BRITISH OBSTETRIC AND GYNÆCOLOGICAL PRACTICE

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ALECK BOURNE

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GENERAL PREFACE

The titles of these volumes explain the aim of the Editors, namely, to present, as far as possible, a description of Obstetrics and Gynæcology as practised in Britain. Not that this branch of British medicine is radically different from that of other countries, but perhaps there are minor, though important, variations that stamp our work in this country with an individuality which has enabled us to contribute to general world progress.

Though, equally with the pioneers of other countries, we have discovered new fields by laboratory and clinical research and devised new methods and techniques, yet it is not so much in detailed additions to the general fund of knowledge that Britain has made its characteristic mark.

There is often a tendency to vagueness when discussing broad generalities, but we feel we are on firm ground when we state our belief that during the last 150 years British Obstetrics and Gynæcology has been guided by the principle of conservatism. We do not claim that this attitude of hesitant acceptance of innovations, which have convinced many enthusiasts at different times as "progress", has always proved judicious or beneficial. Pioneers are impatient of the restraint of the cautious and critical mind which, though sensitive to the promise of the new method or theory, nevertheless will often dissolve away what is unsound and leave a core of new and valid knowledge.

Each country has made its own characteristic contribution to medicine in all its branches. From America have come new ideas of pioneering brilliance many of which have required an appreciable time-lag before acceptance by the gynæcologists of older countries.

Germany has shown us the value of the indefatigable attention to detail, accuracy and records. Radiotherapy, first foreseen in Paris by the Curies, has been developed in Sweden to become one of the major additions to the treatment of malignant disease.

To France belongs the credit of the earliest beginnings of antenatal care by Pinard, whose first impulse was derived from sympathy with and care for "the abandoned pregnant women" of the streets of Paris rather than from a desire to establish the clinical supervision of pregnancy.

Although Ballantyne in Edinburgh developed antenatal care as a technique, at first chiefly for the health of the fœtus, the spiritual heirs of Pinard are the obstetricians of Aberdeen under the direction of Professor Dugald Baird. And here is perhaps the chief modern contribution of Britain to obstetrics, the results of the study of the relation of social and economic conditions to the health of the pregnant woman and the condition of her child.

There have been many great figures in British Gynæcology from whom it is difficult to name one of greatest distinction, but if, as we believe, conservatism has been our own characteristic, then we must describe the late Victor Bonney, not only as a master of technique, but, during his later years, as the apostle of the appeal to conserve as far as possible, in all our surgical operations.

It is inevitable that an edited book should lack the uniformity of style characteristic of a work written by a single author. There is place here for legitimate criticism ; but, in the present day, so wide is the scope of any medical specialism that it is impossible for one writer to produce an authoritative work that covers the whole subject to the satisfaction of the specialist and post-graduate. Nevertheless, we hope that despite the unavoidable diversity, it is enclosed within a unity which can rightly be described as a British Practice.

Finally may we emphasize that these volumes are essentially an exposition of Obstetrics and Gynæcology as practised in this country to-day with a description of physiology and pathology only so far as is necessary for the understanding of clinical methods.

The Editors wish to thank their contributors for their willing cooperation, and the publishers for their kind and patient assistance.

E. H.
A. W. B.

LONDON, 1954.

EDITOR'S PREFACE TO THE SECOND EDITION

During the comparatively short time since the publication of the first edition of this volume an extensive revision has been necessary to include new advances in our knowledge and opinions. While some chapters are of necessity more or less static, others have been largely rewritten by omissions and additions. Errors in editing, only too frequent in a first edition of a work by many contributors, have been corrected.

It is impossible to give a detailed account of all the major revisions, but notice may be made of the comprehensive chapter on "Disorders of Menstruation," by Professor Jeffcoate, the latest results of treatment of carcinoma of the cervix, by J. B. Blaikley, and further experience of chemotherapy in the treatment of genital tuberculosis by John Stallworthy. The chapter by John Gardner on "Medico-Legal Aspects of Gynæcology" records the important judicial decisions made since he wrote the chapter in the first edition.

