

THE RELATION OF THE MAMMARY  
GLAND TO UTERINE FUNCTION

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A Thesis Presented for the  
Degree of Master of Science

by

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That a close physiological relationship exists between the mammary gland and the uterus has been a matter of knowledge since the time of Hippocrates and Celsus. The question, as to whether the mammary glands are organs of internal secretion, in the accepted sense of the term, is still an open one, as is also their relation to the ovary and thus to uterine function. The literature contains many examples of this correlation and especially with particular reference to the definite cycle which the mammary glands undergo in their development, from the time of birth, to puberty and thru the pregnant state, as well as with the cessation of pregnancy, whether normally or abnormally stopped.

That the function of the mammary gland is independent of the nervous system, has been, we believe definitely proven by the work of Ribbert upon the transplantation of mammary gland tissue as well as by the clinical observation of paraplegic patients who have passed thru pregnancy and subsequently nursed their children.

Lane-Clayton and Starling, by the injection of rabbits with extracts made from ovary, uterine wall, uterine mucosa, placenta, placenta plus uterus, fetus, or fetus plus placenta and membranes, have been able to show that in all cases in which they were able to produce hyperplasia of the mammary glands the injections were derived from fetal extracts. They conclude that the growth of the mammary glands during pregnancy is due to a specific chemical

stimulus produced in the fertilized ovum and that lactation is due to the removal of this stimulus.

Halban, however, points out that when premature death of the fetus occurs, without its expulsion, as in the case of extrauterine fetation, the breasts swell two or three days after the death may be presumed to have taken place, and a true secretion of milk may be obtained. He further states that the same thing occurs when the death of the fetus occurs in utero, but the result is not invariable, and that there are cases in which the secretion of milk began two or three days after the presumed death of the fetus, but in other cases, the secretion occurred only after the expulsion of the dead fetus. He ascribes these differences to the differences in the placenta and concludes that the activity of the mammary glands is dependent upon the internal secretion arising in the ovary, except during pregnancy, at which time the function of the ovary is temporarily assumed by the placenta.

Frank and Unger in the most recent investigation of the subject based upon experiments in which they used injections of corpus luteum, ovarian substance and a combination of both, believe that the growth of the mammary glands, as well as the cyclical change in the virgin breast is dependent upon ovarian activity, and that the growth of the breasts in pregnancy is due to the persistence of the corpus luteum.

Ancel and Bouin believe that this change is due to the activity of the so-called myometric gland found in the pregnant uterus.

Loeb has shown that the ovary to a great extent is responsible for the development of cancer in the mammary gland of mice, and that the castration of female mice at a time when they have already entered into a period of sexual maturity, reduces the incidence of cancer from sixty to seventy percent to nine percent. Loeb states, "We may attribute this effect to the elimination of the cyclic growth stimuli which emanate from the ovary and act on the mammary gland in the normal animal. It is uncertain which constituent of the ovary is responsible for this effect." From the foregoing it is apparent that there exists a definite relationship, of some character, between the mammary gland and the ovary.

It has been well established by various investigators, that the endometrium shows characteristic changes during the various phases of the menstrual cycle. The establishment of this fact suggested the inquiry as to whether the corpus luteum of menstruation did not also show cyclic changes corresponding to the various phases of the menstrual cycle. Meyer, upon the basis of the histological changes in the endometrium has shown that the corpus luteum passes thru successive stages from its formation after ovulation to its ultimate fate. As a result of his work we are now able to determine from the histological appearance, the stage of development of the corpus luteum.

Battusaud asserts that during the reproductive period, the ovarian secretion inhibits mammary activity, while Bell believes, "that it is not so much a question of inhibition as that the ovary causes an excretion of lime salts, a process in which the mammary glands are also concerned." In support of this theory it might also be mentioned, that a high calcium content of the blood such as is found before menstruation often leads to activity in the mammary glands.

Upon the basis of the foregoing investigation we may believe that the activity of the mammary gland is in some way related to the menstrual function and that the mammary gland exerts an inhibitory effect upon the ovary, the activity of which in turn furnished the basis for the most commonly accepted theory of menstruation.

We have attempted to investigate this inhibitory activity by the feeding of mammary gland substance to women of the reproductive age, noting, as a basis of this study, the effect upon the menstrual flow. This serves as a criterion of the activity of the glands of internal secretion and by close observation of the process of menstruation, in any given case, it is possible from a clinical standpoint more or less definitely, to deduce what part the ovary and the glands of internal secretion (mammary) are playing in its production.

