NEED to KNOW

HIGHER HUMAN BIOLOGY

Quick and easy revision

Key content at your fingertips

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HODDER GIBSON
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Contents

Getting the most from this book

This *Need to Know* guide is designed to help you throughout your Higher Human Biology as a course companion to your learning but also as a revision aid to be used in preparation for course assessments and for your final examination.

You need to know

Each Key Area begins with a list of the learning outcomes adapted from the SQA course specification for Higher Human Biology. These summarise the general themes of learning within the topic.

The Key Area continues with bullet notes covering the success criteria for each learning outcome. These contain the emboldened vocabulary and phrasing needed to ensure exam success. Some terms are highlighted in green if they are defined as selected key terms.

Key terms

The **selected** key terms are only a small sample of the terms you need to know for your exam. There are many more terms you need to know, which you'll find **emboldened** and defined throughout bullet points in the book.

Exam tips

Exam tips focus on areas that are tricky and are often asked about in the exam. These may contain a hint, a memory aid or a note of what to watch for.

Synoptic links

These are references to other Key Areas in the book to show where related knowledge for Higher Human Biology can be found – these are *always* worth checking out.

Techniques

These are experimental techniques with which you are expected to be familiar for your exam – we give a brief outline of each technique and its purpose.

Area assessment

A group of ten structured questions, worth 60 marks, designed to give you examination practice across a whole area of the human biology course.

Mark your own work here: **hoddereducation.co.uk/needtoknow/answers**

Do you know?

Questions at the end of each Key Area can be used to test yourself on the main knowledge needed. These are in the form of extended-response questions worth between 3 and 8 marks each. Give yourself about 2 minutes for each mark, so a 5-mark question should take you about 10 minutes.

Mark your own work here: **hoddereducation.co.uk/needtoknow/answers**

2.8 Blood glucose levels and obesity

You need to know

- that chronic elevated blood glucose levels lead to atherosclerosis and blood vessel damage
- about pancreatic receptors and the role of hormones in negative feedback control of blood glucose through insulin, glucagon and adrenaline
- the features of type 1 and type 2 diabetes
- the measurement of obesity and its impact on health

Blood glucose levels and vascular disease

- Chronic elevated blood glucose levels may lead to blood vessel damage:
  - Untreated diabetes causes chronic elevation of blood glucose levels.
  - This means that endothelial cells lining blood vessels absorb more glucose than normal, which causes damage.
- Chronic elevated blood glucose levels may also lead to atherosclerosis:
  - Atherosclerosis may lead to cardiovascular disease (CVD), stroke or peripheral vascular disease.
  - Peripheral vascular disease affects blood vessels leading to the arms, hands, legs, feet and toes.
  - Damage to small blood vessels by elevated glucose levels may result in **haemorrhaging** of blood vessels in the **retina**, **renal failure** or **peripheral nerve dysfunction**.

Key terms

Haemorrhage An escape of blood from a ruptured blood vessel.

Retina The light-sensitive layer of the back of the eye.

Renal failure Kidney failure.

Peripheral nerve dysfunction The result of damage to your peripheral nerves, which may impair sensation, movement or gland or organ function.

Exam tip

In your exam you may be asked to describe the effects of chronic elevated blood glucose levels on the circulatory system. These are atherosclerosis, CVD, stroke, peripheral vascular disease, blood vessel damage and hypertension.

Synoptic link

You can read more about CVD, strokes and peripheral vascular disease in Key Area 2.7 (page 62).

Regulation of blood glucose levels

- Blood glucose concentration is monitored by receptors in the pancreas and maintained within tolerable limits by **negative feedback control** involving the hormones **insulin**, **glucagon** and **adrenaline**.
- The pancreas controls blood glucose by manufacturing insulin and glucagon, which act antagonistically. The hormones are transported in the blood to the liver.
- Pancreatic receptors respond to raised blood glucose levels by increasing the secretion of insulin from the pancreas.
  - The insulin makes the liver cells more permeable to glucose and activates the conversion of glucose to glycogen to be stored in the liver cells.
  - This decreases blood glucose concentration.
- Pancreatic receptors respond to lowered blood glucose levels by increasing the secretion of glucagon from the pancreas.
  - Glucagon activates the conversion of glycogen to glucose in the liver.
  - The glucose is released, increasing blood glucose concentration.
- Figure 2.31 provides a summary of the negative feedback regulation of blood glucose levels.