We deeply regret the deaths of Sir Charles Read and Wilfred Shaw, who contributed chapters on "Carcinoma of the Corpus Uteri" and "Ovarian Tumours" and "Endometriosis." The first has been revised by the Editor with assistance by C. A. Simmons on "Treatment," while we have been fortunate in inviting John Howkins to rewrite the chapters on "Ovarian Tumours" and "Endometriosis."

Illustrations have also been edited by suppressing some which were not up to the standard of this book, improving others already published in the first edition and adding new ones.

Again it is a pleasure to thank our contributors for their careful work in revision, some of which has been considerable, and our publishers for their ready and patient advice and assistance.

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London, 1958.

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CONTENTS

CHAPTER I

REPRODUCTIVE CYCLE

W. J. Hamilton and J. D. Boyd

The females of lower mammals show a cyclic sexual activity which reveals itself in a periodic behavioural phenomenon known as œstrus, or heat. Accompanying the cyclic activity, there are marked periodic changes in the ovaries and genital tract. Œstrus itself is associated with maximum secretory activity of the ovarian follicle and marks the time of ovulation. During reproductive life in the human female and related primates, there is also a cycle of events in the ovary and reproductive tract. This cycle has as its most striking external manifestation menstruation, which is the periodic escape of blood from the uterus. Œstrus in lower mammals and menstruation in primates are events in cycles of changes in the reproductive system, but the two phenomena do not have the same time relationship to ovulation. Œstrus, as has been stated, occurs at, or about, the time of ovulation, whereas menstruation follows the termination of the activity of a corpus luteum.

Hormones (gonadotrophins) produced by the anterior lobe of the pituitary are essential for the proper functioning of the reproductive system. Thus if the pituitary is removed in prepubertal animals, sexual infantilism is indefinitely prolonged, while if the operation is performed after puberty, there is atrophy of the reproductive system. At least three hormones produced by the anterior lobe of the pituitary are known to exert a control over reproductive activity. These are a follicular stimulating substance (FSH), a lutealizing substance (LH), often, because of its effect in the male, also called the interstitial cell stimulating hormone (ICSH), and luteotrophin (LTH or prolactin). LTH maintains fully formed corpora lutea and causes them to secrete progesterone. The pituitary undoubtedly produces gonadotrophins before puberty, but not in sufficient quantities to stimulate the full functional activity of the ovary. It has been generally held that the gonadotrophins exert no direct action on the uterus or vagina, but only indirectly through the ovaries. Recently it has been pointed out by Reynolds (1949), however, that the action of progesterone on the uterus is modified after hypophysectomy. It seems likely that the presence of the hypophysis renders the uterus more susceptible to the action of progesterone. There is also some evidence that luteotrophin may act directly on the uterus.

FSH is responsible for the development of the follicle and for the elaboration of œstradiol, but the early growth of the follicle can occur independently of this hormone. LH controls the lutealization of the follicle after ovulation. It is also possible that LH has an effect on the production of progesterone, but it is generally considered that LTH is the principal stimulus causing the cells of the corpus luteum to secrete. Removal of the pituitary after the formation of the corpus luteum leads to its retrogression. It has been shown in many mammals that either FSH or LH may separately produce ovulation, the optimum condition probably being a synergic balance between these two hormones.

The factors responsible for the cyclic production of the gonadotrophic hormones are numerous and are not yet fully understood. The ovarian hormones themselves appear to have a reciprocal effect on the hypophysis, thus an increased production of œstradiol by the ovaries may inhibit production of FSH which will lead to a diminished secretion of œstradiol, with, in turn, the diminution of the inhibitory action (a " negative feed-back " mechanism). That the gonads have an action on the hypophysis is also shown by the histological changes occurring in the latter as the result of spaying, when characteristic involuted cells (" castrate cells ") appear in its pars anterior.

A nervous mechanism appears also to be a factor in the control of the sex cycle. This mechanism involves the hypothalamic nuclei and the hypothalamic-hypophyseal pathways. There may be an inherent rhythmic control by the hypothalamus, but in many vertebrates (birds, ferrets, etc.), environmental conditions, for example, light, may act reflexly by way of the optic nerve and tract and the hypothalamic centres. The nervous mechanism of control of the cycle, however, is subsidiary in importance to the hormonal, for the pituitary can still exert its controlling action when the nerves have been sectioned or even when the gland itself has been transplanted. (See also Chapter II.)

