

معهد التشريح .
كلية : الطب البيطرى - بهانوفر .
جمهورية ألمانيا الاتحادية .

دراسات هستولوجية على البشرة وفقد الشعر وفقد الجلد في أجنة الخراف

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تم دراسة التغيرات التي تحدث في أجنة الخراف في أعمار تتراوح بين
٢٦ يوما و ١٣٠ يوما من الحياة الجنينية .

تظهر البشرة كغشاء عديد الطبقات في اليوم الثامن والخمسون ، بينما
يبدأ غمد الشعر في النمو في اليوم الثامن والسبعون من الحمل حيث يرى
من حوله الغدد العرقية والدهنية .

نوقشت ظاهرة تكون قنوات الشعر التي لوحظت في الأجنة عند عمر
١٠٤ يوما .

لم يتمكن الباحثون من مشاهدة وتعيين المجاميع الثلاثية لغمد
الشعر الأولى ، حيث كانت الألياف الضامة غير كاملة النمو حتى نهاية
مدة الحمل .

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**MICROMORPHOLOGICAL STUDIES ON THE EPIDERMIS, HAIR FOLLICLES
AND SKIN GLANDS OF SHEEP DURING PRENATAL LIFE**
(With One Table and 10 Figures)

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SUMMARY

The histomorphological changes occurring in the sheep fetal skin (Blackface breed), from the 26th to the 130th day of pregnancy, were studied.

The stratification of the epidermis started at the 52^{ed} day of embryonic life.

The anlagen of the hair follicles appeared around the 78th day of fetal life and showed also the commencement of the growth of the tubular and sebaceous glands.

The formation of the hair canals, through its epidermal and sebaceous gland origins, occurred at the 104th day of fetal life. Also at this stage the sebaceous and the tubular glands reached their mature form. The trio-groupings of the primary follicles as well as the groupings of the secondary variety were difficult to be demonstrated during the advanced stages of intrauterine life, as the connective tissue fibers of the dermis were still short and fine.

INTRODUCTION

Although the recent works had devoted much attention to the prenatal development of the epidermis and hair follicles in the Merino sheep, few studies were dealt with these structures in the Blackface breed.

Chronological histomorphological studies of the different stages of the follicle development and the formation of the hair canal in the Merino sheep were described by LYNE (1957). This investigation presented a study on the prenatal development of the epidermis, hair follicles and skin glands in the Blackface sheep from the 26th day to the 130th day of fetal life.

MATERIAL and METHODS

The material for this investigation originated from 11 sheep fetuses (Blackface breed). The specimens covered the period from the 26th day till the 130th day of pregnancy (see table 1). The fetal age was detected from the records of the date of mating of the pregnant ewes. The fetuses were recovered shortly after evisceration, weighed to the nearest gram

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and the CVR (Curved Crown-to-Rump) length was measured to the nearest centimeter. The whole 26 days old- fetuses, and portions of the skin at the flank region fo the other fetuses, were fixed in 10% formalin and embedded in paraplast. The specimens were sectioned at approximately 5-20 μ m thickness and stained with Hematoxylin and Eosin and also with Masson's Trichrome stain.

Table (1)

Material available for study

Fetus No.	Weight (g.)	CVR (cm.)	Age (day)	Sex
1	0.54	1.3	26	§
2	0.50	1.3	26	§
3	36.00	13.0	52	♂
4	30.00	11.3	52	♀
5	350.00	25.2	78	♂
6	1585.00	44.0	104	♀
7	1355.00	39.4	104	♂
8	1610.00	42.7	104	♂
9	4080.00	57.8	130	♀
10	3855.00	52.5	125++	♀
11	3985.00	55.0	130++	♀

§: Sex could not be determined.

++: Age estimated.

RESULTS

Twenty six days:

At the 26th day of fetal life the epidermis was composed of a single layer of cuboidal cells with large centrally located nuclei (Fig. 1). In some regions, the epidermis was consisted of two layers of cuboidal cells, the deeper of which possessed oval basally situated nuclei.

