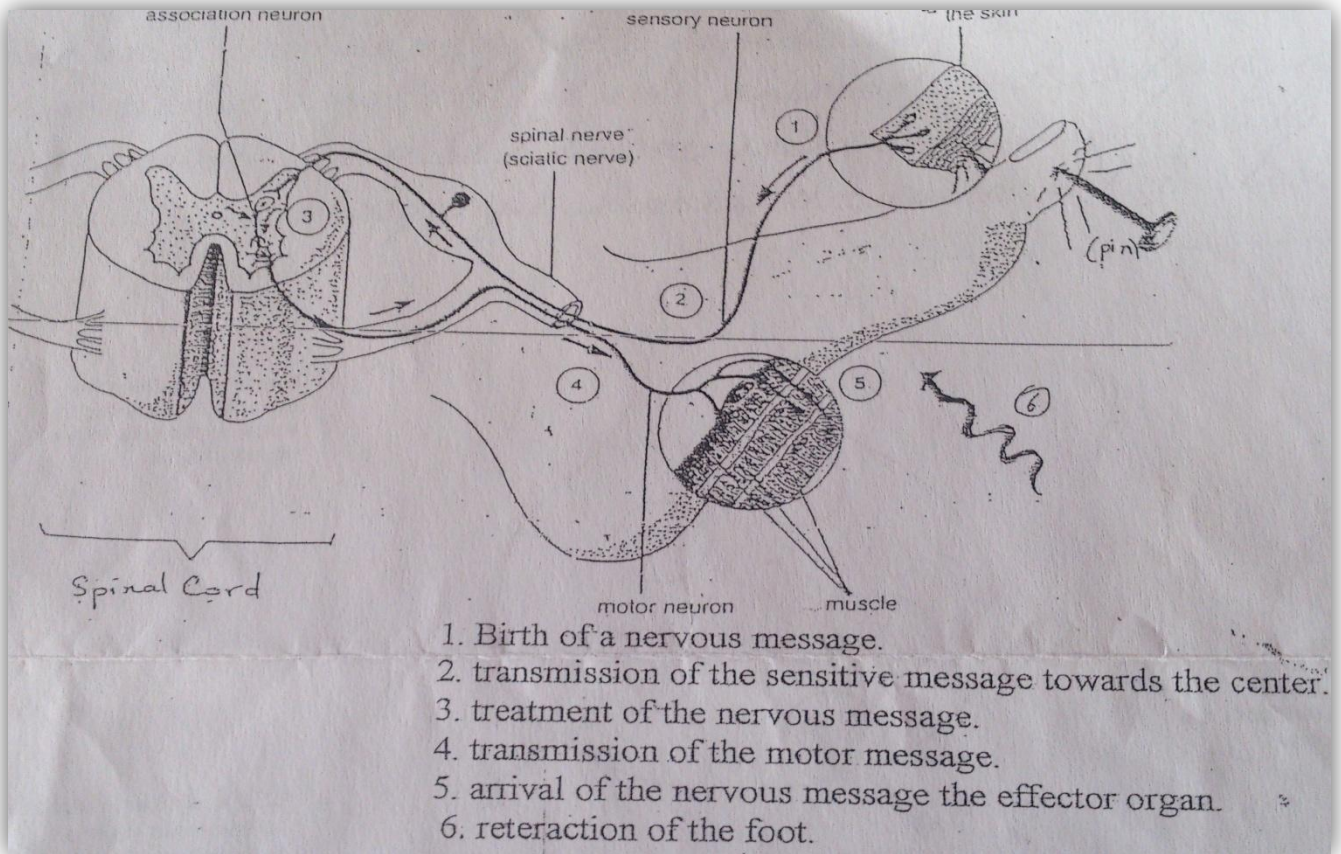


S.E.

Biology

Exercise 1: (5pts)

Observe the following diagram and answer the questions below.



