MIDWIFERY

BY

TEN TEACHERS

UNDER THE DIRECTION OF

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PREFACE TO THE EIGHTH EDITION

This book was originally written and edited under the direction of the late Sir Comyns Berkeley, to whose memory a tribute is due. He made every effort to overcome the difficulties of collective authorship by insisting upon close collaboration at all stages of composition of the first and subsequent editions. We have attempted to achieve this same objective by expressing the unanimous opinion of the ten authors throughout the present edition: only on occasion has it been necessary to accept the views of a majority. A different section has been allocated to each author for thorough revision in accordance with recent developments in our knowledge and modern practice. To each of these authors, representations and suggestions have been made by the other nine to assist him in the preparation of his manuscript. Subsequently, galley proofs have been freely amended at a series of meetings attended by all. Finally the page proofs have been revised by the editors with regard to details only. Certain illustrations have been replaced or deleted; redundant material has been eliminated as far as possible.

Since the appearance of the last edition, Messrs. Arthure, Bell and Roques have replaced as authors Mr. Victor Bonney, Mr. Goodwin and the late Sir Comyns Berkeley.

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CHAPTER I

OVULATION, MENSTRUATION, FERTILIZATION AND DEVELOPMENT

THE process by which the Graafian follicles in the ovary ripen and rupture, setting free the ova into the peritoneal cavity, is known as ovulation, and normal menstruation depends on ovulation. The time in the menstrual cycle at which ovulation occurs is about the 14th day before the onset of the ensuing menstrual period. The formation of the corpus luteum has an important bearing on menstruation, for it regulates the premenstrual changes in the endometrium. If pregnancy occurs the corpus luteum persists for a time and plays an important part in preserving the fertilized ovum These activities of the corpus luteum and of the Graafian follicle which precedes it, are controlled by hormones produced by the anterior lobe of the pituitary body as described on page 5.

OVULATION

At birth the ovary contains many thousands of ova and it was believed that although many of these ova degenerated during childhood, some survived till puberty when one became mature each month till the menopause. It is now thought more probable that the ova which become mature after puberty are all formed from oogonia resulting from the proliferation of the germinal epithelium shortly before the occurrence of puberty and that none of the foetal ova becomes useful.

One of the cells from the group of cells forming an oogonium enlarges to form the primary oocyte and the remainder of the cells of the oogonium forms the follicular layer which soon proliferates and becomes the membrana granulosa. The granulosa cells split and thus enclose a cavity containing fluid—the liquor folliculi—and the whole consistutes a Graafian follicle. The stroma cells of the ovary which are in contact with the growing follicle become altered to form the theca interna ; outside this is the fibrous theca externa. As ripening progresses the follicle grows bigger and projects on the surface of the ovary so that when it ruptures, the ovum is expelled from the ovary and thus ovulation is completed.

Ovulation is a spontaneous process initiated by hormonal stimulation from the pituitary but its timing is possibly sometimes altered by outside influences. One such influence may be coitus which is the

usual mechanism by which ovulation is initiated in the rabbit and ferret. If coitus sometimes causes ovulation in woman, it explains the occurrence of pregnancy when the only sexual act has taken place, say, just before the period. The only alternative explanation is that the ovum is capable of being fertilized for days after ovulation and this is quite improbable, in fact it is believed that the ovum does not survive for longer than 48 hours after ovulation unless it is fertilized.

As regards maturation of the oocyte, it seems that the first division takes place in the ovary and the second when the ovum is in the tube.

