

# SEXOLOGY

## (CCH02)



**ACHARYA NAGARJUNA UNIVERSITY**

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## **Unit - I**

# **ANATOMY OF MALE REPRODUCTIVE SYSTEM**

### **1.0 Objectives:**

After studying the lesson, the student will have a clear cut idea about the structural Anatomy of Male Reproductive System of Human Beings.

Till the initiation into this course, even most science graduates have knowledge of Male Reproductive System of other Vertebrates, which varies remarkably from that of a Human Reproductive System.

The student will also be able to appreciate the basic difference between the structure and Function of Male & Female Reproductive Organs.

### **Structure of The Lesson:**

- 1.1 Introduction**
- 1.2 Anatomy of Male Reproductive System**
- 1.3 Structure of The Testes**
- 1.4 Functions of the Testes**
- 1.5 Structure of the Spermatic Cords**
- 1.6 Structure of the Seminal Vesicles**
- 1.7 Functions of Seminal Vesicles**
- 1.8 The Ejaculatory Ducts**
- 1.9 The Prostate Glands**
- 1.10 Functions of the Prostate Glands**
- 1.11 Urethra**
- 1.12 Penis**
- 1.13 Ejaculation**
- 1.14 Puberty in the Male**
- 1.15 Summary**
- 1.16 Key Words**
- 1.17 Self Assessment Questions**
- 1.18 Suggested Books**

## 1.1 Introduction:

All living beings either plants animals we see with our naked eyes are made up of billions of cells. The unit of the life in multi-cellular organisms is Cell. Earlier the life has begun with one cell. Even we being multi-cellular, begin our life with one cell that is Zygote that will be formed by the union of Mother cell (ovum) and father cell (sperm).

Primitive life can not distinguish between male & female and we may not observe much difference between male & female.

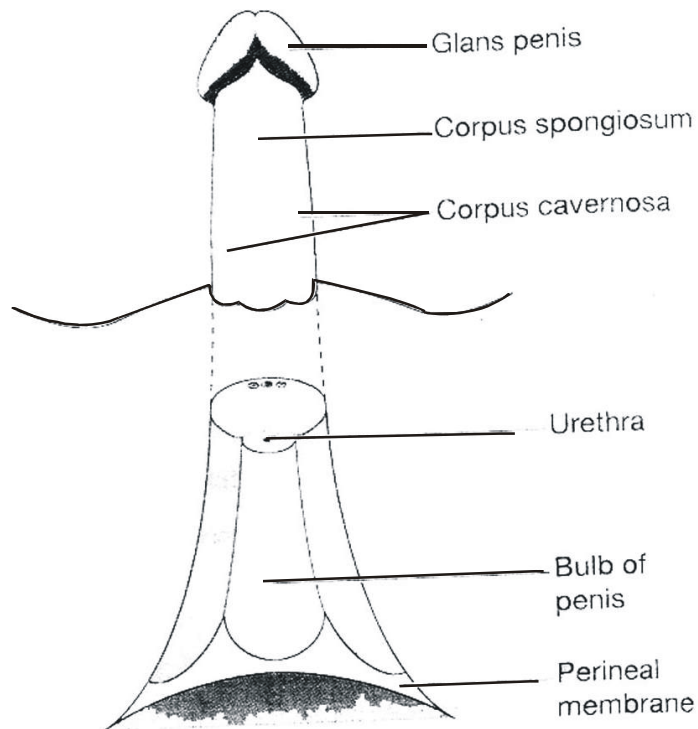
As the life is evolving in to higher and higher forms, the structure of the life has become more & more complex. many cells cluster together and form in to tissues and organs and have a specific function.

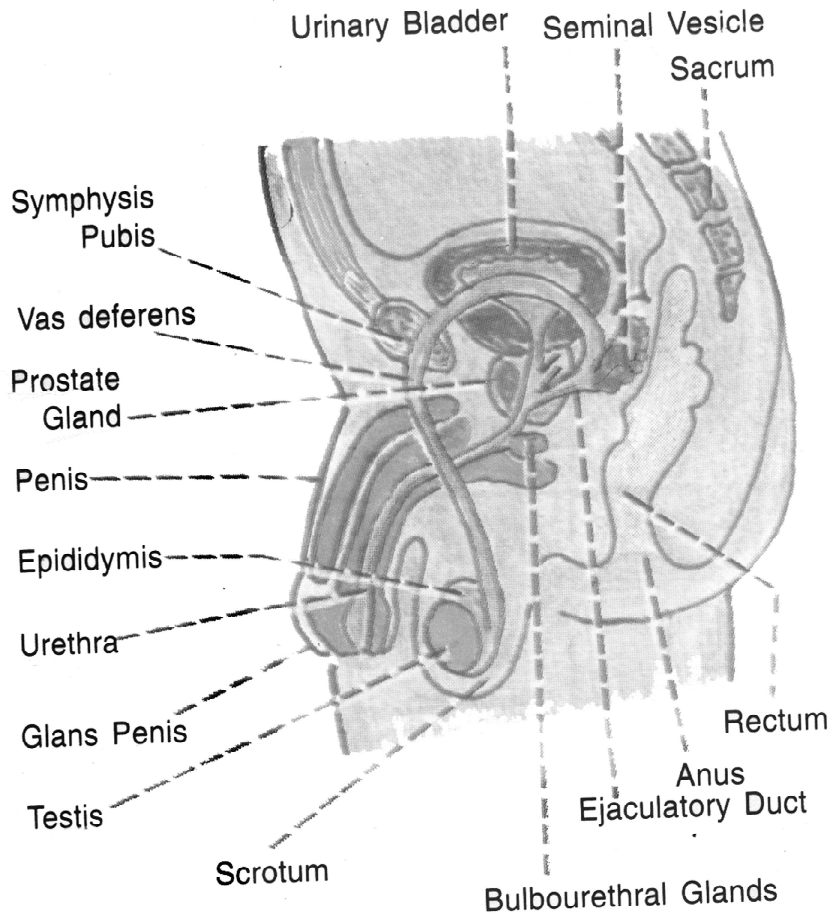
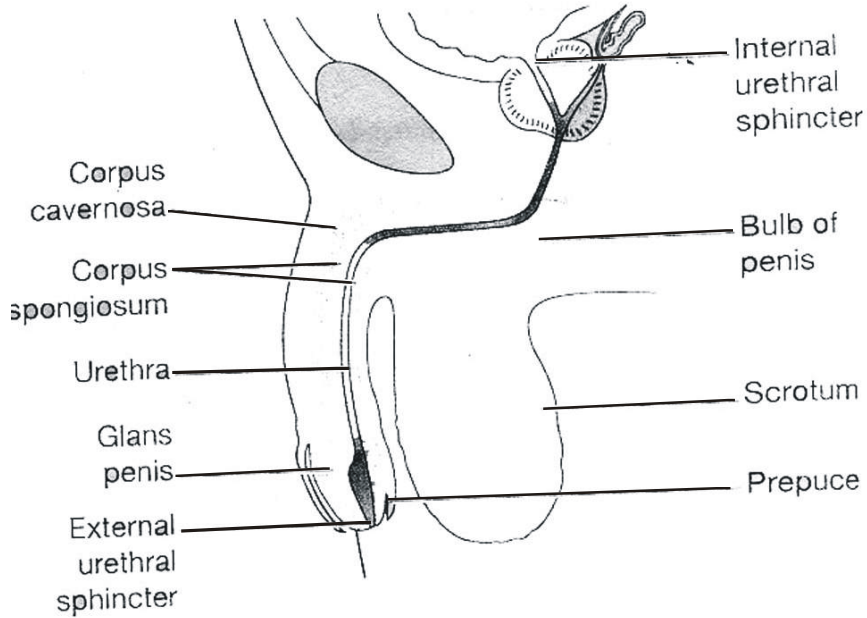
Say for example, Brain has got some peculiar cells which just carry nervous function. But they never attempt to move by themselves, where as the heart muscle always contracts and relaxes rhythmically.

