

الاسم:  
الرقم:مسابقة في الثقافة العلمية  
مادة علوم الحياة  
المدة: ساعة واحدة

Answer the following exercises:

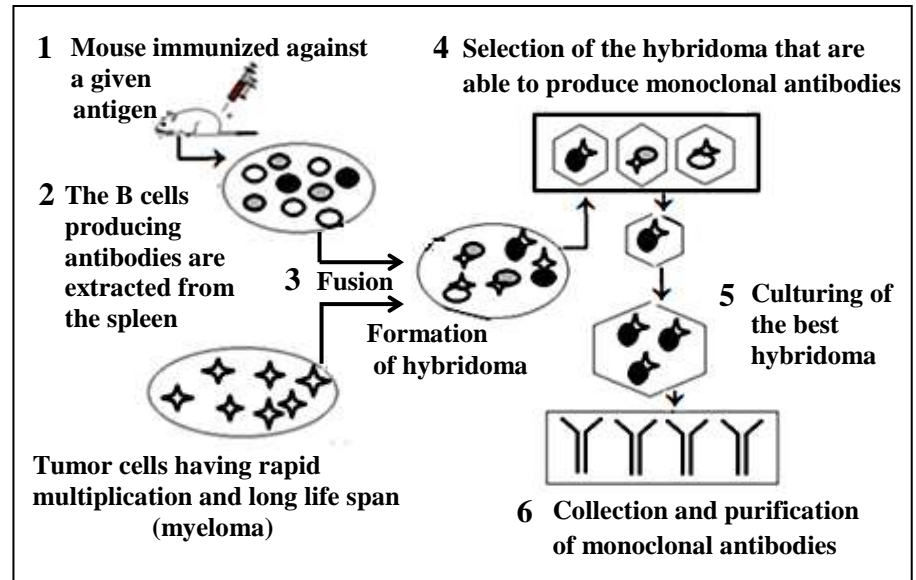
## Exercise 1 (5 points)

## Monoclonal Antibodies

Antibodies are molecules of the immune system that contribute in fighting against infections. In the framework of studying the relation between biotechnology and immunology, an appropriate technique was performed to produce monoclonal antibodies.

The steps of this technique are shown in the adjacent document.

- 1- Write a short text that describes the different steps of this technique.
- 2- Draw out the explanation of the following terms: myeloma and hybridoma.
- 3- Determine the cause that stands behind qualifying the produced antibodies as monoclonal antibodies.
- 4- List two medical applications of monoclonal antibodies.



## Exercise 2 (5 points)

## What is stress?

**Stress is a biological response to an external stimulus that could be physical, psychological or sensory. This is a quasi-reflex which takes place in three phases.**

**First, a shock or an alarm phase that intervenes at the moment you receive the stressful stimulus: the cardiac rhythm increases, muscle tonicity and the rate of blood sugar drop. The body is going to adapt. To do so, the nervous system sends a message to the hypothalamus which, in turn, acts on the adrenal medulla to release adrenaline. Adrenaline provides the body with the needed energy by increasing the heart rhythm in order to supply the muscles and the tissues with a greater amount of oxygen.**

**If the stimulus of stress persists, the individual will pass to a resistance phase. The body begins to secrete other hormones: cortisol and sex hormones and other substances such as dopamine and serotonin. At this stage, the body reacts to survive the dangerous situations. If stress persists, the body passes to an exhaustion phase. The immune defenses are weakened and tension becomes excessive; thus, fatigue, anger, and even depression appear. Stress is never an invariable response. Facing the same situation, individuals react differently.**

- 1- Pick out from the text :
  - 1.1- The symptoms of the alarm phase.
  - 1.2- The role of adrenaline.
  - 1.3- The signs characterizing the exhaustion phase.
- 2- List the common structures that are involved in both stress and innate reflex.
- 3- Specify, by referring to the text and to the acquired knowledge, one difference between stress and innate reflex.

