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# Hair Follicle Cloning and Gene Therapy

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**Abstract:** ***Androgeneticalopecia (AGA) is the most common factor for hair loss. Hair loss is due to continuous minimaturization of affect hair follicles.Hormones that play an important role in AGA are DHT hormone.Hair follicle cloning is the cure for the hair loss in which hair follicle cells are multiplied (in vitro). Three types of treatments in future such ascosmetics, medical and surgical can be correlate and block DHT may help to prevent hair loss. Developing new medications for the target hair loss and causes fewer side effects to reducing DHT levels is to use medications to stop 5 alpha reductase enzyme required for converting testosterone to DHT and development of new drugs that will be more powerfully signal certain cells (bulbs).Gene therapy is another technique of fixing it, changing the genes.***

**Keywords:** Hair follicle cloning, Future cosmetic treatments, Future medical treatments, Future surgical treatments, Gene therapy, Gene identification

## 1. Introduction

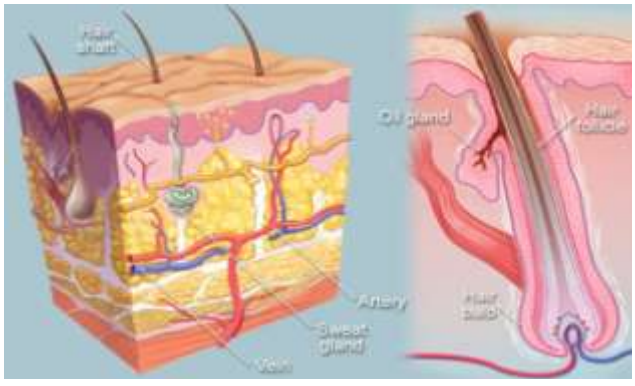
Grasp assumptions of cell biology, organ system development biology, Immune response medicine, process of controlled cell regeneration and differentiation, Human genetics.

Cell biology- cells are the brick work of life. Cells in a multi-celled organism have specialized characteristics that set up them to most efficient do their particular jobs. Individual cells in an organism work together with other similar cells in tissue, or they work together with different types of cells in specialized cell structures called organs. Ex- Hair follicle is a miniature organ. There are several different types of cells work together to grow a hair. Every mature cell is a structure called a nucleus that contains chromosomes composed of double strands of twisted DNA molecules hold information to make the proteins that allow it to perform particular function. Some proteins are structural such as Keratin protein in hair.While others have the function of sending messages, such as the hormone DHT, and some proteins such as the enzymes 5 alpha Reductase, help convert proteins from one form to another.

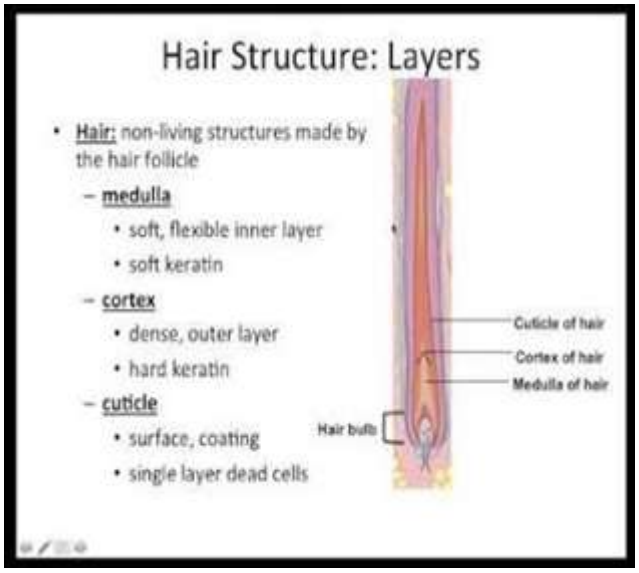
Genetics- Sections of DNA molecules that contain the code for particular types of proteins are called genes. All the genes commandfor make of discrete proteins. There are no genes for particular body characteristics, such as baldness/green eyes/curly eyes. But the particular types of proteins that genes, instruct the cells to make, in turn determine characteristics such as inherited hair loss, eye colour, hair curling. Usually, numberless different genes, and numberless different proteins, together determine particular inherited body characteristics. A remarkable feature of cells in a multi-celled organism is that each contains in its chromosomes a complete DNA blue print of all the genes for all the proteins for the entire organism. Ex- cells in the iris of the eye may make the proteins that express the characteristics for green eyes, but not the proteins that could cause pattern baldness/curly hair, or any of the other thousands of genetic traits of the organism. Unlocking the DNA information in mature specialized cells is an important aspect of some cloning techniques.