Like wise to hold the function of reproductive property of life, reproductive system is developed.

Male sex organisms are meant for penetration in to the female sexual organs where they can release semen which contains sperms (male sex cells for union with ovum). Now you are going to understand the Anatomy of Male Sexual System.

## 1.2 Anatomy of Male Reproductive System:





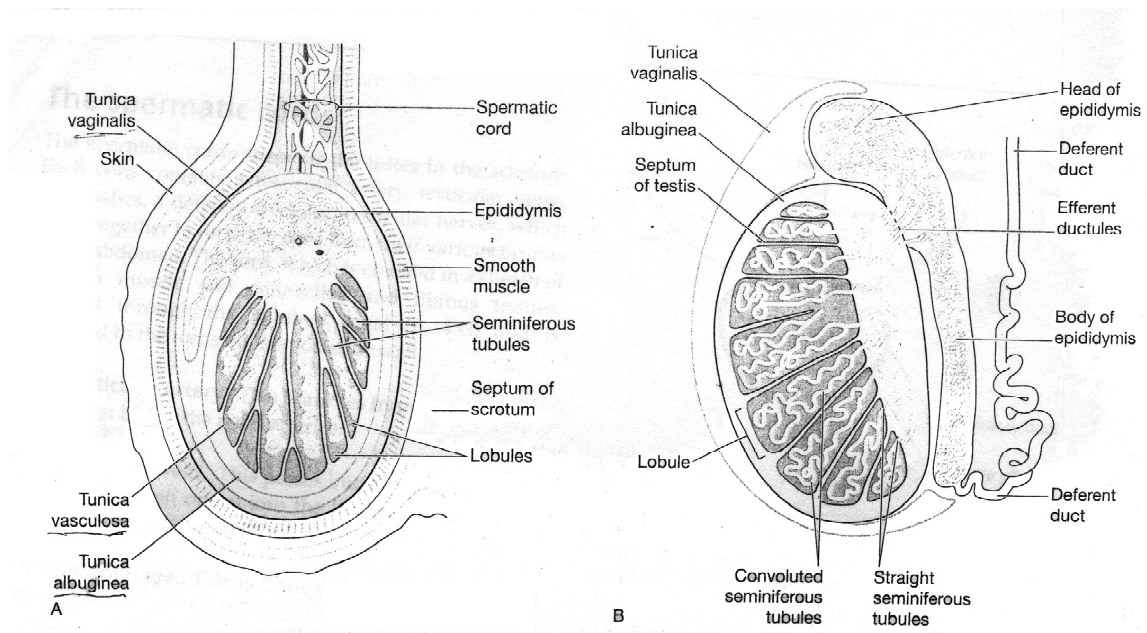
### Scrotum:

The scrotum is a pouch of deeply pigmented skin, fibrous and connective tissue and smooth muscle. It is divided into two compartments each of which contains one testis, one epididymis and the testicular end of a spermatic cord. It lies below the symphysis pubis, in front of the upper parts of the thighs and behind the penis.

### Testes:

The testes are the reproductive glands of the male and are the equivalent of the ovaries in the female. They are about 4.5 cm long, 2.5 cm wide and 3 cm thick and are suspended in the scrotum by the spermatic cords. They are surrounded by three layers of tissue.

## 1.2 Structure of The Testes:

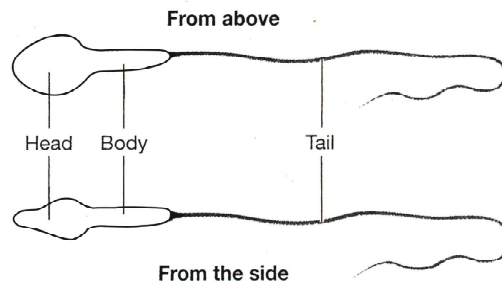


In each testis there are 200 to 300 lobules and within each lobule are 1 to 4 convoluted loops composed of germinal epithelial cells, called seminiferous tubules. Between the tubules there are groups of interstitial cells (of Leydig) that secrete the hormone testosterone after puberty. At the upper pole of the testis the tubules combine to form a single tubule. This tubule, about 6m in its full length, is repeatedly folded and tightly packed into a mass called the epididymis. It leaves the scrotum as the deferent duct (vas deferens) in the spermatic cord. Blood and lymph vessels pass through the spermatic cords into the testes (one on each side).

### 1.3 Functions of The Testes:

Spermatozoa (sperm) are produced in the seminiferous tubules of the testes, and mature as they pass through the long and convoluted epididymis. There they are stored.

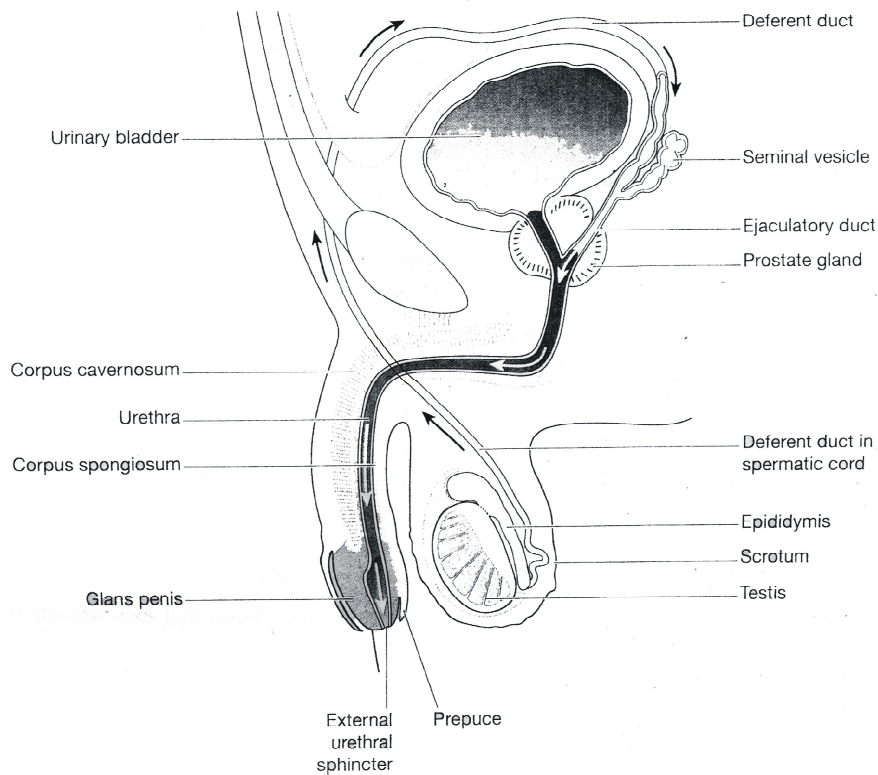
1. The hormone controlling sperm production is FSH from the Anterior pituitary.
2. A mature sperm has a head, a body, and a long whip-like tail that is used for motility.



3. The head is almost completely filled by the nucleus, containing its DNA.
4. It also contains the enzymes required to penetrate the outer layers of the ovum to reach, and fuse with, its nucleus.
5. The body of the sperm is packed with mitochondria, which fuel the propelling action of the tail that powers the sperm on its journey into the female reproductive tract.
6. Successful spermatogenesis takes place at a temperature about 3°C below normal body temperature.
7. The testes are cooled due to their position outside the abdominal cavity, and the thin outer covering of the scrotum has very little insulating fat.

