Hair

There are two main types of human hair: vellus and terminal. Only terminal hair, which is found mainly on men, has a central core or medulla and responds to the male sex hormone, testosterone.

The surface of the human body is covered with millions of hairs. They are most noticeable on the head, around the external genitalia and under the arm. The only regions of the body without hairs are the lips, nipples, parts of the external genitalia, the palms of the hands and the soles of the feet.

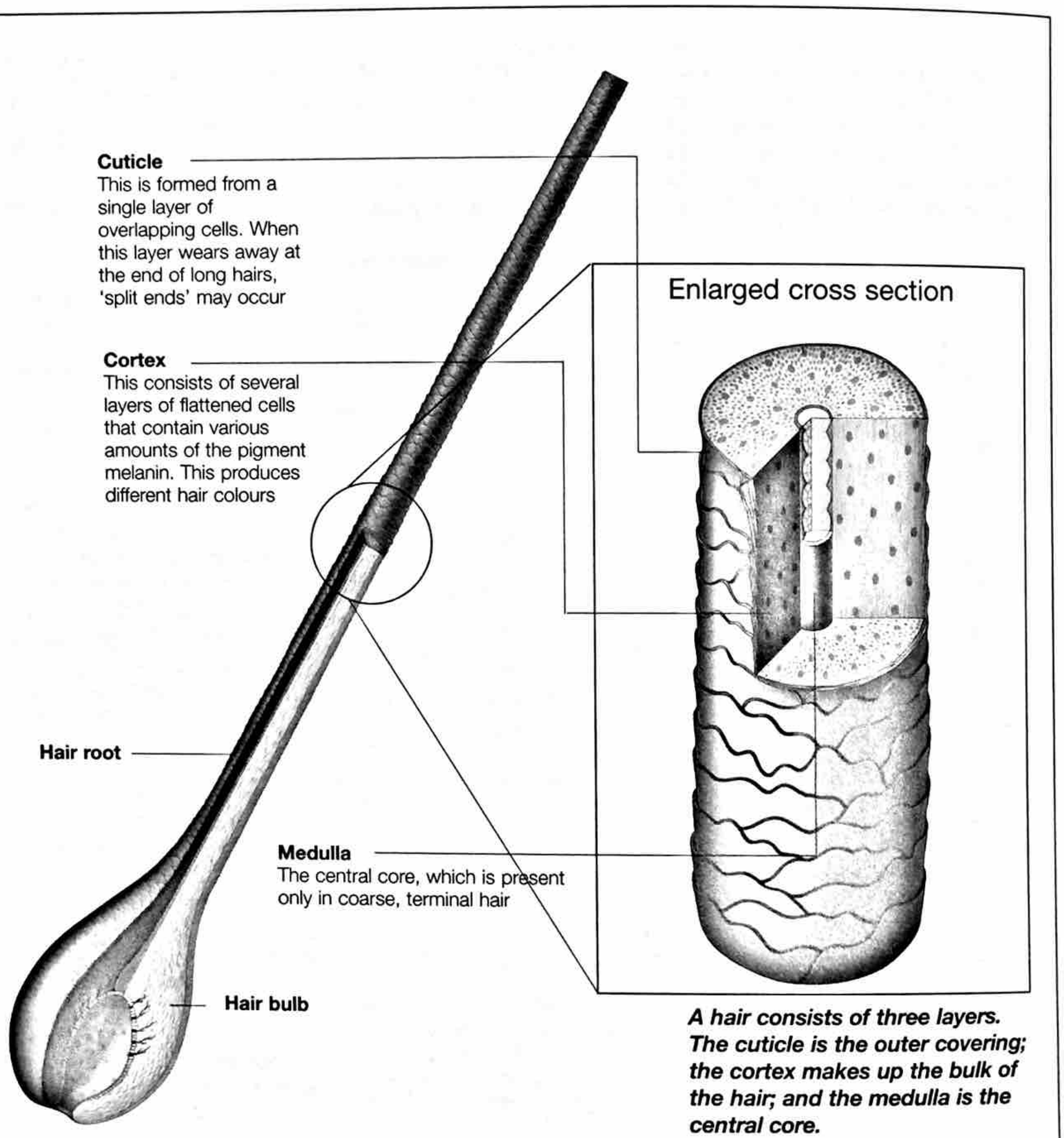
Although hair does not really serve to keep us warm, as it does in other mammals, it has a number of other functions:
- Sensing small objects or insects that approach the skin
- Protecting/insulating the head
- Shielding the eyes
- Sexual signalling.

