Appendix B
ANATOMY AND PHYSIOLOGY OF **HUMAN REPRODUCTIVE TRACTS**

Purpose

This chapter provides an overview of the human reproductive system as part of the introduction to family planning (FP) methods. Specifically, this chapter has the following objectives:

1. To show the different parts and functions of the male and female reproductive systems in relation to the different contraceptives
2. To enumerate the different phases of the menstrual cycle
3. To explain how fertility awareness works

Basic knowledge of the anatomy and physiology of human reproduction will help in understanding the mechanism of reproduction and the action of various contraceptive methods, as described below.

- Fertility awareness-based methods prevent pregnancy through abstinence during the woman's fertile period. The fertile period is determined by observed changes in the cervical mucus and/or basal body temperature and by the length of the menstrual cycle.
- Hormonal methods may either prevent ovulation or thicken the cervical mucus or both.
- Barrier methods prevent the meeting of the egg and the sperm by preventing the transport/ascent of the sperm from the vagina into the uterus/fallopian tubes.
- Voluntary surgical contraceptive methods, such as bilateral tubal ligation, also prevent the meeting of the egg and sperm by blocking the passageway of the sperm from the epididymis to the seminal vesicle (as in vasectomy) or of the ova from the ovary to the fallopian tubes.

MALE REPRODUCTIVE SYSTEM

EXTERNAL GENITALIA

The male external genitalia consist of the following:

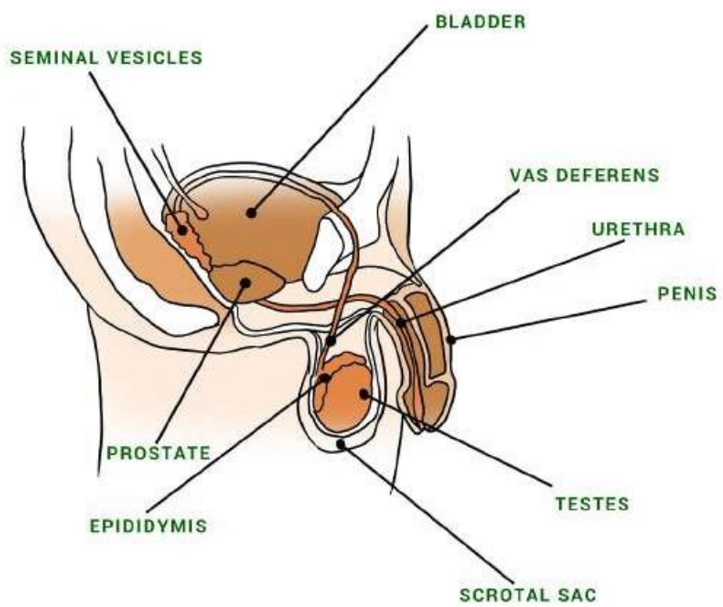
1. Penis
   - It is made up of spongy erectile tissues.
   - The penis becomes erect when a man becomes sexually excited; it stiffens and grows in both width and length.
   - An erect penis is approximately 5 inches to 7 inches in length and approximately 1 inch to 1.5 inches in diameter.
   - The penis serves as a passageway of the urine and of the semen during sexual intercourse.
2. Scrotal sac
   - This is a pair of wrinkled skin pouches that contain and protect the testes or testicles.
   - The scrotum controls the temperature of the testicles. The scrotal temperature is approximately 6 °C lower than the body temperature, which is ideal for sperm production.

INTERNAL GENITALIA

The male internal genitalia consist of the following:

1. Testicles (testes)
   - The testicles are the organs that produce the sperm cells and the male hormone testosterone.
   - These organs are located in the wrinkled-looking pouch called the scrotum, which hangs behind the penis.
   - An adult male has two testicles about the size of plums or a native guava. The testicles contain hundreds of thousands of chambers where the sperms develop.
2. Epididymis
   - The epididymis is a small tube located at the base of the testes.
   - It is the site where maturing sperms develop before ascending the seminal vesicles through the vas deferens.

