

## Factsheet: The Menstrual Cycle

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## The Menstrual Cycle: some facts

### What is the menstrual cycle?

The menstrual cycle is the fertility cycle of the woman during the child-bearing years.

### When does the cycle begin and end?

The first day of the menstrual cycle is the first day of the menstrual period and the last day of the menstrual cycle is the day before the next menstrual period. The cycle length varies from 23 to 35 days, the average length is about 28 days.

### What happens during each menstrual cycle?

During each cycle two events occur simultaneously:

- an ovum (egg) matures in the ovary and is then released into the fallopian tube ready to be fertilised. The release of a mature egg is called ovulation. (Link to Fig. 6.10 ovulation)
- at the same time that the ovum (egg) is maturing in the ovary, the lining of the uterus is being prepared to accept the fertilized ovum, i.e. the lining of the uterus becomes thicker and more vascular in preparation for a possible pregnancy.

### What is menstruation?

Menstruation is the vaginal bleeding that occurs at the end of an ovulatory cycle when fertilization has not occurred and is due to the drop in hormone levels in the bloodstream. Menstruation marks the beginning of a new cycle, and lasts 3 to 5 days.

### Please explain the hormone bit:

During the cycle the two female hormones, oestrogen and progesterone are low at the beginning of the cycle, their levels increase during the cycle and they are low again at the end of the cycle. During the cycle the lining of the uterus proliferates to prepare for a possible pregnancy due to the actions of two hormones, oestrogen before ovulation, and progesterone after ovulation.

If pregnancy does not occur the levels of these hormones start to fall about 7 days after ovulation. As progesterone is required to maintain the integrity of the lining of the womb (endometrium), the drop in progesterone means that the endometrium can no longer be maintained and it is shed about 14 days after ovulation. This shedding is called menstruation. If fertilisation of the ovum does not occur in that cycle menstruation will start about 14 days after ovulation. In other words, when menstruation starts the woman knows that ovulation most likely had occurred 14 days previously.

### What is ovulation?

Ovulation means the release of a mature ovum (egg) from the ovary into the fallopian tube. It occurs once in any cycle, about 14 days before the next period. If two or more ova (eggs) are released in a cycle, all are released within the same 24 hour interval.

### What is the life-span of the ovum?

The ovum lives for 24 hours.

### What is the life-span of the sperm?

Sperm to survive for up to 5 days in fertile-type cervical mucus present in the vagina during the 6 days or so leading up to ovulation.

## Two questions about ovulation:

1. Can the time of ovulation be pin-pointed in regular cycles?
2. Can the time of ovulation be pin-pointed when the cycle is irregular ?

Answer: The exact time that ovulation occurs cannot be pin-pointed by the fertility indicators, i.e. 'cervical mucus' or by 'changes in the cervix itself' whether the cycle is regular or irregular. Ovulation is confirmed by the 'thermal shift'.

## If you cannot pin-point the moment of ovulation, is this not a drawback for those who wish to achieve pregnancy and who may have irregular cycles?

The answer is NO. If you do not know the exact moment of ovulation this is not a drawback to achieve pregnancy, as the life-span of sperm in fertile-type mucus is 5 days and fertile-type mucus is present in the vagina at the time around ovulation itself as well as the 6 days or so leading up to ovulation, i.e. the fertile phase of the cycle. This means that whether the woman has regular cycles or irregular cycles, she is still able to identify the fertile phase of the cycle by the presence of fertile-type cervical mucus at the vulva, the time when there is an increased probability of achieving pregnancy. The thermal shift is the only indicator that confirms that ovulation has occurred.

## What factors can cause irregularity of the menstrual cycle?

The menstrual cycle is regulated by a finely tuned balance of hormones secreted by the ovary and the pituitary gland, and is ultimately under the control of the higher centres of the brain. This delicate mechanism can be disturbed by a number of factors, notably stress, but also by over-doing physical exercise, by dieting and by weight-loss.

## What effects has the 'Pill' on the menstrual cycle?

Women taking hormonal contraception (the Pill) do not have a normal menstrual cycle and the apparent menstrual period when taking the Pill is just a withdrawal bleed due to a drop in synthetic hormone levels in the blood in the pill-free days.

**Menarche:** The first menstrual period is known as menarche and usually occurs about 13 years of age. The normal age of menarche varies from 10 to 16 years. A study done in Ireland of 2940 girls aged 9 to 17 years showed that the average age of menarche in Ireland is 13.5 years, with a standard deviation of 1.3 years.<sup>1</sup> The age of menarche has decreased in the 20th century and this could well be due to improved nutrition. In the 19th century girls in the USA reached a weight of 46kg at about 14 years of age which was the year of the menarche. In Belgium in the 19th century girls reached a weight of 46 kg at about 16.5 years and also attained the menarche at that age. According to Griffin et al,<sup>2</sup> the increase in body fat at adolescence of about 11kg is equivalent to 99,000 calories and the number of calories estimated to maintain a pregnancy is 88,000. Thus one of the main functions of the adolescent growth spurt in females may be the storage of energy to sustain a pregnancy and lactation.

**Menopause:** When the final menstrual period has occurred the woman has reached menopause, and the end of the child-bearing years has arrived. Menopause occurs within a wide age range between the ages of 42 to 58,3 on average at about age 51 and this is unchanged from ancient times.

## References:

<sup>1</sup> Hoey, H.; The age of Menarche in Irish girls; Ir Med J. Oct. 1986, vol 79, no. 10, p283-285

<sup>2</sup> Griffin, James E; Ojeda, Sergio R; Textbook of Endocrine Physiology, 3rd edition, 1996, ch. 9, p187, 188

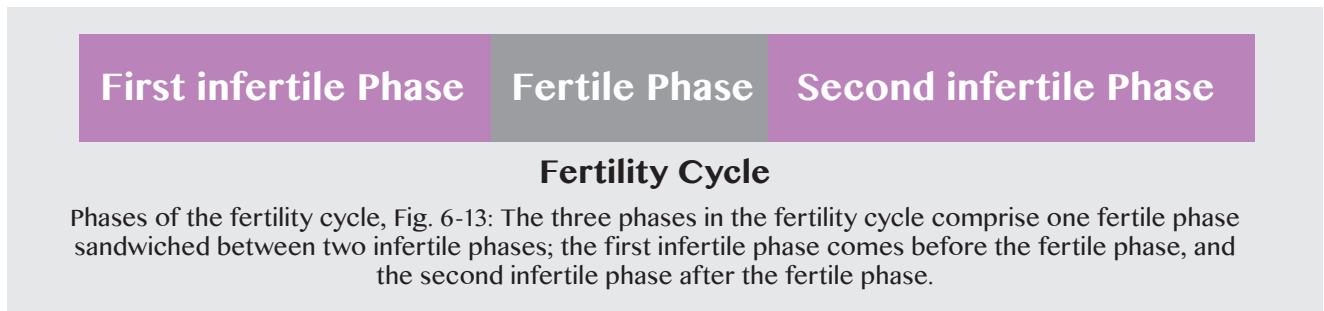
<sup>3</sup> Soules MR, Sherman S, Parrot E et al; Executive summary: Stages of Reproductive Aging Workshop (STRAW). Fertil Steril. 2001; 76: 874

