Energy Systems

3.2.1 Outline the terms metabolism, anabolism and aerobic catabolism

The term metabolism comes from a Greek word (*metabole*) meaning to "to change, convert or transform".

Metabolism can be subdivided into anabolism, the biosynthesis of more complex molecules from simpler ones, and catabolism, involving the network of chemical pathways in which molecules are broken down into smaller molecules.

Sewell et.al 2005

Energy Systems

3.2.2 State what glycogen is and its major storage sites

Glycogen comes from the Greek *glykr* meaning "sweet".

Animals store polysaccharide, as glycogen, in the liver and muscle. The glycogen content of the liver and muscle can be manipulated by diet and exercise to aid competitive endurance exercise performance.

Sewell et.al 2005

Energy Systems

3.2.3 State the major sites of triglyceride storage

Inside the human body, the primary function of body fats for humans is as a store of energy.

Nature originally intended this store of fat to fluctuate depending on availability of food, but in the developed world of the twenty-first century we have problem of over nutrition, which manifests itself as overweight and obesity in large numbers of people in some countries.

Sewell et.al 2005

Energy Systems

3.2.3 State the major sites of triglyceride storage

Adipose tissue cells are specialized cells of connective tissue that store fat.

The consensus is that the number of adipocytes we have remains relatively constant, but the capacity to increase our fat stores is brought about by the ability of adipose cells to greatly increase in size.

Sewell et.al 2005

Energy Systems

3.2.3 State the major sites of triglyceride storage

Adipose tissue is found beneath the skin in the hypodermis and is also found around organs such as the heart and kidneys, in order to protect and cushion.

Fat tends to accumulate in different parts of the body depending on gender; in women around skeletal muscle of the thighs and hips, and in men around skeletal muscle of the abdomen, between the shoulder blades and around the waist.

Sewell et.al 2005

Energy Systems

3.2.4 Explain the role of insulin in the formation of glycogen and the accumulation of body fat.

Insulin is an animal hormone whose presence informs the body's cells that the animal is well fed, causing liver and muscle cells to take in glucose and store it in the form of glycogen, and causing fat cells to take in blood lipids and turn them into triglycerides. In addition it has several other anabolic effects throughout the body.

http://en.wikipedia.org/wiki/Insulin

Energy Systems

3.2.4 Explain the role of insulin in the formation of glycogen and the accumulation of body fat.

In response to an increase in blood glucose, as a result of ingestion of carbohydrates, insulin is released by the pancreas.

Subsequently, after a meal insulin concentrations rise and this stimulates the increased uptake and utilization of glucose in almost all cells of the body, thereby reducing glycaemia (the level of glucose in the blood).

Sewell et.al 2005

Energy Systems

3.2.4 Explain the role of insulin in the formation of glycogen and the accumulation of body fat.

In response to exercise we need muscle to be utilizing glycogen, not storing it in the liver and muscle, so insulin concentration goes down when exercise begins.

Sewell et.al 2005

Energy Systems

3.2.4 Explain the role of insulin in the formation of glycogen and the accumulation of body fat.

Type 2 diabetes is the most common form of diabetes.

In type 2 diabetes, your body does not use insulin properly. This is called insulin resistance. At first, the pancreas makes extra insulin to make up for it. But, over time your pancreas isn't able to keep up and can't make enough insulin to keep your blood glucose levels normal. Type 2 is treated with lifestyle changes, oral medications (pills), and insulin.

When glucose builds up in the blood instead of going into cells, it can cause two problems:

- Right away, your cells may be starved for energy.
- Over time, high blood glucose levels may hurt your eyes, kidneys, nerves or heart.

Energy Systems

3.2.4 Explain the role of insulin in the formation of glycogen and the accumulation of body fat.

Type 1 diabetes is usually diagnosed in children and young adults, and was previously known as juvenile diabetes. Only 5% of people with diabetes have this form of the disease.

In type 1 diabetes, the body does not produce insulin.

With the help of insulin therapy and other treatments, even young children can learn to manage their condition and live long, healthy lives.

Energy Systems

3.2.4 Explain the role of insulin in the formation of glycogen and the accumulation of body fat.

Research task: Explain the role of insulin in the formation of glycogen and the accumulation of body fat.

Le Magazine, September 2004 - Cover Story: Novel Fiber Limits Sugar Absorption

Energy Systems

3.2.5 Outline the terms glycogenolysis and lypolysis

Glycogenolysis:

Is the breakdown of glycogen.

In glycogenolysis, glycogen stored in the liver and muscles, is converted first to glucose-1-phosphate and then into glucose-6-phosphate.

Two hormones which control glycogenolysis are a peptide, glucagon from the pancreas and epinephrine from the adrenal glands.

http://www.elmhurst.edu/~chm/vchembook/604glycogenesis.html

Energy Systems

3.2.5 Outline the terms glycogenolysis and lypolysis

Glucagon is released from the pancreas in response to low blood glucose and epinephrine is released in response to a threat or stress.