1. Give a suitable title for the given schematic drawing.
2. Indicate the type of the stimulus, the conductor, the receptor organ, the central nervous system, effector and the response.
3. Transform the drawing into a well organized text

Exercise 2: (5pts)

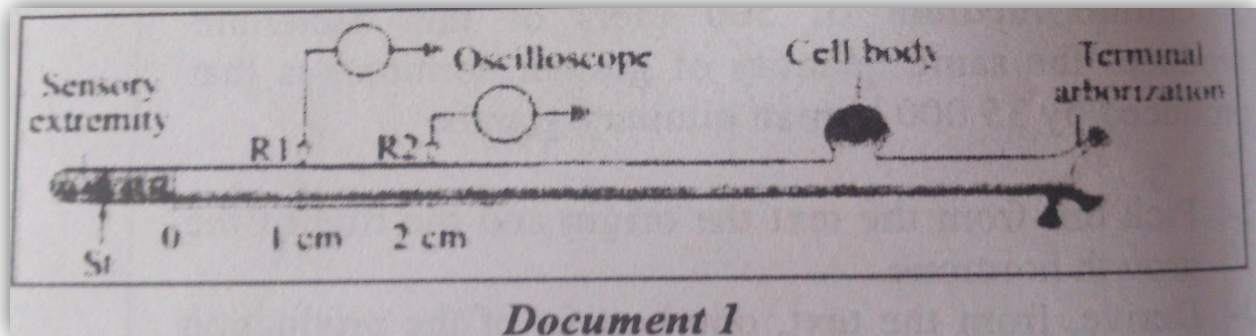
1. Pick up from the given text :
 - a- The symptoms of the disease .
 - b- The origin of this neurodegenerative disease .
 - c- The role of GABA .

“Huntington chorea affects mostly adults between 30 to 50 years old. It is a neurodegenerative disease that provokes a profound alteration of the motor coordination centers leading to a decrease in the physical and intellectual capacities. The psychic troubles, that are almost not exhibited at the beginning of the disease, become very severe with time. The symptoms are varied: clumsiness, nervousness, disequilibrium, behavioral troubles and low intellectual abilities. These symptoms are due to a localized loss of neurons that secrete the neurotransmitter GABA which induces an inhibitory effect at the postsynaptic level. These neurons are situated in the striatum, a region in the encephalon essential for the transfer and control of the information coming from the cerebral cortex. The treatment of such a disease includes the intake of neuroleptic medicines that might be beneficial for patients who manifest strong, uncoordinated body movements. Recently, the grafting of “neurons” seems to be a promising treatment.”

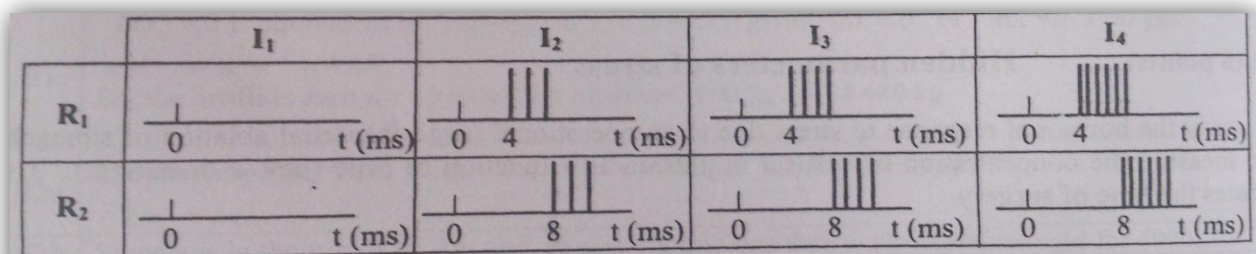
- Based on the information derived from the text, establish the relationship between the motor troubles caused by this disease and its cerebral origin .
- Name 2 other neurodegenerative diseases.

Exercise 3: (5pts)

An experimenter connects 2 microelectrodes R_1 and R_2 to a sensory neuron of an insect placed in a physiological liquid (document 1).



The sensory extremity of the neuron is stimulated mechanically by a stimuli St of increasing intensities ($I_1 < I_2 < I_3 < I_4$). The results obtained are represented in document 2.



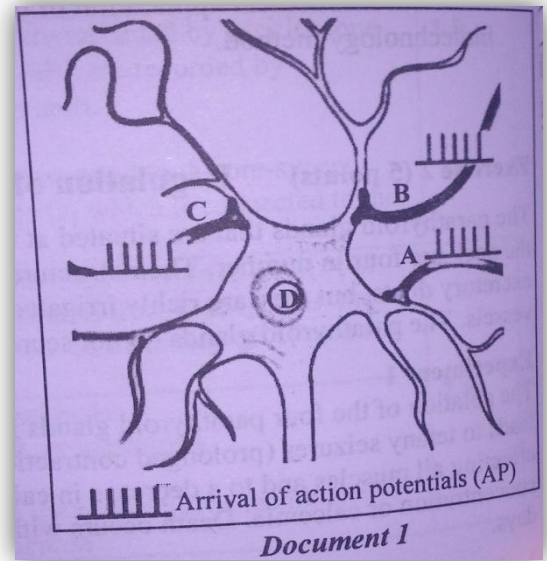
Document 2

Each vertical line corresponds to an action potential. The message recorded at R₂ shows a time delay of 2 ms compared to that recorded at R₁.

