

and the uterus are very well marked, as is shown in the unimpregnated state by the fact of the frequent occurrence of sympathetic pains in the breast in connection with various uterine diseases; and, after delivery, by the well-known fact that suction produces reflex contraction of the uterus and even severe after-pains.

CHAPTER III.

OVULATION AND MENSTRUATION.

Functions of the Ovary.—The main function of the ovary is to supply the female generative element, and to expel it, when ready for impregnation, into the Fallopian tube, along which it passes into the uterus. This process takes place spontaneously in all viviparous animals, and without the assistance of the male. In the lower animals this periodical discharge receives the name of the oestrus or rut, at which time only the female is capable of impregnation and admits the approach of the male. In the human female the periodical discharge of the ovule, in all probability, takes place in connection with menstruation, which may therefore be considered to be the analogue of the rut in animals. Between each menstrual period Graafian follicles undergo changes which prepare them for rupture and the discharge of their contained ovules. After rupture certain changes occur which have for their object the healing of the rent in the ovarian tissue through which the ovule has escaped, and the filling up of the cavity in which it was contained. This results in the formation of a peculiar body in the substance of the ovary, called the *corpus luteum*, which is essentially modified should pregnancy occur, and is of great interest and importance. During the whole of the childbearing epoch the periodical maturation and rupture of the Graafian follicles are going on. If impregnation does not take place, the ovules are discharged and lost; if it does, ovulation is stopped, as a general rule, during gestation and lactation.

Theory of Menstruation.—This, broadly speaking, is an outline of the ovular theory of menstruation, which was first broached in the year 1821 by Dr. Power, and subsequently elaborated by Negrier, Bischoff, Raciborski, and many other writers. Although the sequence of events here indicated may be taken to be the rule, it must be remembered that it is one subject to many exceptions, for undoubtedly ovulation may occur without its outward manifestation, menstruation, as in cases in which impregnation takes place during lactation, or before menstruation has been established, of which many examples are recorded. These exceptions have led some modern writers to deny the ovular

theory of menstruation, and their views will require subsequent consideration.

In order to understand the subject properly, it will be necessary to study the sequence of events in detail.

Changes in the Graafian Follicle.—The changes in the Graafian follicle which are associated with the discharge of the ovules comprise:

1. *Maturation.* As the period of puberty approaches, a certain number of the Graafian follicles, fifteen to twenty in number, increase in size, and come near the surface of the ovary. Amongst these one becomes especially developed, preparatory to rupture, and upon it for the time being all the vital energy of the ovary seems to be concentrated. A similar change in one, sometimes in more than one, follicle takes place periodically during the whole of the childbearing epoch, in connection with each menstrual period, and an examination of the ovary will show several follicles in different stages of development. The maturing follicle becomes gradually larger, until it forms a projection on the surface of the ovary, from five to seven lines in breadth, but sometimes even as large as a nut (Fig. 34). This growth is due to the distention of the follicle by the increase of its contained fluid, which causes it so to press upon the ovarian structures covering it that they become thinned, separated from each other, and partially absorbed, until they eventually readily lacerate. The follicle also becomes greatly congested, the capillaries coursing over it become increased in size and loaded with blood, and being seen through the attenuated ovarian tissue, give it, when mature, a bright-red color. At this time some of these distended capillaries in its inner coat lacerate, and a certain quantity of blood escapes into its cavity. This escape of blood takes place before rupture, and seems to have for its principal object the increase of the tension of the follicle, of which it has been termed the menstruation. Pouchet was of opinion that the blood collects behind the ovule, and carries it up to the surface of the follicle.

2. *Escape of the ovule.* By these means the follicle is more and more distended, until at last it ruptures (Plate III., Fig. 1), either spontaneously, or, it may be, under the stimulus of sexual excitement. Whether the laceration takes place during, before, or after the menstrual discharge is not yet positively known; from the results of post-mortem examination in a number of women who died shortly before or after the period, Williams believes that the ovules are expelled before the monthly flow commences.¹ In order that the ovule may escape, the laceration must, of course, involve not only the coats of the Graafian follicles, but also the superincumbent structures.

Laceration seems to be aided by the growth of the internal layer of the follicle, which increases in thickness before rupture, and assumes a characteristic yellow color from the number of oil-globules it then contains. It is also greatly facilitated, if it be not actually produced, by the turgescence of the ovary at each menstrual period, and by the contraction of the muscular fibres in the ovarian stroma. As soon as the rent in the follicular walls is produced, the ovule is discharged,

¹ Proceedings of the Royal Society, 1875.

surrounded by some of the cells of the membrana granulosa, and is received into the fimbriated extremity of the Fallopian tube, which has been said to grasp the ovary over the site of the rupture. This, however, has never been satisfactorily proved to be the case. Henle supposed that the ovum is washed into the open extremity of the Fallopian tube, by means of currents produced in the peritoneal serum by the vibration of the ciliae of the epithelium which covers both surfaces of the fimbriae. By the vibratile ciliae of its epithelial lining it is then conducted into the canal of the tube, along which it is propelled, partly by ciliary action, and partly by muscular contraction in the walls of the tube.

