

## HUMAN HAIRS: WHY WE HAVE LONG SCALP HAIRS BUT SHORT BODY HAIRS

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### ABSTRACT

**INTRODUCTION** – Hairs are non-vital but have very importance in our personality. We all pay attention to improve quantity and quality of hair for cosmetic reasons. But we want to remove our body hair for some cosmetic reason. By this article we can know all about our hairs (Head + body hairs). Because only modern human beings have long hairs on head and short hairs on rest of the body. Primitive man has large hairs. But when man moves from one place to another for hunting, physical appearance of human gets changed to counteract heat and parasites. **CONCLUSION**- During evolution changes have occurred. Further now – a – days mostly man faces with problem of hair fall. By Medications and by hair transplantation (in baldness) we maintain hairs on our head. Although hair-fall is a natural process (in limited number). Old hair fall and new healthy hairs grow in place of damaged hairs (Hair growth cycle).

**KEY – WORDS**- Hairs, hair fall, evolution, hair transplantation, Body-hairs, U.V. rays

### INTRODUCTION

Hair is actually a modified type of skin. Made by multi-layered flat cells (Epithelium- stratified squamous keratinized). Rope like filaments provide structure and strength of hair shaft.

**HOW HAIRS GROW** – Hair grows out of skin by hair-follicle (situated in dermis of skin).

1. Hair starts growing from root in bottom of hair follicle. Root is made up of protein cells.

2. Scalp/surrounding blood vessels give nutrition to the root, by which more and more cells create and hair grows in length.

3. Hair pushed upward out of skin along with a sebaceous gland. This gland gives natural oil to hairs and keeps hairs shiny and soft. It also makes hairs greasy. That's why we need to wash our hairs.

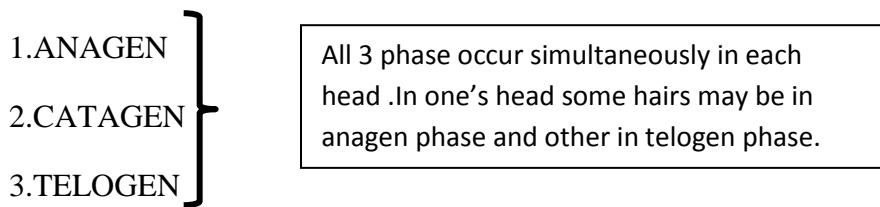
4. By time hair dies when it became out of skin .Therefore hairs are dead ,this is the reason why we don't feel pain when hair are cut.

SOME FACTS-

1. We have about 5 million hairs since childhood.
2. we have about 100,000 hair follicles on our scalp.
3. Male hair grows faster than female hairs.

Hair strand is made by protein and cells that make strand are 2<sup>nd</sup> fastest growing cells of body .(1<sup>st</sup> is -fastest growing cells are of bone –marrow ,which is found within bone).Hairs grow approximately 6 inch per year (1.25 c.m. or 0.5 inch per month).

HAIR GWOWTH CYCLE – 3 PHASES



1. ANAGEN PHASE – Also called as GROWTH PHASE

- A. In this hair grows approximately 1 c.m. per month<sup>1</sup>.
- B. It begins in form of hair -papilla and last for 2-6 years ( duration of growth is genetically pre determined).
- C. hair stay in anagen phase for a long time , If hair gain more length.
- D. Papilla divide and re-divide to produce hair –strand but hair –follicle buries itself into dermal layer of skin to nourish strand .
- E. Approximately 85-90% of hair in a single had are in anagen phase at any given time.

2. CATAGEN PHASE. -Also called as TRANSTIONAL PHASE

- a. Duration of this phase –about 2 weeks
- b. In this phase hair –follicle shrinks due to disintegration and papilla detaches and rest part of hair strand cut from its nourishing blood vascularity.
- c. First sign of this phase –cessation of melanin production in hair bulb and apoptosis of follicular melanocytes<sup>2</sup>.
- d. Ultimately hair follicle remain 1/6<sup>th</sup> of its original length and hair shaft push upward toward skin .
- e. In this phase only 1% of all hair of one's body at any given time .

