

= Menstrual cycle =

The menstrual cycle is the regular natural change that occurs in the female reproductive system like the uterus and ovaries that make pregnancy possible . The cycle is required for the production of ovocytes , and for the preparation of the uterus for pregnancy . Up to 80 % of women report having some symptoms during the one to two weeks prior to menstruation . Common symptoms include acne , tender breasts , bloating , feeling tired , irritability and mood changes . These symptoms interfere with normal life and therefore qualify as premenstrual syndrome in 20 to 30 % of women . In 3 to 8 % , they are severe .

The 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 2 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 some other animals including shrews , bats , and other primates such as apes and monkeys .

= = Onset and frequency = =

The average age of menarche is 12 ? 15 . They may occasionally start as early as eight , and this onset may still be normal . This first period often occurs later in the developing world than the developed world .

The average age of menarche is approximately 12 @. @ 5 years in the United States , 12 @. @ 7 in Canada , 12 @. @ 9 in the UK and 13 @. @ 1 years in Iceland . Factors such as genetics , diet and overall health can affect timing .

The cessation of menstrual cycles at the end of a woman 's reproductive period is termed menopause . The average age of menopause in women is 52 years , with anywhere between 45 and 55 being common . Menopause before age 45 is considered premature in industrialised countries . Like the age of menarche , the age of menopause is largely a result of cultural and biological factors ; however , illnesses , certain surgeries , or medical treatments may cause menopause to occur earlier than it might have otherwise .

The length of a woman 's menstrual cycle typically varies somewhat , with some shorter cycles and some longer cycles . A woman who experiences variations of less than eight days between her longest cycles and shortest cycles is considered to have regular menstrual cycles . It is unusual for a

woman to experience cycle length variations of less than four days . Length variation between eight and 20 days is considered as moderately irregular cycles . Variation of 21 days or more between a woman 's shortest and longest cycle lengths is considered very irregular .

The average menstrual cycle lasts 28 days . The variability of menstrual cycle lengths is highest for women under 25 years of age and is lowest , that is , most regular , for ages 25 to 39 . Subsequently , the variability increases slightly for women aged 40 to 44 .

The luteal phase of the menstrual cycle is about the same length in most individuals ( mean 14 @. @ 13 days , SD 1 @. @ 41 days ) whereas the follicular phase tends to show much more variability ( log @- @ normally distributed with 95 % of individuals having follicular phases between 10 @. @ 3 and 16 @. @ 3 days ) . The follicular phase also seems to get significantly shorter with age ( geometric mean 14 @. @ 2 days in women aged 18 ? 24 vs. 10 @. @ 4 days in women aged 40 ? 44 ) .

= = Health effects = =

Some women with neurological conditions experience increased activity of their conditions at about the same time during each menstrual cycle . For example , drops in estrogen levels have been known to trigger migraines , especially when the woman who suffers migraines is also taking the birth control pill . Many women with epilepsy have more seizures in a pattern linked to the menstrual cycle ; this is called " catamenial epilepsy " . Different patterns seem to exist ( such as seizures coinciding with the time of menstruation , or coinciding with the time of ovulation ) , and the frequency with which they occur has not been firmly established . Using one particular definition , one group of scientists found that around one @- @ third of women with intractable partial epilepsy has catamenial epilepsy . An effect of hormones has been proposed , in which progesterone declines and estrogen increases would trigger seizures . Recently , studies have shown that high doses of estrogen can cause or worsen seizures , whereas high doses of progesterone can act like an antiepileptic drug . Studies by medical journals have found that women experiencing menses are 1 @. @ 68 times more likely to commit suicide .

Mice have been used as an experimental system to investigate possible mechanisms by which levels of sex steroid hormones might regulate nervous system function . During the part of the mouse estrous cycle when progesterone is highest , the level of nerve @- @ cell GABA receptor subtype delta was high . Since these GABA receptors are inhibitory , nerve cells with more delta receptors are less likely to fire than cells with lower numbers of delta receptors . During the part of the mouse estrous cycle when estrogen levels are higher than progesterone levels , the number of delta receptors decrease , increasing nerve cell activity , in turn increasing anxiety and seizure susceptibility .

