

Chapter 1

Basic science

Female anatomy

A woman's body is less muscular than a man's body and therefore has a slighter skeleton to support the muscles. In the abdomen, the non-pelvic organs are similar and subject to the same diseases. Readers are therefore referred to books on general anatomy and this chapter is concerned with female pelvic anatomy. As much changes in pregnancy we introduce the pregnancy aspects in this chapter and Chapter 7.

Uterus (Box 1.1)

A hollow, muscle-walled organ in the pelvis communicating with each fallopian tube and, through its cervix, the vagina.

Pre-pregnancy: $7 \times 5 \times 3$ cm; weight, 40 g.

Full term: $30 \times 25 \times 20$ cm; weight, 1000 g.

Structure

The uterus is a muscle in three layers with vascular anastomoses between them:

1 Outer: thin, longitudinal, merging with ligaments

2 Middle: very thick, spiral muscle fibres with blood vessels between

3 Inner: thin, oblique with condensation at each cornu and at the upper and lower end of the cervical canal—the internal and external os.

Increase in size during pregnancy results mostly from hypertrophy of existing cells rather than an increase in number. Changes are stimulated by oestrogen and gradual stretch (maximum effective stretch about term).

The cavity of the uterus is lined by an epithelial layer (the endometrium), which undergoes changes in response to the steroids oestrogen and progesterone during the menstrual cycle in preparation for implantation of an embryo.

Blood supply (Fig. 1.1)

From the uterine and ovarian arteries, mostly the former. The uterine artery is a branch of the internal iliac artery. It runs in the lower edge of the broad ligament to the junction of the uterine body and cervix before running up the side of the uterus, giving off several branches into the myometrium. The ureter lies immediately beneath the uterine artery.

Cervix (Box 1.2)

Barrel-shaped canal at the bottom of the uterus (Fig. 1.2). Mostly connective tissue with muscle at

Lecture Notes: Obstetrics and Gynaecology, 3rd edition. By Diana Hamilton-Fairley. Published 2009 by Blackwell Publishing. ISBN: 978-1-4051-7801-3.

Box 1.1 Relations of the uterus

Peritoneum	The body and fundus are covered with peritoneum. In front, this is reflected to the upper surface of the bladder. Over the rest of the uterus, the attachment is dense and it cannot be stripped off the uterine muscle
Anterior	The uterovesical pouch and bladder
Lateral	The broad ligaments with their contents
Posterior	The pouch of Douglas The rectum

Box 1.2 Relations of the cervix above the attachment to the vagina

Anterior	Loose connective tissue Bladder Pubocervical ligaments
Lateral	The ureter 1 cm lateral to the cervix The uterine artery Uterine veins Parametrial lymph glands Nerve ganglia The transverse cervical ligament
Posterior	Peritoneum of the pouch of Douglas The uterosacral ligaments

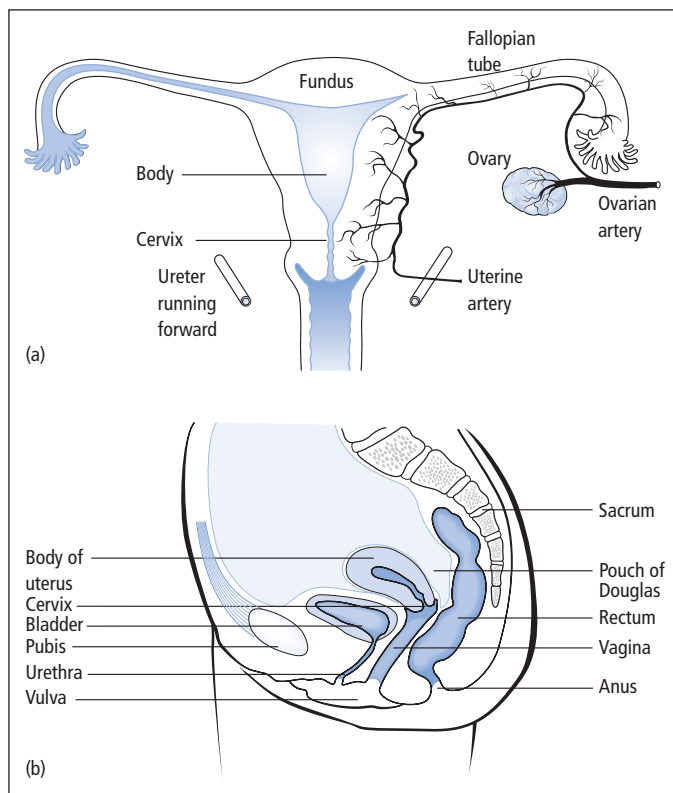


Figure 1.1 Relations of the uterus: (a) anteroposterior view; (b) lateral view. See also Box 1.1.

upper and lower ends (internal os and external os). In late pregnancy the ground substance of the connective tissue becomes less dense with a greater water content, and the cervix becomes softer clinically. The cervical canal is lined by columnar epithelium which undergoes squamous metaplasia at

the external os. This is called the transformation zone and is the area where neoplasia can arise as the cells are constantly transforming from columnar to squamous epithelium. In the presence of high oestrogen levels (pregnancy, combined oral contraceptive pill) the transformation zone can be

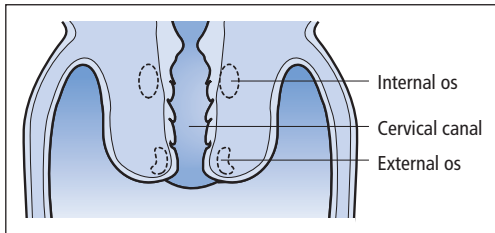


Figure 1.2 A longitudinal section of the cervix.