3. TELOGEN PHASE Also called RESTING or SHEDDING PHASE –

A. Hair follicles remain dormant for 1-4 months.

B. In this phase epidermal cells which line the hair follicle, continue to grow and accumulate around the base of the hair. Now the hair only slightly anchors to its plane (Naturally hair which are out of the scalp only slightly anchor to its plane, therefore they can be torn).

C. After some time the hair follicle again starts to grow and softens the anchoring point of the hair shaft. The base of the hair breaks slowly – slowly and becomes free from its root and the hair will shed (shedding of hairs).

D. Once the Telogen phase is completed, again within 2 weeks new hair will start to grow.

Body hairs also pass through the same phases but the whole cycle lasts only for a month, that is the reason why body hairs have no length as hairs of the scalp.

Each scalp hair follicle grows as a hair strand for a few years because every follicle takes breaks at different times and other hairs keep growing, we don't notice when we lose hairs.

Follicles stop growing hair strands as we become older. So in older people hair density becomes thinner and after 50 years of age baldness starts.

Scalp massage helps to stimulate the blood vasculature of the scalp and remove dead skin cells – both of which encourage healthy hair growth. Trichologist (Expert of scalp and hair health) *Philip Kingsley* (founder of Philip Kingsley Haircare) says 'by using the balls of fingers to massage oil into the scalp, in direction from the hairline to the back of the head, blood flow in the scalp increases and hair follicle growth stimulates'.

*Kingsley* says – However, hairs are non-vital but nutritional deficiency often first appears as excessive hair shedding.

According to *Robert Dorin* (A hair restoration surgeon at True & Dorin Medical group in New-York city) 'Hair is more fragile and prone to break when it is wet. Because the protective layer, the cuticle, is slightly removed. So brushing or binding as in a ponytail done after hair becomes completely dry. *Dorin* says styling creams that maintain moisture of the hair cuticle without creating friction when being brushed. According to *Robert Dorin*, exposure to too much U.V. rays from sunbathing can weaken and damage hair, causing hair to look dull because keratin proteins in hair break down due to U.V. rays.

According to *Jill Crose* (A celebrity hair stylist of Los Angeles) 'Wet hair should not be wrapped in a towel or turban, it causes breakage of hairs.'

Hot water causes unnecessary loss by washing out its natural oil, damaging the hair root. But showering usually does not cause unnecessary loss of hair.

### Different texture of hair –

1. Straight/wavy, curly, kinky.
2. Fine (each hair is shiny and skinny) or coarse (each hair is rough, dull, thick)
3. Dense hairs (a lot of hairs) or sparse hair (not so much hair).

Straight or curly hair determine by shape of hair follicle. Oval shaped follicles give rise to curly hairs and round follicles give rise straight hairs. Type of hairs is genetically pre determined .Texture of hair may be or may not be change since childhood to adult .some times in childhood hairs are curly but when individual grown-up hair may be become straight or it may remain as such.

## EVOLUTION OF HAIRS

- 1.About 300 million years ago hair start to originate in *Synapsids* (common ancestor of mammals).
  - 2.In starting mammals (lower primates) very dense ,soft ,fine and small hair called as Fur are found on the all over body. Function of hairs in lower primates –protection from wound ,bites ,heat ,U.V.Rays.<sup>3</sup>
  - 3.humans are only primates species that have significant hair loss(general hairless in comparison to related species).
- Yet at present 5000 extant species of mammals are also has general hairless- Elephants ,Rhinocroses ,Hippocampus ,Walruses ,Hippopotamus ,Naked mole rates <sup>4</sup>.
- 4.human had lost body hair (but retained hairs on scalp and pubic area) since 3.3 million years ago.(up-to this age Gorilla have louse on his body ,but in no one ancestral human, louse found because when hair is less on body ecto-parasite<sup>5</sup>s can never live a long time).
  5. It may be due to loss of function in pseudo-gene *KRTHAP1* . This gene help in producing keratin in human lineage before about 240,000 years ago .On the individual basis , mutations in gene *HR*<sup>6</sup> can lead to complete hair-loss ,But this is not typical in human.

Clothing start approximately 100.000 years ago. This also is a factor for hair-less-ness in modern human.

