# The Anatomy and Physiology of the Female Reproductive System

CHAPTER 1

## INTRODUCTION

An in-depth understanding of the female reproductive system is fundamental for all those involved in the assessment, diagnosis and care of those individuals assigned female at birth. This chapter provides a comprehensive overview of the anatomical structures and physiological functions that underpin female reproductive health, with a focus on clinical relevance.

The female reproductive system is a complex and highly regulated system responsible not only for reproduction but also for a wide range of physiological processes, including hormonal regulation, secondary sex characteristic development and cyclical changes associated with menstruation and fertility. It comprises both internal and external organs, each with distinct structural features and functions. Internally, the system includes the vagina, cervix, uterus, Fallopian tubes and ovaries, while the external genitalia, collectively referred to as the vulva, provide protective and sensory roles. The breasts are anatomically separate from the genitalia; they are modified sweat glands located on the chest, primarily involved in lactation and secondary sexual characteristics.

Physiologically, the female reproductive system is governed by intricate hormonal feedback mechanisms primarily involving the hypothalamic–pituitary–ovarian (HPO) axis (see Box 1.1). Key reproductive hormones such as oestrogen, progesterone, luteinising hormone (LH) and follicle-stimulating hormone (FSH) orchestrate events such as the menstrual cycle, ovulation and preparation of the endometrium for potential implantation. These hormonal dynamics vary throughout the lifespan, influencing puberty, reproductive years, pregnancy, perimenopause and menopause.

### BOX 1.1 THE HYPOTHALAMIC–PITUITARY–OVARIAN AXIS

Understanding how the female reproductive system is controlled is key to making sense of everything from menstrual cycles to fertility and hormonal disorders. At the heart of this is a sophisticated regulatory communication network known as the HPO axis, a hormonal relay system between the brain and the ovaries.

(*Continued*)

**BOX 1.1 (*CONTINUED*)**

1. The hypothalamus: This region of the brain functions as the central regulator of the body's hormonal activity. The hypothalamus releases a hormone called GnRH (gonadotropin-releasing hormone) in pulses. These pulses are like little messages that tell the next structure in the chain what to do.
2. The pituitary gland: Responds to GnRH, the pituitary (a pea-sized gland located at the base of the brain) releases two key hormones into the bloodstream:
   - FSH
   - LH

These hormones are transported via the bloodstream to the ovaries, where they regulate ovarian function.

3. The ovaries: Under the influence of FSH and LH, the ovaries begin to mature eggs and produce oestrogen and progesterone. These sex hormones not only help with regulating the menstrual cycle but also feed back to the brain, adjusting the release of GnRH, FSH and LH in a delicate balance. This is known as a feedback loop; when hormone levels are too high or low, the brain adjusts its signals to maintain balance.

### Implications for practice

This hormonal cycle is essential for menstruation, ovulation and fertility. If anything goes wrong along the HPO axis, for example, due to stress, illness, weight changes, medications or endocrine disorders, this can disrupt the entire system. The person may present with irregular periods, infertility, early or delayed puberty or symptoms of menopause.

Understanding the HPO axis can also help with the interpretation of blood hormone levels, understand how contraception works and support patients with menstrual or reproductive health concerns.

The HPO axis is a highly integrated regulatory system and plays a central role in women's health.

Understanding the normal anatomy and physiology of the female reproductive system enables those who offer care and support to people to distinguish between physiological variation and pathology, communicate effectively with patients and deliver evidence-based care. It also underpins safe clinical practice in areas such as gynaecological examination, contraception counselling, fertility assessment, menopause management and sexual health.

Human reproduction is a complex process involving a series of coordinated anatomical and physiological events. The reproductive system is primarily designed to support procreation, but its role extends beyond this function. Psychological and social factors also play a significant part in reproduction, as does the capacity for physical pleasure associated with the reproductive organs. Illness affecting the reproductive system can lead to serious consequences, including loss of life, acute and chronic health conditions and both physical and emotional suffering.

This chapter is structured to provide a clear and systematic overview, beginning with anatomical descriptions and followed by physiological processes. It aims to build both foundational knowledge and applied clinical insight, while reinforcing the importance of culturally sensitive and person-centred care in the context of reproductive health.

## THE FEMALE REPRODUCTIVE SYSTEM

The female reproductive system is structured to perform several key functions: the production of ova (eggs); the reception of the penis and ejaculated sperm during sexual intercourse; the support, containment and nourishment of a developing fetus during pregnancy; and the production of breast milk to feed the newborn after birth. In addition to these roles, the system is also involved in the experience of sexual pleasure, which is influenced by both anatomical structures and neurological responses.

From puberty to menopause, the female body typically undergoes a monthly cycle in preparation for pregnancy. If fertilisation does not occur, menstruation takes place and the cycle begins again.

The main components of the female reproductive system include the ovaries, Fallopian tubes (oviducts), uterus, vagina and the external genitalia, collectively referred to as the vulva.

The breasts are also considered part of the reproductive anatomy due to their role in lactation. Although the urethra and urinary meatus are not reproductive structures in females, they are anatomically close to the reproductive organs. As a result, health conditions in one area may affect the other. Figure 1.1 illustrates the anatomical location of the female reproductive organs.

## THE OVARIES

The ovaries are the female gonads, paired, almond-shaped glands situated on either side of the uterus. They are held in place by several ligaments: the ovarian ligament connects each ovary to the uterus, while the suspensory ligament attaches them to the pelvic wall. The ovaries serve as both the site of storage for female germ cells (ova) and as endocrine glands that produce the

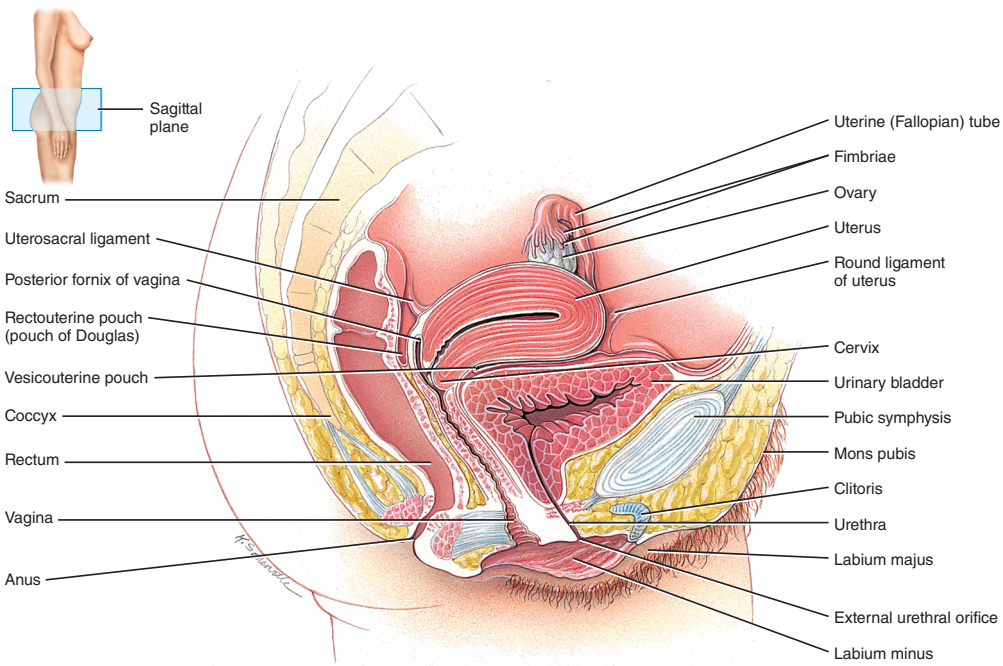


**FIGURE 1.1** The female reproductive system. *Source*: Tortora and Derrickson (2009). With permission of John Wiley & Sons.

hormones oestrogen and progesterone. A woman is born with her lifetime supply of ova and, from puberty until menopause, typically releases one mature ovum each month during ovulation.

