**15. Hair**

**TOPIC 1: THE STRUCTURE AND FUNCTION OF HAIR**

Hair grows in follicles which are in the dermis, the layer of skin beneath the epidermis. (See Chapter 3 for more details of the skin and its structure.) The dermis is connected to the blood and lymph supply as well as the nerves. It is made up of connective tissue, containing sweat glands, sebaceous glands and hair follicles.

**HAIR FOLLICLES**

The hair follicles travel through the epidermis and the dermis. The erector pili muscles are attached to each hair and help with temperature control of the body by pulling the hair upright and trapping a layer of air – goose pimples to keep the body warm (vasoconstriction).

**SEBACEOUS GLANDS**

Associated with each hair follicle is a sebaceous gland. These produce sebum, a fatty acid which keeps the skin moist and lubricates the hair shaft. When sweat and sebum combine on the surface of the skin they form the acid mantle, a protective shield which helps to control bacteria levels, prevents infections and disease, and acts as a natural moisturiser. The pH balance of the skin is 4.5 – 5.6 and this acid environment helps to prevent bacterial growth.

**The hair consists of three different layers:**

* **The Cuticle -** is the outer layer which consists of overlapping, transparent keratin scales.
* **The Cortex -** middle layer consists of elongated cells which contain the pigment melanin, this is what gives the hair its colour.
* **The Medulla -** is the centre of the hair and is composed of loosely connected keratinised cells.

**The layers of the follicle consist of the following:**

* **The Inner Root Sheath -** which includes the Cuticle which interlocks with the cuticle of the hair, Huxley's layer which is 2 or more cells thick and the Henle's layer which is one cell thick.
* **The Outer Root Sheath -** this forms the follicle wall and is a continuation of the growing layer of the epidermis of the skin.
* **Vitreous Membrane -** this separates the connective tissue from the outer root sheath.
* **Connective Tissue -** This surrounds both the follicle and the sebaceous gland providing both the sensory supply and blood supply.

The Dermal papilla supplies the follicle with the blood and nourishment required for growth.

**TYPES OF HAIR**

The hair growing on a human body can be one of three different types, depending on how old the person is and where the hair is growing.

**Lanugo hair**

About six months before a child is born, it begins to develop a coat of fine, soft, downy hair all over its body. These hairs begin growing at the same time, and grow at the same rate. The lanugo hair is normally shed one month before the child is born, but premature babies may be born still covered in lanugo hair.

**Venus hair**

The follicles that produce vellus hairs have no sebaceous glands, and are distributed over most of the body, with the exception of the soles of the feet, palms of the hands, the lips and nipples. Pale in colour, vellus hairs themselves only grow to one to two centimetres in length.

**Terminal hair**

What we normally think of as hair is called terminal hair, and is produced by hair follicles with sebaceous glands. It grows on the head, areas of the face, underarms and the pubic area. Congenital tendencies to baldness may result in terminal hairs becoming shorter and thinner, so that they resemble vellus hairs.

**HAIR GROWTH CYCLE**

The hair that we so often describe as 'growing' is actually mostly dead. The hair grows at its base, the hair bulb, in the follicle, and the hair we see above about a centimetre from the skin is in fact a dead shaft of keratin. The hair will grow from its base in the follicle for many years, and then falls out. The follicle rests for a while, and then resumes production of a new hair. This hair growth cycle has three stages, called the Anagen, Catogen and Telogen.

**Anagen**

The anagen, or growing, phase can last from two to seven years, during which time the hair grows vigorously, at a rate of about a centimetre per month, although the hair can grow more quickly in the summer. Untrimmed, each of our hairs would grow to about a metre long before falling out! During the anagen phase, the hair bulb generates the pigment melanin, which gives our hair its colour. The length of the anagen stage of the cycle is an inherited characteristic.

**Catagen**

The anagen phase is followed by a phase of two to four weeks when the follicle rests. This phase is called the catagen, or intermediate, phase. The bulb produces neither hair cells nor pigment, and shrinks slightly, becoming less deep.

