

JSR IAS ACADEMY

GENERAL SCIENCE

BIOLOGY

Physiology

Human Reproductive System

Human Reproductive System

The sperm head

Male Reproductive System

Testis:

- ❖ Structure of Testes are **oval shaped organs**
- ❖ testes are the **male gonads**, which **produce male gametes (sperms) and male sex hormone (Testosterone)**.
- ❖ Along the inner side of each testis lies a mass of coiled tubules called **epididymis**.
- ❖ testes which lie cells of **Sertoli**, and the **Leydig cells (interstitial cells)**.
- ❖ **The Sertoli cells** of the testes provide nourishment to the developing sperms.
- ❖ **The Leydig cells** secrete testosterone.

Scrotum:

The sperms develop at a temperature of **1-3°C** lower than the normal body temperature.

Fructose is a source of energy for the sperm.

prostate gland and Cowper's glands provides nutrition and helps in the transport of sperms

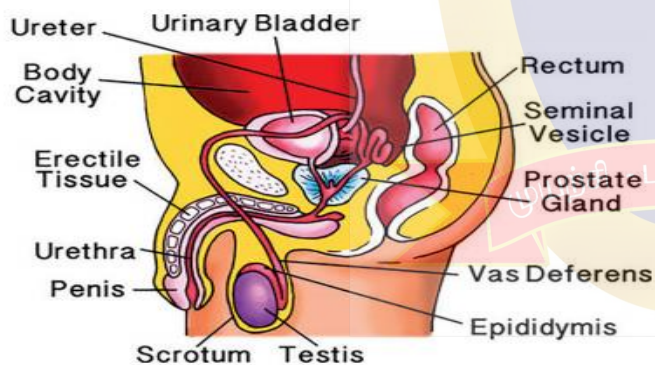


Figure 20.8 Male reproductive system



The sperm is the smallest cell in the male body. A normal male produces more than 500 billion sperm cells in his life time. The process of formation of sperms is known as spermatogenesis.

Structure of Human Sperm

The spermatozoan consists of

1. head,
2. a middle piece and
3. tail.

- ❖ formed by **the condensation of nucleus**.
- ❖ The anterior portion has a cap like structure called **acrosome**.
- ❖ It contains **hyaluronidase** an enzyme that helps the sperm to enter the ovum during fertilization.
- ❖ **The middle piece** contains the **mitochondria** which provides energy for the movement of tail.
- ❖ It brings about **sperm motility** which is essential for fertilization.

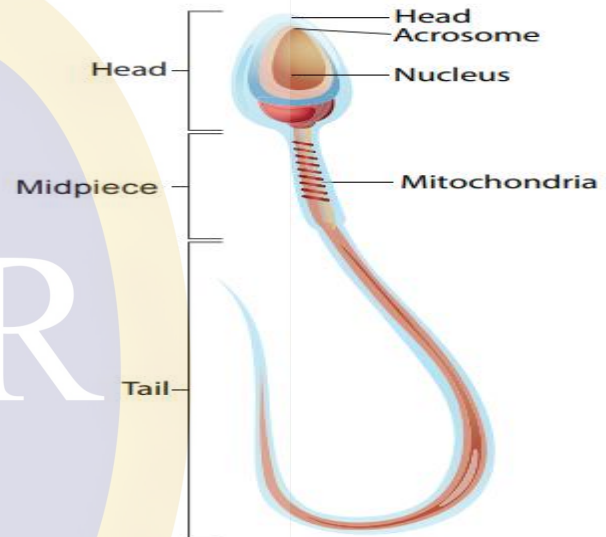


Fig. 17.15 Structure of Sperm

Female Reproductive System

Ovaries:

- ❖ A pair of **almond-shaped** ovaries is located in the lower part of abdominal.
- ❖ The ovaries are the **female gonads**, which **produce female gametes (eggs or ova)** and secrete female sex hormones (**Oestrogen and Progesterone**).
- ❖ The epithelial cells called the **granulosa cells** surround each ovum in the ovary together **forming the primary follicle**.
- ❖ As the egg grows larger, the follicle also enlarges and gets filled with the fluid and is called the **Graafian follicle**.

Structure of Ovum

- ❖ The mature **ovum or egg** is **spherical in shape**.
- ❖ The ovum is **almost free of yolk**.
- ❖ It contains abundant **cytoplasm and the nucleus**.
- ❖ The ovum is **surrounded by three membranes**.
- ❖ The membrane forming the surface layer of the ovum is called **vitelline membrane**.