After the ovule has escaped, certain characteristic changes occur in the empty Graafian follicle, which have for their object its cicatrization and obliteration. There are great differences in the changes which occur when impregnation has followed the escape of the ovule, and they are then so remarkable that they have been considered certain signs of pregnancy. They are, however, differences of degree rather than of kind. It will be well, however, to discuss them separately.

As soon as the ovule is discharged, the edges of the rent through which it has escaped become agglutinated by exudation, and the follicle shrinks, as is generally believed, by the inherent elasticity of its internal coat but according to Robin, who denies the existence of this coat, from compression by the muscular fibres of the ovarian stroma. In proportion to the contraction that takes place, the inner layer of the follicle, the cells of which have become greatly hypertrophied and loaded with fat-granules previous to rupture, is thrown into numerous folds (Plate III., Fig. 2). Between these, young connective tissue begins to form, and vascular offshoots, like papillae, arising from the vascular network surrounding the follicles, also penetrate the interstices. The greater the amount of contraction the deeper these folds become, giving to a section of the follicle an appearance similar to that of the convolutions of the brain (Fig. 41). These folds in the human subject are generally of a bright-yellow color, but in some of the mammalia they are of a deep red. The tint was formerly ascribed by Raciborski to absorption of the coloring matter of the blood-clot contained in the follicular cavity, a theory he has more recently abandoned in favor of the view maintained by Coste, that it is due to the inherent color of the cells of the

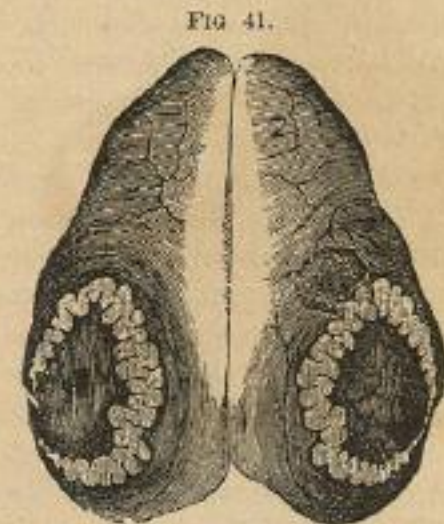


Fig. 41.
Section of ovary, showing corpus luteum three weeks after menstruation. (After DALTON.)

lining membrane of the follicle, which, though not well marked in a single cell, becomes very apparent *en masse*. The existence of a contained blood-clot is also denied by the latter physiologist, except as an unusual pathological condition; and he describes the cavity as containing a gelatinous and plastic fluid, which becomes absorbed as

Plate III.



Fig. 1.
Recently ruptured and bloody Graafian follicle, just developing into a corpus luteum.



Fig. 2.
Corpus luteum ten days after menstruation.



Fig. 3.
Degenerated Graafian follicle which has never ruptured.



Fig. 4.
Corpus luteum of pregnancy.

ILLUSTRATIONS OF THE CORPUS LUTEUM. (AFTER DALTON.)

2. Mars 1847, Pl. I.

contraction advances. The more recent researches of Dalton,¹ however, show the existence of a central blood-clot in the cavity of the follicle, and he considers its occasional absence to be connected with disturbance or cessation of the menstrual function. The folds into which the membrane has been thrown continue to increase in size, from the proliferation of their cells, until they unite and become adherent, and eventually fill the follicular cavity. By the time that another Graafian follicle is matured and ready for rupture, the diminution has advanced considerably, and the empty ovisac is reduced to a very small size. The cavity is now nearly obliterated, the yellow color of the convolutions is altered into a whitish tint, and on section the corpus luteum has the appearance of a compact white stellate cicatrix, which generally disappears in less than forty days from the period of rupture. The tissue of the ovary at the site of laceration also shrinks, and this, aided by the contraction of the follicle, gives rise to one of those permanent pits or depressions which mark the surface of the adult ovary. Slavyansky² has shown that only a few of the immense number of Graafian follicles undergo these alterations. The greater proportion of them seem never to discharge their ovules, but, after increasing in size, undergo retrogressive changes exactly similar in their nature, but to a much less extent, to those which result in the formation of a corpus luteum. The sites of these may afterward be seen as minute striae in the substance of the ovary.

