

## EFFECT OF PREGNANCY ON THE HUMAN HAIR CYCLE\*

YELVA L. LYNFIELD, M.D.

Diffuse hair loss in the postpartum woman is a well-known clinical fact. However, little is known about the mechanism of this hair loss. It was thought that this might be a manifestation of a change in the hair cycle occurring normally during pregnancy. Therefore, the hair cycle of the human scalp was studied during and after pregnancy by examining hair roots periodically.

On the scalp, anagen (the growth phase of the hair cycle) lasts for several years. Telogen (the resting phase which follows anagen and ends with depilation) lasts for a few months (1). Each follicle has its own rhythm, uninfluenced by the follicles in its immediate neighborhood, and usually out of phase with these neighbors.

Van Scott and Reinertson (2) described a method whereby the percentages of growing and resting hairs can be easily established. This percentage is, according to Van Scott (3), a rough measure of the length of anagen and telogen. Van Scott and Reinertson's method was used in the present investigation.

## MATERIALS AND METHOD

The hair roots of twenty-six white women were examined during and after normal pregnancies. They were seen at the Chicago Lying-In Hospital, where they were delivered under spinal anesthesia. A control group consisted of thirty healthy non-pregnant white women. The ages of both groups ranged from 17 to 40. The mean age of the pregnant women was 26, with a standard deviation of 5. The mean age of the control group was 25, with a standard deviation of 5.

In accordance with Van Scott and Reinertson's method (2), a surgical needle-holding forceps was used to pull approximately fifty hairs simultaneously from the temporal scalp about an inch behind the postauricular fold. Then fifty hairs were pulled from a symmetrical site. The 100 hairs were cut short, placed in water in a scored glass Petri dish, and their roots examined

with a dissecting microscope. Anagen (growing), catagen (intermediate), telogen (resting), and dysplastic (abnormal) hairs were easily distinguished. Figure 1 illustrates the appearance of an anagen and a telogen hair in this preparation. A "differential count" of 100 hairs was made. Serial counts in non-pregnant women agreed within 5% when examined before and after shampooing, and at intervals of from 1 to 7 months, indicating that the differential count was fairly constant for the same individual.

Hair from the frontal hairline at the tip of the triangular recession was also examined. This hair was suspected to be more responsive to hormonal changes in pregnancy because of its greater responsiveness to androgens (4). Changes in frontal hair paralleled changes in the temporal scalp. However, the data from the frontal area was discarded as less reliable because a slight difference in location along the frontal hairline made a large difference in proportion of anagen hairs. Frontal hair had 0 to 30% less anagens than temporal hair.

Loose hairs combed out were also examined. They were all normal telogen hairs.

## CASE REPORTS

Four striking examples of changes in the hair cycle in connection with pregnancy are given in the following case reports. (See also Table I).

1. G. W., a 25 year old white primipara, had differential hair root examinations before, during, and after pregnancy. These are graphed in Figure 2. During the second and third trimesters, the proportion of anagen hairs rose considerably above her nonpregnant baseline. This high percentage of growing hairs persisted six days postpartum, but decreased significantly by three weeks postpartum. Lactation was abruptly discontinued five weeks postpartum. Six weeks postpartum there was an even greater decrease in percentage of anagen hairs. This low level persisted until six months postpartum. Hair loss, clinically evident because of a large amount of shed hair, with slight diffuse alopecia, began four months postpartum and lasted for two months. By eight months postpartum, the differential count of hair roots was back to normal. Loose hairs combed out were all

\* From the Section of Dermatology, School of Medicine, University of Chicago, Chicago, Illinois.

Presented at the Twenty-first Annual Meeting of The Society for Investigative Dermatology, Inc., Miami Beach, Florida, June 13, 1960.

