

Endocrine disorders

B.Sc Second year Zoology (Honours) Paper - 4

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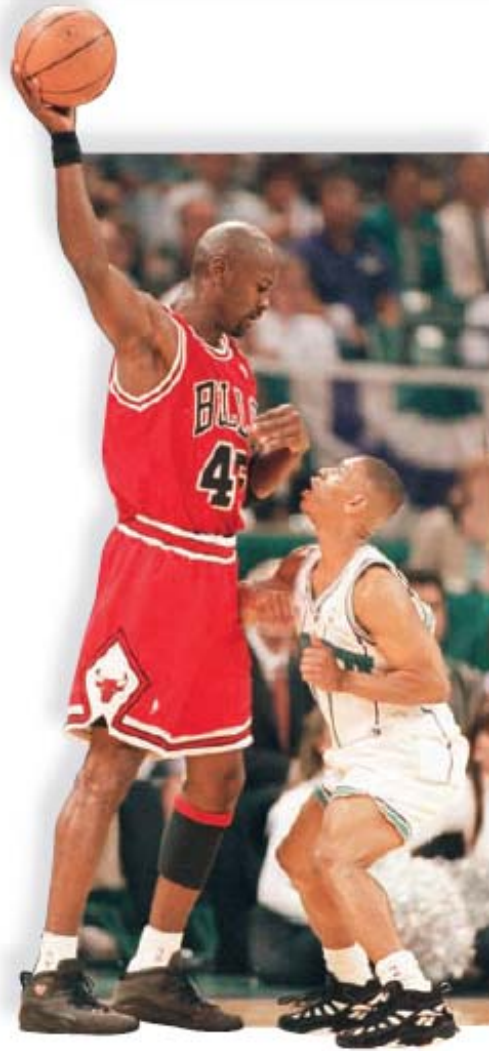
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Effects of Growth Hormone

- Growth hormone is produced by the anterior pituitary. The quantity is *greatest during childhood and adolescence*, when most body growth is occurring.
- If too little GH is produced during childhood, the individual has ***pituitary dwarfism***, characterized by perfect proportions but small stature.
- If too much GH is secreted, a person can become a giant, overproduction of GH in adult ***causes acromegaly***.



a.



b.

Figure 15.8 Growth hormone influences height.



Age 9



Age 16



Age 33



Age 52

Effects of Thyroid Hormones

- To produce triiodothyronine (T3) and thyroxine (T4), the thyroid gland actively requires **iodine**. The concentration of iodine in the thyroid gland can increase to as much as 25 times that of the blood.
- If iodine is lacking in the diet, the thyroid gland is unable to produce the thyroid hormones.
- In response to constant stimulation by TSH from the anterior pituitary, the thyroid enlarges, resulting in a **simple goiter**.
- *Some years ago, it was discovered that the use of iodized salt allows the thyroid to produce the thyroid hormones and, therefore, helps prevent (stop) simple goiter.*



a. Simple goiter



b. Congenital hypothyroidism



c. Exophthalmic goiter

- Thyroid hormones **increase the metabolic rate**. They do not have a target organ. Instead, they stimulate all cells of the body to metabolize at a faster rate. More glucose is broken down, and more energy is used.
- If the thyroid fails to develop properly, a condition called congenital hypothyroidism results.
- Individuals with this condition are **short and stocky** and have **extreme hypothyroidism** (under secretion of thyroid hormone) since infancy or childhood.
- **Thyroid hormone therapy can initiate growth**, but unless treatment is begun within the first two months of life **mental retardation results**.
- The occurrence of hypothyroidism in adults produces the condition known as myxedema.
- The administration of adequate doses of thyroid hormones restores normal function and appearance.

- In the case of hyperthyroidism (oversecretion of thyroid hormone), the **thyroid gland is overactive and a goiter forms**.
- This type of goiter is called exophthalmic goiter.
- The eyes protrude because of edema in eye socket tissues and swelling of the muscles that move the eyes.

➤ Effects of Parathyroid hormone (PTH)

- **Hypoparathyroidism** (lower secretion of PTH) causes a dramatic drop in blood calcium, followed by excessive nerve excitability. Nerve signals happen spontaneously and without rest, causing a phenomenon called **tetany**.
- In tetany, the body shakes from continuous muscle contraction.
- Without treatment, severe hypoparathyroidism causes seizures, heart failure, and death.
- Untreated **hyperparathyroidism** (over secretion of PTH) can result in osteoporosis because of continuous calcium release from the bones. Hyperparathyroidism may also cause formation of calcium kidney stones.

Malfunction of the Adrenal Cortex

- When the blood level of glucocorticoids (steroid) is low due to hyposecretion , a person develops **Addison disease**. The presence of excessive but ineffective ACTH causes a bronzing of the skin because ACTH, like MSH, can lead to a buildup of melanin.
- Without the glucocorticoids, glucose cannot be replenished when a stressful situation arises.

