Indian Journal of Basic & Applied Medical Research; March 2013: Issue-6, Vol.-2, P. 483-500

"A study on Morphological and Histological relations between Thymus gland and Body hair."

[1]Hasi Dasgupta , [2]Kalyan Bhattacharya , [3]Sudeshna Majumdar , [4]P.N. Gupta , [5] Santanu Bhattacharya

[1]Professor of Anatomy, Nilratan Sarkar Medical College, Kolkata – 700014, West Bengal, India.
[2]Associate Professor, Dept. of Anatomy, R.G.Kar Medical College, Kolkata-700004, West Bengal, India.
[3] Professor, Dept.of Anatomy, Nilratan Sarkar Medical College, Kolkata – 700014, West Bengal, India.
[4]Ex – Head of the Department and Professor of Microbiology (Retired), Medical College, Kolkata; Kolkata- 700073, West Bengal, India.
[5]Assistant Professor of Anatomy, Calcutta National Medical College, Kolkata-700014, West Bengal, India.
Corresponding author: Dr. Sudeshna Majumdar
Email: sudeshnamajumdar.2007@rediffmail.com

ABSTRACT:

INTRODUCTION : Immunological efficacy of thymus gland can be directly attributable to the weight of thymus gland. Previous studies led us to investigate whether the weight of thymus gland is in anyway related to the growth of non- androgen dependent body hair and prove the corollary thereof that there exists a difference in the weight of the thymus gland in hairy and non-hairy subjects.

METHODS: We conducted this study by collecting thymus and skin samples from 105 accidental death cases and measured the thymus weight and body hair length accordingly. The thymus gland and skin sample were studied both macroscopically and microscopically.

RESULTS: Weight of the thymus gland is significantly more in hairy subjects and less in non- hairy subjects. Mean thymus weight of hairy individuals was - 15.2754 (± SD 5.5383) gm.**;** significantly heavier than that of non-hairy individuals having mean thymus weight of 5.5383 (± SD2.3748) gm. Thymus Index is significantly more in hairy subjects than in non- hairy subjects Mean thymus index was 0.294(± SD 0.11) in the hairy subjects and the same in the non- hairy individuals was 0.153971 (± SD 5.52599E- 02)

CONCLUSION: From this study we may come to the conclusion that immunogenic status of the thymus gland can be assessed simply by examination of the length of surface hair of an individual.

KEY WORDS: Body hair, Hair follicle, immune system, skin, thymus gland.

INTRODUCTION:

Thymus gland is a primary lymphoid organ where T-cell precursors (thymocytes) undergo proliferation, differentiation and maturation. The thymic microenvironment, through its direct contact with thymocytes aided by

the action of the thymic hormones, plays a significant role of thymocyte maturation [1]. The thymus glands in children and adults do not differ in its microanatomy signifying its pivotal role in our immune system throughout life [2]. Like thymus gland skin is also an immunological organ in our body. Keratinocytes in skin are continually self-renewing stratified squamous epithelial cells of the epidermis. It has been postulated that thymic epithelial cells progress through an antigenically defined pathway of differentiation similar to skin keratinocytes [1, 3]. In fact both thymus and skin contributes to the generation of T- cells [4]. Though in lower animals we find thick body hair with poorly functional eccrine glands, in humans there was a transition towards nudity (hairlessness) with elaboration of the functions of the eccrine glands and the appocrine glands confined to some areas of the body [5]. In fact how the transition towards nudity in humans came up remains a matter of investigation till date [5]. Skin adenexa comprises of hair follicles with sebaceous and sweat glands [5.] It is also noteworthy that except hirsutism, the importance of body hair has never been considered to be important in medicine. In 1979 it was observed that thymectomy in mice caused flattening and thinning of epidermis with loss of pilosebaceous units [6]. We observed gradual regression of glandular elements in thymus with advancing age after puberty (in accordance with the fact established beforehand)[7]. The same phenomenon could be observed in the total number of hair follicles which similarly regressed after puberty [5]. Animal experiments with mice with well-attested regression of both thymus and hair follicle inspired us to launch the present study.

Hair follicle immune system has been well documented [8]. Thymopoietin , a peptide hormone of thymus gland has been described as hair-vitalizer [9]. The studies on nude mice reveal more interesting observations. Some nude mice (nu/nu strains) are both hairless and athymic[10]). A gene transcription factor termed a nude locus has been identified to be the causative agent for such disruption of body hair along with absence of thymus [11, 12]. This observation has been followed by the identification of the human counterpart of a “nude- locus” of hairless gene [13, 14]. A study on skin culture shows expression of some thymic transcription factors those are critical for the differentiation and survival of thymus epithelial cells and deficiency of those factors are clinically characterized by hairlessness and a simultaneous thymic aplasia [15]. It has been well attested that certain diseases, which cause fall of hair, can be cured and or may be significantly improved by the application of thymic extracts [16]. The number of hair follicles varies at different parts of the body per unit area. While in face it is about 600/sq.cm; in other parts of the body it is about 60/sq.cm [7].

