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Answer the following questions.

### Question I (3pts)

Indicate the true statements and correct the false ones.

- A balanced food ration contains more fast sugars than slow sugars.
- The velocity of propagation of the nervous message increases with the diameter of the fiber.
- Kwashiorkor results from lipid deficiency.

### Question II (5pts)

Document 1 represents the structure of a synapse while document 2 represents certain aspects of its functioning.

Certain substances called drugs, have a spatial structure similar to certain neurotransmitters and can fix on the same receptors, leading to different consequences.  
Certain drugs act on the specific receptors either blocking them (inhibition) or stimulating them (hyperstimulation), leading to visual hallucinations.  
The binding of neurotransmitter to its receptor is slightly stable: in a few milliseconds, the receptors sites are freed again for a new message. This is not the case of drugs where the binding is more durable (alcohol), irreversible (LSD), leading sometimes to the destruction of the neurons.

#### Document 1

#### Document 2

- Name each of the letters "a" to "f" of document 1.
- Pick up from document 2 the statements which show :
  - The mode of action of the drugs on the specific receptors.
  - The advantage of the instability of the neurotransmitter-receptor binding for a proper functioning of the nervous system.
  - The long-term consequences of the drugs on the functioning of the neurons.

### Question III ( 6 pts)

A- A man was hospitalized after a heart attack. We perform a coronagraph, which reveals that three coronary vessels are almost blocked.

a- To what is the narrowing of the heart vessels due to? What disease does it cause?

The results of blood analyses of this man are shown in document 1.

Analyzed substances	Normal values (in mg/dL)	Values of the patient (in mg/dL)
Glucose	70-110	87
Total cholesterol	140-200	300
LDL	108-140	180
HDL	40-80	30
Triglycerides	35-150	150

b- After analyzing this document, draw out the origin of the disease.

**B-** Document 2, shows the results of a statistical study done on the frequency of heart diseases in a given population.

Amount of cholesterol (in mg/dL)	<120	150	220	>250
Frequency of heart diseases (in %)	3	4	5	6

**Document 2**

c- What do the results of document 2 reveal?

d- What nutritional advice can you give to this patient?

**Question IV (6 pts)**

In the framework of studying the effects of acetylcholine on the muscular activity, we isolate the right abdominal muscle of a frog and we keep it in an appropriate physiological liquid bath, then we perform the following two experiments.

**1<sup>st</sup> experiment.** We add acetylcholine, of different concentrations, in the physiological liquid bath then we record, for each concentration, the amplitude of the response. The results are shown in document 1.

Concentration of acetylcholine (in a.u)	0	1	2	3	4	5
Amplitude of the contraction (in a.u)	0	2.5	5	10	20	25

**Document 1**

a- Construct the graph that shows the variation of the amplitude of the response as a function of the acetylcholine concentration

b- Analyze the obtained results. What can you deduce concerning the variation of the muscle response?

**2<sup>nd</sup> experiment.** We perform the same experiment, but we add to the physiological liquid bath a limited amount of curare before adding acetylcholine. The results are given in document 2.

Concentration of acetylcholine (in a.u)	0	1	2	3	4	5
Amplitude of the contraction (in a.u)	0	0	0	2.5	10	15

**Document 2**

c- Analyze the results of document 2.

d- Compare the amplitude of the contraction for the same acetylcholine concentration (3 a.u) **with** and **without** curare (document 2 and document1). What can we deduce concerning the role of curare ?

**Answer Key LH**

**2<sup>nd</sup>. session 2004**

**Question I ( 3 pts)**

d- A balanced food ration contains less fast sugars than slow sugars **or** more slow sugars than fast sugars. (1pt)

- e- True. (1pt)
- f- Kwashiorkor results from protein deficiency. (1pt)

### Question II (5pts)

- a- (3 pts)
  - a : Presynaptic neuron ( ½ pt)                      b : Postsynaptic neuron ( ½ pt)
  - c : Synaptic cleft ( ½ pt)                              d : Neurotransmitters vesicle ( ½ pt)
  - e : Specific receptor ( ½ pt)                            f : neurotransmitter ( ½ pt)
- b- 1- Certain drugs act on the specific receptors by blocking them (inhibition) or by stimulating them (hyperstimulation). (1 pt)
- 2- In a few milliseconds, the receptor sites are free again for a new message. ( ½ pt)
- 3- For the drugs, the binding is more durable (alcohol), irreversible (LSD), leading sometimes to the destruction of the neurons. ( ½ pt)

### Question III (6 pts)

- a- The presence of atheroma plaque. (1pt) Atherosclerosis. (1pt)
- b- The analysis of blood shows values out of the normal values only for total cholesterol, LDL and HDL. Cholesterol is 300 mg/dL > than the maximum value which is 200mg/dL. The LDL is 180 mg/dL > the maximum amount, which is 140mg/dL. , while HDL is 30mg/dL < the minimum value, which is 40mg/dL. On the other hand, triglycerides are at their highest limit, which is 150 mg/dL, while glucose is of normal value  $70 < 87 < 110$  mg/dL.  
We can say that his sickness is due to the increase in the amount of blood cholesterol and to the low amount of blood HDL. (2pts)
- c- The results show that the frequency of heart diseases is 3% even if the value of cholesterol is less than 120 mg/dL; then it increases from 3 to 6% with the increase of the amount of cholesterol in the blood from 120 mg/dL to 250 mg/dL. (1 pt)
- d- Reduce the intake of lipids of animal origin. (1 pt)

### Question IV (6 pts)

- a- (3 pts)

**Variation of the amplitude of the muscular response as a function of acetylcholine concentration**

- b- The amplitude of the contraction is nil in the absence of acetylcholine yet it increases from 2.5 to 25 a.u as the concentration of acetylcholine increases from 1 to 5 a.u.  
This implies that acetylcholine provokes contraction and the amplitude of the response increases with the concentration of acetylcholine.  
Thus, acetylcholine is excitatory. The response of muscle is modulated in function of the acetylcholine concentration. (1½ pt)
- c- When the concentration of acetylcholine is 1 or 2 a.u., in the presence of curare, acetylcholine has no effect on the muscle: no contraction. When the concentration becomes 3 a.u. the muscle contracts with an amplitude of 2.5 a.u. This amplitude increases to 20 a.u as the concentration increases to 5 a.u. (½ pt)
- d- For a concentration of acetylcholine of 3 a.u, in the absence of curare (doc.1) the response has an amplitude 10 a.u, while this amplitude is only 2.5 a.u in the presence of curare (doc.2). Hence, the amplitude of the contraction decreases in the presence of curare. Thus, curare inhibits the action of acetylcholine. (1 pt.)