## What is The Fertility Cycle?

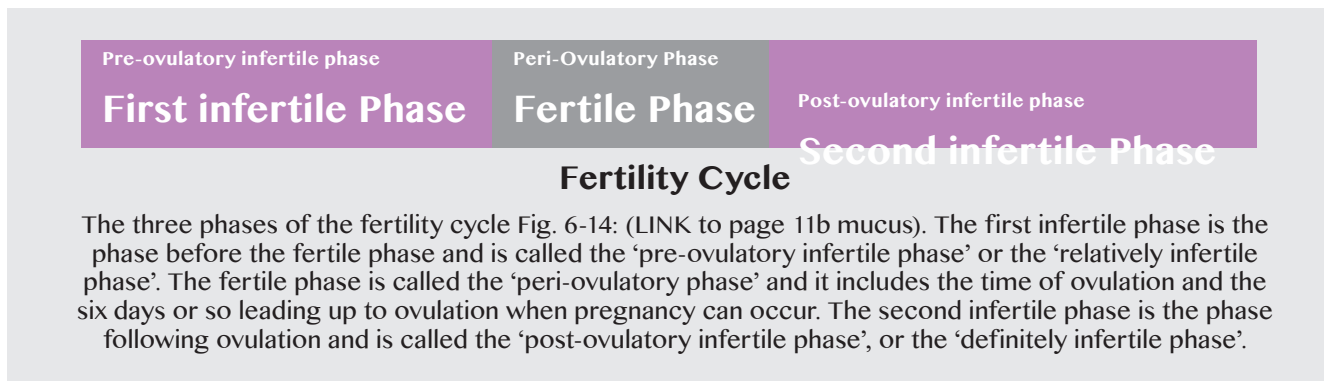
The fertility cycle is the menstrual cycle viewed from the perspective of when in the cycle the woman is infertile or when she is potentially fertile.

### How many phases in the Fertility Cycle – when do they occur?

There are three phases in the fertility cycle as shown on Fig. 6-13 below.



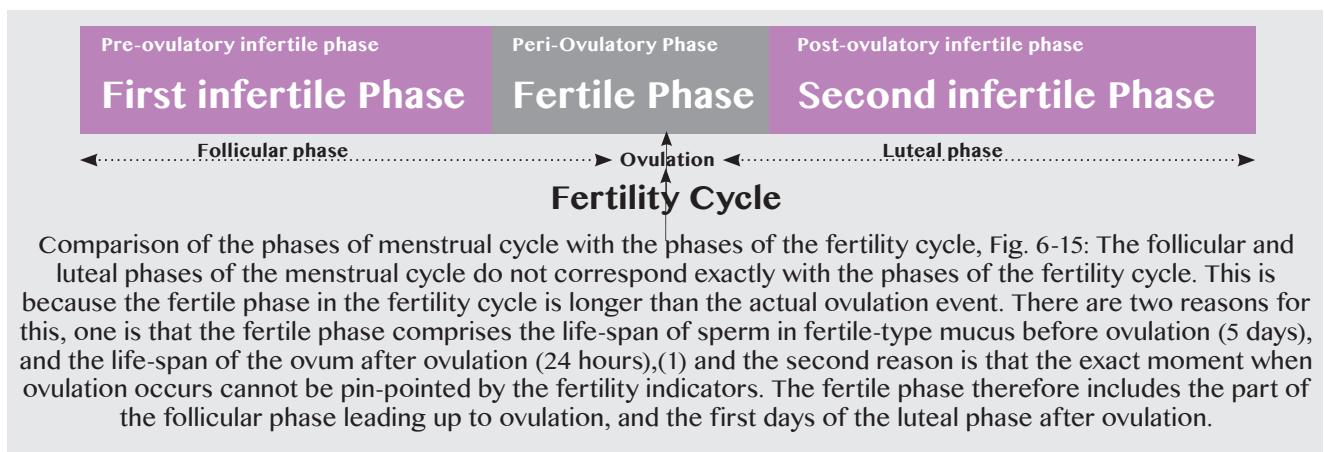
The three phases of the fertility cycle are labelled the pre-ovulatory infertile phase, the peri-ovulatory fertile phase, and the post-ovulatory infertile phase; see Fig. 6-14



### How long does the ovum live? How long does the sperm live? :

The ovum lives for 24 hours. The sperm can survive for up to 5 days in oestrogenic fertile-type mucus.

**Do the phases of the menstrual cycle and the phases of the fertility cycle correspond with each other? : The phases of the menstrual cycle and fertility cycle do not correspond with each other; see Fig. 6-15 below for further details.**



## When is the fertile phase in the cycle and how long does it last?

In the 'symptothermal double-check method' of natural family planning the fertile phase begins with the first sign of cervical mucus at the vulva, cross-checked with the 'calendar rule' whichever comes first, and it ends when there is a sustained rise in the basal body temperature (BBT) cross-checked with the cervical mucus symptom whichever comes last. The LIMITS of the fertile phase are defined by the RULES of the Natural Family Planning Method and the couple must learn these rules from a qualified Natural Family Planning teacher. The potential fertile phase of a couple is the time from the first act of intercourse which may lead to pregnancy to the demise of the ovum.<sup>1</sup> According to Freundl 4 there are only 6 – 9 days of the menstrual cycle on which intercourse may result in pregnancy. The fertile phase normally occupies not more than one-third of the cycle.<sup>3</sup>

## Does ovulation occur on the same day in every cycle and is it always in mid-cycle?

The day of ovulation is not fixed in the middle of the cycle, but it varies from one cycle to another. It usually occurs about 14 days before the next period because the luteal phase after ovulation has a relatively constant length of 14 days, (range 10-16 days). [If the cycle length is 30 days, ovulation probably occurred on Day 16 of the cycle (30 minus 14 = 16), and if the cycle length is 25 days, ovulation would probably have occurred on Day 11 of the cycle, (25 minus 14 = 11)].

## Does ovulation occur just once in the cycle? :

If two ova mature in any particular cycle, as in the case of twins, both ova will be released within the same 24 hour period.

## References

1. Wilcox AJ, Weinberg CR, Baird DD; 'Timing of sexual intercourse in relation to ovulation – effects on the probability of conception, survival of the pregnancy, and sex of the baby'; N Engl J Med 1995; 333;1517-21.
2. World Health Organization; 'Temporal relationship between indices of the fertile period',1983 page 1; Fertil & Steril; 39; 647-655. (Dr Anna Flynn was one of the WHO task force investigators for this study).
3. Klaus, Hanna; 'Natural family planning – Is it scientific? Is it effective?' page 1; Newman Lecture Series 1; May 21, 2000. (on the internet if you google 'natural family planning, Dr Hanna Klaus'.
4. Freundl G et al; "Estimated maximum failure rates of cycle monitors using conception probabilities in the menstrual cycle"; Human Reproduction, (2003), vol 18, no12, p 2628-2633.

