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Describe the cyclic changes in the cervix.

The cervix is also called the cervix uteri. It is the lower part of the uterus in the human female reproductive system. The cervix is usually 2 to 3 cm long (~1 inch) and roughly cylindrical in shape, which changes during pregnancy. The narrow, central cervical canal runs along its entire length, connecting the uterine cavity and the lumen of the vagina. The opening into the uterus is called the internal os, and the opening into the vagina is called the external os. The lower part of the cervix, known as the vaginal portion of the cervix (or ectocervix), bulges into the top of the vagina. The cervical canal is a passage through which sperm must travel to fertilize an egg cell after sexual intercourse. Several methods of contraception, including cervical caps and cervical diaphragms, aim to block or prevent the passage of sperm through the cervical canal.

The cervical canal is lined with a single layer of column-shaped cells, while the ectocervix is covered with multiple layers of cells topped with flat cells. The two types of epithelia meet at the squamocolumnar junction. Infection with the human papillomavirus (HPV) can cause changes in the epithelium, which can lead to cancer of the cervix.

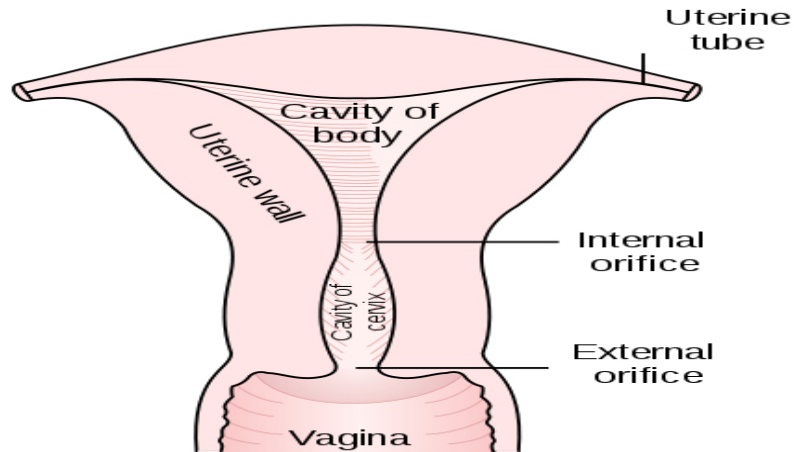


Diagram of the Uterus and part of the vagina.

Cyclic changes of the cervix throughout a month

Every woman has a different 'normal', but certain changes in the cervix throughout the month indicate when a person may be ovulating.

Alongside the Basal Body Temperature (BBT), Cervical Mucous (CM) and tracking the person's menstrual cycle, notes on cervical changes should be integral to the person's fertility diary.

When a person starts her period (Day One of her cycle), there's no need to feel the cervix for changes, as the person is clearly menstruating.

Once the bleeding stops, she may have a few days (possibly up to a week) as a 'pre-fertile' phase. This is the time from when the bleeding finishes and when the fertile phase begins.

During the pre-fertile phase, the lining of the uterus starts to thicken, regenerating after the period has finished. At the same time, a group of eggs in the ovaries start to ripen.

Fertile ground

After your pre-fertile phase, the person moves into the fertile phase of the cycle, which is when she really want to start noting any changes in the cervix, particularly if the person is having trouble tracking the cervical mucous (CM).

As oestrogen levels increase, a woman's uterus and cervix start to produce a special fertile mucous which is capable of protecting the man's sperm and helping them survive for up to three to five days in the woman's body. The fertile mucus sits in the opening of the woman's cervix and lines her uterus and fallopian tubes. The mucus acts as a continuous stream to transport sperm up into a woman's fallopian tubes, in readiness for when an egg is released. Once the woman releases an egg (or ovulates) it only survives for around 12 to 24 hours.

The fertile phase is also called the follicular or proliferative stages, as the egg is still maturing and the lining of the uterus continues to thicken. A woman's fertile phase usually starts about three to five days before ovulation, until the egg is released.

If a person feels her cervix it should be higher, softer, wetter and slightly more open when compared to the previous days.

During ovulation, the cervix will now be at it highest point and may even be difficult to reach. It should feel very wet, soft and open.

