Section 13.4: Review Answers

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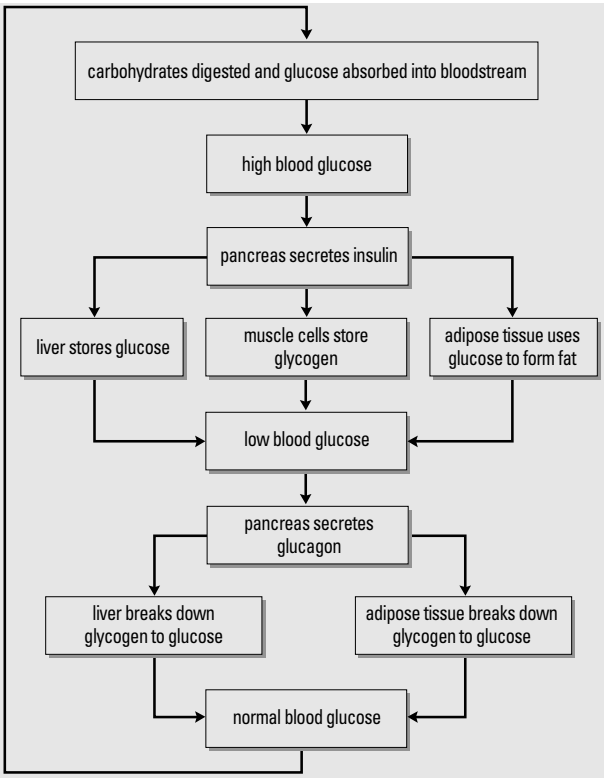
1. A negative feedback mechanism for regulation of blood glucose levels is shown below:



2. Skipping breakfast lowers blood sugar levels. To maintain homeostasis, the pancreas secretes the hormone glucagon into the blood. Glucagon causes adipose tissue to break down fat to glucose and the liver to break down glycogen to glucose. Both of these raise blood glucose levels.

3. Type 2 diabetes can occur if the insulin receptors on the body's cell membranes stop responding to insulin. In this case, insulin injections are not effective because the problem is not a lack of insulin, but the fact that the specific receptors on the target cells do not allow an increase in the permeability of these cells to glucose. Hyperglycemia is the result. Other treatments include diet, exercise, and oral medications.

4. Advantages of synthetic insulin might include the following: the cost of manufacturing it is lower, it is pure human insulin and not insulin from another animal, and the supply would be uninterrupted. The disadvantages of any medication are the negative side effects that can occur in some people.

5. (a) The individual's insulin levels drop after he/she starts to exercise. Rigorous exercise (or skipped meals) can cause blood glucose levels to drop. As a result, insulin production will drop to keep blood glucose levels higher to meet the metabolic requirements of the body during exercise. A drop in insulin production means that the liver will stop storing glucose, the muscle cells will stop storing glycogen, and the adipose tissues will stop using glucose to form fat.

(b) The individual's glucagon levels rise after he/she starts exercising. Low blood sugar caused by exercise

stimulates the pancreas to release glucagon. Glucagon stimulates the liver to convert glycogen back into glucose and the adipose tissue to break down glycogen to glucose. The glucose is then released into the blood.

(c) Having a large meal at 4 hours would raise blood glucose levels which, in turn, would increase the amount of insulin released by the pancreas and decrease the amount of glucagon.

(d) If a person had type 1 diabetes mellitus, you would expect extremely low levels of insulin (the line would be quite close to the *x*-axis). If the alpha cells of the pancreas are still intact, glucagon levels would rise over the 4 hours as the glucose levels go from extremely high at the beginning of the period to dangerously low at the end of 4 hours of exercise. If the alpha cells have also been destroyed, no glucagon will be produced.