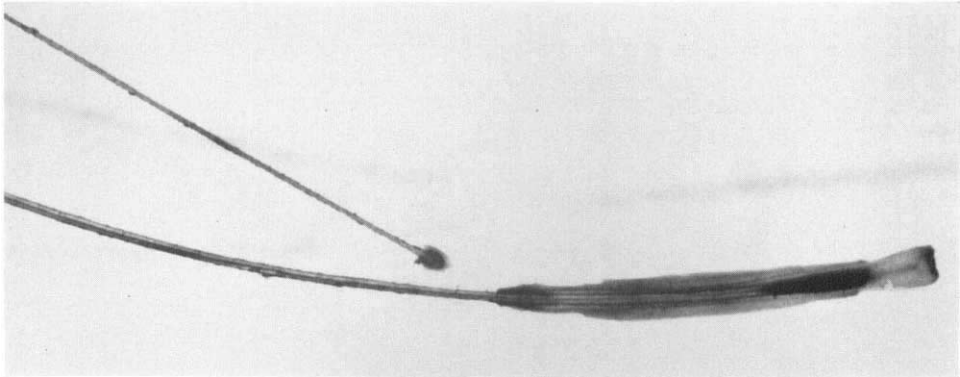


FIG. 1. Telogen hair, above; anagen hair, below

TABLE I

*Percentage of anagen hairs in eight women followed closely during and after pregnancy*

Patient	Age	Second Trimester	Third Trimester	First Week Postpartum	Six Weeks Postpartum	Three Months Postpartum	Clinical Hair Loss
G. W.....	25	96	94	97	74	74	4 to 6 months postpartum
M. B.....	24		93	88	70		1 week to 2½ months postpartum
P. H.....	20		87, 85		56		None
W. K.....	38		87	91		91	None
E. P.....	32	98	100	97	65		None
D. H.....	26		98	99	89	54	None
L. S.....	25		99, 97	97		89	None
K. H.....	23		96	94	92	77	None

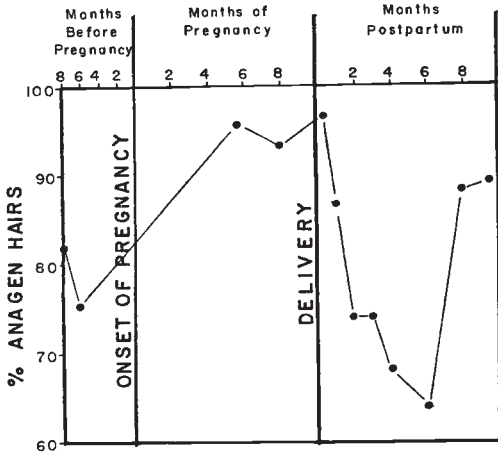
normal telogen whenever examined. No dysplastic hair was seen.

2. M. B., a 24 year old white woman, was studied during and after her third pregnancy. She had noticed that during each pregnancy her hair and skin became drier, requiring lubrication. All three pregnancies were uncomplicated, with delivery at term under spinal anesthesia. She stated that approximately one week after the first two deliveries she began to lose a great deal of hair, and that her rate of hair loss did not slow down to normal until five months postpartum. Examination of her hair roots showed that her percentage of anagen hairs was 93 in her third trimester. Five days postpartum it was 88. It decreased to 70 six weeks postpartum, when many loose hairs, all normal telogen, were observed. Further examinations were prevented by her moving to another city, but she reported that increased hair loss began one week postpartum and ended almost three months postpartum. She did not breast feed any of her children.

3. P. H., a 20 year old white primipara, noticed no change in her hair during or after pregnancy. Examination of her hair roots during her eighth month of pregnancy showed 87% anagen; during her ninth month, 85% anagen. Delivery was normal, under spinal anesthesia. Lactation was suppressed. Six weeks postpartum, the percentage of anagen hairs was 56. Five months postpartum it was 72. It is interesting to note that although her hair cycle changed greatly she had no clinically evident hair loss.