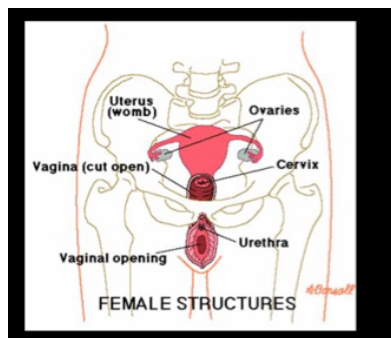
After ovulation

The time after ovulation is the post-fertile phase of the menstrual cycle. The post-fertile phase lasts for about 14 days (ranging from 12 to 16 days) until the bleeding starts again. The medical terms for this phase are the 'Luteal phase' – which refers to the capsule left in the ovary that encased the released egg called the 'Corpus Luteum' (or 'white body'). The corpus luteum produces the progesterone hormone, bringing the lining of the uterus (or 'endometrium') to maturity. Or the alternative, the 'Secretory phase', because the lining of the uterus is now able to secrete glucose, aimed at feeding a developing baby until they fully implant in the lining of the uterus and start to draw on their mother for nourishment.

At this time, the cervix should feel quite similar to the pre-fertile phase: lower, firmer, only slightly moist or even dry and tightly closed again.

Describe the Cyclic Change in Vagina

Vagina is a short tubular organ. It is lined by mucus membrane, which is formed by stratified epithelial cells.



The vagina is the tube between the vulva and the cervix. This tube is the connection between your uterus and the outside world. The vagina is what babies exit through during birth, and what menstrual blood exits through during your period. The vagina is also used for insertion, such as with a penis, fingers, female condoms, sex toys, tampons, or menstrual cups.

The vagina can also act as a route to other parts of the body. During penis-vagina sex, ejaculate is deposited in the vagina, allowing sperm to enter the uterus through the cervix. The walls of the vagina can also be used as an administrative route for medications and contraceptives, such as intervaginal hormone creams, the hormonal vaginal contraceptive ring, or vaginal suppository medications.

Anatomy of the vagina

The vagina is much more than just a tube. When it is in a relaxed state (not aroused), the walls of the vagina are collapsed against each other, flattened by the pressure of the surrounding organs and tissues within the pelvis.

During this state, a cross-section of the vaginal canal (the vaginal lumen) can resemble an “H” or a “W” shape, as the walls flatten against themselves. From the sides, the vagina offers movable support and pressure, which allow your tampon to stay in place.

The walls of the vagina are covered by many folds called rugae. The walls and folds of the vagina have many purposes, providing both a barrier and access route between the cervix and the outside world. All of these folds allow the vagina to be stretched and expand like an accordion when pressure is applied to the sides (like when a baby’s head is passing through).

The walls of the vagina are composed of different layers of tissue. The surface layers of the vaginal wall are made of mucosal tissue—similar to the tissue that lines your mouth, nose, and digestive tract. Underneath the mucosal tissue are layers of smooth muscle tissue, collagen, and elastin fibers, which give the vagina both structure and ability to stretch.

Fluids are released through the walls of the vagina to keep the area moist, and during times of sexual arousal, to increase lubrication. The vagina is also capable of absorbing some substances such as medications, hormonal creams, or contraceptives into the body.

How the vagina changes during the menstrual cycle

The vagina also changes in response to hormonal fluctuations of the menstrual cycle. Around mid-cycle, when estrogen is highest, vaginal tissue becomes thicker and fuller.

The cervix, at the top of the vagina, moves and changes shape throughout the cycle. Before and after the fertile window, the cervix is low and can be felt in the vagina, with a firm texture, and the hole in the center of the cervix is closed. During the fertile window, the hole in the cervix opens to facilitate the entrance of sperm into the uterus, the cervix rises higher in the vagina, and is softer when touched.

