

Exercise walk-through

13.1

Neurons, synapses and brain systems: evidence and transfer

GRE · GRE Subject Test · GRE Psychology

Concepts 1 (1)

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The action potential begins at the axon hillock, where graded inputs sum; once the threshold is reached the neuron fires a complete spike (the all-or-none principle), and during the absolute refractory period it cannot fire again. Stimulus intensity is coded by firing rate and by how many neurons fire, not by spike size. Myelin insulates the axon and speeds conduction by saltatory conduction between the nodes of Ranvier; demyelinating disease slows or blocks conduction.

Concepts 2

Concepts 2

Structure-function anchors: the amygdala supports emotion and fear learning; the hippocampus is needed to form new episodic memories; the hypothalamus regulates drives and homeostasis; the cerebellum coordinates movement; Broca's area supports speech production and Wernicke's area comprehension; the prefrontal cortex supports planning and control. Localisation is real but partial: most behaviours involve distributed networks.

Dopamine illustrates specificity: it supports movement and reward, its loss produces Parkinson's disease, and excessive dopaminergic signalling is linked to positive symptoms of schizophrenia, which many antipsychotics treat by blocking D2 receptors. One transmitter serves many systems, so a drug's behavioural effect depends on the pathway, not the molecule alone.

Check the transfer argument

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Unchanged spike amplitude fits all-or-none action potentials. Firing rate can carry information about input strength, and more neurons may also be recruited. Separate spike amplitude from number of spikes per second and population activity. A diagram must label which quantity is plotted before being interpreted.

Accept a different explanation when its evidence and limits are justified.

Exercises 2.1·2.2

2.1 The action potential is triggered at which part of the neuron? [1]

A. dendrite B. cell body C. axon hillock D. terminal button E. dendritic spine

2.2 The myelin sheath around an axon serves to: [1]

A. protect the axon from overheating B. supply the axon with nutrients C. increase the speed of impulse conduction D. store neurotransmitter vesicles E. generate new action potentials

Exercises 2.1·2.2

2.1 The action potential is triggered at which part of the neuron? [1]

A. dendrite B. cell body C. axon hillock D. terminal button E. dendritic spine

2.1 Answer: C. Graded potentials sum at the axon hillock; crossing threshold there launches the spike. The other options do not satisfy the stated defining conditions.

2.2 The myelin sheath around an axon serves to: [1]

A. protect the axon from overheating B. supply the axon with nutrients C. increase the speed of impulse conduction D. store neurotransmitter vesicles E. generate new action potentials

2.2 Answer: C. Myelin enables saltatory conduction between nodes of Ranvier, speeding the impulse. Compare the exact process, design or evidence, rather than an associated keyword.

Exercises 2.3·3.1

2.3 Revisit the worked case. State one conclusion its evidence supports and one stronger conclusion it does not support. Explain the difference. [2]

3.1 A stronger stimulus produces more spikes of unchanged height. A pupil calls this evidence against all-or-none firing. Correct the inference. Give the interpretation, supporting reasoning, a relevant alternative or limitation, and an appropriate check. [4]

Exercises 2.3-3.1

2.3 Revisit the worked case. State one conclusion its evidence supports and one stronger conclusion it does not support. Explain the difference. [2]

2.3 Use the worked case evidence to support a bounded claim and explain why a causal, universal or stronger claim needs additional evidence. The claim must fit the specific design and observed process.

3.1 A stronger stimulus produces more spikes of unchanged height. A pupil calls this evidence against all-or-none firing. Correct the inference. Give the interpretation, supporting reasoning, a relevant alternative or limitation, and an appropriate check. [4]

3.1 Unchanged spike amplitude fits all-or-none action potentials. Firing rate can carry information about input strength, and more neurons may also be recruited. Separate spike amplitude from number of spikes per second and population activity. A diagram must label which quantity is plotted before being interpreted. Award B1 each (authored) for the interpretation, its reasoning, a relevant limitation/alternative and an appropriate check, up to four points. Accept a different justified answer satisfying these demands.