Should pregnancy occur, all the changes above described take place; but, inasmuch as the ovary partakes of the stimulus to which all the generative organs are then subjected, they are much more marked and apparent (Plate III., Fig. 4). Instead of contracting and disappearing in a few weeks, the corpus luteum continues to grow until the third or fourth month of pregnancy; the folds of the inner layer of the ovisac become large and fleshy, and permeated by numerous capillaries, and ultimately become so firmly united that the margins of the convolutions thin and disappear, leaving only a firm fleshy yellow mass, averaging from 1 to 1½ inches in thickness, which surrounds a central cavity, often containing a whitish fibrillated structure, believed to be the remains of a central blood-clot. This was erroneously supposed by Montgomery to be the inner layer of the follicle itself, and he conceived the yellow substance to be a new formation between it and the external layer; while Robert Lee thought it was placed external to both the external and internal layers.

Between the third and fourth months of pregnancy, when the corpus luteum has attained its maximum of development (Fig. 42), it forms a firm projection on the surface of the ovary, averaging about one inch in length and rather more than half an inch in breadth. After this it commences to atrophy (Fig. 43), the fat-cells become absorbed, and the capillaries disappear. Cicatrization is not complete until from one to two months after delivery.

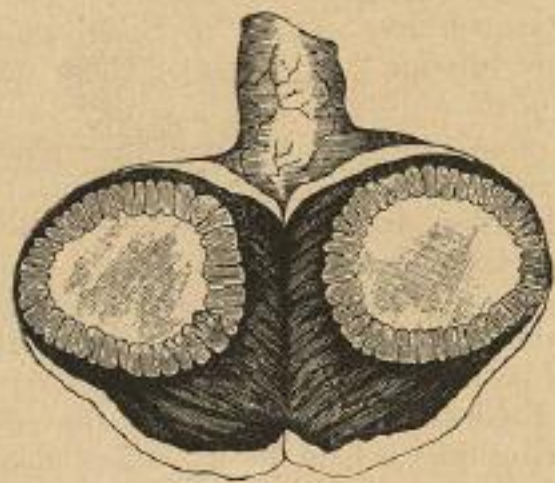
On account of the marked appearance of the corpus luteum, it was formerly considered to be an infallible sign of pregnancy; and it was

¹ "Report on the Corpus Luteum," *American Gyneec. Trans.*, 1877, vol. ii. p. 111.

² *Archiv de Phys.*, March, 1874.

distinguished from the corpus luteum of the non-pregnant state by being called a "true" as opposed to a "false" corpus luteum. From what has been said it will be obvious that this designation is essentially wrong, as the difference is one of degree only. Dalton¹ applies the term "false corpus luteum" to a degenerated condition sometimes met with in an unruptured Graafian follicle consisting in reabsorption of its contents and thickening of its walls (Plate III., Fig. 3). It differs from the "true" corpus luteum in being deeply seated in the substance of the ovary, in having no central clot, and in being unconnected with a cicatrix on the surface of the ovary. Nor do obstetricians attach by any means the same importance as they did formerly to the presence of the corpus luteum as indicating impregnation; for even when well marked, other and more reliable signs of recent delivery, such as enlargement of the uterus, are sure to be present, especially at the time when the corpus luteum has reached its maximum of development; while after delivery at term it has no longer a sufficiently characteristic appearance to be depended on.

FIG. 42.

Corpus luteum of the fourth month of pregnancy
(After DALTON.)

Menstruation.—By the term *menstruation* (catamenia, periods, etc.) is meant the periodical discharge of blood from the uterus which occurs, in the healthy woman, every lunar month, except during pregnancy and lactation, when it is, as a rule, suspended.

The first appearance of menstruation coincides with the establishment of puberty, and the physical changes that accompany it indicate that the female is capable of conception and childbearing, although exceptional cases are recorded in which pregnancy occurred before menstruation had begun. In the temperate climates it generally commences between the fourteenth and sixteenth years, the largest number of cases being met with in the fifteenth year. This rule is subject to many exceptions, it being by no means very rare for menstruation to become established as early as the tenth or eleventh year, or to be

¹ Op. cit., p. 64.

delayed until the eighteenth or twentieth. Beyond these physiological limits a few cases are from time to time met with in which it has begun in early infancy, or not until a comparatively late period of life.

