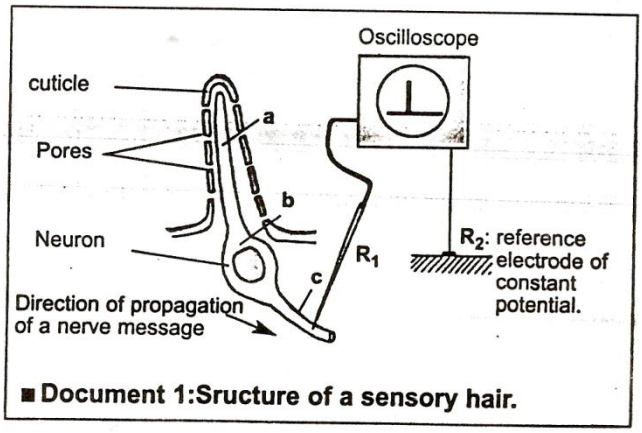
**Subject: Biology** **Mid-Year Exam** **Duration: 1 hour**

## Question I

### *Part A : Sensory receptor (5 pts)*

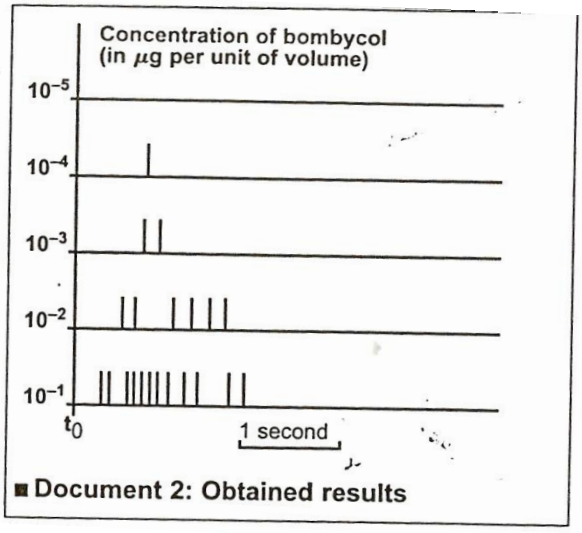
• In the night butterfly, the bombyx of the Mulberry-tree, the female emits a very volatile substance called the bombycol. The bombycol is detected by the antennas of the male. These antennas have around 20,000 sensory "hairs or receptors whose longitudinal section of it's structure is drawn in document 1 .



■ **Document 1:Sructure of a sensory hair.**

**1-** What are the elements indicated by the letters a,b,c of the sensory neuron of document 1 .(1.5pts)

By means of an oscilloscope, we can record the electric activity of the schematized neuron when, a rod submerged in a bombycol solution of different concentrations, is brought near the sensory hair (document 2).



■ **Document 2: Obtained results**

**2-** Draw a table which indicates the variation of the number of action potential as a function of the concentration of bombycol ( in µg per unit of volume ) .(1.5pts)

**3-** Analyze the results of document 2 and deduce the coding form of nervous message .(2pts)

***Part B : nervous reflex (3.5 pts)***

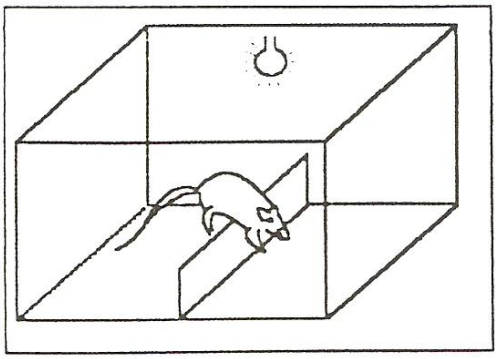
We perform the following experiments on a rat:

**Exp 1:** We apply an electric shock on one of the legs of the rat, the rat jumps on place.

**a)** Precise the nature of this reaction , justify your answer.(0.5pt)

**b)** Indicate the main characteristics of this type of reaction .(1pt)

**Exp 2 :** A rat is placed in a cage made up of two compartments that are separated by a barrier as shown in the figure .



