LECTURE NOTES ON
GYNAECOLOGY

FIFTH EDITION

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PREFACE TO THE
FIFTH EDITION

Lecture Notes on Gynaecology was originally written for medical students preparing for their final examinations and based on lectures and tutorials given for revision purposes. When it was completed it became a comprehensive account of current practice in gynaecology and as such gained a wider appeal.

It has been gratifying to find that the book has proved helpful to general practitioners, doctors in family planning clinics, those preparing for the Diploma of the Royal College of Obstetricians and Gynaecologists, student nurses and many others.

Every effort has been made to bring this fifth edition up to date and to include all the many changes and advances in investigation and treatment that are part of any modern medical discipline. But this has not led to any great increase in the size or format of the book, the aim of which is to present essential facts in a compact and yet readable form.

The practice of including a number of examination questions from recent examinations has been continued since students have found these helpful as a guide to study. It is recognised that many examining boards and universities are moving away from the formal essay paper towards multiple choice papers and continuous assessment.

Modern gynaecology impinges on many disciplines in medicine and on most aspects of modern life. It is hoped that this small book will help to maintain good standards of practice.

PREFACE TO THE
FIRST EDITION

This book has grown out of lectures and tutorials given over the years, mainly to medical students but also to postgraduates and student nurses. In giving tutorials in gynaecology to final year students I have always felt aware of the large syllabus they have to cover in medicine, surgery and obstetrics as well. Tutorials are thus designed to give a comprehensive survey of the subject without omitting any condition of importance to the student or postgraduate, but with a minimum of detailed study of rare conditions.

Great changes have occurred in the field of gynaecology in recent years. Some of these have resulted from general scientific progress in all fields of medical science and from improvements in operating techniques. The discovery of hormones has also changed the treatment of many conditions and a certain amount of space has therefore been devoted to endocrinology including its application in oral contraception. But in spite of these advances the basic needs of the doctor and patient remain unchanged: the student must have a basic knowledge of anatomy, physiology and pathology, and must learn how to make a clinical examination, to interpret his findings and to understand the significance of symptoms and signs.

In compiling these lecture notes I have constantly felt indebted to my own teachers and especially to those from whom I learnt the importance of thorough examination and accurate diagnosis. In particular I must mention Professor F. J. Browne who taught me above all the importance of teaching in simple and easily understood terms. I must also mention another great teacher, Clifford White, whose tutorials to final year students at University College Hospital helped so many to reach the standard required for the final examinations in obstetrics and gynaecology.

This book is to a great extent based on what I learnt from these two great men and from many others who devote their professional lives to the training of good doctors.

ACKNOWLEDGMENTS

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CHAPTER 1. ESSENTIAL GYNAECOLOGICAL ANATOMY

THE OVARY

The *ovaries* are situated in the pelvis one on each side of the uterus and in close relation to the Fallopian tube. Each ovary is attached to the back of the broad ligament by a peritoneal fold called the *mesovarium*; the blood supply, venous and lymphatic drainage of the ovary and its nerve supply pass through the mesovarium. A fibromuscular cord, the *round ligament of the ovary*, attaches it to the back of the uterus. It represents the remains of the *gubernaculum*.

The ovary is shaped like an almond and its surface is often wrinkled. The ovaries vary much in size in different women and even in the same woman; the approximate dimensions are 3.5 to 5 cm long, 2.5 cm wide and 1.5 cm thick. Each ovary weighs 5 to 10 grammes.

STRUCTURE OF THE OVARY

The *ovary* is described as having two main parts, the *cortex* and the *medulla* (Fig. 1). In fact it consists of large numbers of ova supported by a connective tissue stroma.

The outer surface of the ovary is covered by a single layer of cubical epithelium, the *germinal epithelium*; this layer is often missing from ovaries removed from adult women. Beneath this is the fibrous capsule of the ovary, the *tunica albuginea*, a protective layer derived from the fibrous connective tissue.