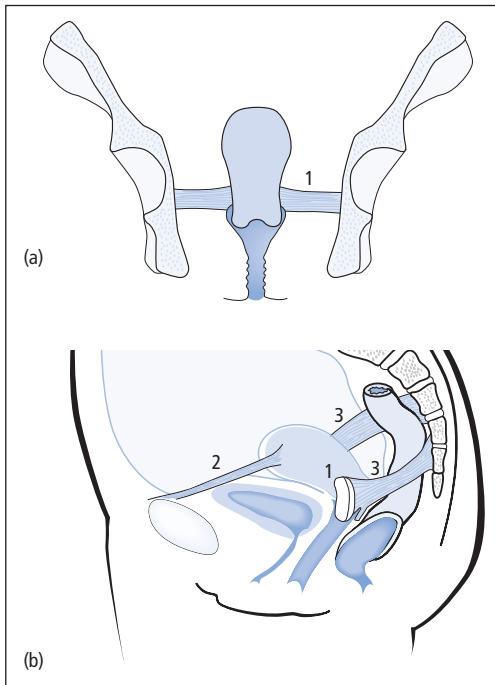


Figure 1.3 The ligamentous supports of the uterus: (a) frontal view; (b) lateral view. 1, transverse cervical ligament; 2, round ligaments; 3, uterosacral ligaments.

present on the outer surface of the cervix (an ectropion) whereas after the menopause it often retreats into the canal, making it more difficult to detect abnormal cells on a smear.

The cervix secretes fluid from glands present in the columnar epithelium. The nature of the secretion changes under the influence of oestrogen (making it thin and stretchy so that sperm can swim readily through it) and progesterone (more viscid and creamy coloured, making it

Box 1.3 Relations of the ovary

The ovary lies free in the peritoneal cavity

Anterior	The broad ligament
Posterior	The peritoneum of the posterior wall of the pelvis
	The common iliac artery and vein
	The internal iliac (hypogastric) artery
	The ureter
Lateral	Peritoneum over the obturator internus muscle
	The obturator vessels and nerve
	Further out, the acetabulum and hip joint
Above	The fallopian tube, which curls over the ovary
	Loops of bowel
On left	The pelvic colon and its mesentery
On right	The appendix if it dips into the pelvis

more difficult for sperm and bacteria to enter the uterus).

Ligaments

The uterus is supported by ligaments (Fig. 1.3). The principal supports of the uterus are the transverse cervical ligaments (cardinal ligaments), the uterosacral ligaments and the round ligament. The round ligament rises from the fundus of the uterus anterior to the fallopian tube and passes into the inguinal canal, ending in the labia majora. In pregnancy these ligaments are stretched and thickened. They soften because of the effect of progesterone and relaxin on collagen.

The broad ligament is made of two layers of peritoneum that run over the fallopian tubes anteriorly to the uterovesical reflection and posteriorly to the rectovaginal reflection.

Ovary (Box 1.3)

The ovaries have twin functions: steroid production and gametogenesis. They are a pair of organs on each side of the uterus, in close relation to the fallopian tubes. Each ovary is attached to the back of the broad ligament by a peritoneal fold, the mesovarium, which carries the blood supply, lymphatic drainage and nerve supply of the ovary. The

blood supply to the ovaries is principally from the ovarian arteries, which arise from the aorta just below the renal arteries. Medially the ovary is attached to the uterus by the infundibular/tubo-ovarian ligament.

The ovary is approximately 4 cm long, 3 cm wide and 2 cm thick and weighs about 10 g. A general view of the organs in the pelvis is shown in Fig. 1.1b.

Structure

The ovary has an outer cortex and inner medulla (Fig. 1.4) and consists of large numbers of primordial oocytes supported by a connective tissue stroma. It is covered by a single layer of cubical, germinal epithelium which is often missing in adult women. Beneath is the fibrous capsule of the ovary, the tunica albuginea, a protective layer derived from fibrous connective tissue.

The cortex of the ovary at menarche contains about 500 000 primordial oocytes which may become follicles—cysts about 0.1 mm in diameter. They have a single layer of granulosa cells that produce estradiol and specially differentiated theca cells that produce androgens.

The ovarian cycle is mediated through the hypothalamic pituitary axis (see p. 9). During each menstrual cycle many primordial follicles are

recruited, but usually only one develops fully to become a mature graafian follicle and expels its oocyte. The granulosa cells multiply and secrete follicular fluid rich in oestrogen. The oocyte with its granulosa layer projects into the follicle (Fig. 1.4). The stroma cells outside the granulosa cell layer differentiate into:

- the theca interna (a weak androgen secretor)
- the theca externa (no hormone-secreting function).

Shortly before ovulation, meiosis is completed in the primary oocyte in response to the surge of luteinizing hormone (LH). The oocyte casts off the first polar body, resulting in the number of chromosomes in the remaining nucleus being reduced from 46 to 23. Thus the primary oocyte and the first polar body each contain the haploid number (23) of the chromosomes.

At this stage, the ripe follicle is about 20 mm in diameter. At ovulation it ruptures, releasing the oocyte usually into the fimbriated end of the fallopian tube.