Fifty two days:

At the 52^{ed} day of intrauterine life, the epidermis was composed of three layers of cells. The inner layer, was formed of cuboidal cells which contained large oval basally situated nuclei. The middle layer, was composed of polygonal cells with elliptical nuclei. The outermost layer, which was occasionally missed in some portions of the skin, was formed of flattened cells which had spindle-shaped nuclei (Fig. 2).

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Seventy eight days:

In the 78th day old fetuses, the epidermis could be differentiated into 4-6 distinct layers. The stratum basale was composed of a single layer of columnar cells resting on the basement membrane. The stratum spinosum, was formed of 2-3 irregular layers of large polygonal cells with varying sizes which contained oval centrally or eccentrically situated nuclei. Their cytoplasm was conspicuous in proportion to the size of the cells. The periderm was consisted of 1-2 layer (s) of flattened cells. They contained spindle or flattened nuclei (Fig. 3).

The primitive stages of the hair follicles began by the appearance of a localized thickening of the stratum basale accompanied by an invagination of the epidermis into the dermis. This constituted the follicle plugs (Fig. 3). The invagination of the epidermis extended in some regions to the length of the outer third of the dermis. The cells of the follicle plug were arranged either regularly around the periphery where they were continued with the stratum basale, or scattered irregularly within the center of the plug (Fig. 3).

The primordia of the tubular glands appeared as a solid bud of follicular cells beyond the boundary of the plug at the ental side of the growing hair follicle (Fig. 3). This swelling propagated into the dermis till it showed a distal swelling with a well defined margin (Fig. 4). The sebaceous gland rudiment appeared as a follicular cell budding on the ental side of the follicle below the tubular gland bud.

One hundred and four days:

The epidermis increased slightly in thickness. A fourth layer of cells was demonstrated beneath the periderm presented pyknotic nuclei representing the primordia of the stratum corneum. Several hair follicles contained well differentiated keratinized hairs. Both the inner and outer root sheaths were clearly defined. The hair bulb was enlarged and contained numerous melanocytes arranged around the opening of the bulb (Fig. 5). Several hair follicles (primary follicles) extended to the deep dermal level or more within the subcutis. Each of the primary follicles was accompanied by M. Arrector pili and apocrine gland. M. Arrector pili was composed of two fascicles of smooth muscle fibres. These fascicles enclosed the beginning of the excretory part of the tubular gland. The glandular epithelium of the tubular glands was represented by a single layer of cuboidal cells. The excretory duct coursed along the ental side of the corresponding hair follicle and passed between the two lobes of the sebaceous gland where it opened nearby the opening of the hair follicle.

The sebaceous glands were comparatively large and extended beyond the boundary of their own hair follicles (Fig. 6). They were composed of large polygonal cells which contained oval central nuclei. Although most of the hair canals were completely developed, some of them were still demonstrated undergoing several stages of development (Fig. 7). The formation of the hair canals depended on the degeneration of the sebaceous gland cells at the neck of the hair follicle and or the degeneration of the epithelial cells which lied above them.

One hundred and thirty days:

The epidermis was composed of four layers of epithelial cells. The stratum basale was composed of low columnar cells with large rounded or oval nuclei. Both the stratum spinosum and stratum corneum were composed also of single layer of cells. The outer configuration of the epidermis was corrugated due to the exits of the hairs at the hair pits (Fig. 8).

The hair follicles extended along the thickness of the dermis and the subcuticular layer. Some of them followed a flexuous course (Fig. 8). Many of the hair follicles did not penetrate the epithelium. In cross section the primary hair follicles were arranged singly or in groups and their bilobed sebaceous glands bounded the excretory duct of their own tubular glands (Fig. 9). The secondary hair follicles occurred in groups each consisted of 2-6 follicles. They were mostly neighbouring to the primary hair follicle. Their sebaceous glands were smaller than that of the primary follicles. The secondary follicle grouping occurred either beside or around the primary follicles.