**To be most effective, the woman must be taught the Symptothermal Double-Check Method of Natural Family Planning by a qualified natural family planning teacher.**

## The Uterus during the cycle

### Changes in the Endometrium (i.e. the lining of the uterine cavity)

During the menstrual cycle the superficial layer of the endometrium undergoes changes to prepare for possible pregnancy, and these changes are termed the uterine cycle. These cyclical changes in the endometrium can be divided into three phases,

- (i) menstrual phase, (Figs.6-8, 6-12)
- (ii) proliferative phase, (Figs.6-9, 6-10, 6-12)
- (iii) secretory phase. (Figs.6-11, 6-12).

#### (a) Menstrual Phase:

During the menstrual phase the superficial layer of the endometrium is discharged as the menstrual flow, (menstruation).

#### (b) Proliferative Phase :

In the proliferative phase the endometrial cells proliferate stimulated by oestrogen from the growing follicle (ovum) in the ovary before ovulation, the thickness of the endometrium increases 3-5 fold.(1) The proliferative phase of the endometrium corresponds to the follicular phase of the cycle in the ovary (i.e. when the follicle is developing in the ovary).

#### (c) Secretory Phase:

After ovulation the glands in the endometrium become more complex in preparation for implantation of the fertilized ovum (secretory phase of the endometrium). This is due to stimulation from progesterone, secreted by the corpus luteum in the ovary. The secretory phase of the endometrium corresponds to the luteal phase of the cycle (i.e. when the corpus luteum is functioning in the ovary).

### Changes in the Uterine Cervix - Role of cervical mucus in achieving pregnancy (Fig. 6-8 to 6-12):

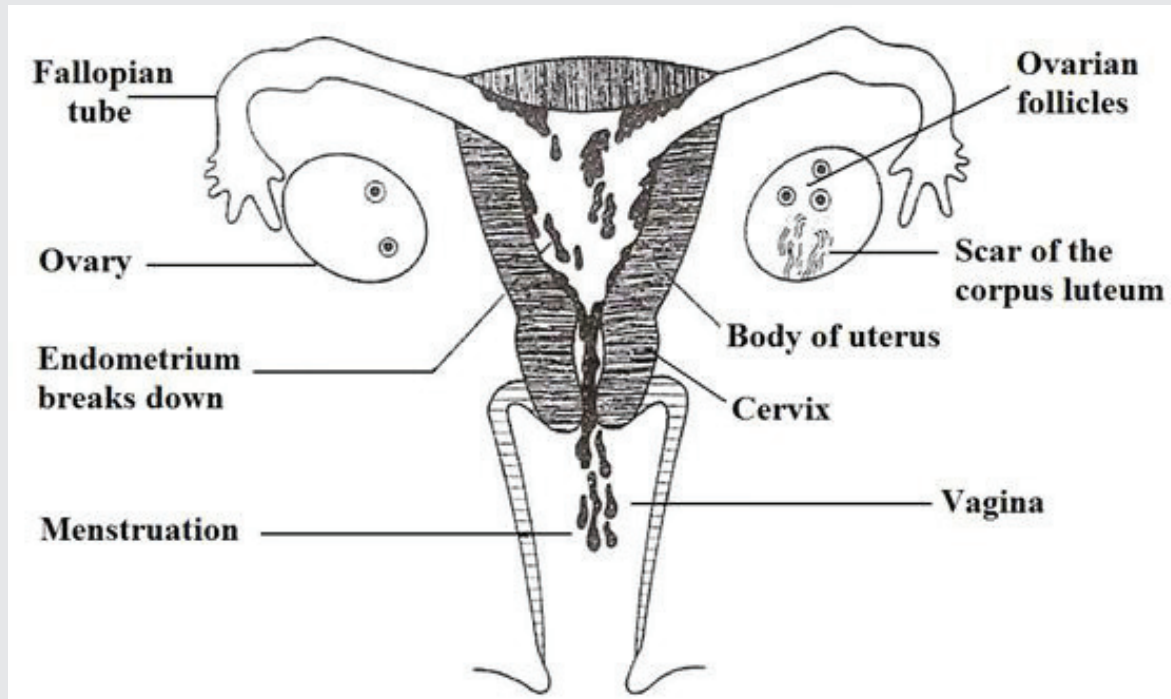
Pregnancy cannot occur without fertile-type cervical mucus. During the menstrual cycle the glands in the crypts of the cervix secrete fertile-type mucus due to the stimulation of oestrogen. Fertile-type mucus (S mucus) is essential to achieve pregnancy, as it aids sperm transport and survival. Cervical mucus is the most important fertility indicator as the discharge of mucus from the vagina can be observed by the woman herself and she knows that it is significant as it indicates that the ovum is developing in the ovary. The cervical mucus changes in quality and quantity during the mucus build-up for the six days or so leading up to ovulation. These changes from 'less-fertile' mucus to 'more-fertile' mucus can be observed by the woman as a change in sensation at the vulva and a change in appearance of the mucus itself.

### THE OVARY AND UTERUS DURING THE PHASES OF THE OVARIAN CYCLE: (menstrual phase, follicular phase, ovulation, luteal phase)

Menstrual Phase (Figure 6-8): Menstruation is the vaginal bleeding that occurs at the end of an ovulatory cycle when fertilization has not occurred, and is due to the drop in oestrogen and progesterone levels in the bloodstream. The first day of the menstrual cycle is the first day of the period, and the last day of the menstrual cycle is the day before the next period. During the cycle the endometrium undergoes changes to prepare for a possible pregnancy, at first from the action of oestrogen before ovulation, (proliferative phase) and after ovulation

due to progesterone, (secretory phase). Progesterone maintains the endometrium and when pregnancy does not occur the progesterone level falls causing the endometrium to be shed as the menstrual period. The menstrual bleeding lasts from 3 -5 days.

## Menstruation: Fig. 6-8

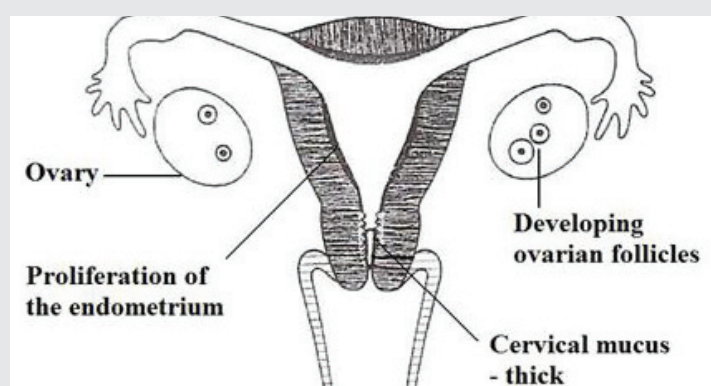


Menstruation is sloughing of the endometrium due to the drop in progesterone secondary to the demise of the corpus luteum. Day 1 of the period marks the beginning of a new cycle when the endometrium will be renewed in expectation of pregnancy in the new cycle. In the left ovary the atretic corpus luteum is shown as a 'scar'. Some recruited follicles in the ovary are at the pre-antral stage of development.