Fallopian tubes (Oviducts):

The **fimbriae** pick up the ovum released from ovary and push it into the fallopian tube.

Uterus:

- ❖ It lies between urinary **bladder and rectum**.
- ❖ **Development of foetus** occurs **inside the uterus**.

Vagina:

- ❖ It connects **cervix and the external genitalia**.
- ❖ It **receives the sperms**,
- ❖ **acts as birth canal** during child birth (parturition).

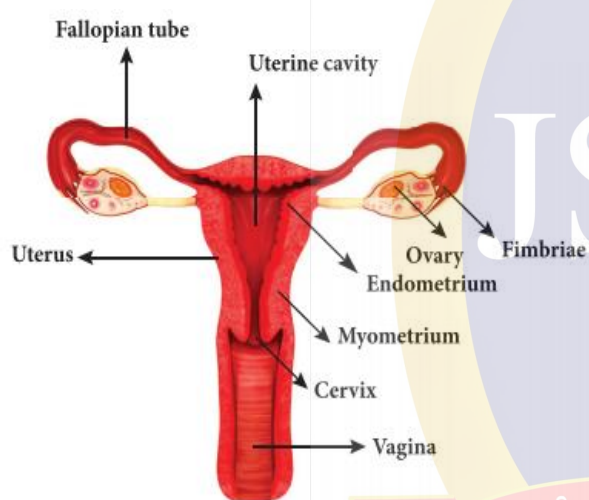


Figure 20.9 Female reproductive system

An ovum is the largest human cell. The process of formation of ova is known as **oogenesis**.

Sexual Reproduction in Human

- ❖ New individuals develop by the **fusion of gametes**.
- ❖ Sexual reproduction **involves the fusion of two haploid gametes** (male and the female gametes) to form a **diploid individual (zygote)**.

Organs of the reproductive system are divided into **primary and secondary (accessory) sex organs**.

Primary reproductive organs

1. Testes in male
2. Ovaries in female

Accessory sex organs™**Male:**

Vas deferens, epididymis, seminal vesicle, prostate gland and penis.™

Female:

Fallopian tubes, uterus, cervix and vagina.

The primary sex organs are

gonads, which produce gametes (sex cells) and secrete sex hormones.

The secondary (accessory) sex organs

- ❖ include the **genital ducts and glands**
- ❖ which help in the **transportation of gametes and enable the reproductive process**.
- ❖ structures which are involved in the 'Process of ovulation'
- ❖ Fusion of the male and female gametes (fertilization)'
- ❖ Division of the fertilized egg upto the formation of embryo'
- ❖ Pregnancy'
- ❖ Development of foetus'
- ❖ Child birth.

The number of primordial follicles in new born female child ranges over 7 million and during reproductive period (at puberty) the number is around 60,000 to 70,000. During a woman's lifetime, she will only ovulate 300 to 400 of the 1-2 million eggs, she was initially born with. On the other side, men will produce over 500 billion sperms in their lifetime.

Puberty

- The reproductive system in both males and females becomes functional and **an increase in sex hormone production** resulting in puberty.
- ends at the age of 19 (commonly known as teenage).
- The term adolescence is derived from the Latin word 'adolescere' meaning 'to grow' or 'grow to maturity'.
- This phenomenon tends to **start earlier in females** than in males.

- **Generally boys** attain puberty between the age of **13 to 14 years**,
- **while girls** reach puberty between **11 to 13 years**.
- The average age for the onset of puberty is 10 or 11 for girls and 12 or 13 for boys.
- **In male**, the onset of puberty is triggered by the secretion of the hormone **testosterone** in the testes,
- **in female** the secretion of **estrogens and progesterone** from the ovary.

Changes in body

- ❖ It usually begins at the age of 10 to 12 in girls and 12 to 13 in boys.
- ❖ It is almost complete at around 17 to 19 in girls and 19 to 20 in boys.
- ❖ During adolescence both boys and girls add around 23 cm to 26 cm in the **height**.
- ❖ **The average weight gain** during this period is about 17 kg to 19 kg.

Secondary Sex Characteristics of Boys

- ❖ the growth of the larynx is larger in boys than that of girls.
- ❖ The growing voice box in boys can be seen as a protruding part of the throat called **Adam's apple**

Secondary Sex Characteristics of Girls

- ❖ Due to the **enlargement of the pelvic bone** and the development of **subcutaneous fat**, the **hip becomes wider and rounder**.
- ❖ Voice becomes not change

Role of Hormones in Reproduction

Follicle Stimulating Hormone (FSH)

- ❖ FSH in the female influences the development of the Graafian follicle and secretion of **estrogens**.
- ❖ In the male it is necessary for the development of seminiferous tubules, and for spermatogenesis.

