

Name:

Date:

Topic 3.2 – Carbohydrate & Fat Metabolism

IB SEHS

3.2.1 Outline the terms metabolism, anabolism and aerobic catabolism

The term _____ comes from a Greek word (*metabole*) meaning to “to change, convert or transform”.

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

3.2.2 State what glycogen is and its major storage sites

- Glycogen comes from the Greek *glykr* meaning “sweet”.
 - Animals store _____, 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 _____ exercise performance.

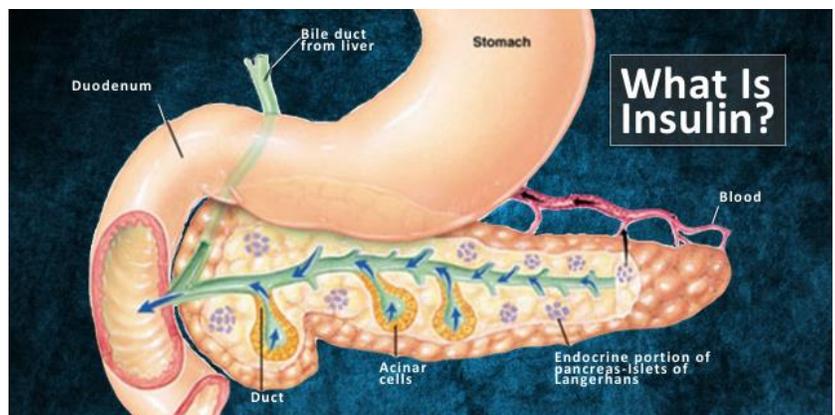
3.2.3 State the major sites of triglyceride storage

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

- Nature originally _____ this store of fat to fluctuate depending on availability of _____, but in the developed world of the twenty-first _____ we have problem of over nutrition, which manifests itself as overweight and _____ in large numbers of people in some countries.
- _____ tissue cells are specialized cells of _____ tissue that store fat. The consensus is that the number of _____ 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.
- Adipose tissue is found _____ the skin in the hypodermis and is also found around organs such as the _____ and kidneys, in order to _____ and cushion.
 - Fat tends to accumulate in _____ parts of the body depending on gender; in women around _____ muscle of the thighs and hips, and in men around skeletal muscle of the abdomen, between the shoulder blades and around the waist.

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

- **Insulin** is an animal _____ 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 _____, and causing fat cells to take in blood lipids and turn them into triglycerides.
 - In addition, it has several other anabolic (biosynthesis) effects throughout the body.



- In response to an increase in blood glucose, as a result of ingestion of _____, 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).

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

Diabetes

Type 2 diabetes is the most common form of diabetes.

In type 2 diabetes, your body does not use _____ properly. This is called insulin resistance. At first, the _____ 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 _____ 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 _____ for energy.
- Over time, high blood glucose levels may hurt your eyes, _____, nerves or heart.

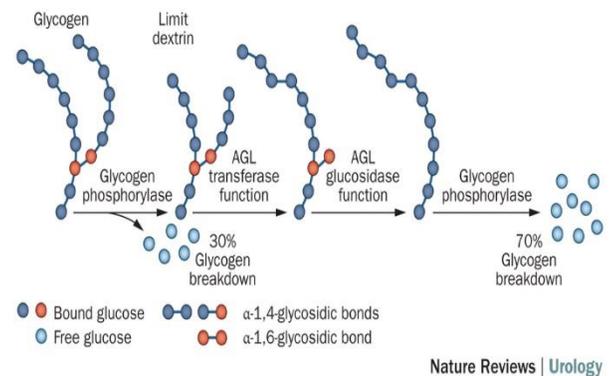
Type 1 diabetes is usually _____ in children and young adults, and was previously known as juvenile diabetes. Only 5% of people with diabetes have this form of the disease.

- In type 1 diabetes, the body does not _____ insulin.
- With the help of insulin therapy and other _____, even young children can learn to manage their condition and live long, healthy lives.

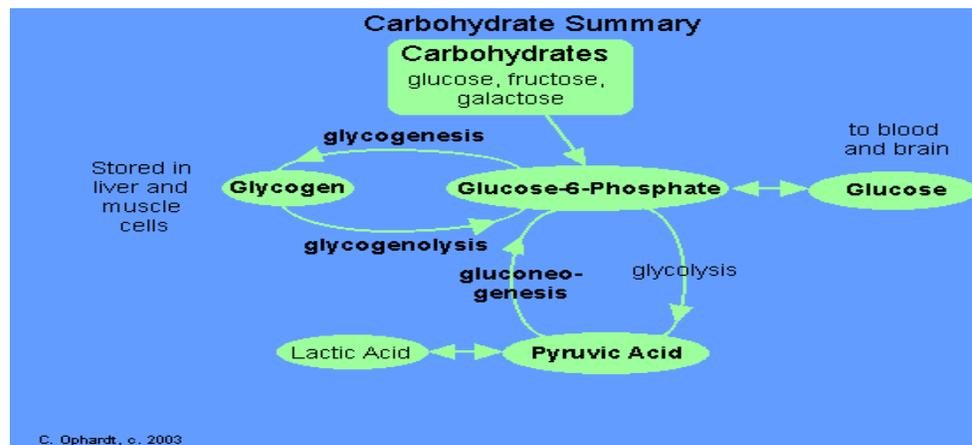
3.2.5 Outline the terms glycogenolysis and lipolysis:

It is the _____ of glycogen.

- In glycogenolysis, glycogen is stored in the _____ and muscles, is converted first to glucose-1-phosphate and then into glucose-6-phosphate.
- Two hormones which control _____ are a peptide, glucagon from the pancreas and epinephrine from the adrenal glands.
- Glucagon is released from the _____ in response to low blood glucose and epinephrine is released in response to a threat or stress.
- Both _____ act upon enzymes to stimulate glycogen _____ to begin glycogenolysis and inhibit glycogen synthase (to stop glycogenesis).
- Glycogen is a highly branched polymeric structure containing _____ as the basic monomer.



- **Glycogen phosphorylase** – enzyme responsible for _____ the breakdown of glucagon
- **Epinephrine**, also called adrenaline, hormone that is secreted mainly by the _____ 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
- Glucose-6-phosphate is the first step of the _____ pathway if glycogen is the carbohydrate source and further energy is needed.
- If energy is not _____ needed, the glucose-6-phosphate is converted to glucose for distribution in the blood to various cells such as brain cells.

Lipolysis is the breakdown of fat stored in fat cells.

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

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

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

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.

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

- Insulin and _____ are antagonistic hormones that regulate the concentration of glucose in the blood.
- Antagonistic hormones - Hormones that act to return body _____ to within acceptable limits from opposite extremes
- _____ balance depends on maintaining blood glucose concentrations near a set point, which is around 90mg/100mL in humans.
- When blood glucose _____ below a set point, due to exercise, _____ is released, and its effects increase blood glucose _____.
- Subsequently, insulin and muscle contractions have both been shown to increase _____ glucose transport, and subsequent uptake into skeletal muscle.

