جامعة بنها
كلية العلوم
قسم الفيزياء

Course: biophysics 323ph

Time: 2 hrs. **Date: /05/2019**

Answer the following questions.

Q1. Write about the function of cell membrane **5 Marks**

Q2. Write about the glass microelectrode **10 Marks**

Q3. Write about hypotonic solution **5 Marks**

Q4. Define the following (dc/dt dn/dc $V_{con.}$) **10 Marks**

Q5. What is the meaning of EMG, EEG, ECG and ERG **8 Marks**

Q6. If a stimulation was given to a muscle and the beginning of the signal was recorded after 25 millisecond and the motor nerve has a conduction velocity of 50 m/sec, then:- **10 Marks**

A. **How long will it take an action potential to reach a muscle 0.5 m from the spinal cord?**

a. zero b. 25 millisecond c. 5 millisecond d. 10 millisecond

B. **Calculate the signal delay time = ...milliseconds**

a. zero b. 25 c. 5 d. 10

Model Answer

Q1. Write about the function of cell membrane 5 Marks

I. 1-3.5.Membrane function's

In animal cells the cell membrane alone establishes a separation between interior and environment, whereas in fungi, bacteria, and plants an additional cell wall forms the outermost boundary. However, the cell wall plays mostly a mechanical support role rather than a role as a selective boundary. One of the key roles of the membrane is to maintain the cell potential. The functions of the cell membrane include, but are not limited to:

- Controlling what goes in and out of the cell.
- Anchoring of the cytoskeleton to provide shape to the cell
- Attaching to the extracellular matrix to help group cells together in the formation of tissues
- Transportation of particles by way of ion pumps, ion channels, and carrier proteins
- Containing receptors that allow chemical messages to pass between cells and systems
- Participation in enzyme activity important in such things as metabolism and immunity

New material is incorporated into the membrane, or deleted from it, by a variety of mechanisms:

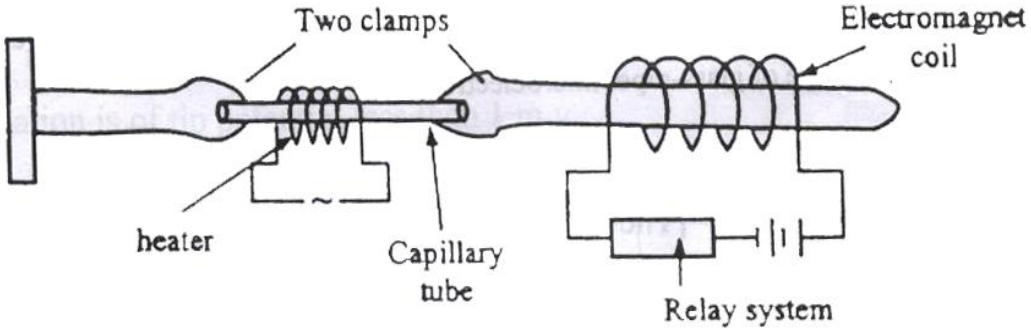
- Fusion of intracellular vesicles with the membrane not only excretes the contents of the vesicle, but also incorporates the vesicle membrane's components into the cell membrane. The membrane may form blebs that pinch off to become vesicles.
- If a membrane is continuous with a tubular structure made of membrane material, then material from the tube can be drawn into the membrane continuously.
- Although the concentration of membrane components in the aqueous phase is low (stable membrane components have low solubility in water), exchange of molecules with this small reservoir is possible.

Q2. Write about the glass microelectrode 10 Marks

Glass microelectrodes:

I. Due to the disadvantages of the metal microelectrodes, glass microelectrodes are now most commonly used for the intracellular stimulation and recording from the living cells and tissues. they are prepared with tip diameter greatly less than 0.1 micron and electric resistance more than 100MΩ.

II. The glass microelectrodes are in the first stage prepared from Pyrex glass capillary tubes of diameter 1-2mm. this tube is then horded between the two microelectrode puller machine clamps, which was first constructed by Alexander and Nastuk, 1953. This machine is consisted of two clamps one is fixed and the other moves freely by the action of an electromagnet coil. Fig.(3) shows a simple schematic diagram for such machine.



III.

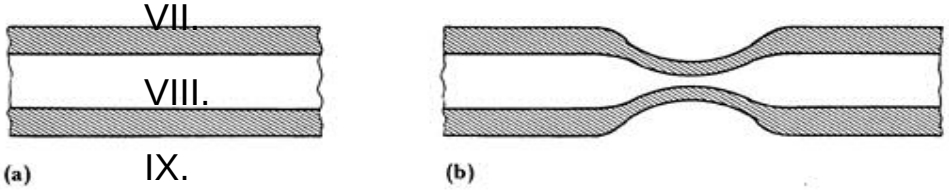
IV. Fig.(5): Schematic diagram of a microelectrode puller machine.

V. The technique of this machine could be as the follows. At the beginning, a Pyrex glass capillary tube of diameter 1-2mm is holded between the two machine clamps, as shown in Fig.(3). When the machine is started on, the heater begins to heat up the capillary tube. When it gets red, the machine relay system starts to control the current passing in the electromagnet coil in a manner that first to produce a gentle pull proceeded by a strong one. The result is the production of two identical microelectrodes.

VI. The tip diameter of the produced electrodes depends on both the heater temperature and the pulling forces in addition to the initial diameter of the capillary tube.

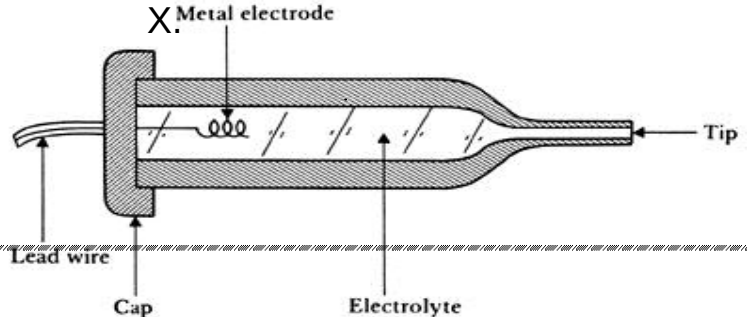
VII.

VIII.



IX.

X.



Q3. Write about hypotonic solution **5 Marks**

Hypotonic solution is the solution when the cell is placed in a medium free of salts i.e. the concentration of salt inside cell is greater than that of outside

Hypotonic solutions

If the concentration of water in the medium surrounding a cell is greater than that of the cytosol, the medium is said to be **hypotonic**. Water enters the cell by osmosis, as in fig.(8-a) a red blood cell placed in a hypotonic solution (e.g., pure water) bursts immediately ("hemolysis") from the influx of water.

Plant cells and bacterial cells avoid bursting in hypotonic surroundings by their strong cell walls. These allow the buildup of **turgor** within the cell. When the turgor pressure equals the osmotic pressure, osmosis ceases.

Q4. Define the following (dc/dt dn/dc $V_{con.}$) **10 Marks**

dc/dt is the concentration gradient

dn/dc is the diffusion rate

V_{con} is the conduction veleocity

Q5. What is the meaning of EMG, EEG, ECG and ERG **8 Marks**

EMG is Electromyography

EEG is Electroencephalography

ECG is Electrocardiography

ERG is Electroretinography

Q6. If a stimulation was given to a muscle and the beginning of the signal was recorded after 25 millisecond and the motor nerve has a conduction velocity of 50 m/sec, then:- **10 Marks**

A: (d) B: (b)