- Even a mild infection can lead to death.
- In some cases, hyposecretion of aldosterone results in a **loss of sodium and water**. Low blood pressure and, possibly, severe dehydration can develop as a result. Left untreated, Addison disease can be fatal.
- When the level of **glucocorticoids (cortisol)** is high due to hypersecretion, a person develops **Cushing syndrome**.
- The excess glucocorticoids result in a tendency toward diabetes mellitus as muscle protein is metabolized and subcutaneous fat is deposited in the midsection. The result is a **swollen “moon” face** and an obese trunk, with arms and legs of normal size.





a.

b.

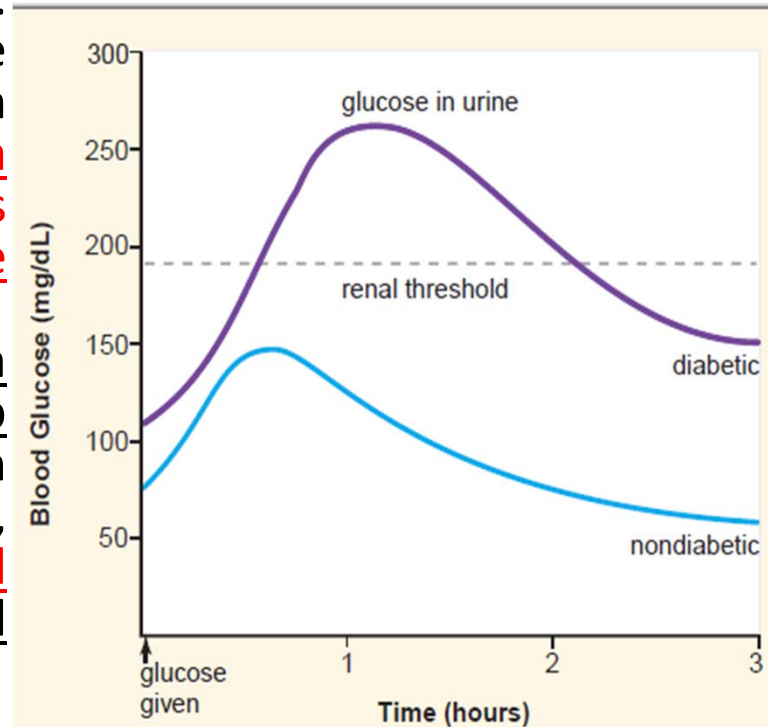
- Children show obesity and poor growth in height.
- Depending on the cause and duration of the Cushing syndrome, some people may have more dramatic changes. These include masculinization (to produce certain male secondary sex characteristics in a female) with increased blood pressure and weight gain. Cushing syndrome may be treated by the use of cortisol-inhibiting drugs.

➤ **Diabetes Mellitus**

- This disease is characterized by the inability of the body's cells to take up glucose, especially liver and muscle cells.
- This causes blood glucose to be higher than normal, and cells rely on other "fuels" like fatty acids for energy.
- A common symptom of diabetes mellitus is glucose in the urine (mellitus, from Greek, refers to "honey" or "sweetness").
- As blood glucose increases, more glucose and water are excreted in the urine.
- The glucose tolerance test assists in the diagnosis of diabetes mellitus.
- After the patient is given 100 grams of glucose, the blood glucose concentration is measured at intervals. In a diabetic, the blood glucose level rises greatly and remains elevated for several hours. In the meantime, glucose appears in the urine.
- In a non-diabetic person, the blood glucose level rises somewhat and then returns to normal after about two hours.

Types of Diabetes

- There are two types of diabetes mellitus. In type 1 diabetes, the pancreas is not producing insulin. This condition is believed to be brought on by exposure to an environmental agent, most likely a virus, whose presence causes cytotoxic T cells to destroy the pancreatic islets.
- The body turns to the metabolism of fat, which leads to the buildup of ketones in the blood and, in turn, to acidosis (acid blood), which can lead to coma and death. As a result, the individual must have daily insulin injections.



- These injections control the diabetic symptoms but can still cause inconveniences because the blood sugar level may swing between **hypoglycemia** (low blood glucose level) and **hyperglycemia** (high blood glucose level).
- Most of the diabetics in the United States have *type 2 diabetes*. Often, the patient is **obese**. Usually, after insulin binds to a plasma membrane receptor, the number of protein carriers for glucose increases and more glucose than usual enters the cell.
- In the case of type 2 diabetes, **insuline binds to the receptor but the number of carriers does not increase**. Therefore, the cell is said to be **insulin resistant**. It is possible to prevent or at least control type 2 diabetes by adhering to a low-fat, low-sugar diet and exercising regularly.
- If this fails, **oral drugs are available to treat type 2 diabetes**.
- Long-term complications of both types of diabetes are **blindness**; **kidney disease**; and **cardiovascular disorders**,

including **atherosclerosis**, **heart disease**, **stroke** and **reduced circulation**.

- Pregnancy carries an increased risk of diabetic coma , and the child of a diabetic is somewhat more likely to be stillborn or to die shortly after birth.
- These complications of diabetes are not expected to appear if the mother's blood glucose level is carefully regulated and kept within normal limits.