

Unit 8:

The reproductive system



1. The reproduction function

2. The reproductive system

- 2.1. The male reproductive system
- 2.2. The female reproductive system

3. Physiology of reproduction

- 3.1. Formation of gametes
- 3.2. The female reproductive cycles
- 3.3. Fertilisation
- 3.4. Gestation
- 3.5. Childbirth

Think and answer?

- a. What does it mean that human reproduction is sexual?
- b. What is the difference between ovum or spermatozoon and other types of body's cells?
- c. What is menstruation?
- d. What is the role of placenta during pregnancy?

UNIT OBJECTIVES

In this unit you will learn:

- The anatomy of the male and female reproductive systems.
- The processes of producing gametes.
- To relate the processes of the maturation of ova and the changes in the uterus.
- To distinguish among fertilisation, gestation and childbirth.
- To appreciate the importance of healthy habits related to the reproductive system.
- The main diseases of the reproductive systems.

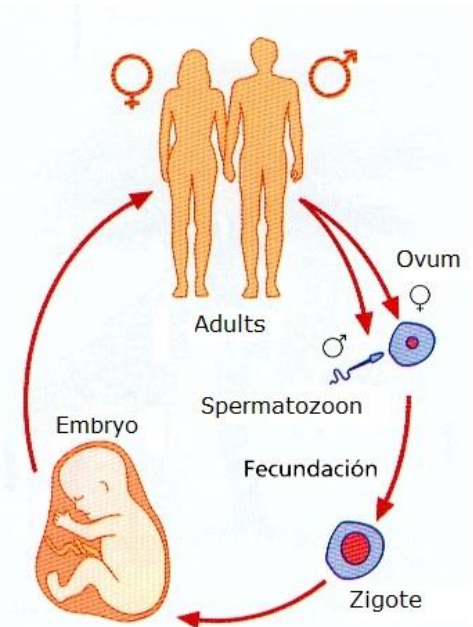
1. The reproduction function

The reproduction function is the set of processes that allow living beings to produce offspring. It is essential to ensure the survival of the species, so that new individual will replace those who die.

Human reproduction is **sexual**. That means that to perpetuate our species, it is necessary for two individuals of different sex, male and female, to take part. Each of them produces a type of reproductive cell or gamete.

Reproduction involves five processes:

- **Gametogenesis**. This is the process of forming gametes (ovum and spermatozoon). This formation takes place in the gonads, specialised male (testicles) and female organs (ovaries).
- **Fertilisation**. This is the joining of two gametes (an ovum and a spermatozoon) and the formation of the first cell of the new individual (zygote). Fertilisation is **internal**: it takes place inside the female reproductive system.
- **Embryo development**. Cell division increases the number of cells that make up the zygote, which becomes an embryo. We are **viviparous**. This means that the embryo continues developing inside the woman's uterus and becomes a foetus (gestation).
- **Childbirth**. This is the birth of the baby. Human beings are live-bearing. The baby is born alive and fully formed.
- **Development**. The baby grows and reaches maturity. This process covers several stages from birth to adulthood.



a) The beginning of reproductive life

When a baby is born, its reproductive organs are already formed. These reproductive organs are called the **primary sexual characteristics**.

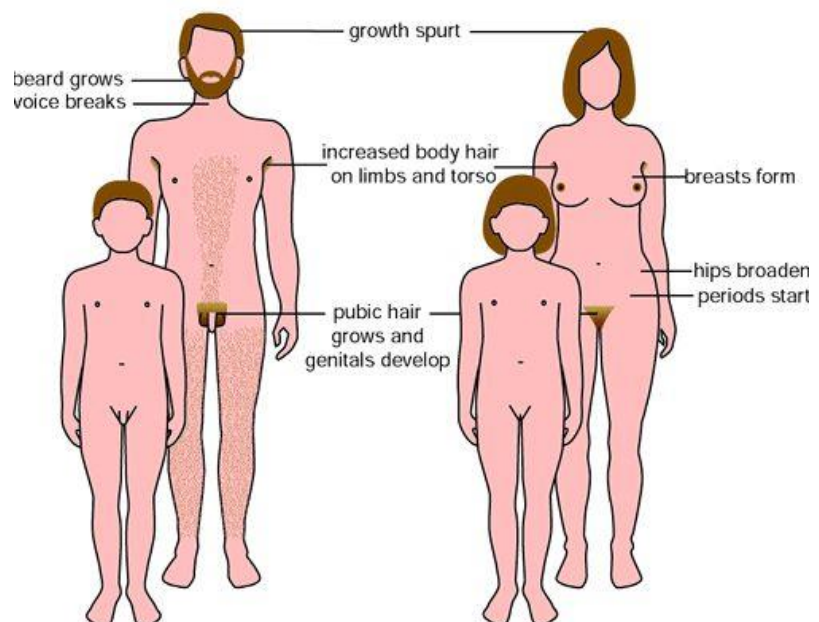
However for people to reproduce, these organs must mature and produce sex cells. This stage is known as **puberty**.

