

GCSE Biology B (Twenty First Century Science)
J257/04 Depth in biology (Higher Tier)

Question Set 5

1 The human body responds to changes so that it can maintain a constant internal environment.

(a) Many of these responses involve muscles as effectors. Muscles are made of cells.

Explain why muscle cells have more mitochondria than most other types of cell in the body.

Muscle contraction requires more ATP than in other cell types. ATP is provided by respiration which happens in mitochondria. [2]

(b)* When temperature receptors in the skin and hypothalamus detect a drop in temperature, the hormone adrenaline is released from the adrenal gland.

Explain how the release of adrenaline could help the body to raise its core temperature back to normal.

Adrenaline causes the heart rate to increase which increases breathing rate. This means more oxygen and glucose is pumped around the body to supply cells and remove waste products like CO_2 more quickly. This enables increased cellular respiration which is an exothermic process that heats the body to help bring the temperature up. This also produces lots of ATP which is used in increased muscle contraction because of adrenaline. As the muscles contract it leads to vasoconstriction and then goosebumps where erector muscles in skin contract to raise hair and trap air. All of this helps to bring the temperature up back to normal. [6]

(c) The sensitivity of cells to the hormone adrenaline is increased by the hormone thyroxine.

(i) Explain how the production of thyroxine is regulated by negative feedback.

Pituitary gland releases TSH which causes thyroid gland to make thyroxine. Thyroxine then inhibits TSH production. [3]

(ii) Hormones stimulate cells by binding to receptors on the cell surface. These receptors are protein molecules.

Suggest how the hormone thyroxine could cause a cell to become more sensitive to the hormone adrenaline.

Thyroxine binds to thyroxine receptors on cell surface. This causes an increase in gene expression of the genes coding for adrenaline receptors. This causes increase in protein synthesis which causes cell to make more adrenaline receptors. [4]

Total Marks for Question Set 5: 15

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