مسابقة في الثقافة العلميّة – مادة علوم الحياة
المدة: ساعة واحدة

الاسم:
الرقم:

Exercise 1 (7pts) **Atherosclerosis**

A food diet rich in lipids favors an increase in the concentration of cholesterol in blood. Consequently, lipids deposit on the walls of arteries causing the formation of atheroma plaque which is at the origin of atherosclerosis disease.

The cross section of the coronary artery of a healthy person shows a wide lumen with a thin wall, permiting the circulation of a great volume of blood. However, the cross section of the artery of a person suffering from atherosclerosis shows a deposition of atheroma plaque on its own wall reducing thus the volume of the circulated blood.

1. Draw out the consequences of the formation of atheroma plaque on the blood circulation.
2. Justify the following statement: LDL is a "bad cholesterol"

A study showing the relation between smoking and the risk of atherosclerosis development shows the following results. when the number of the consumed cigarettes per day is zero, the risk of developing atherosclerosis is 1%, however, when the number of cigarettes is between 1and 9, this risk becomes 2%. In addition, when the number of cigarettes is greater than 20, the risk becomes 3%.

3.1 Analyze the obtained results
3.2 Derive a conclusion.

4. Suggest two actions that the governement would take to prevent atherosclerosis development in the population.

Exercise 2 (6pts) **Nerve Message**

Sensory cells for taste are sensory receptors situated on the surface of the tongue. These receptors are involved in the detection of taste: Salty, sour, bitter, and sweet.
In order to determine the characteristics of the nerve message, NaCl solutions of increasing concentrations are applied on a taste receptor.
Two oscilloscopes O1 and O2 are connected to the nerve fibers F1 and F2 respectively.F1 belongs to the sensory neuron issued from the sensory taste receptor, and F2 belongs to the neuron synapsing with this sensory neuron.

The recordings registered at the level of O1 prove the following results. The frequency of action potential was zero when the concentration of NaCl was 1mmol/L. For a concentration of NaCl of 3 mmol/L, the frequency is 1. In addition, , for a concentration of 10 mmol/L NaCl, the frequency becomes 5, for a concentration of 30 mmol/ L NaCl, the frequency becomes 8 and for a concentration of 100 mmol/ L NaCl, the frequency becomes 13. All these recording have the same amplitude.

1- Specify the threshold intensity of fiber F1.

2- Show that the nerve message at the level of fiber F1 is coded by frequency of action potential and not by amplitude.
Oscilloscope O2 records a nervous message for a concentration of the NaCl solution which is equal or above 10mmol/L.

3- Indicate if synapse S is excitatory or inhibitory. Justify the answer.
4- List the steps of the transmission of the nerve message at the level of the synapse.

Exercise 3 (6pts) Vaccines and Genetic Engineering

Herpes is a disease caused by a virus, HSV. This disease is characterized by skin lesions, eye lesions, genital ulcerations, and fatal encephalitis. Once infected by this virus, the organism develops a specific immune response, secreting antibodies against envelope proteins of the HSV virus.

1- Pick out:

1-1- the reaction of the organism against HSV

1-2- The symptoms of herpes disease.

A biotechnological method permits the production of a vaccine against this harmful virus using a harmless virus. The steps and results of this technique are represented in the below document.

DNA is extracted from the Herpes virus, and the specific gene of envelope protein of HSV virus is isolated. The DNA is extracted from the harmless virus and then undergoes cleavage. Later on, the isolated gene is ligated with the cleaved DNA where a recombinant DNA virus is obtained and introduced into the harmless virus. Then the harmless virus is injected into the human body provoking the appearance of the envelope protein of HSV. Finally, antibodies against the protein of HSV are produced.

2- Indicate the donor and the receiver of the transferred gene.
3- Name the enzyme used to isolate the transferred gene
4- Show that this biotechnological method can be qualified as transgenesis.
5- State another application of transgenesis .