A lamp is connected to the cage that could be lighted from outside the cage .The ground in the two compartments of the cage can be electrified independently from each other.

A number of experiments are done on this rat as follows:

The lamp is lighted for 2 sec then the ground in compartment in which the rat found is electrified. The rat jumped to the other compartment which not electrified.

We repeated this experiment for 5 times, at the 5$^{th}$ trail the rat jumped from compartment which is electrified to the non electrified just from lighting without electrifying the ground of compartment.

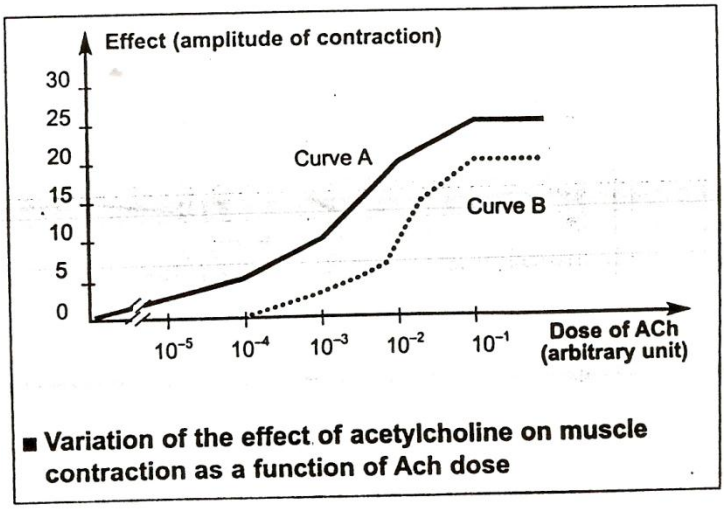
**1-** What is the nature of this reaction? (0.5pts)

**2-** Pick up from the text the characteristics of this reaction (1.5pts)

**Question II: Effects of acetylcholine and curare (6pts)**

We study the effects of acetylcholine on the abdominal right muscle of a frog. This muscle after being removed, is placed in an appropriate physiological medium .

- First different concentration of acetylcholine (Ach) are used and the amplitude of muscular response for each




■ **Variation of the effect of acetylcholine on muscle contraction as a function of Ach dose**

concentration is recorded which translates the effect of acetylcholine (curve A).
We repeated the same experiment but before adding acetylcholine we injected curare. Knowing that Curare is antagonistic to acetylcholine, it binds to acetylcholine receptors on muscle fibers but has no effect on them.

**1-** Interpret the 2 graphs .(3pts)
**2-** Explain the action of curare .(2pts)
**3-** Formulate a hypothesis which explains the constant amplitude of muscular response. (1pt)

**Question III: The thyroid gland (5.5 pts)**

In an animal deprived of thyroid gland , the injection of thyroid hormone provokes an increase in the amount of oxygen consumed by certain tissues .

The table below represents the variation of the consumption of oxygen by the liver, the kidney and the testicle following the injection the injection of thyroid hormone.

| **Time (hrs)** | | **0** | **12** | **24** | **36** | **48** |
|---|---|---|---|---|---|---|
| **The oxygen consumed (in a.u) following the injection of the thyroid hormone** | **Liver** | 100 | 110 | 120 | 125 | 135 |
| | **Kidney** | 100 | 105 | 110 | 115 | 120 |
| | **Testicle** | 100 | 100 | 100 | 100 | 100 |

**a-** Construct on the same graph the curves that represent the consumption of oxygen by the liver, the kidney and testicle as a function of time. (1.5pts )
**b-** Analyze the results of the table ( 2pts )
**c-** Explain the mode of releasing of thyroid hormone and precise their mode of action at the level of target organs. (2pts)