### 1.4 Structure of The Spermatic Cords:

The spermatic cords suspend the testes in the scrotum. Each cord contains a testicular artery, testicular veins, lymphatics, a deferent duct and testicular nerves, which come together to form the cord from their various origins in the abdomen. The cord, which is covered in a sheath of smooth muscle and connective and fibrous tissues, extends through the inguinal canal and is attached to the testis on the posterior wall.



## 1.5 Seminal Vesicles:

The seminal vesicles are two small fibromuscular pouches lined with columnar epithelium, lying on the posterior aspect of the bladder

At its lower end, each seminal vesicle opens into a short duct which joins with the corresponding deferent duct to form an ejaculatory duct.

## 1.6 Functions of The Seminal Vesicles

The seminal vesicles contract and expel their stored fluid contents during ejaculation. Seminal fluid, which forms 60% of the bulk of the fluid ejaculated at male orgasm, contains nutrients to support the sperm during their journey through the female reproductive tract.

1. The seminal fluid carries the HIV virus. The person who has undergone Vasectomy also carries HIV organisms.
2. Hence any person with injuries in the hands or in other parts of the body, comes in contact with the Semen of HIV infected person has a risk of getting the infection.
3. if the semen is ejaculated into the mouth of the partner having gingivitis and oral ulcers she/he will have equal risk of contracting HIV/AIDS.

## 1.7 The Ejaculatory Ducts:

The ejaculatory ducts are two tubes about 2 cm long, each formed by the union of the duct from a seminal vesicle and a deferent duct. They pass through the prostate gland and join the prostatic urethra, carrying seminal fluid and spermatozoa to the urethra.

## 1.8 The Prostate Glands:

The prostate gland lies in the pelvic cavity in front of the rectum and behind the symphysis pubis, surrounding the first part of the urethra. It consists of an outer fibrous covering, a layer of smooth muscle and glandular substance composed of columnar epithelial cells.

## 1.9 Functions of The Prostate Gland:

The prostate gland secretes a thin, milky fluid that makes up about 30% of semen, and gives it its milky appearance. It is slightly alkaline, which provides a protective local environment for sperm arriving in the acidic vagina. It also contains a clotting enzyme, which thickens the semen in the vagina, increasing the likelihood of semen being retained in the vicinity of the cervix.

## 1.10 Urethra:

The male urethra provides a common pathway for the flow of urine and semen, the combined secretions of the male reproductive organs. It is about 19 to 20 cm long and consists of three parts. They are prostatic urethra, membranous urethra and penile urethra. The Urethra terminates at the external urethral orifice in the glans penis.

## 1.11 Penis:

The penis has a root and a body. The root lies in the perineum and the body surrounds the urethra. It is formed by three cylindrical masses of erectile tissue and involuntary muscle. The erectile tissue is supported by fibrous tissue and covered with skin and has a rich blood supply.

The two lateral columns are called the corpora cavernosa and the column between them, containing the urethra, is the corpus spongiosum. At its tip it is expanded into a triangular structure known as the glans penis. Just above the glans the skin is folded upon itself and forms a movable double layer, the foreskin or prepuce.

The penis is supplied by autonomic and somatic nerves. Parasympathetic stimulation leads to filling of the spongy erectile tissue with blood, caused by arteriolar dilatation and venoconstriction, which increases blood flow into the penis and obstructs outflow. The penis therefore becomes engorged and erect, an essential prerequisite for coitus to occur.

## 1.12 Ejaculation:

During ejaculation, which occurs at the point of male orgasm (Peak Sexual Satisfaction), spermatozoa are expelled from the epididymis and pass through the deferent duct, the ejaculatory duct and the urethra. The semen is propelled by powerful rhythmical contraction of the smooth muscle in the walls of the deferent duct. The muscular contractions are sympathetically mediated.



Muscle in the walls of the seminal vesicles and prostate gland also contracts, adding their contents to the fluid passing through the genital ducts. The force generated by these combined processes leads to emission of the semen through the external urethral sphincter (Fig.)

Sperm comprises of only 10% of the final ejaculate, the remainder being made up of seminal and prostatic fluids, which are added to the sperm during male orgasm, as well as mucus produced in the urethra. Between 2 and 5 ml of semen are produced in a normal ejaculate, and contain between 40 and 100 million spermatozoa per ml. If not ejaculated, sperms gradually lose their capability (fertility) after several months and are reabsorbed by the epididymis.

### 1.13 Puberty in The Male:

This occurs between the ages of 10 and 14. Luteinising hormone from the anterior lobe of the pituitary gland stimulates the interstitial cells of the testes to increase the production of testosterone. This hormone influences the development of the body to sexual maturity. The changes which occur at puberty are :

- growth of muscle and bone and a marked increase in height and weight
- enlargement of the larynx and deepening of the voice – it 'breaks'
- growth of hair on the face, axillae, chest, abdomen and pubis
- enlargement of the penis, scrotum and prostate gland
- maturation of the seminiferous tubules and the production of spermatozoa
- the skin thickens and becomes more oily.

In the male, fertility and sexual ability tend to decline gradually with ageing. The secretion of testosterone gradually declines, usually beginning at about 50 years of age. There is no period comparable to the female menopause.

### 1.14 Summary:

To summarize, Penis & Scrotum are the visible male sexual organs. After careful observation, you can understand that the sperms will not directly reach of penis opening but will reach seminal vesicle through spermatic cord and both urine and semen will come out from the orifice at glans penis through urethra. The micro trauma will occur on glans penis and its prepuce.

### 1.15 Key Words:

Male Sexual Organs

Pigmentation

Lobules

Anterior

Motility

Mature

DNA

Lymphatic

Posterior

Ejaculation

Vasectomy

Gingivitis

Engorgement

Erection

Orgasm

Puberty

### 1.16 Self Assessment Questions:

1. Draw the diagram of penis and name the parts.
2. Write briefly about the functions of seminal vesicle.

#### Write Short note:

Prostate Gland

Urethra

Ejaculation

Prepuce

Testes

### 1.17 Suggested Books:

- |                                    |   |                                    |
|------------------------------------|---|------------------------------------|
| Ross & Wilson Anatomy Physiology   | - | Annewaugh 10th Edi., 2006          |
| Principles of Anatomy & Physiology | - | Gerard J. Tortora, 10th Edi., 2003 |
| Human Anatomy (Vol I.II.III)       | - | BD. Chaurasia, 4th Edi., 2004      |

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## **Unit - II**

# **ANATOMY OF FEMALE REPRODUCTION SYSTEM**

## **2.0 Objectives:**

After studying the lesson, the student will have a clear cut idea about the structural Anatomy of the Female Reproductive System of Human Beings.

Till the initiation in to this course, even most science graduates have only knowledge of female reproductive system in other vertebrates, which varies remarkably from that of a Human Reproductive System.

The student will also be able to appreciate the basic difference between the structure and Function of Male & Female Reproductive Organs.

## **Structure of The Lesson:**

- 2.1 Introduction**
- 2.2 Anatomy of Female Reproduction System**
- 2.3 Functions of Female Reproductive System**
- 2.4 External Genitalia**
- 2.5 Perineum**
- 2.6 Internal Genitalia**
- 2.7 Uterus**
- 2.8 Structure of the Uterus**
- 2.9 Functions of Uterus**
- 2.10 Fallopian Tubes**
- 2.11 Ovaries**
- 2.12 Structure of the Ovaries**
- 2.13 Functions of the Ovaries**
- 2.14 Puberty in Female**
- 2.15 The Menstrual Cycle**
- 2.16 Menopause**
- 2.17 Female Breasts**
- 2.18 Structure of The Breast**
- 2.19 Functions of The Breast**
- 2.20 Summary**
- 2.21 Key Words**
- 2.22 Self Assessment Questions**
- 2.23 Suggested Books**

## 2.1 Introduction:

The ability to reproduce is one of the properties which distinguishes living from non-living matter. The more primitive the animal, the simpler is the process of reproduction. In human beings the process is one of sexual reproduction in which the male and female organs differ structurally and functionally.