4. The following case experienced unusually severe postpartum alopecia. C. A., a 29 year old white woman, was studied only after her third delivery. All three pregnancies were uncomplicated, with delivery under spinal anesthesia. She noticed no change in her hair during pregnancy. One month after her first delivery, marked defluvium began. She consulted a dermatologist, who did a thorough medical workup, with the final diagnosis of "postpartum hair loss". Hair stopped "coming out in handfuls" six months

**FIGURE II**  
**PERCENTAGE OF ANAGEN HAIRS**  
**IN CASE NO. I**  
(See text)



**MONTHS**  
**FIG. 2**

postpartum. After her second pregnancy, there was no unusual hair loss. Three weeks after her third delivery, she again began to lose hair profusely. Six weeks postpartum, her percentage of anagen hairs was 72. She breast fed all her babies.

5. A remarkable exception from the rather characteristic increase in proportion of anagen hairs during pregnancy and precipitous fall postpartum is represented by the following case. W. K., a 38 year old white woman, was studied during and after her seventh pregnancy. She denied any changes in her hair at any time. During her third trimester, the percentage of anagen hairs was 87. Five days postpartum it was 91. Three months postpartum it was still 91. She did not breast feed. One may speculate that, after many pregnancies, her hair roots were no longer responsive to the hormonal fluctuations of pregnancy and the puerperium.

**RESULTS**

The percentages of anagen hairs found at various times during and after pregnancy in eight women who were studied closely are shown in Table I. Seven of them showed a significantly higher percentage of anagen hairs during pregnancy than postpartum. Additional data were obtained from eighteen other pregnant and postparturient women, who were seen only once or twice. All

**TABLE II**  
*Percentage of anagen hairs in pregnancy and postpartum in 26 cases*

Patient	Age	1st Trim.	2nd Trim.	3rd Trim.	1st Week Postpartum	6 Weeks Postpartum	3 Months Postpartum	Clinical Hair Loss
E. M. . . . .	29	84						
B. M. . . . .	21	87						
J. N. . . . .	22	89						
B. H. . . . .	24	81						
B. J. . . . .	25	83						
D. W. . . . .	29		95					
M. O. . . . .	26		93					
P. B. . . . .	21		91					
N. G. . . . .	23			95				
G. K. . . . .	24			98				
L. P. . . . .	34			90				
A. U. . . . .	26			91, 91				+
P. W. . . . .	17			97, 98	95			
J. W. . . . .	23			94	92			
M. S. . . . .	31			95, 100	95	73		
L. P. . . . .	38					72		
C. A. . . . .	29					77		+
G. D. . . . .	21					77		
G. W. . . . .	25		96	94	97	74	74	+
M. B. . . . .	24			93	88	70		+
P. H. . . . .	20			87, 85		56		-
W. K. . . . .	38			87	91		91	-
E. P. . . . .	32		98	100	97	65		-
D. H. . . . .	26			98	99	89	54	-
L. S. . . . .	25			99, 97	97	89		-
K. H. . . . .	23			96	94	92	77	-

**TABLE III**  
*Mean values of percentage anagen hairs in pregnancy and postpartum*

	Age	1st Trim.	2nd Trim.	3rd Trim.	1st Week Postpartum	6 Weeks Postpartum	3 Months Postpartum
Mean . . . . .	26	85	95	94	94	76	77
Standard Deviation . . . . .	5	3	3	4	3	11	13
Number of Cases . . . . .	26	5	5	15	11	9	5

the differential counts are summarized in Table II.

The mean percentage of anagen hairs in the non-pregnant control group (30 women) was 85, with a standard deviation of 5.6.

The mean percentage of anagen hairs in the first trimester (five women) was 85, which is identical with the mean percentage of anagen hairs in the control group. In the second trimester (five women) it was 95, which represents a significant rise. In the third trimester (15 women) it was 94, again significantly higher than normal. Five to seven days postpartum (11 women) it was still 94. Six weeks postpartum (9 women) it was 76. Three months postpartum it was 77. Both these values are below the non-pregnant mean.

