



ANSWER BOOK

Receptors: turning a stimulus into something a neurone can carry

Nervous coordination, receptors, muscles and behaviour · Unit B14

AQA 3.6.1.3 · OCR A 5.1.3, 5.1.5 · Edexcel A Topic 8.11–8.14 · CAIE 15.1.1–15.1.2

6 questions · 22 marks

NAVY EDITION

SECTION A · Short, 1 to 2 marks

- A1** **B1** the sensory neurone carries impulses from the receptor into the spinal cord. [2]
B1 the motor neurone carries impulses from the spinal cord to the effector.
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SECTION B · Standard, 3 to 5 marks

- B1** **B1** the pressure deforms the lamellae of connective tissue, which stretches the [5]
membrane of the nerve ending inside them. **B1** stretch-mediated sodium channels in
that membrane are pulled open. **B1** sodium ions diffuse into the ending down their
electrochemical gradient, so the inside becomes less negative. **B1** this depolarisation is
the generator potential, and it is graded, so a firmer pressure opens more channels
and gives a larger one. **A1** the generator potential is large enough to bring the
membrane to the threshold of about -55 mV, so an action potential is triggered in the
sensory neurone.
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- B2** **B1** the pathway is short: the impulses enter the spinal cord and leave it again [4]
without travelling up to the brain first. **B1** there are only two synapses to cross, and each
synapse adds a delay of about half a millisecond. **B1** the pathway is fixed, so no
conscious decision has to be made before the effector is stimulated. **A1** impulses do
reach the brain along a branch of the pathway, which is how the pain is felt a moment
later; the point is that the response does not wait for a decision from it.
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- B3** **B1** rods contain rhodopsin, which is broken down by dim light, whereas cones [4]
contain iodopsin, which needs much brighter light to break down. **B1** rods are found in
the peripheral retina and are absent from the fovea, whereas cones are concentrated
at the fovea and thin out towards the edges. **B1** rods respond to all wavelengths
together and give a monochrome image, whereas cones come in three types with
different pigments, so comparing them gives colour. **B1** there are about 120 million rods
and only about 6 million cones, and several rods share one bipolar neurone whereas
each cone has one to itself.
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- B4** **B1** several rods converge on a single bipolar neurone, whereas each cone has [4]
a bipolar neurone to itself. **B1** in dim light one rod produces only a small generator
potential, but the contributions of several rods are added together by spatial
summation. **B1** the total is enough to reach threshold and an impulse is sent, while a
cone must reach threshold on its own and so needs far more light. **A1** two points of light
falling on two rods that share a neurone send one impulse along one fibre and are
seen as one point, whereas two cones send impulses along separate fibres and the
points are resolved.
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B5 **B1** sodium ions would diffuse into the nerve ending continuously even with no pressure applied, so the membrane would be permanently depolarised. **B1** the depolarisation would already be at or beyond threshold, so action potentials would be sent to the central nervous system when nothing was touching the skin. **B1** the generator potential could no longer be graded by the pressure, because the channels cannot open any further, so impulse frequency would no longer report how firm the pressure was. [3]