The cortex of the ovary contains thousands of *primordial follicles*. Each consists of an *oögonium* or egg with a single layer of granulosa cells, specially differentiated stroma cells which secrete hormones. The primordial follicle is 0.25 to 1 mm in diameter.

During each menstrual cycle one primordial follicle undergoes full ripening to become a Graafian follicle (Fig. 2). The granulosa cells multiply and secrete clear fluid, the *liquor folliculi*. This pushes the oögonium, now 0.1 mm in diameter and called the oöcyte, to one side. The oöcyte is surrounded by a clear area, the *zona pellucida*, and invested with granulosa cells, the *corona radiata*. The oöcyte with its granulosa layer projects into the follicle as the discus proligerus

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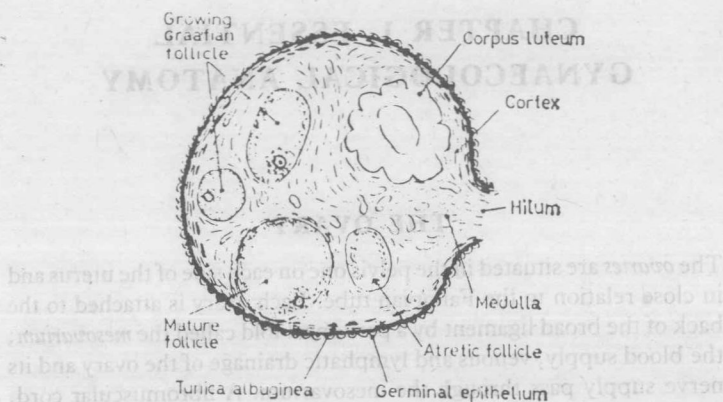
Fig. 1. Histology of the normal ovary

(cumulus oöphori). The follicle is lined with more granulosa cells, the *membrana granulosa*. The stroma cells outside the membrana granulosa become differentiated to form hormone secreting cells, the *theca interna*. The stroma cells outside this form a false capsule, the *theca externa*, which has no hormone secreting function.

The ripe follicle is 7 to 8 mm in diameter. At ovulation it ruptures, releasing the oöcyte with its corona radiata. This is called *ovulation*.

Shortly before ovulation the process of *meiosis* is completed in the primary oöcyte. The oöcyte casts off the *first polar body* and as a result the number of chromosomes in the nucleus is reduced from 46 to 23, the primary oöcyte and the first polar body both containing the haploid number (23) of the chromosomes. At fertilization the primary oöcyte unites with a spermatazoön, which also has the haploid number of chromosomes (23); this secondary oöcyte, now properly called an ovum, has 46 chromosomes. It casts off the *second polar body* and becomes a *zygote*. The first polar body also divides, making three in all. If the primary oöcyte is not fertilised it quickly shrivels and degenerates.

The Graafian follicle now collapses and the cells undergo luteinization, the granulosa cells become *luteal cells* and the theca interna *theca lutein cells*. A *corpus luteum* develops and projects from the surface of the ovary. It is recognized by its crenated outline and the yellow appearance of the cells which secrete *oestrogen* and *progesterone*. If the ovum is not fertilized the corpus luteum degenerates in about 10 days. A small amount of bleeding occurs into the cavity, the cells
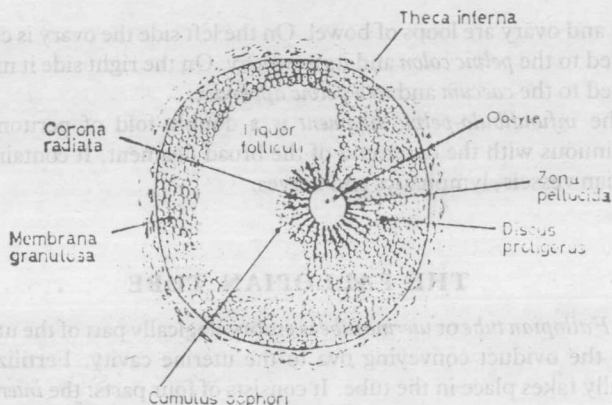
Fig. 2. Maturing Graafian follicle

undergo hyaline degeneration and a *corpus albicans* is formed. If pregnancy occurs, the corpus luteum grows and may reach 3 cm in diameter. It persists for 80 to 120 days and then gradually degenerates.

