
AP Biology

Sample Student Responses and Scoring Commentary

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AP[®] BIOLOGY
2017 SCORING GUIDELINES

Question 8

Estrogens are small hydrophobic lipid hormones that promote cell division and the development of reproductive structures in mammals. Estrogens passively diffuse across the plasma membrane and bind to their receptor proteins in the cytoplasm of target cells.

- (a) **Describe** ONE characteristic of the plasma membrane that allows estrogens to passively cross the membrane. **(1 point)**

Description (1 point)

- Hydrophobic/nonpolar
- Space between phospholipids

- (b) In a laboratory experiment, a researcher generates antibodies that bind to purified estrogen receptors extracted from cells. The researcher uses the antibodies in an attempt to treat estrogen-dependent cancers but finds that the treatment is ineffective. **Explain** the ineffectiveness of the antibodies for treating estrogen-dependent cancers. **(2 points)**

Explanation (2 points)

- Antibodies are unable to enter the cell.
- (Extracellular) antibodies will not bind to (intracellular) estrogen receptors.

8. Estrogens are small hydrophobic lipid hormones that promote cell division and the development of reproductive structures in mammals. Estrogens passively diffuse across the plasma membrane and bind to their receptor proteins in the cytoplasm of target cells.
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- (b) In a laboratory experiment, a researcher generates antibodies that bind to purified estrogen receptors extracted from cells. The researcher uses the antibodies in an attempt to treat estrogen-dependent cancers but finds that the treatment is ineffective. Explain the ineffectiveness of the antibodies for treating estrogen-dependent cancers.

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a). Plasma membranes are formed of phospholipid bilayers with a middle region made of hydrophobic tails. Because these are hydrophobic the estrogens can diffuse between the tails & into the cell. This allows small & uncharged (hydrophobic) molecules to diffuse into the cell passively.

b). Antibodies are unable to cross the plasma membranes of the cells. The receptor proteins are located within the cytoplasm of the cell. Because of this using antibodies to block the receptors would be useless as the antibodies are too large to enter the cell & bind to the receptors.

8B1

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8A.) The semi-permeability of the plasma membrane is the characteristic that allows estrogens to passively cross the membrane through diffusion.

8B.) The treatment is ineffective, due to the fact that antibodies do not freely pass through cellular membranes. These antibodies must be able to enter the cells in order to bind to the estrogen receptors.

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8C

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(a) the plasma membrane has tails that are hydrophobic, and estrogen is hydrophobic and ~~can allow~~ the plasma membrane can allow estrogen to diffuse across.

(b) The antibodies attribute the ineffectiveness because antibodies can attach to anything / not specific.

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2017 SCORING COMMENTARY

Question 8

Overview

This question focused on the selective permeability of cellular membranes. Students were asked to describe one characteristic of the plasma membrane that allows estrogens to passively cross the membrane. Students were then presented with an experiment where antibodies that bind to purified estrogen receptors extracted from cells were ineffective in the treatment of estrogen-dependent cancers. Students were asked to explain the ineffectiveness of the antibodies for treating estrogen-dependent cancers.

Sample: 8A

Score: 3

The response earned 1 point in part (a) for describing the characteristic of the plasma membrane as having a middle region made of hydrophobic tails. The response earned 1 point in part (b) for explaining that antibodies are unable to cross the plasma membrane. The response earned 1 point in part (b) for explaining that antibodies are unable to bind to the receptors.

Sample: 8B

Score: 2

The response earned 1 point in part (b) for explaining that antibodies do not pass through the cell membrane. The response earned 1 point in part (b) for explaining that antibodies are unable to bind to the estrogen receptors.

Sample: 8C

Score: 1

The response earned 1 point in part (a) for describing the characteristic of the plasma membrane as having hydrophobic tails.