STRUCTURE OF A HAIR

Hair is composed of flexible strands of the hard protein, keratin. It is produced by hair follicles within the dermis (the inner layer of the skin) but arises from an 'inpouching' of the epidermis (the outer layer).

Each hair follicle has an expanded end – the hair bulb – which receives a knot of capillaries to nourish the root of the growing hair shaft. The shape of the hair shaft determines whether the hair is straight or curly: the rounder the shaft in cross section, the straighter the hair.

Each hair is made up of three concentric layers:
- The medulla
- The cortex
- The cuticle.



A hair consists of three layers. The cuticle is the outer covering; the cortex makes up the bulk of the hair; and the medulla is the central core.

Types of hair and their distribution

Although it seems as though there are many different types of human hair, it can be divided into just two main groups:
- Vellus hair
- Terminal hair.

VELLUS HAIR

Vellus hair is the name given to the soft hair that covers most of the body in women and children. It is short, fine and usually light in colour, making it much less noticeable than terminal hair. Vellus hair shafts do not have a central medulla.

Eyelashes are one of the few examples of terminal hair to be found on men, women and children. They prevent foreign bodies from entering the eye.

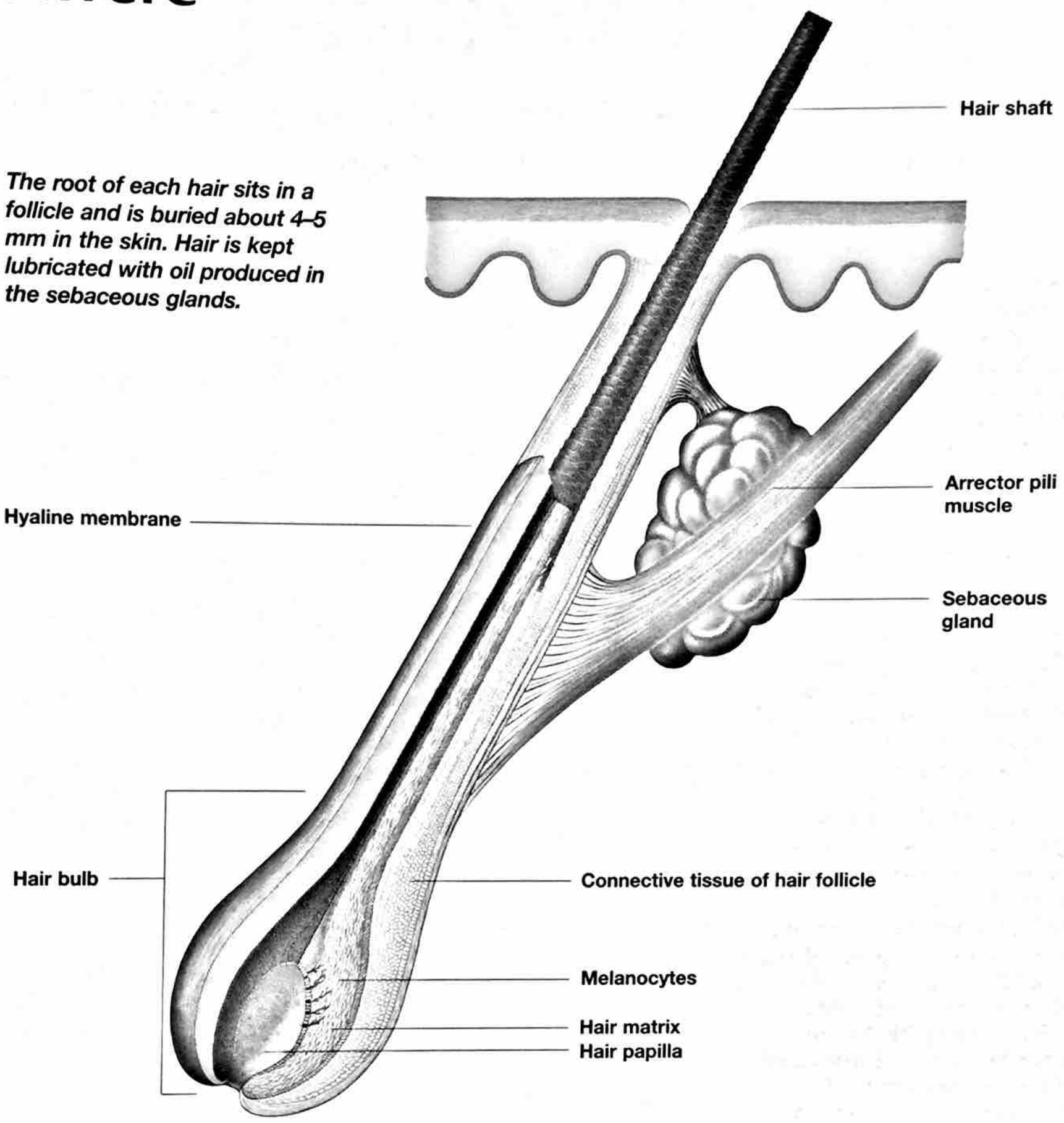
TERMINAL HAIR

Terminal hair is much coarser than vellus hair. It occurs on top of the head, as eyelashes and eyebrows, as pubic and axillary (armpit) hair, and it makes up most of the body hair of adult men. Terminal hair does have a central medulla within its shaft.

Terminal hairs develop and grow in response to the presence of male sex hormones, such as testosterone. In medical conditions where women have too much of these hormones, unwanted male pattern hair growth (hirsutism) occurs.