The ovaries of a newborn girl contain about 2 million oöcytes; by 7 years of age there are some 300 000; by 45 to 55 a few hundred. Wastage of germ cells occurs by atresia so that imperfect cells are weeded out.

Some follicles mature but do not rupture and no corpus luteum is formed. In this case the liquor is gradually absorbed and the follicle regresses forming a *corpus fibrosum*.

RELATIONS OF THE OVARY

The *ovary* lies free in the *peritoneal cavity* and attached to the back of the *broad ligament* which forms its anterior relation. The *Fallopian tube* curls over the ovary and is *medial, superior* and *lateral* to it. The ovary itself lies in the *ovarian fossa* (fossa ovarica); its posterior relation is the *peritoneum* lining the posterior wall of the true pelvis. Behind this is the *common iliac artery and vein*. The common iliac artery divides at this point into external and internal iliac (hypogastric) arteries and the ovary is more often related to the *internal iliac vessels*. The *ureter* enters the pelvis in front of the bifurcation of the common iliac artery and is thus a close posterior relation of the ovary. Lateral to the ovary is the lateral wall of the pelvis with the *obturator internus muscle* and the *obturator vessels and nerve*. Above the Fallopian

tube and ovary are loops of bowel. On the left side the ovary is closely related to the *pelvic colon* and its *mesentery*. On the right side it may be related to the *caecum* and to a *pelvic appendix*.

The *infundibulo-pelvic ligament* is a double fold of peritoneum, continuous with the outer end of the broad ligament. It contains the ovarian vessels, lymphatics and nerves.

THE FALLOPIAN TUBE

The *Fallopian tube* or *uterine tube* is embryologically part of the uterus. It is the oviduct conveying ova to the uterine cavity. Fertilization usually takes place in the tube. It consists of four parts: the *interstitial* or *intramural* part traverses the wall of the uterus; it is 1 to 2 cm long and about 1 mm in diameter; the *isthmus* is narrow and lies near the uterus; it is 2 to 3 cm long and its diameter is 1 to 2 mm; the *ampulla* is vide, thin-walled and curved, measuring 5 cm in length; the *infundibulum* is the outer end of the tube and is trumpet shaped with the *fimbriae*, frond-like processes that surround the outer opening of the tube or *abdominal ostium*. One fimbria is longer than the others and is attached to the ovary, the *fimbria ovarica*. In life the fimbriae have a sucking action which wafts the ovum into the tube.

STRUCTURE OF THE FALLOPIAN TUBE

The tube has three coats, the outer *serous* layer consisting of peritoneum; this covers the tube except in its intramural part and over a small area over its attachment to the broad ligament. The *muscle* layer consists of *outer longitudinal and inner circular* layers of *smooth muscle*. A delicate layer of connective tissue separates the muscle layer
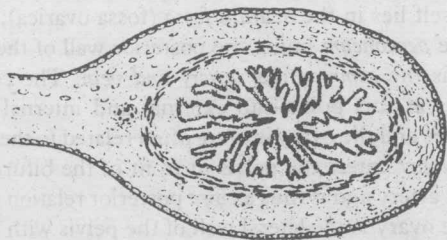

Fig. 3. Anatomy of the Fallopian tube

from the mucosa, the *endosalpinx* which lines the tube and is thrown into numerous longitudinal folds or *rugae*. The rugae consist of a core of connective tissue covered with a tall columnar epithelium. In the inner part of the tube the epithelium is thrown into only three or four folds and the epithelial cells are smaller (Fig. 3).

HISTOLOGY

Three main types of cell are found: 1. Ciliated cells. 2. Non-ciliated or 'secretory' cells which may be pear-shaped or dumb-bell shaped. 3. 'Peg' or intercalary cells. These are cells with long narrow nuclei, squeezed between the other cells. There are rhythmic changes in the epithelium during the menstrual cycle. In the follicular or proliferative phase the cells increase in height and activity.