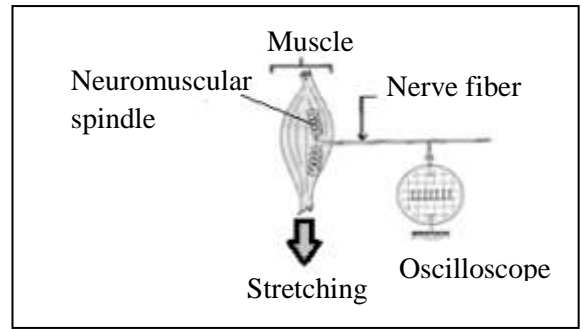
**Exercise 3 (5 points)**

**The Encoding of the Nervous Message**

In the middle of the contractile muscle fibers of a muscle, there exist spiral structures that are called: neuromuscular spindles. Each spindle is innervated by a myelinated afferent nerve fiber.

- 1- Specify the importance of the presence of myelin on the nerve fiber.

We implant a microelectrode of an oscilloscope in the nerve fiber (document 1) and we study the response of this fiber upon subjecting the muscle to stretching of increasing lengths.



*Document 1*

Document 2 represents the obtained results. Each vertical line represents an action potential.

Stretching length	50 mm	55 mm	60 mm	70 mm
The obtained recordings (in AP/ 1s)				

*Document 2*

- 2- Indicate the stimulus used in this experiment as well as its receptor.
- 3- Analyze the results of document 2. What can we draw out concerning the encoding of the nervous message?
- 4- Explain the absence of response for a stretching of 50 mm length.

**Exercise 4 (5 points)**

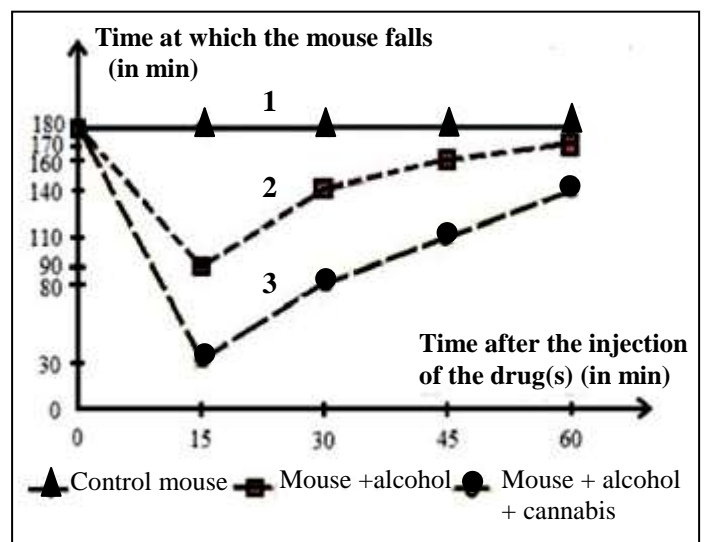
**The Effects of Alcohol and Cannabis**

Cannabis acts on the nervous system. As alcohol or other drugs, it perturbs the transmission of nerve messages at the level of synapses. This slows down reflexes, increases the time of reaction and decreases the mental concentration of the individual.

- 1- Define drugs.

Laboratory researchers can visualize the effects of alcohol and cannabis on the motor skills of a mouse using the experiment of the rotating bar. They place a mouse on a bar that rotates and measure the time at which the animal falls.

The opposite document shows, with respect to a control mouse (1), the results of this test applied on a mouse that is injected with alcohol alone (2) or with alcohol and cannabis (3).



- 2- Compare, at 15 minutes after the injection of the drugs, the time at which the control mouse falls to the time at which the other mouse, injected with alcohol alone, falls. Draw out a relation concerning the action of alcohol.
- 3- Compare, at 15 minutes after the injection of the drugs, the time at which mouse 2 falls to the time at which mouse 3, injected with alcohol and cannabis, falls. Draw out a relation.

A recent campaign for road accident prevention states: "On the road, cannabis + alcohol is 15 times more risky for mortal accidents".

- 4- Justify referring to what precedes the statement of this campaign.