Within each ovary are numerous small structures known as ovarian follicles. Each follicle contains an immature egg cell or oocyte. During each menstrual cycle, follicular development is stimulated by the hormones FSH and LH, which lead to the maturation of one dominant follicle and the release of a mature ovum at ovulation.

Follicles are confined to the ovarian cortex, the outer layer of the ovary, where they are embedded in dense, irregular connective tissue. In contrast, the ovarian medulla, the inner region of the ovary, contains blood vessels, nerves and lymphatic structures within a looser connective tissue matrix. The boundary between the cortex and medulla is not distinctly defined.

## OOGENESIS AND FOLLICULAR DEVELOPMENT

Oogenesis is the process by which ova are formed within the ovaries (see Figure 1.2). This process begins during fetal development, when diploid (2*n*) stem cells known as oogonia (Tortora and Derrickson 2023) multiply and enlarge to form primary oocytes. These primary oocytes enter the first stage of meiosis before birth but do not complete it. Consequently, females are born with a finite supply of immature gametes, in contrast to males, who continuously produce sperm throughout adulthood.

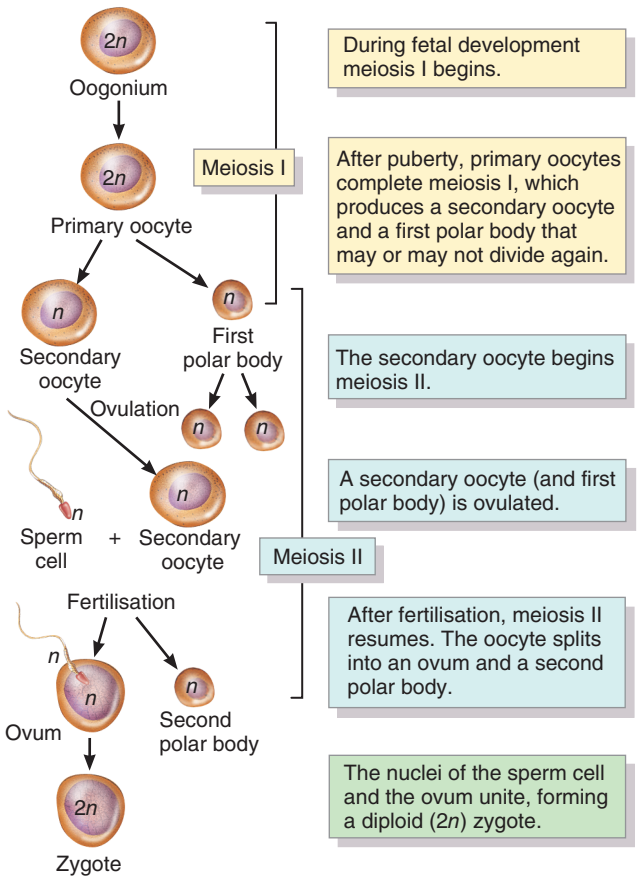


**FIGURE 1.2** Oogenesis. *Source*: Tortora and Derrickson (2009). With permission of John Wiley & Sons.

The primary oocytes remain arrested in the first meiotic division until puberty. At this point, hormonal changes create the necessary conditions for further development of both the follicle and the oocyte it contains. Each primary oocyte is surrounded by a single layer of flattened follicular cells, forming a primordial follicle (see Figure 1.3).