Thickness or width and length of hair follicles also vary greatly from less than a millimeter to more than a meter [7]. Apart from this phenotype expression of hair, different individuals present wide variation in the same population. With this background in mind the present study was done to investigate whether the weight of the thymus gland is in anyway related to the growth of non- androgen dependent body hair and hair follicles to prove the corollary thereof, that there exists a difference in the weight of the thymus gland in hairy and non-hairy subjects in both the genders.

MATERIALS AND METHODS:

Hairs from general body surface are concerned here. Hair from cheek/beard, axilla, chest and pubis and androgen dependent hair e.g., hair from balding sites of both sexes (as studied by Hamilton, Norwood [17, 18,] Eblings, Reynolds, [19, 20)] are excluded here. Thymus glands were collected from adult cadavers (following accidental deaths) at an age ranging from 25 to 45 years.

Total number of cases- 105

Number of adult males- 67

Number of adult females- 38

Thymus and skin samples were collected during autopsy within 24 hours of death. The name, age, sex, address, mid arm circumference,height and body weight were recorded in each case.

Collection of thymus gland:- An area of mediastinal fat containing the thymus gland was excised. Each gland was displayed on a table and it was dissected out from mediastinal fat. The anatomical configuration with some amount of glandular elements of thymus could be recognized in most of the cases. The glands were placed on a blotting paper to remove any excess tissue fluid and thereafter weighed. Each gland was preserved in 10% formal saline for subsequent histological studies.

Collection of skin sample:- A square piece of skin with hair measuring 1cm x 1cm and of a thickness of about .05 cm was excised from the middle of the dorsal surface of the left forearm of each subject. The skin sample had some amount of subcutaneous fat with it. Any broken hair or deformed hair was excluded by examination with a hand lens.

Two hairs from each piece of skin were carefully epilated so that the whole length (from bulb to tip) of the hairs was intact. The hairs so epilated were mounted on adhesive transparent cellophane tape. Subsequently length of the hair was measured and the skin samples were transferred to 10% formal saline for histological studies.

Representative sample of skin was taken from forearm only because it is evident from Table-1 that different parameters of hair length, girth, population have different values in different parts of body, but in case of hair from forearm these values are midway between the two extremities (forehead and lower leg).

1. The following parameters were adopted in case of Thymus Gland

- **Macroscopy:-** Size and weight of the gland (before formal saline fixation). Mean thymic weight was calculated from the available data.
- **Thymus index**, a specific marker of immune capacity mediated through the thymus gland was calculated by the following formula- [21]

$$\textbf{Thymus Index} = \frac{\textit{Weight of the thymus gland in grams}}{\textit{Body weight in kilogram}}$$

Histological studies of thymus glands and corresponding piece of skin from each case were conducted with Haematoxylin and Eosin stain (H & E stain) under low power (4X) and medium power (10X) and high power (40X) objectives.

The following points were observed in Histology:-

a) Gross appearance of the cortical tissues and lymphoid follicles.

b) Gross appearance of the medulla, Hassall's corpuscles and adipocytes.

c) Any unusual finding – e.g. calcified patches etc.

2. The following parameters were adopted in case of of the corresponding skin samples:

a) Macroscopy:- length of entire hair from bulb to tip (before formal saline fixation). The length of hair pasted on cellophane adhesive tapes was measured using graph paper and Vernier scale.

b) Gross hair changes.

c) Gross appearance of the epidermis – changes in thickness.

d) Associated changes in the pilosebaceous unit, i.e., hair follicles, sebaceous glands and arrector pilli muscles.

OBSERVATIONS AND RESULTS:

This difference as appreciated is because of the nature of the terminal body hair in adults having differences in the length, girth and texture [5]. Amongst the most easily perceptible parameters of skin, therefore, hairy and non-hairy nature of the body can be attributed to the length of the terminal body hair. Accordingly hairy person means person having increased length of terminal hair at a given area of body surface under reference, e.g. middle of dorsal aspect of left forearm. Persons having the reverse attributes to the above mentioned statements can hence be termed as non- hairy. The cut off length of body hair was determined by calculating the mean length of body hair to be 1.65cm (+ SD 0.76cm) and accordingly the subjects were divided into two groups:

a) Hairy Subjects: hair length more than 1.65cm. on the dorsal aspect of the middle of left forearm.

b) Non-hairy Subjects: hair length less than or equal to 1.65cm. on the dorsal aspect of the middle of left forearm.

2. CALCULATION OF MEAN THYMUS WEIGHT: Mean weight of thymus glands were calculated separately hairy as well as non-hairy subjects. It has been observed that the weight of the thymus gland is significantly more in hairy subjects and less in non- hairy subjects (Tables- III, V & VI).