3. Vas deferens (sperm duct)
   - The vas deferens passes from the testes to the back of the prostate gland.
   - Each of the two sperm ducts joins with the seminal vesicle on each side before entering the prostate gland as a single duct.
   - The vas deferens acts as a storage place and passageway for the sperm from the testes to the prostate gland.
4. Seminal vesicles
   - The seminal vesicles produce the nourishing and lubricating seminal fluid that contributes part of the semen.
   - This is where the sperm and the semen mix.
5. Prostate gland
   - The prostate gland is situated at the base of the urinary bladder and surrounds part of the urethra.
   - It secretes an alkaline fluid that forms part of the semen.
6. Urethra
   - The urethra is a duct that passes from the lower part of the bladder through the prostate gland and then into and through the penis.
   - It serves as a common pathway for semen or urine.



PHYSIOLOGY

- Sperms are produced daily in the testes of males at the start of puberty. Males remain fertile throughout their lifetimes unless diagnosed with an injury or a disease that affects fertility.
- Sperms are microscopic male reproductive cells that comprise less than 2% of the total ejaculate. They are much smaller than the egg cells. Each has a head and a tail like a tadpole.
- Sperms that are produced pass through the epididymis, vas deferens, and then seminal vesicles where they mix with the seminal fluid.
- Sperms mix with the seminal fluid and enter the prostate gland where additional fluid is added to nourish them.
- Sperms can survive in the vas deferens and seminal vesicle for up to 90 days.
- Sperms ejaculated during sexual intercourse swim through the vagina, cervical opening, uterus, and then fallopian tubes.
- Sperms can live for four to six hours in the vagina but can live for three to five days once they reach the uterus and the fallopian tubes. They usually reach the tubes within 1 hour to 1.5 hours after ejaculation.
- Sperms that reach the top of the uterus are divided between the two fallopian tubes. They swim against the strong current set up by the cilia in the fallopian tubes, which draw the egg down toward the uterus.
- Each ejaculate contains 100 to 600 million sperms in approximately a teaspoon of seminal fluid.
- Only approximately 2,000 of the 100 to 600 million sperms reach the tubes, and only one sperm actually penetrates the egg cell. The rest help in dissolving the covering of the egg to enable one sperm to penetrate it. The rest of the sperms die and are absorbed by the body after fertilization.

FEMALE REPRODUCTIVE SYSTEM

EXTERNAL GENITALIA

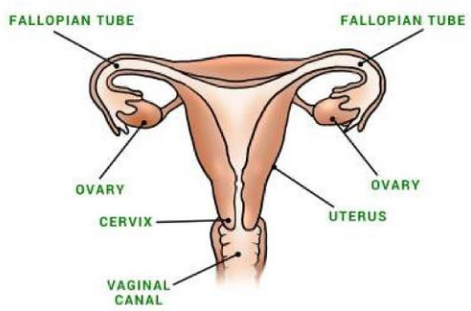
The female external genitalia consist of the following:

1. Vagina
   - The vagina is the passage that extends from the external structure or vulva to the cervix.
   - This passage receives the penis during sexual intercourse.
   - It allows the flow of menstrual blood from the uterine cavity to the exterior.
   - It is the usual passage through which the baby is born.
2. Labia majora
   - The labia majora are made up of two thick outer folds of skin that protect the inner sensitive parts of the vulva.
3. Labia minora
   - The labia minora consists of two thinner internal folds of tissues that cover the vaginal opening and meet in front over a sexually sensitive structure called the clitoris.
4. Clitoris
   - The clitoris is a small-pea sized organ composed of highly sensitive tissue similar to that of the penis.
5. Urethra
   - The urethra is the tube through which the urine passes from the bladder to the exterior at the urethral opening between the clitoris and the vaginal opening.

INTERNAL GENITALIA

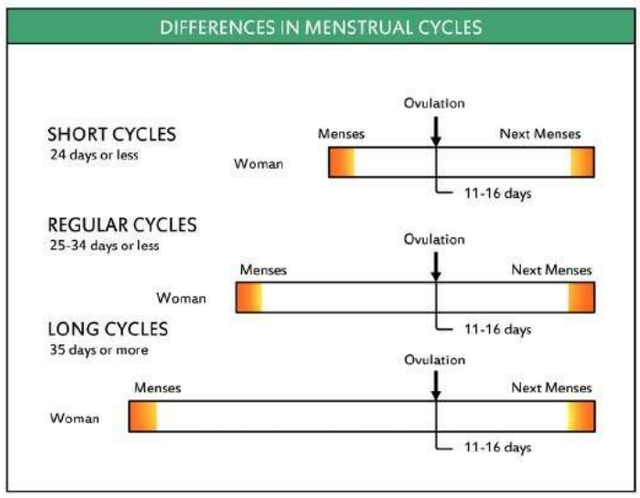
The female internal genitalia consist of the following:

1. Uterus
   - The uterus is a hollow muscular organ that lies between the bladder and the rectum.
   - A lining called the endometrium covers the cavity of the uterus.
   - The uterus receives the fertilized ovum.
   - It expands as the fetus (baby) grows and expels the baby at birth.
2. Cervix
   - The cervix is the lower part of the uterus that opens into the vagina.
   - Glands called the cervical crypts line the cervical canal. These glands produce cervical mucus under the influence of the hormone estrogen. The spermatozoa depend on the cervical mucus for their survival and transport to the female reproductive tract.
3. Fallopian tubes
   - The fallopian tubes are located on each side of the upper part of the uterus.
   - The end of each fallopian tube is dilated and opens close to the ovary.
   - The fallopian tubes transport the ovum released from the ovary to the uterus.
   - They enable the sperm to move from the uterus toward the ovary.
   - Fertilization of the ovum by the sperm occurs at the distal third of the fallopian tubes closest to the ovary.
4. Ovaries
   - The ovaries are the female reproductive organs that produce the ova or eggs.
   - These organs are attached to either side of the uterus.
   - They produce two hormones, estrogen and progesterone, which prepare the lining of the uterus to receive a fertilized ovum.



MENSTRUAL CYCLE

- The menstrual cycle begins on the first day of menstrual bleeding and ends on the day before bleeding begins again. Bleeding normally lasts from three to five days.
- The length of a woman's menstrual cycle normally varies by a few days from cycle to cycle.
  - A menstrual cycle is usually 25 to 34 days long (also known as a regular cycle).
  - Some women may have short cycles (24 days or less) or long cycles (35 days or more).
- The postovulatory days are usually fixed in all of these cycles (11 to 16 days), whereas the preovulatory days vary in length.



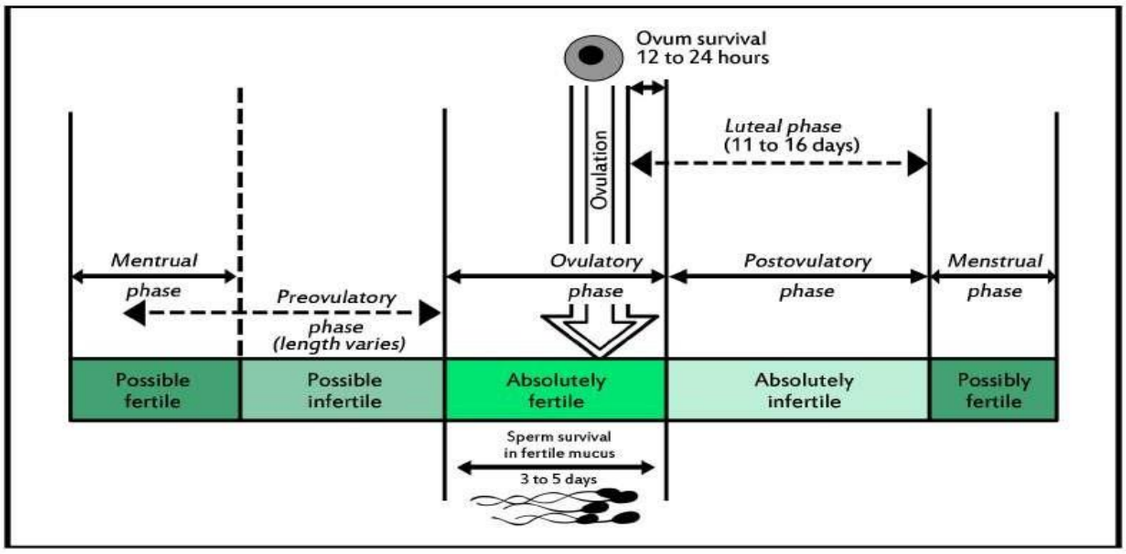
The physiological and anatomical changes during the menstrual cycle are summarized in a matrix in Table 1.