The tubular glands possessed a wide cavity and lined with one layer of cuboidal epithelium showing rounded or oval centrally situated nuclei (Fig. 10).

DISCUSSION

The chronological events concerning the development of the epidermis and the hair follicles demonstrated by the present study simulate the description given by LYNE (1957 & 1966) in the Merino sheep. The epidermis of the Blackface sheep fetuses lacked a stratum granulosum, a feature which coincides the findings of SPÖTTEL and TÄNZER (1923) and LYNE (1957) in Merinos. The former authors considered that the relatively slight development of the epidermis in Merino sheep compensated the dense hair covering.

The description provided by the present investigation dealing with the formation of the hair canals could be supported by the findings of DIEM (1907) who described the formation of hair canals as a function both of the sebaceous gland cells, which were degenerated in the neck region of the follicle, and the epidermal cells which became keratinized some distance above them. However, the latter author considered that the sebaceous gland cells were only secondary for the formation of the epidermal portion of the lumen of hair canals, where they possibly widened the canal by means of the secretion introduced into the lumen. In addition DUERDEN and RITCHIE (1924) added that these canals were formed by disintegration of both cells of the wall of the hair canals and the sebaceous gland cells. On the other hand, MARTS (1895), SPÖTTEL and TÄNZER (1923) and WILDMAN (1932) attributed the origin of the hair canals to the activity of the sebaceous cells alone.

Similar to what was mentioned in the present investigation, several literature described the primary follicles as having a sebaceous gland, an Arrector pili muscle and a tubular gland. LYNE and HOLLIS (1968) described the primary follicles in the vicinity of the naked part of the muzzle as to lack a tubular gland and M. Arrector pili. The bilobed appearance and the form of the sebaceous glands of the primary follicles during the late stages of development in the Blackface sheep fetuses were described by LYNE and HOLLIS (1968) in the Merinos in relation to the secondary follicles. The aforementioned authors stated that the apocrine (tubular) glands, as well, their excretory ducts which passed between the two strands of M. Arrector pili opened immediately below the epidermis into hair canals in the Merino sheep. A matter which coincides that found in the present investigation.

The trio-grouping of the primary follicles in the Merinos (BURNS, 1955; CARTER, 1955 and LYNE, 1966) were not exactly presented in the Blackface breed during the prenatal life as the connective tissue of the dermis played an important role in this arrangement. BURNS (1955) stated that the connective tissue fibers of the dermis, as becoming longer and a little stronger and the trabeculae wider, the trio-groupings were much obvious in the age of 6 weeks than that in the one day old Suffolk breed. These findings clarified the difficulties in estimating the percentage frequency of groupings the primary as well

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as the secondary follicles in the Black-face sheep during the late prenatal development. In conclusion, a complete study of the developmental changes occurring within the skin of sheep must involve further investigations during the early postnatal life.

REFERENCES

- Burns, M. (1954): Observations on the development of the fleece and follicle population in suffolk sheep. *J. Agric. Sci. Camb.* 44, 86-99.
- Carter, H.B. (1955): The hair follicle group in sheep. *Anim. Breed. Abstr.* 23, 101-116.
- Diem, M.F. (1907): Beiträge zur Entwicklung der Schweisdrüsen an der behaarten Haut der Säugetiere. *Anat. Hefte* 34, 187-236.
- Dureden, J.E. and RITCHIE, M.J.F. (1924): Development of the merino wool fiber. *S. Afr. J. Sci.*, 21, 480-497.
- Lyne, A.G. (1957): The development of the epidermis and hair canals in the merino sheep fetus. *Aust. J. biol. Sci.*, 10, 390-397.
- (1966): The development of the hair follicles. *Aust. J. Sci.*, 28, 370-377.
- and D.E. Hollis (1968): The skin of the sheep: A comparison of body regions. *Aust. J. biol. Sci.* 21, 499-527.
- Marts, P. (1895): Untersuchungen über die Entwicklung der Haut, insbesondere der Haar- und Drüsenanlagen bei der Haussäugetieren. *Dissert. Berlin* (quoted by DIEM, 1907).
- Spöttel, W. und E. Tänzer (1923): Rassenanalytisch Untersuchungen an Schafen unter besonderer Berücksichtigung von Haut und Hair. *Arch. Naturgesch. Abt. A* 89 (6), 1-242.
- Wildman, A.B. (1932): Coat and fiber development in some British sheep. *Proc. Zool. Soc. Lond.*, 257-285.