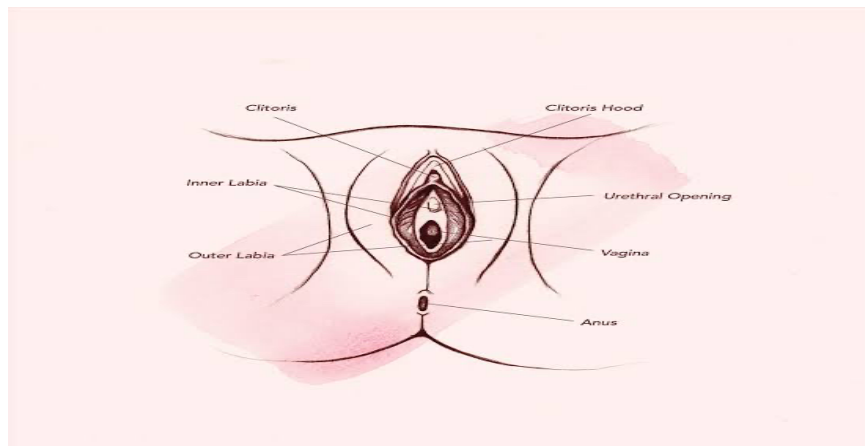


Diagram of the vagina

Menstrual Cycle

The **menstrual cycle** is the regular natural change that occurs in the female reproductive system (specifically the uterus and ovaries) that makes pregnancy possible. The cycle is required for the production of oocytes, and for the preparation of the uterus for pregnancy. The menstrual cycle occurs due to the rise and fall of estrogen. This cycle results in the thickening of the lining of the uterus, and the growth of an egg, (which is required for pregnancy). The egg is released from an ovary around day fourteen in the cycle; the thickened lining of the uterus provides nutrients to an embryo after implantation. If pregnancy does not occur, the lining is released in what is known as menstruation.

First period usually begins between twelve and fifteen years of age, a point in time known as menarche. They may occasionally start as early as eight, and this onset may still be normal. The average age of the first period is generally later in the developing world and earlier in developed world. The typical length

of time between the first day of one period and the first day of the next is 21 to 45 days in young women and 21 to 35 days in adults (an average of 28 days). Menstruation stops occurring after menopause which usually occurs between 45 and 55 years of age. Bleeding usually lasts around 3 to 7 days. The menstrual cycle is governed by hormonal changes. These changes can be altered by using hormonal birth control to prevent pregnancy. Each cycle can be divided into three phases based on events in the ovary (ovarian cycle) or in the uterus (uterine cycle). The ovarian cycle consists of the follicular phase, ovulation, and luteal phase whereas the uterine cycle is divided into menstruation, proliferative phase, and secretory phase.

Stimulated by gradually increasing amounts of estrogen in the follicular phase, discharges of blood (menses) flow stop, and the lining of the uterus thickens. Follicles in the ovary begin developing under the influence of a complex interplay of hormones, and after several days one or occasionally two become dominant (non-dominant follicles shrink and die). Approximately mid-cycle, 24–36 hours after the luteinizing hormone (LH) surges, the dominant follicle releases an ovocyte, in an event called ovulation. After ovulation, the ovocyte only lives for 24 hours or less without fertilization while the remains of the dominant follicle in the ovary become a corpus luteum; this body has a primary function of producing large amounts of progesterone. Under the influence of progesterone, the uterine lining changes to prepare for potential implantation of an embryo to establish a pregnancy. If implantation does not occur within approximately two weeks, the corpus luteum will involute, causing a sharp drop in levels of both progesterone and estrogen. The hormone drop causes the uterus to shed its lining in a process termed menstruation. Menstruation also occurs in closely related primates (apes and monkeys). The follicular phase is characterized by the maturation of the follicle containing an ovule and a retinue of follicular cells, which are responsible for transforming androstenedione into estradiol, which in turn is released and, among many other actions, stimulates endometrial renewal.

The luteal phase, named because the follicular cavity that left the ovule after hatching, is transformed into a corpus luteum and continues to produce estrogen, but it also releases important amounts of progesterone. The luteal phase is preceded by a significant increase in LH, and ovulation marks its onset; then, it lasts ± 14 fairly constant days when comparing different women. During this phase, the average total body temperature of women is constantly

0.5°C higher than in the follicular phase.

If there is no embryo implantation, the endometrium is detached giving rise to menstrual flow, which has normal volume parameters, up to 80 mL, in duration, 3–8 days, content, absence of clots and symptoms, and absence of pain.