We did not see dysplastic changes in hair roots, like those described after radiation (5) or toxic drugs (2) or sometimes after infections (4).

#### DISCUSSION

The above findings seem to indicate that during pregnancy the conversion of hair from anagen to telogen is slowed down. This change would account for the observed increase in percentage of anagen hairs. While this seems to be the most probable explanation, an alternate possibility is that pregnancy is associated with a more rapid shedding of telogen hairs.

Postpartum, the conversion from anagen to telogen is accelerated, accounting for the decrease in percentage of anagen. This is in agreement with Van Scott's observation that "where loss of hair has occurred in postpartum patients who have not had fever, the abnormality has consisted only of an increase in the proportion of telogen hairs." (3).

The observed alterations of the hair cycle by pregnancy are probably due to the changed endocrine constellation. In animal experiments, hormonal influences on the hair cycle have been clearly demonstrated. Among the observed effects the most pertinent observation has been that estrogens prolong the anagen phase once a cycle has begun (6).

One must be cautious in applying data obtained from animal experiments to human scalp hair, particularly because in laboratory mammals, in sharp contrast to human scalp hair, the telogen phase is longer than the anagen. Also, in most laboratory mammals, there are synchronized waves of growth of hair which sweep over their bodies, while in man each hair has its individual rhythm.

Little attention has been paid in medical literature to changes of the scalp hair during pregnancy. Behrman observed that women "with

the seborrheic diatheses and even male pattern alopecia" improved at the end of the second month of gestation: "Their scalps are less oily, the sebum diminished to a normal amount, and the amount of hair fall is temporarily arrested." (7)

There are several reports of generalized hypertrichosis during pregnancy which disappeared postpartum (8). Stoddard described two such cases in which the hair growth was especially prominent on the face. He attributed this change to an excess of corticosteroids, analogous to the hirsutism of Cushing's syndrome (9). Possibly, in these cases, the cycle of facial and body hair is altered in the same way as that of scalp hair, based on the same hormonal change.

Postpartum hair loss is well known to dermatologists, and is usually classified together with postinfectious, postoperative, and post-traumatic hair loss as "symptomatic alopecia." These alopecias have in common their diffuseness and their good prognosis. Sabouraud (10), who is widely quoted, thought that hair loss begins suddenly 70 to 75 days after childbirth, and lasts six weeks.

Unlike these estimates, the time of onset and duration of postpartum hair loss in the present study was variable. It began almost immediately after delivery in two women, one month postpartum in one, and four months postpartum in one. It lasted up to 5 months.

In conclusion, an increase in the percentage of hairs in anagen during pregnancy and a decrease in the percentage of anagen hairs during the postpartum period seems to be a general behavior pattern for human scalp hair. Accelerated hair loss after delivery probably occurs to some degree in most women, sometimes with short, sometimes with longer latent periods.

#### SUMMARY

Scalp hair roots were examined in women during and after pregnancy. These were compared with controls from non-pregnant women. The mean percentage of anagen hairs in non-pregnant women was 85. In pregnant women it was significantly higher. Postpartum it was significantly lower. Hair lost was normal telogen hair, without dysplastic changes.

Hair loss seems to decrease during pregnancy and increase after delivery because the conversion of hair from anagen to telogen is slowed down during pregnancy and is accelerated postpartum.

Clinically evident defluvium may occur immediately after delivery or after a variable latent period, up to several months postpartum.

#### ACKNOWLEDGMENT

The author is indebted to Dr. Stephen Rothman, Dr. Richard P. Reinertson and Dr. Robert Auerbach for their help in this study, to Dr. M. Edward Davis for permission to examine pregnant women attending the Chicago Lying-In Hospital, and to Miss Jean Altenberg and Miss Mary Elmlblad for their enthusiastic cooperation.

