



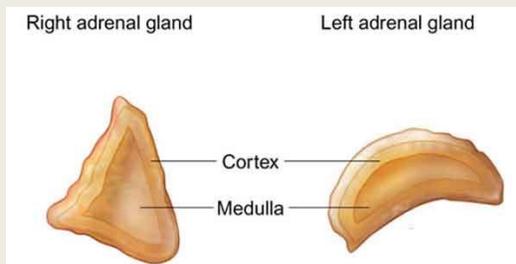
Medicine for Managers

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What Are My Adrenal Glands

We all have two adrenal glands which are located on the top of the kidneys. Each weighs about 4-5 grams and measures about 3 cm wide by 6 cm long. They are often forgotten but they are vital for general function and wellbeing. They are particularly important for staff working in the NHS because they produce the hormones required during periods of stress.

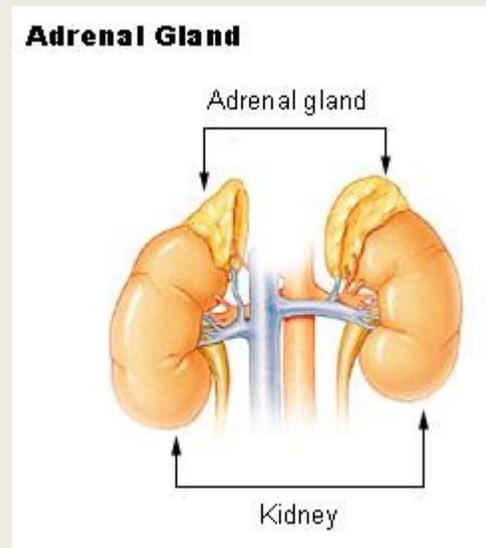
Interestingly, although they are a pair of glands, they are not symmetrical. The right gland is triangular, the left is shaped more like a half-moon.



3. **fasciculate** (which manufactures steroid hormones) and the **reticularis** (which makes sex hormones). The names are derived from descriptions of their structure.
4. **The Medulla**. This is located in the centre of the gland and comprises about 20% of the total volume.

Each gland has three distinct parts.

1. **The Capsule**. There is a protective layer of fat which surrounds each gland. The purpose is to enclose and protect each gland.
2. **The Cortex**. This composes about three quarters of the total volume of the gland and is composed of three separate zones which each have different functions. The zones are respectively the **glomerulosa** (which manufactures the hormone controlling fluid and salt), the



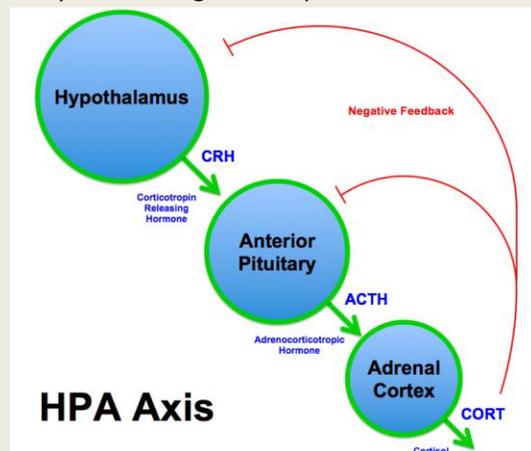
The hormones secreted by the adrenal cortex are necessary for life; those secreted by the adrenal medulla are not.

Hormones of the adrenal cortex:

The cortex secretes two types of steroid (more correctly called corticosteroid) hormones, **glucocorticoids** and **mineralocorticoids**.

The adrenal cortex forms part of the **hypothalamic-pituitary-adrenal axis**. I realise that I have probably lost you, so let me try to rescue the situation.

At the base of the brain is a structure called the **hypothalamus**. It is situated above the pituitary to which it is attached by a stalk. The hypothalamus maintains **homeostasis** (the status quo in the body). It responds to information provided to it from all round the body; such things as temperature, blood



pressure, hunger and a range of levels of hormones. If things are going wrong it increases its output of **CRH (corticotrophin-releasing hormone)** which travels to the **pituitary gland**. The gland is responsible for regulating vital bodily functions and general wellbeing. It is known as the **master gland** because it controls virtually all other glands. When acted upon by CRH it produces **ACTH (adrenocorticotrophic hormone)**. This hormone is released directly

into the blood and acts on the adrenal glands to produce the steroid hormones.

The **glucocorticoids** released by the adrenal cortex include:

- **Hydrocortisone** regulates how the body converts carbohydrate, fat and protein to energy, regulates blood pressure and cardiovascular function
- **Corticosterone**. This hormone relates the immune response and suppresses inflammation.