During gradual process in which Homo-erectus start a transition from furry skin to naked skin expressed by Homo-sapiens ,Hair texture gradually changed from straight hair (Fur is present on mammals including human's closest cousins –chimpanzee) to Afro-textured hair or kinky (ie.tightly coiled).This is explained on the bases of that curly hairs better impedes passage of U.V. Rays in to body in comparison to straight hair. Therefore curly or coiled hair are beneficiary in light –skinned hominids living at equator .It is also supported by *Lyengar*' s(1998) findings that ultra –violet light can enter into straight human hair roots and thus into body through skin via hair shaft.

This phenomenon just like passage of light through fiber-optic tubes (which don't function effectively when tubes are kinked or sharply curved or coiled). In this way when hominids (Homo-erectus)were gradually lose their straight body hairs and exposed initially pale skin underneath their fur to sun ,straight hairs would have gone to an adaptive change. When humans travelled farther from Africa ,straight hair may have evolved to aid entry of ultra –violet light into body during transition from dark ,U.V. Light protected skin to paler skin .

*Nina Jablonski* <sup>7</sup> (Anthropologist) suggest that Afro –hair (tightly coiled but sparse hairs)are comparatively sparse dense and springy coils ,this combination provide an airy ,almost sponge –like structure that facilitate an increase in circulation of cool air onto scalp .In addition wet Afro-hair does not stick to the neck and scalp and

have a tendency to retain its basic spongy puffiness because it less respond to moisture and sweat in comparison to straight hairs.

In cold climate hairs are straight and naturally fall over ears and neck to enhanced comfort level (prevention) in cold climate.

The EDAR LOCUS – is a region of modern human genome that contributes to hair texture variation in most individuals of East –Asian descent .this support hypothesis that’s why in East –Asian straight hairs developed in ancestors of lineage of modern human subsequent to original expression of tightly coiled natural Afro –hairs .<sup>8,9,10</sup> Specifically relevant findings indicate that EDAR mutation coding for predominant East –Asia ‘coarse’ or thick ,straight hair texture arise about 65000years ago,at that time migration of primitive man start from ‘out of Africa’.

Why we loss body hairs – Mammals (including Human ) developed sweat gland for cooling their bodies as they moved for hunting. Sweating is very effective way to maintain temperature /heat control. Sweating happen in skin ,and blocked by Fur present on skin .For this requirement fulfilling mammals loss their fur . In primates over the time (course of generation) fur is replaced by small-small hairs. With time hair become comparatively thin and sparse.

Second hypothesis is that human hair was reduced in response to ectoparasites <sup>11,12</sup>( parasites found on skin).A hairless primate would harbor fewer parasites on skin .

Survive of fittest favour decreasing body hairs because those with thick hair –coat have more lethal disease ,carrying ecto-parasites and there-by have less fitness.

Another hypothesis – by use of fire,body hairs reduce in human body<sup>13</sup>.

Well truth is –human loss their body hairs with evolution. This occur due to in change in gene ,physical and chemical change in body environment .Therefore hair loss is a slowly physical change in human ,it is hard us to notice.

Body hair is miniaturized ,less dens and spread all over body . It is difficult to notice how much body hair we loss per day .and . Body hair will grow only to a limited length then stop to grow and then fall -out .And again grow new hairs on body (body hair –follicles are also unlimited growth cycles as our head hair-follicle). Body hair –follicles has very limited time period per growth cycles –only about 1 months ,so hairs can gain only a little length .We all noticed that most of hair on our body grows only to a certain length and then stop, so we need never hair-cutting on our forearm or on other body –parts. So We think our body hairs are permanent but in fact we loss our body hairs just as frequently as the head-hairs. All hair follicles of body eventually get older and stop working which is why our body hair become thin over time but this process is much slower than head hair . In our life time we clear cut observe scalp hair loss (specially in male- complete scalp hair loss -baldness) but rarely we observe all of (complete ) body hair fall ,because Protein makeup and susceptibility to testosterone and to environments is different for body and head hairs .If we live for a very long life (more than 80 years),than we can noticed approximately complete body hair -fall

**Function of hairs in Human-**

- 1.All hairs of body (head + body hair)help to regulate body temperature and also reduce friction during body movement .
- 2.Hairs of human and modern animals are connected to nerves ,so act as a transmitter for sensory input.