By inserting droplets of lipiodol into the poles of the ovary and into the fimbriated end of the tube it has been shown that just before

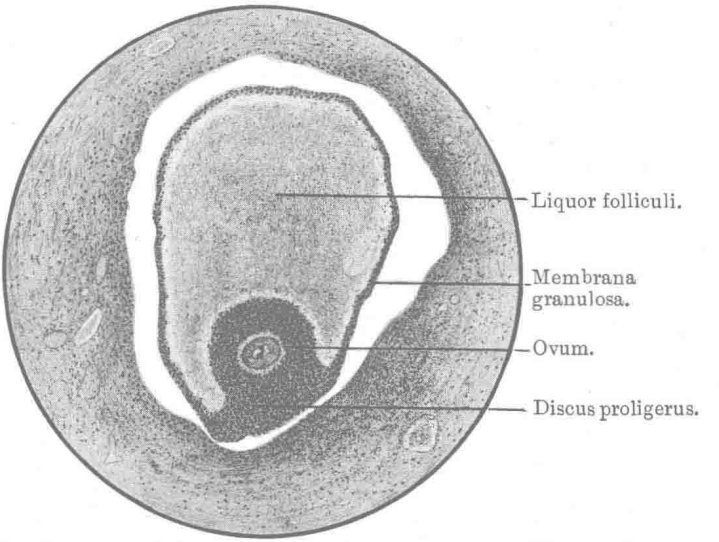

FIG. 1—SECTION OF AN INFANTILE OVARY, SHOWING A NEARLY RIPE GRAAFIAN FOLLICLE.

ovulation the fimbriated end of the tube surrounds the ovary first on the ventral and then on the posterior surface. The entry of the ovum into the tube is thus facilitated. The action of the tubal cilia is important in promoting the entry of the ovum into the ampullary portion of the tube. From there it is propelled towards the uterus by ciliary action and tubal contractions which are unusually active at this time in the menstrual cycle. The time taken for the fertilized ovum or zygote to reach the uterus is not accurately known but, from analogy with what occurs in monkeys. it is thought to vary from 5 to 8 days.

Corpus Luteum. After ovulation the walls of the Graafian follicle collapse and are thrown into folds. The cells of the membrana granulosa enlarge considerably to form luteal cells containing pigment

(lutein) and because of their origin are known as granulosa luteal cells. The cells of the theca interna also grow to form theca-luteal (paraluteal) cells which contain lutein but are smaller than the granulosa luteal cells. The proliferation of these 2 layers of cells causes the

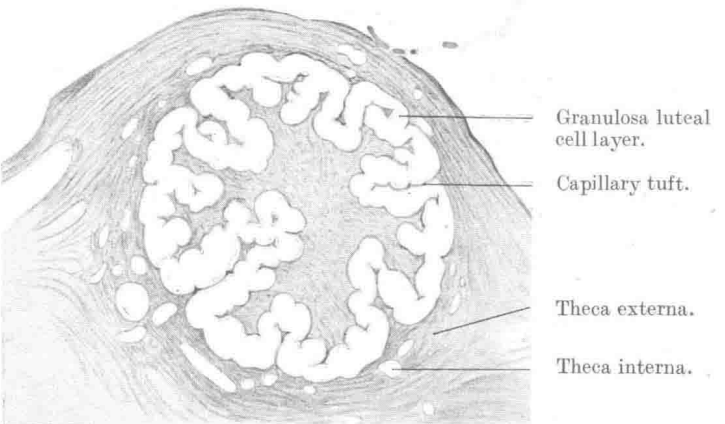

FIG. 2.—SECTION OF A CORPUS LUTEUM IN THE STAGE OF RETROGRESSION. × 3.

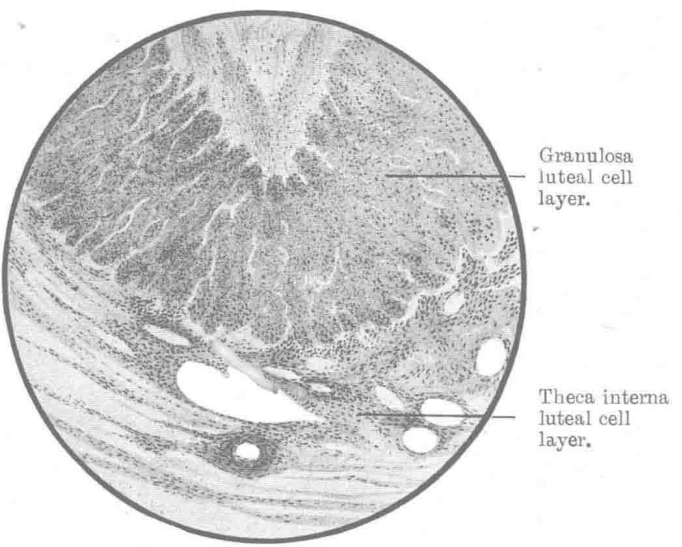

FIG. 3.—SECTION OF A CORPUS LUTEUM FROM AN ADULT OVARY. × 15.

convoluted appearance of the fully developed corpus luteum. The carotin-like pigment found within the luteal cells gives the yellow colour to the mature and degenerating corpus luteum.