RELATIONS OF THE FALLOPIAN TUBE

Anterior to the Fallopian tube is the top of the bladder and the utero-vesical peritoneal pouch. *Superior* to it are coils of intestine with the caecum on the right and the pelvic colon on the left. *Posterior* to it are the ovary and the pouch of Douglas (utero-rectal pouch) and its contents. *Lateral* to it are the structures in the lateral pelvic wall, the peritoneum covering the obturator internus muscle with the obturator vessels and nerve.

Inferior to the Fallopian tube lie the structures contained within the layers of the *broad ligament*; in addition to the tube and the round ligament of the uterus these include the following: the anastomosis between the ovarian and uterine arteries, a plexus of veins, draining into the uterine and ovarian veins: lymphatic vessels and a lymph node lying close to the cervix: a plexus of *nerves* and the *cervical nerve ganglion*: certain vestigial structures, namely the *epoöphoron*, the *paroöphoron* and *Gärtner's duct* (mesonephric duct).

FUNCTIONS OF THE FALLOPIAN TUBE

The functions of the Fallopian tube are complex and incompletely understood. It actively sucks the oöcyte into its ampulla where fertilization takes place. Tubal secretion, which contains among other constituents lactate, pyruvate and bicarbonate, is essential for 'capacitation' of the spermatozoön and the oöcyte. After fertilization the ovum must remain in the tube for 3 days to undergo the early stages of division. It is then transported to the uterus, probably by the movement of the cilia in the tubal epithelium, and becomes implanted about 5½ days after fertilization.

THE UTERUS

The *uterus* (Fig. 4) is a hollow muscular organ which lies at about the centre of the true pelvis and is covered over most of its surface with peritoneum. It consists of the following parts:

1 The *fundus* is the part above the opening of the Fallopian tubes.
2 The *cornu* is the part into which the Fallopian tube opens.
3 The *body* is the main part of the cavity of the uterus.
4 The *isthmus* is the narrow lowest part of the body and is bounded above by the *histological* internal os and below by the *anatomical* internal os of the uterus.
5 The *cervix* (neck) runs from the histological internal os to the external os which opens into the vagina.

DIMENSIONS

The nulliparous uterus is about 9 cm long, 6 cm wide and 4 cm thick and weighs about 50 grammes.
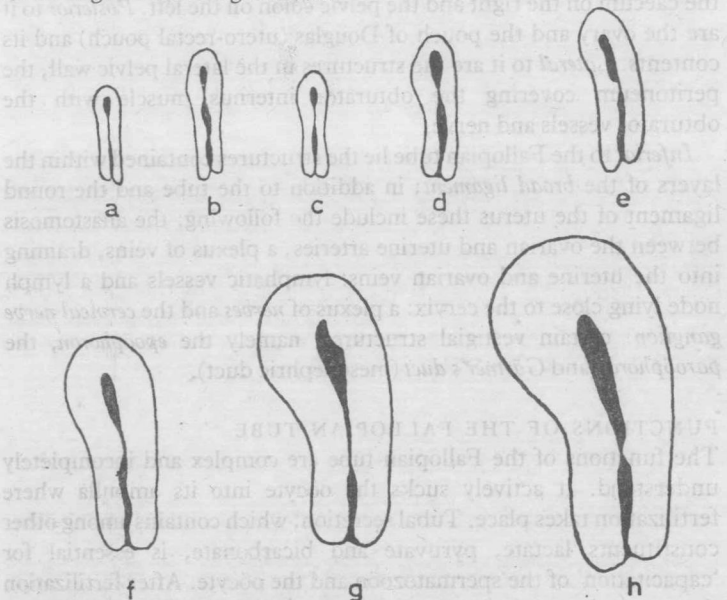

Fig. 4. Uterus with cervix at different ages
a—28 weeks fetus   e—10 years
b—at birth   f—2 years, before menarche
c—1 month   g—14 years, after menarche
d—2 years   h—22 years nulliparous

The uterus changes in size and shape during a woman's life. In the child the cervix exceeds the body in length but at puberty there is growth of the muscle until the uterus attains adult size. After childbirth the uterus is always larger. At the menopause and after, the body of the uterus atrophies to a varying degree.