The hair follicle

Hairs are produced within hair follicles, which are present on most of the skin surface. A number of other structures are associated with these follicles, including sebaceous glands, nerve endings and tiny muscles that pull the hair erect.



The root of each hair sits in a follicle and is buried about 4–5 mm in the skin. Hair is kept lubricated with oil produced in the sebaceous glands.

Sebaceous, or oil, glands lie alongside hair follicles wherever they are on the surface of the body. They produce an oily substance, known as sebum, which drains out of the gland through a sebaceous duct into the hair follicle. The sebum then passes out around the emerging hair shaft to reach the surface of the body.

The amount of sebum produced depends upon the size of the sebaceous gland, which in turn depends upon the levels of circulating hormones, especially androgens (male sex hormones). The largest sebaceous glands are found on the head, neck, and back and front of the chest.

The function of sebum is to soften and lubricate the skin and hair, and to prevent the skin from drying out. It also contains substances that kill bacteria, which might otherwise cause infection of the skin and hair follicle.

NERVE ENDINGS

A network of tiny nerve endings lie around the bulb of the hair follicle. These nerves are stimulated by any movement of the base of the hair. If the hair is bent by pressure somewhere along its shaft, these nerve endings will fire, sending signals to the brain. This is what happens, for instance, when an insect alights on the skin; the slight bending of hairs it causes sets off a chain of events, resulting in a reflex action to remove it before it stings. In this way hair contributes to our sense of touch.