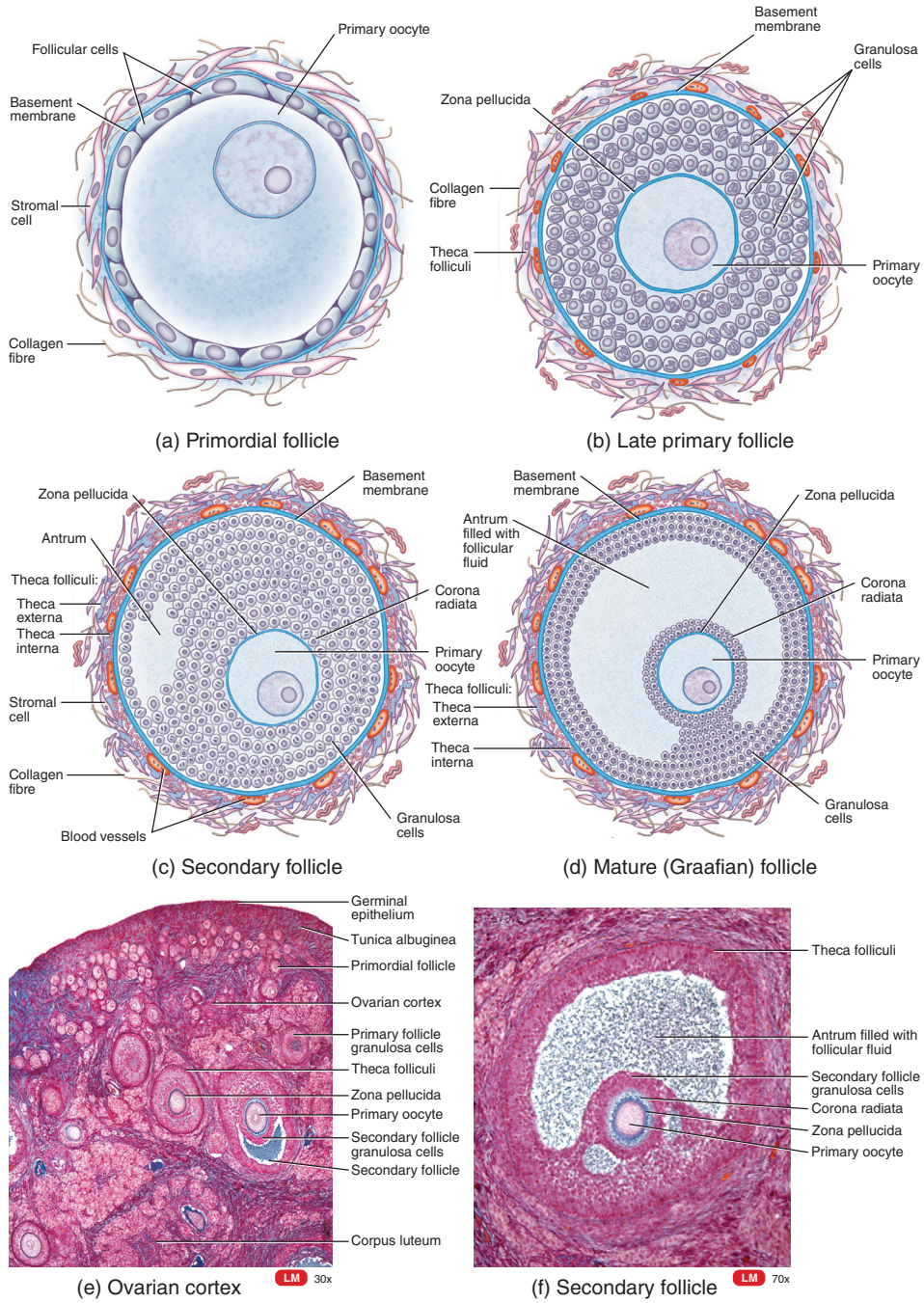


**FIGURE 1.3** The developmental sequences associated with maturation of an ovum. *Source*: Tortora and Derrickson (2009). With permission of John Wiley & Sons.

From puberty until menopause, the anterior pituitary gland releases FSH and LH in a cyclical pattern. These hormones stimulate a cohort of primordial follicles to begin developing each month. As follicles mature, they transition into secondary follicles, characterised by an increased number of follicular cells and the formation of a fluid-filled cavity known as the antrum (Figure 1.3). At this advanced stage, the follicle is referred to as a Graafian follicle.

Just prior to ovulation, the primary oocyte within the Graafian follicle completes the first meiotic division, producing a haploid secondary oocyte and a smaller cell called a polar body, which contains minimal cytoplasm. The polar body functions to discard excess nuclear material not required by the developing ovum. The secondary oocyte then enters the second meiotic division but becomes arrested again. This division will only be completed if fertilisation occurs.

In addition to preparing the oocyte for ovulation, the Graafian follicle also secretes oestrogen, which stimulates the thickening of the endometrium in preparation for potential implantation. Typically, only one of the Graafian follicles reaches full maturity and releases its oocyte each month in a process that is known as ovulation.

## CORPUS LUTEUM

Following ovulation, the remnants of the ruptured Graafian follicle transform into a temporary endocrine structure known as the corpus luteum. This structure plays a crucial role in the second half of the menstrual cycle by secreting the hormones oestrogen and progesterone, which act to maintain and support the endometrium in preparation for possible implantation of a fertilised ovum.

If fertilisation does not occur, the corpus luteum gradually degenerates. As it breaks down, it ceases hormone production and is eventually replaced by fibrous scar tissue on the surface of the ovary, known as the corpus albicans. This process marks the end of one menstrual cycle and the beginning of another.

## ROLE OF FEMALE SEX HORMONES

The ovaries secrete three key hormones in a cyclical and coordinated pattern:

1. Oestrogens
2. Progesterone
3. Androgens

Although oestrogen is present throughout the entire menstrual cycle, its levels peak just before ovulation.

## OESTROGENS

Oestrogens play a central role in the regulation and maintenance of the female reproductive system. They are essential for the development of secondary sexual characteristics during puberty, such as breast development, the distribution of body fat and the growth of pubic and axillary hair. In the adult female, oestrogens help prepare the reproductive tract for pregnancy by promoting the thickening of the endometrium and increasing cervical mucus receptivity to sperm (Stromberg 2026).

Beyond their reproductive functions, oestrogens also have important systemic effects. They contribute to the maintenance of skin elasticity, vascular tone and bone density by

reducing the rate of bone resorption. Additionally, oestrogens influence lipid metabolism by increasing levels of high-density lipoprotein (HDL) cholesterol and reducing low-density lipoprotein (LDL) cholesterol, which supports cardiovascular health. They also promote blood clotting by enhancing the production of certain clotting factors.

## PROGESTERONE

This hormone, predominantly secreted by the corpus luteum after ovulation, works in concert with oestrogen to further prepare the endometrium for implantation. It also plays a role in reducing uterine contractility to support early pregnancy and influences breast tissue development in preparation for lactation.

## ANDROGENS

Although produced in smaller amounts, androgens (such as testosterone) also contribute to libido, support the growth of pubic and axillary hair, and are precursors for oestrogen synthesis.

Table 1.1 summarises the key roles of the three primary female sex hormones, highlighting both their reproductive and systemic functions.

**Table 1.1** The three primary female sex hormones

| Hormone | Primary source | Main reproductive functions | Additional systemic effects |
|---|---|---|---|
| Oestrogens | Ovarian follicles (pre-ovulation); corpus luteum (post-ovulation) | • Development of secondary sexual characteristics<br>• Thickening of endometrium<br>• Regulation of menstrual cycle<br>• Increased cervical mucus receptivity | • Maintains skin elasticity and vascular tone<br>• Reduces bone resorption<br>• Increases HDL, lowers LDL<br>• Promotes blood clotting |
| Progesterone | Corpus luteum (post-ovulation) | • Prepares endometrium for implantation<br>• Reduces uterine contractility<br>• Supports early pregnancy<br>• Prepares breast tissue for lactation | • Mild thermogenic effect (raises basal body temperature)<br>• Mood-regulating effects in some individuals |
| Androgens | Ovaries (small amounts); adrenal glands | • Contribute to libido<br>• Promote pubic and axillary hair growth<br>• Precursors for oestrogen synthesis | • Influence muscle mass and bone strength<br>• May affect mood and energy levels |

*Source*: Adapted from Endocrine Society (2022).

## THE INTERNAL ORGANS

The internal organs of the female reproductive system include the vagina, cervix, uterus, oviducts (also known as Fallopian tubes or uterine tubes) and the ovaries. The ovaries, which have been discussed previously, serve as the primary reproductive organs in females. They are responsible not only for the production and release of ova (eggs) but also for secreting essential female sex hormones, including oestrogen and progesterone.

The remaining structures – the vagina, uterus and Fallopian tubes – function as accessory reproductive organs. These organs play crucial roles in supporting the processes of fertilisation, embryonic development and childbirth. The Fallopian tubes provide the site for fertilisation and serve as the passageway for the ovum to reach the uterus. The uterus supports the implantation and development of the embryo into a fetus, while the vagina serves as the canal for sperm entry, menstrual flow exit and the passage of the baby during delivery.

## THE UTERUS

The uterus is commonly referred to as the womb. It is a hollow, muscular organ that is located within the pelvic cavity. It lies posterior and superior to the urinary bladder and anterior to the rectum, nestled centrally within the female pelvis (see Figure 1.4 for an anatomical overview of the uterus and associated structures). In the non-pregnant state, the uterus measures approximately 7.5 cm in length, though its size and shape can vary depending on factors such as age, parity (this is the number of times a woman has given birth to a fetus that reached a viable gestational age, regardless of whether the baby was born alive or stillborn) and hormonal status.