- In girls, it starts at around 10 to 13 years of age.
- In boys, it starts at around 12 to 14 years of age.

During puberty, the body matures sexually. The reproductive organs begin to produce sexual hormones. These hormones cause **secondary sexual characteristics** to develop:

- In girls, breasts and external genitalia develop. Hips widen and pubic and underarm hair grows.
- In boys, bones thicken and muscles grow. Voice deepens, pubic and underarm hair grows.
Hair grows on face and chest.

Adolescence extends from puberty to adulthood. During this stage, physical maturity is accompanied by psychological and social changes. Sexual desire appears. We feel the need to explore our body and we need the support of our friends. We also begin to question decisions made by the adults around us.



b) The end of reproductive life

Men produce spermatozoa throughout almost their whole life, although the quantity and quality of these gametes decrease gradually after 50 years of age.

Women, on the other hand, stop ovulating and therefore menstruating at between 45 and 50 years of age. This period is known as **menopause**.

ACTIVITIES

1.1. Explain the meaning of these sentences:

- a. Human reproduction is sexual
- b. Human fertilisation is internal
- c. Human embryonic development is viviparous

1.2. Listen and complete this text:

Psychological changes

*During, teens experience increases in both physical and psychological
This involves changes, as levels increase, changes occur
affecting and personality.*

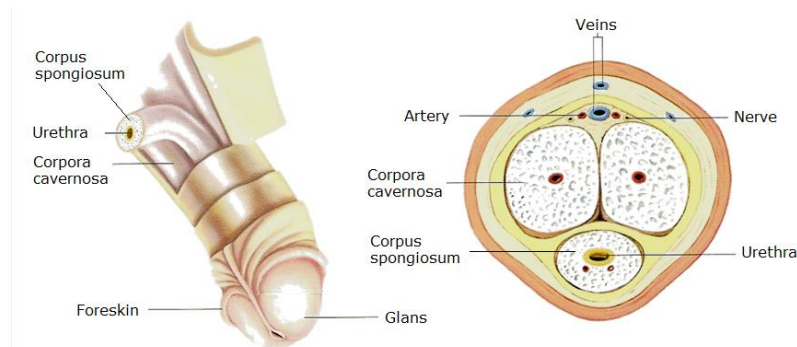
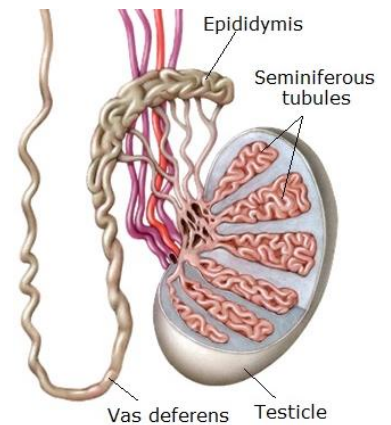
*These are responsible for the adolescent drive for, which often leads to
..... with adults as adolescents reaffirm their*

2. The reproductive system

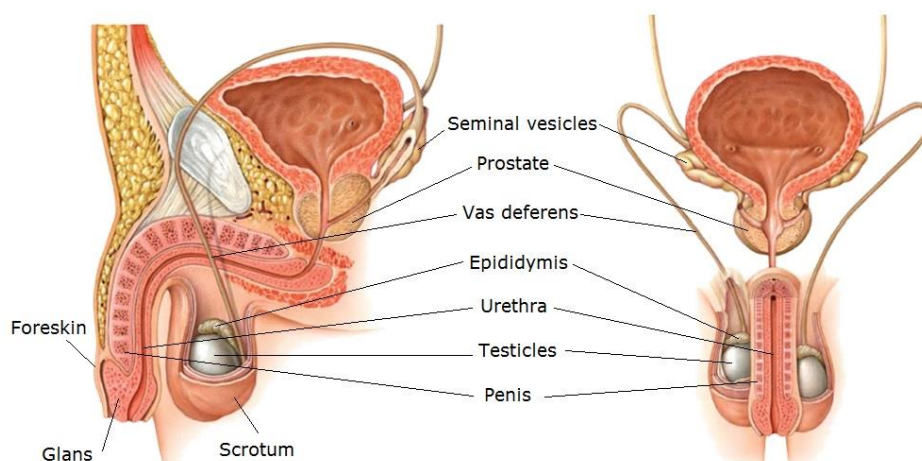
2.1. The male reproductive system

The organs of the male reproductive system are:

- **Testicles.** They are the male gonads. They have the size and shape of an egg. These organs are made up of numerous coiled **seminiferous tubules** that produce spermatozoa and male sexual hormones. They are located outside the abdominal cavity covered by a pouch of skin called the **scrotum**.
- **Reproductive tracts.** They are the tubules that sperm flows through on its way out of the body. They are:
 - **Epididymis.** This tubule is where spermatozoa mature. It is connected to the testicle.
 - **Vasa deferentia.** Long tube which connect the epididymis to the urethra. Spermatozoa are stored here.
 - **Urethra.** A tube used for urination and ejaculation. It extends inside the penis.
- **Penis.** This is the male copulatory organ. It is made up of two spongy masses of erectile tissue (**corpora cavernosa**) located above the urethra. The urethra is surrounded by the **corpus spongiosum**. Its end, called the **glans** is very sensitive and it is covered by a fold of protective skin, the **foreskin**. When the blood vessels dilate, the penis fills with blood and becomes erect.



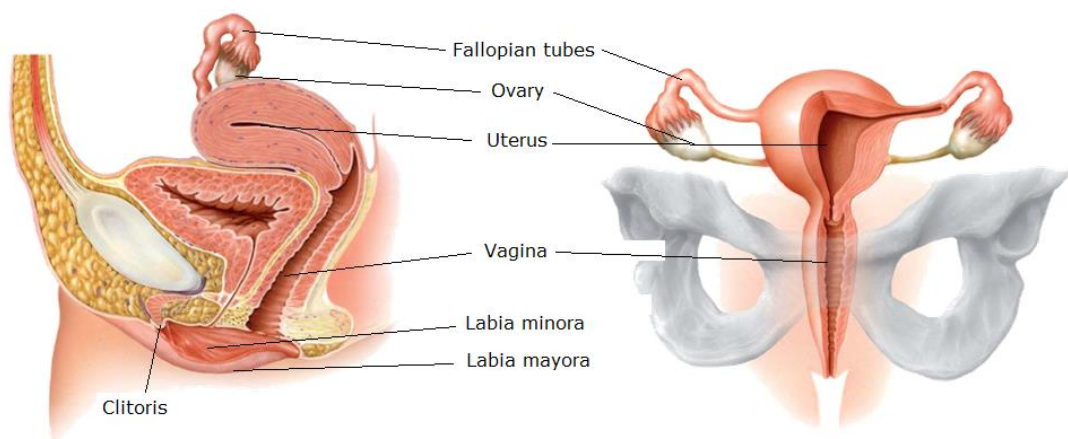
- **Accessory glands.** These glands secrete substances which mix with spermatozoa to form semen. Semen is the mixture of spermatozoa (10%) with seminal and prostatic fluids.
 - **Seminal vesicles.** Glands that produce **seminal fluid** which feeds and transports spermatozoa. They are connected to the vas deferens.
 - **Prostate.** A gland that surrounds the urethra and secretes **prostatic fluid** which contains substances that protect and stimulates the movement of the sperm.
 - **Cowper's glands.** Glands that secrete a mucous substance that facilitates the penetration.



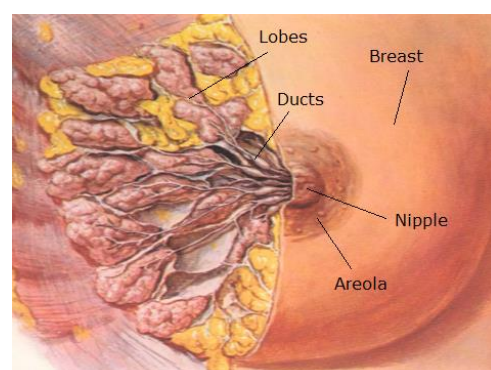
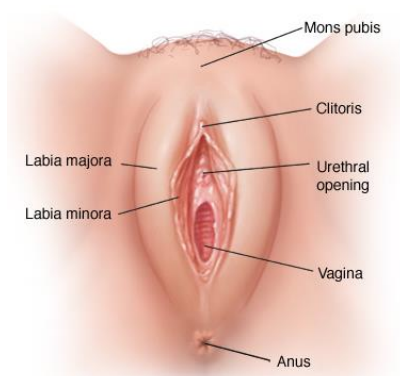
2.2. The female reproductive system

The female reproductive system consists of:

- **Ovaries.** They are the female gonads. They are located inside the abdominal cavity. They are the shape and size of an almond. They produce the ova and the female sexual hormones.
- **Reproductive tracts:** Tubules in which the gametes circulate.
 - **Fallopian tubes.** They are two tubes that connect the ovaries and the uterus. The end that faces the ovary is wider and has projections. It receives the ovum released from the ovary. Their lumen is lined by ciliated epithelia which vibrations move the ovum towards the uterus.
 - **Uterus (womb).** This hollow, pear-shaped organ has thick muscular walls (myometrium) covered with a mucosa (endometrium). The cervix, or neck of the uterus, connects the uterus with the vagina. It supports the foetus during the pregnancy.
 - **Vagina.** This is the female organ for copulation. Their walls are elastic and muscular and produce lubricant to facilitate penetration. At its mouth there are mucous glands (**Bartholin's glands**) that lubricate the external genitalia. It opens through the vaginal orifice located between the urethra and the anus.



- **Vulva.** These organs are external.
 - **Labia majora.** These two folds of skin either side of the vaginal orifice cover the other external genitalia.
 - **Labia minora.** These two folds of skin are located inside the labia majora.
 - **Clitoris.** It is a small very sensitive erectile organ. It is located where the labia minora join at the front.
- **Mammary glands.** The two mammary glands produce milk when a baby is born.



ACTIVITIES**2.1. Indicate the function of these parts of the male reproductive system:**

- a. Seminiferous tubules
- b. Epididymis
- c. Prostate
- d. Foreskin

2.2. Listen and indicate which part of the male reproductive system is described:**2.3. Indicate the functions of these parts of the female reproductive system:**

- a. Labia majora
- b. Ovaries
- c. Uterus
- d. Bartholin's glands

2.4. Listen and indicate which part of the female reproductive system is described:

3. Physiology of reproduction

3.1. Formation of gametes

Gametes are formed by a process called **gametogenesis**. This process takes place in **gonads** (ovaries and testicles). Gametes form from **germ cells** which like other human cells have 46 chromosomes. However when gametes are formed the number of chromosomes is halved through a special type of cell division called **meiosis**. The resulting cells therefore only have 23 chromosomes.

a) Spermatogenesis

This is the male gametogenesis. It takes place in the walls of the **seminiferous tubules** of the **testicles**.

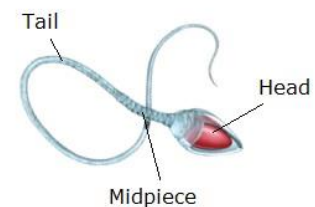
The process takes about two months and after puberty it occurs continuously throughout the man's lifetime. Spermatozoa are produced in large quantities (millions) each day.

After meiosis the cells become spermatozoa, male gametes, through a process of cellular specialisation during which they change their shape.

- They reduce their volume
- The organelles disappear except the nucleus and the acrosome.
- The flagellum develops.

A spermatozoon has three parts:

- **Head**. This contains the nucleus (genetic material) and the acrosome (organelle that contains digestive enzymes to dissolve the outer layer of the ovum)
- **Midpiece**. This part is located between the head and the tail. It contains lots of mitochondria that provide the energy required to move the flagellum.
- **Tail**. It is a flagellum which enables the spermatozoon to move.



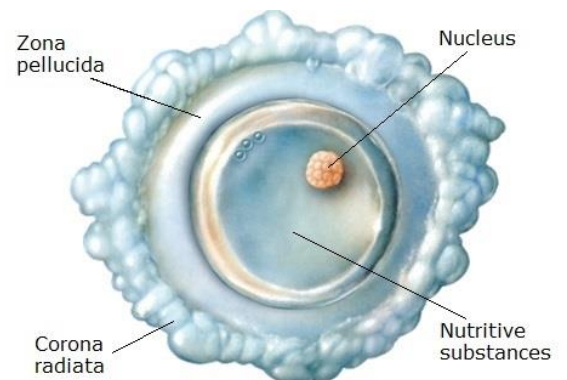
b) Oogenesis

This is the female gametogenesis. It takes place in **ovaries**, inside structures called **follicles**.

After puberty, oogenesis takes place regularly in woman, approximately every 28 days. An ovum develops, matures and is released each time.

As spermatozoa, ova changes after meiosis to become a specialised cell. Its size increases because of the accumulation of **nutritive substances** which will be the support of the embryo during the first few days after fertilisation.

In addition, ovum is covered by two protective layers: the **zona pellucida** (mucous substance) and the **corona radiata** (remains of follicular cells).



ACTIVITIES

3.1. Answer these questions:

- a. How do ovum and spermatozoon differ?
- b. What are the differences between the production of male and female gametes?