LEGENDS

Fig. (1): Vertical section of the skin on the 26th day, showing the epidermis consisting of a single layer of cuboidal cells (H & E, 320 X).

Fig. (2): Vertical section of the skin on the 52^{ed} day, showing stratified epidermis consisting of three layers of cells (H & E, 320 X).

Fig. (3): Vertical section of the skin on the 78th day, showing the epidermis consisting of the stratum basale, stratum spinosum and the periderm. Notice the primitive states of the hair follicles, follicle plug (Fp), as well as, the primordia of the tubular gland (Ag) that appeared at the ental side of the growing hair follicle (H & E, 400 X).

Fig. (4): Vertical section of the skin on the 78th day, showing that the growing tubular gland (Ag) propagated within the dermis till it showed a distal swelling with a well defined margin (H & E, 400 X).

Fig. (5): Vertical section of the skin on the 104th day, showing well differentiated keratinized hairs, inner and outer root sheaths and numerous melanocytes arranged around the opening of the bulb (H & E, 100 X).

Fig. (6): Transverse section of the skin on the 104th day, showing that the sebaceous glands (sg) are present near the openings of the hair follicles (H & E, 400 X).

Fig. (7): Vertical section of the skin on the 104th day, showing the different stages of the hair canals formation (H & E, 256 X).

Fig. (8): Vertical section of the skin on the 130th day, showing the corrugation of the outer configuration of the epidermis (H & E, 100 X).

Fig. (9): Transverse section of the skin on the 130th day, showing that the primitive hair follicles (PF) are arranged singly or in groups and their bilobed sebaceous glands (Sq) bound the excretory duct (Ed) of their own tubular glands (H & E, 256 X).

Fig.(10): Transverse section of the skin on the 130th day, showing that the tubular glands (Ag) possessed a wide cavity and lined by a single layer of cuboidal epithelium (H & E, 256 X).

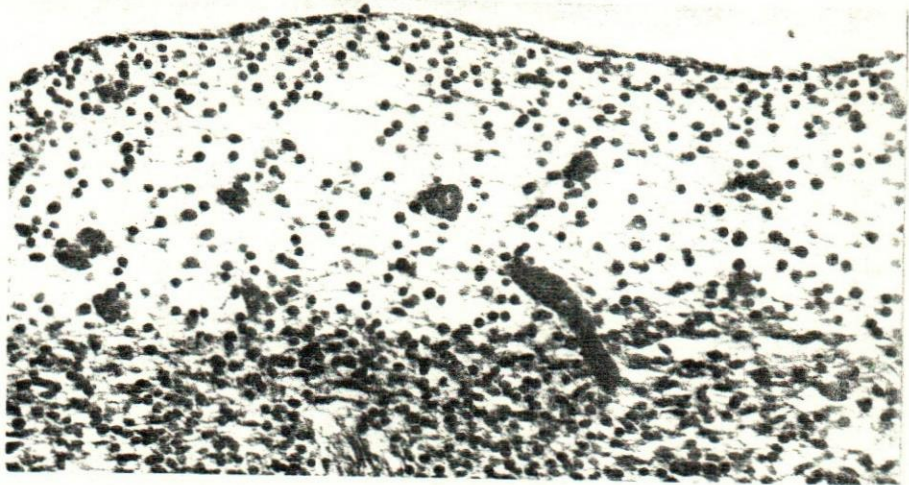


Fig.1.