Cell replication- In a rapidly growing embryo, cells replicate by splitting in half and then growing to full size again. Cell mitosis and each half cell that splits containing a complete and exact set of an organism, it's cells begin to make specialized cell replication shifts to special precursor cells called stem cells. Matured specialized cells do not replicate easily, probably as a defence against cancer which is characterized by uncontrolled cell division. Some cells only last for days, other for years, other for decades but eventually all cells wear out. The inability of mature cells to replicate themselves limits the body's ability to repair itself, to heal wounds and to replace aging cells. It also makes the process of cloning more difficult. In mature organism undifferentiated cells called stem cells are responsible for replacing old or injured specialized cells. Stem cells are present in all repairing tissue, but most stem cells are difficult to detect in mature living organism. Stem cells in a mature organism are like embryonic cells, in that they can create many different types of specialized cells. When stem cells are not actively making new cells, they divide infrequently, which reduces the risk of undesirable DNA mutations. But when they are signalled to make new cells of a particular type, they produce typically short- lived intermediate cells called as transient amplifying cells. Which in turn engage in rapid cell mitosis and create the specialized cells that the organism need's.

## 2. Structure of hair



Hair is simple in structure.Hair is made of a tough protein called keratin. A hair follicle anchors each hair into the skin. The hair bulb forms the base of the hair follicle. In the hair bulb, living cells divide and grow to build the hair shaft. Blood vessels nourish the cells in the hair bulb, and deliver hormones that modify hair growth and structure at different times of life.
Hair growth occurs in cycles consisting of three phases:




Anagen (growth phase): Most hair is growing at any given time. Each hair spends several years in this phase.

Catagen (transitional phase): Over a few weeks, hair growth slows and the hair follicle shrinks.

Telogen (resting phase): Over months, hair growth stops and the old hair detaches from the hair follicle. A new hair begins the growth phase, pushing theold hair out.

Hair grows at different rates in different people; the average rate is around one-half inch per month. Hair colour is created by pigment cells producing melanin in the hair follicle. With aging, pigment cells die, and hair turns grey.

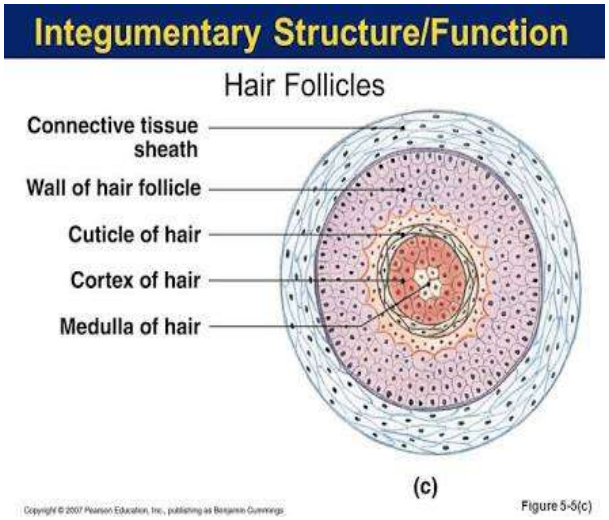
## 3. Hair Conditions

Alopecia areata: Round patches of total hair loss, usually from the scalp. The cause of alopecia is unknown; the hair usually grows back.

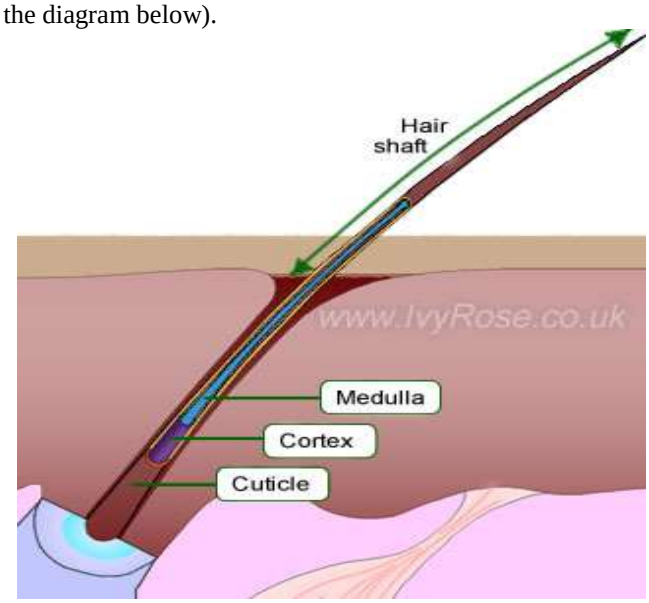
Male pattern baldness: The most common type of hair loss in men. Male pattern baldness usually includes either a receding hairline, hair loss at the crown, or both.

Female pattern baldness: In women, hair loss usually includes uniform thinning across the scalp, with a preserved hairline. The crown may be affected, but hair loss rarely proceeds to baldness as in men. See a picture of female pattern baldness.