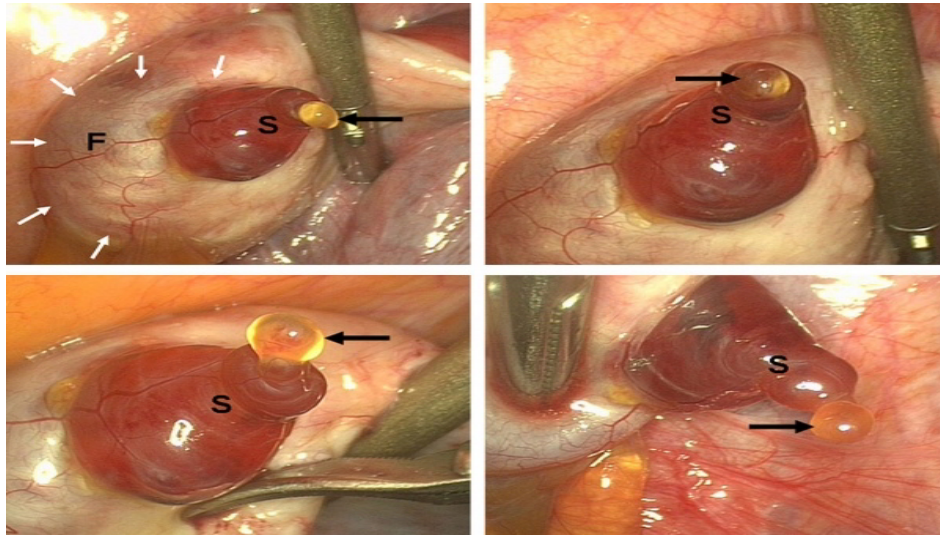


Diagram of the human ovary undergoing ovulation.

Function

Hormones are secreted in a negative and positive feedback manner to control the menstrual cycle. Hormone secretion begins in the hypothalamus where gonadotropin-releasing hormone (GnRH) is secreted in an increased, pulsatile fashion once puberty starts. GnRH is then transported to the anterior pituitary where it activates its 7-transmembrane G-protein receptor. This provides a signal to the anterior pituitary to secrete stimulating follicle hormone (FSH) and luteinizing hormone (LH). FSH and LH provide input to the ovaries. Within the ovarian follicle, there are 2 cell types responsible for hormone production, theca cells, and granulosa cells. LH stimulates theca cells to produce progesterone and androstenedione by activating the enzyme, cholesterol desmolase. Once androstenedione is secreted, the hormone diffuses to the nearby granulosa cells. Here, FSH stimulates the granulosa cells to convert androstenedione to testosterone then 17-beta-estradiol by activating the enzyme, aromatase. As levels of 17-beta-estradiol or progesterone increase

based on the phases of the menstrual cycle, there is negative feedback back to the anterior pituitary to lower the levels of FSH and LH being produced and subsequently, the levels of 17-beta-estradiol and progesterone produced. An exception to this is during ovulation, in this case, once a critical amount of 17-beta-estradiol is produced it provides positive feedback to the anterior pituitary to produce increased amounts of FSH and LH. This feedback system is represented in figure 1. Additionally, within the feedback system, the granulosa cells produce inhibin and activin, which inhibit and stimulate FSH release from the anterior pituitary, respectively. This feedback mechanism is controlled by up regulating, to increase hormone production, or down regulating to decrease hormone production, the GnRH receptors on the anterior pituitary.

Some disorders of Menstrual cycle include

abnormal uterine **bleeding** (AUB), which may include heavy **menstrual bleeding**, no **menstrual bleeding** (amenorrhea) or **bleeding** between **periods** (irregular **menstrual bleeding**) dysmenorrhea (painful **menstrual periods**) premenstrual syndrome (PMS) premenstrual dysphonic **disorder** (PMDD).

Clinical significance

A female has an average of 450 menses throughout her lifetime; therefore, it is important to understand the menstrual cycle and its physiology because of the various complications, consequences, and distress that it may have for a female patient. A female presenting with primary or secondary amenorrhea will need to undergo clinical testing to diagnose the reason, but reasonable testing from the level of the ovaries to the hypothalamus cannot be performed unless a clinician thoroughly understands the hormone feedback system. Additionally, there may be problems with her menses itself such as premenstrual syndrome, hm dysmenorrhea, or menorrhagia. Without an understanding of the female anatomy and menstrual cycle physiology, a clinician would be unable to obtain a complete history and physical to allow

understanding of the underlying cause. Infertility is a prominent issue in our society, and the menstrual cycle is the basis for how a woman's body prepares for pregnancy, so each patient's menstrual cycle must be evaluated as a possible area of concern for her infertility. As clinicians, we must understand the menstrual cycle in its entirety to provide relevant clinical care to our female patients.

References

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