AP® Biology
2004 Sample Student Responses
Form B

3R1

3. Homeostasis, maintaining a steady-state internal environment, is a characteristic of all living organisms. Choose <u>three</u> of the following physiological parameters and for each, describe how homeostasis is maintained in an organism of your choice. Be sure to indicate what animal you have chosen for each parameter. You may use the same animal or different animals for your three descriptions.

- Blood-glucose levels
- Body temperature
- pH of the blood
- Osmotic concentration of the blood
- Neuron resting-membrane potential

Blood-glucose levels in humans are regulated by the hormones, glucagon and insulin produced in the islets of Langerhans (in the pancreas) by α and β cells, respectively. When the hypothalamus detects that glucose concentration is too low, it signals the pancreas to release glucagon. Glucagon "signals" the liver to break down glycogen into glucose, thereby, increasing the concentration of glucose in the bloodstream. Glucagon also signals cells in the body to reduce their glucose uptake from the bloodstream. However, when glucose levels rise too high, the hypothalamus "orders" the release of insulin from the pancreas. Insulin is anagonistic to glucagon, decreasing the concentration of glucose in the blood stream. Insulin signals the liver to start synthesizing glycogen from glucose and encourages cells to increase their uptake of glucose. It also signals the kidneys to retain more water, so that the concentration of glucose in the bloodstream can be diluted.

Body temperature in a human is controlled by the rate of metabolism (since humans are endotherms). Humans can react to changes in environmental temperatures by behavioral responses – such as seeking shade or basking in the sun. Else, ~~ps~~ physiological responses may also help regulate internal temperature. Shivering when it is too cold, sweating when it is too hot (evaporative cooling), or constriction and dilation of blood vessels (when

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it is too ~~cold~~ and ~~hot~~, respectively) are all examples of how humans respond to environmental temperatures. In addition, metabolic rate speeds up when the environment ~~is~~ is too cold, thus generating more body heat. When the temperature rises, vice versa happens. Of course, humans can also pick their ~~co~~ choice of clothes now according to the outside climate!

Neuron resting-membrane potential can be reached after deplorization via ~~reptor~~ ~~repolarized~~ ~~repto~~ repolarization during a refractory period. During the action potential, sodium ions (Na^+) have diffused into the neuron, ~~via~~ creating a positive charge within the cell, and potassium ions (K^+) have diffused out the cell. To "regain" the original potential of -70 mv within the cell, the neuron must expel the Na^+ ions and take in the K^+ ions. This is done by the sodium-potassium pump in the cell's membrane, which through active transport (using ATP → ADP+P), ~~drains~~ "kicks out" 3 Na^+ ions for 2 K^+ ions (against ~~K^+'s concentration~~ the electrochemical gradient). The cytoplasm therefore returns to its original more negative (compared to the extracellular environment) ~~s~~ state.
electrically

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Blood-glucose levels:

In humans blood-glucose levels are regulated by hormones, insulin & glycogen, which are released from the pancrease. If blood-glucose levels are low, it triggess a response to the brain, which in turns signals to the pancrease to release glycogen, which in turn, tell the liver to release stored glucose molecules into the blood stream. If the levels of ~~gl~~glucose get too high, a similiar response to low blood sugar levels ~~are~~ is released, except in this case, the request is ~~for~~ to lower blood sugar. The pancrease then releases insulin, which ~~tells~~ signals to the liver to stop releasing glucose.

Body Temperature:

In humans, body temperature is regulated in a variaty of ways. ~~This includes~~ In cold weather, this includes shivering (which is an attempt to warm the body up through movement), vasoconstriction, (which prevents blood flow to the surface of the skin & consequent heat loss), and "goose bumps" (which are erector muscles for skin hair that constrict & attempt to trap heat).

In hot weather, humans sweat. This cools the body down

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because water has a high temperature for evaporation, & most of this energy is coming from the organism itself. Humans ~~cats~~ blood vessels will also go through vasodilation, where the blood will run close to the surface of skin so that it may loose heat.

Osmotic concentration of the blood:

In humans, osmotic concentrations in blood are controlled by the solutes in the blood. This includes minerals like Na^+, Cl, & blood sugars. There are pumps that actively transport Na^+ into the blood stream. The Na^+ is then used for other reactions within the blood stream.

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In human, alot of body function and metabolism are driven by enzymes, therefore maintaining a stable body temperatures becomes critical, for any alteration of body temperature can result in the denaturing of enzymes, that is, the disruption of enzyme's tertiary structure. Human body regulates temperature by ~~sweating pores~~ diffusing hot air & water through pores on skin. When it is too hot, the water released would cool body temperature. Also, bodies regulate temperatures by dialating blood vessels. When it is not, ~~blood vessels~~ capillaries such as those on the surface of your face extand, releasing heat with the increased surface area which is why your face is red when its hot. When it's cold the capillaries stays below to preserve heat from heat lost.

In human blood-glucose levels is maintained by insulin. After intake of meals the pancrease would secret more insulin to avoid letting glucose being in blood which could cause serious damage such as mental retardation.

pH of blood in human is regulated by a protein called buffer. haemoglobin has an iron chain, since CO_2 is acidic there has to be a balance between CO_2 and O_2.

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