Hair Cuticle-




The **cuticle** of a hair is the outermost layer of the hair (see the diagram below).




To appreciate this in the overall context of the structure of hair, note that, structurally, hairs are threads of fused (i.e. attached together), dead, keratinized cells. They consist of two main parts:

The hair shaft is the visible part of the hair that protrudes through the skin. It is composed of three layers. The innermost layer is called the medullaand is only present in large thick hairs. The middle layer is called the cortex and outermost layer is called the cuticle**.**

The hair root is the part of the hair below the surface of the skin that includes and/or interacts with many other associated structures within the dermis and hypodermis layers of skin.

**Hair follicle cloning-** A term that is often used to broadly a set of ideas on how to use laboratory techniques to solve problem of hair loss. Hair follicle cloning is a promising treatment for androgenetic alopecia, or common genetic hair loss that is being actively researched by pioneering hair restoration today. To develope “cure” for the hair loss. In hair cloning-A sample of a person’s developing hair follicle

cells are multiplied outside the body (in vitro) and thus new permanent hair is grown.

Hair follicle features - are Miniature hair growing organs cycle through growth and rest cycles. In addition to hairs being grown and follicle itself disintegrates almost entirely by the end of the regression phase, an almost entirely new follicle is created at the beginning of the next growth phase.

**1} Future cosmetic treatments**

In Future-Hair styling products that give much more powerful appearance of a full head of hair, compared to today's hair thickening gels and Hair shaft counting mousses.

In Future- cosmetic Hair appliances such as Hairpieces and wigs will likely be constructed of even finger and much with durable materials, which will appear and feel even more genuine, and be even less detestable.

Advantages will be Time consuming, less maintenance and replacement. Attachment methods will continue…Very secure, Easier, Faster to release, Reducing maintenance effort and Improving hygiene. Ex-Spa

**2} Future medical treatments**

Currently we don't have a complete understanding of exactly whycertain disease cause hair loss? Ex-alopeciaareata, thyroid problems, Cancer-Hodgkin's lymphoma, Muscular dystrophy (adult form), Pituitary gland, HIV.

In many cases we treat the symptoms such as thinning of hair, shedding of hair, loss hair all over your scalp (general hair loss), loss of hairs only in one area (focal hair loss), inherited hair loss and not the causes of the diseases such as stress, chemotherapy, wearing tight braids/ponytails, curling/ straightening irons, colour dyes and malnutrition. Our ability to treat symptoms has limited effectiveness.

Today's doctors prescribe to counteract androgenetic alopecia (genetic pattern hair loss) and these prescribed have only a limited effect on some patients and the cost of drugs that must be taken continuously adds up to a large life time expense. Unanswered questions are such as control of normal hair growth, various disease conditions affecting hair growth. New medicines will be developed which more effectively target the hair loss and less side effects.Previous research shown the 5 alpha Reductase inhibitors can shrink an enlarged prostate within 3 months to 2 years of use.

In market-prescribed to treat enlarge prostate glands are dutasteride and propecia *drug's* currently being sold under the brand name of Avodart and Proscar. Like propecia, dutasteride is a 5 alpha Reductase inhibitor taken as a pill, it has been shown to dramatically decrease the amount of testosterone in the blood from being converted into dihydrotestosteron (DHT). High level of DHT in the blood over many years can cause enlarged prostate glands in men.DHT in the blood stream also signals hair follicles to reduce hair growth, causing pattern hair baldness in people who have inherited hair follicles that are sensitive to DHT.Reducing DHT in blood causes the chemical message to "Stop growing hairs" to become weaker and which will not affect the susceptible hair follicles.

Important aspects of lowering DHT levels are as below-

1) To reduce DHT levels is to use a medication to stop the 5 alpha Reductase enzyme from converting testosterone one in to DHT.
2) If testosterone is not converted to DHT, the DHT message never gets to the cells in the susceptible hair follicles will continue to grow new hair.

There are 2 types of 5 alpharRductase:

1) AlphaReductase that convert testosterone to DHT.
2) While propecia, effectively blocks the type 2 5 alpha Reductase enzyme, dutasteride had been show to effectively block both type 1 and type 2, 5 alpha Reductase.

While Propecia use typically results an65 to 70% decrease in DHT in the blood of Men and Dustasteride has been shown to decrease DHT in the blood by 90% or more. Dustasteride will work better for females with inherited pattern hair loss than any other medication currently available , as well as good results from Propecia.

Side effects- Dustasteride are believed to be same as Propecia. However, dosage appropriate for treating genetic hair loss has not been determined, and side effects are dosage related.

Prevent the effectiveness of hair loss by the medications & simultaneously reduce side effects are to target the cells causing the hair loss.