The uterus is anatomically divided into three main regions:

1. The fundus, which is the broad, curved upper portion, is situated above the openings of the Fallopian tubes. This muscular area plays a key role during pregnancy and labour.
2. The body (corpus), the central and largest section of the uterus, extends from the fundus to the isthmus, a narrowed region that connects the body to the cervix.

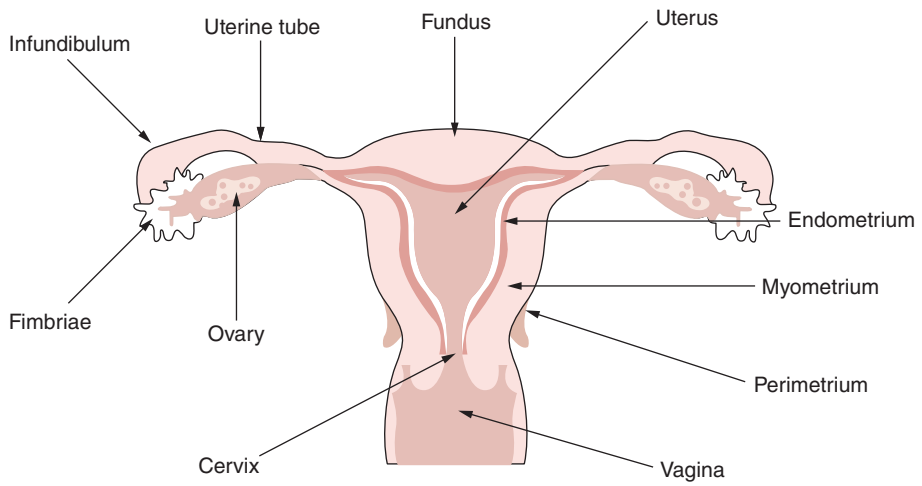


**FIGURE 1.4** The uterus and associated structures. *Source*: Nair and Peate (2009). With permission of John Wiley & Sons.

3. The cervix, the lower, narrow part of the uterus, projects into the vagina and forms the opening of the uterine canal. It serves as a protective barrier and facilitates the passage of sperm, menstrual fluid and during childbirth, the baby.

In addition to its structural regions, the uterus is composed of three distinct tissue layers, each with a specific function:

1. Perimetrium: The outermost serous layer, which is continuous with the peritoneum. It provides a protective covering for the external surface of the uterus.
2. Myometrium: The thick, middle muscular layer, which constitutes the bulk of the uterine wall. This layer is composed of smooth muscle fibres arranged in multiple directions, enabling powerful, coordinated contractions during menstruation and labour and allowing the uterus to expand significantly during pregnancy.
3. Endometrium: The innermost mucosal layer, which lines the uterine cavity. This layer undergoes cyclical changes in response to hormonal fluctuations and is shed during menstruation if implantation does not occur. The endometrium also plays a critical role in embryo implantation and the maintenance of early pregnancy.

These anatomical and histological features of the uterus enable it to fulfil its central roles in reproduction, gestation and childbirth. A detailed summary of the three uterine layers is provided in Table 1.2.

## THE FALLOPIAN TUBES

The Fallopian tubes (they are named after Gabriele Falloppio, a sixteenth-century Italian anatomist who first described them in detail), also referred to as oviducts, salpinges or uterine tubes, are a pair of slender, cylindrical structures measuring approximately 8–14 cm in length

**Table 1.2** Structural and functional characteristics of the uterine wall layers

| Layer | Location | Structure | Function | Clinical relevance |
|---|---|---|---|---|
| Perimetrium | Outermost layer | Thin serous membrane composed of simple squamous epithelium and underlying connective tissue; continuous with the peritoneum | • Protects the uterus<br>• Reduces friction between the uterus and surrounding organs | • May be involved in pelvic adhesions following pelvic surgery or infection |
| Myometrium | Middle muscular layer | Thick layer of smooth muscle fibres arranged in longitudinal, circular and oblique directions | • Facilitates uterine contractions during menstruation and labour<br>• Enables uterine expansion during pregnancy | • Site of uterine fibroids (leiomyomas)<br>• Target of medications that modulate contractions (e.g. oxytocin) |

(*Continued*)

**Table 1.2** (*Continued*)

| Layer | Location | Structure | Function | Clinical relevance |
|---|---|---|---|---|
| Endometrium | Innermost mucosal layer | Highly vascularised layer with two sub-layers:<br>• Stratum functionalis (superficial)<br>• Stratum basalis (deep, regenerative layer) | • Undergoes cyclical changes during the menstrual cycle<br>• Supports implantation and early pregnancy<br>• Sheds during menstruation | • Site of endometriosis, endometrial hyperplasia and endometrial carcinoma<br>• Commonly evaluated with biopsy or ultrasound |

(Marieb and Keller 2022). These delicate tubes serve as critical conduits in the female reproductive tract. Each Fallopian tube extends laterally from the superior aspect of the uterus and is anchored in place by the broad ligament, a peritoneal fold that helps stabilise the reproductive organs within the pelvic cavity.

At their lateral (distal) ends, the Fallopian tubes remain open to the peritoneal cavity and terminate in a fringe of finger-like projections that are known as fimbriae. These fimbriae drape closely over the adjacent ovary and play an essential role in capturing the ovum at the time of ovulation. Once released from the ovary, the ovum is guided into the tube by the sweeping motion of the fimbriae.

Structurally, the Fallopian tubes are composed of a wall of smooth muscle and are internally lined with ciliated, mucus-secreting columnar epithelial cells. The coordinated beating of the cilia, along with rhythmic contractions of the smooth muscle, facilitates the movement of the ovum through the tube towards the uterine cavity. Fertilisation, when it occurs, typically takes place in the ampulla, the widened portion of the tube near the ovary, making the Fallopian tube the usual site of conception. If fertilisation occurs outside the ampulla, especially in abnormal locations such as the isthmus or even outside the Fallopian tube (e.g. abdominal cavity), it may lead to an ectopic pregnancy, which is a medical emergency (Lewis 2024). See Box 1.2 for ectopic pregnancy.

## BOX 1.2 ECTOPIC PREGNANCY

An ectopic pregnancy occurs when a fertilised ovum implants outside the uterine cavity, most commonly within the Fallopian tube. While fertilisation typically takes place in the ampulla, the embryo is meant to travel to the uterus for implantation. If this journey is disrupted due to factors such as tubal damage, infections, previous ectopic pregnancies, endometriosis or smoking, the embryo may implant in the tube or, more rarely, the ovary, cervix or abdominal cavity.

Because these sites cannot support a growing pregnancy, the expanding embryo can cause the tube to rupture, leading to internal bleeding and potentially life-threatening shock.

