Chapter 23 Summary

Things to know about digestion of starches

Digestion of starches and glycogen begins in the mouth where an enzyme, amylase, breaks them down into the disaccharide maltose.

Amylase from the mouth continues to break down starches and glycogen in the stomach.

A different type of amylase breaks down starch and glycogen in the small intestine.

There are enzymes in the small intestine that break down disaccharides to form monosaccharides.

Monosaccharides are taken up into the blood stream from the small intestine.

Monosaccharides move into cells through protein channels.

Movement into the cells is regulated by the organism.

Things to Know About Glycolysis

Glycolysis takes place in the cytosol (the region of the cell that is not inside its organelles),

Glycolysis produces ATP and NADH from glucose.

The initial phosphorylation of glucose keeps the glucose from leaving the cell.

ATP and NAD^+ are required in order for glycolysis to take place.

Glucose is broken into 2 three carbon molecules.

Each of these three carbon molecules are metabolized to produce 1 NADH, as well as 2 ATP.

The final product of glycolysis is pyruvate.

1 mole of glucose is converted into 2 moles of pyruvate.

Pyruvate is used in the mitohondria to produce acetyl-S-CoA that will be used in the citric acid cyles.

When oxygen is in short supply, NAD^+ is generated by reducing pyruvate to lactate.

Pyruvate can move from the cytosol (the region of the cell that is not inside its organelles), into the mitochondria, where it is converted to acetyl-S-CoA.

When 1 mole pyruvate is converted to acetyl-S-CoA, 1 mole of CO_2 and 1 mole of NADH are produced.

Things to Know About Starvation

Glycogen is stored in the liver and in muscle cells.

When glucose is not available from food the body breaks down glycogen in order to supply glucose to the body.

It only takes about half of a fairly inactive day for a body to use up all of its stores of glycogen.

The brain relies on blood glucose in order to function.

When glucose is not available from food, cells in the body, other than brain cells, receive less glucose.

Starvation has different stages.

1. Initially glycogen stores are used up.
2. Then blood glucose comes principally from breaking down proteins, and energy is provided to many cells in the body by using acetyl-S-CoA from fatty acids.
3. Once acetyl –S-CoA levels become excessive the body switches over to a system in which energy can be obtained from ketone bodies. This is a method of energy production is not seen under normal conditions and even the brain is able to obtain ATP from ketone bodies.

As long as enough water is available a person can usually survive a few months on just water.

What to Know About Blood Glucose Regulation

Hypoglycemia is low blood sugar.

Hyperglycemia is high blood sugar.

That when blood sugar drops the body releases the hormone glucagon.

Glucagon causes the following

- Slows the entry of glucose into cells.
- The break down on glycogen in the liver,
- Promotes the breakdown of lipids and proteins.
- Promotes gluconeogenisis.

When blood glucose increases the body releases insulin.

Insulin causes the following in a healthy individual.

- Faster uptake of glucose into cells.
- Increased glycolysis,

- Increased glycogen synthesis in muscle cells and in the liver.
- Increased rate of synthesis of proteins and lipids.

Diabetes

Diabetes Mellitus is the longer name for diabetes.

In individuals with diabetes blood glucose is poorly regulated.

There are 2 types of diabetes; they have very similar symptoms but different causes.

In diabetes insulin is unable to decrease the level of glucose in the blood.

Diabetes results in high blood glucose levels that are maintained until the blood glucose is used up by normal metabolic processes.

High levels of glucose in the blood mean that glucose appears in the urine of individuals with diabetes.

High levels of glucose in the blood mean that water in the body shifts into the cells from the blood stream. This causes excessive thirst.

Diabetes can cause a body to waste away even though it has adequate caloric intake.

Type I diabetes, juvenile diabetes, and insulin dependent diabetes are the same thing.

- In these individuals, the pancreatic beta cells are nonfunctional and so insulin cannot be released into the blood stream.
- Treatment for Type I diabetes includes insulin shots.
- Type I diabetes can result in ketoacidosis when acidic ketone bodies build up in the blood. This occurs because of prolonged high levels of blood sugar.
- Ketoacidosis makes breath smell like acetone. (Acetone is one of the ketone bodies. Breath often will smell more like alcohol than like acetone.)
- Ketoacidosis results in a rapid respiration rate because removal on CO_2 can result in a decrease in the pH.
    - $H^+ + HCO_3^- \rightarrow H_2CO_3 \rightarrow H_2O + CO_2$
- In individuals with Type I diabetes blood sugar can also reach dangerously low levels. This can occur because of an overdose of insulin, or a missed meal.

Type II diabetes, adult onset diabetes, and insulin independent diabetes are the same thing.

- Type II diabeties results when the body is no longer sensitive to insulin.
- Type II diabetes seems to results when insulin receptors no longer recognize insulin.
- Drugs that increase insulin, increase the number of insulin receptors, and careful diet are used to treat Type II diabetes.

- Development of Type II diabetes seems to be diet dependent.

Things to know about glycogenisis and glycogenolysis

Glycogenisis is the process that creates glycogen from glucose-6-phospate.

Glycogenesis requires energy input,.

Glycogenolysis is the process that converts glycogen to glucose-6-phosphate.

Glycogenolysis does not require energy input.

Glucose taken from glycogen in muscle cells cannot be released into the blood stream while that in the liver can be released into the blood stream.

Things to Know About Gluconeogenisis.

Gluconeogenisis is the creation of glucose from not carbohydrate molecules.

Glucose can be made from amino acids, lactate, and glycerol.

Glucogenesis occurs mainly in the liver.

Gluconeogenesis requires 2 ATP equivalents/glucose molecule.