Table 1. Menstrual cycle matrix (based on an average 28-day cycle)

Structures	Menstrual phase	Preovulatory phase	Ovulatory phase	Postovulatory phase
Lining of uterus	Sheds during this phase	Begins to thicken	Continues to thicken	Stays in place until menstruation starts
Egg	Begins to grow in the ovaries	Continues to grow	Matures and is finally released	If not fertilized, dissolves and is absorbed
Cervical mucus	None	At the beginning of this phase, thick, sticky, and opaque	Wet, slippery, stretchy, and clear; vaginal sensation is wet	Loses its wet quality and is no longer sticky and stretchy; vaginal sensation is dry
Basal body temperature	Low (~36 °C–36.5 °C)	Low (~36 °C–36.5 °C)	Slightly drops by 0.2 °C to 0.5 °C	Rises by 0.2 °C to 0.5 °C and remains high until next menstruation starts
Change in cervix	Open	Firm and closed	Soft and open	Firm and closed
Hormonal change	Both estrogen and progesterone levels drop.	Capsule around the egg begins secreting estrogen, and its level rises.	Estrogen slightly drops but remains high; progesterone begins to rise.	Estrogen and progesterone remain high until day 22 when they begin to decrease.

FERTILITY AND JOINT FERTILITY

- Fertility is the ability of a person to bear children. Females and their male partners must be fertile to bear a child.
- Although the female is the one who becomes pregnant, carries the child, and goes through childbirth, fertility involves contributions from both the male and the female, with the former contributing the sperm and the latter contributing the egg.
- During their reproductive years, males are always fertile. Their bodies constantly function every single day and make females pregnant any time. The male's fertility ends either at death or at the diagnosis of an injury or disease that affects fertility.
- By contrast, females undergo changes every few weeks that cause their bodies to be fertile for only a few days at a time and then become infertile during the other days before becoming fertile again. Female fertility ends at menopause.
- Joint or combined fertility involves the united and equal contribution of the male and female in the decision and ability to have a child.



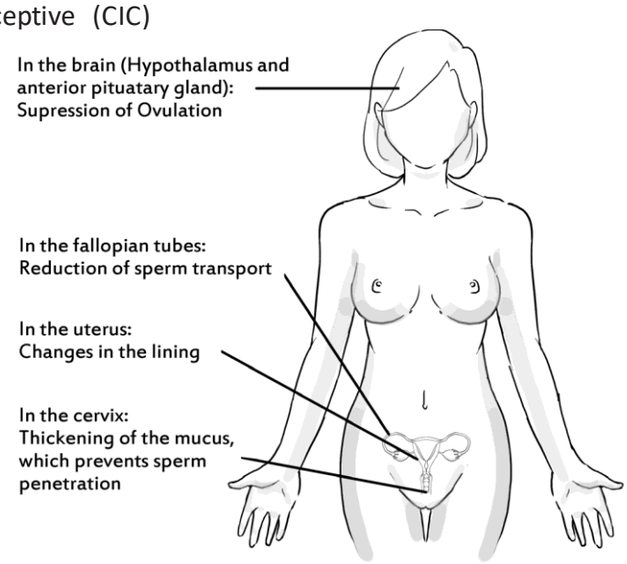
Combined Fertility

MECHANISMS OF ACTION OF DIFFERENT FP METHODS

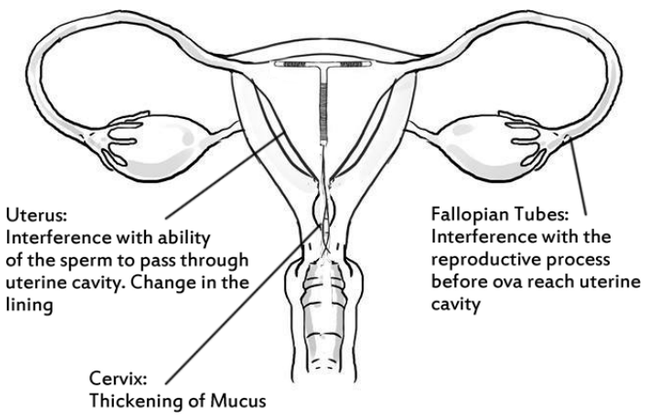
- The brain controls the hormones that regulate the reproductive systems. It also affects sexual activities.
- Hormones are substances produced by special organs or glands in the body; these substances are carried by the bloodstream to targeted parts of the body where certain actions are needed.
- The pituitary gland releases the hormones that control the release of other hormones from other glands in the body and the actions of the reproductive structures in the bodies of both males and females.
- Although most of these actions are involuntary, they can be controlled or modified by the person through various interventions, such as the timing of sexual intercourse, or through the use of contraceptive drugs and devices.