Symptoms include unilateral abdominal pain, missed periods, vaginal bleeding, and in severe cases, shoulder pain or collapse. Diagnosis is made using ultrasound and blood tests. Treatment may involve surgical intervention or medical management with methotrexate to terminate the ectopic pregnancy and prevent complications.

In summary, ectopic pregnancy is a medical emergency and underscores the importance of normal embryo transport and correct implantation within the uterine cavity.

*Source*: Adapted from Ellenson and Roberts (2025) and Lewis (2024).

In clinical and anatomical contexts, the term adnexa is used collectively to refer to the Fallopian tubes, ovaries and their associated supporting connective tissues. The adnexa are frequently assessed in gynaecological examinations and imaging studies, particularly when evaluating pelvic pain, masses or reproductive pathology.

## THE VAGINA

The vagina is a flexible, tubular fibromuscular canal measuring approximately 8–10 cm in length (Tortora and Derrickson 2023). It plays multiple essential roles in the female reproductive system. Functionally, the vagina serves as the receptacle for the penis during sexual intercourse, acting as a key organ in sexual pleasure and response. It also functions as the outlet for menstrual flow, providing a passage for the shedding of the endometrial lining during menstruation. Moreover, the vagina forms the birth canal through which a baby passes during delivery.

Anatomically, the vagina is situated within the pelvic cavity, posterior to the urinary bladder and urethra and anterior to the rectum. Its uppermost section partially envelops the uterine cervix, creating a recessed space that is known as the fornix, which is divided into anterior, posterior and lateral fornices. These anatomical relationships are clinically important during gynaecological examinations and procedures.

The internal lining of the vaginal canal features mucosal folds that are called rugae. These are membranous ridges that enable the vagina to stretch considerably during intercourse and childbirth without injury. These rugae are lined by non-keratinised stratified squamous epithelium; vaginal lubrication is provided by transudation from the vaginal walls and cervical mucus rather than local mucus-secreting glands. This multilayered epithelial lining provides mechanical protection against abrasion, maintains lubrication and contributes to overall vaginal comfort.

Physiologically, the vagina maintains a characteristic moist environment with an acidic pH ranging from 3.8 to 4.2, which acts as a natural defence mechanism. This acidity is bacteriostatic, inhibiting the growth of many pathogenic microorganisms and thus protecting against infections. The maintenance of this low pH results from a complex interplay between hormonal regulation and the vaginal microbiota.

Specifically, the hormone oestrogen stimulates the proliferation and thickening of the vaginal mucosal cells, increasing their glycogen content. The glycogen stored in these epithelial cells is metabolised by lactobacilli, beneficial bacteria that dominate the healthy vaginal flora. Through fermentation, lactobacilli convert glycogen into lactic acid, which lowers the pH of vaginal secretions, sustaining the acidic environment necessary for microbial balance and infection prevention.

This intricate relationship between hormones, epithelial tissue and commensal microorganisms is fundamental for maintaining vaginal health. It supports reproductive functions by optimising the vaginal environment for sperm survival and transport during intercourse, while simultaneously providing a protective barrier against sexually transmitted infections and other pathogens.

The vagina is a highly adaptable organ whose anatomical structure and physiological processes work together to fulfil its multiple reproductive, protective and sexual functions.

## THE CERVIX

The cervix is the lower, cylindrical portion of the uterus that extends into the upper part of the vagina, forming a critical anatomical and functional gateway between the uterine cavity and the external genital tract (see Figure 1.5). Structurally, the cervix measures approximately 2.5–3 cm in length, although its size and consistency can vary with age, hormonal status, parity and pregnancy.

The cervix contains two anatomical openings: the internal os, which communicates with the uterine cavity, and the external os, which opens into the vaginal canal. The passage between these two openings is known as the endocervical canal, a narrow channel that serves multiple physiological functions. It allows for the outflow of menstrual blood, provides a route for sperm to enter the uterus during the fertile window and forms the birth passageway through which the fetus is delivered during labour.

Histologically, the cervix is composed of two distinct epithelial types. The endocervical canal is lined with simple columnar epithelium, which is specialised for mucus secretion. In contrast, the ectocervix, which is the part protruding into the vagina, is covered by non-keratinised stratified squamous epithelium, which is adapted to withstand friction and the acidic environment of the vaginal canal. The junction between these two epithelial types, known as the transformation zone, is of particular clinical significance, as it is the most common site for the development of cervical dysplasia and cervical cancer.

The cervical mucus, secreted by glandular cells of the endocervical canal, plays a pivotal role in fertility and protection. Under the influence of oestrogen during the ovulatory phase of the menstrual cycle, cervical mucus becomes thin, watery and alkaline, creating a favourable environment for sperm survival and motility. This facilitates the passage of sperm through the cervix into the uterus for potential fertilisation. In contrast, during the luteal phase

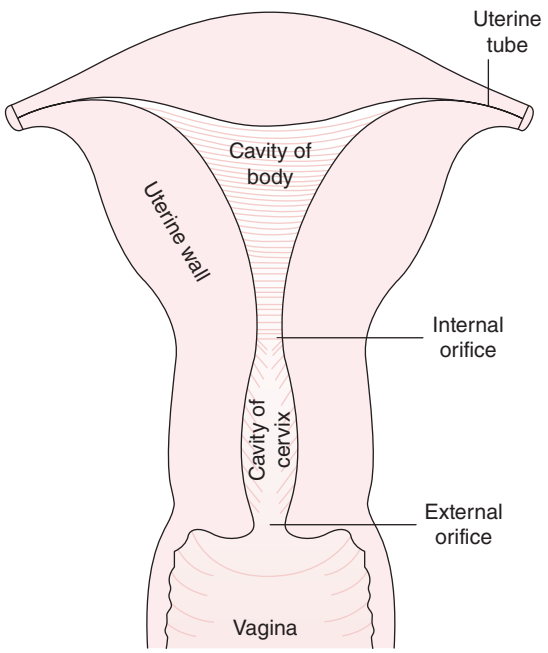


**FIGURE 1.5** The cervix. *Source*: Peate (2021). With permission of John Wiley & Sons.

(when progesterone predominates), cervical mucus becomes thick and viscous, which forms a barrier that inhibits sperm penetration and helps prevent the ascent of pathogens.

During pregnancy, cervical mucus increases in volume and forms a mucus plug (operculum) within the endocervical canal. This plug acts as a mechanical and immunological barrier, protecting the uterine environment from ascending infections. As labour approaches, hormonal changes lead to softening and effacement (thinning) of the cervix, followed by dilation of the cervical canal to allow for the passage of the fetus.

The cervix is also a site of significant immune activity. It hosts immune cells that interact with the microbial and hormonal environment to protect against infection while permitting sperm entry at the appropriate time. Inflammation, infection (e.g. human papillomavirus, HPV) or hormonal imbalances can disrupt cervical function and contribute to reproductive or oncological pathology.

