Exercise walk-through

The Neuron and Neural Firing ▪ 1.3

eXercise

You must be able to

- label the parts of a neuron and state what each does
- explain the **all-or-none** 全或无 principle
- describe what happens at the **synapse** 突触
- match a **neurotransmitter** 神经递质 to a function it influences

Method — The parts of a neuron

Dendrites receive signals. The **cell body** integrates them. The **axon** carries the signal away, wrapped in a **myelin sheath** that speeds transmission. **Terminal buttons** release neurotransmitters.

Method — All-or-none

A neuron either fires at full strength or does not fire. Increasing the stimulus does not make one action potential larger; it makes the neuron fire **more often**. Intensity is coded by rate, not by size.

Method — At the synapse

An action potential reaches the terminal, neurotransmitter is released into the **synaptic gap**, it binds to receptors on the next neuron, and is then reabsorbed (**reuptake**) or broken down. The next neuron becomes more or less likely to fire.

Method — Excitatory and inhibitory

An **excitatory** signal pushes the receiving neuron toward firing; an **inhibitory** signal pushes it away. A neuron fires when excitatory input exceeds inhibitory input by enough to reach **threshold**.

Practice 2.1 ▪ 2 marks

State the function of dendrites and of the axon.

Solution 2.1

Method: The parts of a neuron

Worked steps

dendrites receive incoming signals from other neurons B1; the axon carries the outgoing signal away from the cell body B1.

Practice 2.2 ▪ 2 marks

Explain the all-or-none principle.

Solution 2.2

Worked steps

a neuron fires at full strength or not at all B1; a stronger stimulus produces more frequent firing, not a larger action potential B1.

Practice 2.3 ▪ 1 mark

A drug blocks the reuptake of a neurotransmitter.
(a) State what happens to the amount of that neurotransmitter in the synaptic gap.
(b) State the likely effect on the receiving neuron.

Solution 2.3

Method: At the synapse

Worked steps

(a) it stays in the gap longer / accumulates B1. (b) the receiving neuron is stimulated for longer, so its firing is more affected B1.

Exam-style 3.1 ▪ 1 mark

A more intense stimulus is signalled to the brain mainly by

A larger action potentials

B a faster rate of firing

C slower firing

D thicker myelin

Solution 3.1

Method: All-or-none

A larger action potentials

B a faster rate of firing ✓

C slower firing

D thicker myelin

Worked steps

B. intensity is coded by rate because each action potential is the same size.

Exam-style 3.2 ▪ 1 mark

The myelin sheath principally

A releases neurotransmitters

B speeds conduction along the axon

C receives incoming signals

D stores memories

Solution 3.2

Method: The parts of a neuron

A releases neurotransmitters

B speeds conduction along the axon ✓

C receives incoming signals

D stores memories

Worked steps

B. myelin insulates the axon and speeds conduction.

Exam-style 3.3 ▪ 1 mark

A neuron receives both excitatory and inhibitory input.
(a) State the condition under which it fires.
(b) Explain why inhibitory signals are as important as excitatory ones.

Solution 3.3

Method: Excitatory and inhibitory

Worked steps

(a) when excitatory input exceeds inhibitory input by enough to reach threshold B1. (b) without inhibition every input would push toward firing B1, so the nervous system could not select between signals or stop a response B1.