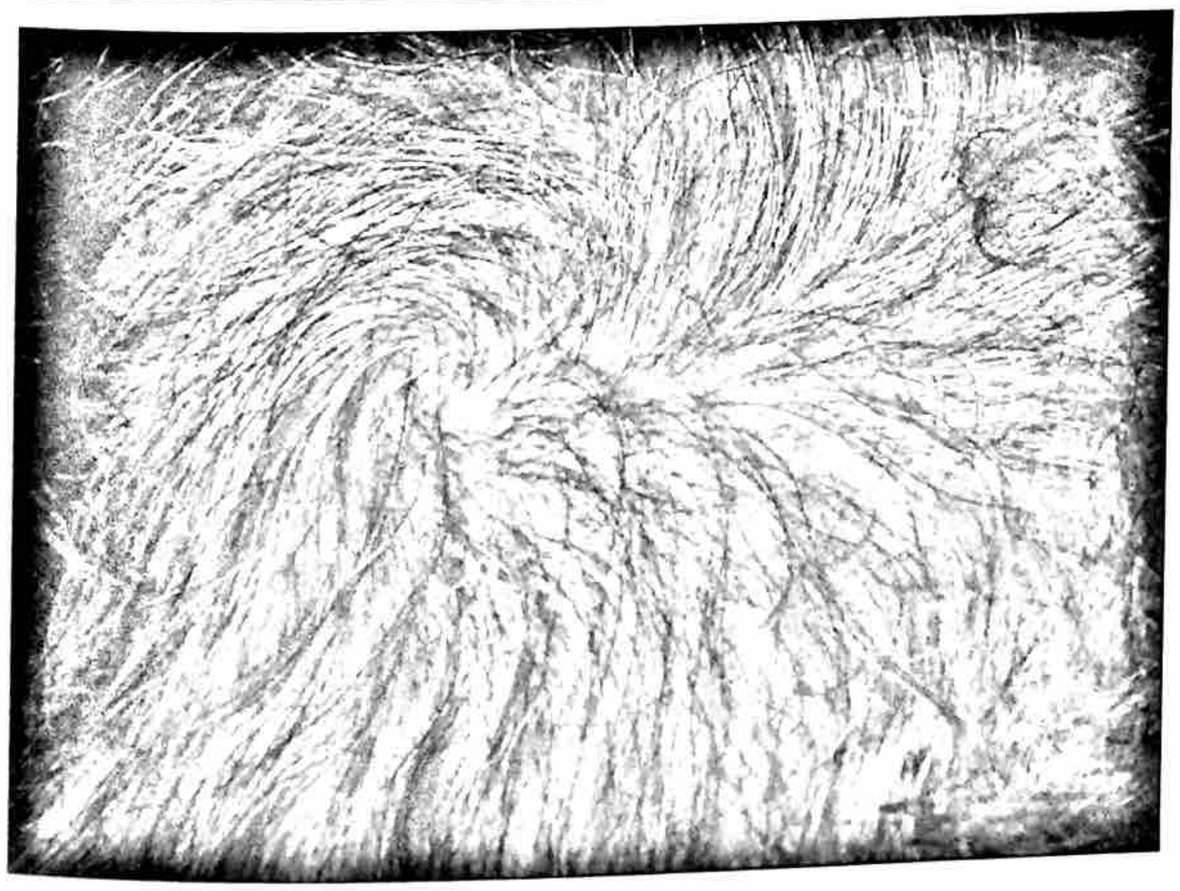
ARRECTOR PILI MUSCLE

Each hair follicle is attached to a tiny muscle called an arrector pili, which literally means 'raiser of hair'. When this muscle contracts, it causes the hair to move from its normal, angled position to a vertically erect one.

When this occurs within many hair follicles, we see (and feel) the condition known as goosepimples, which is commonly stimulated by either cold or fear.

The action of these muscles is more important in furry mammals, as it allows them to trap a large amount of air within their fur for insulation from the cold.

Hair thinning and baldness



Hair growth is fastest between childhood and early adulthood. After about the age of 40 this high rate of growth starts to fall as the hair follicles begin to age.

Hairs are not replaced as rapidly when they fall out, leading to general thinning, and some degree of baldness in both men and women. Thinning of the hair is also caused by the replacing of coarse terminal hairs with less noticeable, softer vellus hair.

After the age of around 40, hair follicles start to age and hair is not replaced as quickly as it falls out. Thicker terminal hair is also replaced by thinner vellus hair.

ONSET OF BALDNESS

True baldness, which is usually known as male pattern baldness, is a different condition, linked to a number of factors. These include:

- Family history
- Levels of androgens (male sex hormones)
- Increasing age.