To summarise, the cervix is a structurally complex and physiologically dynamic organ that not only connects the uterus and vagina but also plays essential roles in menstruation, fertility, pregnancy and childbirth. Its ability to adapt in response to hormonal cues and physiological demands underscores its central role in female reproductive health.

## THE EXTERNAL GENITALIA

The external female genitalia are collectively referred to as the vulva, a term encompassing several anatomically distinct but functionally interrelated structures. These include the mons pubis, labia majora, labia minora, clitoris, urethral and vaginal openings and associated glands (see Figure 1.6). Together, these structures play critical roles in protection, sexual arousal, sensory perception and the excretion of reproductive and urinary fluids.

The mons pubis is a rounded, fatty pad of adipose tissue situated anterior to the symphysis pubis. It is covered by skin and, following puberty, becomes densely populated with coarse pubic hair, which serves to trap pheromones and offer a modest degree of friction reduction during sexual activity. Functionally, the mons acts as a cushion that helps absorb physical impact to the underlying pubic bone during intercourse or trauma.

The labia, meaning 'lips', are paired folds of tissue that serve to enclose and protect the more delicate structures of the vulva. The labia majora are the larger, outermost folds. They extend from the mons pubis to the perineum and contain abundant fatty tissue, sweat glands and sebaceous (oil) glands. After puberty, they become pigmented and bear pubic hair.

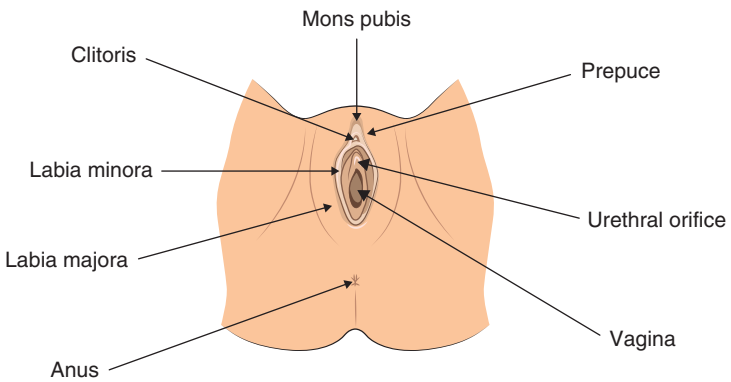


**FIGURE 1.6** The female external genitalia. *Source*: Peate (2021). With permission of John Wiley & Sons.

Their role is largely protective, shielding the inner vulval structures from mechanical irritation and microbial invasion.

Nestled within the labia majora are the labia minora. These are thinner, more delicate folds of skin that lack hair follicles but contain sebaceous glands, connective tissue and small amounts of erectile tissue. These folds surround the vestibule, the central area containing the vaginal and urethral openings. The labia minora vary greatly in size and pigmentation among individuals. During sexual arousal, they can become engorged with blood, enhancing their sensitivity and contributing to sexual response.

The clitoris is a highly specialised organ primarily involved in female sexual pleasure. It has a similar structure (homologous) to the penis in males and is composed of erectile tissue, primarily two corpora cavernosa, along with a dense network of sensory nerves and blood vessels. Only the glans clitoris, the external, visible portion, is exposed, situated at the anterior junction of the labia minora. This glans is partially covered by a fold of skin that is known as the clitoral hood (prepuce), which offers protection while maintaining sensitivity. The internal components of the clitoris extend deeper into the pelvic region and include crura and bulbs that surround the vaginal canal. Stimulation of the clitoris can trigger a cascade of neurovascular responses, contributing significantly to the female orgasm.

The vestibule, located between the labia minora, houses the urethral opening, vaginal orifice and the openings of the vestibular glands (e.g. Bartholin's glands). These glands secrete mucus that aids in lubrication during sexual activity, maintaining vaginal moisture and reducing friction. The urethral meatus is located just inferior to the clitoris and serves as the external opening of the urinary tract. The vaginal opening lies further posterior and may be partially covered by the hymen, a thin membranous structure that varies in form and presence among individuals.

Physiologically, the vulva is richly innervated and vascularised, making it highly sensitive to tactile, thermal and pain stimuli. It plays a central role in sexual arousal and orgasmic response, mediated by autonomic and somatic pathways. In addition to sensory and reproductive functions, the vulva provides a first line of defence against pathogens, aided by the acidic pH of the surrounding tissues, resident microbiota and glandular secretions.

## THE BREASTS

The breasts, also referred to as the mammary glands, are dome-shaped structures located on the anterior chest wall, typically extending between the third and seventh ribs. Their size and shape vary widely among individuals due to differences in genetic, hormonal and adipose tissue composition. Functionally, the breasts are specialised organs of the female reproductive system, primarily responsible for milk production (lactation) following childbirth.

Each breast is structurally supported by the underlying pectoralis major muscle and a network of fibrous connective tissue known as Cooper's ligaments, which help maintain the breast's contour. The breasts are richly supplied with blood vessels, lymphatic drainage and sensory nerves, making them responsive to hormonal changes and external stimuli (Ford 2024).

Centrally located on the surface of each breast is the nipple, a cylindrical projection through which milk is delivered. Surrounding the nipple is a pigmented area called the areola, which contains numerous sebaceous glands. These glands secrete sebum, a lubricating and protective substance composed of fat and cellular debris, which helps maintain moisture and prevents irritation of the nipple during breastfeeding.

The nipple typically protrudes outwards and can become erect in response to cold temperatures, tactile stimulation or sexual arousal, due to the presence of smooth muscle fibres that contract under autonomic control (see Figure 1.7).