## Early Follicular Phase: (Fig. 6-9)

In the first few days of the cycle, oestrogen and progesterone levels are low allowing FSH from the pituitary gland to stimulate a few follicles in the ovary to grow.

Oestrogen from the growing follicles (a) stimulates proliferation of the endometrium to prepare for a possible pregnancy (proliferative phase of the endometrium), (b) oestrogen stimulates the cells in the crypts of the cervix to secrete mucus. The cervical mucus is observed by the woman as a change of sensation at the vulva from one of dryness to one of moistness. This change marks the beginning of the fertile phase of the cycle. The mucus initially is thick and opaque



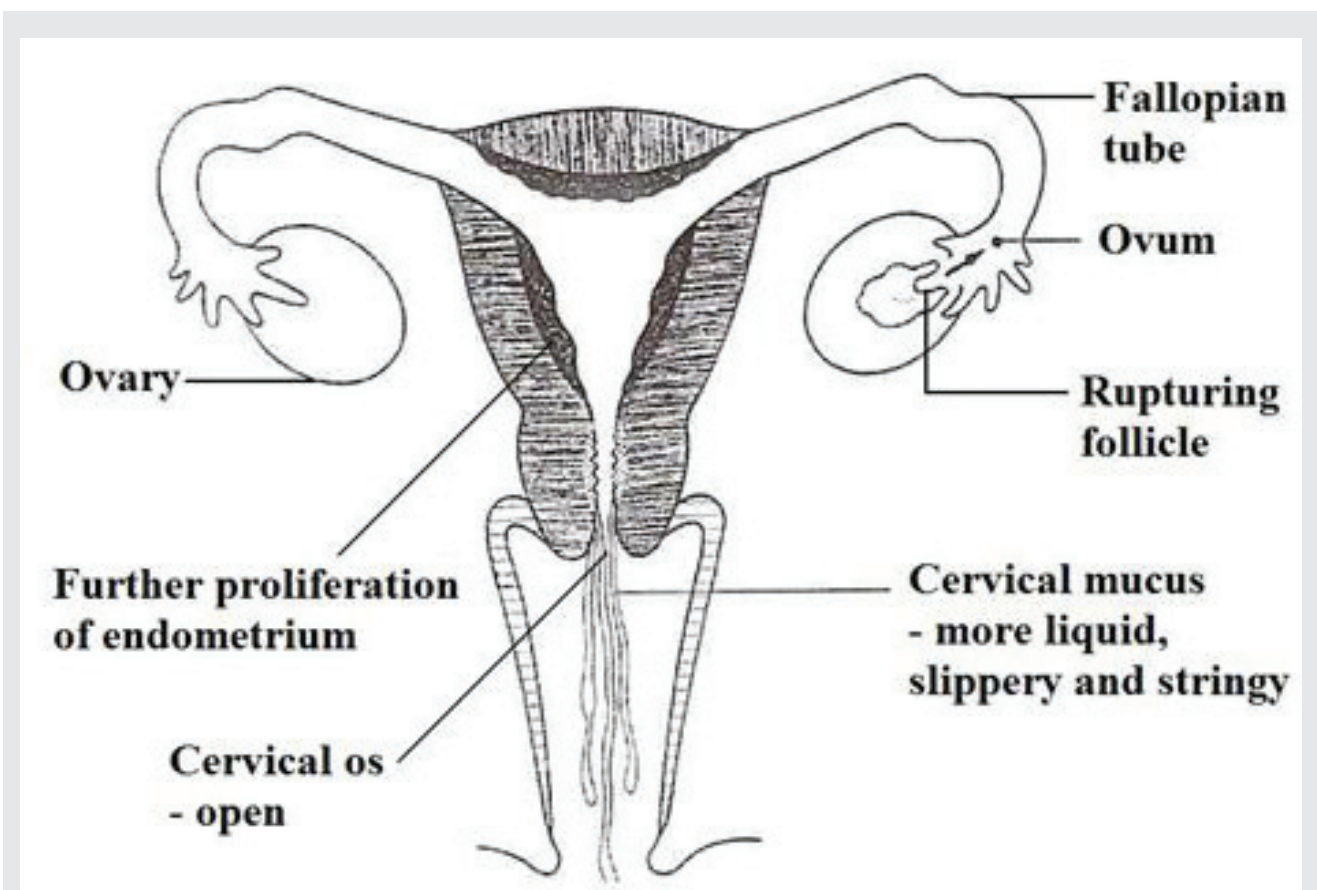
Early Follicular Phase Fig. 6-9: In the early part of the follicular phase FSH from the pituitary stimulates growth of a number of follicles in the ovary. The developing follicles secrete oestrogen which causes proliferation of the endometrium and the secretion of mucus [LINK to 11h for Fig. 11-12, L mucus], from the glands in the crypts of the cervix. The woman perceives the presence of the cervical mucus as a sensation of moistness at the vulva or sees a vaginal mucus discharge.

in appearance and breaks on stretching between the fingers - characteristics of 'less- fertile' mucus. The presence of cervical mucus whether it is the 'less-fertile' or the 'more-fertile' type indicates potential fertility.

### Late Follicular Phase and Ovulation: (Fig. 6-10)

In the ovary one of the developing follicles becomes dominant and continues to grow (Graafian follicle), and the other developing follicles become atretic (atrophy). The rising blood oestrogen level from the Graafian follicle stimulates (a) further growth of the endometrium, (b) the secretion of 'more-fertile' type mucus by the cervix so that the sensation at the vulva (the opening of the vagina), changes from one of moistness to one of lubrication or slipperiness.

The appearance of the mucus at the vulva changes from the 'less-fertile' thick, opaque mucus, to the 'more-fertile' mucus which is a clear, stretchy and looks like raw egg-white, (spinnbarkeit is the term used for the elasticity of mucus). The 'more-fertile' mucus transports and nourishes sperm and its presence is a sign of imminent ovulation, (c) high oestrogen stimulates luteinizing hormone (LH) secretion by the pituitary gland (LH surge) which lasts about 36 hours. LH triggers the rupture of the Graafian follicle and the release of the mature ovum into the outer end of the fallopian tube and this event is called ovulation (Fig. 6-10).



Late follicular phase and ovulation, Fig. 6-10 : In the late follicular phase one of the developing follicles becomes dominant and is called the Graafian follicle. The rising oestrogen level from the Graafian follicle causes further proliferation of the endometrium, the cervical mucus secretion becomes more fluid and has the characteristics of 'more-fertile' mucus.