STRUCTURE OF THE UTERUS

The *body*, with the *fundus* of the uterus, is covered with peritoneum except at its sides where the broad ligaments are attached to it. There are two layers of smooth muscle, a thin outer longitudinal layer continuous with that of the Fallopian tube and the vagina, and an inner layer arranged in oblique spirals. There is fibrous tissue among the muscle fibres. The epithelium is the *endometrium* and rests directly on the muscle layer with no intervening submucous layer.

The *isthmus* no more than 5 mm long lies between the body of the uterus from the *histological internal os* where the endometrium is less sensitive to hormone influences to the *anatomical internal os*, the upper border of the cervix. It is much larger in the pregnant uterus and takes part, with the supravaginal cervix, in the formation of the *lower segment* of the uterus in labour.

The *cervix* is a fusiform canal, one-third of which lies above the attachment of the vagina while two-thirds of it projects into the vagina. It is made up mainly of fibrous tissue and elastic tissue; the upper part contains smooth muscle which is condensed in a circular pattern to form the *internal os* or sphincter of the uterus.

The *cervical canal* is lined by columnar epithelium; this is thrown up into several longitudinal folds and numerous lateral folds the *arbor vitae*. The epithelium is continued into the compound racemose glands (distinct from the simple tubular glands of the endometrium) which dip deep into the stroma of the cervix; these glands produce the mucous secretion of the cervix.

The **vaginal part of the cervix** (portio vaginalis) is covered with squamous epithelium continuous with that of the vagina. The junction between the columnar and squamous epithelium is at the *external os*.

RELATIONS OF THE UTERUS

The body and fundus of the uterus are covered with peritoneum; in front this is reflected on to the upper surface of the bladder at the level of the internal os. Here the peritoneum is loosely attached, but over the rest of the uterus the attachment is so dense that it cannot be

stripped off the uterine muscle. The body of the uterus is related *anteriorly* to the *utero-vesical pouch* and *bladder*; as the bladder fills the uterus becomes more vertical in position. *Laterally* the *broad ligaments* with their contents are attached to the side of the uterus. The *round ligaments* are fibro-muscular cords which contain blood vessels and lymphatics; the round ligament ends by passing through the inguinal canal.

Posteriorly the peritoneum passes down into the pouch of Douglas; this varies in depth in different women; it contains bowel, small or large intestine, which separates the uterus from the rectum.

The *cervix* is only covered by peritoneum on its posterior surface above the attachment of the vagina. Its relations are as follows:

Above the attachment of the vagina:

Anterior: The cervix is separated from the bladder by loose connective tissue. The pubo-cervical (utero-vesical) ligament is attached to it and runs forward to the back of the pubis.

Lateral: The ureter lies lateral to the cervix, ½ to 1 cm away from it; above the ureter is the uterine artery which divides at the level of the internal os into ascending and descending branches. The descending branch supplies the cervix and upper part of the vagina. The artery is accompanied by the uterine veins. A lymph gland and a nerve ganglion are also lateral to the cervix in the base of the broad ligament. The *cardinal ligament* (transverse cervical ligament, Mackenrodt's ligament) is attached to the lateral side of the supra-vaginal cervix and to the lateral vaginal fornix.

Posterior: The supra-vaginal cervix is covered by peritoneum which forms the anterior lining of the pouch of Douglas. The *utero-sacral folds* run from the back of the cervix, encircling the rectum, to the front of the sacrum.

Below the attachment of the vagina:

The cervix projects into the vagina forming the *four fornices*.

The *anterior fornix* is the shallowest and separates the cervix from the vaginal wall and the base of the bladder.

The *lateral fornices* are bounded laterally by the vaginal wall to which are attached the cardinal ligaments.

The *posterior fornix* is the deepest of the four and is bounded posteriorly by the vaginal wall which separates it from the pouch of Douglas and its contents.