**Types of hairs-**

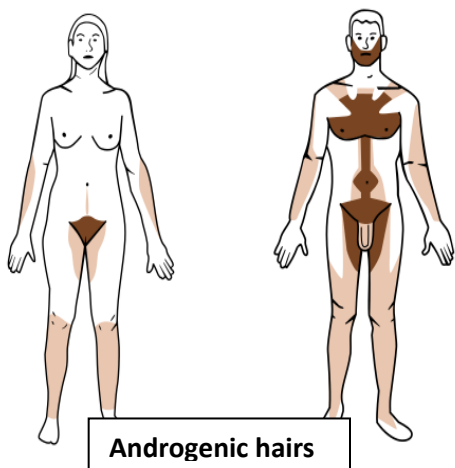
1. Villus- found since birth and remain throughout all life in females (in cheeks ,arms).These hairs are small,very thin,light coloured and some what invisible.
- 2.Androgenic hairs -after puberty at arm pit legs, pubic area in both sex and in male mooches ,bar brio . these are Long ,Thick ,dark colored hairs ,also found on scalp .

**Pubic hairs -**

Zoologist Desmond morris put theory that pubic hairs appearance is signal of sexual maturity . Genital area of males and females inhabit by lighter ,shorter ,villus hairs (these are invisible),then hairs become darker ,thicker at time of puberty (in male –at 12 years and in female at – 11 years) when pituitary gland secrete gonadotropin hormone which stimulate production of testosterone from test is and ovaries .  
Fuction of Pubic hair-

- 1.Testosterone promote pubic hair growth.pubic hairs protect skin from chafing during intercourse.
- 2.Pubic hair traps bacteria It is just like nose-hair which traps pollen grains ,dust and germs from entering our nose and keep pubic skin infection free.
- 3.Pubic hair prevent bacteria and other infectious agent entering in vagina. If pubic hairs remove away chances of bacterial infection such as U.T.I. increase.

Pubic hair is more thicker and darker than scalp hairs and general body hairs. Growth rate and length of pubic hairs are more than body hairs but less than general body hairs.



**Areas of distribution of Androgenic hairs**  
 -arm pit ,forearm, legs, pubic area in both sex and  
 in male- mooches ,bar brio and chest ,arm hairs

## WHY DO WE HAVE HAIR ON OUR HEAD-

Over millions of years long hairs (in comparison to hairs present rest of body) are found on human head. It is a rare finding, most of animal found at present time have hairs on all over body and on head has equal length.

Man is only animal which has erect posture, so head is most exposed part of body to sunlight (equatorial sun of Africa where we evolved first)

1. Hair protect scalp from overheating, because brain by which thinking can possible, require an optimum temperature for work properly.

2. Hairs reflect ultra-violet rays from scalp, so harmful rays can not be absorbed by scalp skin.

## HAIR –LOSS-

### Why hair fall is a natural process. -

Now –a –days we lose roughly approximately 100 hairs per day from our head. Scalp contains approximately 100,000 hairs.

Each hair follicle on our head grows in a somewhat fixed growth cycle. Hair takes origin from a hair follicle, single and grows, extends in length for 5-7 years. Hair attaches very slightly with hair follicle because hair is a dead entity and after a certain period or by exerting pull on hairs, hairs fall down. After this time that hair – follicle stops its function and takes a break for a short time before starting a new growth cycle of hairs.

### Pattern of hair –loss -

Male Pattern of hair –loss (MPHL) - Present as a receding hair-line. Classic male pattern hair –loss begins from temples and vertex of scalp. As it progresses only a rim of hair (hair present only at sides and back of head) remains. This is called as ‘Hippocratic Wreath’<sup>14</sup> and rarely progresses to complete baldness.

In male hair –loss is due to combination of genetic constitution and male hormone ‘Dihydrotestosterone’

Female Pattern of hair –loss (FPHL)- Present as low density of hairs. Total hair loss<sup>15</sup> (baldness) rarely found in female. Mostly on top and front of scalp diffuse thinning of hairs occurs in female.