3.2. The female reproductive cycles

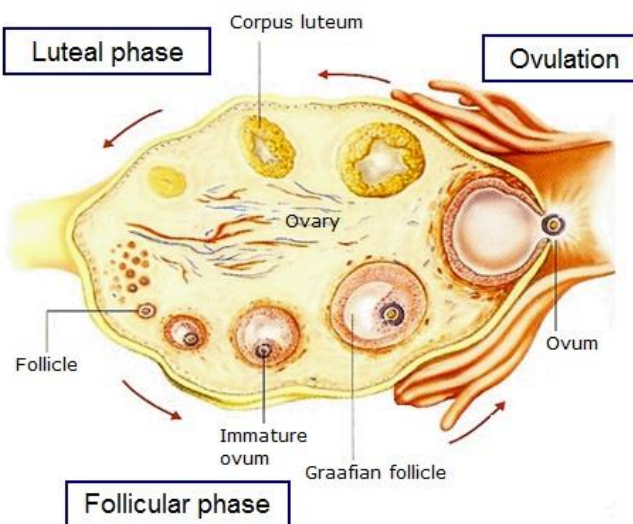
The **female reproductive cycle** lasts 28 days and involves periodic changes in the sex organs. These changes are caused by hormones produced by the hypophysis and the ovaries. Changes occur simultaneously in the ovaries and in the uterus.

- **Ovarian cycle.** Set of changes in the ovaries are caused by hypophysis hormones, FSH (follicle stimulating hormone) and LH (luteinising hormone).
- **Uterine or menstrual cycle.** Set of changes in the endometrium of the uterus are caused by oestrogens and progesterone produced by the ovaries.

a) Ovarian cycle

It involves three stages:

Follicular phase	Ovulation	Luteal phase
It lasts around 14 days. It is caused by FSH. One follicle starts to develop.	It occurs when ovum is mature. It is caused by LH. Ovum is released to the Fallopian tubule.	It lasts around 10 or 12 days. It is caused by the follicle that has change into the corpus luteum and secretes progesterone. This phase finishes when the corpus luteum stops to produce hormone.



b) Uterine or menstrual cycle

It refers to all the periodical changes that take place in woman’s sex organs. The aim of the cycle is to prepare the uterus for implantation of an embryo if the ovum is fertilized. This cycle involves three stages.

- Menstrual phase or period

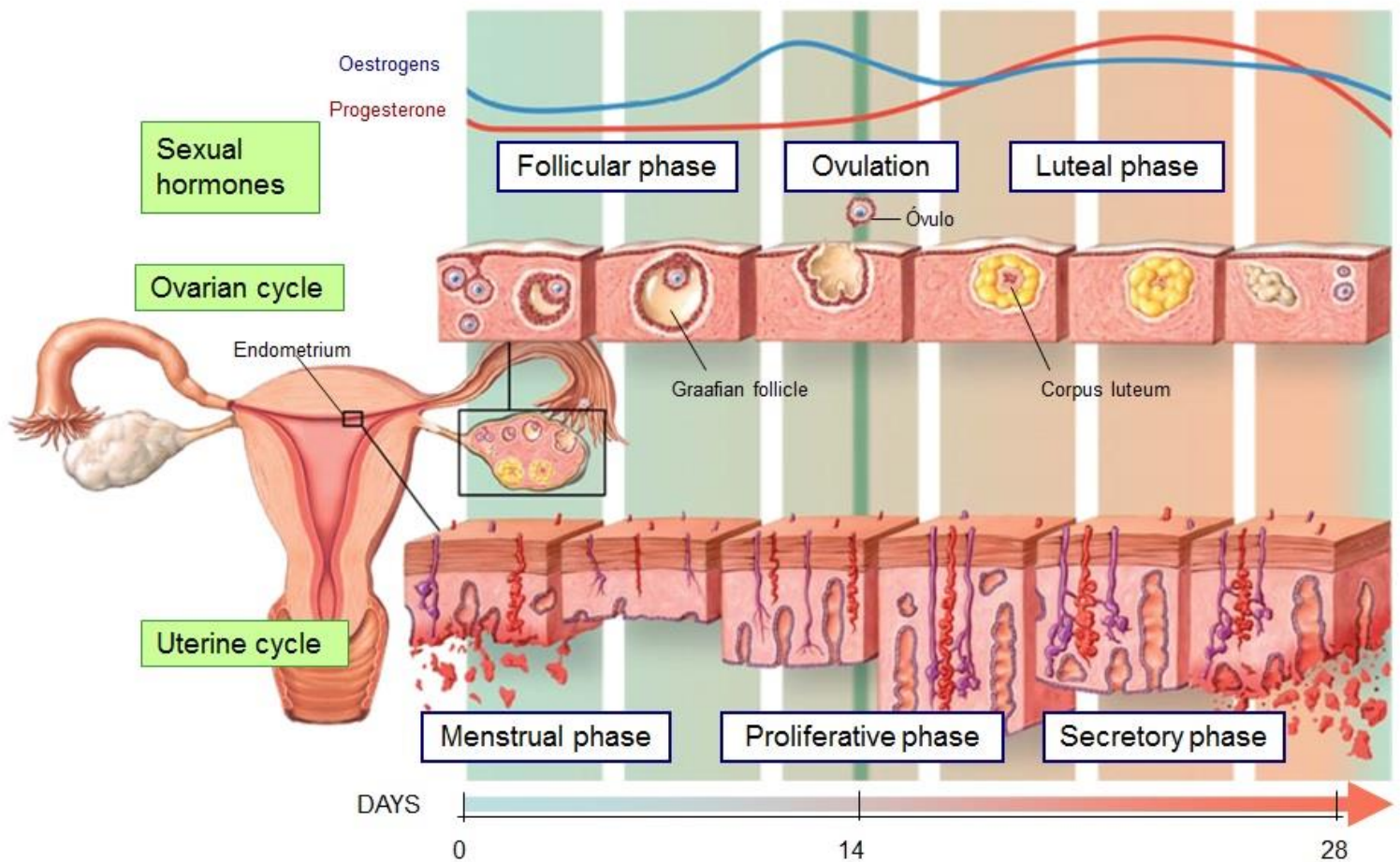
It is caused by the sharp decrease in the amount of hormones produced by the ovaries. As a result, the mucosa of the uterus which is now very thick and highly vascularised is shed and expelled from the body via vagina along with haemorrhage. This phase usually lasts between 4 and 5 days.