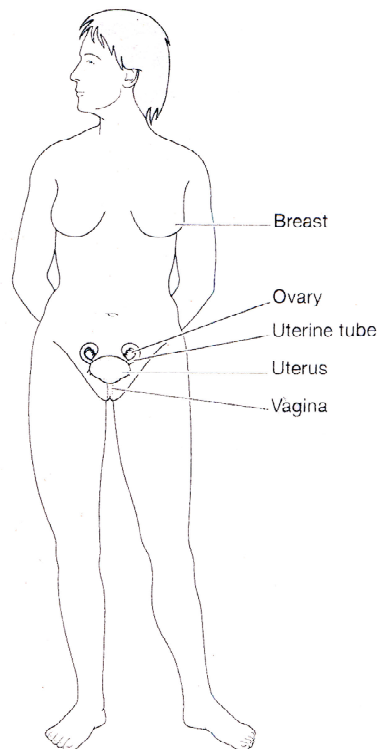
Both males and females produce specialized reproductive germ cells, called gametes. The male gametes are called spermatozoa and the female gametes are called ova. They contain the genetic material, or genes, on chromosomes, which pass inherited characteristics on to the next generation.

Body cells contain 46 chromosomes and they are arranged in 23 pairs but in the gametes there are only 23. When the ovum (Female Gamete) is fertilized by a spermatozoon (Male Gamete) a Zygote is formed.

The Zygote contains 23 pairs of chromosomes, one from each pair obtained from the father (Male Gamete) and the mother (Female Gamete) respectively.

The zygote embeds itself in the wall of the uterus where it grows and develops during the 40-weeks gestation period (Pregnancy) before birth.

## 2.2 Anatomy of Female Reproductive System:



**The Female Reproductive Organs. Faint lines indicate the positions of the lower ribs and the pelvis.**

External genitalia (Vulva)

Internal genitalia

Vagina

Uterus

Uterine tubes (Fallopian tubes)

Ovaries

Puberty in the female

The menstrual (sexual) cycle

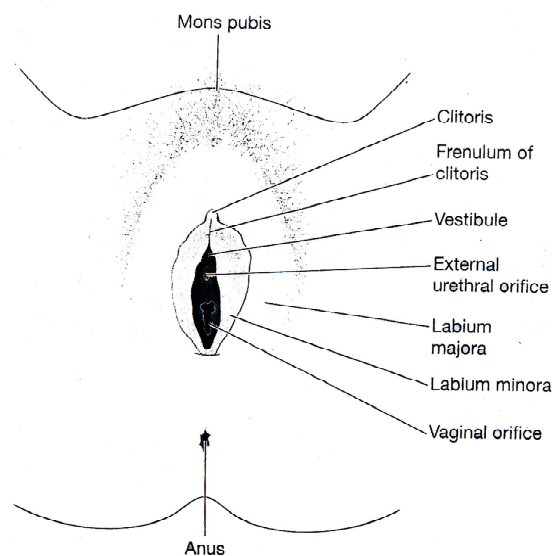
Menopause.

Breasts or mammary glands

### 2.3 The Functions of The Female Reproductive System:

- Formation of female gametes : the Ova
- Reception of male gametes : the spermatozoa
- Provision of suitable environments for fertilization of the ovum by spermatozoa and development of the Foetus.
- Parturition (child birth)
- Lactation, i.e. the production of breast milk, which provides complete nourishment for the baby in its early life.

#### The external genitalia of the female



## 2.4 External Genitalia (Vulva):

The female external genitalia are known collectively as the vulva, and consist of the Labia Majora and Labia Minora, the clitoris, the vaginal orifice, the vestibule, the hymen and the vestibular glands (Bartholin's glands).

### Labia majora:

These are the two large folds which form the boundary of the vulva. They are composed of skin, fibrous tissue and fat and contain large numbers of sebaceous glands. Anteriorly the folds join in front of the symphysis pubis (Anterior part of Pelvis), while posteriorly they merge with the skin of the perineum.

### Labia minora:

These are two smaller folds of skin between the labia majora, containing numerous sebaceous glands.

The cleft between the labia minora is referred to as the vestibule. The vagina, urethra and ducts of the greater vestibular glands open into the vestibule.

### Clitoris:

The clitoris corresponds to the penis in the male and contains sensory nerve endings and erectile tissue. As it is having sensory Nerve endings it provides sexual stimulus and satisfaction to the female partner when touched by her male partner.

### Hymen:

The hymen is a thin layer of mucous membrane, which partially occludes the opening of the vagina. It is normally incomplete to allow for the passage of menstrual flow.

### Vestibular glands:

The vestibular glands (Bartholin's glands) are situated one on each side near the vaginal opening. They are about the size of a small pea and have ducts opening into the vestibule immediately lateral to the attachment of the hymen. They secrete mucus that keeps the vulva moist.

### Lymphatic drainage:

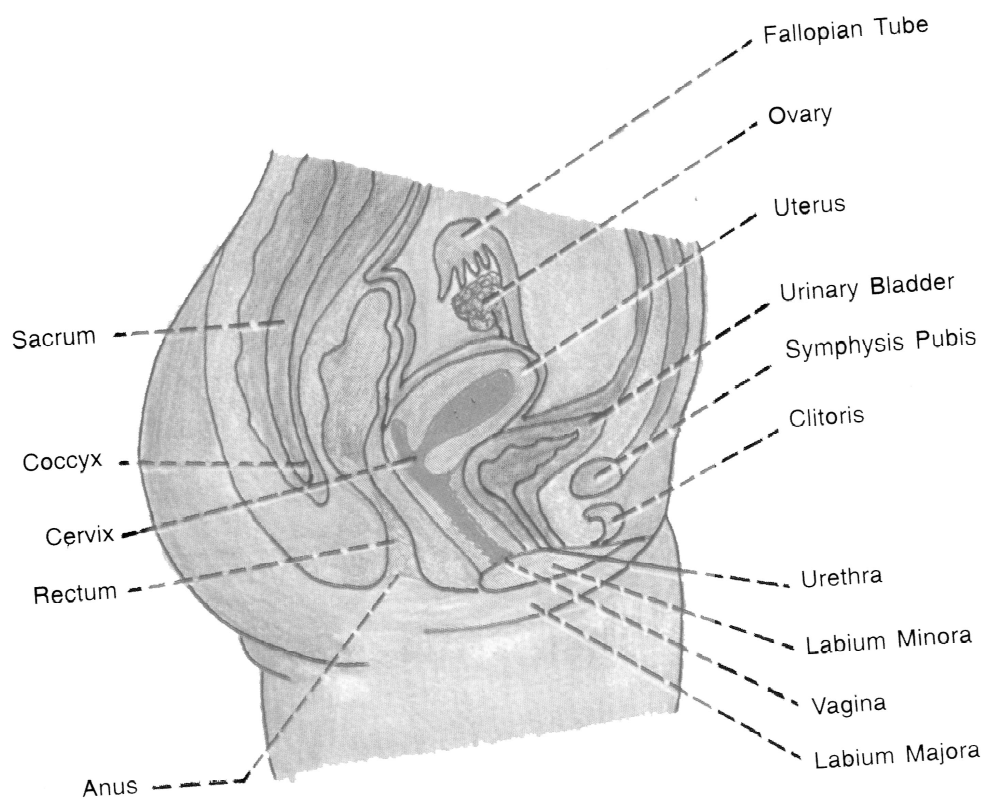
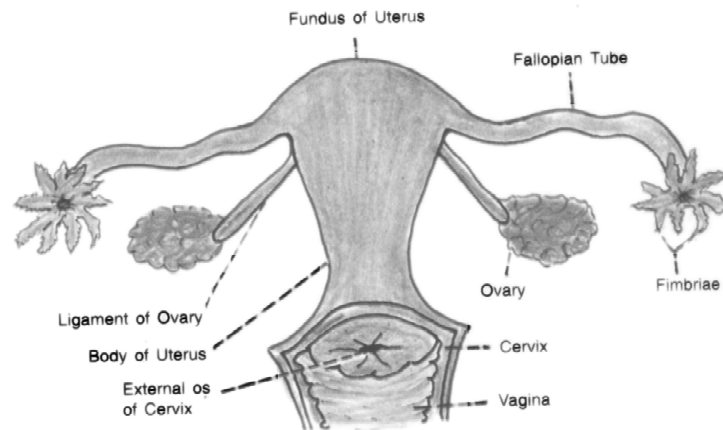
This is through the superficial inguinal nodes.

