4.7 Glycemic Response, Insulin, & Glucagon

If only 30-40% of glucose is being taken up by the liver, then what happens to the rest? How the body handles the rise in blood glucose after a meal is referred to as the glycemic response. The pancreas senses the blood glucose levels and responds appropriately. After a meal, the pancreatic beta-cells sense that glucose levels are high and secrete the hormone insulin, as shown below.¹

![Figure 4.71 Pancreatic beta-cells sense high blood glucose and secrete insulin](image)

Thus, as can be seen in the following figure, blood insulin levels peak and drop with blood glucose levels over the course of a day.

![Figure 4.72 Representative figure of blood glucose and insulin levels during a 24-hour period](image)
Blood glucose and insulin levels rise following carbohydrate consumption, and they drop after tissues have taken up the glucose from the blood (described below). Higher than normal blood sugar levels are referred to as hyperglycemia, while lower than normal blood sugar levels are known as hypoglycemia.

Insulin travels through the bloodstream to the muscle and adipose cells. There, insulin binds to the insulin receptor. This causes GLUT4 transporters that are in vesicles inside the cell to move to the cell surface as shown below.

![Diagram of insulin and GLUT4 transporters](image)

Figure 4.73 Response of muscle and adipose cells to insulin; 1) binding of insulin to its receptor, 2) movement of GLUT4 vesicles to the cell surface.

The movement of the GLUT4 to the cell surface allows glucose to enter the muscle and adipose cells. The glucose is phosphorylated to glucose-6-phosphate by hexokinase (different enzyme but same function as glucokinase in liver).
Glucagon is a hormone that has the opposite action of insulin. Glucagon is secreted from the alpha-cells of the pancreas when they sense that blood glucose levels are low as shown below.

Glucagon binds to the glucagon receptor in the liver, which causes the breakdown of glycogen to glucose as illustrated below.

This glucose is then released into circulation to raise blood glucose levels as shown below.
Figure 4.77 Glucagon leads to the release of glucose from the liver

Subsections:

4.71 Diabetes
4.72 Glycemic Index
4.73 Glycemic Load

References & Links