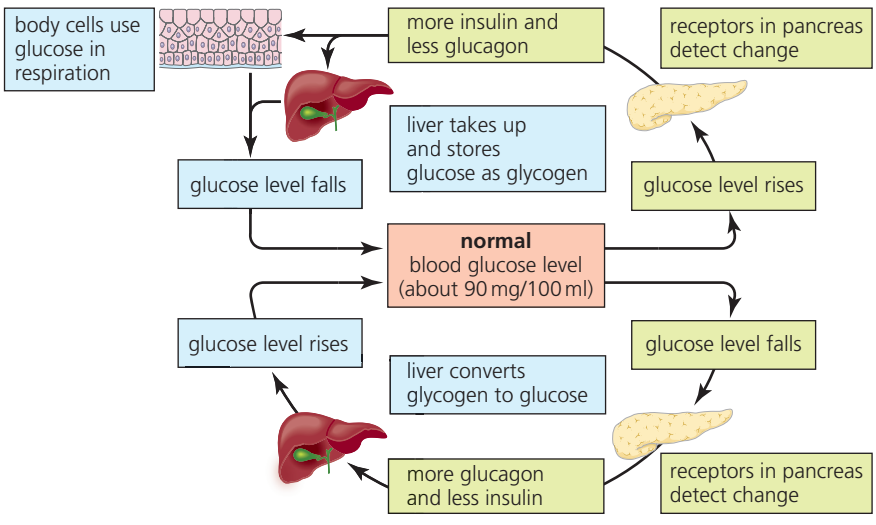

Figure 2.31 Control of blood glucose concentration by negative feedback

- During exercise and in fight-or-flight responses, glucose concentration in the blood is raised by the hormone adrenaline.
- Adrenaline is released from the **adrenal glands** located on the top of each kidney.
- Adrenaline stimulates glucagon secretion and inhibits insulin secretion.

Key terms

Insulin Hormone produced by the pancreas that stimulates the conversion of glucose into glycogen in the liver.

Glucagon Hormone produced by the pancreas that stimulates the conversion of glycogen into glucose in the liver.

Adrenaline Hormone produced by the adrenal glands that stimulates the release of glucose from glycogen during stress or exercise.

Exam tip

Make sure you can describe how negative feedback control works. It is a means of maintaining a constant internal environment (homeostasis). A change from the normal level is detected and a corrective mechanism is switched on. When conditions return to the normal level, the corrective mechanism is switched off.

Key term

Adrenal glands Endocrine glands located on the top of each kidney that produce a variety of hormones, including adrenaline.

Type 1 and type 2 diabetes

- Vascular disease can be a chronic complication of diabetes.
- **Type 1 diabetes** usually shows up in childhood:
  - Affected individuals cannot produce insulin.
  - Treatment involves regular injections with carefully measured doses of insulin.
- **Type 2 diabetes** typically develops later in an individual's life:
  - Being overweight increases the chances of developing type 2 diabetes.
  - Affected individuals produce insulin but their liver cells are insulin-resistant. This means that they have a smaller number of insulin receptors on their surface, which leads to failure to take up glucose and convert it to glycogen.
- In both types of diabetes:
  - Blood glucose concentration rises rapidly after a meal.
  - The kidneys are unable to reabsorb all the glucose, resulting in glucose being excreted in the urine.
  - Testing urine for glucose is often used as an indicator of diabetes.
- The **glucose tolerance test** is used to diagnose diabetes:
  - The blood glucose concentrations of the individual are first measured after fasting.
  - The individual then drinks a standard dose of glucose solution.
  - Changes in their blood glucose concentration are measured for at least the next 2 hours to determine how quickly the glucose is cleared from the blood.
  - The blood glucose concentration of an individual with diabetes usually starts at a higher level than normal.
  - During the test, their blood glucose concentration increases to a much higher level than that of someone without diabetes, and takes longer to return to its starting concentration.

Exam tip

In your exam you may be asked to describe the difference between type 1 and type 2 diabetes. Individuals with type 1 diabetes are unable to produce insulin, while individuals with type 2 diabetes produce insulin but their cells are less sensitive to it.

Key term

Glucose tolerance test
Blood test that measures the body's ability to maintain a normal blood glucose level.

Obesity

- **Obesity** may impair health and is a major risk factor for cardiovascular disease (CVD) and type 2 diabetes.
- It is characterised by excess body fat in relation to lean body tissue, such as muscle.
- **Body mass index (BMI)** is commonly used to measure obesity.
- BMI is a measurement of body fat based on height and weight.
- BMI = body mass (kg) divided by height (m) squared.

- BMI can be used to categorise individuals as obese, overweight, normal or underweight, as shown in Table 2.1. A BMI greater than 30 kg m^{-2} is used to indicate obesity.
- One disadvantage of the BMI measurement is that someone may be wrongly classified as overweight or obese when additional mass is actually muscle or bone and not fat.

Technique

Measuring BMI is a technique you are expected to be familiar with for your exam. Make sure you are familiar with the formula for BMI (BMI = body mass (kg) divided by height (m) squared) and be aware of the problems that arise when using the index with individuals who possess extremely muscular physiques.

Table 2.1 BMI measurements used to categorise individuals

BMI range	Category
<18.5	Underweight
18.5–24.9	Normal
25–29.9	Overweight
30+	Obese

- Obesity is linked to high-fat diets and a decrease in physical activity.
- In preventing and tackling obesity, the energy intake in the diet should be reduced by limiting fats and free sugars.
- Fats have a high calorific value per gram and free sugars require no metabolic energy to be expended in their digestion.
- Exercise can be used to increase energy expenditure and preserve lean tissue.
- Exercise can also help to reduce risk factors for cardiovascular disease (CVD) by keeping weight under control, minimising stress, reducing hypertension and improving HDL blood lipid profiles.

Synoptic link

You can read more about HDL to LDL ratios in Key Area 2.7 (page 62).

Do you know?

1 Write notes on the control of blood glucose following an increase in blood glucose concentration after a meal. [4]

2 Write notes on the control of blood glucose following a decrease in blood glucose concentration after exercise. [4]