Six days before the onset of the next menstrual period the corpus

luteum becomes mature, it begins to degenerate before the menstrual flow commences. If examined during the time of the menstrual period the luteal cells are seen to show fatty changes, they lose their outlines and their nuclei, and the whole structure becomes hyaline, and later is converted into a corpus fibrosum (corpus albicans).

This series of changes is seen in the Graafian follicle whether pregnancy occurs or not. There is a difference, however, in the time occupied by the various processes; during pregnancy the corpus luteum is much larger, reaching its maximal size at the end of the 3rd month; when pregnancy does not occur the corpus luteum goes through its series of changes much more quickly, and shrinks to a comparatively small size by the time the next monthly flow begins and disappears in 3 months.

MENSTRUATION

The periodic flow of blood and debris from the uterus commences at puberty, and then persists for over 30 years. The usual age at which cessation of menstruation occurs, known as the menopause, is about 48. In this country, 14 years is the average age for menstruation to commence. It is sometimes stated that it begins at an earlier age in a warm than in a cold climate; but it is probable that race is more important than climate and there are marked variations among members of similar races.

The onset of menstruation is accompanied by changes which characterize the transition from childhood to puberty. Normal menstruation follows a regular rhythm, varying somewhat in different individuals, but is usually four-weekly. The number of days during which the flow persists also varies in different women, 4 to 5 days being the commonest length of time, and the amount of blood normally lost varies from 2 to 8 ounces.

The number of days (usually 28) between the 1st day of menstruation and the 1st day of the next period constitute the menstrual cycle. The cycle consists of two phases, the first is the follicular and is due to the action of oestrogen. The follicular phase includes the time of the bleeding followed by the period of repair and growth. This phase ends when ovulation occurs on the 14th day. By that time, the surface epithelium which was cuboidal becomes columnar and the endometrium begins to show a division into a superficial compact layer, an intermediate spongy layer and a basal layer. The second or progestational phase is due to the action of progesterone combined with the continued secretion of oestrogen; it is characterised by continued proliferation with secretory changes which end with the onset of

bleeding. During the secretory stage the superficial portion of the glands continue to be straight and the basal parts do not change much but the glands of the intermediate layer become markedly tortuous and convoluted. The cells lining the glands pour out secretion containing glycogen and mucin into the lumina of the glands. The stroma is oedematous and the cells swollen. At the end of the progestational phase the superficial stroma cells become enlarged like the decidual cells of pregnancy but to a lesser degree. The arteries are arranges in a spiral around the glands, and the whole endometrium and uterus become more vascular. This hypertrophy is to be regarded as a step towards the formation of a pregnancy decidua, preparing for the reception of a fertilized ovum. If pregnancy does not occur, the menstrual flow occurs on the 28th day, and is brought about by oozing of blood from the vessels and the formation of a hæmatoma just deep to the superficial compact layer. This hæmatoma causes a plane of cleavage in the endometrium and the blood and disintegrated endometrium are shed into the uterine cavity.

The anterior part of the pituitary gland secretes certain gonadotrophic hormones which control and activate the ovarian internal secretions. There are two anterior pituitary hormones which are named prolan A and prolan B. Prolan A activates the ovarian follicles to produce œstrogen, while prolan B controls the formation of the corpus luteum and the formation of progesterone. In human beings œstrogen is necessary for the full development of the uterus, and plays a part in the stage of hypertrophy of the endometrium during the menstrual cycle. It will not, however, alone give rise to the secretory phase of the endometrium ; it must be assisted by the luteal hormone progesterone. The retrogression of the corpus luteum, and the cutting off of the supply of progesterone is followed by the disintegration of the menstrual decidua, and the menstrual flow begins.

