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PERSPECTIVE

Concept of Carbohydrate Metabolism

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Description

The entire set of biochemical procedures involved in the metabolic synthesis, disintegration, and interconversion of carbs in living things is known as carbohydrate metabolism. Many vital metabolic pathways depend on carbohydrates. Through the process of photosynthesis, plants create carbohydrates from carbon dioxide and water, which enables them to internally store solar energy. Cellular respiration is a process that occurs when animals and fungi consume plants to release energy into the cells. For utilization in numerous cellular activities, both plants and animals temporarily store the released energy in the form of high-energy molecules like ATP.

The several types of carbohydrates that humans can eat are broken down by digestion into simple monomers like glucose, fructose, mannose, and galactose. Following resorption in the gut, the monosaccharides are transported to the liver *via* the portal vein, where all non-glucose monosaccharides are also converted to glucose. Blood sugar that is high in glucose is delivered to tissues' cells, where it is either metabolized during cellular respiration or stored as glycogen. Carbon dioxide and water are the byproducts of the metabolism of glucose and oxygen during cellular respiration, which produces energy.

Metabolic pathways

Glycolysis: A glucose molecule is broken down into two pyruvate molecules during the process of glycolysis, and the energy that is released during this process is stored as ATP and NADH. Glycolysis is used by almost all organisms that metabolise glucose. The two main ways in which these pathways vary between organisms are in how glucose is regulated and how products are used. Glycolysis is the only way for some tissues and organisms to produce energy. Both anaerobic and aerobic respiration uses this route.

Gluconeogenesis: A metabolic process known as gluconeogenesis (GNG) produces glucose from specific carbon sources that are not carbohydrates. It is a universal process that occurs in all living things, including fungi, bacteria, and other microbes. In vertebrates, the liver and, to a lesser extent, the kidney cortex are where gluconeogenesis primarily takes place. It is one of the two main mechanisms that humans and many other animals use to keep blood sugar levels stable and prevent low levels. The other mechanism is the degradation of glycogen. Due to the tendency of rumen organisms to digest dietary carbohydrates, gluconeogenesis happens in ruminants independent of fasting, low-carbohydrate diets, exercise, etc. Many other animals go through the same process when they fast, starve, eat low carbohydrate foods, or exercise a lot.

Glycogenolysis: The breakdown of glycogen is referred to as glycogenolysis. This process takes place in the liver, muscles, and kidney to produce glucose when required. A single glucose molecule is separated from a branch of glycogen during this process, and it is changed into glucose-1-phosphate. The glycolysis pathway intermediate glucose-6-phosphate can then be produced from this molecule. The process of glycolysis can then continue with glucose-6-phosphate. When the glucose comes from glycogen, only one ATP molecule needs to be added to the process of glycolysis. Alternatively, glucose-6-phosphate can be converted back into glucose in the liver and the kidneys, allowing it to raise blood glucose levels if necessary. When blood glucose levels are decreased, a condition known as hypoglycemia, glucagon in the liver drives glycogenolysis. Between meals, the liver's glycogen can serve as a backup source of glucose. The central nervous system benefits the most from liver glycogen. During activity, adrenaline accelerates the breakdown of glycogen in skeletal muscle. Glycogen in the muscles provides a readily available energy source for movement.

Glycogenesis: The process of creating glycogen is

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known as glycogenesis. This is how glucose is turned to glycogen in humans. Glycogen is a highly branching structure made up of the core protein Glycogenin, which is encircled by branches of connected glucose molecules. Glycogen is more soluble because of its branching, which also makes more glucose molecules available for simultaneous breakdown. Main sites of glycogenesis include the kidney, skeletal muscles, and liver. Like most synthetic processes, the glycogenesis pathway uses energy since each glucose molecule requires the use of an ATP and a UTP.

Fructose metabolism: Before fructose can start the glycolysis process, it must go through a few extra processes. Certain tissues' enzymes have the ability to phosphate group fructose. Fructose-6-phosphate, an intermediary in the glycolysis process that can be directly metabolised in those tissues, is produced by this phosphorylation. The kidney, fat tissue, and muscles all include this route. Fructose-1-phosphate is created by enzymes in the liver, where it enters the glycolysis pathway and is eventually broken down into glyceraldehyde and dihydroxyacetone phosphate.

Galactose metabolism: One molecule of glucose and one molecule of galactose make up lactose, often known as milk sugar. Galactose travels to the liver to be converted to glucose after being separated from glucose. One molecule of ATP is used by galactokinase to phosphorylate galactose. In order to be broken down in glycolysis, the phosphorylated galactose is next transformed into glucose-1-phosphate and subsequently glucose-6-phosphate.