1. State the role of the nerve fiber and justify it according to document 2.
2. Determine using the different frequencies of document 2 the form by which the nervous message is coded along the nerve fiber .
3. Specify the direction of propagation of the nervous message along the sensory neuron. Justify depending on the 2 given documents.
4. Calculate the speed of the nervous message propagation using this formula:
Speed=distance (m) / time (sec)

Exercise 4: (5pts)

Document 1 presents the synaptic junctions of three afferent neurons (A,B,C) with a motor-neuron (D) . we seek to study the response of neuron D following independent stimulations or simultaneous stimulations of different neurons.



The results are represented in document 2.

- 1- Specify in each of the 3 cases 1,2,3 whether the neuron D is excited or inhibited. justify the answer.
- 2- Tell whether the synapse between C and D is excitatory or inhibitory. justify
- 3- What is the role of neuron D revealed in the experiment?
- 4- List the steps of the nervous message transmission at the level of synapse A.

Case	1	2	3
Stimulated neurons	A	A + B	A + B + C
Results in D	+	-	+
+ = presence of action potentials		- = absence of action potentials	

Document 2

Good luck !!!

Answer key

Exercise 1: (5pts)

- 1- The schematic drawing shows the pathway followed by a nervous message and its treatment upon certain stimulation in the leg. (1pt)
- 2- Stimulus: mechanical stimulation
Conductor: pin
Nervous center: spinal cord
Receptor: skin receptors in the leg
Effector: the muscles of the leg
Response: muscle contraction (0.25 pt each)
- 3- Applying mechanical stimulation using a pin leads to the birth of a nervous message in the receptors of the leg skin. A transmission of the nervous message toward the center (spinal cord) by sensory neuron takes place. After passing through the sciatic nerve (spinal nerve) a treatment of the nervous message takes place in the spinal cord having association neuron. After the integration the transmission of the motor message is done by the help of the motor neuron reaching the effector organ (muscles of the leg) . This leads to the contraction of the foot. (2.5pt)

Exercise 2: (5pts)

- 1- a- the symptoms are: clumsiness, nervousness, disequilibrium, behavioral troubles, low intellectual abilities. (1pt)
b- the origin of this disease is the loss of localized neurons that secrete the neurotransmitter GABA. (1pt)
C – GABA induces an inhibitory effect at the postsynaptic level. (1pt)
- 2- The neurons of the striatum produce the neurotransmitter GABA. The degeneration of these neurons at the origin of GABA deficit which has an inhibitory effect. So, motor troubles are the clinical manifestation of this disease. (1pt)
- 3- Parkinson and Alzheimer. (0.5pt each)

Exercise 3: (5pts)

- 1- The nerve obeys the role of all or none (0.5pt) since no response is obtained with the first stimulation and after which a response is observed for the latter stimulation with the same amplitude but different frequencies. (1pt)
- 2- The nervous message is modulated by frequency and not by amplitude since the frequency of AP in R1 AND R2 increases from 3 AP to 6 AP with the increase in the intensity of stimulation while the amplitude remains constant. (1.5pt)

- 3- The direction of the nervous message propagation is from the sensory extremity cell body toward the terminal arborizations since the nervous message have unidirectional pathway and it is recorded at R1 first and then at R2. (1pt)
- 4- $\text{Speed} = \Delta \text{ distance} / \Delta \text{ time} = 1\text{cm} / 4 \text{ ms} = 0.25 \text{ cm/ms} = 2.5 \text{ m/s}$ (1pt)

Exercise 4: (5pts)

- 1- In the case of stimulations of neuron A+B the neuron D is inhibited because no AP is recorded in this neuron. In the case of stimulation of neuron A or A+B+C, neuron D is excited and an AP is recorded . (1pt)
- 2- The synapse between C and D is excitatory because the stimulation of both A + B gives no AP. The stimulation of neurons A+B with neuron C leads to the generation of AP in neuron D. (1pt)
- 3- Integrating role coming from the different afferent neurons (A, B, C) (1pt)
- 4- arrival of the nervous message to the pre neuron
 exocytosis of the neurotransmitter
 release of the neurotransmitter in the synaptic cleft
 formation of a neuro –receptor complex
 generation of a post synaptic potential
 neurotransmitters are degraded by a specific enzymes or recaptured by the pre synaptic neuron.
 (2pts)