## 2.5 Perineum:

The perineum is the area extending from the base of the labia minora to the anal canal. It is roughly triangular and consists of connective tissue, muscle and fat. It gives attachment to the muscles of the pelvic floor.

## 2.6 Internal Genitalia:

### The Female Reproductive Organs in the Pelvis



**Lateral view of the female reproductive organs in the pelvis and their associated structure**

The internal organs of the female reproductive system lie in the pelvic cavity and consist of the vagina, uterus, two uterine tubes and two ovaries.

### **Vagina:**

The vagina is a Fibromuscular tube lined with stratified squamous epithelium, connecting the external and internal organs of reproduction. It runs obliquely upwards and backwards at an angle of about  $45^{\circ}$  between the urinary bladder in front and rectum and anus behind. In the adult the anterior wall is about 7.5 cm (3 inches) long and the posterior wall about 9 cm long. The difference is due to the angle of insertion of the cervix through the anterior wall.

### **Structure of the vagina:**

The vagina has three layers:

An outer covering of areolar tissue,

A middle layer of smooth muscle

&

An inner lining of stratified squamous epithelium.

The Squamous Epithelium forms ridges or rugae. It has no secretory glands but the surface is kept moist by Cervical Secretions. Between puberty and the menopause, Lactobacillus acidophilus bacteria are normally present, which secrete lactic acid. The acidity inhibits the growth of most other microbes that may enter the vagina from the perineum.

### **Functions of the Vagina:**

The vagina acts as the receptacle for the penis during coitus, and provides an elastic passage (way) through which the baby passes during childbirth.

## **2.7 Uterus:**

The uterus is a hollow muscular pear-shaped organ, flattened anteroposteriorly. It lies in the pelvic cavity between the urinary bladder and the rectum

In most women, it leans forward (anteversion), and is bent forward (anteflexion) almost at right angles to the vagina, so that its anterior wall rests partly against the bladder below, and forming the vesicouterine pouch between the two organs.

When the body is in the upright position the uterus lies in an almost horizontal position. It is about 7.5 cm long, 5 cm wide and the walls are about 2.5 cm thick. It weighs from 30 to 40 grams. The parts of the uterus are the fundus, body and cervix

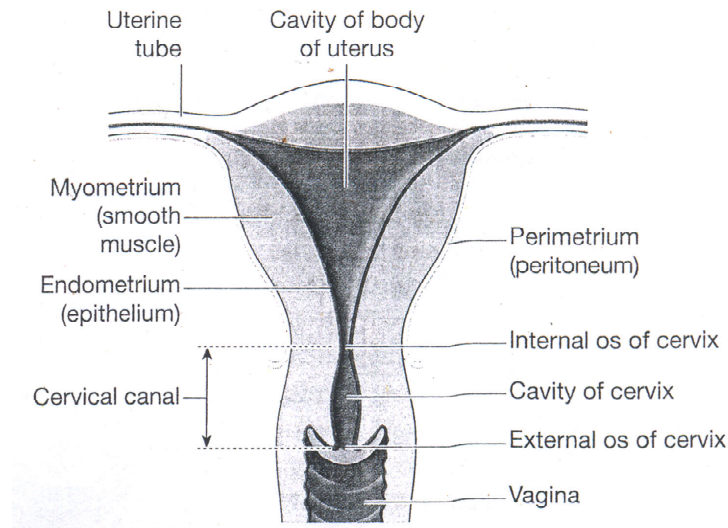
The fundus. This is the dome-shaped part of the uterus above the openings of the uterine tubes.

The body. This is the main part. It is at its narrowest inferiorly at the internal os where it is continuous with the cervix.

The cervix ('neck' of the uterus). This protrudes through the anterior wall of the vagina, opening into it at the external os.



## 2.8 Structure of the uterus:



**A section of the uterus**

The walls of the uterus are composed of three layers of tissue :

- Perimetrium,
- Myometrium
- Endometrium

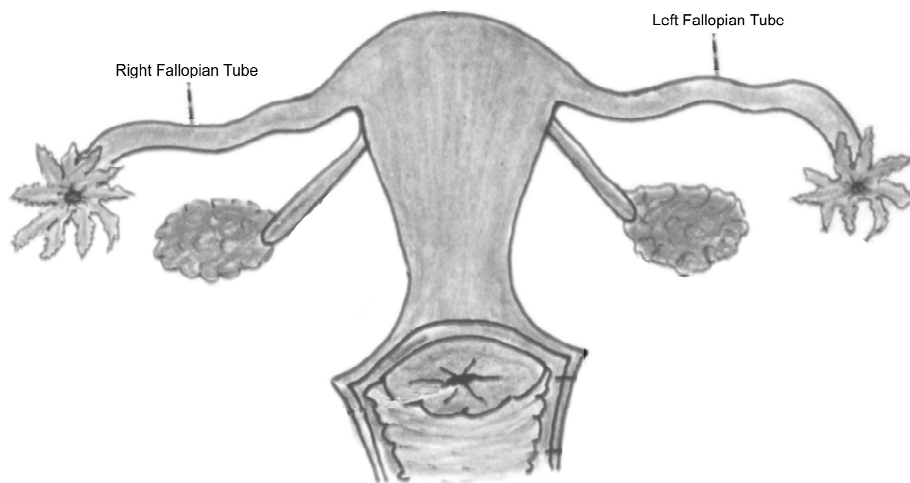
## 2.9 Functions of Uterus:

After puberty, the endometrium of the uterus goes through a regular monthly cycle of changes, the menstrual cycle, which is under the control of hypothalamic and anterior pituitary hormones. The purpose of the cycle is to prepare the uterus to receive, nourish and protect a fertilised ovum. The cycle is usually regular, lasting between 26 and 30 days. If the ovum is not fertilised a new cycle begins with a short period of bleeding (menstruation).

If the ovum is fertilised the zygote embeds itself in the uterine wall. The uterine muscle grows to accommodate the developing baby, which is called as an embryo during its first 8 weeks, and a fetus for the remainder of the pregnancy. Uterine secretions nourish the ovum before it implants in the endometrium. After implantation the rapidly expanding ball of cells is nourished by the endometrial cells themselves. This is sufficient for only the first few weeks and the placenta is the organ that takes over thereafter. The placenta, which is attached to the fetus by the umbilical cord, is firmly attached to the wall of the uterus, and provides the means by which the growing baby receives oxygen and nutrients, and gets rid of its wastes. During pregnancy, which normally lasts about 40 weeks, the muscular walls of the uterus are prevented from contracting and expelling the baby early by high levels of the hormone progesterone secreted by the placenta. At the end of pregnancy (at term) the hormone oestrogen, which increases uterine contractility, becomes the predominant sex hormone in the blood. Additionally, oxytocin is released from the posterior pituitary,

which also stimulates the uterine muscle. Control of oxytocin release is by posterior pituitary, which also stimulates the uterine muscle. Control of oxytocin release is by a positive feedback (see also Fig.). During labour, the uterus forcefully expels the baby by means of powerful rhythmical contractions.