If pregnancy occurs, the corpus luteum persists and continues to produce progesterone, which in association with oestrogen causes the full development of the pregnancy decidua. It may also inhibit the uterine contractions, and so tends to prevent abortion and premature labour. The corpus luteum of pregnancy commences to retrogress at the end of the 3rd month of pregnancy, when the production of progesterone is taken over by the placenta. After the 14th week the corpus luteum is less important than the placenta as a source of progesterone.

Progesterone is excreted as sodium pregnandiol glycuronidate, and can be estimated in this form in the urine. Specific tests for estimating progesterone in the blood are wanting at present.

Although the ovarian follicles are the primary source of œstrogen in the non-pregnant state, in pregnancy œstrogen is found in large quantities in the placenta, amniotic fluid and urine. Œstrogen is also found in the blood, in amounts varying with the state of the genital tract, and the amount is highest during pregnancy, when the hormone is actively secreted by the placenta. Anterior pituitary-like hormones are found in large amounts in the placenta and urine of pregnant women, and are given the name of chorionic gonadotrophin.

DEVELOPMENT

The union of the spermatozoon with the ovum takes place in the outer third of the uterine (Fallopian) tube, and the early stages of

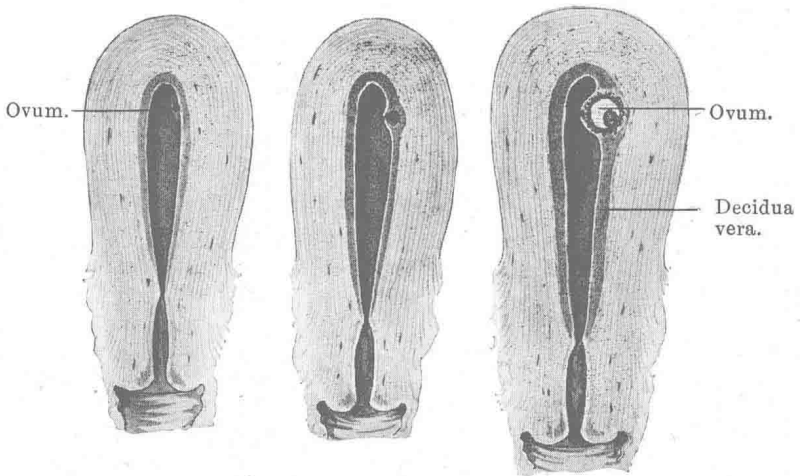

FIG. 4.—DIAGRAMS TO SHOW THE METHOD OF EMBEDDING OF THE OVUM IN THE UTERINE MUCOUS MEMBRANE.

development occur there also. This delay in the tube is essential in order to permit the progestational changes in the endometrium to take place under the influence of the corpus luteum which takes some time to secrete progesterone freely. There is evidence that the human embyro becomes embedded in the secretory endometrium by the 8th day after ovulation. It has then reached the blastocyst stage of development.

It embeds in virtue of the power possessed by the outer layers of cells of the cell-mass (the trophoblast) of eating into and digesting the endometrial tissue with which they come in contact. It sinks into the endometrium which is in the secretory phase, like a hot shot into a sheet of wax (interstitial implantation), with the difference that as it

sinks it grows, so that the aperture of entrance is soon too small for return and becomes sealed over by a plug of fibrin.