CYCLIC CHANGES IN THE FEMALE GENITAL TRACT

The Ovary

The human ovary consists of a vascular medulla which is completely covered, except at the hilum, by a thick cortex, within which the germinal elements grow and mature. There is, however, no clear cut boundary between the cortex and the medulla. The cortex is covered by a single layer of small cuboidal cells called the germinal epithelium. Beneath this germinal epithelium there is a condensation of connective tissue forming a poorly defined tunica albuginea. During the child-bearing period the cortex constitutes more than half of the thickness of the ovary and consists of a stroma of connective tissue in which are embedded the ovarian follicles at different stages of development at various times in the ovarian cycle. Consequently the histological picture presented by the cortex of the ovary varies at different periods of this cycle. The ovarian cycle has two main phases, follicular and luteal, of about equal duration (see pp. 12–16). The follicular phase is that in which the ovarian follicle is formed, matures and eventually ruptures or becomes atretic. This phase, therefore, normally terminates with ovulation (Fig. 1.I). The luteal phase is that in which the corpus luteum develops and matures ; it terminates with retrogression of the corpus luteum just previous to the onset of menstruation.

FOLLICULAR PHASE

This phase, in the human subject, is about fourteen days in length, but it varies from individual to individual and, frequently, even in one and the same individual in different cycles. It is much less constant in duration than the luteal phase.

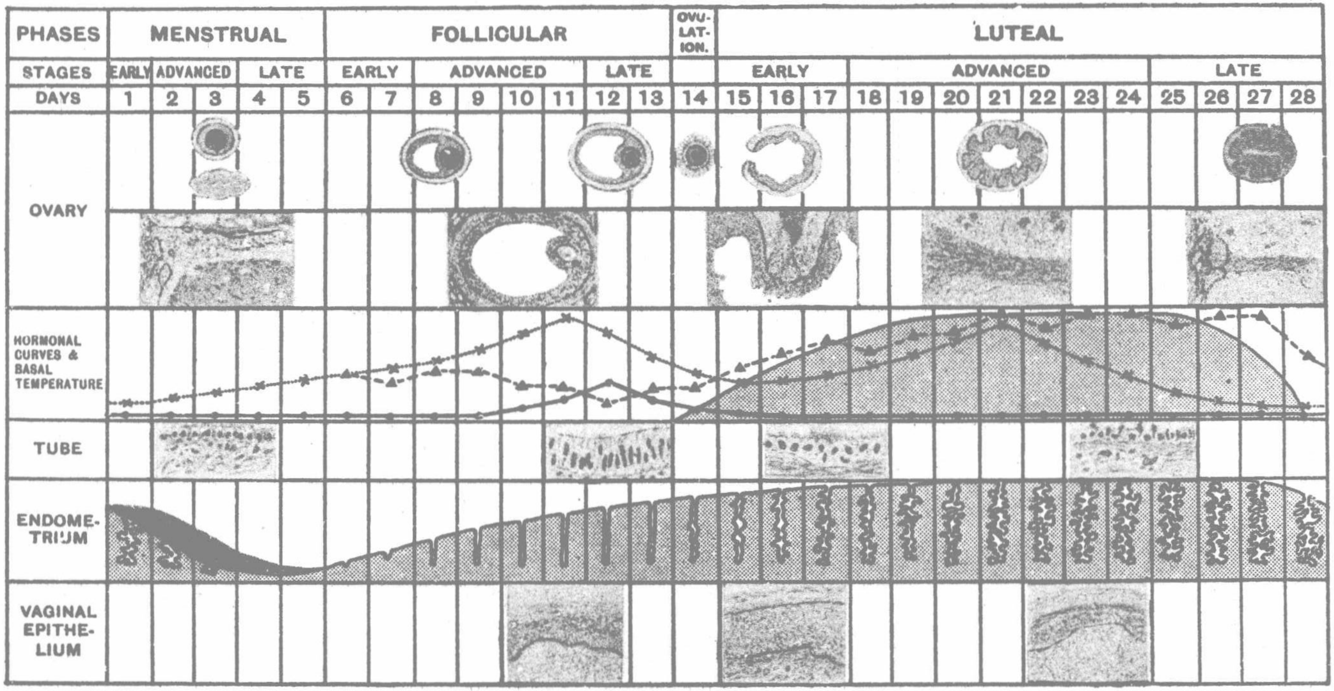

FIG. 1.1. The correlation of the cyclical changes occurring in the female genital tract. (Based on a chart in "The Epithelia of Woman's Reproductive Organs," by Papanicolaou *et al.*, 1948; and personal observations.)