## 2.10 Fallopian Tubes:



The Fallopian-tubes are about 10cm long and extend from the sides of the uterus between the body and the fundus. They lie in the upper free border of the broad ligament and their trumpet-shaped lateral ends penetrate the posterior wall, opening into the peritoneal cavity close to the ovaries. The end of each tube has fingerlike projections called fimbriae. The longest of these is the ovarian fimbria which is in close association with the ovary.

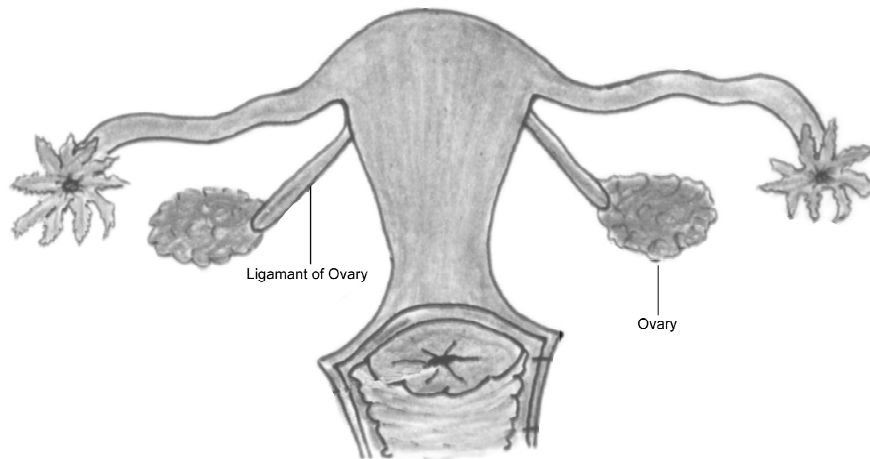
### Structure of the Fallopian tubes:

The Fallopian-tubes have an outer covering of peritoneum (broad ligament), a middle layer of smooth muscle and are lined with ciliated epithelium.

### Function of the Fallopian tubes:

The Fallopian-tubes convey the ovum from the ovary to the uterus by peristalsis and ciliary movement. The mucus secreted by the lining membrane provides ideal conditions for movement of ova and spermatozoa. Fertilisation of the ovum usually takes place in the Fallopian-tube, and the zygote is propelled into the uterus for implantation.

## 2.11 Ovaries:



The ovaries are the female gonads, and they lie in a shallow fossa on the lateral walls of the pelvis. They are 2.5 to 3.5 cm long, 2 cm wide and 1 cm thick. Each is attached to the upper part of the uterus by the ovarian ligament and to the back of the broad ligament by a broad band of tissue, the mesovarium. Blood vessels and nerves pass to the ovary through the mesovarium.

## 2.12 Structure of the Ovaries

The ovaries have two layers of tissue.

The medulla. This lies in the centre and consists of fibrous tissue, blood vessels and nerves.

The cortex. This surrounds the medulla. It has a framework of connective tissue, or stroma, covered by germinal epithelium. It contains an ovum. Before puberty the ovaries are inactive but the stroma already contains immature (primordial) follicles, which the female already has from birth. During the childbearing years, once in about every 28 days, one ovarian follicle (Graafian follicle) matures, ruptures and releases its ovum into the peritoneal cavity. This is called ovulation and it occurs during most menstrual cycles.

## 2.13 Functions of the ovaries:

Ovaries release ovum under the influence of Hormones. These hormones are produced by

1. Anterior pituitary
2. Follicle lining cells
3. Corpus-Luteum
4. Fertilized parts.

**The Hormones are:**

1. FSH,
2. LH ,
3. Progesterone
4. Oestrogen
5. Human chorionic gonadotrophin

If the ovum is not fertilised the corpus-Luteum degenerates and a new cycle begins with menstruation.

**2.14 Puberty in The Female:**

Puberty is the age at which the internal reproductive organs reach maturity. This is called the menarche, and marks the beginning of the childbearing period. The ovaries are stimulated by the gonadotrophins from the anterior pituitary, follicle stimulating hormone and luteinising hormone.

The age of puberty varies between 10 and 14 years and a number of physical and psychological changes take place at this time :

- The uterus, the uterine tubes and the ovaries reach maturity.
- The menstrual cycle and ovulation begin (menarche)
- The breasts develop and enlarge
- Pubic and Axillary hair begins to grow
- There is an increase in the rate of growth in height and widening of the pelvis
- There is an increase in the amount of fat deposited in the subcutaneous tissue, especially at the hips and breasts.
- Psychological changes also occur in the female and she develops interest IN sexual issues. She may get attracted to male partners. Because of the social inhibitions young adult avoids coitus. If fear of pregnancy, STD/AIDS and Moral inhibition (chastity) are absent there will be much greater risk of sexual-inter-course (Coitus) before marriage and out-side marriage, leading to dangerous consequences.

**2.15 The Menstrual Cycle:**

This is a series of events, occurring regularly in females once in every 26 to 30 days throughout the childbearing period of about 36 years.

The average length of the menstrual cycle is about 28 days. By convention the days of the cycle are numbered from the beginning of the menstrual phase of the menstrual cycle which usually lasts about 4 days. The menstrual flow consists of the secretions from endometrial glands, endometrial cells, blood from the broken down capillaries and the unfertilised ovum.

If the female partner is HIV Positive, especially during Menstruation, unsafe sex is associated with much greater risk.

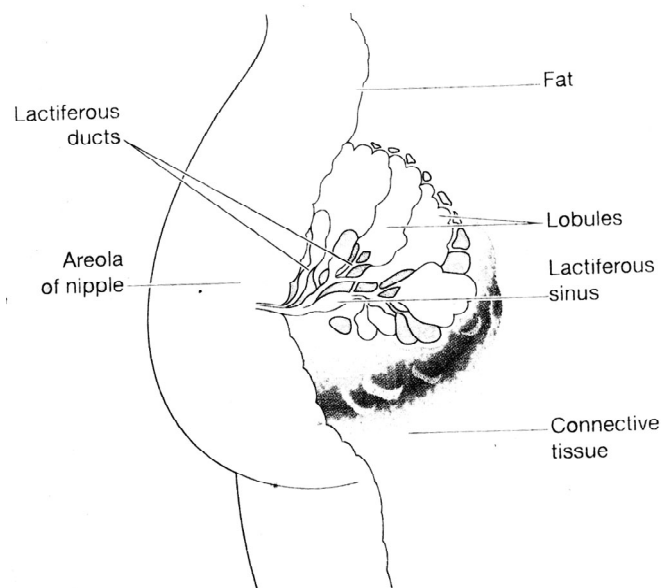
## 2.16 Menopause:

The menopause usually occurs between the ages of 45 and 50 years, marking the end of the child bearing period.

Menopause is characterized by the following features

- short-term unpredictable vasodilatation with flushing, sweating and palpitations, causing discomfort and disturbance of the normal sleep pattern
- Shrinkage of the breasts
- Auxillary and PUBLIC hair become sparse
- Atrophy of the sex organs

## 2.17 Female Breasts (Mammary Glands):



**Structure of the breast**

The breasts or mammary glands are accessory glands of the female reproductive system. They exist also in the male but only in a rudimentary form.

In the female the breasts are small and immature until puberty. Thereafter they grow and develop to their mature size under the influence of oestrogen and progesterone. During pregnancy these hormones stimulate further growth. After the baby is born the hormone prolactin from the anterior pituitary stimulates the production of milk.

## 2.18 Structure of The Breast:

The mammary glands consist of glandular tissue, fibrous tissue and fatty tissue.