**Telogen**

In the telogen phase a new hair begins to grow in the hair follicle. As it does so, the old hair will be shed as we brush or wash our hair. By the end of the telogen phase, which lasts about three months, the old hair has been shed, and a new one is growing from the follicle and out of the skin, ready to begin its own anagen phase.

**FACTORS THAT AFFECT THE HAIR GROWTH CYCLE**

A range of factors can affect hair growth. These factors may be hormonal, dietary, environmental or, as we saw when discussing the hair growth cycle, they may be hereditary.

**Hormonal factors**

As we will see in the next topic on the endocrine system, there are a variety of hormonal factors that affect the hair growth cycle. As the state of the endocrine system changes as an individual grows, and varies according to stress, menstrual cycles, etc., the hair growth cycle is also affected.

Changes in androgen (male hormone) levels particularly affect the hair, and affect the rate of hair growth and the thickness of the hairs.

Female hormone levels (oestrogens) slow hair growth and extend the growing phase of the hair growth cycle.

As a result, hair growth can be affected in several ways by the balance of androgens and oestrogen in the blood. At the time of puberty the rise in androgen levels is responsible for the hair on the body changing into recognisable terminal hair, and the development of underarm and pubic hair. Later in life, changes in hormone levels will increase face, chest, nose and ear hair growth. In women, hair growth can be affected by hormonal changes during pregnancy, when they have high levels of oestrogen. and during the menopause when the oestrogen levels reduce.

Other hormones can also affect the hair, example thyroid hormone accelerating hair growth.

**DIET AND ENVIRONMENTAL FACTORS**

Hair growth can be affected by both general diet, and specific dietary deficiencies. A very poor diet can lead to hair loss, through its effect on the endocrine system, and the changes of hormone levels that it induces. This can be seen in people who go on crash diets, or those who suffer from anorexia. Problems may also be caused by factors as varied as anaemia, alcohol consumption, or a lack of Vitamin B or zinc in a diet.

**TOPIC 1: THE EAR**

The ears provide hearing and maintain body balance. The ear structure has three parts - the outer ear, the middle ear and the inner ear.

**THE OUTER EAR**

The outer ear is the visible part of the ear. It protects the inner structures from damage. The External auditory meatus (auditory canal) is lined with ceruminous glands and hairs, which filter out dust and foreign particles. The outer ear is also the passage for sound waves. The tympanic membrane (eardrum) separates the auditory canal from the middle ear.

**THE MIDDLE EAR**

The middle ear is found within a cavity in the temporal bone. It has minute bones known as auditory ossicles that transmit sounds from the tympanic membrane to the inner ear.

**THE INNER EAR**

The inner ear is responsible for hearing and balance. Within the inner ear structures, the vibrations of sound waves are translated into nerve impulses. Structures within the inner ear, the semicircular canals and vestibule, help to maintain posture and balance.

**THE EUSTACHIAN TUBE**

The Eustachian tube connects the middle ear to the throat. It maintains the atmospheric pressure of air within the ear, enabling the eardrum to vibrate as the sound waves reach it. This is vital for hearing.

The ears are complex, sensitive organs and are susceptible to damage in many ways. Loud noise or trauma many damage the sensitive receptors in the ears, causing hearing loss. Viral or bacterial infections may cuase disorders such as Otitis media. Problems with the inner ear can cause conditions such as Menieres disease, tinnitus, vertigo or labrynthitis, which affect the balance and health of the client.

**TOPIC 2: THE NOSE**

**STRUCTURE**

Most of the nose is concerned with breathing: inhaling air into the body and exhaling it from the body (see p.158). However, it is also the organ of smell. At the top of the nose there are two areas of pigmented tissue known as olfactory membranes. They contain the olfactory, or smell-sensing cells, which have fine hair-like protrusions called cilia. The olfactory cells connect to nerves in an area known as the olfactory plexus. Once triggered, these nerves send messages along the olfactory nerves to the brain, particularly the limbic system. This area of the brain deals with memory, emotions, our basic instincts and mechanical functions.