In the classical description which attributes the formation of the oöcytes to the germinal epithelium, it was assumed that tubular down-growths (Pfluger's tubes) of this epithelium in which the oöcytes were formed, develop only during fœtal life. It was believed that some of these ova degenerated during childhood but that many lay dormant until after puberty when one (or more) matured and was shed in each cycle, in the absence of pregnancy, until the menopause. Probably all the oöcytes formed during fœtal life undergo degeneration (i.e. become atretic) and are replaced post-natally by cyclic proliferations of the oogonia in the cortex after birth and until the menopause. It is, however, possible that these replacing oöcytes are derived from cells predetermined to become oöcytes (i.e. from early segregated primordial germ cells, see p. 27). The extensive postnatal atresia of oöcytes formed during fœtal life is possibly due to the withdrawal of maternal œstrogens from the child. In some species, including man, there may even be uterine bleeding in the newborn infant due to the withdrawal of the maternal hormones. Maturation of the oöcytes and ovulation does not occur until sexual maturity is reached (usually after puberty in the human subject). It has been shown that ovulation depends upon the release of gonadotrophins from the anterior lobe of the pituitary. These hormones are apparently not present in sufficient quantity before sexual maturity to bring about ovulation.

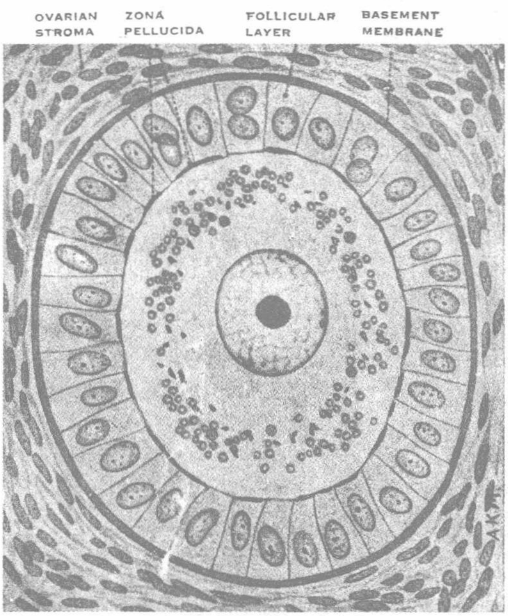

FIG. 2.1. A schematic drawing of a primary oöcyte showing the further dispersal, into the periphery of the cytoplasm, of the mitochondria and Golgi apparatus and the remains of the fat globules which are now less numerous. Irregular blocks of darker material (future zona pellucida) develop between the surface of the oöcyte and the columnar follicular cells. The ovarian stroma is concentrically arranged around the follicular cells. × c. 730.

[Reproduced from "Human Embryology," 2nd ed., Heffer, by the courtesy of Professors Hamilton, Boyd and Mossman.

The early, or primary, oöcytes found in the cortex of the ovary soon become surrounded by a single layer of cells. This is the follicular epithelium. The cells which form the follicular epithelium are sometimes considered to be genetically related to the primordial ova but they are apparently derived from the surrounding stromal cells. From the developmental aspect, there is no valid reason why the follicular epithelium may not be formed from either germinal epithelium or stroma since both are of mesodermal origin. The primary oöcyte grows rapidly and by the time that it is surrounded by a single layer of follicular cells, it is approximately 40 microns in diameter. Between the oöcyte and the surrounding follicular cells a clear homogeneous and apparently structureless membrane develops, the zona pellucida (Fig. 2.1). The zona appears to be a product of the activity of the follicular cells. In subsequent development of the follicle, there is an increase in the size of the ovum and an increasing differentiation of the surrounding follicular cells, which now constitute a membrana granulosa. The granulosa cells multiply until the follicle becomes an ovoid structure, with the ovum situated eccentrically and surrounded by about eight or ten layers of granulosa cells. By the time the oöcyte has reached its maximum size of about 120 microns, spaces appear between the granulosa cells which are nearer to the surface of the ovary. The spaces become confluent and, as a result, the primordial ovarian follicle is transformed into a fluid-filled definitive ovarian follicle, the cavity of which is usually called the antrum (Fig. 3.1). The oöcyte and the zona are surrounded by granulosa cells, the cumulus. At one point the cumulus cells are attached, by the discus proligerus, to the peripheral granulosa cells lining the interior of the follicle.