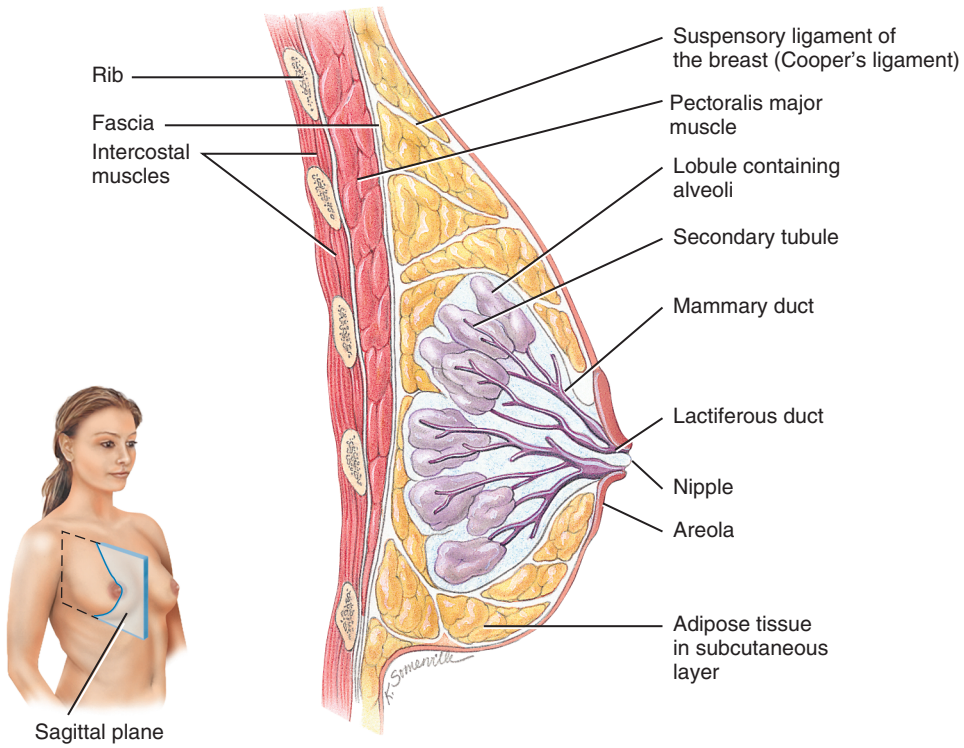


**FIGURE 1.7** The breast

## THE MENSTRUAL CYCLE

The menstrual cycle is the umbrella term that includes the uterine cycle, ovarian cycle and hormonal regulation. The uterine cycle specifically refers to what is happening in the endometrium, shedding, rebuilding and preparing for implantation (Critchley et al. 2020).

The menstrual cycle is a recurring physiological process in women and people with a uterus, typically lasting around 28 days, though cycles may range from 21 to 35 days. It prepares the body for a potential pregnancy through a series of hormonal, ovarian and uterine changes.

The cycle is regulated and involves the coordinated release of hormones, primarily FSH, LH, oestrogen and progesterone. These hormones orchestrate the maturation and release of an ovum (egg) from the ovary, the thickening of the uterine lining to support implantation and the shedding of that lining if pregnancy does not occur. The menstrual cycle is divided into four key phases:

1. Menstrual phase (menses): Shedding of the uterine lining (endometrium), resulting in menstrual bleeding
2. Follicular (proliferative) phase: Follicle development in the ovary and regeneration of the endometrium under the influence of oestrogen

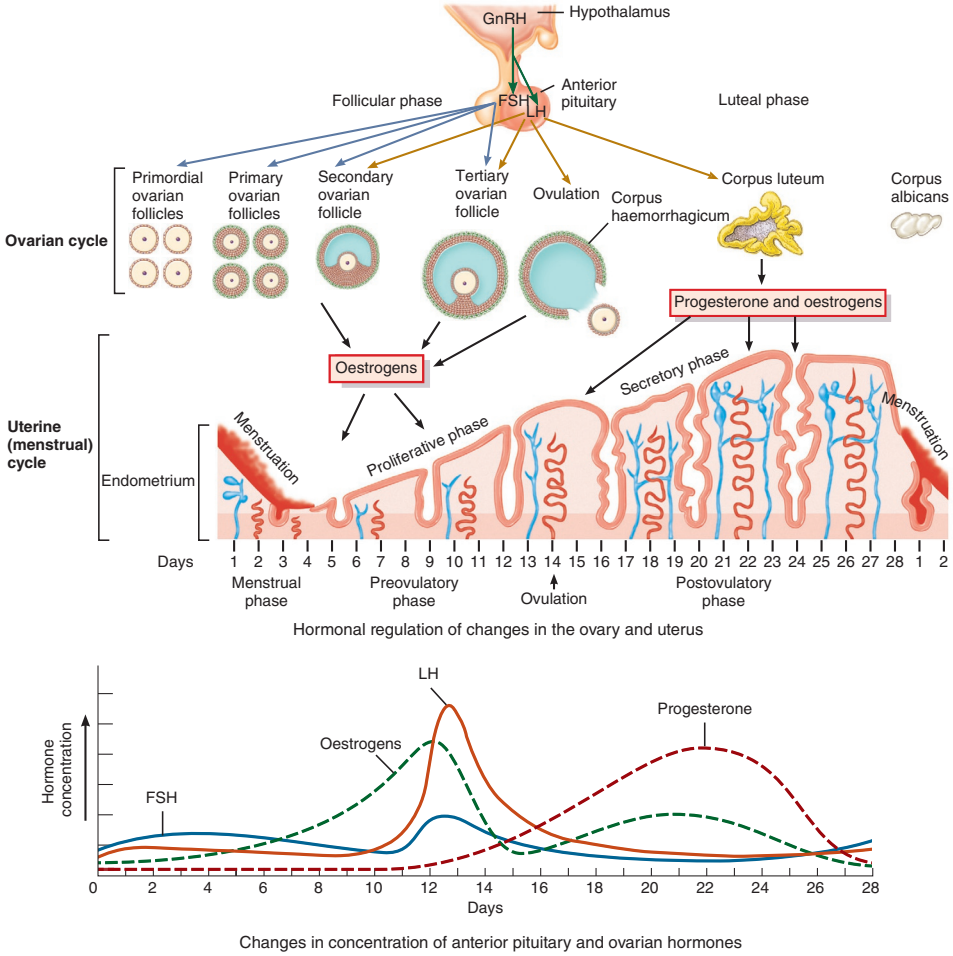


**FIGURE 1.8** Phases of the menstrual cycle

3. Ovulation: Release of a mature egg from the ovary, triggered by a surge in LH
4. Luteal (secretory) phase: Secretion of progesterone from the corpus luteum to prepare the endometrium for implantation

If fertilisation does not occur, hormone levels fall, the corpus luteum breaks down and the cycle begins again with menstruation. This cyclical process is essential for reproduction and is also a marker of general hormonal and reproductive health.

See Figure 1.8 for phases of the menstrual cycle.

## CONCLUSION

A comprehensive understanding of the anatomy and physiology of the female reproductive system is fundamental for all healthcare professionals involved in the care of women across the lifespan. The female reproductive organs, both internal and external, are intricately

structured and hormonally regulated to support essential functions such as menstruation, fertilisation, pregnancy, childbirth and lactation.

Physiological processes such as the menstrual cycle, ovulation and hormonal feedback mechanisms not only underpin reproductive health but also influence systemic health and emotional well-being. Anatomical knowledge of structures such as the uterus, cervix, vagina and external genitalia is essential for performing clinical assessments, conducting procedures (e.g. pelvic examinations, cervical screening) and recognising normal versus pathological findings.

Moreover, an appreciation of the dynamic changes that occur during puberty, the menstrual cycle, pregnancy and menopause enables those providing care and support to adopt a person-centred approach that recognises both the biological and psychosocial dimensions of women's health. This understanding informs safe and effective interventions from contraceptive advice to managing gynaecological conditions, fertility issues and reproductive health education.

Ultimately, a strong foundation in female reproductive anatomy and physiology empowers the promotion of health, early detection of abnormalities, provision of evidence-based care and advocacy for the reproductive rights and well-being of individuals in their care.