## MANAGEMENT OF HAIR -LOSS-

### Medication

In early stages of hair –loss can be slowed by medications approved by United States ‘Food & Drug’ Administration (FDA) -

1. Ketoconazole shampoo

2. Minoxidil, Finasteride but Finasteride proves ineffective in females and causes birth defect when taken during pregnancy.<sup>16</sup>

3. Hair transplant surgery

## HAIR CLONING (HAIR MULTIPLICATION )-

1. Technique developed to counteract hair-loss.

2. Upto few days ago scientist think that in complete baldness, hair follicles are totally absent in scalp. But now-a-days scientist discovered that stem cell of hair follicle found in bald scalp, by these cells new hair strand can grow.

Basic idea of hair cloning (still in research phase) –

Healthy hair –follicle or dermal papilla can be extracted from areas that have some hairs and cloned by various culturing methods and newly generate cells can be injected back in bald area of scalp, in this are new hair – follicular cell regenerate and produce hairs.

## **VARIOUS Cloning METHODS –**

### **1. Intercytex –**

1. 1<sup>st</sup> company which start experiments with hair cloning for cure baldness.

2. Aim - To treat patient who have hair loss due to hereditary factors.

3. In this therapy no need of donor hairs required; Hairs grown from patients own cell.<sup>17</sup>

4. New hair follicles clone from stem cells harvested from back of neck.

5. But therapy is under trial because success rate is not 100% (only 2/3<sup>rd</sup> bald patient get benefits by this).

### **2. Aderans research institute<sup>18</sup> -**

1. Japanese company researching for hair cloning.

2. Company worked on 'Ji Gami' process. In this scientists remove a small strip of scalp then broken down into individual follicular stem cells.

3. Now follicular stem cells are cultured, multiply and injected back into bald areas of scalp.

4. But scientist observe that multiplication is not so good, only revitalization of hair –follicles can occur.

### **3. Berlin Technical University –**

1. In Germany.

2. In 2010, first time scientist were able to grow artificially hair –follicles from stem cells.

3. Scientists of this university created hair –follicles by animal cells, As a result thinner than normal hairs produce.

4. By this therapy approximately 80% patient with baldness can cure.

### **4. University of Pennsylvania<sup>19</sup> -**

1. In 2011 scientist found that None –bald and bald scalp have same numbers of stem cells: But progenitor cell significantly depleted in bald scalp.



2. Scientist investigate method to convert regulator stem cells into progenitors cell.
3. BY this therapy in bald scalp regeneration or natural growth of hairs<sup>20</sup> can occur.

### 5. Durham University

1. In late 2013 scientist of Durham University tried cloning of original cells not in 2D but in 3D system.
2. Scientist first took healthy dermal papilla ,After dissecting them they cultured in a petri- dish.
3. Only in 30 hours duration 3000 dermal papilla produced.
4. now cloned cells inject in non-hairy skin area; these human skin sample when grafted in rats (experimental animal) .After 6 weeks cloned papillae cells produce new hair follicles. From them new hair can grow.

### 6. Replicel life sciences-

1. Vancouver –based firm.
2. Try to replacement of hormone –compromised hair follicle cells can occur by Replicel life sciences .

### 7. Riken Center for Developmental Biology -

In 2016 ,in Japan scientists successfully grown human skin in a laboratories .Skin was created by using induced pluripotent stem cells and when implanted in a mouse, skin grow hairs successfully.

**CONCLUSION-** *During evolution human had loss body hair with time.*

In past primates body cover completely with hairs. But since very old time human beings had lost their body hairs because it was become needful .Only scalp preserve old pattern of long hair for protecting U.V, rays which were harmful for body -interna ( Due to erect posture U.V. rays directly fall on scalp ). Hair loss is increase with age while androgen level fall with age but possible explanation of androgenic alopecia is Higher conversion of Testosterone to DHT locally with increasing age , because higher level of 5-alpha reductase <sup>21</sup>are found in bald scalp .Also with age stress in life increase, and with age we are exposed to U.V. rays or other chemicals which cause hair -loss. But with time humans become more conscious about hair; and try to maintain more and good looking hairs on their scalp. So oil of minoxidil is very popularly ,particularly in males. Hair transplantation is also done by someone who can effort it.

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