Influence of Climate, Race, etc.—Various accidental circumstances have much to do with its establishment. As a rule it occurs somewhat earlier in tropical, and later in very cold than in temperate climates. The influence of climate has been unduly exaggerated. It used to be generally stated that in the Arctic regions women did not menstruate until they were of mature age, and that in the tropics girls of ten or twelve years of age did so habitually. The researches of Robertson, of Manchester,¹ first showed that the generally received opinions were erroneous; and the collection of a large number of statistics has corroborated his opinion. There can be no doubt, however, that a larger proportion of girls menstruate early in warm climates. Joulin found that in tropical climates, out of 1635 cases, the largest proportion began to menstruate between the twelfth and thirteenth years; so that there is an average difference of more than two years between the period of its establishment in the tropics and in temperate countries. Harris² states that among the Hindoos 1 to 2 per cent. menstruate as early as nine years of age; 3 to 4 per cent. at ten; 8 per cent. at eleven; and 25 per cent. at twelve; while in London or Paris probably not more than one girl in 1000 or 1200 does so at nine years. The converse holds true with regard to cold climates, although we are not in possession of a sufficient number of accurate statistics to draw very reliable conclusions on this point; but out of 4715 cases, including returns from Denmark, Norway and Sweden, Russia, and Labrador, it was found that menstruation was established on an average a year later than in more temperate countries. It is probable that the mere influence of temperature has much to do in producing these differences, but there are other factors, the action of which must not be overlooked. Raciborski attributes considerable importance to the effect of race; and he has quoted Dr. Webb, of Calcutta, to the effect that English girls in India, although subjected to the same climatic influence as the Indian races, do not, as a rule, menstruate earlier than in England; while, in Austria, girls of the Magyar race menstruate considerably later than those of German parentage.³ The surroundings of girls, and their manner of education and living, have probably also a marked influence in promoting or retarding its establishment. Thus, it will commence earlier in the children of the rich, who are likely to have a highly developed nervous organization, and are habituated to luxurious living, and a premature stimulation of the mental faculties by novel-reading, society, and the like; while amongst the hard-worked poor, or in girls brought up in the country, it is more likely to begin later. Premature sexual excitement is said also to favor its early appearance, and the influence of this among the factory girls of Manchester, who are exposed in the course of their work to the temptations arising from the promiscuous mixing of the sexes, has been pointed out by Dr. Clay.⁴

¹ Edin. Med. and Surg. Journ., 1832.² Amer. Journ. of Obstet., 1870-71, vol. iii. p. 611. R. P. Harris "On Early Puberty."³ Op. cit., p. 227.⁴ Brit. Record of Obstet. Med., vol. 1.

FIG. 43.

Corpus luteum of pregnancy at term.
(After DALTON.)

[**Precocious Physical Womanhood.**—We emphasize the term "physical," because in a mental and moral sense the subjects are fortunately, with rare exceptions, only children in years and tastes. Precociously developed girls are, as a rule, of very unusual size for their years, and usually enjoy good health, while precocity in male children is apt to be associated with semi-idiocy and epilepsy. Where menstruation begins in the first year, the girl may at three or four years of age present the evidences of puberty in the appearance of pubic and axillary hair, rounded mammae, and a broad pelvis, associated with well-rounded arms and legs and a strength and height much beyond her years. In three children born in this State, these characteristics were marked, respectively, at four and a half years, five, and six. The five-year-old girl was a beautifully formed miniature woman, and the one of six was large, fat, and had the developed features of twice her age; still, she was only a child in tastes, and as such devoted to her dolls and toys. The sexual passion is very rarely a marked characteristic in such subjects, as it is in the other sex, and hence the ability to procreate has rarely been tested; but occasionally in the lower classes pregnancy has occurred at an early age.

The youngest English mother on record was nine years seven months and nine days old when Mr. Henry Dodd, of Billington, York, who was present at her birth, delivered her of a seven-pound healthy child, after a labor of six hours, on March 17, 1881. She commenced to menstruate at twelve months, and became pregnant about six weeks before she was nine years old.¹

The youngest American mother became such at ten years and thirteen days, giving birth to a child of seven and three-quarters pounds. She also menstruated at one year, and at the time of her labor was four feet seven inches in height and weighed one hundred pounds. The case was reported by Dr. Rowlett, of Kentucky.² A still younger mother was reported by Schmitt more than a century ago. The child began to menstruate at two years, and when eight years and ten months old bore a dead fetus which was thought by its development to have reached its full term. The mother had the mammae and pubes of a girl of seventeen.³—ED.]

Changes Occurring at Puberty.—The first appearance of menstruation is accompanied by certain well-marked changes in the female system, on the occurrence of which we say that the girl has arrived at the period of puberty. The pubes become covered with hair, the breasts enlarge, the pelvis assumes its fully developed form, and the general contour of the body fills out. The mental qualities also alter; the girl becomes more shy and retiring, and her whole bearing indicates the change that has taken place. The menstrual discharge is not established regularly at once. For one or two months there may be only premonitory symptoms—a vague sense of discomfort, pains in the breasts, and a feeling of weight and heat in the back and loins. There then may be a discharge of mucus tinged with blood, or of

¹ Barnes's *Obstetric Medicine and Surgery*.