3. Concept and calculation of Thymus Index As stated earlier, Thymus Index, a specific marker of immune capability mediated through thymus could be ascertained.

Body weights of subjects were already recorded. Weights of thymus glands were previously measured. Hence the thymus index has been calculated in each subject according to the formula previously mentioned. Mean thymus index was calculated separately in hairy and non hairy individuals. Thymus Index is significantly more in hairy subjects than in non- hairy subjects (Tables IV, V & VI)

4. HISTOLOGICAL FINDINGS OF THYMUS GLAND (Table- VI)

Macroscopy of the thymus gland revealed that the average size of thymus was larger in hairy and smaller in non- hairy subjects. Serial section of each thymus gland was taken and stained with haematoxylin and eosin stain. From each specimen of thymus gland largest possible area of section was chosen. Slides of thymus from hairy subjects were subsequently compared with those of non- hairy subjects. Amongst the specimens from hairy subjects cortical tissue containing lymphocytes was occupying a larger area. In the medulla, adipocytes and Hassall's corpuscles were observed to be occupying a smaller area. Patches of calcification were detected in both cases; they were more abundant among the thymus specimens of hairy subjects. In all the slides, however, Hassall's corpuscles could be identified.

5. HISTOLOGICAL FINDINGS OF CORRESPONDING SKIN SAMPLES (Table- VI)

The skin samples were also examined after haematoxylin and eosin stain under light microscope.

Thickness of the whole epidermis could be measured using slides fitted with measuring scales. Hypertrophy of the pilosebaceous units were noted in 58 out of 66 cases of skin slides of hairy subjects. The finding was significantly comparable with non-hairy subjects where 36 out of 39 slides showed normal texture of such glands. Increased thickness of the epidermis could be detected in few cases of skin slides of hairy subjects only and so this finding could be marked as insignificant and non-specific.

RESULTS :

a. It has been observed **that mean thymus weight of hairy individuals was - 15.2754 (± SD 5.5383) gm.;** significantly heavier than that of **non-hairy individuals having mean thymus weight of 5.5383 (± SD2.3748) gm.** (Tables- III, V, VI).
b. It had been observed that mean **thymus index was 0.294(± SD 0.11)** in the hairy subjects and the same in the non- hairy individuals was **0.153971 (± SD 5.52599E- 02) -** Tables- IV, V,VI .
c. Under light microscopy (Table- VI) -

   Thymus :Majority of the thymus slides of hairy subjects had larger cortical areas with larger zones filled with lymphocytes and a correspondingly smaller zone of medulla containing a fewer number of adipocytes and Hassall's corpuscles . Patches of calcification were more visible in thymus slides of hairy subjects. The aforementioned findings were in comparison with the thymus slides of non-hairy subjects.
d. Skin: In striking contrast to the skin of non- hairy subjects, which showed almost normal skin histology (37 out of 39), the skin slides of hairy subjects showed definite hypertrophy of the pilosebaceous units and hair follicles in majority (61 out of 66) of the cases.

DISCUSSION: Thymus is a multilobulated primary lymphoid organ present deep beneath the root of the neck and or superior mediastinum depending upon the age of the individual. T lymphocytes developing from the thymus express receptors such as TCR, CD3, CD4, CD8 and CD2. T-lymphocytes also undergo 'thymic education' through a microenvironment unique to thymus gland. In adult humans removal of thymus does not compromise T-

cell functions. It is also worthwhile to mention that the fine structural architecture of the cortex, medulla and connective tissue in the remaining islands in the adult thymus investigated was not different to the thymus of the children and hence human thymus serves an immunological function throughout life [2, 22, 23]. Mean weight of thymus is fairly constant at about 20gm. until 6th decade. The thymus persists actively into old age and the older thymus can be differentiated clearly from the surrounding fat only by the presence of its capsule[23].

Skin and Body Hair

The rate of hair growth has been determined by various methods[24-30]. Direct measurements were made to determine growth rate of marked hair in situ[27, 28]. Comparable measurements are obtained by all methods. We have used direct measurements.

Evidences of Relation between Thymus Gland with Body Hair : Immunological Relations It is well accepted that in myasthenia gravis 12% of the patients may have generalized hair follicle hamartoma of the skin[31]. It is also known that a substantial percentage of patients with myasthenia gravis have an associated thymoma [32]. Cells in the lower part of hair follicle below the insertion of arrector pili muscle show reduced or absent expression of class I major histocompatibility complex [33](MHC) and hence this led to the suggestion that an immune process mediated by macrophages contributes to the control of hair cycles[8] (Table- VII).

Pathological Relations:

As hair is a component of skin, pathological changes associated with skin are likely to involve the hair. An interrelation can be obtained by the fact that during their lifespan, T-cells from thymus express some markers. One of such markers TCR cells, migrate to the epidermis, where these cells are known as dendritic epidermal T-cells[10]. Hassall's corpuscles, a product of medullary (stromal) thymic cells, contains keratins identical to those seen in stratum corneum of skin[1, 4]. Thus a definite relation exists between integrity of the thymus growth and body hair (Table-VII).