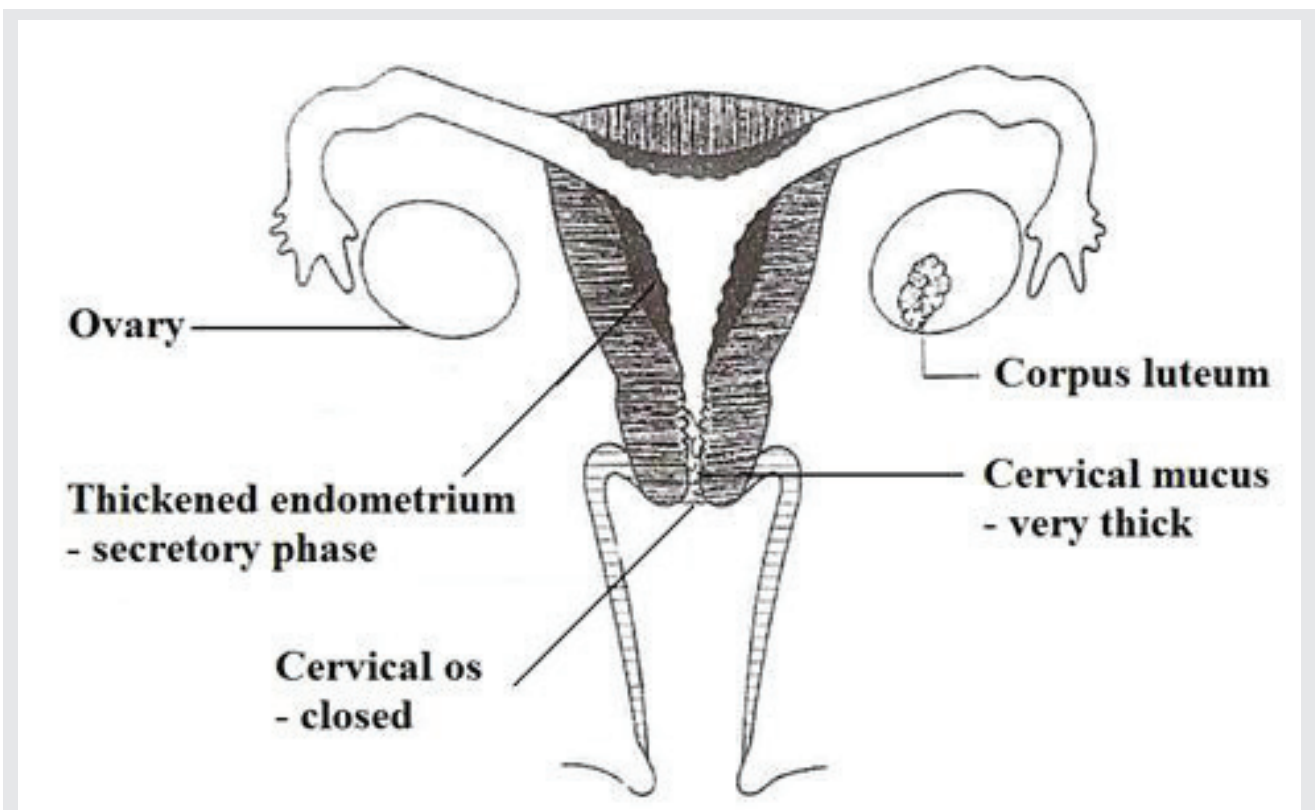
The woman perceives the presence of the 'more-fertile' mucus as a sensation of wetness or slipperiness at the vulva and/or sees a copious vaginal discharge of clear stretchy mucus. The high oestrogen level suppresses further FSH release from the pituitary and stimulates the LH surge from the pituitary which triggers the rupture of the Graafian follicle and the release of the ovum into the outer end of the fallopian tube, i.e. ovulation.



## Luteal Phase: (Fig. 6-11)

After ovulation, in the ovary the granulosa cells in the wall of the follicle become luteinized and secrete progesterone.<sup>2</sup> Progesterone causes (a) a decrease in the proliferation of the endometrium, the endometrial glands become more tortuous and glycogen accumulates in the cells as nourishment for the fertilized ovum,<sup>(1)</sup> (secretory phase of the endometrium), (b) Progesterone decreases the quantity and the elasticity of cervical mucus,<sup>(1)</sup> i.e. it causes the oestrogenic mucus discharge to dry up.

The woman observes a change in sensation at the vulva to one of dryness and there is no mucus discharge. Progesterone stimulates the secretion of gestogenic G mucus which occludes the cervical canal, (c) Progesterone causes a rise in the basal body temperature which is a sign the ovulation has occurred.



Luteal phase, Fig. 6-11: After ovulation, during the luteal phase in the ovary the wall of the ruptured follicle with its granulosa cells becomes the corpus luteum which secretes progesterone. The progesterone from the corpus luteum prepares the endometrium for implantation of a conceptus, (secretory phase of the endometrium). Progesterone stimulates the crypts in the cervix to secrete G mucus which is thick and occludes the cervical canal. The cervical os is closed. The woman perceives a sensation of dryness at the vulva and there is no vaginal discharge. Progesterone raises body temperature and is one of the fertility indicators of ovulation.

## Summary of changes in the uterus and ovary during the cycle: (Fig.6-12)

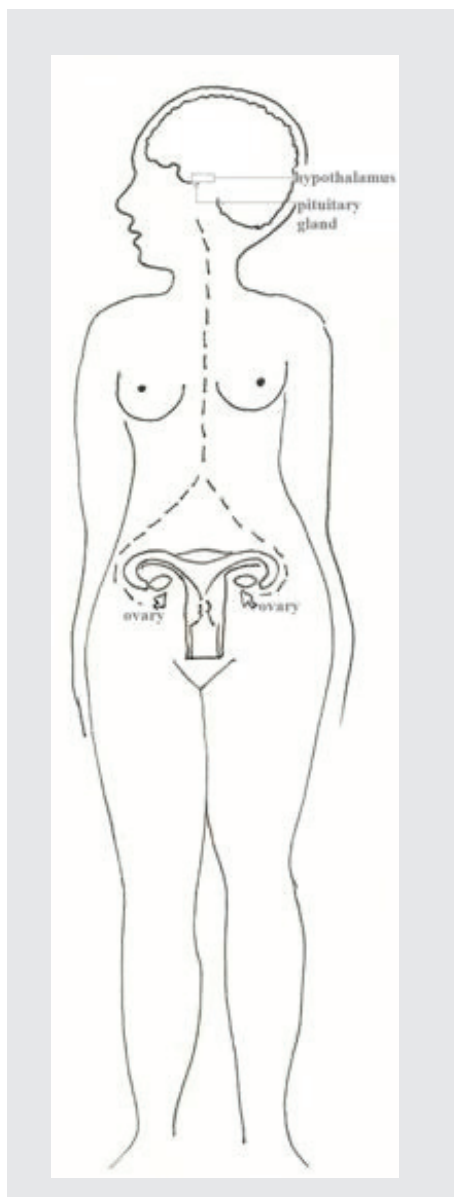
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|  | <p style="text-align: center;"><b>Menstruation</b></p> <p>The first day of the menstrual period is day 1 of the cycle. Progesterone maintains the lining of the uterus (endometrium); when the blood progesterone level falls, (because pregnancy has not occurred), the lining of the uterus is no longer maintained and is shed as menstruation.</p>   |
|  | <p style="text-align: center;"><b>Early follicular phase / Relatively infertile phase</b></p> <p>Oestrogen from the maturing follicle causes: (a) proliferation of the endometrium and (b) secretion of cervical mucus which causes the 'dry' sensation at the vulva to change to a sensation of 'moistness', <i>less fertile-type</i> mucus is observed at the vulva.</p>   |
|  | <p style="text-align: center;"><b>Fertile phase / Ovulation</b></p> <p>The rising oestrogen from the Graafian follicle (mature follicle) causes: (a) further proliferation of the endometrium; (b) the '<i>more-fertile-type</i>' mucus is now present; (c) the cervical os is open; (d) oestrogen stimulates LH release from the pituitary gland which triggers rupture of the Graafian follicle and release of the mature ovum into the outer end of the fallopian tube (ovulation).</p>   |
|  | <p style="text-align: center;"><b>Luteal phase</b></p> <p>Progesterone from the corpus luteum causes (a) the secretory phase in the endometrium; (b) the cervical mucus becomes thick and occludes the cervical canal; (c) the cervical os is closed; (d) the basal body temperature (BBT) is raised.</p> <p>When the progesterone level falls the endometrium is shed as menstruation. The last day of the cycle is the day before the next menstrual period.</p> <p style="text-align: center;"><b>MENSTRUATION / NEW CYCLE BEGINS</b></p> |