² *Transylvania Med. Journ.*, vol. vii. p. 447.

³ Sue's *Essais historiques*, Paris, 1779, vol. ii. p. 344.

pure blood, and this may not again show itself for several months. Such irregularities are of little consequence on the first establishment of the function, and need give rise to no apprehension.

Duration.—As a rule, the discharge recurs every twenty-eight days, and with some women with such regularity that they can foretell its appearance almost to the hour. The rule is, however, subject to very great variations. It is by no means uncommon, and strictly within the limits of health, for it to appear every twentieth day, or even with less interval; while in other cases as much as six weeks may habitually intervene between two periods. The period of recurrence may also vary in the same subject. I am acquainted with patients who sometimes only have twenty-eight days, at others as many as forty-eight days, between their periods, without their health in any way suffering. Joulin mentions the case of a lady who only menstruated two or three times in the year, and whose sister had the same peculiarity.

The duration of the period varies in different women, and in the same woman at different times. In this country its average is four or five days, while in France, Dubois and Brierre de Boismont fix eight days as the most usual length. Some women are only unwell for a few hours, while in others the period may last many days beyond the average without being considered abnormal.

The quantity of blood lost varies in different women. Hippocrates puts it at ℥xviiij, which, however, is much too high an estimate. Arthur Farre thinks that from ℥ij to ℥iij is the full amount of a healthy period, and that the quantity cannot habitually exceed this without producing serious constitutional effects. Rich diet, luxurious living, and anything that unhealthily stimulates the body and mind, will have an injurious effect in increasing the flow, which is, therefore, less in hard-worked countrywomen than in the better classes and residents in towns.

It is more abundant in warm climates, and our countrywomen in India habitually menstruate over-profusely, becoming less abundantly unwell when they return to England. The same observation has been made with regard to American women residing in the Gulf States, who improve materially by removing to the Lake States. Some women appear to menstruate more in summer than in winter. I am acquainted with a lady who spends the winter in St. Petersburg, where her periods last eight or ten days, and the summer in England, where they never exceed four or five. The difference is probably due to the effect of the overheated rooms in which she lives in Russia.

The daily loss is not the same during the continuance of the period. It generally is at first slight, and gradually increases so as to be most profuse on the second or third day, and as gradually diminishes. Toward the last days it sometimes disappears for a few hours, and then comes on again, and is apt to recur under any excitement or emotion.

As the menstrual fluid escapes from the uterus it consists of pure blood, and if collected through the speculum, it coagulates. The ordinary menstrual fluid does not coagulate unless it is excessive in

amount. Various explanations of this fact have been given. It was formerly supposed either to contain no fibrin, or an unusually small amount. Retzius attributes its non-coagulation to the presence of free lactic and phosphoric acids. The true explanation was first given by Mandl, who proved that even small quantities of pus or mucus in blood were sufficient to keep the fibrin in solution; and mucus is always present to greater or less amount in the secretions of the cervix and vagina, which mix with the menstrual blood in its passage through the genital tract. If the amount of blood be excessive, however, the mucus present is insufficient in quantity to produce this effect, and coagula are then formed.

On microscopic examination the menstrual fluid exhibits blood corpuscles, mucous corpuscles, and a considerable amount of epithelial scales, the last being the *débris* of the epithelium lining the uterine cavity. According to Virchow, the form of the epithelium often proves that it comes from the interior of the utricular glands. The color of the blood is at first dark, and as the period progresses it generally becomes lighter in tint. In women who are in bad health it is often very pale. These differences doubtless depend upon the amount of mucus mingled with it. The menstrual blood has always a characteristic faint and heavy odor, which is analogous to that which is so distinct in the lower animals during the rut. Raciborski mentions a lady who was so sensitive to this odor that she could always tell to a certainty when any woman was menstruating. It is attributed either to decomposing mucus mixed with the blood, which, when partially absorbed, may cause the peculiar odor of the breath often perceptible in menstruating women; or to the mixture with the fluid of the sebaceous secretion from the glands of the vulva. It probably gave rise to the old and prevalent prejudices as to the deleterious properties of menstrual blood, which, it is needless to say, are altogether without foundation.