The follicle in the ovary collapses, the granulosa cells become luteal cells whereas the theca interna forms the theca lutein cells. A corpus luteum develops and projects from the surface of the ovary. It can be recognized by the naked eye by its crinkled outline and yellow appearance. Its cells secrete oestrogen and progesterone. If the ovum is not

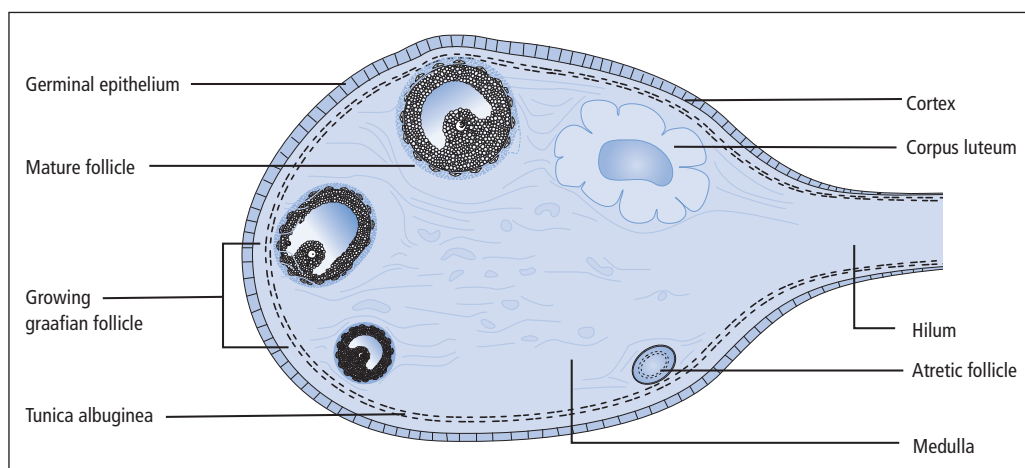


Figure 1.4 Maturation of the oocytes to follicles.

fertilized, the corpus luteum degenerates in about 10 days. A small amount of bleeding occurs into its cavity, the cells undergo hyaline degeneration and a corpus albicans is formed. If pregnancy does occur, the corpus luteum grows and may reach 3–5 cm in diameter. It persists for 80–120 days and then gradually degenerates.

The fallopian tube (Box 1.4)

The fallopian tube is the oviduct conveying sperm from the uterus to the point of fertilization and ova from the ovary to the uterine cavity. Fertilization usually takes place in the distal part of the tube. Plates 1 and 2 show the anatomy of the pelvis and the relationship between the ovary and tube visualized at laparoscopy.

Box 1.4 Relations of the fallopian tubes

Anterior	Top of the bladder Uterovesical peritoneal pouch
Superior	Coils of intestine On the right, caecum On the left, pelvic colon
Posterior	Ovary Pouch of Douglas and its contents
Lateral	Peritoneum over the obturator muscle Obturator vessels and nerve
Inferior	Structures in the broad ligament

The tube has four parts:

- 1 The intramural (cornual) part is 2 cm long and 1 mm in diameter.
- 2 The isthmus is thick walled, 3 cm long and 0.7 mm in diameter.
- 3 The ampulla is wide and thin walled, being about 5 cm long and 20 mm in diameter (Fig. 1.5).
- 4 The infundibulum is the lateral end of the tube. It is trumpet shaped and crowned with the fimbriae that surround the outer opening of the tube. The fimbriae stabilize the abdominal ostium over the ripening follicle in the ovary.

Structure

The tube has three coats:

- 1 An outer *serous* layer of peritoneum that covers the tube except in its intramural part and over a small area of its attachment to the broad ligament
- 2 A *muscle* layer with outer longitudinal and inner circular smooth muscles
- 3 The *mucosa* or endosalpinx that lines the tube and is thrown into numerous longitudinal folds or rugae. The rugae have a core of connective tissue covered with a tall columnar epithelium.

Three types of cell are found in the mucosa:

- 1 *Ciliated cells*, which beat a current usually in a medial direction

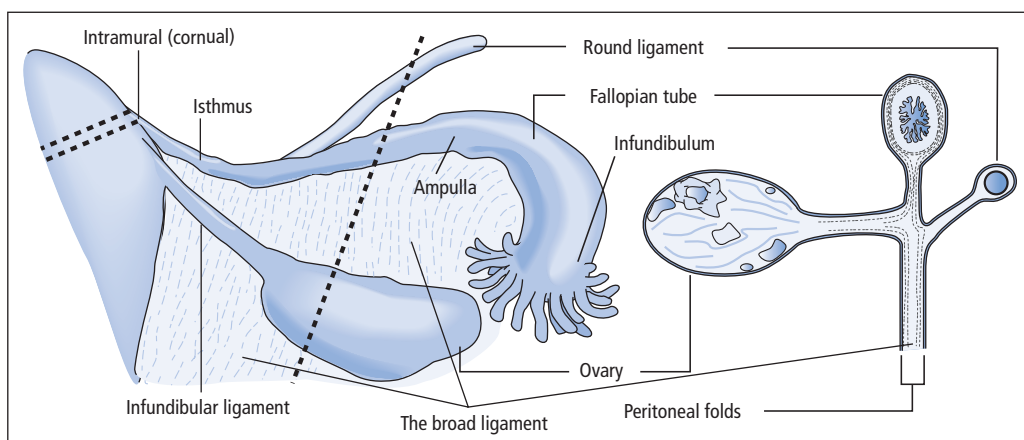


Figure 1.5 Peritoneal folds to two layers of peritoneum.

2 *Secretory cells*, which provide the secretion for the rapidly developing blastocyst, allowing exchange of oxygen, nutrients and metabolites

3 *Interciliary cells* with long narrow nuclei, squeezed between the other cells. There are rhythmic changes in the epithelium during the menstrual cycle; in the proliferative phase the cells increase in height and activity with increased secretions just after ovulation.

Vagina (Box 1.5)

The vagina is a fibromuscular canal extending from the vestibule of the vulva to the cervix, around which it is attached to form the fornices.

Structure

The anterior vaginal wall is about 10 cm long and the posterior wall 15 cm. It is capable of great distension, as in childbirth, after the prolonged hormonal stimulation of pregnancy. Normally, the anterior and posterior walls are in contact so the cavity is represented by an H-shaped slit.

The walls have the following:

- An outer connective tissue layer to which the ligaments are attached—it contains blood vessels, lymphatics and nerves
- A muscular layer consisting of an outer longitudinal layer and an inner circular layer of variable thickness and function
- The epithelium of stratified squamous epithelium, which in women contains glycogen and is composed of three layers:
 - a basal layer
 - a functional layer
 - a cornified layer.