Both hormones act upon enzymes to stimulate glycogen phosphorylase to begin glycogenolysis and inhibit glycogen synthase (to stop glycogenesis).

http://www.elmhurst.edu/~chm/vchembook/604glycogenesis.html

Energy Systems

3.2.5 Outline the terms glycogenolysis and lypolysis

- **Glycogen phosphorylase** – enzyme responsible for catalyzing the breakdown of glucagon
- **Epinephrine**, also called adrenaline, hormone that is secreted mainly by the **medulla** of the **adrenal glands** and that functions primarily to increase cardiac output and to raise glucose levels in the **blood**.
- **Glycogen Synthase** catalyzes elongation (build up) of glycogen chains

Energy Systems

3.2.5 Outline the terms glycogenolysis and lypolysis

Glycogen is a highly branched polymeric structure containing glucose as the basic monomer.

http://www.elmhurst.edu/~chm/vchembook/604glycogenesis.html

Energy Systems

3.2.5 Outline the terms glycogenolysis and lypolysis

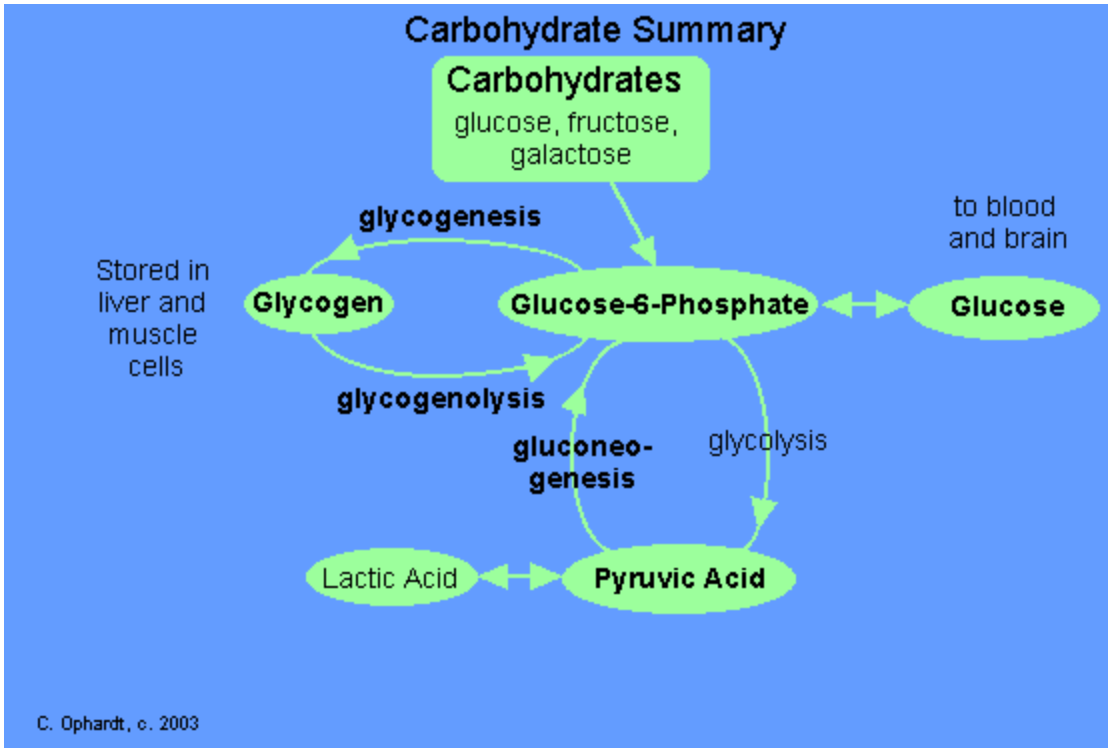
Glucose-6-phosphate is the first step of the glycolysis pathway if glycogen is the carbohydrate source and further energy is needed.

If energy is not immediately needed, the glucose-6-phosphate is converted to glucose for distribution in the blood to various cells such as brain cells.

http://www.elmhurst.edu/~chm/vchembook/604glycogenesis.html

Energy Systems

3.2.5 Outline the terms glycogenolysis and lypolysis



http://www.elmhurst.edu/~chm/vchembook/604glycogenesis.html

Energy Systems

3.2.5 Outline the terms glycogenolysis and lypolysis

Lipolysis is the breakdown of fat stored in fat cells.

During this process, free fatty acids are released into the bloodstream and circulate throughout the body.

http://en.wikipedia.org/wiki/Lipolysis

Energy Systems

3.2.6 Outline the functions of glucagon and adrenaline during fasting and exercise

Glycogenolysis transpires in the muscle and liver tissue, where glycogen is stored, as a hormonal response to epinephrine (e.g., adrenergic stimulation) and/or glucagon, a pancreatic peptide triggered by low blood glucose concentrations.

http://en.wikipedia.org/wiki/Glycogenolysis

Energy Systems

3.2.6 Outline the functions of glucagon and adrenaline during fasting and exercise

Writing task: Using the information presented on the preceding slides, put in your own words the functions of glucagon and adrenaline during fasting and exercise.

Energy Systems

3.2.7 Explain the role of insulin and muscle contraction on glucose uptake during exercise

Insulin and glucagon are antagonistic hormones that regulate the concentration of glucose in the blood.

Antagonistic hormones - Hormones that act to return body conditions to within acceptable limits from opposite extremes

Metabolic balance depends on maintaining blood glucose concentrations near a set point, which is around 90mg/100mL in humans.

Energy Systems

3.2.7 Explain the role of insulin and muscle contraction on glucose uptake during exercise

When blood glucose drop below a set point, due to exercise, glucagon is released, and it's effects increase blood glucose concentration.

Subsequently, insulin and muscle contractions have both been shown to increase muscle glucose transport, and subsequent uptake into skeletal muscle.

Campbell et.al 2006
http://physiologyonline.physiology.org/cgi/content/full/20/4/260