Each breast consists of about 20 lobes of glandular tissue, each lobe being made up of a number of lobules that radiate around the nipple. The lobules consist of a cluster of alveoli which open into small ducts and these unite to form large excretory ducts, called lactiferous ducts. The lactiferous ducts converge towards the centre of the breast where they form dilatations or reservoirs for milk. Leading from each dilatation, or lactiferous sinus, is a narrow duct which opens on to the surface at the nipple. Fibrous tissue supports the glandular tissue and ducts, and fat covers the surface of the gland and is found between the lobes.

**The nipple.** This is a small conical eminence at the centre of the breast surrounded by a pigmented area, the areola. On the surface of the areola are numerous sebaceous glands (Montgomery's tubercles) which lubricate the nipple during lactation.

## 2.19 Function of The Breast:

The mammary glands are only active during late pregnancy and after the birth of a baby when they produce milk (lactation). Lactation is stimulated by the hormone prolactin.

Milk Carries HIV virus. Hence if Breast milk is Fed (given) to the child there will be risk of getting HIV infection to the (Breast fed) baby. If child is fed on artificial baby foods, the risk of Infant Mortality will be high. Hence depending on Mothers intelligence and Socio – Economic status one shall judge whether to advise for breast feeding or not. The choice shall be given to the Mother to choose the type of feeding to her child.

## 2.20 Summary:

To summarize female reproductive system, consists of two Breasts to provide milk the to new born, external and genitalia for receiving semen which contains male reproductive cells (sperms), organs for preproduction offemale reproductive cell (ovum), organs for transport travel of ovum (Zygote) and fertilized ovum and organ for child bearing and delivery.

## 2.21 Key Words:

Female sexual organs

Female Gamete

Clitoris

Coitus

Zygote

Menstruation

Chromosomes

Vulva

Bartholin's Glands

Fertilization

Menarche

Menopause

## 2.22 Self Assessment Questions:

1. Draw the diagram of external genitalia of the female (Women)
2. Write briefly about the functions of uterus.

### Write short Notes On:

Menstruation

Coitus

Breast and its Function

Name The Female Sexual Hormones

Bartholin's Glands

## 2.23 Suggested Books:

- |                                    |   |                                    |
|------------------------------------|---|------------------------------------|
| Ross & Wilson Anatomy & Physiology | - | Annewaugh, 10th Edi., 2006         |
| Principles of Anatomy & Physiology | - | Gerard J. Tortora, 10th Edi., 2003 |
| Human Anatomy (VOL. I.II.III)      | - | D.B. Chaurasia, 4th Edi., 2004     |

Lesson Writer

**Maruthi Sarma Mannava**

## **Unit - III**

# **PHYSIOLOGY OF HUMAN SEXUAL ACT**

### **3.0 Objectives:**

The lesson is intended to create awareness about the various aspects of complexity of Human Physiology where Sexual process is under hormonal and nervous influence which dominates the intellectual inhibitions beginning from strong desire to the end of sexual act.

### **Structure of The Lesson:**

- 3.1 Introduction**
- 3.2 Physiology of Male Sexual Act**
  - 3.2.1 Physiology of Male Sexual Act**
  - 3.2.2 Psychic Element of Male Sexual Stimulation**
  - 3.2.3 Integration of the Male Sexual Act in the Spinal - Cord**
  - 3.2.4 Stages of the Male Sexual Act**
  - 3.2.5 Lubrication**
  - 3.2.6 Emission & Ejaculation**
- 3.3 Physiology of Female Sexual Act**
  - 3.3.1 The Female Sexual Act**
  - 3.3.2 Female Erection & Lubrication**
  - 3.3.3 Female Orgasm**
  - 3.3.4 Human Sexual Act & HIV Risk**
- 3.4 Altered Sexual Behaviour**
  - 3.4.1 Altered Sexual Behaviour**
  - 3.4.2 Sodomy**
  - 3.4.3 Common Clinical Findings in a Case of Sodomy**
  - 3.4.4 Incest**
  - 3.4.5 Buccal Coitus (Oral Sex)**
  - 3.4.6 Masturbation**
- 3.5 Summary**
- 3.6 Key Words**
- 3.7 Self Assessment Questions**
- 3.8 Suggested Books**



### 3.1 Introduction:

For reproduction and maintaining a life, the sperm & Ovum shall unite meet and then only fertilization occurs. Hence the male and female in the reproductive age group (15 - 45 years) will be attracted to each other. Then they are supposed to participate in pre sexual play which will lead to coitus and ends with orgasm preceded by Male Ejaculation.

### 3.2 Physiology:

**3.2.1 Physiology of Male Sexual Act: Neuronal Stimulus for Performance of The Male Sexual Act:** The most important source of sensory nerve signals for initiating the male sexual act is the glans penis. The glans contains an especially sensitive sensory end - organ system that transmits impulses to the central nervous system; a special modality of sensation called sexual sensation.

The slippery massaging action of intercourse on the glans stimulates the sensory end - organs, and the sexual signals in turn pass through the pudendal nerve, then through the sacral plexus into the sacral portion of the spinal cord, and finally up the cord to undefined areas of the brain.

Impulses may also enter the spinal cord from areas adjacent to the penis to aid in stimulating the sexual act. For instance, stimulation of the anal epithelium, the scrotum, and perineal structures in general can send signals into the cord that add to the sexual sensation.

Sexual sensations can even originate in internal structures, such as in areas of the urethra, bladder, prostate, seminal vesicles, testes and vas deferens. Indeed, one of the causes of "sexual drive" is filling of the sexual organs with secretions.

Mild infection and inflammation of these sexual organs sometimes cause almost continual sexual desire and "aphrodisiac" drugs, such as cantharides, increase sexual desire by irritating the bladder and urethral mucosa.

**3.2.2 Psychic element of Male Sexual Stimulation:** Appropriate psychic stimuli can greatly enhance the ability of a person to perform the sexual act. Simply thinking of sexual thoughts or even dreaming that the act of intercourse is being performed can initiate the male act, culminating in ejaculation. Indeed, nocturnal emissions during dreams occur in many males during some stages of sexual life, especially during the teens. This is a perfect normal Physiological Process.

**3.2.3 Integration of the Male Sexual Act in the Spinal Cord:** Although psychic factors usually play an important part in the male sexual act and can initiate or inhibit it, brain function is probably not necessary for its performance because appropriate genital stimulation can cause ejaculation in some animals and occasionally in humans also after their spinal cords have been cut above the lumbar region.

Therefore, the male sexual act results from inherent reflex mechanisms integrated in the sacral and lumbar spinal cord, and these mechanisms can be initiated by either psychinc stimulation from the brain or actual sexual stimulation from the sex organs, but usually it is a combination of both.

**Note:** The sexual stimulus is entirely dependant on Hormonal Activity and nervous function. The person under influence of alcohol, gets sexual stimulation. The intelligence factor cannot work much, unless strong inhibitory psychic factors play a role.

**3.2.4 Stages of the Male Sexual Act: Penile Erection - Role of the Parasympathetic Nerves:** Penile erection is the first effect of male sexual stimulation and the degree of erection is proportional to the degree of stimulation, whether psychic or physical.

Erection is caused by parasympathetic impulses that pass from the sacral portion of the spinal cord through the pelvic nerves to the penis. These parasympathetic fibers, are believed to secrete nitric oxide and/or vasoactive intestinal peptide in addition to acetylcholine.

The nitric oxide especially relaxes the arteries of the penis, as well as the trabecular meshwork of smooth muscle fibers in the erectile tissue of the corpora cavernosa and corpus spongiosum in the shaft of the penis, as shown in the figure.

This erectile tissue is nothing more than large cavernous sinusoids, which are normally relatively empty of blood but become dilated tremendously when arterial blood flows rapidly into them under pressure while the venous outflow is partially occluded.