## GLOSSARY OF TERMS

**Adnexa:** The structures adjacent to the uterus, including the ovaries, Fallopian tubes and supporting ligaments.

**Areola:** The pigmented circular area surrounding the nipple of the breast, containing sebaceous glands.

**Cervix:** The narrow, lower part of the uterus that projects into the vagina, with openings called the internal and external os.

**Corpus luteum:** A temporary endocrine structure formed after ovulation from the ruptured follicle that secretes progesterone.

**Endometrium:** The innermost lining of the uterus, which thickens during the menstrual cycle and is shed during menstruation if no pregnancy occurs.

**Fallopian tubes (oviducts/uterine tubes):** Paired tubular structures that transport the ovum from the ovary to the uterus and are the usual site of fertilisation.

**Fimbriae:** Finger-like projections at the lateral end of the Fallopian tubes that help capture the ovum after ovulation.

**Follicle-stimulating hormone (FSH):** A hormone secreted by the anterior pituitary gland that stimulates growth and maturation of ovarian follicles.

**Fundus:** The rounded, upper portion of the uterus located above the openings of the Fallopian tubes.

**Hypothalamic–pituitary–ovarian (HPO) axis:** The hormonal feedback system involving the hypothalamus, pituitary gland and ovaries that regulates the menstrual cycle.

**Internal os:** The opening of the cervix into the uterine cavity.

**Labia majora:** The larger, outer folds of skin surrounding the vaginal opening.

**Labia minora:** The smaller, inner folds of skin located within the labia majora that surround the vestibule.

**Luteinising hormone (LH):** A hormone from the anterior pituitary gland that triggers ovulation and stimulates corpus luteum formation.

**Menarche:** The onset of the first menstrual period in a female.

**Menopause:** The permanent cessation of menstruation, typically occurring between the ages of 45 and 55 years, marking the end of reproductive capability.

**Myometrium:** The thick, muscular middle layer of the uterine wall responsible for contractions during labour and menstruation.

**Oestrogen:** A primary female sex hormone produced mainly by the ovaries that regulates the development and maintenance of female reproductive tissues.

**Ovary (ovaries):** Paired female gonads responsible for producing oocytes (eggs) and secreting female sex hormones.

**Ovulation:** The release of a mature egg from a dominant ovarian follicle into the Fallopian tube. The outer serous layer of the uterus, continuous with the peritoneum.

**Progesterone:** A hormone produced mainly by the corpus luteum that prepares the endometrium for pregnancy and maintains early gestation.

**Rugae:** The mucosal folds in the vagina that allow it to expand during intercourse and childbirth.

**Uterine cycle (menstrual cycle):** The cyclical changes in the uterus involving menstruation, proliferation and secretion phases, regulated by hormonal fluctuations.

**Uterus:** A hollow, muscular organ located in the pelvic cavity that houses and nourishes the developing fetus during pregnancy.

**Vagina:** A fibromuscular canal extending from the cervix to the external genitalia, serving as the birth canal, menstrual flow outlet and sexual organ.

## MULTIPLE CHOICE QUESTIONS

1. Which hormone primarily stimulates the growth and maturation of ovarian follicles?
   **a)** Luteinising hormone (LH)
   **b)** Follicle-stimulating hormone (FSH)
   **c)** Progesterone
   **d)** Oxytocin

2. Where does fertilisation of the ovum usually occur?
   **a)** Uterine cavity
   **b)** Ampulla of the Fallopian tube
   **c)** Ovary
   **d)** Cervix

3. The thick muscular layer of the uterine wall responsible for contractions is called the:
   **a)** Endometrium
   **b)** Perimetrium
   **c)** Myometrium
   **d)** Serosa

4. The menstrual cycle is regulated by hormonal interactions primarily involving the:
   **a)** Hypothalamic–pituitary–adrenal axis
   **b)** Hypothalamic–pituitary–ovarian axis
   **c)** Renin-angiotensin system
   **d)** Thyroid gland

5. Which vaginal characteristic helps inhibit bacterial growth?
   **a)** Low pH (acidic environment)
   **b)** High pH (above 7)
   **c)** Presence of sebaceous glands
   **d)** Keratinised epithelium

6. What structure connects the uterus to the vagina?
   **a)** Fallopian tube
   **b)** Labia majora
   **c)** Ovary
   **d)** Cervix

7. Which layer of the uterus is shed during menstruation?
   **a)** Perimetrium
   **b)** Myometrium
   **c)** Endometrium
   **d)** Serosa

8. The release of the ovum from the ovary is called:
   **a)** Fertilisation
   **b)** Menstruation
   **c)** Ovulation
   **d)** Implantation

9. The area of pigmented skin surrounding the nipple is called the:
   **a)** Areola
   **b)** Labia minora
   **c)** Clitoris
   **d)** Mons pubis

10. The vaginal mucosa is lined by:
    **a)** Stratified squamous non-keratinised epithelium
    **b)** Simple cuboidal epithelium
    **c)** Transitional epithelium
    **d)** Columnar epithelium

## REFERENCES

Critchley, H.O.D., Maybin, J.A., Armstrong, G.M. et al. (2020). Physiology of the endometrium and regulation of menstruation. *Physiological Reviews* 100: 1149–1179. https://doi.org/10.1152/physrev.00031.2019.

Ellenson, L.H. and Roberts, D.J. (2025). The female genital tract (Chapter 22). In: *Pathologic Basis of Disease*, 11e (ed. V. Kumar, K. Abul, and J.C. Abbas et al.). St Louis: Elsevier.

Endocrine Society (2022). Reproductive hormones. https://www.endocrine.org/patient-engagement/endocrine-library/hormones-and-endocrine-function/reproductive-hormones (accessed July 2025).

Ford, C. (2024). The female reproductive system and associated disorders (Chapter 3). In: *Fundamentals of Maternal Anatomy and Physiology* (ed. I. Peate and C. Leader). Oxford: Wiley.

Lewis, G. (2024). Nursing patients with disorders of the breast and reproductive systems (Chapter 8). In: *Alexanders Nursing Practice*, 6e (ed. I. Peate). London: Elsevier.

Marieb, E.N. and Keller, S.M. (2022). *Essentials of Human Anatomy and Physiology*, 13e. Harlow: Pearson.

Nair, M. and Peate, I. (2009). *Fundamentals of Applied Pathophysiology: An Essential Guide for Nursing Students*. Oxford: John Wiley & Sons, Ltd.

Peate, I. (2021). *Fundamentals of Applied Pathophysiology: An Essential Guide for Nursing and Healthcare Students*, 4e. John Wiley & Sons.

Stromberg, H.K. (2026). The reproductive system – Medical-surgical nursing. In: *Medical-Surgical Nursing. Concepts and Practice*, 6e (ed. Stromberg, H.K.). St Louis: Elsevier.

Tortora, G.J. and Derrickson, B.H. (2009). *Principles of Anatomy and Physiology*, 12e. Hoboken, NJ: John Wiley & Sons, Inc.

Tortora, G.J. and Derrickson, B.H. (2023). *Principles of Anatomy and Physiology*, 16e. New Jersey: Wiley.