Embryological Relation:

Thymus gland is derived from two sources. The usual and major source is from ventral part of 3rd pharyngeal pouch endoderm, which, in adult thymus is represented by cells of reticulum and concentric corpuscles (of Hassall) of thymus [34]. Important contribution comes from neural crest, which is ectodermal in origin and probably from placodes, which are also ectodermal in origin[7]. Epidermis of the skin along with its appendages including pilocebaseous units also develop from surface ectoderm. Ectoderm constitutes an important component of epithelial sheets common to both skin and thymus gland [7]. Thymus and skin can thus be developmentally linked and further authenticated by a study in which it has been reported that ectopic tissues such as ectodermal sebaceous glands can sometimes be found in a normally located thymus gland because of their common embryogenesis[35]. Also numerous desmosomes and tonofibrils in tumour cells of thymoma indicate epithelial origin (presence of spindle cells) of thymus[36] (Table-VII).

Genetic Relations: Deficiency of Foxn-1 gene[14] and mutation of whn gene[15] has been proved to produce the nude (i.e. hairless) phenotype in mice. Both of these events led to simultaneous hairlessness and athymia (Table-VII).

Other experimental Relations :

An array of hormonal factors plays a role in linking thymus with growth of general body-hair [37, 38, 39]. Though synergistic effect of thymulin (a thymic hormone) could be observed with androgen in promoting hair growth [14], orchidectomy in mice had been seen to induce a continuous hypertrophic and hyperplastic changes in thymus gland [40,41]. This hypertrophied thymus might in turn, cause increased level of other thymic hormones e.g. thymulin, thymopoietin and thymosin, which finally might lead to increased growth (and length) of body hair, possibly through hair follicle immune system[8]. Thus a possible nexus cannot be overruled between androgen, thymus and body hair. Well documented evidences exist proving that nude (hairless) mice had rudimentary thymus[11,12, 15]. Lack of T- cells from thymus had been shown to cause hairlessness in skin of mice. The preceding observations were strongly supported by one study where thymectomy in mice was found to result in atrophy of pilosebaceous units and non-specific flattening of epidermis[6]. Another intrinsic hormone secreted by thymus, thymopoietin, had also been postulated to promote hair growth[9] (Table- VII).

CONCLUSION: An important fact has been detected; the fact that females have a heavier thymus than age, race and weight matched males both in hairy and on-hairy subjects. Therefore, it is presumed that the females are immunologically more competent than males can thus be agreed in the light of previous studies (Szabo, 1967[40], Castro et al, 1973[41]).

TABLE-I : HAIR PARAMETERS FOR ADULT HUMAN BEING (BOTH GENDERS)

Site	Population per square cm.	Length from bulb to tip in cm.	Type
Forehead	765 ± 20	1.5 ±0.5	All are pigmented terminal hair having cuticle, cortex, medulla from outside inwards.
Scalp (Occipital)	350 ± 50	Variable; 4- 90cms	
Forearm	95 ± 15	3 ± 1.5	
Abdomen	70 ± 15	3.5 ± 1.5	
Thigh	55 ± 5	4 ± 1.5	
Lower leg	45 ± 10	4.5 ± 1	
References	Szabo(1967)[42].	Burman et al (1965) [42].	Gray's Anatomy, 39th Edition[5].

TABLE-II

T- Test Group Statistics

Hair Type	Number of Cases (Males + Females)	Mean	Standard Deviation	Standard Error Mean
Hairy	49	2.247	0.635	9.068E-02
Non- Hairy	56	1.123	0.375	5.013E-02

Independent Samples Test

Assumed Variances In values of hair length	Leven's Test for Equality of Variances		T-test for Equality of Means						
	Varia-nce	Signi figance	't'	Degree of freedom $(n_1-1)+(n_2-1)$	Signi-ficance 2(tailed)*	Mean Differ-ence	Standard Error Differ-ence	95% Confidence Interval of Difference	
								Lower	Upper
Equal Varia-nces of Hair-Length assumed	20.591	0.00	11.203	103	0.000	1.124	0.100	0.925	1.323
Equal Varia-nces of Hair-Length not assumed			10.845	75.652	0.000	1.124	0.104	0.917	1.330

NB. * '0.000'= P value may be 0.0001/0.00001 like that, it means highly significant. If P value is <0.05, it means significant at 95% confidence interval. If P< .01, it means significant at 99% confidence interval.

Analysis was done using the 'Hair Length' as output variable, and 'Hairy' as group variables.

Comment: The above Independent or Unpaired 'T' test shows that in Group Statistics there is significant'mean' difference between Hairy individuals and Hair Length. F ratio is also highly significant in 2- tailed study.