#### REFERENCES

1. PILLSBURY, D. M., SHELLEY, W. B. AND KLIGMAN, A. L.: *Dermatology*, p. 41. Philadelphia, W. B. Saunders Company, 1956.
2. VAN SCOTT, E. J. AND REINERTSON, R. P.: The growing hair roots of the human scalp and morphologic changes therein following amethopterin therapy. *J. Invest. Dermat.*, **29**: 197-204, 1957.
3. VAN SCOTT, E. J.: Response of Hair Roots to Chemical and Physical Influences, in Montagna and Ellis, edit.: *Biology of Hair Growth*, pp. 441-9. New York, Academic Press, 1958.
4. FLESCH, P.: Hair Growth, in Rothman, S.: *Physiology and Biochemistry of the Skin*, pp. 630-632. Chicago, Univ. of Chicago Press, 1954.
5. VAN SCOTT, E. V. AND REINERTSON, R. P.: Detection of radiation effects on hair roots of the human scalp. *J. Invest. Dermat.*, **29**: 205-212, 1957.
6. MOHN, M. P.: The Effects of Different Hormonal States on the Growth of Hair in Rats, in Montagna and Ellis, edit.: *Biology of Hair Growth*, pp. 336-393. New York, Academic Press, 1958.
7. BEHRMAN, HOWARD T.: *The Scalp in Health and Disease*, p. 101. St. Louis, the C. V. Mosby Company, 1952.
8. TROTTER, M.: Activity of hair follicles with reference to pregnancy. *Surg., Gynec., & Obst.*, **60**: 1092-1095, 1935.
9. STODDARD, F. J.: Hirsutism in Pregnancy. *Am. J. Obst & Gynec.*, **49**: 417-422, 1945.
10. SABOURAUD, R.: Alopecies, in *Nouvelle Pratique Dermatologique*, Vol. VII, p. 153. Paris, Masson et Cie, 1936.

#### DISCUSSION

DR. J. GRAHAM SMITH, JR. (Durham, N. C.): We have used this same technic in studying post-partum hair loss. It has been interesting to see that in the majority of our patients who have lost hair post-partum, the hair loss seems to be greater with each succeeding delivery. Has this been your experience?

DR. EUGENE J. VAN SCOTT (Bethesda, Md.): We have wondered, along with many others, what brings about telogen in pregnancy, whether the stimulus might be corticoid hormones. Franz Herrmann and his colleagues have shown that in the mouse cortisone may cause hair to remain in the resting phase for prolonged periods (HERRMANN, F., *et al.*, *J. Invest. Dermat.* **25**: 423-438, 1955). We have been unable to find a similar event in patients receiving large doses of corticosteroids.

DR. HERMANN PINKUS (Detroit, Michigan): Dr. Lynfield's findings are introducing a most interesting modification of our view of what causes hair loss after pregnancy. It has usually been stated that defluvium begins about 3 months after delivery, and since this interval is similar to the start of hair loss after acute disease or other stress on the body, it was assumed that

childbirth acts as a stress that induces many hairs to die and fall out. Dr. Lynfield now has told us that during pregnancy hair is not lost as much as normally, and that after pregnancy there are many overaged hairs, which all of a sudden go to telogen. Post-partum defluvium thus means restoration of normality rather than something pathological.

DR. YELVA LYNFIELD (in closing): In answer to Dr. Smith's question about the effect of successive pregnancies, we did not observe that the hair loss increased with successive pregnancies. There was no consistent relationship between the number of pregnancies a woman had and the amount of hair loss. For example, one woman whom we studied had consulted many dermatologists following her first pregnancy because of very severe postpartum hair loss. After her second pregnancy she observed no hair loss, and then after her third she again became terrified by the magnitude of her hair loss.

I thank Dr. Van Scott and Dr. Pinkus for their discussion, and Dr. Stephen Rothman and Dr. Richard Reinertson for their help in preparing this paper.