As the follicle increases in size, the stroma cells in contact with the periphery of the membrana granulosa become transformed into a layer known as the theca interna. The cells of the theca interna constitute the so-called "thecal gland" (Mossman, 1937; Stafford *et al.*, 1942; and Harrison, 1948). Between the theca interna and the granulosa cells, a delicate basement membrane, the membrana propria, is formed. With further growth of the follicle, yet another layer, of fibrous tissue and called the theca externa, becomes evident. It is believed that the thecal gland is responsible for the formation of most of the œstrogens during the follicular phase of the ovarian cycle (Corner, 1938).

During the early part of the follicular phase, primary follicles are found in various positions in the cortex. Later in this phase, however, many of the follicles with their contained ova, migrate towards the surface of the ovary. During the preovulation period in many mammals, including man, the theca interna shows an eccentric proliferation at the superficial aspect of the larger follicles to form a "thecal cone" (Strassmann, 1941; and Harrison, 1948). Before ovulation the stroma cells round the cone become œdematous and so are possibly more readily separated at ovulation. Previous to ovulation there is an increase in the amount of follicular fluid, which probably facilitates the expulsion of the oöcyte. The actual rupture of the follicle has not been observed in man. In mammals the ovarian surface at the site of impending rupture becomes thin and translucent. (For details see Walton and Hammond, 1928; and Markee and Hinsey, 1936.) Ovulation has occasionally been attributed to the contraction of muscular tissue in the ovary. The investigations of Claesson (1947), however, have shown that there is no involuntary muscle in the wall of the follicle. It seems likely that the rupture of the mature follicle is due to an increase of the intrafollicular tension which causes the overlying cells of the ovary to separate or to disintegrate.

During the growth of the oöcyte, important changes occur in its nucleus. The formation of the first polar spindle initiates the first maturation, or reduction, division. The secondary oöcyte and the first polar body are formed as a result of this division. A second polar spindle then arises and it is at this stage that ovulation occurs in the great majority of mammals, including man.

The time required for the formation and maturation of each generation of follicles is variable (Papanicolaou *et al.*, 1948). At ovulation the follicles are not all at the same stage of development. This may account for one particular ovum being at a more advanced stage than the others, and hence for its selection for ovulation. There are possibly other factors involved, e.g. the position and blood supply of the different follicles.