- Proliferative phase

The uterine lining is rebuilt thanks to the oestrogens produced by the ovaries. This phase lasts about 11 days.

- Secretory phase

The uterine lining reaches its maximum thickness and gets ready to receive the fertilised ovum. This phase takes place as a result of the progesterone released by the corpus luteum. It lasts around 12 days, until the hormone stop being produced. If fertilisation has taken place, the corpus luteum continues to secrete progesterone and the uterine lining is not shed.



ACTIVITIES

3.2. The following sentences are wrong. Correct them.

- When ovum is released to the Fallopian tube, the vagina mucosa is fully formed.
- Follicular phase is caused by the release of progesterone in pituitary gland.
- Menstruation begins when the hormones produced by the ovary start to produce.
- The remains of the Graafian follicle (corpus luteum) produce oestrogens.

3.3. Listen and relate each sentence with the correspondent phase of the ovarian cycle.

- Follicular phase
- Ovulation
- Luteal phase

3.4. Listen and relate each sentence with the correspondent phase of the uterine cycle.

- Menstrual phase
- Proliferative phase
- Secretory phase

3.3. Fertilisation

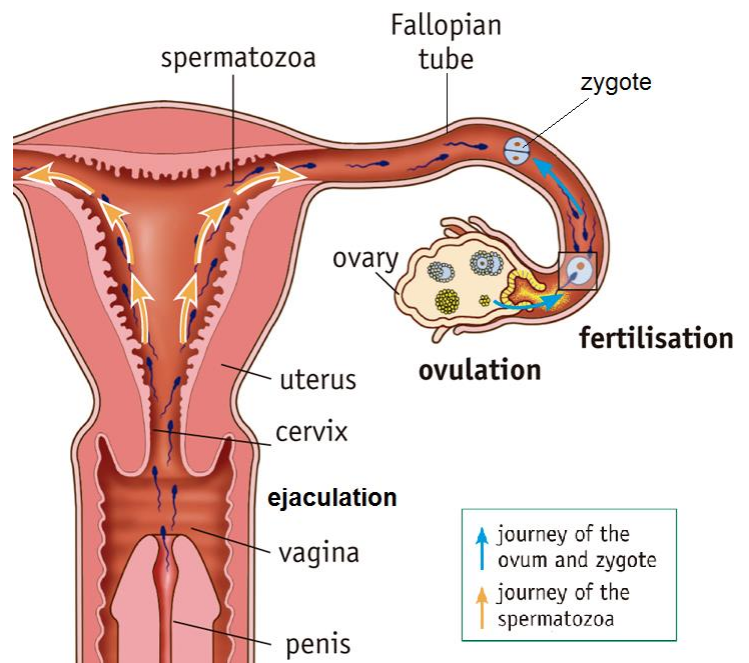
Fertilisation is the fusion of the spermatozoon and the ovum to form the zygote. This process takes place in the Fallopian tubes.