Experiments upon seventy-nine subjects, who gave either normal or abnormal menstrual histories furnish the basis for this paper. Two groups of patients were used, (1) girls selected from the student

body of Ohio State University and (2) the highest type of inmates of the State Institution for Feeble-minded at Columbus, Ohio. These subjects were selected at random and their ages varied from fifteen to thirty-three years, the majority being nulliparous, but a few having borne children. No preliminary attempt was made to classify the subjects as normal or abnormal, in so far as menstrual function was concerned, since we believe that this method of procedure would best serve two purposes:

1. It gives a certain number of normal subjects to use as controls, in-as-much as their general hygiene, school life, working conditions, recreation, rest, diet, etc., are the same as those who presented abnormal menstrual histories, and,
2. From a practical standpoint, it represents the general average of subjects who present themselves for endocrine therapy.

All patients were first carefully interviewed, and a statement as to their general health and habits was obtained. A careful menstrual history was then recorded upon the accompanying form. This history included, the age at which the first menses occurred, its character, the character of the second menses, the menstrual interval, the duration of the menstrual flow and the presence or absence of dysmenorrhea and its relation to the time of flow. In addition to this,

Case No..... Date.....

Name.....M.S.W. Age.....Color.....

Address.....Occupation.....Nativity,....

General Health:

Habits: (Clothing, constipation, diet, exercise, sleep, weather, etc.)

Menstrual History:

1. Age at first menses.....Character.....

2. Character of second menses.....

3. Type.....Duration.....Amount.....

4. Pain. (Location, character, things that influence it, etc.)

5. Date of last menstruation.....Character.....

General Data:

Date	
Duration	
Amount	
Pain	
Pulse and Temp.	
Depression	
Heat and Cold	
Breast enlarg.	
Pain in breasts	
Thyroid enlarg.	
Headache	
Weight in pelvis	
Backache	
Bladder irritab.	
Discharge	

Remarks:

a statement was obtained as to the presence or absence of certain disturbances, oftentimes associated with menstruation, namely, general depression, enlargement of the breasts, mastodynia, thyroid enlargement, headache, backache, sensation of weight in the pelvis, bladder irritability, etc. In no instance where the menstrual flow was found to be abnormal was an attempt made to establish the underlying pathological cause, if any.

Following this history each subject was kept under observation for a length of time varying from one to six months, during which period a careful study was made in order to establish definitely the various phenomena listed in the history. This method of procedure served several purposes, in that it definitely established the normal for each individual, as well as ruled out factors, such as variation in work, climate, sickness, etc., which at times, and in some individuals may influence menstrual function. After this period of observation, mammary gland substance was administered by mouth to each subject.\* Each grain of this substance represented four grains of fresh sheep gland. The gland substance was given in doses varying from two to eight grains three times a day. The time of administration with relation to the onset of menstrual flow was also varied. Some subjects received it one week, other two, and some three weeks before the onset, while others were given tablets during the entire menstrual cycle.

\* For the gland substance used in this work we are indebted to the courtesy of Armour & Co., Chicago, Ill.



The gland substance was administered to all the subjects for a period of one to three complete menstrual cycles after which the administration was discontinued and the same data collected as during the pre-feeding and feeding periods. In no case was the subject informed as to the probable effects to be expected, and few knew what they were receiving.

The data thus collected may be summarized as follows:

#### A. NORMAL CASES.

Forty-nine subjects (62%) gave a normal menstrual history; that is, there was no evidence of menorrhagia, metrorrhagia or unusual dysmenorrhea.

During the period in which the gland substance was given:

- (a) Thirty-one subjects (63%) showed no change in the amount or duration of the menstrual flow.
- (b) Ten subjects (20.4%) showed a slight decrease in the amount or duration of the menstrual flow.
- (c) Three subjects (6%) showed a slight increase in the amount or duration of the menstrual flow.
- (d) Three subjects (6%) showed a slight increase in the first period after feeding was begun followed by normal or slightly decreased periods.
- (e) Two subjects (4.2%) can not be classified in the above classification. In one of these the flow was

lessened in amount but the duration was prolonged. In the other the flow was absent for a period of two months followed by a regular interval with a decrease in the amount of flow.

#### B. ABNORMAL CASES.

Thirty subjects (38%) gave abnormal menstrual histories with reference to the existence of menorrhagia, metrorrhagia or dysmenorrhea, or a combination of these.