### References:

Griffin JE, Ojeda SR; 'Textbook of Endocrine Physiology 3rd Edition, 1996, pgs 171,172; Oxford University Press, ISBN 0-19-510755-1 (pbk)

Mansfield MJ, Emans SJ; 'Anorexia nervosa, athletics, and amenorrhea'; Ped. Clinics of North America; Vol 36, No 3, June 1989, 533-549

## THE HPO Axis



THE HPO AXIS (Hypothalamic-Pituitary-Ovarian axis; H-P-O axis; hormonal control of the menstrual cycle)/ feedback mechanism :

The events of the menstrual cycle are controlled by an interplay of five hormones secreted by three organs and known as the hypothalamic-pituitary- ovarian-axis, (H-P-O axis). (Fig. 6-6).

**The three organs are:**

- (i) the hypothalamus at the base of the brain which secretes gonadotropic releasing hormone (GnRH),
- (ii) a tiny gland called the pituitary gland just below the hypothalamus which secretes follicle stimulating hormone (FSH) and luteinizing hormone (LH),
- (iii) the ovary which secretes the steroid hormones oestrogen and progesterone.

The interplay of hormones in the HPO axis is regulated by a feedback mechanism.

**The HPO Axis Fig. 6-6: The three organs of the H-P-O axis are the hypothalamus at the base of the brain, the pituitary gland just below it and the ovaries, one on each side of the pelvis.**

**Feedback Mechanism – role of the hypothalamus and pituitary gland(Fig. 6-7) :**

The gonadotropin hormones **FSH** and **LH** are secreted by the pituitary gland. FSH is necessary for the development of the immature ovum, (i.e. the primordial follicle in the ovary), and LH triggers ovulation. The secretion of FSH and LH

from the pituitary gland is under the control of gonadotropin releasing hormone (GnRH) from the hypothalamus, and the hypothalamus in turn is controlled by the levels of the ovarian steroid hormones oestrogen and progesterone in the blood by means a feedback mechanism. The hypothalamus may also be affected by external factors e.g. stress.