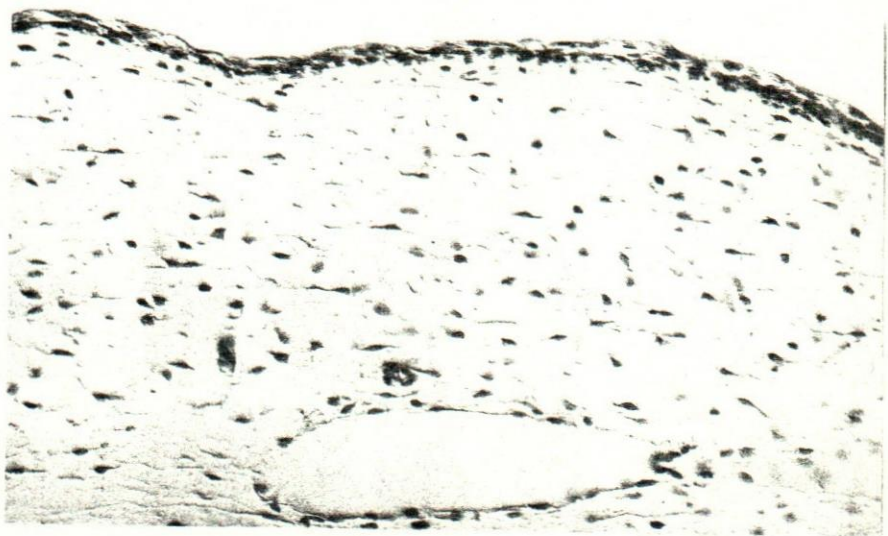


Fig.2.

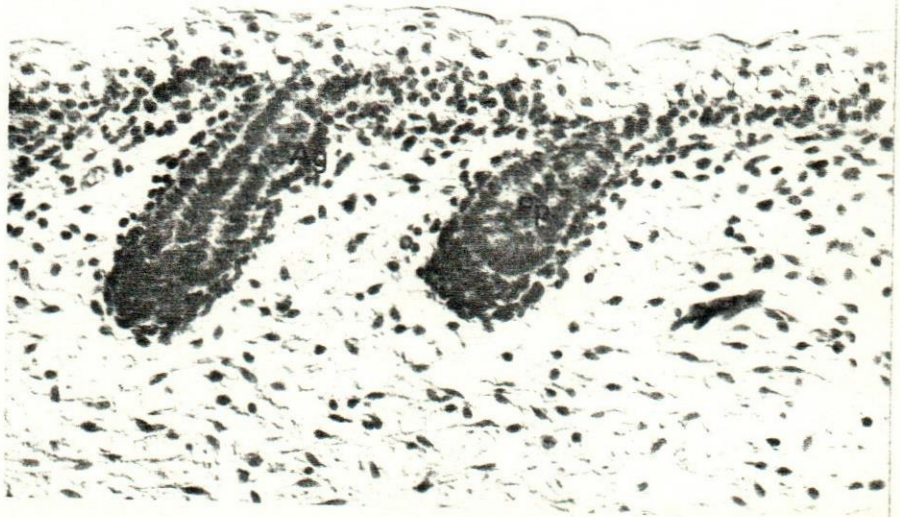


Fig.3.