TABLE-III

T-Test **Group Statistics**

Weight of Thymus in	Number of Cases (Males+ Females)	Mean (in gm.)	Standard Deviation	Standard Error Mean
Hairy Cases	49	15.2754	5.5383	0.7912
Non-Hairy Cases	56	5.5383	2.3748	0.3173

Independent Samples Test

Assumed Variances In values of the weight of thymus gland	Levene's Test for Equality of Variances		T-test for Equality of Means						
	Varia-nce	Signi figance	't'	Degree of freedom $(n_1-1)+(n_2-1)$	Signi Figance 2(tailed)*	Mean Differ-ence	Standard Error Differ-ence	95% Confidence Interval of Difference	
								Lower	Upper
Equal varia-nces of thymus weight assumed	25.207	0.000	9.742	103	0.000	7.9127	0.8138	6.2988	9.5265
Equal varia-nces of thymus weight not assumed			9.282	63.258	0.000	7.9127	0.8524	6.2093	9.6060

NB. * '0.000'= P value, it may be 0.0001/ 0.00001 like that, it means highly significant. If P value <0.05, it means significant at 95% confidence interval. If P< .01, it means significant at 99% confidence interval.
Analysis was done using the 'Weight of Thymus Gland' as output variable, and 'Hairy' as group variables.
Comment: The above Independent or Unpaired 'T' test shows that in Group Statistics there is significant 'mean' difference between Hairy individuals and Thymus Indices. F ratio is also highly significant in 2- tailed study

TABLE-IV

Correlative Analysis Using All Possible Data*

Correlations	Parameters	Body weight	Weight of Thymus	Thymus Index	Hair Length
Body Weight	Pearson correlation	1.000	0.254	-0.050	0.329
	Significance (2 tailed)		0.0009	0.615	0.001
	Number of Cases	105	105	105	105
Weight of Thymus	Pearson correlation	0.254**	1.000	0.945**	0.557**
	Significance (2 tailed)	0.009		0.000	0.000
	Number of Cases	105	105	105	105
Thymus Index	Pearson correlation	-0.050	0.945**	1.000	0.478**
	Significance (2 tailed)	0.615	0.000		0.000
	Number of Cases	105	105	105	105
Hair Length	Pearson correlation	0.329**	0.557**	0.478**	1.000
	Significance (2 tailed)	0.001	0.000	0.000	
	Number of Cases	105	105	105	105

*Data: Body Weight; Weight of Thymus, Thymus Index, Hair Length.
**Correlations are significant at 0.01 level (2 tailed).

Note: The above table shows that there are significant 'association' / 'positive correlation' between the variables-

a) Thymus size and Hair Length.
b) Thymus index and Hair Length.
c) Body weight and Hair Length.

TABLE-V

T-Test **Group Statistics**

Thymus index in	Number of Cases (Males+ Females)	Mean	Standard Deviation	Standard Error Mean
Hairy Cases	49	0.294194	0.110596	1.58E-02
Non-Hairy Cases	56	0.153971	5.52599E-02	7.38E-02

Independent Samples Test

Assumed Variances In values of Thymus Index	Levene's Test for Equality of Variances		T-test for Equality of Means						
	Varia-nce	Signi figance	't'	Degree of freedom $(n_1-1)+(n_2-1)$	Signi Figance 2 (tailed)*	Mean Differ-ence	Standard Error Differ-ence	95% Confidence Interval of Difference	
								Lower	Upper
Equal Varia-nces of Thymus Index assumed	13.980	0.000	8.372	103	0.000	0.1402	1.605E-02	0.107	1.173
Equal Varia-nces of Thymus Index not assumed			8.040	68.413	0.000	0.1402	1.744E-02	0.105	1.750

NB. * '0.000'= P value, it may be 0.0001/ 0.00001 like that, it means highly significant. If P value is <0.05 it means significant at 95% confidence interval, if P value <0.01 , it means significant at 99% confidence interval.

Analysis was done using the 'Thymus Index' as output variable, and ' Hairy' as group variables.

Comment: The above 'Independent' or Unpaired 'T' test shows that in Group Statistics there is significant 'Mean' difference between Hairy individuals and Thymus Indices. F ratio is also highly significant in 2-tailed study.