It is now universally admitted that the source of the menstrual blood is the mucous membrane lining the interior of the uterus, for the blood may be seen oozing through the *os uteri* by means of the speculum, and in cases of prolapsus uteri; while in cases of inverted uterus it may be actually observed escaping from the exposed mucous membrane, and collecting in minute drops upon its surface. During the menstrual *nixus* the whole mucous lining becomes congested to such an extent that, in examining the bodies of women who have died during menstruation, it is found to be thicker, larger, and thrown into folds, so as to completely fill the uterine cavity. The capillary circulation at this time becomes very marked, and the mucous membrane assumes a deep-red hue, the network of capillaries surrounding the orifices of the utricular glands being especially distinct. These facts have an unquestionable connection with the production of the discharge, but there is much difference of opinion as to the precise mode in which the blood escapes from the vessels. Coste believed that the blood transudes through the coats of the capillaries without any laceration of their structure. Farre inclines to the hypothesis that the uterine capillaries terminate by open mouths, the escape of blood

through these, between the menstrual periods, being prevented by muscular contraction of the uterine walls. Pouchet believed that during each menstrual epoch the entire mucous membrane is broken down and cast off in the form of minute shreds, a fresh mucous membrane being developed in the interval between two periods. During this process the capillary network would be laid bare and ruptured, and the escape of blood readily accounted for. Tyler Smith, who adopted this theory, states that he has frequently seen the uterine mucous membrane, in women who have died during menstruation, in a state of dissolution, with the broken loops of the capillaries exposed. The phenomena attending the so-called membranous dysmenorrhœa, in which the mucous membrane is thrown off in shreds, or as a cast of the uterine cavity—the nature of which was first pointed out by Simpson and Oldham—have been supposed to corroborate this theory. This view is, in the main, corroborated by the recent researches of Engelmann,¹ Williams,² and others. Williams describes the mucous lining of the uterus as undergoing a fatty degeneration before each period, which commences near the inner os, and extends over the whole mucous membrane, and down to the muscular wall. This seems to bring on a certain amount of muscular contraction, which drives the blood into the capillaries of the mucosa, and these, having become degenerated, readily rupture, and permit the escape of the blood. The mucous membrane now rapidly disintegrates, and is cast off in shreds with the menstrual discharge, in which masses of epithelial cells may always be detected. Engelmann, however, holds that the fatty degeneration is limited to the superficial layers, and that a portion only of the epithelial investment is thrown off. As soon as the period is over, the formation of a new mucous membrane is begun, which arises either from proliferation of the elements of the muscular coat itself, or from the proliferation of the epithelial cells lining the bases of the uterine glands which remain imbedded in the muscular tissue after the mucous membrane has been thrown off, and at the end of a week the whole uterine cavity is lined by a thin mucous membrane. This grows until the advent of another period, when the same degenerative changes occur unless impregnation has taken place, in which case it becomes further developed into the decidua. Lowenthal³ believes that the menstrual decidua is produced by the imbedding of an ovum in the lining membrane of the uterus, which, if impregnation occurs, is developed into the decidua of pregnancy. If conception does not take place, the ovum dies, and this is followed by the degeneration and expulsion of the menstrual decidua, accompanied by a flow of blood, which is the menstrual discharge.

Theory of Menstruation.—That there is an intimate connection between ovulation and menstruation is admitted by most physiologists, and it is held by many that the determining cause of the discharge is the periodic maturation of the Graafian follicles. There is abundant

¹ American Journal of Obstetrics, 1875-76, vol. viii, p. 30.

² "On the Structure of the Mucous Membrane of the Uterus," *Obstet. Journ.*, 1875-76, vol. iii, p. 496.

³ *Arch. f. Gyn.*, Bd. xxiv., Heft 2, S. 169: "Eine neue Deutung des Menstruations-Prozess."

evidence of this connection, for we know that when, at the change of life, the Graafian follicles cease to develop, menstruation is arrested; and when the ovaries are removed by operation, of which there are now numerous cases on record, or when they are congenitally absent, menstruation does not generally take place. A few cases, however, have been observed in which menstruation continued after double ovariectomy, or the removal of the ovaries by Battey's operation, and these have been used as an argument by those physiologists who doubt the ovular theory of menstruation. Slavyansky has particularly insisted on such cases, which, however, are probably susceptible of explanation. It may be that the habit of menstruation may continue for a time even after the removal of the ovaries; and it has not been shown that menstruation has continued permanently after double ovariectomy, although it certainly has occasionally, although quite exceptionally, done so for a time. It is possible, also, that in such cases a small portion of ovarian tissue may have been left unremoved, sufficient to carry on ovulation. Roberts, a traveller quoted by Depaul and Guéniot in their article on Menstruation in the *Dictionnaire des Sciences Médicales*, relates that in certain parts of Central Asia it is the custom to remove both ovaries in young girls who act as guards to the harems. These women, known as "hedjeras," subsequently assume much of the virile type, and never menstruate. The same close connection between ovulation and the rut of animals is observed, and supports the conclusion that the rut and menstruation are analogous. The chief difference between ovulation in man and the lower animals is that in the latter the process is not generally accompanied by a sanguineous flow. To this there are exceptions, for in monkeys there is certainly a discharge analogous to menstruation occurring at intervals.