**FUNCTION**

When odor molecules pass over the olfactory cells, it is thought that these cells trigger receptor areas which send an impulse via the olfactory plexus and nerves to the brain. Here the information is processed and interpreted (i.e. is it a new smell, a nice smell, a smell withpositive or negative associations?). Depending on the interpretation, the brain sends messages to other parts of the body to elicit a response.

**TOPIC 3: THE EYE**

The eyes are the organs of sight. They are positioned separately, but function generally as a pair, assisting in the maintenance of balance.

The eyelids are layers of tissue above and below the front of the eye. They protect the eyes through blinking (20-30 times per minute) and the eyelashes that line the edges of the eyelids filter and trap substances such as dust. Sebaceous and mucous secretions lubricate the eyelids. Lacrimal glands secrete a fluid that keeps the surface of the eye moist and prevents the cornea from drying out. If a foreign body enters the eye, extra fluid is produced to wash away the particle. Parasympathetic stimulation of these glands causes crying, when large amounts of fluid are produced.

The eyes have a fibrous outer layer known as the sclera or white of eye. At the front of the eye this is covered by a thin mucous membrane, the conjunctiva. The conjunctiva also lines the inside of the eyelids and helps prevents damage and drying of the eye through mucous secretions.

The eye is divided into two sections, or chambers, each one filled with fluids that maintain the internal pressure and shape of the eyeball. The anterior chamber sits between the cornea and the lens and contains the aqueous humour. The vitreous chamber is the cavity behind the lens and is filled with the vitreous humour.

Light enters the eye through a transparent dome, the cornea, and it is focused onto the retina at the back of the eye. It passes through the cornea, the pupil and the iris. The iris is the coloured disc in the centre of the eye, and it controls the amount of light entering through dilation or contraction of the pupil, which appears as a black dot in the middle. The pupil dilates when the light is low and contracts when the light is bright, permitting or restricting the passage of light through the opening. The lens of the eye sits behind the pupil and refracts (bends) light reflected by objects. The ciliary muscles control the thickness of the lens,

refracting light and allowing the eyes to focus. The lens becomes thicker to focus on objects nearby and thinner to focus on objects in the distance.

The retina forms the inner layer of the eye wall. It contains light sensitive cells (photoreceptors). Near the centre of the retina is the macula, which is highly sensitive and contains millions of photoreceptors called rods and cones. The photoreceptors permit the conversion of light rays into nerve impulses. In the centre of the macula is a small dimple, the fovea, which provides sharpest vision and is the location of most colour perception At the nasal side of the macula, the nerve fibres gather to form the optic nerve, one of the cranial nerves. This nerve leaves the eye through an area known as the blind spot, where there are no light-sensitive cells.

**TOPIC 4: DISEASES AND DISORDERS (PATHOLOGIES)**

**THE EAR**

**Deafness -** Partial or complete loss of hearing.

**Labrynthitis** - Is an inflammation of the inner ear which can cause balance disorders.

**Meniere's disease -** Is a disorder of the inner ear that can affect hearing and balance. It is characterized by episodes of dizziness and tinnitus and progressive hearing loss, usually in one ear.

**Motion sickness -** Is the state of being dizzy or nauseated because of the motions that occur while travelling in or on a moving vehicle.

**Otitis media -** Is an acute or chronic inflammation of the middle ear.

**Tinnitus -** Is a ringing or booming sensation in one or both ears; a symptom of an ear infection.

**Vertigo -** Is dizziness: a reeling sensation; a feeling that you are about to fall.

**THE EYE**

**Blepharitis -** Inflammation of the eyelids characterized by redness, swelling and dried crusts.

**Cataracts -** An eye disease that involves the clouding or opacification of the natural lens of the eye.

**Conjunctivitis -** An inflammation of the eye's outer membrane, which causes redness, swelling, itching and watering in one or both eyes and is contagious.

**Corneal ulcer -** Is an inflammatory or, more seriously, infective condition of the cornea, involving disruption of its epithelial layer with involvement of the corneal stroma.

**Glaucoma -** An eye disease that damages the optic nerve and impairs vision (sometimes progressing to blindness).