TABLE-VI : THICKNESS OF EPIDERMIS IN THE SKIN SLIDES (in mm)

HAIRY GROUP			**NON-HAIRY GROUP**		
No. of slides	Average of epidermal thickness in each slide (in mm)	Average among the whole group (in mm)	No. of slides	Average of epidermal thickness in each slide (in mm)	Average among the whole group (mm)
1.	45.39		1.	24.73	
2.	65.47		2.	31.3	
3.	64.13		3.	31.33	
4.	59.06	60.9886	4.	27.7	32.9396
5.	60.78		5.	38.87	
6.	84.71		6.	42.54	
7.	61.17		7.	43.45	
8.	55.64		8.	38.1	
9.	50.45		9.	26.01	
10.	63.08		10.	25.36	

TABLE-VII: ***SUMMARY OF DIFFERENCES OF PARAMETERS OF THYMUS IN HAIRY AND NON-HAIRY SUBJECTS***

Parameters of thymus and hair bearing skin of hairy subjects	Parameters of thymus and hair bearing skin of non- hairy subjects
1. Pilosebaceous and hair follicular hypertrophy and increased epidermal thickness on histology. 2. Larger cortical zone of thymus. 3. Larger areas of lymphoid follicles and calcified patches. 4. Heavier Thymus. 5. Higher thymic index. 6. Hairy females had heavier thymus and higher thymus indices than hairy males.	1. Normal pilosebaceous units and hair follicles on histology with less epidermal thickness. 1. Smaller cortical zones of thymus tissue. 6. Correspondingly smaller aggregates of lymphocytes in each follicle. Calcified patches were occasional. 4. Lighter Thymus. 5. Lower thymic index. 6. Non- hairy females had heavier thymus and higher thymus indices than hairy males.

Acknowledgement:

We sincerely acknowledge the contributions of Dr. Jagadish Gargi, Dr. S.K. Tripathi and Dr. A. K. Gupta, who, as Heads of the Department of Forensic and State Medicine of Government Medical College, Amritsar, Punjab; Institute of Medical Sciences, Banaras Hindu University, Uttar Pradesh; and Medical College, Kolkata, West Bengal respectively have sheltered our post-mortem studies.

Prof. Sabitri Sanyal, ex Head of the Department of Pathology and Prof. Anjan Sen, ex Head of the Department of Anatomy; both dignitaries from Medical College, Kolkata, West Bengal; imparted upon academic and affectionate help in all possible ways. We do hereby duly acknowledge their efforts also.

We express our heartful thanks to Dr. Gopal Chandra Mondal, MD (Anatomy) and Dr. Partha Sarathi Pal, MD (Community Medicine); for their cooperation to complete this study.

FIGURES

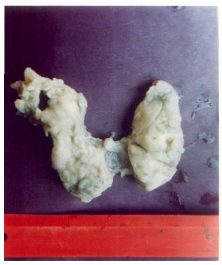

Fig.-1 : Thymus gland with two lobes obtained from a 20 year old hairy male person.

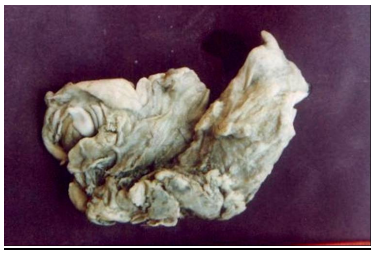

Fig .-2 : A big thymus (34gm. in weight) gland obtained from one thirty year old hairy female.

Histology of Thymus gland:

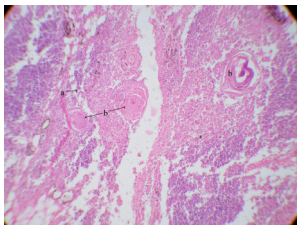

Fig.-3 : Photomicrograph of the largest thymus gland obtained from one hairy female subject showing the lobules packed with T-lymphocytes , Hassall's corpuscles present in the medulla - (10X magnification) [a - T-lymphocytes, b - Hassall's corpuscles].

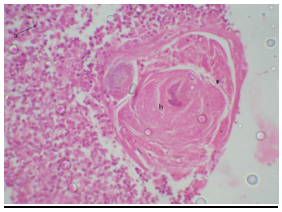

Fig.-4 : Photomicrograph of the former thymus gland showing Hassall's Corpuscle in the medulla along with T-Lymphocytes - (100X magnification) [a - T-lymphocytes, b - Hassall's corpuscles].

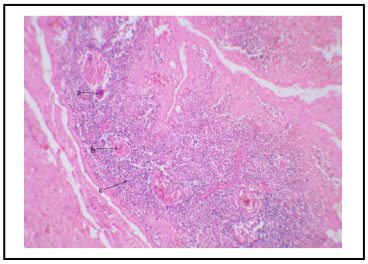

Fig.-5 : Photomicrograph of a thymus gland of a hairy male showing points of calcification along with densely packed T- lymphocytes, Hassall's corpuscles in the lobules – (10X magnification) [a- point of calcification, b- Hassall's corpuscle, c- lymphocytes].

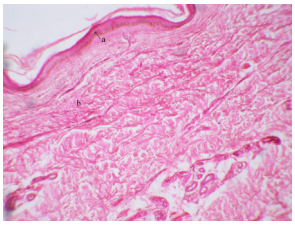

Fig.-6 : Photomicrograph of skin of a hairy female showing thick epidermis and features of dermis [a – epidermis, b – dermis].