During the period in which the gland substance was given:

- (a) Nine subjects (30%) showed no change in the amount or duration of the menstrual flow.
- (b) Eight subjects (26%) showed a slight or moderate decrease in the amount or duration of the menstrual flow or a decrease in the amount of pain.
- (c) Four subjects (13.4%) showed an increase in the amount or duration of the menstrual flow or an increase in the amount of pain.
- (d) Five subjects (16.6%) showed a slight increase in the amount of flow the first period, followed by a decrease in the amount or duration of the flow during the subsequent periods.
- (e) Four subjects (13.4%) gave responses which could not be included in any of the above classes. One subject showed a slight increase the first month after feeding was begun and the balance of the time the

amount and duration of the flow was the same as prior to the administration of the gland substance but the interval varied from two to five weeks. Another subject, showed a reduction in the amount of flow and of pain as long as the feeding was continued but menstruated twice a month following the discontinuance of the feeding. A third subject showed a slight decrease in the duration of the flow followed by a six weeks' interval and then reverted to the same type as before feeding. The remaining subject had a flow of six to eight days duration prior to the administration of gland substance, normal in amount, but a menstrual interval which varied from twenty-one to forty-two days. Menstrual flow was accompanied by mild uterine colic and slight nausea. This patient received two grains of mammary gland substance three times a day for seven days prior to the onset of the menstrual flow. On the day the flow began she was seized with severe abdominal colic, a temperature of 101 degrees Fahr., nausea, vomiting and marked general depression.

