BIOLOGY 2017

Unit 3
Key Topic Test 7 – Cellular signals

Recommended writing time*: 45 minutes
Total number of marks available: 45 marks

SOLUTIONS

SECTION A: Multiple-choice questions (1 mark each)

Question 1

Answer: B

Explanation:

The process where cells respond to an extracellular signal and convert the signal from on form to another is called signal transduction.

Question 2

Answer: D

Explanation:

A target cell requires access to the signal molecule, an appropriate receptor and appropriate intracellular signalling pathways in order to respond to an extracellular signal.

Question 3

Answer: C

Explanation:

Steroid hormones are lipid based hormones which are able to diffuse through the phospholipid bilayer and bind to nuclear receptors in order to initiate a response.

Question 4

Answer: D

Explanation:

Synaptic signalling occurs between neurons and requires neurotransmitters.

Question 5

Answer: D

Explanation:

Immunoglobulins, T receptors and B receptors are all utilised by the immune system.

Question 6

Answer: A

Explanation:

In apoptosis which is programmed cell death inflammation is avoided. Cytokines produced by phagocytes protect surrounding cells.

Question 7

Answer: B

Explanation:

There must be a stimulus in order for the stimulus-response model to be initiated.

Question 8

Answer: B

Explanation:

Feedback mechanisms can be positive or negative. C represents a negative feedback whereas D represents a positive feedback mechanism. The question was asking for a broad response and therefore B is correct as it applies to both positive and negative feedback mechanisms.

Question 9

Answer: C

Explanation:

Hormones can elicit different responses in different cell types despite binding to the same receptor.

Question 10

Answer: C

Explanation:

Auxin promotes growth in plants by causing elongation of cells in the stems.

SECTION B: Short-answer questions

Question 1

a.

Classification	Location of target cell
Autocrine	the secreting cell
Paracrine	adjacent to secreting cell
Endocrine	distant location from secreting cell

3 marks

i. Hydrophilic hormones cannot pass through the cell membrane and must therefore bind with receptors on the surface of the cell membrane (1 mark). Secondary messengers inside the cell then transduce the signal (1 mark). Hydrophobic hormones are able to pass through the plasma membrane and therefore bind to receptors inside the cell (1 mark). They then directly induces changes in the cell (1 mark).

4 marks

ii. 1 mark for each of the following:

Receptor is shown on cell surface for hydrophilic hormone
Receptor is shown in the cytosol or nucleus for the lipophilic hormone
Secondary messenger is shown for hydrophilic hormone
Parts are correctly labeled

4 marks

Total 11 marks

Question 2

a.

Plant Hormone	**Function**
Auxin	Promotes stem elongation
Cytokinins	Promotes cell division
Gibberellins	Promotes seed germination
Abscisic acid	Maintains seed dormancy
Ethylene	Promotes fruit ripening

5 marks

b.

i. Apoptosis.

ii. Death receptor pathway (1 mark) as the process has been initiated outside the cell by plant hormones.

1 + 2 = 3 marks

c. Cells that would ordinarily receive the message to die due to malfunctions do not receive this message (1 mark) and are therefore allowed to proliferate unchecked (1 mark).

2 marks

Total 10 marks

Question 3

a.

i. Neurotransmitter

ii. Receptor of target cell.

iii. X binds to Y and initiates a response by either blocking or promoting gene transcription.

1 + 1 + 1 = 3 marks

b. In this example the stimulus is touching something hot which is detected by sensory receptors in the skin (1 mark) this message is sent via nervous impulse to the central nervous system and then to muscles in the hand where it is transduced (1 mark) into a response of withdrawing your hand from the hot object (1 mark).

3 marks
Total 6 marks

Question 4

a.

Feature	Nervous system	Endocrine system
Speed of transmission	Fast	Slow
Method of transmission	Chemical messengers Nerve impulse	Chemical messengers Travel through bloodstream
Duration of response	Short	Long lasting
Example	Reflex arc	Blood glucose regulation

8 marks
Total 8 marks