Luteinizing Hormone (LH)

- ❖ In the female the secretion of the luteal hormone **progesterone**, and for the final maturation of the Graafian follicle.
- ❖ In the male it stimulates the interstitial (Leydig) cells of testes and the secretion of **testosterone**, and is referred to as the Interstitial Cell Stimulating Hormone (ICSH).

Prolactin (PRL) or Lactogenic Hormone

The main function of this hormone is **milk secretion** during lactation.

Lactation

The process of milk production after child birth from mammary glands of the mother is called lactation.

Oxytocin Hormone

- ❖ Oxytocin causes **expulsion of milk from the breast**
- ❖ it is also involved in the contraction of **smooth muscles of uterus during child birth**

The milk produced from the breast during the first 2 to 3 days after child birth is called colostrum. It contains immune substances and provides immunity to the new born which is essential for the body.



Estrogen is not a single hormone but a collection of related steroid hormones.

Girls	Boys
Height and weight increase.	Height and weight increase.
Fatty and subcutaneous tissues develop.	Muscles develop.
Hip broadens.	Shoulder broadens.
Hair grows in arm pits and pubic area.	Hair grows in the arm pits and pubic area, and facial hair also appears.
Voice becomes shrill.	Voice break takes place due to lengthening of vocal cord and enlarging of larynx.
Breast develops.	Size of the penis increases.

Menstrual Cycle-Process of Ovulation

In human females **the menstrual cycle starts at the age of 11-13 years** which marks the onset of puberty and is called **menarche**,

around **48-50 years** of age and this stage is termed **menopause**.

The menstrual cycle consists of 4 phases

1. Menstrual or Destructive Phase
2. Follicular or Proliferative Phase
3. Ovulatory Phase
4. Luteal or Secretory Phase

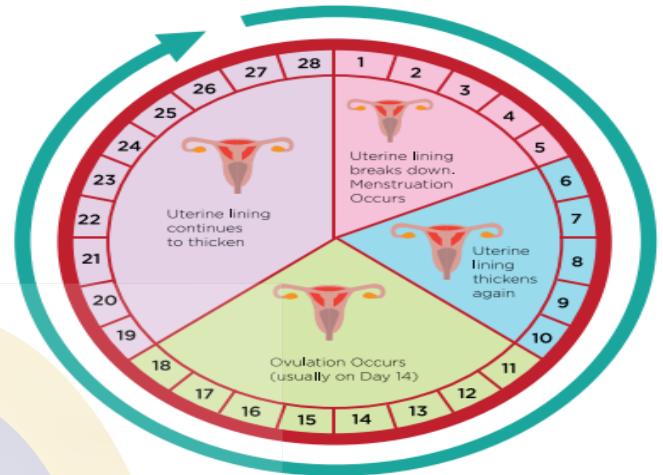


Figure 6.4 Menstrual Cycle

Phase	Days	Changes in Ovary	Changes in Uterus	Hormonal Changes
Menstrual phase	4-5 days	Development of primary follicles	Breakdown of uterine endometrial lining leads to bleeding	Decrease in progesterone and oestrogen
Follicular phase	6 th -13 th day	Primary follicles grow to become a fully mature Graafian follicle	Endometrium regenerates through proliferation	FSH and oestrogen increase
Ovulatory phase	14 th day	The Graafian follicle ruptures, and releases the ovum(egg)	Increase in endometrial thickness	LH peak
Luteal phase	15 th -28 th day	Emptied Graafian follicle develops into corpus luteum	Endometrium is prepared for implantation if fertilization of egg takes place, if fertilization does not occur corpus luteum degenerates, uterine wall ruptures, bleeding starts and unfertilized egg is expelled	LH and FSH decrease, Corpus luteum produces progesterone and its level increases followed by a decline, if menstrual bleeding occurs

- Thus in a **28 days cycle ovulation** occurs about day 14.
- It takes place usually in the **ampulla** of the fallopian tube.
- An **oocyte** is alive for about 24 hours after it is released from the follicle.
- If **fertilization** takes place the **corpus luteum** persists, **continues to secrete progesterone** maintains the thickened state of uterine wall and **prevents maturation of another follicle** till the end of pregnancy
- If **fertilization** does not occur, **corpus luteum degenerates**, the egg disintegrates and the uterine lining slowly breaks, **discharged as blood and mucus** leading to menstrual events.