The epithelium undergoes cyclical changes during the menstrual cycle and characteristic changes during pregnancy. After the menopause it atrophies so that smears taken from postmenopausal women contain a high proportion of basal cells. There are no glandular cells in the vaginal epithelium and so the term ‘vaginal mucosa’ should not be used.

Vaginal fluid is composed of cervical secretion and transudation through the vaginal epithelium. The vagina allows colonization of lactobacilli which produce lactic acid from the glycogen in the epithelial cells.

Box 1.5 Relations of the vagina

Anterior	The bladder and urethra
Posterior	Upper—the pouch of Douglas Lower—the rectum, separated by the recto-vaginal septum and perineal body
Lateral	The cardinal ligaments and the levator ani muscles

Vulva

The vulva or external genitalia of the female includes the mons, labia major, clitoris, labia minor, vestibule, external urethra meatus, Bartholin’s glands and hymen (Fig. 1.6).

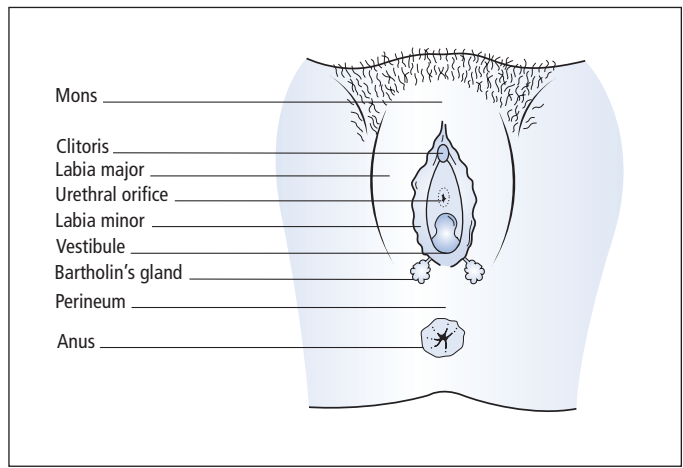


Figure 1.6 The vulva.

The *mons* is a pad of fat that lies over the pubic symphysis. It is covered with skin in which hair grows profusely from puberty to the menopause.

The *labia major* are two folds of skin that enclose the vaginal opening. They are made up of fatty tissue that is very sensitive to oestrogen stimulation; the skin of the labia major is covered with hair after puberty.

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

The *labia minor* are delicate folds of skin, containing fibrous tissue, numerous blood vessels and erectile tissue. The skin contains sebaceous glands, but no hair follicles, and epithelium that lines the vestibule and vagina.

The *vestibule* is the area between the labia minor into which opens the vagina, with the external meatus of the urethra in front and the ducts of Bartholin's glands behind.

The *external urethral meatus* is the opening of the urethra covered with squamous epithelium. Skene's ducts from the posterior urethral glands open on to the posterior margin of the meatus.

Bartholin's glands are a pair of glands, the ducts of which are lined by columnar epithelium. Each gland is the size of a pea and in structure the glands resemble salivary glands. The secretion is colourless and mucoid, and is produced mainly on sexual excitement.

The *hymen* is a circular or crescentic fold of squamous epithelium and connective tissue that partly closes the vaginal entrance in young women. Its shape and size vary. It is often ruptured or stretched by tampon insertion or intercourse; childbirth destroys it.

Perineum

The perineum is the area between the vaginal opening and the anus. The perineal body is a pyramidal mass of fibromuscular tissue into which the fibres of levator ani and the deep transverse perineal muscles are inserted. These are the muscles that are often torn or cut (episiotomy) during childbirth.

Bony pelvis

The false pelvis is to the true pelvis like a saucer on the top of a cup. The true pelvis is important in obstetrics; the false pelvis is not. Diameters of the true pelvis are shown in Fig. 1.7.

The longest axis of the pelvis changes through 90°, going from top to bottom. Hence the fetus passing through must rotate. There is a long curved posterior wall and a short anterior wall, so the fetus passing through takes a curved course (Fig. 1.8).

The three bones—two ilia and a sacrum—are held together at joints by ligaments (sacroiliac ligaments posteriorly and the symphysis anteriorly); these soften in pregnancy, allowing some laxity at these sites.

The coccyx is a fused group of the last vertebrae, hinged on the sacrum by a joint that easily allows bending back in childbirth.

Pelvic muscles

Lining lateral wall of pelvis

- Piriformis
- Obturator internus.

Making pelvic diaphragm

- Levatores ani comprising:
 - pubococcygeus
 - iliococcygeus
 - ischiococcygeus.

Beneath pelvic diaphragm

- Anterior triangle:
 - deep perineal: compressor urethrae; deep transverse perinei
 - superficial perineal: ischiocavernosus; bulbocavernosus; superficial transverse perinei.
- Posterior triangle: sphincter ani.

Essentials of pelvic musculature

- The piriformis muscles reduce the useful transverse diameter of upper and mid-cavities, thus thrusting the fetus forward.
- The pelvic diaphragm and its fascia are like a pair of cupped hands tilted slightly forward (Fig. 1.9).