The cells of the ovum in contact with the lining of the uterus are the trophoblast and they erode the surface epithelium and make contact with the endometrial stroma which is undergoing a decidual change. The growing trophoblast divides into 2 layers, the inner, made of epithelial cells is the cytotrophoblast (layer of Langhans)

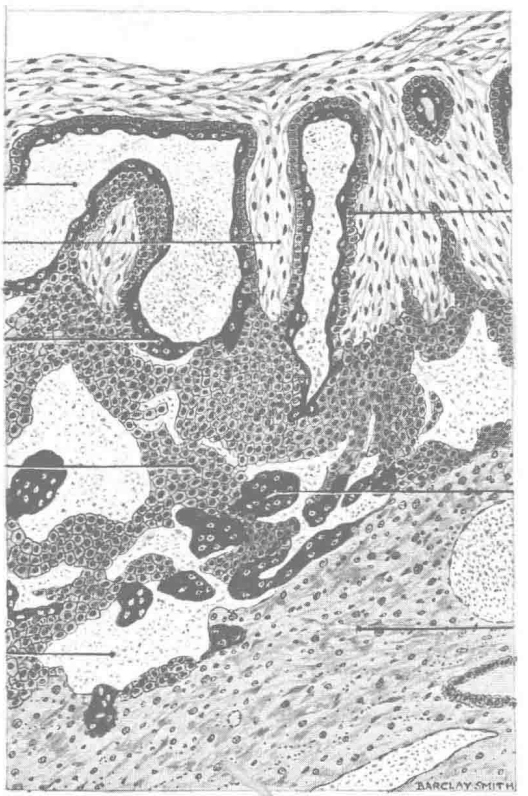

FIG. 5.—INVASION OF DECIDUA BASALIS BY CHORIONIC VILLI.

and the outer layer the syncytiotrophoblast or syncytium. The syncytium covers the cytotrophoblast and is the layer in contact with the superficial cells of the endometrium. While the primary chorionic villi are forming, the cores made of cells of Langhans grow into and through the syncytiotrophoblast and invade the decidua. After the blastocyst is embedded, it is customary to call the altered endometrium the decidua. The cells of the cytotrophoblast are round and hyaline with reticulate nuclei and as in all areas where tissue destruction is going on, giant cell-forms (syncytia) appear, and these take the form of

masses of undifferentiated protoplasm with a number of small, deeply staining nuclei. A section across the line of contact between trophoblast and maternal tissue shows the trophoblast cells actively invading and destroying the tissues of the mother and large areas of fibrinous degeneration and blood extravasation. The function of the trophoblast is to make a living-space for the ovum, and to procure food for the embryo while a placental system is being established (Fig. 5).

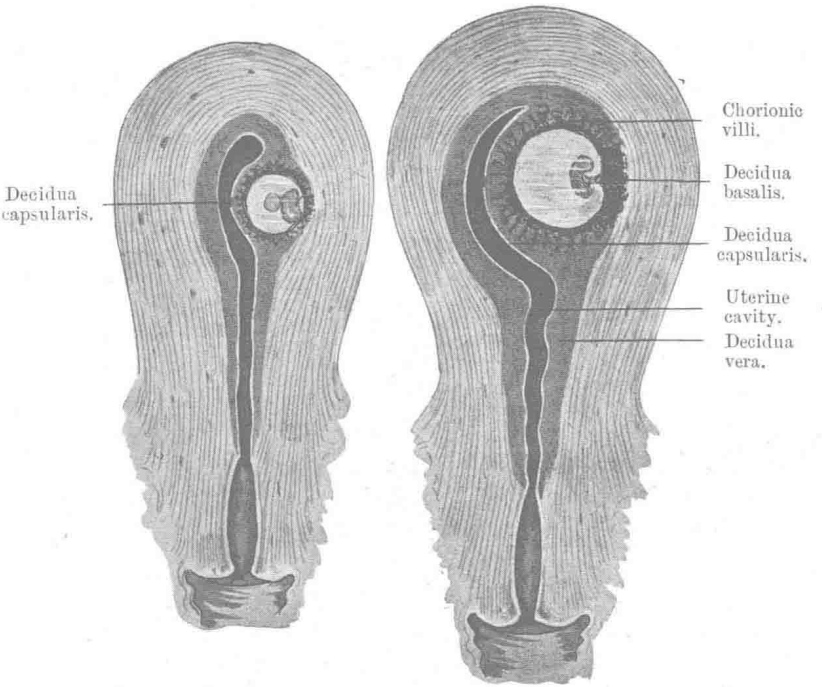

FIG. 6.—DIAGRAMS TO SHOW THE EMBEDDING OF THE OVUM, THE FORMATION OF THE DECIDUA, AND THE DIFFERENTIATION OF THE DECIDUA BASALIS AND THE DECIDUA CAPSULARIS FROM THE DECIDUA VERA.