Another point of distinction is that in animals conception never takes place except during the rut, and that it is then only that the female is capable of conception; while in the human race conception only occurs in the interval between the periods. This is another argument brought against the ovular theory, because, it is said, if menstruation depend on the rupture of a Graafian follicle and the emission of an ovule, then impregnation should only take place during or immediately after menstruation. Coste explains this by supposing that it is the *maturation* and not the *rupture* of the follicle which determines the occurrence of menstruation; and that the follicle may remain unruptured for a considerable time after it is mature, the escape of the ovule being subsequently determined by some accidental cause such as sexual excitement. However this may be, there is good reason to believe that the susceptibility to conception is greater during the menstrual epochs. Raciborski believes that in the large proportion of cases impregnation occurs in the first half of the menstrual interval, or in the few days immediately preceding the appearance of the discharge. There are, however, very numerous exceptions, for in Jewesses, who almost invariably live apart from their husbands for eight days after the cessation of menstruation, impregnation must constantly occur at some other period of the interval, and it is certain that they are not less prolific than other people. This rule with them is very strictly adhered to, as

will be seen by the accompanying interesting letter from a medical friend who is a well-known member of that community, and which I have permission to publish.¹ This fact is of itself sufficient to disprove the theory advanced by Dr. Avrard,² that impregnation is impossible in the latter half of the menstrual interval. This, and the other reasons referred to, undoubtedly throw some doubt on the ovular theory, but they do not seem to be sufficient to justify the conclusion that menstruation is a physiological process altogether independent of the development and maturation of the Graafian follicles. All that they can be fairly held to prove is that the escape of the ovules may occur independently of menstruation, but the weight of evidence remains strongly in favor of the theory which is generally received.

It should be stated that several recent writers, Lawson Tait amongst the number, attribute considerable influence in menstruation to the Fallopian tubes. Robinson, of Chicago, in an interesting paper,³ contends that menstruation is governed by nervous ganglia situated in the walls of the Fallopian tubes and uterus, which he calls "automatic menstrual ganglia." These he considers to be analogous to the nerve ganglia found in the heart, intestines, and other hollow viscera, and to have the function of producing rhythmical peristalsis in the tubes, which favors the passage of the ovum along their canal. He believes that ovulation is entirely unconnected with menstruation, and goes on independently of it, the greater part of the ovules being lost in the peritoneal cavity; and that it is only when the periodic and rhythmical action of the tubes begins that menstruation is established. These views cannot be taken as proved, but they certainly suggest an explanation of some of the phenomena of menstruation otherwise difficult to understand, such as its occasional continuance after the removal of the ovaries, and are well worthy of further investigation.

The cause of the monthly periodicity is quite unknown, and will probably always remain so. Goodman⁴ has suggested what he calls the "cyclical theory of menstruation," which refers the phenomena to a

¹ 10 BERNARD STREET, RUSSELL SQUARE, JULY 21, 1878.

MY DEAR SIR: 1. To the best of my knowledge and belief, the law which prohibits sexual intercourse among Jews for seven clear days after the cessation of menstruation, is almost universally observed, the exceptions not being sufficient to vitiate statistics. The law has perhaps fewer exceptions on the Continent—especially Russia and Poland, where the Jewish population is very great—than in England. Even here, however, women who observe no other ceremonial law observe this, and cling to it after everything else is thrown overboard. There are doubtless many exceptions, especially among the better classes in England, who keep only three days after the cessation of the menses.

2. The law is—as you state—that should the discharge last only an hour or so, or should there be only one gush or one spot on the linen, the five days during which the period *might* continue are observed; to which must be superadded the seven clear days—twelve days per mensem in which connection is disallowed. Should any discharge be seen in the inter-menstrual period, seven days would have to be kept, but not the five, for such *irregular* discharge.

3. The "bath of purification," which must contain *at least* eighty gallons, is used on the last night of the seven clear days. It is not used till after a bath for cleansing purposes; and, from the night when such "purifying" bath is used, Jewish women are accustomed to calculate the commencement of pregnancy. That you should not have heard it is not strange; its mention would be considered highly indelicate.

4. Jewish women reckon their pregnancy to last nine calendar or ten lunar months—270 to 280 days. There are no special data on which to reckon an average, nor do I know of any books on the subject, except some Talmudic authorities, which I will look up for you if you desire it. Pray make no apologies for writing to me: any information I possess is at your service.

I am, dear Sir, yours very truly,

A. ASHER.

DR. PLAYFAIR.