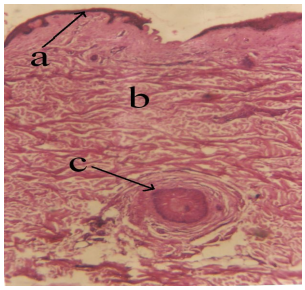

Fig. 7 : Photomicrograph of skin of a hairy male showing large pilosebaceous units in dermis - (10X magnification) [a - epidermis, b- dermis, c – large hair follicle].

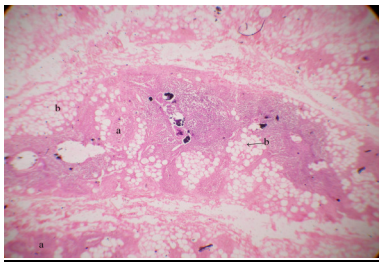

Fig.-8 : Photomicrograph of thymus gland in a non-hairy male showing lymphocytes in the lobules with fat cell infiltration - (10X magnification) [a – lymphocytes, b – fat cells or adipocytes].

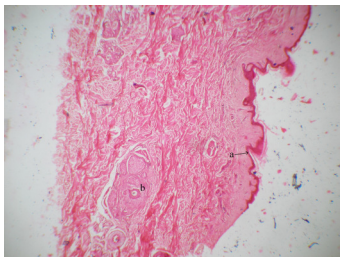

Fig.-9 : Photomicrograph of skin in a non hairy male person showing thinning of epidermis and features of dermis - (10X magnification) [a - epidermis, b- dermis].

REFERENCES:

1. Laster AJ, Etoh T, Palker TJ, Haynes BF (1986). The Human Thymic Microenvironment: Thymic epithelium contains specific keratins associated with early and late stages of epidermal keratinocyte maturation, differentiation. 31(1): 67-77.
2. Von Gaudecker B (1978). Ultrastructure of the age involved adult human thymus. Cell Tissue Res. 186(3): 507-25.
3. Baxter RM, Brisette JL (2002). Role of nude gene in epithelial terminal differentiation. Journal of Investigative Dermatology. 118(2):303-9.
4. Clarke RA, Yamanaka K, Bai M, Dowgiert R, Kupper T (2005). Human skin cells support thymus- independent T- cell Development. Journal of Clinical Investigation. 115:3239-49.
5. Burns T, Breathnach S, Griffiths C, editors (2004). Rook's Textbook of Dermatology. Massachusetts (7th Edition) Blackwell Science Publishing Company: 63.2.

6. Gupta PN, Gupta S, Biswas SK, Dutta SK (1995). Is Body Thymus Hair Thymus dependant? Effect of thymectomy on pilosebaceous gland. Bulletin of School of Tropical Medicine: 43 (1-4): 12-15.
7. Standring S, Shah P, Johnson D. Ellis H, Healy JC, Johnson D. William A, Collins P (2005). Gray's Anatomy- The Anatomical Basis of Clinical Practice. Introduction and Systemic Overview; Mediastinum. Edinburgh and eight cities (39th edition). Elsevier Churchill Livingstone : 157-77 & 980- 4;
8. Paus R, Van-der Veen C, Eichmuller S (1998). Generation and cyclic remodeling of hair follicle immune system in mice. Journal of Investigational Dermatology: 11: 1-7.
9. Tosti A (1991). A Riview of Pharmacology; Clinical Applications and Toxicology of Thymopoietin. Journal of Steve Christian Ashville.
10. Decker JM. T- cell development. Tutorial (Cited 2003 August, 26); MIC (419). Available from http//www.microvet.arizona.edu/Courses/MIC419/Tutorial/Tcelldevelopment.html/.
11. Brody TB, Jumeaux/ Domina. The interactive Fly [homepage on Internet]. In: Society of Developmental Biology's web server; [1995 & 1996]. Available from e-mail brodyt@codon.nih. gov/
12. Brooke HC (1926).Hairless mice. J Hered.:17:173-4.
13. Ahmed W, Haque MF, Brancolini V, Tsou HC, Haque S, Lam H (1988). Alopecia universalis associated with a mutation in the human hairless gene. Science: 279:720-4.
14. Nehls M, Pfeifer D, Schorpp M, Hedrich H, Boehm T (1994). New Member of the winged helix protein family disrupted in mouse and rat nude mutation. Nature: 372-103-7.
15. Serge JA, Nemhauser JA, Taylor BA, Nadeau JH, Lander ES (1995). Positional cloning of the nude locus: genetic physical and transcription maps of the region and mutations in the mouse and rat, Genomics: 28:549-59.
16. Walker M. Bald No More, Preventing and Successfully treating Hair Loss for Both Men and Women. Keningston Publishing Corporation [serial on Internet]. [About 225 pages]. Available from:http://www.onlinesuperstore.com/h&b/thymuskin/mortwalker baldness.htm/.
17. Hamilton JB (1951). Patterened Hair Loss in man: types and incidences. Ann N Y Acad Sci.; 53; 708-14.
18. Norwood O' TT (1975). Male pattern baldness. South Medical Journal. 68:1359-70.
19. Eblings FGJ (1990). The hormonal control of Hair Growth. In :Orfanos CE, Happle R editors. Hair and hair diseases . Berlin Springer- Verlag : 267-99.
20. Reynolds EL (1951). The appearance of adult patterns of body hair in man. Ann N Y Acad Sci.; 53:576-84.