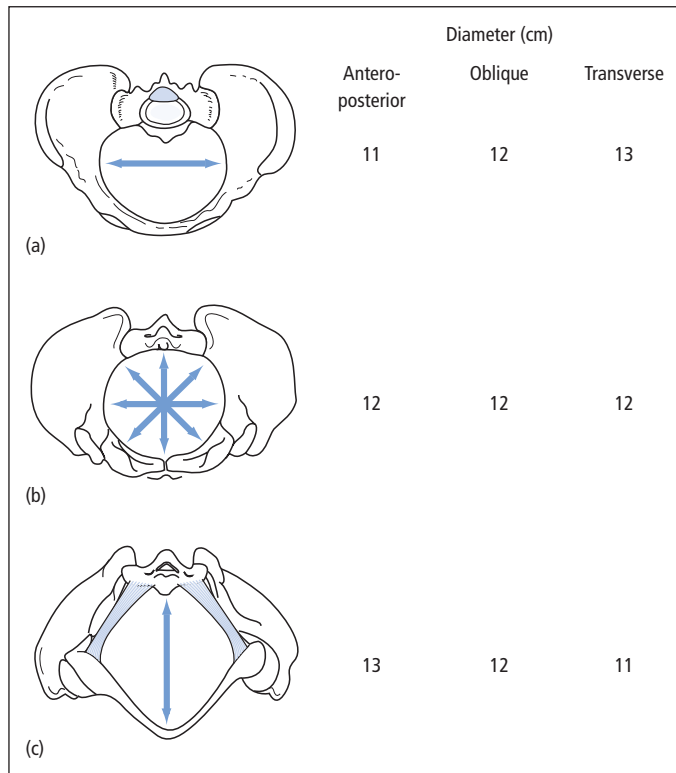


Figure 1.7 The bony pelvis: (a) inlet: longest diameter transverse, bean shaped; (b) midcavity: all diameters equal, circle; (c) outlet: longest diameter anteroposterior, diamond shaped.

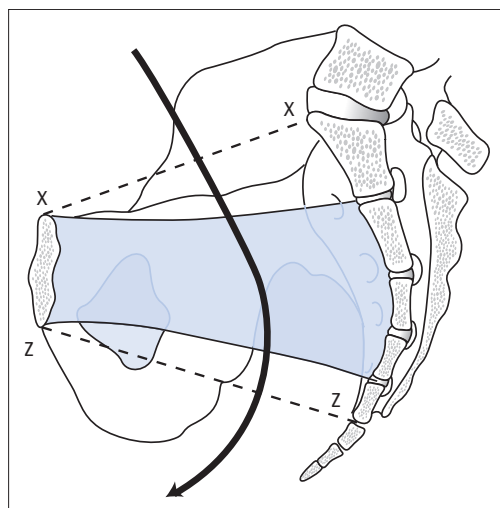


Figure 1.8 Side view of bony pelvis, showing the plane of the inlet (x-x), the zone of the midcavity (toned) and the plane of the outlet (z-z).

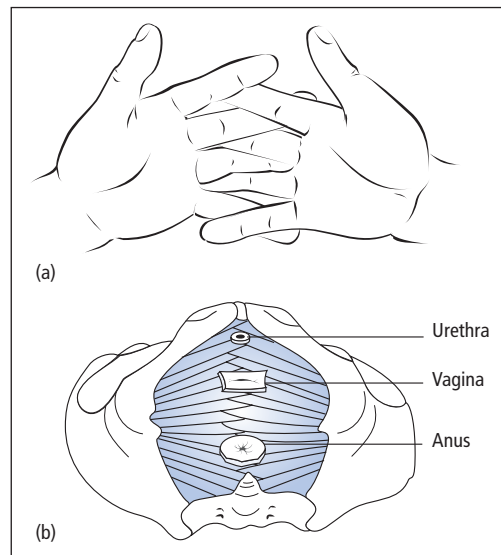


Figure 1.9 Interlocking hands (a) illustrate the lacing of the muscle fibres in the pelvic diaphragm (b).

Muscle fibres lace the one hand with the other, being especially thick around the three tubes which broach the diaphragm—the urethra, the vagina and the rectum. These muscle slings pull each of these forward making an extra sphincter.

Female physiology

The hypothalamic–pituitary–ovarian axis

The cyclical interaction of the hormones from the hypothalamus, anterior pituitary and the ovaries is shown in Fig. 1.10.

The ovarian cycle is determined by a complex series of biofeedback mechanisms that originate in the hypothalamus—a small area of the brain situated just above and anterior to the pituitary gland. The hypothalamus secretes a decapeptide called gonadotrophin-releasing hormone (GnRH) in a pulsatile fashion, which activates the production and secretion of follicle-stimulating hormone (FSH) and LH in the anterior pituitary. Its secretion is inhibited by high concentrations of oestrogen and progesterone.

Pituitary hormones

Follicle-stimulating hormone

FSH is a soluble glycoprotein. Production is activated by GnRH from the hypothalamus. FSH is produced in the anterior lobe of the pituitary gland and production is increased in the first half of the menstrual cycle, when oestrogen levels are low (positive feedback). This production is diminished by increasing oestrogen levels (negative feedback) (Fig. 1.11). FSH acts on the enzyme aromatase in the granulosa cells surrounding the oocyte, converting testosterone (produced by the theca cells) into 17β -estradiol (E_2). This starts and maintains the recruitment of oocytes and their maturation.

Luteinizing hormone

LH is a soluble glycoprotein activated in the pituitary by GnRH. It acts on the theca cells at the start

of the menstrual cycle to produce testosterone. As the follicle containing the oocyte grows under the influence of FSH, LH plays a role in choosing the dominant follicle and arresting the development of the other oocytes. As the oestrogen concentration rises, it reaches a level (800–1200 pmol/l) that causes LH to be released from the pituitary in a bolus at midcycle, initiating ovulation (rupture of the follicle and release of the oocyte) and completion of the first meiotic division. Ovulation takes place 36 hours after the LH surge. LH causes luteinization of the granulosa cells.

Ovary

There are seven million primordial oocytes in each ovary of the female fetus, which drops to two million at birth and is further reduced to half a million at puberty.

In each menstrual cycle over 400 primitive oocytes migrate to the surface of the ovaries under the influence of FSH. LH and FSH act in concert to select a single oocyte. When one follicle reaches approximately 20 mm in diameter, the oocyte is squeezed to the surface of the ovary (Fig. 1.12). The remaining follicles atrophy.