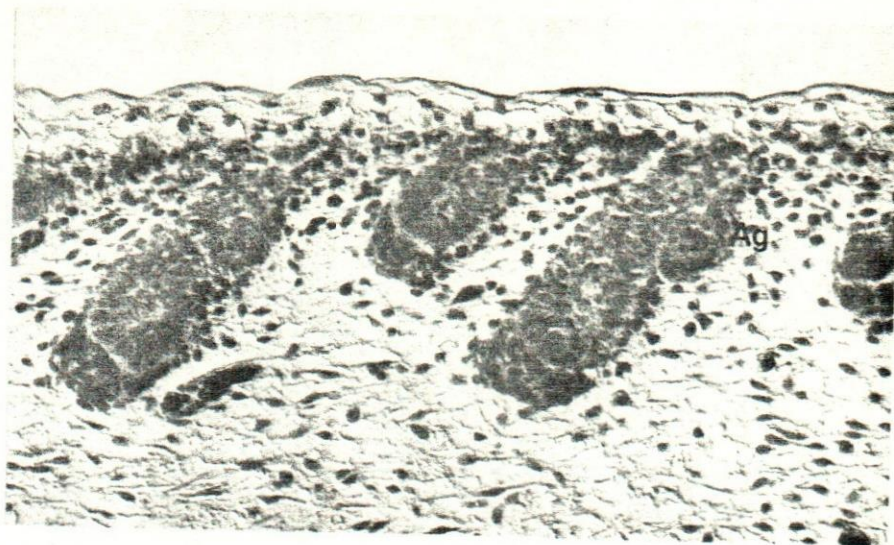


Fig. 4.

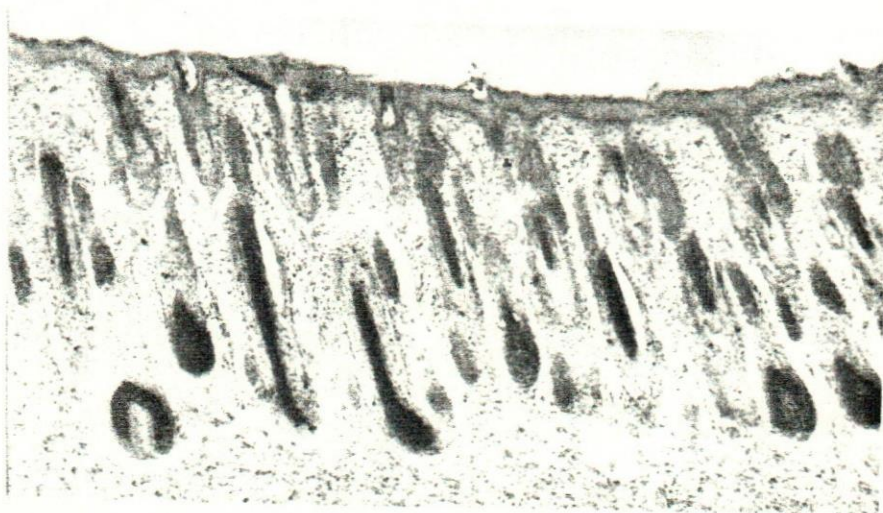


Fig. 5.

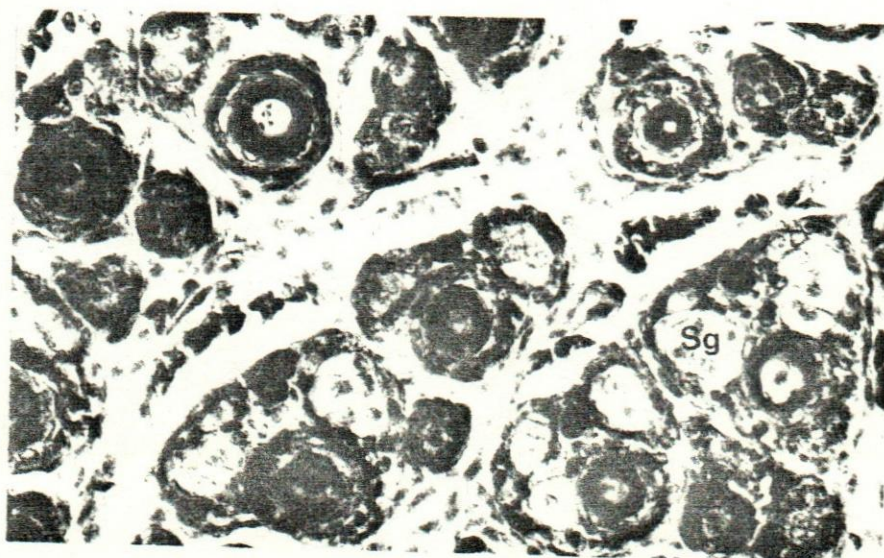


Fig. 6.