In future applying topical lotions to the scalp that more effectively block DHT message from getting in to hair follicle cells.

At present medications in pill forms are-Propecia and Dustasterid which effect DHT levels in the blood and DHT concentrations at the cellular level in hair follicles. As, a result of treating the entire system with the medication, unwanted side effects can occur in areas other than the hair follicle cells.

It is possible to have better affect of DHT levels in the cells in the hair follicles, which control hair loss, and reduce unwanted side effects.

In future Medications will be combined with shampoos or hair conditioners, and these products will become a common way to keep hair from falling out, such as fluoride in tooth paste is now used to help prevent teeth from falling out.

Advance medications can be used for treating hair loss conditions other than genetic pattern hair loss. Development new drugs which will be more powerfully signal certain cells in the hair follicles to start or remain in the anagen (growing phase), and continue to grow hair, even when they get other signals to shut down, such as from sudden stressful events.

Diseases that cause temporary hair loss are called Non-scarring alopecia by Doctors. These diseases do not harm or scar the hair follicle in permanent way. The hair is lost, but it either grows all by itself, or with the right chemical signals, can be made to regrow.

Hair losses that are resulting from the chemotherapy, and moderate doses of radiation treatment, are non-scarring. Hair shafts that are pulled or plucked from the follicle do not permanently damage the follicle. After been plucked, the follicles rest and recovers and a new hair bulbs is grown, and it then forms a new hair.

Non-scarring alopecia affect the "bulb" portion of the hair follicle, which is located at the base of the follicle deep in the skin. The specialized cell in the bulb do the work of growing the hair shaft for 4 to 6 years during each hair growth cycle, but at the end of the growth cycle they seem to deteriotes as the hair follicle shrink in size and enters the rest stage of the normal growth cycle.

In future it is possible to protect the cells in the "bulbs" of the hair follicles which may result in more effective treatment for alopecia areata, as well as less hair loss from stressful events and cancer treatments.

Diseases thatcause's permanent hair loss are called scarring alopecia by the Doctors. The disease alters or scars the hair follicle in such a way that it loses the ability to grow new hairs. Some scarring alopecia, such as lupus erythematosus and lichen planopilaris, trigger inflammatory immune response where the body white blood cells attack cells in the "bulge" area of the hair follicle. The bulgearea is located near the middle of the hair follicles, below the attachment point for the arrectorpili muscle (tiny muscle that allows hairs to stand "stand on end"). androgenetic alopecia (genetic pattern hair loss) is also considered as soarsing alopecia, it diminishes hair follicle production overtime until no new hairs are grown.

New research- The area of inflammation in these permanent hair loss diseases is the "bulge" portion of the hair follicle and certain cells in the "bulge" portion of the hair follicle are believed to be responsible for re-growing of hair follicle at the beginning of each new growth stage.

It is believed of each growth stage, certain cells in the "bulge" produce the cells in the bulb which in turn grow new hairs. When the cells in the "bulge" are injured, the hair follicle is not able to grow a new bulb, and no new hair is produced.

In future medications that protect the cells in the "bulge" area of the hair follicle will more effectively treat permanent hair loss diseases, including genetic pattern hair loss.

**3} Future surgical treatments**

Surgical treatments available today are less effective because no new hair is added.

The art of surgical hair restoration is rearranging the patients existing DHT- resistant hair follicles, for an appearance that looks fuller.

Current surgical methods simply cannot produce a full head of thicker hair and current surgical methods are very intensive and costly.

Improvement in surgical treatment is done by cloning hair follicles. Successfully cloning- multiple hair follicles from a donor area follicle that is already programmed to continue to grow new hairs for a life time will result in a limitless supply of hair transplant grafts, which translate into limitless hair thickness. The cloned follicles may even be individually, injected directly in to the scalp, eliminating surgery. Scientist has already cloned an entire sheep, why it is not possibleto carry out human hair follicle cloning?

**Gene therapy** is changing of genes for treating inherited diseases. By gene therapy functions of cells are changed, which can be applied for inherited hair loss.With gene therapy- The hair follicles with DHT sensitive cells could be changed in to follicles with DHT resistant cells and hair follicles would continue to grow new hairs for a lifetime.

It is a study how an inherited medical condition occurs at the DNA molecule level and then going in and fixing it. It is a fashion of changing genes of extant cells in the body, and there by mutate cell function. For construe the inherited hair loss. Follicle cells of single individual containing cells with same DNA can express different characteristics such as DHT resistance and DHT sensitivity. It is the challenge to identify these genes and to change them slightly so that they will synthesize the proteins which create DHT resistance hair follicles rather than DHT sensitive, without any unwanted side effects.

Genes can be modified from DHT sensitive to DHT resistant. But care should be taken that there will be no any unwanted side effect.

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