Estrogen levels may affect thyroid behavior . For example , during the luteal phase ( when estrogen levels are lower ) , the velocity of blood flow in the thyroid is lower than during the follicular phase ( when estrogen levels are higher ) .

Among women living closely together , it was once thought that the onsets of menstruation tend to synchronize . This effect was first described in 1971 , and possibly explained by the action of pheromones in 1998 . Subsequent research has called this hypothesis into question .

Research indicates that women have a significantly higher likelihood of anterior cruciate ligament injuries in the pre @- @ ovulatory stage , than post @- @ ovulatory stage .

= = = Fertility = = =

The most fertile period ( the time with the highest likelihood of pregnancy resulting from sexual intercourse ) covers the time from some 5 days before until 1 to 2 days after ovulation . In a 28 ? day cycle with a 14 ? day luteal phase , this corresponds to the second and the beginning of the third week . A variety of methods have been developed to help individual women estimate the relatively fertile and the relatively infertile days in the cycle ; these systems are called fertility awareness .

Fertility awareness methods that rely on cycle length records alone are called calendar @-@ based methods . Methods that require observation of one or more of the three primary fertility signs ( basal body temperature , cervical mucus , and cervical position ) are known as symptoms @-@ based methods . Urine test kits are available that detect the LH surge that occurs 24 to 36 hours before ovulation ; these are known as ovulation predictor kits ( OPKs ) . Computerized devices that interpret basal body temperatures , urinary test results , or changes in saliva are called fertility monitors .

A woman 's fertility is also affected by her age . As a woman 's total egg supply is formed in fetal life , to be ovulated decades later , it has been suggested that this long lifetime may make the chromatin of eggs more vulnerable to division problems , breakage , and mutation than the chromatin of sperm , which are produced continuously during a man 's reproductive life . However , despite this hypothesis , a similar paternal age effect has also been observed .

As measured on women undergoing in vitro fertilization , a longer menstrual cycle length is associated with higher pregnancy and delivery rates , even after age adjustment . Delivery rates after IVF have been estimated to be almost doubled for women with a menstrual cycle length of more than 34 days compared with women with a menstrual cycle length shorter than 26 days . A longer menstrual cycle length is also significantly associated with better ovarian response to gonadotropin stimulation and embryo quality .

= = = Mood and behaviour = = =

The different phases of the menstrual cycle correlate with women 's moods . In some cases , hormones released during the menstrual cycle can cause behavioral changes in females ; mild to severe mood changes can occur . The menstrual cycle phase and ovarian hormones may contribute to increased empathy in women . The natural shift of hormone levels during the different phases of the menstrual cycle has been studied in conjunction with test scores . When completing empathy exercises , women in the follicular stage of their menstrual cycle performed better than women in their midluteal phase . A significant correlation between progesterone levels and the ability to accurately recognize emotion was found . Performances on emotion recognition tasks were better when women had lower progesterone levels . Women in the follicular stage showed higher emotion recognition accuracy than their midluteal phase counterparts . Women were found to react more to negative stimuli when in midluteal stage over the women in the follicular stage , perhaps indicating more reactivity to social stress during that menstrual cycle phase . Overall , it has been found that women in the follicular phase demonstrated better performance in tasks that contain empathetic traits .

Fear response in women during two different points in the menstrual cycle has been examined . When estrogen is highest in the preovulatory stage , women are significantly better at identifying expressions of fear than women who were menstruating , which is when estrogen levels are lowest . The women were equally able to identify happy faces , demonstrating that the fear response was a more powerful response . To summarize , menstrual cycle phase and the estrogen levels correlates with women 's fear processing .