Case No	Before Administration of Gland Substance			During Administration			After Administration		
	Duration of Flow	Amount	Pain	Duration	Amount	Pain	Duration	Amount	Pain
2	7 6 6	S S S	0 0 0	5	S	0			
4	3 6	N N	0 0	4 3 4	N N N	0 0 0	4 5	N N	0 0
5	3 5 4 5	N N N N	0 0 0 0	8 6	L N	0 0			
6	5 5 5 5	N N N N	0 0 0 0	5	N	0			
7	6 7	N+N+	++++	6 7 7	L N+N+	+++++0	7 7	N+N+	0 0
8	3 7	N+N+	++++	6 3 4	N N N	+++ +0	7 5	N+N+	0 0
9	7 6 6 7 7	L L L L L	+++++ +++++	4	N+	0			
10	6	N	0	5 5 4	N N N	0 0 0			
11	4 6 7 6	N N N N	+++++0	6 5	N N	0 0			
12	4 5	N N	+ 0	6 4 4	N-N N	0 0 0	6	N	0
13	6 8	N+N+	++ ++	6 7 6	L N-N	+ ++ 0			
14	6 7 6 5	N N N N	+ + + +	5 6	N N	+ +			
15	5 5	N+N+	+ +	4 4 5	N-N-N	0 0 0	5	N	0
16	8 6 7 7	N+N+N+N+	+ + + + +	8 4	L N	0 0			
17	6 5	N+N+	0 0	5 5 5	N+N+N	0 0 0	6	N	0
20	5 6 5	N+N+N+	+ + +	4 4 5	N+N+N+	0 0 0			
21	8 11	L L	0 0	9 4 4	L N N	0 0 0	6 7	N N	0 0
22	7 7 4	N+N+N+	0 0 0	4 5 4	N N N-	0 0 0			
23	4 5	N N	0 0	6 5 5	N-N-N-	+ + 0			
24	3 5	N N	0 0	4 4 4	N N N	0 0 0	4	N	0
25	3 6 5 5	N N N N	+ 0 + 0	5 5	N-N-	0 0			
26	7 9 7 5 4	N L L N N	0 0 0 0 0	6	N	0			
27	4 5 8 9 6 13	N+N+N+N+N+	+ + + + + +	7	N	0			
29	6 6	L L	+++	4 9	L L	0 0			
33	3	N	0	5	S	0			
38	3 6 4	N+N+N+	+++++	8	L	0			
39	5 5	N N	++ ++	5	N-	0			
43	7 8 8	N+N+N+	0 0 0	5	N	0			
44	4 4	N N	0 0	5	N	0			
45	7 9	L L	+++	6	N+	+			
51	7 12 8 5	N+N+N+N+	+ + + 0	6 7	N+N+	0 0			
52	6 6	N+N+	++++	6 5 5	L N N	0 + + +	5	N	0
53	2 3 3	N N N	0 0 0	3 3	N-N-	0 0			
56	7 6 5 5	N N N N	+ + + +	6	N	0			
57	5	N	+	5 5 7	N N N	+ + +			
58	4	N	+	4 4 4	N N N	+ 0 +	4	N	0
59	6	N	+	6 8 5	N N N	+ + +	6	N	+
60	3 11	N N	0 0	8 8 8	N N N	0 + 0	4	N	0
62	5 5 5	N N N	+ + +	5 4	N N	0 0			
63	7	N	++	5 4 6	N-N-N	0 0 0	5	N	0
64	3 4 3	N N N	+ + +	5 7 3	N+N N-	+ + 0 0	3	N	+
65	4 5 6	N N N	+ 0 ++	7	N-	+			
66	4 4	N N	+ +	7 5 6	N N S	+ 0 0	5	S	0
67	4 3 4 5	N N N N	0 0 0 0	5 5	N+N+	0 0			
68	7 9	N N	+ +	6 6 7	N N N	0 0 0	7	N	0
69	4 3	N N	+ +	3 4 3	N N N	0 0 0	3	N	0
70	5 6	N N	0 +	6 5 5	N N N	+ + + +	5 4	N S	0 +
71	4 4 4 4	N N N N	0 0 0 0	5 4 4	N N+N	0 0,0			
72	6	N	+	4 3 6	N+N-N-	0,0 0	6 6	N-N	+ 0
73	7 7 5	N N N	0 + 0	8 7 5	N N N	0 0 0			
74	4 5 5	N N N	+++ +0	5	N	0			
76	5 5	N N	+ +	6	N+	++			
78	5 6 5	N N N	0 0 0	5	N	0			
79	7 7 8 6	N N N N	0 0 0 0	7 7 6	N N N	0 0 0			
80	7 6 7 6	N N N N	+ + 0 0 0	6	N	0			
81	5 7 7 4	N N N N	+ + + +	6	N	+			
82	7 7 4 5	L L L L	+ + 0 0	6 6	N+N+	0 0			
83	5 7 5 6	N N N N	+ + + + +	6 6	N N	0 0			
84	7 8	N N	++++	8 7 7	N N N	0 0 0			
85	4 5 7	N N N	+++++	4 6 4	N N N	0 0 0			
86	6 7	N N	+ +	6 6 6	N N+N	0 0 0			
88	6 5 4	N N N	0 0 0	3 6 6	N N N	0 0 0			
89	6 6 6 6	N N N N	+ + + +	5 6	N N	0 0			
90	2 3 4 4	N N N N	+ + + +	4 3 4	N N N	+ 0 0			
91	7 7 7	N+N+N+	+ 0 0	8 5 4	L N N	+ 0 0			
92	3 5 4	N N N	0 0 0	4 5 3	N N N	0 0 0			
93	7 8	L L	0 0	5 6 5	L L L	0 0 0	6	L	0
94	5 5	N+N+	0 0	4 5 5	N+N+N+	0 0 0	4 4	N+N+	0 0
95	7 6 5	N N N	+ + +	6 5 5	N N N	0 0 0			
96	7 7 7 9 7	N N N N N	+ + + + +	6 6 5	N N N	+ 0 0	5 4	N S	0 0
97	5 5	N N	+ +	7	N	+			
99	5 5	N N	0 0	6 5 4	N-N-N-	0 0 0			
100	6 6 4	N N N	0 0 0	5	N	0			
101	8 6	N N	+ +	5 7 5	N N N	+ 0 0			
102	3 3 4	N N N	0 0 0	3 3	N N	0 0			
103	5 7 5	N N N	0 0 0	6	N	0			
107	6 7 7	N N+N	+++++	9	N+	++			
111	5 8	N N	0 ++	4	N+	+++			
112	6 6	N N	+ +	5	N	++			

Note: Duration of flow in days. S-small amount; N-,less than normal; N,normal; N+,greater than normal; L,large. 0,pain absent; +,slight pain; ++,moderate pain; +++,severe pain;++++very severe pain.

Remarks: Case 7. Interval irregular after feeding began  
Case 8. Flowed twice in the first month after rest began.  
Case 20. Forty-two day interval after feeding began.  
Case 29. Flowed twice during the first month on feeding.  
Case 65. One period missed when feeding began.  
Case 71.Floded twice during the first month of feeding.  
Case 112. Severe pain,nausea,vomiting,temperature 101 F.,during first period after feeding began.