The process of ovulation is preceded by:

- the release of LH from the pituitary which initiates ovulation and completion of the first meiotic division
- a spurt of oestrogen from the tissues of the follicle.

The outward signs and changes associated with ovulation are:

- the cervical mucus becomes less viscid, becoming watery and increasing in amount
- in some women peritoneal pain is caused by irritation of released blood from the follicle (*mittelschmerz*)
- the body temperature may increase by about 0.6°C .

At ovulation the break in the follicle reseals and fluid builds up again to form a corpus luteal cyst. The large surge in LH causes a metabolic change in the granulosa cells so that they start to produce progesterone as well as oestrogen. This has a profound effect on the endometrium, which readies

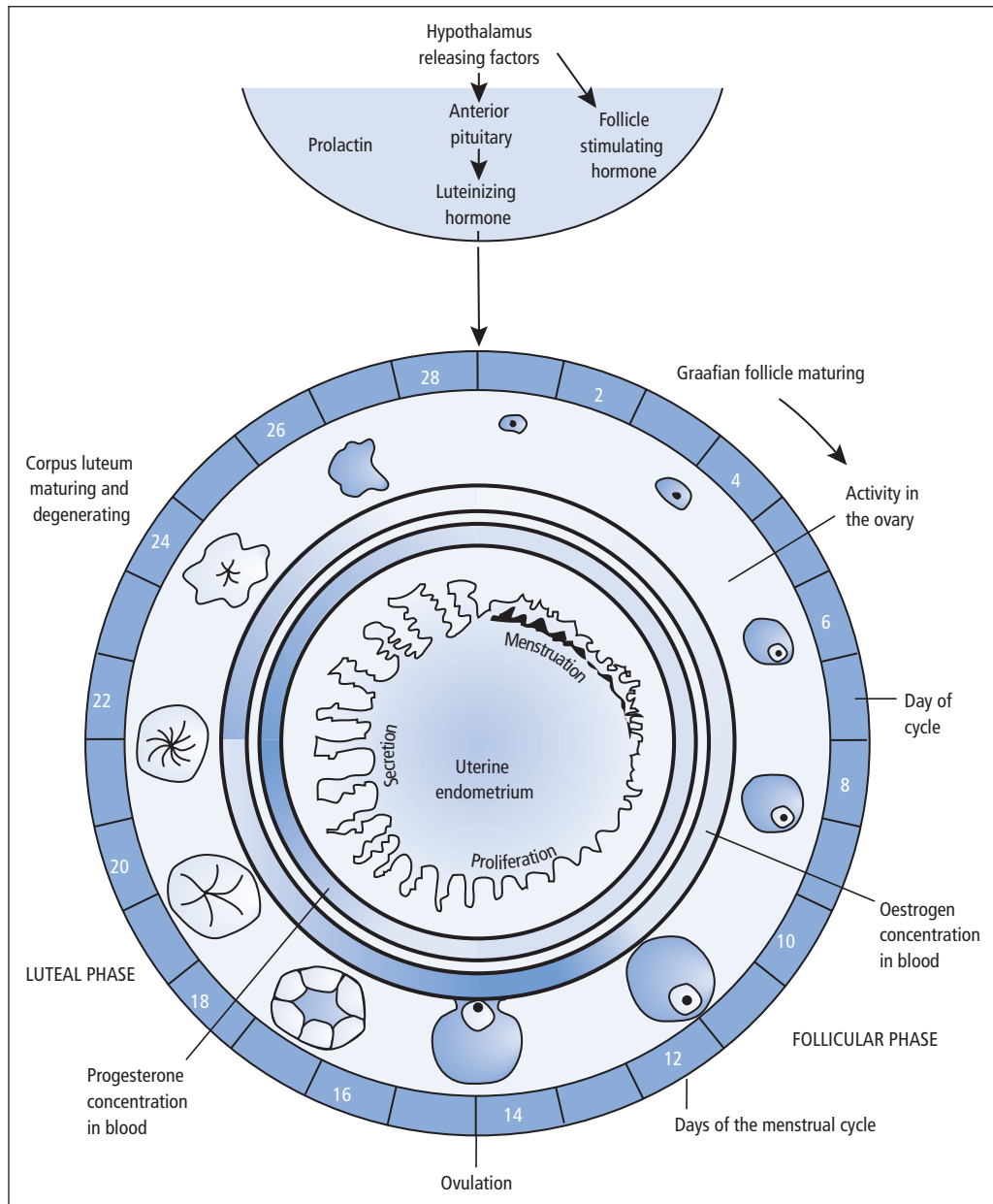


Figure 1.10 Composite diagram of the menstrual cycle and histology of the endometrium.

itself to accept an embryo 7–8 days after ovulation.

The oocytes that are unselected degenerate at a steady rate. At menopause there are no more follicles available for ovulation and so there is diminution of oestrogen production.

Fertilization

The fimbriated end of the fallopian tube, possibly excited by chemotaxis, closes to embrace the ovary like a hand holding a rugby football. The egg has virtually no transperitoneal passage.

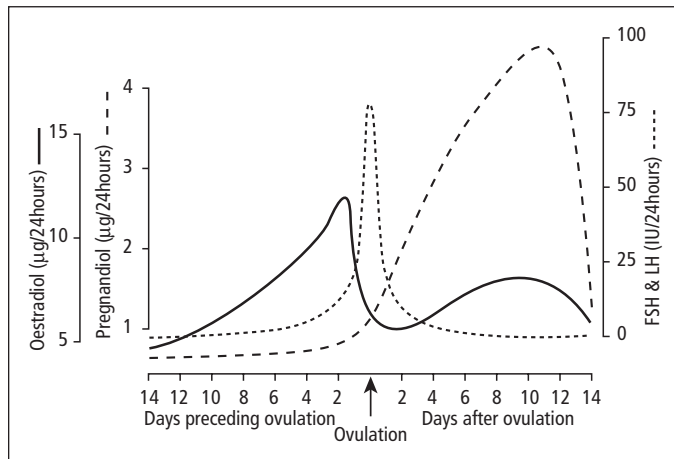


Figure 1.11 Hormone levels before and after ovulation.