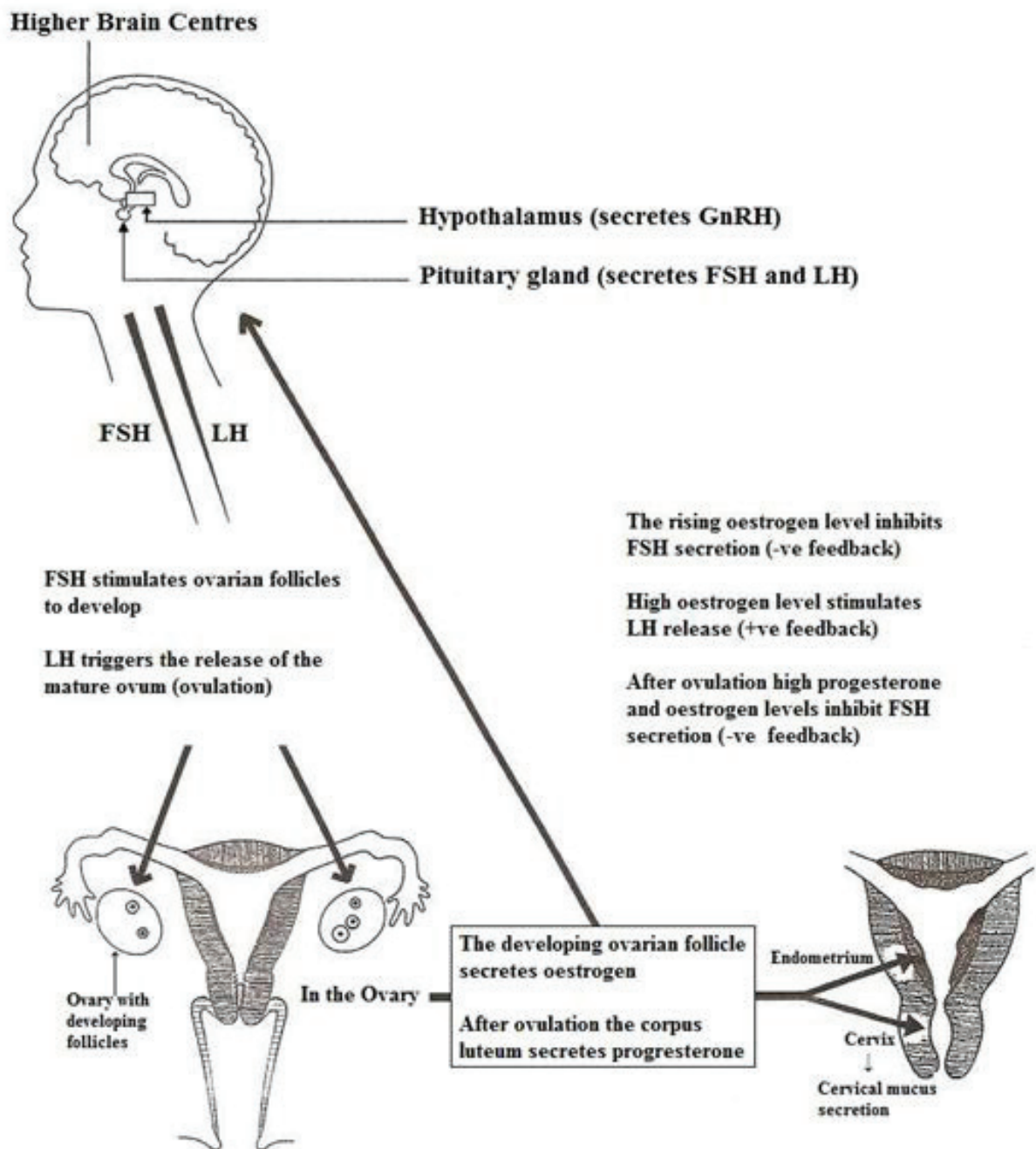
### Hormone Regulation

The hypothalamic-pituitary-ovarian axis (HPO axis) and feedback mechanism, Fig. 6-7: As oestrogen and progesterone levels are low at the beginning of the cycle this allows follicle stimulating hormone (FSH) to be released from the pituitary gland under the stimulation of Gonadotropin Releasing Hormone (GnRH) from the hypothalamus. FSH stimulates a number of ovarian follicles to develop. The growing follicles in the ovary secrete oestrogen which causes proliferation of the endometrium (proliferative phase of the endometrium), and secretion of cervical mucus. The rising oestrogen from the developing follicles suppresses FSH secretion in order to inhibit development of any new follicles, (negative

feedback mechanism). By day 7 of an average 28 day cycle one of the developing follicles becomes dominant (Graafian follicle), and the others regress. The high oestrogen from the dominant follicle stimulates the secretion of luteinizing hormone (LH) surge from the pituitary (positive feedback) which triggers ovulation. After ovulation the ruptured follicle become the corpus luteum which secretes progesterone and oestrogen. Progesterone stimulates further development of the endometrium to prepare for possible pregnancy, (secretory phase of the endometrium), and stimulates the glands in the cervical crypts to secrete gestogenic G mucus which occludes the cervical canal. The high progesterone and oestrogen levels in the luteal

## Regulation of Hormones

(Feedback Mechanism)



phase suppress FSH secretion (negative feedback). If pregnancy does not occur the corpus luteum regresses 14 days after ovulation and the drop in progesterone causes sloughing of the endometrium (menstruation). The low oestrogen and progesterone at the beginning of the cycle allows the suppression of FSH to be lifted and a new cycle begins.

## **THE FEEDBACK MECHANISM – ROLE OF THE OVARY (Fig. 6-7)**

### **BEFORE OVULATION:**

At the end of the menstrual cycle just before menstruation begins, oestrogen and progesterone are both at a low level allowing FSH secretion from the pituitary to rise. FSH stimulates some follicles (immature ova) in the ovary to develop and they secrete oestrogen. The rising oestrogen level from the developing follicles then suppresses FSH secretion by negative feedback mechanism on the pituitary gland in order to inhibit the development of more follicles. By day 7 of an average 28 day cycle one follicle becomes dominant and continues to grow and is called the Graafian follicle. When oestrogen reaches a high level it stimulates the release of LH (the LH surge) by a positive feedback mechanism on the pituitary gland and LH triggers ovulation.

### **AFTER OVULATION:**

After ovulation, (luteal phase), the granulosa cells in the wall of the ruptured follicle in the ovary become the corpus luteum. During the luteal phase of the cycle, the corpus luteum secretes progesterone and oestrogen which suppress the secretion of FSH by a negative feedback mechanism on the pituitary so that no further ovulation can occur in that cycle, (Fig. 6-7). Progesterone, which maintains the endometrium, is at its highest level seven days after ovulation. If fertilization has not occurred the corpus luteum then starts to regress causing the progesterone level to fall. The drop in progesterone to a critical low level has two effects; (a) the endometrium is no longer maintained and is shed as menstruation about 14 days after ovulation, (b) the suppression of FSH secretion is lifted and a new cycle begins.

**To be most effective, the woman must be taught the Symptothermal Double-Check Method of Natural Family Planning by a qualified natural family planning teacher.**

## The Menstrual Cycle: more detail

The menstrual cycle is the cycle of the woman's fertility which occurs each month during her child-bearing years, the most obvious sign being menstruation.

The two objectives of the menstrual cycle are (a) development of the immature ovum and (b) development of the lining of the womb (endometrium):

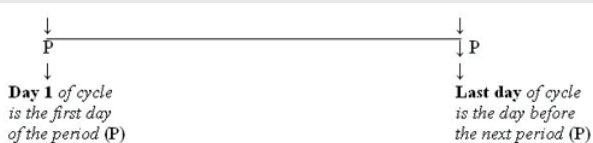
**(a)** During each menstrual cycle an immature ovum (follicle, egg) develops and is released as a mature ovum into the fallopian tube ready to be fertilised, (ovulation). Ovulation usually occurs about 14 days before the next menstrual period and the ovum lives for 24 hours.

**(b)** The first day of the cycle is the first day of the period, and when the menstrual period has finished the lining of the womb (endometrium) starts to develop again, at the same time as the ovum is maturing in the ovary. This is to prepare the endometrium for possible pregnancy in order to nourish the fertilised ovum after it has implanted in the uterus. However if fertilisation does not occur the lining of the womb is shed as menstruation about 14 (10-16) days after ovulation.

**Details of the menstrual cycle are outlined on diagrams under the following headings:**

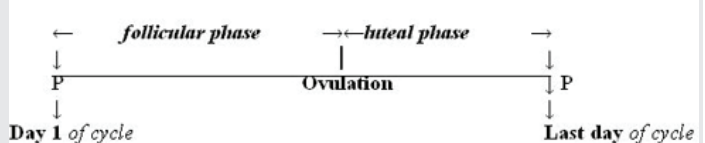
- The length of the cycle: Fig. 6-1
- How many phases in the menstrual cycle: Fig. 6-2
- When does ovulation occur? - are the follicular and luteal phases of the cycle the same length? Fig. 6-3
- Hormone secretion by the growing ovarian follicle and corpus luteum in the ovary during the cycle: Fig. 6-4
- Overview of the phases of the cycle: Fig. 6-5
- The length of the cycle Fig. 6-1

### Length of the cycle: Fig. 6-1



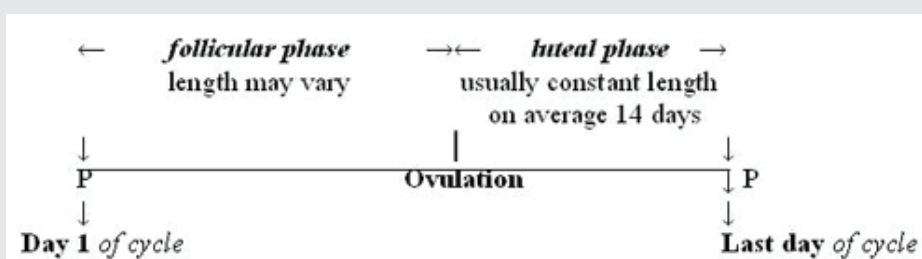
The length of the menstrual cycle Fig. 6-1: By convention Day 1 of the cycle is the first day of the menstrual period, and the last day of the cycle is the day before the next menstrual period. The length of the cycle can vary from 21-35 days, and is on average 28 days.