However , the examination of daily moods in women with measuring ovarian hormones may indicate a less powerful connection . In comparison to levels of stress or physical health , the ovarian hormones had less of an impact on overall mood . This indicates that while changes of ovarian hormones may influence mood , on a day @-@ to @-@ day level it does not influence mood more than other stressors do .

= = = Eating behaviour = = =

Females have been found to experience different eating habits at different stages of their menstrual cycle , with food intake being higher during the luteal phase than the follicular phase . Food intake increases by approximately 10 % during the luteal phase compared to the follicular phase .

Various studies have shown that during the luteal phase woman consume more carbohydrates ,

proteins and fats and that 24 hour energy expenditure shows increases between 2 to 5 to 11 to 5 % . The increasing intake during the luteal phase may be related to higher preferences for sweet and fatty foods , which occurs naturally and is enhanced during the luteal phases of the menstrual cycle . This is due to the higher metabolic demand during this phase . In particular , women tend to show a cravings for chocolate , with higher cravings during the luteal phase .

Females with premenstrual syndrome ( PMS ) report changes in appetite across the menstrual cycle more than non sufferers of PMS , possibly due to their oversensitivity to changes in hormone levels . In women with PMS , food intake is higher in the luteal phase than follicular . The remaining symptoms of PMS , including mood changes and physical symptoms , also occur during the luteal phase . No difference for preference of food types has been found between PMS sufferers and non sufferers .

The different levels of ovarian hormones at different stages of the cycle have been used to explain eating behaviour changes . Progesterone has been shown to promote fat storage , causing a higher intake of fatty foods during the luteal phase when progesterone levels are higher . Additionally , with a high estrogen level dopamine is ineffective in converting to noradrenaline , a hormone which promotes eating , therefore decreasing appetite . In humans , the level of these ovarian hormones during the menstrual cycle have been found to influence binge eating .

It is theorised that the use of birth control pills should affect eating behaviour as they minimise or remove the fluctuations in hormone levels . The neurotransmitter serotonin is also thought to play a role in food intake . Serotonin is responsible for inhibiting eating and controlling meal size , among other things , and is modulated in part by ovarian hormones .

A number of factors affect whether dieting will affect these menstrual processes : age , weight loss and the diet itself . First , younger women are likely to experience menstrual irregularities due to their diet . Second , menstrual abnormalities are more likely with more weight loss . For example , anovulatory cycles can occur as a result of adopting a restricted diet , as well as engaging in a high amount of exercise . Finally , the cycle is affected more by a vegetarian diet compared to a non vegetarian diet .

=== Substance abuse ===

Studies investigating effects of the menstrual cycle on alcohol consumption have found mixed evidence . However , some evidence suggests that individuals consume more alcohol during the luteal stage , especially if these individuals are heavy drinkers or have a family history of alcohol abuse .

The level of substance abuse increases with PMS , mostly with addictive substances such as nicotine , tobacco and cocaine . One theory behind this suggests this higher level of substance abuse is due to decreased self control as a result of the higher metabolic demands during the luteal phase .

=== Menstrual disorders ===

Infrequent or irregular ovulation is called oligoovulation . The absence of ovulation is called anovulation . Normal menstrual flow can occur without ovulation preceding it : an anovulatory cycle . In some cycles , follicular development may start but not be completed ; nevertheless , estrogens will be formed and stimulate the uterine lining . Anovulatory flow resulting from a very thick endometrium caused by prolonged , continued high estrogen levels is called estrogen breakthrough bleeding . Anovulatory bleeding triggered by a sudden drop in estrogen levels is called withdrawal bleeding . Anovulatory cycles commonly occur before menopause ( perimenopause ) and in women with polycystic ovary syndrome .

Very little flow ( less than 10 ml ) is called hypomenorrhea . Regular cycles with intervals of 21 days or fewer are polymenorrhea ; frequent but irregular menstruation is known as metrorrhagia . Sudden heavy flows or amounts greater than 80 ml are termed menorrhagia . Heavy menstruation that

occurs frequently and irregularly is menometrorrhagia . The term for cycles with intervals exceeding 35 days is oligomenorrhea . Amenorrhea refers to more than three to six months without menses ( while not being pregnant ) during a woman 's reproductive years .