21. Olesen AB, Andersen G, Benn CS, Jull S, Thestrup C (2005). Thymus is enlarged in children with current atopic dermatitis. A cross- sectional study. Acta Dermo- Venereologica. 85(3):240-3.
22. Stinmann GG (1986). Changes in human thymus during ageing. In: Muller Hermelink HK, (editor). The Human Thymus Histopathology and Pathology. Berlin. Springer-Verlag.
23. Kendall MD (1990). The cell biology of cell death. Thymus update. 3:53-76.
24. Ebling FJ, Thomas AK, Cook ID (1977). Effect of cyproterone acetate on hair growth, sebaceous secretion and endocrine parameters in a hirsute subject. British Journal of Dermatology. 971:371-81.
25. Pelfini C, Cerimele D, Pisanu G (1969). Ageing of the skin and hair growth in man. In: Montagna W, Dobson RL, editors. Advances in the Biology of the skin . Pergamon: Oxford ; p: 153-60.
26. Hale PA, Ebling FJ (1975). The effects of epilation and hormones on the activity of rat hair follicles. Journal of Experimental Zoology. 191:49-62.
27. Comaish S (1969). Autoradiographic Studies of hair growth in various dermatomes:Investigation of a possible circadian rhythm in human hair growth. British Journal of Dermatology: 81: 283-88.
28. Munro DD (1966). Hair growth measurement using intradermal sulphur ^{35}cysteine. Arch Dermatol. 93:119-22.
29. Johnson E (1958). Qualitative Studies of Hair Growth in the Albino Rat II. The effect of sex hormones. Journal of Endocrinology. 16:351-9.
30. Ebling FJ, Johnson E (1964). The Action of Hormones on the Spontaneous Hair Growth Cycles in Rat. Journal of Endocrinology: 29:193-201.
31. Trotter M (1924). The life cycle of hair in selected regions of the body. American Journal of physiological Anthropology. 7: 427-37.
32. Wetfriend S, David M, Gingberg A, Sandbank M, Generalised Hair Follicle Hamartoma. The third case report in association with Myasthenia Gravis (1987). American Journal of Dermatopathology: 9: 428-32.
33. Harris TJ, Ruitar DJ, Milim MC (1983). Distribution of Major Histocompatibility Antigens in Normal Skin. British Journal of Dermatology. 109: 623-33.
34. Sebuwufu PH (1968). Ultrastructure of Human Foetal Thymic Cilia. Journal of Ultrastructure Res. 24:171-80.
35. Wolf M, Rosai J, Wright DH (1984). Sebaceous Gland within the Thymus. Report of 3 cases. Human Pathology. 15:341-3.

36. Levine GD, Bensch KG (1972). Epithelial nature of spindle cell culture thymoma; an ultrastructural study. Cancer. 30:500-11.

37. Arches CB (1998). Skin (Chapter-4). In: Champion RH, Burton JL, Burns DA, Breathnach SM, editors. Textbook of Dermatology by Rook, Wilkinson and Ebling. Oxford (6TH Edition). Blackwell Science : 113-22.

38. Johnson E. Qualitative Studies of Hair Growth in the Albino rat. III. The role of Adrenal Glands (1958). Journal of Endocrinology. 16:360-8.

39. Wise Thomas H, Fold JJ (1999). Effects of thymic peptide thymulin on in –vitro and in-vivo testicular steroid concentrations in white composite and Meishan boars. Agricultural Res. 05:11.

40. Szabo G (1967). The regional Anatomy of the human integument with special reference to the distribution of the hair follicles, sweat glands and melanocytes. Philos Trans R. Soc London B Biological Science. 252: 447-85.

41.Castro JE, Medawar PB, Hamilton DNH (1973). Division of Surgical Sciences. (Transplantation Biology Section), Clinical Research Centre, Harrow. Orchidectomy, a method of immunopotentiation in mice. Ciba Geigy Foundation Symposium :237-52.

42. Burman JM, Astore I, Pecoravo V (1965). The normal tichogram of adults. Journal of Investigational Dermatology. 44: 233-6.

Date of Submission: 22 December 2012
Date of Provisional acceptance: 08 January 2013
Date of Final acceptance: 16 February 2013
Date of Publication: 05 March 2013
Source of Support: Nil Conflict of Interest: Nil