مسابقة في الثقافة العلمية  
مادة علوم الحياة  
اسس التصحيح

Parts of ex	Answer key	Note
<b>Exercise 1 (5 points)</b>		
1	We immunize a mouse against a given antigen then we extract B cells producing antibodies from its spleen. Then the B cells are fused with tumor cells having rapid multiplication and long life span (myeloma) to form hybridoma. After that, we select the hybridoma that are capable of producing monoclonal antibodies. The best hybridoma are then cultured, and the monoclonal antibodies are collected and purified.	11/2
2	Myeloma: tumor cells having rapid multiplication and long life span. (3/4 pt) Hybridoma: hybrid cells resulting from the fusion of a myeloma cell and an antibody-producing B cell. (3/4 pt)	1 1/2
3	The produced antibodies are so-called monoclonal antibodies since they are produced by a single clone of B cells and are specific to one antigen.	1
4	Screening of the hormone HCG (pregnancy test) (1/2 pt) Screening of cancer cells (1/2 pt) Or others .....	1

Parts of ex	Answer key	Note
<b>Exercise 2 (5 points)</b>		
1-1	The cardiac rhythm increases, muscle tonicity and the rate of blood sugar drop.	3/4
1-2	Adrenaline provides the body with the needed energy by increasing the heart rhythm in order to supply the muscles and the tissues with a greater amount of oxygen.	3/4
1-3	The immune defenses are weakened and tension becomes excessive; thus, fatigue, anger, and even depression appear.	11/4
2	The common structures are: sensory receptors, sensory pathways, nervous centers, motor pathways and effectors.	11/4
3	Stress is never an invariable response while reflex is an invariable response. In fact during stress individuals react differently facing the same stressful situation while in the reflex all individuals react in the same manner.	1

<b>Parts of ex</b>	<b>Answer key</b>	<b>Note</b>
	<b>Exercise 3 (5 points)</b>	
<b>1</b>	The presence of myelin speeds up the transmission of the nervous message.	<b>1</b>
<b>2</b>	The stimulus is the stretching of the muscle. <b>(3/4 pt)</b> The receptor is the neuromuscular spindle. <b>(3/4 pt)</b>	<b>11/2</b>
<b>3</b>	There is no response to a stretching of 50 mm length, however starting from a stretching of 55 mm of length a response is recorded, under the form of a series of action potentials whose frequency is 8 AP/s of constant amplitude. This frequency increases to reach a value of 15 AP/s having always the same amplitude when stretching length increases to 70 mm. <b>(1 pt)</b> This implies that, above a certain threshold of stimulation, the nervous message at the level of the fiber is coded by modulation of frequency of AP and not by amplitude. <b>(1/2 pt)</b>	<b>11/2</b>
<b>4</b>	The stretching of 50 mm is ineffective because it is less than the threshold intensity of stimulation. This explains the absence of response for this stretching.	<b>1</b>

<b>Parts of ex</b>	<b>Answer key</b>	<b>Note</b>
	<b>Exercise 4 (5 points)</b>	
<b>1</b>	Drug: chemical substance that alters the nervous communication and induces physical and psychic dependency as well as tolerance.	<b>1</b>
<b>2</b>	15 minutes after injection, the mouse injected with alcohol alone falls after a duration of 90 minutes which is less than that of the control mouse 180 minutes. <b>(3/4 pt)</b> . Thus the alcohol weakens the motor skills of the mouse. <b>(3/4 pt)</b> . Or Slows down the mouse reflexes	<b>1 1/2</b>
<b>3</b>	The mouse injected with cannabis and alcohol together falls after a duration of 30 minutes which is less than that of the mouse injected with alcohol alone 90 minutes. <b>(3/4 pt)</b> Thus the cannabis amplifies the effect of alcohol by increasing the weakening of its motor skills and slowing down more its reflexes. <b>(3/4 pt)</b> Or The cannabis and the alcohol are agonist.	<b>1 1/2</b>
<b>4</b>	The alcohol as well as the cannabis, alters the transmission of the nervous messages at the level of synapses. This slows down reflexes and reactions and also diminishes the mental concentration and the motor skills. Together, their effect is amplified, leading to 15 times more mortal road accidents.	<b>1</b>