### How many phases in the cycle: Fig. 6-2



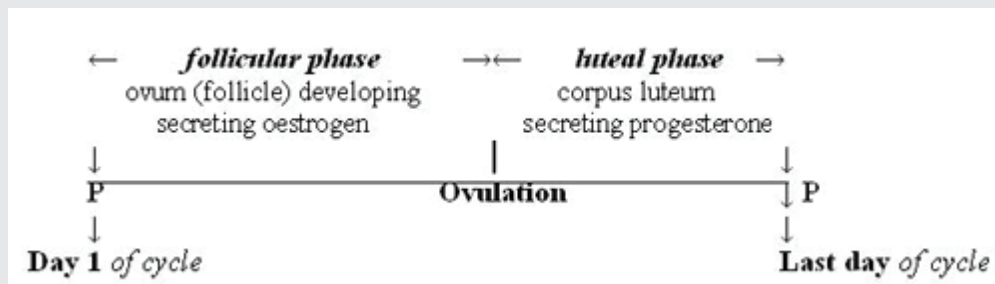
The phases of the menstrual cycle Fig. 6-2: The menstrual cycle is divided into two phases by ovulation (the release of the ovum): (a) the follicular phase when the ovum is maturing before ovulation and (b) the luteal phase after ovulation.

### When is ovulation; are the follicular and luteal phases the same length? Fig. 6-3



Does ovulation occur at the same time in every cycle; are the two phases of the cycle equal in length? Fig. 6-3: The day of ovulation is not fixed in the middle of the cycle but can vary from one cycle to another. It usually occurs about 14 days before the next period. This is because the luteal phase after ovulation has a relatively constant length of 14 days, (range 10-16 days). [e.g. If the cycle length is 30 days, ovulation probably occurred on Day 16 of the cycle (30 minus 14 = 16), and if the cycle length is 25 days, ovulation would probably have occurred on Day 11 of the cycle, (25 minus 14 = 11)]. This means that if the woman's menstrual cycle is longer or shorter than usual it is the change in length of the follicular phase which causes the longer or shorter cycle.

### Hormone secretion in the ovary during the cycle: (Fig. 6-4)



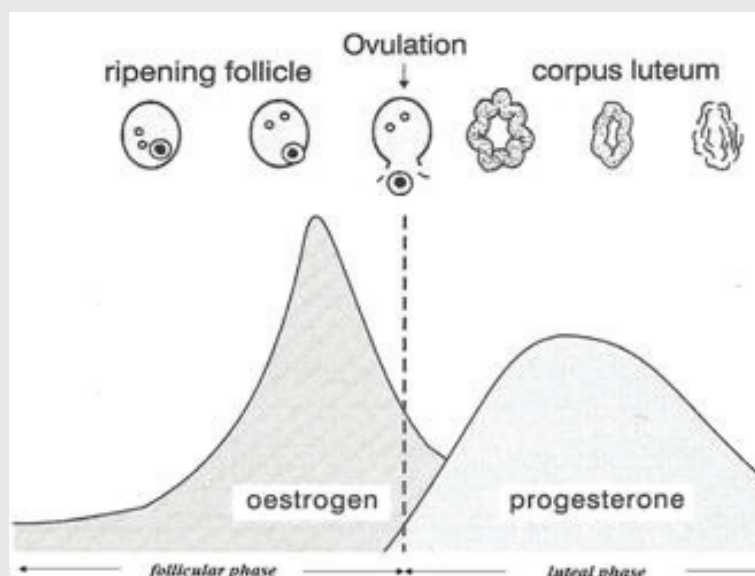
Hormone secretion in the ovary during the phases of the cycle Figure 6-4: During the menstrual cycle two steroid hormones are secreted in the ovary; oestrogen by the growing follicle before ovulation and after ovulation progesterone is secreted by the corpus luteum.

### OVERVIEW OF THE PHASES OF THE MENSTRUAL CYCLE (Fig. 6-5)

#### The two phases of the menstrual cycle, follicular and luteal, are separated by ovulation.

Follicular Phase (Pre-ovulatory phase): The cycle begins when the pituitary gland releases follicle stimulating hormone (FSH) into the bloodstream. This stimulates a few primordial follicles containing the immature ova in the ovaries to grow, hence the term follicular phase. One follicle continues to grow, becomes dominant, and the others regress. The mature follicle is called the Graafian follicle and consists of the ovum surrounded by follicular fluid. The growing follicle secretes oestrogen, which (a) stimulates the endometrium to grow and

Overview of the phases of the cycle Fig. 6-5:  
 There are a few ripening follicles in the ovary and one becomes dominant, and is released as a mature ovum at ovulation.  
 In the follicular phase of the cycle the oestrogen level in the blood rises as it is secreted by the developing follicle in the ovary before ovulation. When the oestrogen level is high it stimulates the secretion of luteinizing hormone (LH surge) from the pituitary gland (not shown). LH stimulates the mature follicle (Graafian follicle) in the ovary to rupture and the ovum is released into the fallopian tube (ovulation). (LINK to H-P-O Axis, Fig. 6-7 6b) (LINK to Fig. 6-10 ovulation). In the luteal phase of the cycle after ovulation the progesterone level in the blood is high as it is secreted by the corpus luteum. (the corpus luteum alone and not the ovary is shown in the diagram). (Fig. 6-5 from the Fertility Education Trust UK, 2003, is used with the kind permission of Wyn Worthington).



(b) stimulates the glands of the cervix to secrete mucus necessary for sperm transport and survival.

**OVULATION:** When the Graafian follicle has reached its maximum size it ruptures, releasing the mature ovum into the outer end of the fallopian tube. This event is called ovulation (LINK to 6e for Fig. 6-16 ovulation) and is triggered by the luteinizing hormone (LH surge) from the pituitary gland. The ovum lives for just 24 hours after it is released. Fertilization takes place in the outer end of the fallopian tube and implantation occurs seven days later in the endometrium.

**LUTEAL PHASE (post-ovulatory phase):** After ovulation the ruptured follicle in the ovary becomes a small gland called the corpus luteum (yellow body) which secretes both progesterone and oestrogen. Progesterone maintains the integrity of the endometrium. The corpus luteum has a finite life of about 14 days and this means that the luteal phase has a relatively constant length of 14 days, (range 10-16 days). Progesterone reaches its highest level seven days after ovulation and if the ovum has not been fertilized the corpus luteum will then start to regress causing a marked drop in progesterone level. Following this the endometrium can no longer be maintained and is shed as menstruation about 14 days after ovulation. A new cycle then begins.

**To be most effective, the woman must be taught the Symptothermal Double-Check Method of Natural Family Planning by a qualified natural family planning teacher.**