P. S.—The Biblical foundation for the law of the seven clear days is Leviticus xv., verse 19 till the end of the chapter—especially verse 28.

² Rev. de Therap. Méd.-Chir., 1867.

³ American Journal of Obstetrics, Sept. 1861.

⁴ *Ibid.*, 1878, vol. xi. p. 673.

general condition of the vascular system, specially localizing itself in the generative organs, and connected with rhythmical changes in their nerve-centres. It does not seem to me, however, that he has satisfactorily proved the recurrence of the conditions which his ingenious theory assumes. The purpose of the loss of so much blood is also somewhat obscure. To a certain extent it must be considered an accident or complication of ovulation, produced by the vascular turgescence. Nor is it essential to fecundation, because women often conceive during lactation, when menstruation is suspended; or before the function has become established. It may, however, serve the negative purpose of relieving the congested uterine capillaries which are periodically filled with a supply of blood for the great growth which takes place when conception has occurred. Thus, immediately before each period the uterus may be considered to be placed by the afflux of blood in a state of preparation for the function it may suddenly be called upon to perform. That the discharge relieves a state of vascular tension which accompanies ovulation is proved by the singular phenomenon of vicarious menstruation which is occasionally, though rarely, met with. It occurs in cases in which, from some unexplained cause, the discharge does not escape from the uterine mucous membrane. Under such circumstances a more or less regular escape of blood may take place from other sites. The most common situations are the mucous membranes of the stomach, of the nasal cavities, or of the lungs; the skin, not uncommonly that of the mammae, probably on account of their intimate sympathetic relation with the uterine organs; from the surface of an ulcer; or from hemorrhoids. It is a noteworthy fact that in all these cases the discharge occurs in situations where its external escape can readily take place. This strange deviation of the menstrual discharge may be taken as a sign of general ill-health, and it is usually met with in delicate young women of highly mobile nervous constitution. It may, however, begin at puberty, and it has even been observed during the whole sexual life. The recurrence is regular, and always in connection with the menstrual nixus, although the amount of blood lost is much less than in ordinary menstruation.

Cessation of Menstruation.—After a certain time changes occur, showing that the woman is no longer fitted for reproduction; menstruation ceases, Graafian follicles are no longer matured, and the ovary becomes shrivelled and wrinkled on its surface. Analogous alterations take place in the uterus and its appendages. The Fallopian tubes atrophy, and are not unfrequently obliterated. The uterus decreases in size. The cervix undergoes a remarkable change, which is readily detected on vaginal examination; the projection of the cervix into the vaginal canal disappears, and the orifice of the os uteri in old women is found to be flush with the roof of the vagina. In a large number of cases there is, after the cessation of menstruation, an occlusion both of the external and internal os; the canal of the cervix between them, however, remains patulous, and is not unfrequently distended with a mucous secretion.

Period of Cessation.—The age at which menstruation ceases varies much in different women. In certain cases it may cease at an unusually

early age, as between thirty and forty years, or it may continue far beyond the average time, even up to sixty years; and exceptional, though perhaps hardly reliable, instances are recorded, in which it has continued even to eighty or ninety years. These are, however, strange anomalies, which, like cases of unusually precocious menstruation, cannot be considered as having any bearing on the general rule. Most cases of so-called protracted menstruation will be found to be really morbid losses of blood depending on malignant or other forms of organic disease, the existence of which, under such circumstances, should always be suspected.

In England menstruation usually ceases between forty and fifty years of age. Raciborski says that the largest number of cases of cessation are met with in the forty-sixth year. It is generally said that women who commence to menstruate when very young cease to do so at a comparatively early age, so that the average duration of the function is about the same in all women. Cazeaux and Raciborski, whose opinion is strengthened by the observations of Guy in 1500 cases,¹ think, on the contrary, that the earlier menstruation commences the longer it lasts, early menstruation indicating an excess of vital energy which continues during the whole childbearing life. Climate and other accidental causes do not seem to have as much effect on the cessation as on the establishment of the function. It does not appear to cease earlier in warm than in temperate climates. The change of life is generally indicated by irregularities in the recurrence of the discharge. It seldom ceases suddenly, but it may be absent for one or more periods, and then occur irregularly; or it may become profuse or scanty, until eventually it entirely stops. The popular notions as to the extreme danger of the menopause are probably much exaggerated; although it is certain that at that time various nervous phenomena are apt to be developed. So far from having a prejudicial effect on the health, however, it is not an uncommon observation to see an hysterical woman, who has been for years a martyr to uterine and other complaints, apparently take a new lease of life when her uterine functions have ceased to be in active operation; and statistical tables abundantly prove that the general mortality of the sex is not greater at this than at any other time.

¹ Med. Times and Gaz., 1840.