Fig. 7.

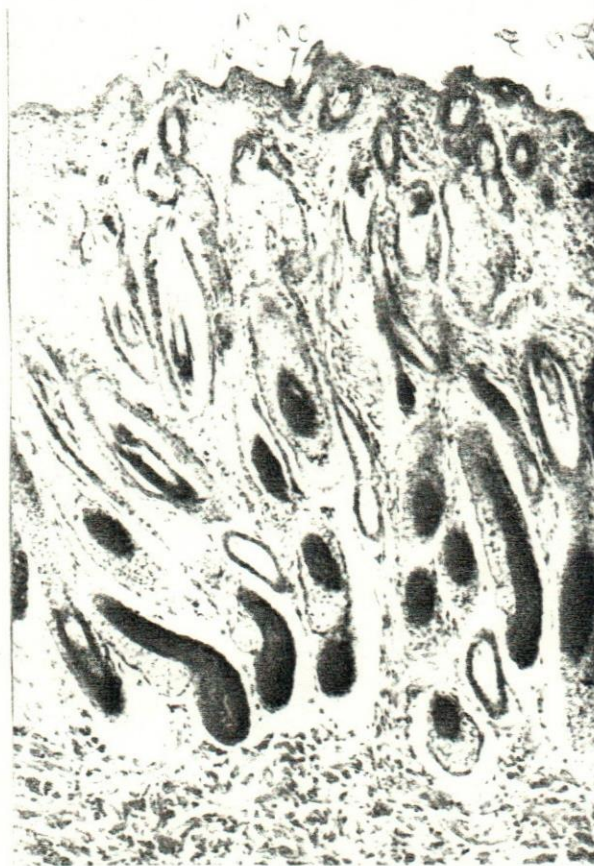


Fig. 8.



Fig. 9.

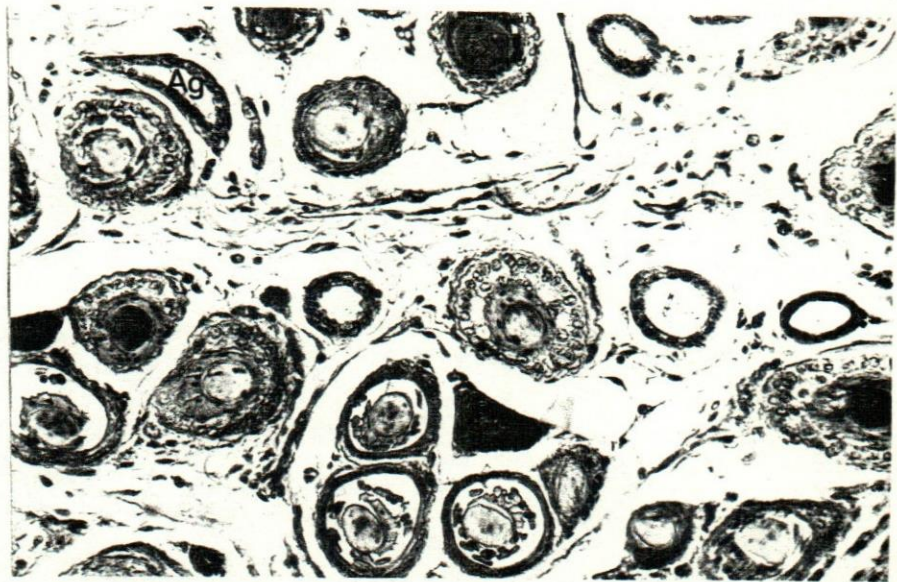


Fig. 10.