Below are the sites of action of the different FP methods.

1. Hormonal contraceptives: Combined Oral Contraceptive (COC), Progestin- Only Pill (POP), Progestin-Only Injectable (POI), Combined Injectable Contraceptive (CIC)



2. Intrauterine devices: Copper T380A, IUS



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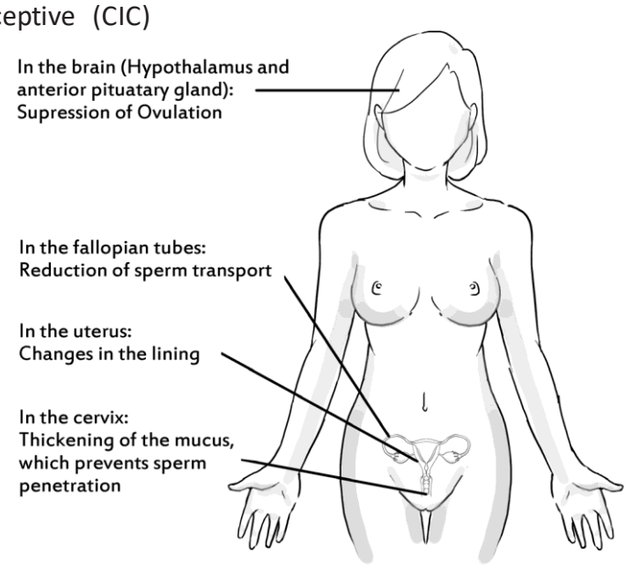

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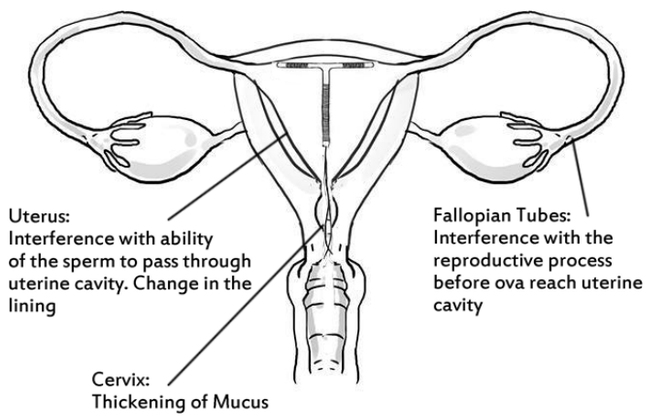
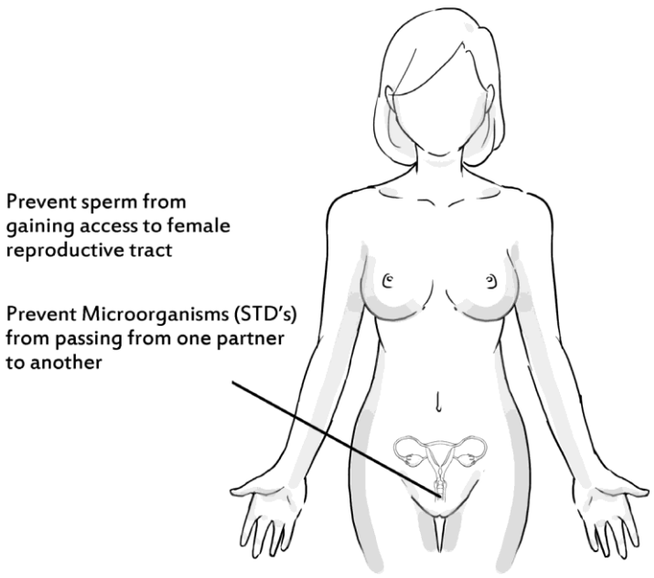


5. Barrier methods: male and female condoms, diaphragm, cervical caps, spermicides



6. Fertility awareness-based methods
   - For contraception, sexual intercourse should be avoided during the fertile phase of the menstrual cycle.
   - For contraception, sexual intercourse could be near midcycle (usually 10 to 15 days) when conception is most likely.