= = Cycles and phases = =

The menstrual cycle can be described by the ovarian or uterine cycle . The ovarian cycle describes changes that occur in the follicles of the ovary whereas the uterine cycle describes changes in the endometrial lining of the uterus . Both cycles can be divided into three phases . The ovarian cycle consists of the follicular phase , ovulation , and the luteal phase whereas the uterine cycle consists of menstruation , proliferative phase , and secretory phase .

= = = Ovarian cycle = = =

= = = = Follicular phase = = = =

The follicular phase is the first part of the ovarian cycle . During this phase , the ovarian follicles mature and get ready to release an egg . The latter part of this phase overlaps with the proliferative phase of the uterine cycle .

Through the influence of a rise in follicle stimulating hormone ( FSH ) during the first days of the cycle , a few ovarian follicles are stimulated . These follicles , which were present at birth and have been developing for the better part of a year in a process known as folliculogenesis , compete with each other for dominance . Under the influence of several hormones , all but one of these follicles will stop growing , while one dominant follicle in the ovary will continue to maturity . The follicle that reaches maturity is called a tertiary , or Graafian , follicle , and it contains the ovum .

= = = = Ovulation = = = =

Ovulation is the second phase of the ovarian cycle in which a mature egg is released from the ovarian follicles into the oviduct . During the follicular phase , estradiol suppresses production of luteinizing hormone ( LH ) from the anterior pituitary gland . When the egg has nearly matured , levels of estradiol reach a threshold above which this effect is reversed and estrogen stimulates the production of a large amount of LH . This process , known as the LH surge , starts around day 12 of the average cycle and may last 48 hours .

The exact mechanism of these opposite responses of LH levels to estradiol is not well understood . In animals , a gonadotropin @-@ releasing hormone ( GnRH ) surge has been shown to precede the LH surge , suggesting that estrogen 's main effect is on the hypothalamus , which controls GnRH secretion . This may be enabled by the presence of two different estrogen receptors in the hypothalamus : estrogen receptor alpha , which is responsible for the negative feedback estradiol @-@ LH loop , and estrogen receptor beta , which is responsible for the positive estradiol @-@ LH relationship . However , in humans it has been shown that high levels of estradiol can provoke abrupt increases in LH , even when GnRH levels and pulse frequencies are held constant , suggesting that estrogen acts directly on the pituitary to provoke the LH surge .

The release of LH matures the egg and weakens the wall of the follicle in the ovary , causing the fully developed follicle to release its secondary oocyte . The secondary oocyte promptly matures into an ootid and then becomes a mature ovum . The mature ovum has a diameter of about 0 @.@ 2 mm .

Which of the two ovaries ? left or right ? ovulates appears essentially random ; no known left and right co @-@ ordination exists . Occasionally , both ovaries will release an egg ; if both eggs are fertilized , the result is fraternal twins .

After being released from the ovary , the egg is swept into the fallopian tube by the fimbria , which is a fringe of tissue at the end of each fallopian tube . After about a day , an unfertilized egg will

disintegrate or dissolve in the fallopian tube .

Fertilization by a spermatozoon , when it occurs , usually takes place in the ampulla , the widest section of the fallopian tubes . A fertilized egg immediately begins the process of embryogenesis , or development . The developing embryo takes about three days to reach the uterus and another three days to implant into the endometrium . It has usually reached the blastocyst stage at the time of implantation .

In some women , ovulation features a characteristic pain called mittelschmerz ( German term meaning middle pain ) . The sudden change in hormones at the time of ovulation sometimes also causes light mid @-@ cycle blood flow .