It is believed to be due to a gene that only 'switches on' in adult life and somehow alters the response of the hair follicle to circulating hormones.

Abnormal hair thinning or loss may also be linked to a wide variety of medical conditions and treatments of which doctors should be aware.

How the body produces sweat

Sweat is secreted from the sweat glands during physical exercise, stress and in excessive heat. It is produced in two different types of glands, both of which are located in the dermis of the skin.

The body constantly produces sweat. This process is the body's main way of ridding itself of excess heat.

The amount of sweat the body produces depends upon the state of emotion and physical activity. Sweat can be produced in response to stress, high air temperature and exercise.

SWEAT GLANDS

Sweat is manufactured in the sweat glands. These are located in the dermis of the skin, along with nerve endings and hair follicles. On average, each person has around 2.6 million sweat glands, which are distributed over the entire body, with the exception of the lips, nipples and genitals.

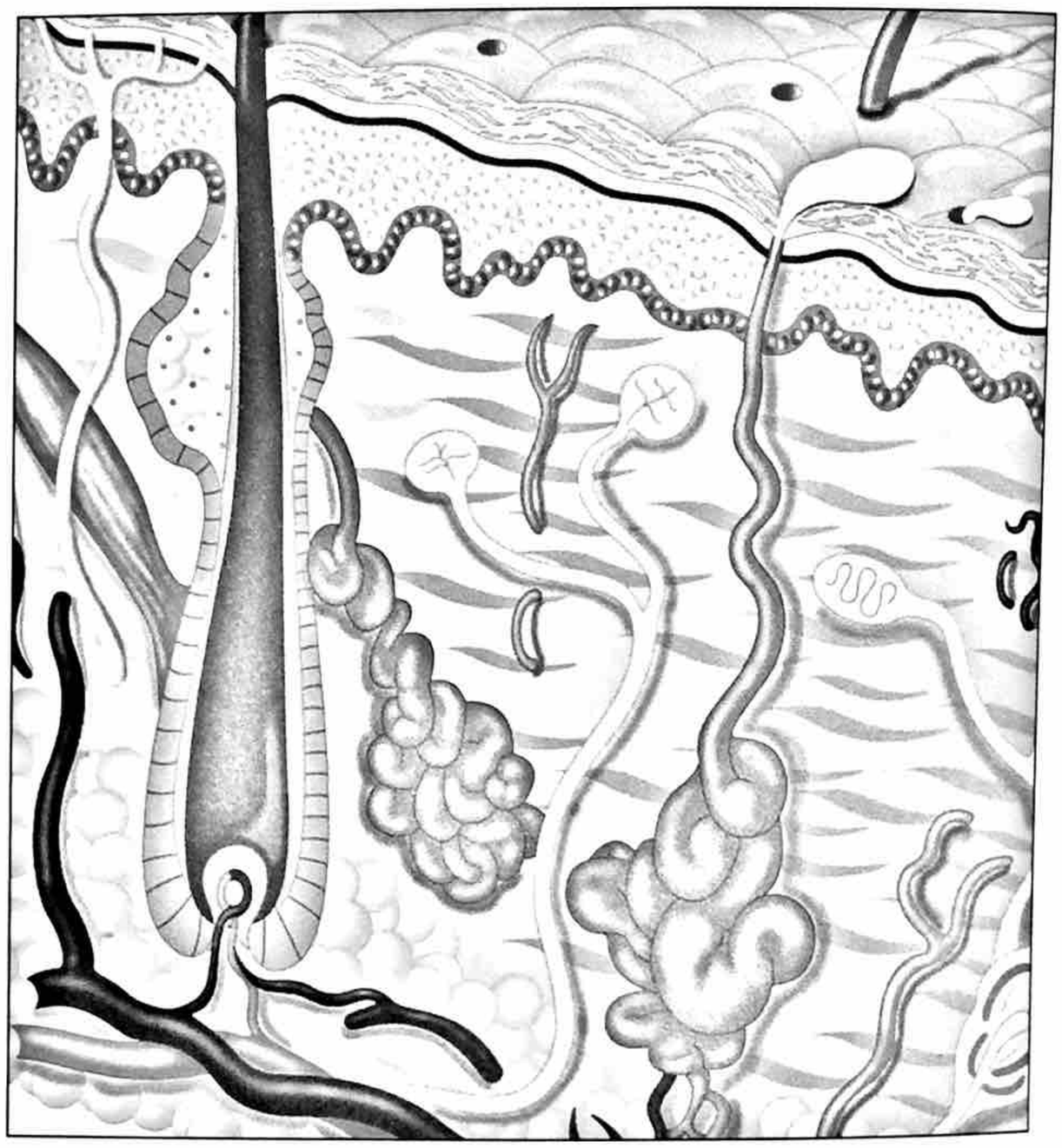
Sweat glands consist of long, coiled, hollow tubes of cells. The coiled portion in the dermis is where sweat is produced. The long portion is a duct that connects the gland to tiny openings (pores) located on the outer surface of the skin. Nerve cells from the sympathetic nervous system (a division of the autonomic nervous system) connect to the sweat glands.