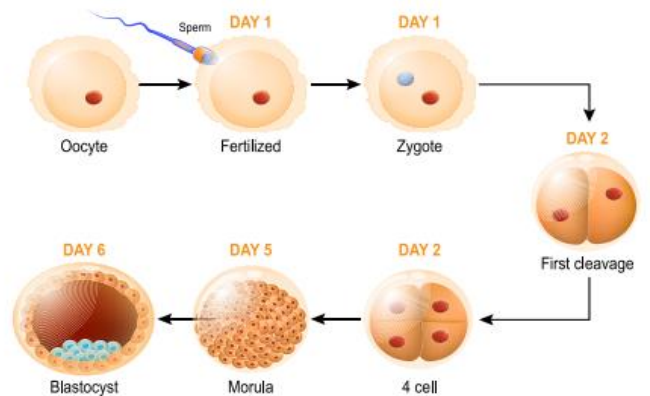


Figure 17.18 Developmental stages of zygote from cleavage to blastocyst formation



Sometimes ovaries releases two eggs and each is fertilised by a different sperm, resulting in **Non-Identical Twins (Fraternal Twins)**. If single egg is fertilised and then divides into two foetus, **Identical Twins** develop.



The inverted red triangle is a symbol of family planning in India for family welfare. It is displayed prominently at all hospitals, primary health clinics and family welfare centres where any help or advice about family planning is available free of cost. The symbol is displayed along with a slogan *Small Family, Happy Family*.

The placenta

- ❖ It allows the exchange of food materials,
- ❖ diffusion of oxygen,
- ❖ excretion of nitrogenous wastes and
- ❖ elimination of carbon dioxide.

Normally gestation period of human last for about **280 days**.

During pregnancy the **uterus expands upto 500 times of its normal size**.

Menstrual Cycle

The menstrual cycle begins with the casting off of **endometrial lining** of the uterus and bleeding.

- ❖ Menstruation stops temporarily when the ovum gets fertilized and the women gets pregnant.
- ❖ This is because, in this case **the thick and soft lining of the uterus containing lot of blood vessels** is needed for the growth and development of the fertilized ovum to form a baby.
- ❖ Menstruation restarts after the birth of the baby.
- ❖ Menstruation also stops due to nutritional deficiencies, low body weight, stress, eating disorder, excessive weight gain etc.

Family Planning Programme

India has been one of the first country in the world to launch the nation wide family planning programme in 1952.

Reproductive and Child Health Care (RCH) Programme: which include

Pregnancy and child birth

Postnatal care of the mother and child

Common contraceptive methods used to prevent pregnancy are discussed here.

1. Barrier methods
2. Hormonal methods
3. Intra-Uterine Devices (IUDs)
4. Surgical methods

Barrier Methods

This method prevents sperms from meeting the ovum.

(a) Condom:

- ❖ Condoms are made of thin rubber or latex sheath.
- ❖ Condom also protect against sexually transmitted diseases (STD) like syphilis, AIDS.

(b) Diaphragm (Cervical cap):

Vaginal diaphragm fitting into the vagina or a cervical cap fitting over the cervix.

Hormonal Methods

- ❖ Hormonal preparations are in the form of **pills or tablets (contraceptive pills)**.
- ❖ **These hormones stop (interfere with ovulation) the release of egg** from the ovary.

Intra-Uterine Devices (IUDs)

- ❖ There are two synthetic devices commonly used in India are Lippe's **Loop and Copper-T**
- ❖ made of **copper and plastic (non irritant)**.
- ❖ This can **remain for a period of 3 years**.
- ❖ This **reduces the sperm fertilizing capacity and prevents implantation**.

Surgical Methods

- ❖ This procedure in males is **vasectomy** (ligation of vas deferens)
- ❖ in females it is **tubectomy** (ligation of fallopian tube).

Every year May 28 is observed as Menstrual Hygiene day to make girls and women aware of maintaining menstrual hygiene and importance of menstrual hygiene for good health. By way of awareness through films, discussions and campaigns menstrual hygiene has taken quite the centre stage in recent days.

The menstrual hygiene scheme to provide subsidized sanitary napkins was launched by the Health ministry in 2011.

In Tamil Nadu, UNICEF has developed an affordable incinerator that uses firewood to handle sanitary napkin waste at schools and special wells are equipped where sanitary napkins are composted.