higher number of postsynaptic receptors.	<b>1</b>

<b>Q.</b>	<b>Exercise 3 (7 points)                      Omega-3 and Health</b>	<b>Mark</b>
<b>1</b>	A disease due to the formation of atheroma plaques on the wall of the coronary arteries causing the narrowing of these arteries.	<b>0.75</b>
<b>2</b>	LDL (or the bad cholesterol)	<b>0.75</b>
<b>3</b>	The Mediterranean food diet is rich in oleic acid and in omega 3.	<b>0.75</b>
<b>4</b>	The Mediterranean food diet `decreases the relative risk of death due to cardiac disease in patients suffering from atherosclerosis.	<b>0.75</b>
<b>5</b>	Document 1 specifies the food which is considered like a « source of the fatty acid omega 3 » if it supplies at least 2g of omega 3 in 100g of food. However, the label of this myonaise indicates 3 g of Omega 3 in 100g, a value greater than 2 g. This justifies the inscription « source of Omega 3 ».	<b>1.5</b>
<b>6</b>	Document 1 specifies that a food « participate in re-ensuring the equilibrium of the supply of the fatty acid omega 3 if the ratio omega 6 / omega 3 is less than or equal to 5. Since the ratio of omega 6 / omega 3 of this mayonaise is $28.5 / 3 = 9.3$ a value greater than 5 , this inscription should not be present on the label of this mayonaise	<b>1.5</b>
<b>7</b>	Since this type of myonaise is rich in lipids (73 g in 100g of lipids) and since the obtained ratio of omega 6 / omega 3 is 9.3, a value greater than 2 which is obtained for the Mediterranean food diet that protects against the death due to cardiovascular diseases, then this type of mayonaise is not recommended for patients suffering from atherosclerosis.	<b>1</b>