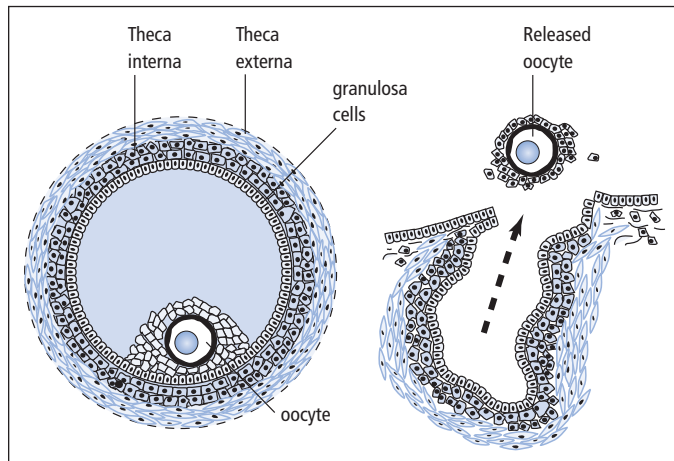


Figure 1.12 The follicle just before and just after the oocyte is released.

At the time of intercourse millions of sperms are deposited in the vagina. They travel in all directions, some through the cervix, where, in midcycle, the molecules of cervical mucus untangle their barbed-wire-like morphology to assume straight lines. A few sperm reach each fallopian tube where they swim countercurrent, the first arriving near the oocyte within 30 minutes of intercourse. One sperm only penetrates the zona pellucida by hyaluronidase activity; the tail is shed, the sperm's neck becomes the centrosome and the head is the male pronucleus containing half the genetic potential of the future fetus (Fig. 1.13).

Sperm penetration into the ovum initiates the second meiotic division of the ovum, with a reduction in chromosomes from 46 to 23 and the extru-

sion of a second polar body. The haploid nuclei of the oocyte and the sperm combine, restoring the diploid state of 46 chromosomes and fertilization is achieved.

Fertilization usually occurs at the ampullary end of the fallopian tube within 12–24 hours of oocyte production. The fertilized egg then travels along the tube propelled by:

- muscular peristalsis of the tube
- currents in the tube whipped by cilia.

During this period, nutrition and oxygenation are from the fluid secreted by the glandular cells of the fallopian tube lining. Arriving in the uterus 4–5 days later, the egg is in the cavity for 2–3 days and implants in the thick endometrium in the secretory phase on about day 22 of the cycle. The blastocyst

starts to put out pseudopodia so that the surface area available for maternofetal exchange is increased. All transfer is by osmosis and diffusion at this stage.

Major ovarian hormones

Oestrogens

These are mostly produced by the maturing follicle. Levels gradually increase to a peak at the time of ovulation (Fig. 1.14).

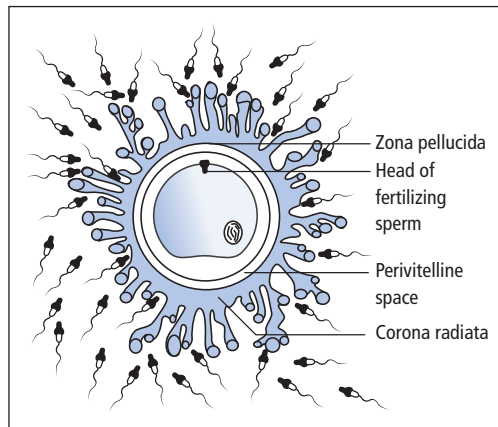


Figure 1.13 Several sperm surround the oocyte, but only one penetrates.

The recognized functions of oestrogens are to:

- stimulate growth of the vagina, uterus and oviducts in childhood
- increase the thickness of the vaginal wall and distal third of the urethra by increased stratification of the epithelium
- reduce vaginal pH by the action of Doderlein's bacillus on the glycogen to form lactic acid
- decrease viscosity of cervical mucus to facilitate sperm penetration
- facilitate the development of primordial follicles
- inhibit FSH secretion
- stimulate proliferation of the endometrium
- increase myometrial contractility
- stimulate growth of breasts with duct proliferation
- promote calcification of bone
- promote female fat distribution
- promote female hair distribution.

Oestrogen is metabolized by the liver and conjugated with glucuronic acid so that 65% is excreted in urine.

Progesterone

This hormone is produced by the corpus luteum in large amounts after ovulation and by the placenta in pregnancy. Its functions are to:

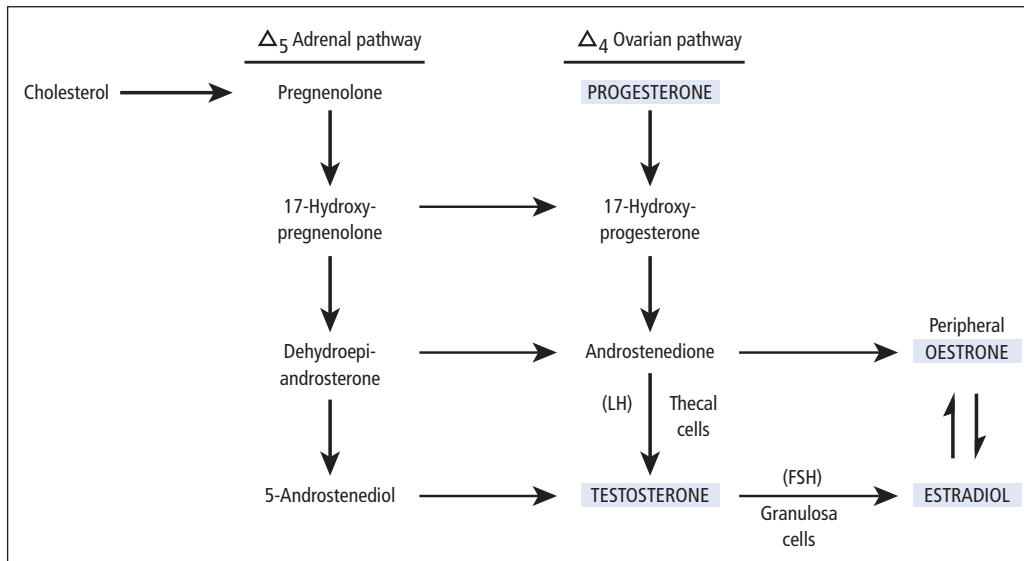


Figure 1.14 Pathways of oestrogen metabolism. Estradiol is a pregnancy oestrogen metabolized by the fetoplacental unit and does not appear here. FSH, follicle-stimulating hormone; LH, luteinizing hormone.

- induce endometrial secretory changes
- increase the growth of the myometrium in pregnancy
- decrease myometrial activity in pregnancy
- increase secretory activity in the uterine tubes
- decrease motility of the uterine tubes
- increase the glandular activity in the breasts.

Progesterones are metabolized in the liver; 80% becomes pregnanediol.

The endometrium during the menstrual cycle

The endometrium is the end organ of these changes responding to the changes in oestrogen and progesterone. Any disruption that occurs in the process of ovulation will cause a change in the pattern of bleeding experienced by the woman, which may lead to her seeking medical help.

- The production of oestrogen and later oestrogen and progesterone by the ovaries results in changes in the endometrium.
- The *endometrium* is the mucous membrane of the uterus, consisting of tubular glands with supporting stroma. There are numerous blood vessels that arise from the spiral arterioles, the terminal branches of the uterine arteries.
- The endometrium rests on the *uterine musculature*; its basal areas are so closely applied that they cannot be removed with a curette but can be reached at endometrial ablation.
- The *basal layer* comprises tubular glands that regenerate after menstruation.
- The *superficial compact layer* is covered with ciliated columnar epithelial cells, which extend down into the endometrial glands.

Changes in the menstrual cycle

At the end of menstruation, the endometrium enters a short resting phase, when it is thin, its glands are straight and the stroma compact and non-vascular. As oestrogen levels rise, the endometrium enters a proliferative phase with the endometrial glands becoming more tortuous, although the arterioles remain relatively straight; the stroma becomes cellular.

After ovulation, the corpus luteum is formed under the influence of LH; it secretes oestrogen and progesterone. In the luteal phase, the endometrium becomes secretory; it is thick, pale and glycogen appears in the glands, which in turn become full of secretions. The glands become more tortuous and the arterioles become more tightly coiled like springs.

If the ovum is fertilized

The endometrium grows to become the decidua of pregnancy. Stroma cells swell. Implantation occurs on the decidua, which provides nutrition for the rapidly developing blastocyst.

In the absence of fertilization

About 12–14 days after ovulation, there is an intense spasm of the endometrial arterioles leading to tissue hypoxia and death in the superficial layers. Fissuring of the endometrium follows with cleavage of the endometrium from its spongy layer. It is shed in small areas with accompanying bleeding—the menstrual loss. After this, regeneration occurs from the remaining basal layer and the cycle recommences.

The fallopian tubes

Their functions are to:

- convey a spermatozoon from the endometrial cavity to the ovum in the outer third of the fallopian tube
- transmit the fertilized oocyte into the endometrial cavity
- provide nutrients to the developing embryo on its 5-day passage.

Oestrogen increases the peristalsis of the tubes; at the time of ovulation there is a reversal of peristalsis to help the sperm travel more easily up the crypts between the folds of the mucus.

The oocyte is squeezed out of the follicle and sticks to the surface of the ovarian fimbria of the tube. The fimbria embraces the ovary and the oocyte moves directly into the fallopian tube with no transperitoneal journey. Fertilization is by a single sperm penetrating the zona pellucida.

Chapter 1 Basic science

Peristalsis of the muscle of the tube and the action of fine cilia move oviduct fluid and the passive ovum from the peritoneal end of the fallopian tube into the endometrial cavity, taking about 5 days.

During this passage, the fertilized ovum receives nutrition from secretions of the mucosa of the tube. Here gas exchange between the rapidly growing blastocyst and fallopian tube fluid also takes place. These tubal secretions are under the influence of oestrogen priming and increase greatly with progesterone. Mucopolysaccharide concentration and the calcium ions within the tubes also increase.

The vulva and vagina

The vagina is a tube lined by stratified squamous epithelium, which contains no mucous glands so there are no vaginal secretions. Any lubrication is a combination of secretions from the cervical canal mixed with secretions from vulval glands and a transudate from the vagina.

The labia minor are normally in apposition as are the fatter labia major in normal standing, sitting and lying down positions, only parted when the legs abduct.

Sexual activity

On sexual stimulation, there is a vascular engorgement of the labia major and minor and the clitoris. The sweat glands of the labia minor increase their secretions and at the same time mucus is secreted from Bartholin's glands and the endocervical glandular epithelium.

Abduction of the thighs opens the labia major and the voluntary musculature of the vagina and vulva helps to dilate the upper vagina while gripping the penis in the lower vagina.

The sexual response in women is usually slower than in men, but a plateau of response is more prolonged and it does not disappear so rapidly after orgasm as is often the case in men.