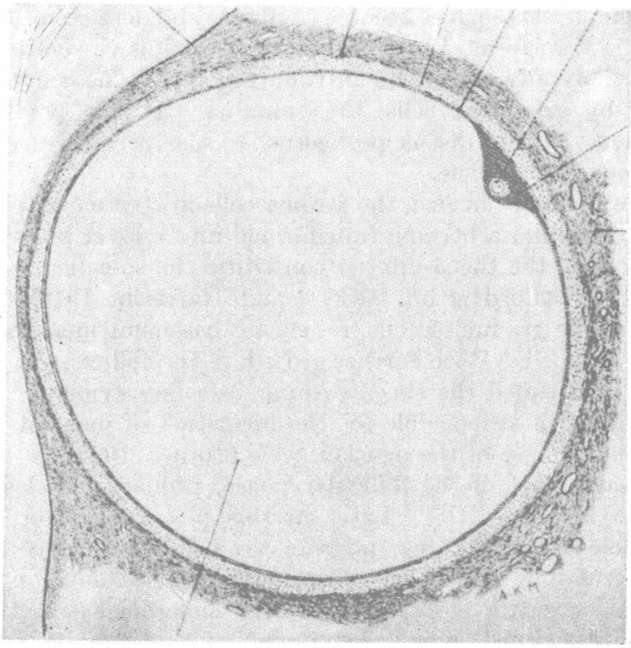

FIG. 3.I. The mature ovarian (Graafian) follicle. The follicular cavity has become distended with fluid and now measures approximately 6 mm. in diameter. The oöcyte surrounded by some of the follicular cells (cumulus oöphoricus) is attached to the inner aspect of the follicle on its deep side. The enlarging follicle now produces a swelling on the surface of the ovary. Immediately surrounding the follicle the ovarian stroma forms the theca interna or thecal gland. × c. 12.

[*Reproduced from " Human Embryology," 2nd ed., Heffer, by the courtesy of Professors Hamilton, Boyd and Mossman.*

The follicles which fail to rupture, together with their oöcytes, undergo degenerative changes and become atretic. Degeneration of the ovum is usually the first definite sign of atresia. It shows itself by loss of chromatin substance and crenation of the zona pellucida. The ovum then loses its attachment to the follicular wall, and with its cumulus of granulosa cells, is shed into the antrum. At about this time, blood vessels with accompanying connective tissue elements from the theca interna invade the granulosa which also shows degenerative changes. Eventually the walls of the antrum collapses and the degenerated follicle is gradually replaced by connective tissue and ultimately cannot be distinguished from the stromal tissues of the ovary.

LUTEAL PHASE

Following ovulation the ruptured follicle collapses and its walls become folded. The granulosa cells hypertrophy and become polyhedral in shape to form the luteal cells (Fig. 4.1). These cells develop a yellowish carotinoid pigment

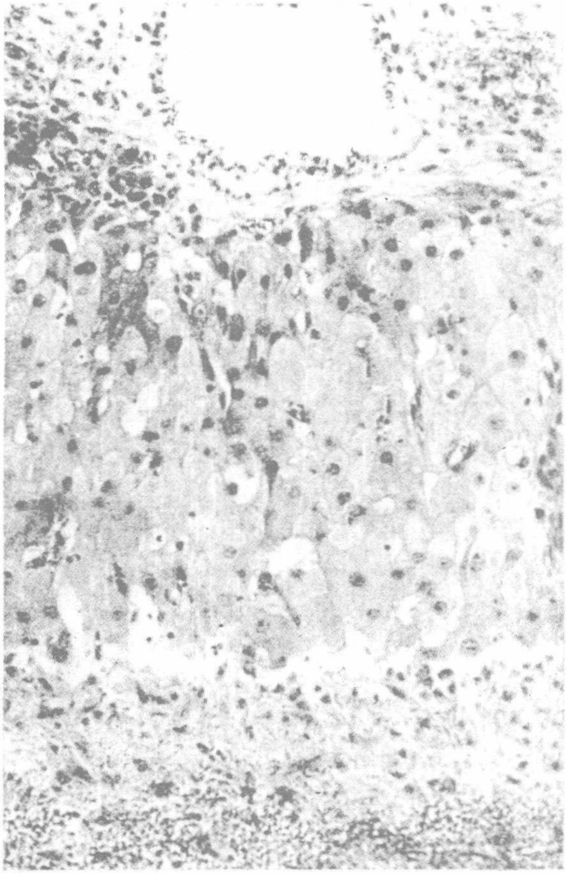

FIG. 4.1. A photograph of a section of a corpus luteum of estimated age one to two days. The site of rupture in the ovary is not yet closed.

which gives the corpus luteum its characteristic colour. In some mammals there is a wave of mitosis in the granulosa cells immediately after ovulation.

The fate of the corpus luteum in the human subject, but not in all mammals, depends on whether or not pregnancy follows ovulation. In the absence of pregnancy a corpus luteum (spurium) of menstruation is formed. Such a corpus luteum begins to retrogress nine to eleven days after ovulation, and is non-functional four days later. The retrogression, in which colloid degenerative changes occur, is not fully completed in a given corpus luteum for several ovarian cycles. Finally, a corpus luteum is replaced by a homogeneous matrix and