In order for the spermatozoa reach here, it is necessary the release of semen (**ejaculation**) inside the vagina. This occurs during the sexual intercourse (**coitus** or **copulation**).

From the vagina, spermatozoa go up through the uterus until they reach the Fallopian tubes. If they meet an ovum here, fertilisation may take place.

Spermatozoa only live for 4 days after ejaculation and the ovum only lives for 2 days after ovulation. This means that the gametes must come together during this time, to fertilisation occurs.

The first of the spermatozoa that touch the ovum releases the enzymes of its acrosome and breaks the protective covering of the ovum allowing the spermatozoon's nucleus to enter. Immediately the nuclei of both gametes fuse and zygote is formed. Once fertilised a chemical barrier is formed around the ovum to prevent other spermatozoa entering.



ACTIVITIES

3.5. Answer the following questions:

- Where does fertilisation usually take place?
- How is semen released?
- How long do spermatozoa live for?
- How long does an ovum live for after ovulation?
- What is a fertilised ovum called?

3.6. Listen and find the ten mistakes in the text:

Fertilisation

Fertilisation is the name given to the join of an ovum and a spermatozoa, which creates a zygote, the first stage of an embryo. Of the hundreds of millions of sperm deposited in the uterus, a few hundred will manage to get through the uterus and reach the Fallopian tubes to meet the ovary.

Only one of these gametes will manage to pass through the thick layer that protects the ovum. When a sperm has entered, the properties of the outer membrane of the ovum change to prevent other sperm from entering.

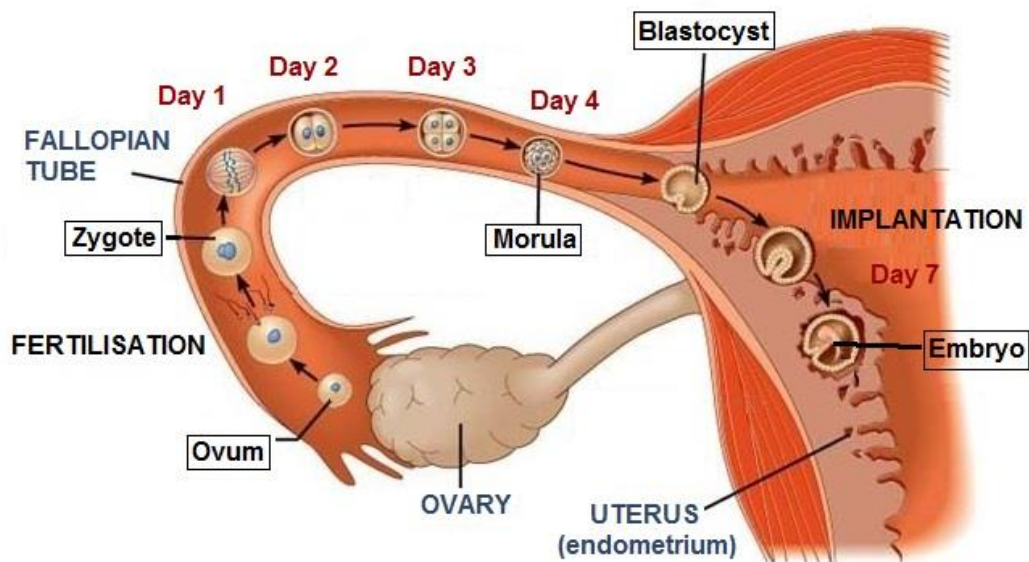
Sperm can stay alive for about five days after ejaculation, so fertilisation is also possible if copulation takes place a few days before menstruation.

3.4. Gestation

After fertilisation, the zygote starts to divide several times until it becomes a hollow ball of cells, the **embryo**.

Embryo is dragged towards the uterus by the cilia of the cells of the Fallopian tubes during approximately 7 days. When it reaches the uterus, it sticks to the endometrium. This process is called **implantation**.