SUPPORTS OF THE UTERUS

The chief supports of the uterus are the ligaments attached to the

supra-vaginal cervix. It is obvious that this must be so, allowing the fundus of the uterus to be mobile so that it can expand and move up into the abdomen during pregnancy.

THE VAGINA

The *vagina* is a fibro-muscular canal which extends from the vestibule of the vulva to the cervix, around which it is attached to form the *fornices*.

STRUCTURE OF THE VAGINA

The vagina is normally 7.5 to 10 cm long in its anterior wall and 12.5 to 15 cm long in its posterior wall. It is capable of great distension as in childbirth. Normally the anterior and posterior walls are in contact so the cavity is represented by an H-shaped slit.

There are three layers: an outer connective tissue layer to which the ligaments are attached and which contains blood vessels, lymphatics and nerves; a muscular layer consisting of an outer longitudinal layer and an inner circular layer; the epithelium is stratified squamous epithelium which in adult women contains glycogen.

The *epithelium* is composed of three layers: a basal layer, a functional layer and a cornified layer. The epithelium undergoes cyclical changes during the menstrual cycle and characteristic changes during pregnancy. After the menopause the epithelium atrophies and smears taken from postmenopausal women contain a high proportion of basal cells. The *secretion* of the vagina in adult women is acid, pH about 4 to 5. It is made up of cervical secretion, desquamated epithelial cells, transudation through the vaginal epithelium and Döderlein's bacilli. The lactobacillus of Döderlein is a large Gram positive rod which produces lactic acid from the glycogen in the epithelial cells.

RELATIONS OF THE VAGINA

The *anterior* wall of the vagina is in close contact with the *bladder* and *urethra* and the tissue between them constitutes the *vesico-vaginal septum*.

The *posterior* wall is related to the *peritoneum* of the *pouch of Douglas* in its upper part. Its lower part is related to the *rectum*, separated from it by the *recto-vaginal septum* and *perineal body*.

Laterally the *cardinal ligaments* and *levator ani* muscles are attached to the vagina.

THE VULVA

The *vulva* (Fig. 5) or *external genitalia* of the female consists of the following parts: the mons Veneris, the labia majora, the clitoris, the labia minora, the vestibule, the glands of Bartholin and the hymen.
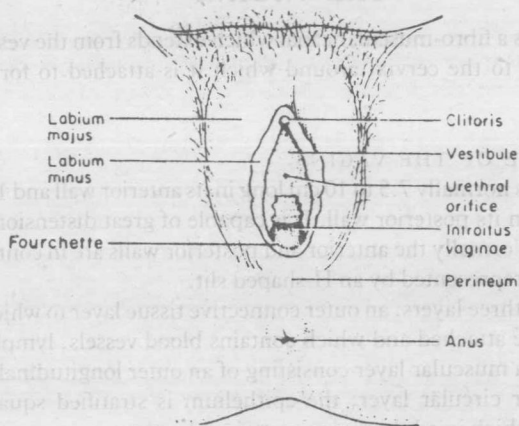

Fig. 5. The vulva

The *mons veneris* is a pad of fat which lies over the symphysis pubis. It is covered with skin in which hair grows at puberty.

The *labia majora* are two folds of skins which enclose the vaginal opening. They contain fatty tissue, and the round ligament of the uterus, emerging from the inguinal canal, ends in the upper part of the labium majus. The skin of the labium majus is covered with hair after puberty.

The *clitoris* contains erectile tissue and is attached to the pubic arch by its *crura*. Folds of skin from the labia minora form the prepuce of the clitoris.

The *labia minora* are delicate folds of skin, containing fibrous tissue and numerous blood vessels constituting erectile tissue. The skin contains sebaceous glands but no hair follicles and represents the transition from true skin to the squamous epithelium which lines the vestibule and vagina.

The *vestibule* is the area between the labia minora. Four orifices open into it: the vagina, the external meatus of the urethra and the two ducts of Bartholin.

The external *urethral meatus* is the external opening of the urethra.