TYPES OF SWEAT GLAND

There are two types of gland:

- Eccrine – these are the most numerous type of sweat gland, found all over the body, particularly on the palms of the hands, soles of the feet and forehead. Eccrine glands are active from birth
- Apocrine – these sweat glands are mostly confined to the armpits and around the genital area. Typically, they end in hair follicles rather than pores. These are larger than eccrine glands, and only become active once puberty has begun.

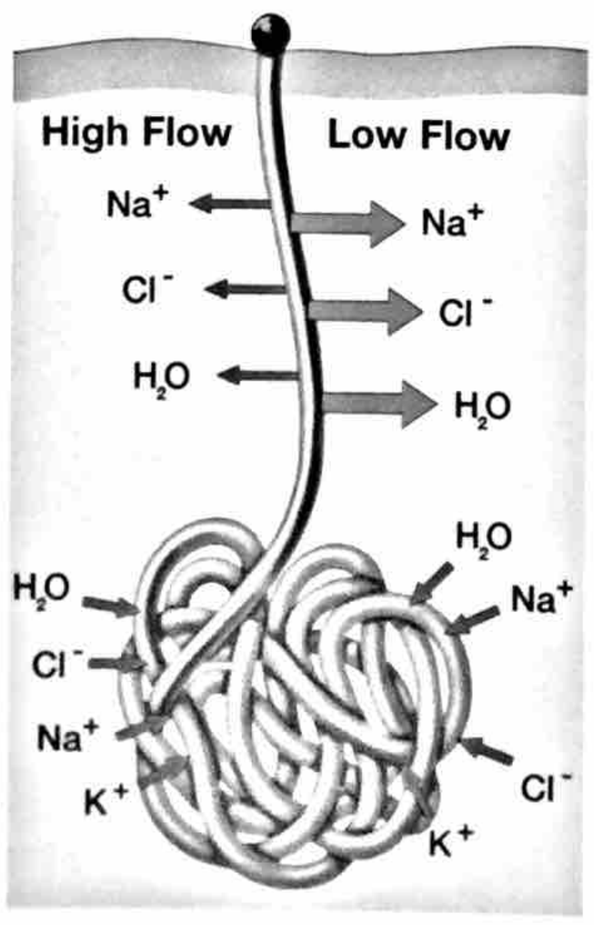
Sweat is produced in sweat glands, located in the dermis. These glands comprise long, coiled tubes of cells that connect to pores on the skin surface.



Sweat production

Stimulation of an eccrine gland causes the cells lining the gland to secrete a fluid that is similar to plasma, but without the fatty acids and proteins. This is mostly water with high concentrations of sodium and chloride (salts) and a low concentration of potassium.

This fluid originates in the spaces between cells (interstitial spaces), which are provided with fluid by the blood vessels (capillaries) in the dermis.