## DISCUSSION.

We recognize the fact, that the results obtained in any experimental work involving the investigation of the incretory functions based upon the feeding of gland substances, is subject to many modifying factors. Some of these, to a certain extent, can be eliminated by the proper selection of control subjects. To this end it might be stated that the control subjects for this work were living under the same environmental conditions as the abnormal subjects. In spite of this we realize that controls as well as abnormal subjects may show individual variation.

We also recognize that a pelvic examination of all the abnormal subjects, might in a measure, have been of some help in the interpretation of the results which we have obtained, but, on the other hand, we believe that they represent the typical quality of patients as seen by the practitioner and to whom endocrine therapy might be applied by him.

In no instance have we been able to correlate the results obtained, with the amount of gland substance administered. Neither have we found that the time of administration prior to the onset of the menstrual flow has any effect upon the results obtained.

We also realize that the gland substance which we used may not contain the active mammary hormone. This may be due to some fault in the technique of its preparation or the substance, as obtained commercially, may vary in its activity depending upon the state of activity of the glands from which it was prepared.

## CONCLUSIONS

We are lead to believe from the foregoing observations that mammary gland substance is not inert; that the effect upon ovarian activity, of feeding this substance, as evidenced by changes in the character of the menstrual flow in patients with normal and abnormal menstrual histories, is not constant. Neither is it of practical value, from a clinical standpoint, in abnormal subjects where the abnormality is supposedly due to ovarian hyperactivity, in-as-much as the results obtained were neither constant nor sufficient in amount to warrant its use.

## BIBLIOGRAPHY

1. Battuaud, J.  
L'opotherapie Mammaire en gynecologie.  
Rev.de Mal de la Nutrit.,1909,vol.vii,p.260
2. Bell,Blair  
The Sex Complex.  
W.M.Wood and Co.,1920
3. Bouin,P.  
Les deux glandes a secretion interne de l'ovaire  
la glande interstitielle et le corps jaune.  
Rev.med.de l'Est.,Par.Nancy,1902,XXXIV,p.465
4. Bouin,P.and Ancel,P.  
Recherches sur les fonctions de corps jaune  
gestatif II.Sur le determinisme du developp-  
ment de la glande Mammaire au cours de la  
gestation.  
J.de Physiol.et Path.Gen.,Par.1911 XIII p.31
5. Bouin and Ancel,P.  
Sur les fonctions de corps jaune gestatif.  
J.Physiol.et path.gen.,Par.,1910,XII,p.1.
6. Flatau,M.G.  
Ueber Ovariectomie wahrend der Schwangerschaft.  
Munchen.med.Wchschr.,1905,LII,2542.
7. Foges,A.  
Schwangerschaftshypertrophie der Mammae und  
Nebenmammae.  
Wein.klin.Wchnschr.,Wein.u.Leipz.1901,XIV,1255
8. Foges,A.  
Zur physiologischen Beziehung swischen Mamma  
und Genitalien.  
Zentralbl.f.Physiol.,Leipz.u.Wein,1905,XIX,233
9. Fraenkel,L.  
Die Function des Corpus Luteum.  
Arch.f.Gynaek.,Berl.,1903,LXVIII,438.
10. Frank,R.T.  
Function of the Ovary.  
Amer.J.of Obst.,1911,64,p.297.

11. Frank, R.T.  
Influence of Duct Glands on Menstruation and Ovulation.  
Dublin J.M. Science, vol., II, p.637.
12. Frank and Rosenbloom.  
Physiologically active substances contained in the placenta and in the corpus luteum.  
Surg.Gynec.and Obst., 1915, 21, p.646.
13. Frank (R.T.) and Unger (A).  
An experimental study of the causes which produce growth in the mammary gland.  
Arch.Int.Med., 1911, vol.VII, 812.
14. Gauthier, L.  
Ein Fall von Milchsekretion aus den Brustan an stelle der Menstruation bei ein jungen Mädchen.  
Centralbl.f.Gynaek., Leipz., 1904, XXVIII, 127
15. Halban, J.  
Die Innere Sekretion von Ovarium und Plazenta und ihre Bedeutung fur die Function der Milchdruse.  
Arch.f.Gynaek., Berl., 1905, LXXV, 352, 1 pl.
16. Halban, J.  
Ueber der Einfluss der Ovarien auf die Entwicklung des Genitales.  
Monatschr.f.Geburtsh.u.Gyn., 1900, XII, 496
17. Hippocrates,  
Sydenham Soc.Transl.by Francis Adams, 1849, vol.2.Aphorisms, vol.5, p.747
18. Jacoby, A.  
The Effect of the Thymus and the Mammary Glands on Menstruation.  
N.Y.Medical Jour.1921, CXIII, p.243
19. Lane-Claypon (J.E.) and Starling, (E.H.)  
An Experimental Inquiry into the Factors which determine the Growth and Activity of the Mammary Glands.  
Proc.Roy.Soc.ser.B., 1905-1906, vol.LXVIII, p.505