= = = = Luteal phase = = = =

The luteal phase is the final phase of the ovarian cycle and it corresponds to the secretory phase of the uterine cycle . During the luteal phase , the pituitary hormones FSH and LH cause the remaining parts of the dominant follicle to transform into the corpus luteum , which produces progesterone . The increased progesterone in the adrenals starts to induce the production of estrogen . The hormones produced by the corpus luteum also suppress production of the FSH and LH that the corpus luteum needs to maintain itself . Consequently , the level of FSH and LH fall quickly over time , and the corpus luteum subsequently atrophies . Falling levels of progesterone trigger menstruation and the beginning of the next cycle . From the time of ovulation until progesterone withdrawal has caused menstruation to begin , the process typically takes about two weeks , with 14 days considered normal . For an individual woman , the follicular phase often varies in length from cycle to cycle ; by contrast , the length of her luteal phase will be fairly consistent from cycle to cycle .

The loss of the corpus luteum is prevented by fertilization of the egg . The syncytiotrophoblast , which is the outer layer of the resulting embryo @-@ containing structure ( the blastocyst ) and later also becomes the outer layer of the placenta , produces human chorionic gonadotropin ( hCG ) , which is very similar to LH and which preserves the corpus luteum . The corpus luteum can then continue to secrete progesterone to maintain the new pregnancy . Most pregnancy tests look for the presence of hCG .

= = = Uterine cycle = = =

The uterine cycle has three phases .

= = = = Menstruation = = = =

Menstruation ( also called menstrual bleeding , menses , catamenia or a period ) is the first phase of the uterine cycle . The flow of menses normally serves as a sign that a woman has not become pregnant . ( However , this cannot be taken as certainty , as a number of factors can cause bleeding during pregnancy ; some factors are specific to early pregnancy , and some can cause heavy flow . )

Eumenorrhea denotes normal , regular menstruation that lasts for a few days ( usually 3 to 5 days , but anywhere from 2 to 7 days is considered normal ) . The average blood loss during menstruation is 35 milliliters with 10 ? 80 ml considered normal . Women who experience Menorrhagia are more susceptible to iron deficiency than the average person . An enzyme called plasmin inhibits clotting in the menstrual fluid .

Painful cramping in the abdomen , back , or upper thighs is common during the first few days of menstruation . Severe uterine pain during menstruation is known as dysmenorrhea , and it is most common among adolescents and younger women ( affecting about 67 @.@ 2 % of adolescent females ) . When menstruation begins , symptoms of premenstrual syndrome ( PMS ) such as breast tenderness and irritability generally decrease . Many sanitary products are marketed to women for use during their menstruation .

===== Proliferative phase =====

The proliferative phase is the second phase of the uterine cycle when estrogen causes the lining of the uterus to grow , or proliferate , during this time . As they mature , the ovarian follicles secrete increasing amounts of estradiol , and estrogen . The estrogens initiate the formation of a new layer of endometrium in the uterus , histologically identified as the proliferative endometrium . The estrogen also stimulates crypts in the cervix to produce fertile cervical mucus , which may be noticed by women practicing fertility awareness .

===== Secretory phase =====

The secretory phase is the final phase of the uterine cycle and it corresponds to the luteal phase of the ovarian cycle . During the secretory phase , the corpus luteum produces progesterone , which plays a vital role in making the endometrium receptive to implantation of the blastocyst and supportive of the early pregnancy , by increasing blood flow and uterine secretions and reducing the contractility of the smooth muscle in the uterus ; it also has the side effect of raising the woman 's basal body temperature .

== Ovulation suppression ==

== Birth control ==

While some forms of birth control do not affect the menstrual cycle , hormonal contraceptives work by disrupting it . Progesterone negative feedback decreases the pulse frequency of gonadotropin @-@ releasing hormone ( GnRH ) release by the hypothalamus , which decreases the release of follicle @-@ stimulating hormone ( FSH ) and luteinizing hormone ( LH ) by the anterior pituitary . Decreased levels of FSH inhibit follicular development , preventing an increase in estradiol levels . Progesterone negative feedback and the lack of estrogen positive feedback on LH release prevent a mid @-@ cycle LH surge . Inhibition of follicular development and the absence of a LH surge prevent ovulation .