The **mineralocorticoid** released by the cortex is principally **aldosterone**. This is vital for salt and water balance in the body and also controls blood pressure.

Sex hormones are also produced in the adrenal cortex, which releases both male and female hormones. Normally their effects are overshadowed by the larger amounts of oestrogen and testosterone released respectively by the ovaries and the testes.

Hormones of the adrenal medulla:

Medullary hormones are not vital for survival in the same way that cortical hormones are. However, they are still important and are released when the **sympathetic nervous system** is stimulated, which occurs when you are **stressed**. You will be aware of the **fright, flight or fight** response in times of threat and the medulla produces hormones that form a key part of this response

- **Adrenaline**. The hormone responds to stress by increasing the heart

rate, raising blood sugar and directing blood to brain and muscle.

- **Noradrenaline.** Released alongside adrenaline and produces similar actions to adrenaline, although it causes blood vessels to become narrowed, raising blood pressure.

Disorders of the Adrenal Glands

Because of the essential nature of the glands, any disorder may have serious systemic effects.

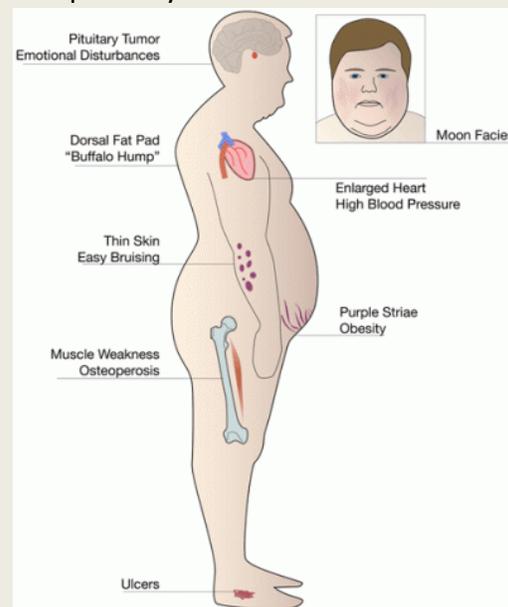
Addison's Disease (named after Thomas Addison, Physician at Guy's Hospital), is a relatively rare disorder which may affect people of any age and is the result of underproduction of steroid hormones and mineralocorticoids. It is the most common auto-immune disease in the Western world. It usually presents as characteristic pigmentation of the skin and fatigue. Failure to diagnose or treat may result in an **adrenal crisis**, with vomiting, fever, collapse and coma. Treatment is by injections of steroid (hydrocortisone) drugs. John F Kennedy suffered from Addison's disease.



Conn's syndrome: A disease characterised by overproduction of aldosterone resulting in high blood pressure and disturbances in electrolyte balance, particularly of sodium and potassium.

Adrenal Cancer: Benign tumours are regularly found by chance during imaging for another problem. True adrenal cancers are rare, the incidence being about one per million per year. **Phaeochromocytoma** (pronounced Fee-o-crome-o-site-o-ma) is a tumour beloved of medical students and causes headaches, sweating, anxiety and palpitations. Signs are palpitations and high blood pressure. They are removed surgically.

Cushing's Syndrome: It is an uncommon disease which results in the overproduction of steroid hormones, which may be the result of malignant disease in the adrenal or of a pituitary disorder. The disease



produces a range of signs including obesity, hirsutism, diabetes, increased blood

pressure, osteoporosis, depression and the characteristic striae (stretch marks) on the skin

Congenital Adrenal Hyperplasia: This is a genetic disorder characterised by low levels of cortisone hormones and, often, of aldosterone as well. Androgen production is reduced resulting in ambiguous genitalia and disturbed secondary sexual characteristics.

The adrenal (sometimes called suprarenal) glands were believed to have been described by Bartolomeo Eustachi (of Eustachian tube in the ear fame), an Italian Anatomist, in around 1563. They were named because of their proximity to the kidney (*ad- Latin, near; renes Latin kidneys*). The fact that they did not form part of the kidneys was not recognised until the nineteenth century. Thomas Addison first described diseases of the adrenal in 1855, but the name of Addison's Disease was not used until coined by by Georges Trousseau. Oliver and Schafer discovered the blood pressure raising effects of extract of the glands in 1894.

It was, however, really only well understood after the work of Kendall, Hench and Reichstein who were awarded the Nobel Prize for Medicine in 1950 for their discoveries of adrenal hormones.

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