The fluid passes from the coiled portion and up through the straight duct. What happens to this fluid when it reaches the straight portion of the sweat duct depends upon the rate of sweat production.

- Low sweat flow – at rest and in a cool environment, the sweat glands are not stimulated to produce much sweat. The cells of the straight duct have time to reabsorb most of the water and salts, so not much fluid actually reaches the surface of the skin as sweat.

The composition of this sweat is different from that of its primary source: it contains less sodium and chloride, and more potassium.

- High sweat flow – this occurs in higher temperatures or during exercise. Cells in the straight portion of the sweat duct do not have time to reabsorb all the water, sodium and chloride from the primary secretion. As a result, alot of sweat reaches the surface of the skin, and its composition is similar to that of the primary secretion.

The constituents of sweat vary according to temperature and activity. If sweat production is minimal, then the sweat contains less salts.

APOCRINE SWEAT

Sweat is produced in the apocrine glands in a similar way, but apocrine differs from eccrine sweat in that it contains fatty acids and proteins. For this reason, apocrine sweat is thicker and milky-yellow in colour.

ODOUR

Sweat itself has no odour, but when bacteria present on the hair and skin metabolize the proteins and fatty acids present in apocrine sweat, an unpleasant odour is produced. Deodorants are designed to eliminate this distinctive body odour.

The role of sweat

When sweat evaporates, it takes excess body heat with it. In a very hot climate, the sweat glands can produce up to three litres of sweat an hour.

The role of sweat is to cool the body. Sweat on the surface of the skin evaporates into the atmosphere, taking with it excess body heat.

VAPORIZATION HEAT

Heat loss from sweating is governed by a basic rule of physics. Heat is required to convert water from a liquid to a vapour (gas); when sweat evaporates this heat is taken from the body.

However, not all of the sweat evaporates and much runs off the skin and is absorbed by items of clothing. Not all heat energy produced by the body is lost through sweat; some is directly radiated from the skin to the air, and some is lost through breathing.

EVAPORATION RATE

Humidity affects the rate at which sweat evaporates. If the air is humid, for example, then it already has water vapour in it and might not be able to take more (near-saturation). If this is the case, then sweat does not evaporate and cool the body as it does when the air is dry.

When the water in sweat evaporates, it leaves the salts (sodium, chloride and potassium) behind on the skin, which is why the skin can taste salty.