20. Loeb, L.  
Relation of Ovary to Uterus and Mammary Gland  
from the experimental aspect.  
Surg.Gynec.and Obst., 1917, XXV, p.300
21. Loeb, L.  
Factors in the growth and Sterility of the  
Mammalian Ovary.  
Science, 1917, vol., 45, p.591.
22. MacKensie, K.  
An Experimental Investigation of the Mechanism  
of Milk Secretion with Special Reference to  
the action of Animal Extracts.  
Quart.J.Exp.Physiol., London, 1911, IV, 305
23. Mandl und Kreidl  
Die klinische Bedeutung der Milchsekretion  
bei bestehender Schwangerschaft.  
Wein.klin.Wchschr., Wein.u.Leipz., 1905, XVIII, 73
24. Marshall F.H.A.  
Physiology of Reproduction.  
Longmans, Green and Co., London, 1910.
25. Mayo, W.J.  
Conservation of the Menstrual Function.  
J.A.M.A., 1920, vol.74, p.1688.
26. Meyer, R.  
Ueber Corpus luteum-Bildung beim Menschen.  
Arch.f.Gynaek., Berlin, 1911, XCIII, 354.  
  
Zur Corpus luteum Bildung beim Menschen  
Zentralbl.f.Gynak., Leipz., 1911, XXXV, 1206.  
  
Ueber die Beziehung der Eizelle und des  
befruchteten Eies zur Follikelapparat, sowie  
des corpus luteum zur menstruation. Ein Beitrag  
zur normalen und pathologischen Anatomie und  
Physiologie des Ovariums.  
Arch.f.Gynaek., Berlin, 1913, C, 1-19, 2 pl.  
  
Beiträge zur Lehre von der normalen und Krank-  
haften Ovulation und der mit Beziehung  
Gebrachten Vorgänge am Uterus.  
Arch.f.Gynack., Berlin, 1920, CXIII, 259

Zur Lehre von der Ovulation und der damit in  
Beziehung stehenden pathologischen Vorgänge  
am Uterus.  
Gesellsch.f.Geburtsh.u.Gynak., Berlin, Feb., 27, 1920

Zur Lehre von der Ovulation und den mit ihr  
in Beziehung stehenden normalen, etc.,  
Zentralbl.f.Gynak., Leipz. 1920, No. 19.

27. Mironow, W.

De l'influence des systèmes nerveux sur le  
fonctionnement des glandes mammaires.  
Arch. des sci. biolog., St. Petersburg,  
1895, III, 354.

28. Novak, Emil

Menstruation and its Disorders.  
Appelton, 1921.

Organotherapy of Menstrual Disorders  
Med. and Surg., 1917, I, 576.

29. Novak, Emil

Role of the Endocrines in Menstrual Disorders.  
Endocrinology, vol., 4, July-Sept., 1920 411

30. O'Donoghue, C.H.

The growth changes in the mammary apparatus  
of Dasyurus and the relation of the corpus  
luteum thereto.  
Quart. J. Mich. Sci., London, n.s. 1911, LVII, p. 2,  
187-234, 2 pl.

31. O'Donoghue, C.H.

The Artificial Production of Corpus Luteum  
and their relation to the mammary glands.  
Proc. Physiol. Soc., London, 1913, p. 6

32. O'Donoghue, C.H.

The Relation between Corpus luteum and the  
growth of the mammary gland.  
Proc. Physiol. Soc., London, 1911, p. 16

33. Ribbert, H.

Ueber Transplantation von Ovarium, Hoden, und  
Mamma.  
Arch. f. Entwicklungsmech. d. Organ., Leipz., 1898,  
VII, 688.

34. Sunes, L.

Menstrual Statistics: A Study based on 4500

Menstrual Histories.  
Amer.J.Obst.,1916,73,p.93.

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