The degree of ovulation suppression in progesterone @-@ only contraceptives depends on the progesterone activity and dose . Low dose progesterone @-@ only contraceptives ? traditional progesterone only pills , subdermal implants Norplant and Jadelle , and intrauterine system Mirena ? inhibit ovulation in about 50 % of cycles and rely mainly on other effects , such as thickening of cervical mucus , for their contraceptive effectiveness . Intermediate dose progesterone @-@ only contraceptives ? the progesterone @-@ only pill Cerazette and the subdermal implant Nexplanon ? allow some follicular development but more consistently inhibit ovulation in 97 ? 99 % of cycles . The same cervical mucus changes occur as with very low @-@ dose progesterones . High @-@ dose , progesterone @-@ only contraceptives ? the injectables Depo @-@ Provera and Noristerat ? completely inhibit follicular development and ovulation .

Combined hormonal contraceptives include both an estrogen and a progesterone . Estrogen negative feedback on the anterior pituitary greatly decreases the release of FSH , which makes combined hormonal contraceptives more effective at inhibiting follicular development and preventing ovulation . Estrogen also reduces the incidence of irregular breakthrough bleeding . Several combined hormonal contraceptives ? the pill , NuvaRing , and the contraceptive patch ? are usually used in a way that causes regular withdrawal bleeding . In a normal cycle , menstruation occurs when estrogen and progesterone levels drop rapidly . Temporarily discontinuing use of combined hormonal contraceptives ( a placebo week , not using patch or ring for a week ) has a similar effect of causing the uterine lining to shed . If withdrawal bleeding is not desired , combined hormonal contraceptives may be taken continuously , although this increases the risk of breakthrough bleeding .

### === Breastfeeding ===

Breastfeeding causes negative feedback to occur on pulse secretion of gonadotropin releasing hormone ( GnRH ) and luteinizing hormone ( LH ) . Depending on the strength of the negative feedback , breastfeeding women may experience complete suppression of follicular development , but no ovulation , or normal menstrual cycle may resume . Suppression of ovulation is more likely when suckling occurs more frequently . The production of prolactin in response to suckling is important to maintaining lactational amenorrhea . On average , women who are fully breastfeeding whose infants suckle frequently experience a return of menstruation at fourteen and a half months postpartum . There is a wide range of response among individual breastfeeding women , however , with some experiencing return of menstruation at two months and others remaining amenorrheic for up to 42 months postpartum .

### === Society and culture ===

### === Etymological ===

The word " menstruation " is etymologically related to " moon " . The terms " menstruation " and " menses " are derived from the Latin mensis ( month ) , which in turn relates to the Greek mene ( moon ) and to the roots of the English words month and moon .

### === The Moon ===

Even though the average length of the human menstrual cycle is similar to that of the lunar cycle , in modern humans there is no relation between the two . The relationship is believed to be a coincidence . Light exposure does not appear to affect the menstrual cycle in humans . A meta analysis of studies from 1996 showed no correlation between the human menstrual cycle and the lunar cycle .

Dogon villagers did not have electric lighting and spent most nights outdoors , talking and sleeping ; so they were apparently an ideal population for detecting a lunar influence ; none was found . Other scholars counter , however , that the Dogon ? unlike ancestral African hunter gatherer populations ? are polygamous , meaning that reproductive synchrony would not be expected on theoretical grounds .

### === Work ===

In a number of countries , mainly in Asia , legislation or corporate practice has introduced formal menstrual leave to provide women with either paid or unpaid leave of absence from their employment while they are menstruating . Countries with policies include Japan , Taiwan , Indonesia , and South Korea . The practice is controversial due to it being seen to criticize women 's work efficiency , as well as being seen as possible sexism .