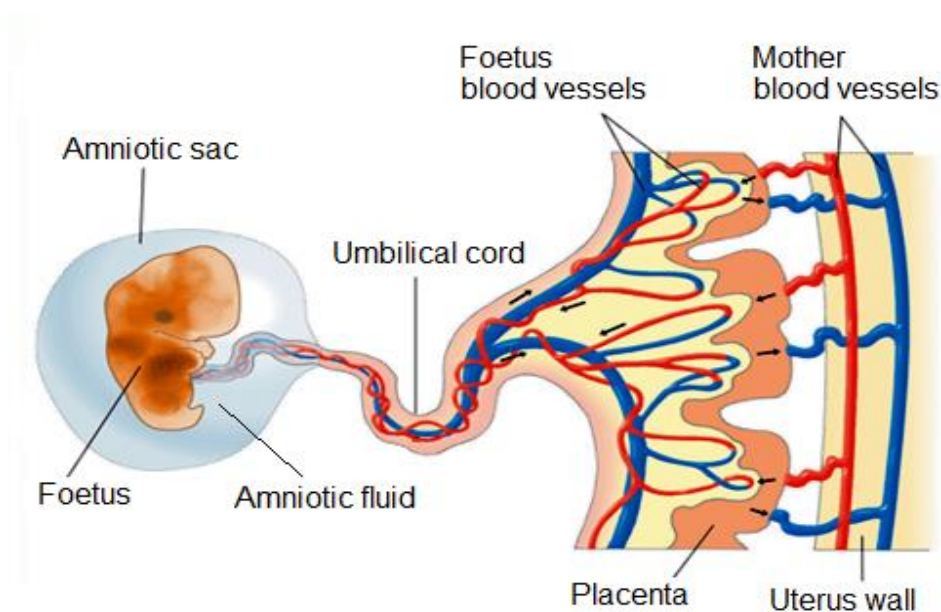
Once implantation occurs the female reproductive system pauses. There is no menstruation or follicle development until the pregnancy ends.






Gestation is the period of time between implantation and birth. During this process the development of the embryo occurs.

After implantation, several organs that will enable the gestation develop:

- **Placenta.** This organ is formed from the uterus mucosa and from embryo's tissues. It performs the exchange of substances between the mother and the embryo.
- **Umbilical cord.** This is the connexion between the placenta and the developing embryo.
- **Amniotic sac.** This is a bag which embryo develops into, submerged in **amniotic fluid**.



CHANGES	FIRST TRIMESTER	SECOND TRIMESTER	THIRD TRIMESTER
BABY	<p>The head and the limbs are distinguishable. Internal organs start to mature.</p> <p>Embryo <10 cm 50-80 g.</p>	<p>The nervous system is developed. It responds to stimuli. It moves. Excretory and circulatory systems mature.</p> <p>Sex can be distinguish at the 4th month.</p> <p>Foetus > 30 cm 1 kg</p>	<p>All organs are matured. Increase of the weight and size. Lots of activity. It sleeps.</p> <p>Baby 50 cm 2'5-4 kg</p>
MOTHER	<p>Menstruation is missing. Sickness. Sharp smell. More appetite</p>	<p>The uterus is dilated. Increase of the abdominal perimeter. Increase of the volume of the mammary glands. She feels the foetus movements..</p>	<p>Very bulging abdomen. Uterus comprises the rest of the internal organs. Discomfort.</p>
			

ACTIVITIES

3.7. Answer the following questions:

- a. Why are follicle development and menstruation paused during pregnancy?
- b. How does embryo arrive to the uterus after fertilisation? How long does it take?
- c. Is a woman pregnant before embryo implantation takes place? Why?

3.8. Listen and identify the described organ:

- a. Placenta
- b. Umbilical cord
- c. Amniotic sac

3.9. Answer these questions:

- a. What is the belly button (navel)?
- b. When can we know the sex of the baby?
- c. In which moment can the mother feel the kicks of the foetus?
- d. Why is very unusual the survival if the baby is born before the six month of gestation?

3.5. Childbirth

In the eight month of the pregnancy, the foetus turns around in the uterus so that the head is pointed downwards, getting ready to be born, when it will come out of the body after the 40th week of gestation.

Labour takes place in three phases:

- **Dilation.** This phase lasts about three and twelve hours. When the cervix (uterine neck) dilates, the myometrium undergoes a series of contractions which become more and more intense and frequent, pushing the foetus towards the vagina. At the end of this phase, the amniotic sac breaks and the amniotic fluid flows out (the waters break).
- **Expulsion of the foetus.** This phase can last between thirty minutes and an hour. The foetus comes out head first. Once it has come out, the umbilical cord is clamped and cut, leaving behind a wound which will heal to form a scar known as the **navel** or **belly button**.
- **Delivery of the placenta.** About fifteen minutes after the baby is born, the uterus undergoes further contractions to expel the placenta and the umbilical cord.



In the first few days after the birth, the mother's mammary glands produce a very nutritious liquid rich in antibodies called **colostrum**. On the third day, they start to produce milk that will nourish the new-born baby.

ACTIVITIES

3.10. Listen and relate each sentence with the correspondent phase of the labour.

- Dilation
- Expulsion of the foetus
- Expulsion of the placenta

3.11. Why do you think the first days' milk after the childbirth, the colostrum, is special and different?