DEHYDRATION

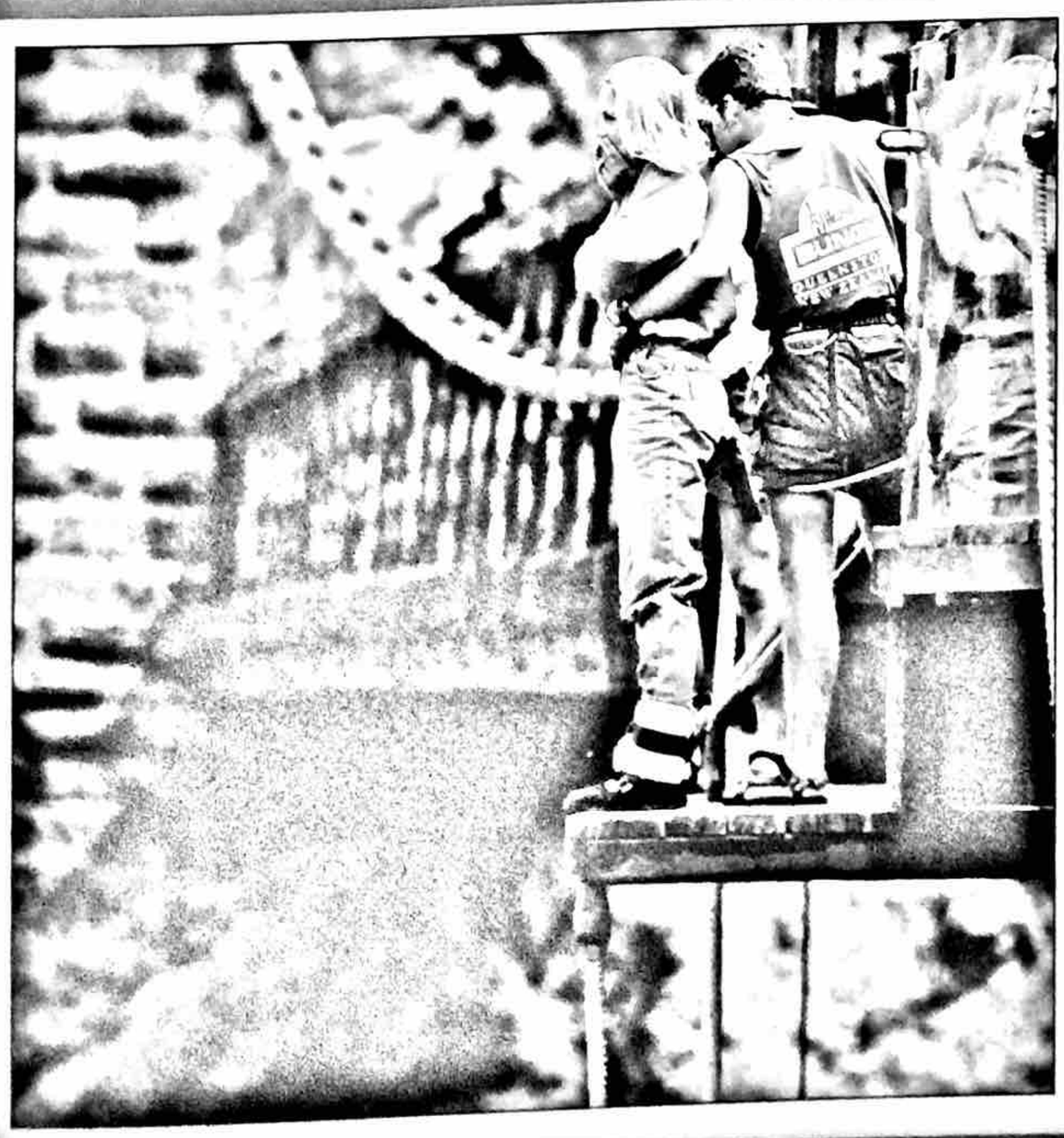
A body that is not acclimatized to very hot temperatures can easily produce one litre of sweat per hour. In fact, the maximum amount that the body can produce appears to be around two to three litres per hour.

The loss of excessive water and salts from the body can lead to dehydration, causing circulatory problems, kidney failure and heat stroke. It is important therefore to drink plenty of fluids when exercising or in high temperatures.

Specialized drinks are also available for people taking part in sports – these contain vital salts to replace those lost through sweating.

In areas of high humidity, such as tropical rain forests, the air is already saturated with water. Thus, reduced evaporation of sweat prevents body cooling.

Other causes of sweating



Sweating can also occur as a result of nervous activity, or as the sign of a disorder.

Nervous sweating

Sweating responds to the emotional state. If a person is nervous, afraid or anxious, there is an increase in sympathetic nerve activity, and an increase in adrenaline secretion from the adrenal gland.

Adrenaline acts on the sweat glands, particularly those on the palms of the hands and armpits, causing them to produce sweat. This phenomenon is often referred to as a 'cold sweat' and is a factor exploited in the use of lie detector tests. This is because the increased sympathetic nerve activity in the skin changes its electrical resistance.

People in stressful situations can sweat in the absence of a high temperature. This is due to an adrenaline surge that stimulates the sweat glands.

Excessive sweating

Diaphoresis or hyperhidrosis is a condition in which excessive sweating occurs. The exact cause of this embarrassing condition is not known, although it may be due to the following:

- Overactive thyroid gland – the thyroid hormone increases body metabolism and heat production
- Certain foods and medications
- Overactivity of the sympathetic nervous system
- Hormonal imbalances – for example the menopause.

If the problem of sweating becomes severe, surgery to remove the sympathetic nerve trunk may be performed – this procedure is know as a sympathectomy.