Decidual Reaction.—While this is happening, reactive changes are occurring in the endometrium, at first only in the immediate neighbourhood of the ovum, but presently throughout the whole of the corporeal lining. These changes result in the decidua of pregnancy and consist in the enlargement and multiplication of certain of the stroma cells into large closely packed polygonal cells with spherical nuclei, and without any intervening fibrils, so that the endomentrium becomes much thicker and softer (Fig. 5). The uterine glands run through the decidual cells, elongated, but otherwise unchanged in the more superficial part of their course, but deeper down they are

tortuous and dilated. The decidua is thereby differentiated into two layers, a superficial compact and a deep spongy layer.

According to its relation to the ovum, 3 areas of the decidua are distinguished (Fig. 6).

Decidua Basalis.—This is the portion of the decidua which intervenes between the ovum and the muscular wall of the uterus. It

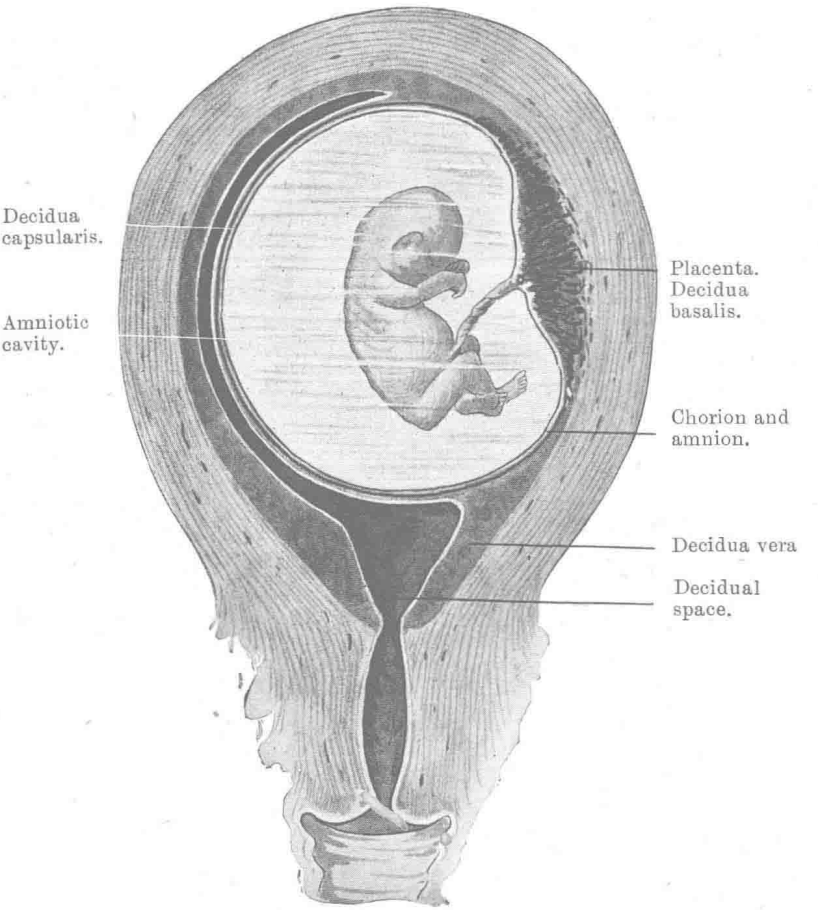

FIG. 7.—TO SHOW THE CONTENTS OF THE UTERUS AT THE TENTH WEEK OF GESTATION.

bounds the deeper half of the implantation cavity and its first function is to prevent the syncytiotrophoblast from reaching the muscular wall, which it never does under normal conditions. Later on it forms the site of attachment of the discrete placenta, and a number of thin-walled sinuses pass through it, bringing blood to the intervillous spaces.