In addition, the erectile bodies, especially the two corpora cavernosa, are surrounded by strong fibrous coats. Therefore, high pressure within the sinusoids causes ballooning of the erectile tissue to such an extent that the penis becomes hard and elongated. This is the phenomenon of erection.

**3.2.5 Lubrication, a Parasympathetic Function:** During sexual stimulation, the parasympathetic impulses, in addition to promoting erection, cause the urethral glands and the bulbourethral glands to secrete mucus. This mucus flows through the urethra during intercourse to aid in the lubrication of coitus.

However, most of the lubrication of coitus is provided by the female sexual organs rather than by the male. Without satisfactory lubrication, the male sexual act is seldom successful because un-lubricated intercourse causes grating i.e., a type of painful sensations that inhibit rather than excite sexual sensations.

**3.2.6 Emission and Ejaculation - A Function of the Sympathetic Nerves:** Emission and ejaculation are the culmination of the male sexual act. when the sexual stimulus becomes extremely intense, the reflex centers of the spinal cord begin to emit sympathetic impulses that leave the cord at T-12 to L-2 and pass to the genital organs through the hypogastric and pelvic sympathetic nerve plexuses to initiate emission, the forerunner of ejaculation.

Emission begins with contraction of the vas deferens and the ampulla to cause expulsion of sperm into the internal urethra. then, contractions of the muscular coat of the prostate gland followed finally by contraction of the seminal vesicles expel prostatic and seminal fluid also into the urethra, forcing the sperms forward. All these fluids mix in the internal urethra with mucus already secreted by the bulbourethral glands to form the semen. The process to this point is referred to as emission.

The filling of the internal urethra with semen elicits sensory signals that are transmitted through the pudendal nerves to the sacral regions of the cord, giving the feeling of sudden fullness in the internal genital organs.

Also, these sensory signals further excite rhythmical contraction of the ischiocavernosus and bulbocavernosus muscles that compress the bases of the penile erectile tissue. These effects together cause rhythmical, wavelike contractions. This increases the pressure in both the erectile tissues of the penis and the genital ducts and urethra, which "ejaculate" the semen from the urethra to the exterior.

This final process is called ejaculation. At the same time, rhythmical contractions of the pelvic muscles and even of some of the muscles of the body trunk cause thrusting movements of the pelvis and penis, which also help propel the semen into the cervix of the uterus.

This entire process of emission and ejaculation is called the male orgasm. At its termination, the male sexual excitement disappears almost entirely within 1 to 2 minutes and erection ceases, a process called resolution.

### 3.3 The Female Sexual Act:

**3.3.1 Stimulation of the Female Sexual Act:** As is true in the male sexual act, successful performance of the female sexual act depends on both psychic stimulation and local sexual stimulation.

Also, as in men, sexual thoughts can lead to female sexual desire; this aids greatly in the performance of the female sexual act. Such desire is based very much on a woman's background training as well as on her physiologic drive, although sexual desire does increase in proportion to the level of secretion of the sex hormones. Desire reaches a peak near the time of ovulation, probably because of the high levels of estrogen secretion during the preovulatory period.

Local sexual stimulation in women occurs in more or less the same manner as in men because massage and other types of stimulation of the vulva, vagina and other perineal regions can create sexual sensations. The clitoris is especially sensitive for initiating sexual sensations.

As in the male, the sexual sensory signals are transmitted to the sacral segments of the spinal cord through the pudendal nerve and sacral plexus. Once these signals have entered the spinal cord, they are transmitted to the cerebrum. Also, local reflexes integrated in the sacral and lumbar spinal cord are at least partly responsible for some of the reactions in the female sexual organs.

**3.3.2 Female Erection and Lubrication:** Located around the introitus and extending into the clitoris is the female erectile tissue almost identical to the erectile tissue of the penis. This erectile tissue, like that of the penis, is controlled by the parasympathetic nerves that pass from the sacral plexus to the external genitalia.

In the early phases of sexual stimulation, parasympathetic signals dilate the arteries of the erectile tissue, probably resulting from the release of acetylcholine, nitric oxide and vasoactive intestinal polypeptide (VIP) at the nerve endings. This allows rapid accumulation of blood in the erectile tissue so that the introitus tightens around the penis; this in turn aids the male greatly in his attainment of sufficient sexual stimulation for ejaculation to occur.

Parasympathetic signals also pass to the bilateral Bartholin's glands located beneath the labia minora and cause them to secrete mucus immediately inside the introitus. This mucus is responsible for much of the lubrication during sexual intercourse, although much is also provided by mucus secreted by the vaginal epithelium and a small amount from the male urethral glands. The lubrication is necessary for establishing during intercourse a satisfactory massaging sensation rather than an irritative sensation, which may be provoked by a dry vagina. A massaging sensation constitutes the optimal stimulus for evoking the appropriate reflexes that culminate in both the male and female climaxes.

**3.3.3 Female Orgasm:** When local sexual stimulation reaches maximum intensity, and especially when the local sensations are supported by appropriate psychic conditioning signals from the cerebrum, reflexes are initiated that cause the female orgasm, also called the female climax.

In addition to the possible effects of the orgasm on fertilization, the intense sexual sensations that develop during the orgasm also pass to the cerebrum and cause intense muscle tension throughout the body. But after culmination of the sexual act this gives way during the succeeding minutes to a sense of satisfaction characterized by relaxed peacefulness, an effect called resolution.

**3.3.4 Human Sexual Act & HIV Risk:** During the sexual act ("coitus") the entire male external organ (Penis) occupies the vagina. In this the prepuce reverts back and will come into contact with vaginal wall of female sex organ.

During coitus micro injuries occur both for vaginal wall and for prepuce (internal surface) & to GLANS PENIS.

Through these micro injuries the body fluids come into contact with each other. This facilitates the HIV organisms to enter the Uterus.

Female has a higher risk of getting the HIV because the semen is released into the vagina. Semen carries the HIV viruses.

## 3.4 Altered Sexual Behavior:

Customs which influence the conduct of civilized society expect only heterosexual intercourse between husband and his wife, with the external sex organs intended for the purpose, with an emphasis on reproduction.

**3.4.1 Altered Sexual Behavior:** This is the purpose of and the normal mode of gratification of the sex desire. Anything which departs from this is abnormal and is termed as Altered Sexual Behavior, deviation or paraphilia (meaning parallel to love).

A person who indulges in 'altered sexual behavior' is called as a pervert or a deviate. Some of these are offences, because they are contrary to law, and are therefore punishable such as for example, sodomy and bestiality (vide infra). These are therefore called as sexual offences. Other are not punishable by law, e.g., incest, (unless it is against the consent of the passive partner).

The altered sexual behavior generally results from sex starvation. When a man is deprived for whatever reason of the company of woman for a long time he suffers from what is called sex starvation. When the natural outlet of coitus is denied to him, he may indulge in abnormal sexual practices, some of which will now be considered.

### 3.4.2 SODOMY: Syn: Buggery

Sodomy according to The Bible, was practised in a town named Sodom. Hence the name.

A man is said to commit sodomy, if he has anal inter course with another man or woman. Sodomy therefore can be homosexual or heterosexual. The Man actively involved to penetrate his penis in sodomy is called the active agent, and the person who allowed his/her anus to be penetrated for the act is called the passive agent.

Paederasty, paederastia or paedophilia is that type of sodomy where the passive agent, is a child.

Hijrahs or Eunuchs are people who earn their livelihood by offering themselves as passive sexual partners (catamites) in sodomy. In other words they are habitual catamites. They are therefore also called as male commercial sex workers (prostitutes).

Because their genitals are cut off, they are safe from committing adultery or rape, so far as women are concerned so originally these persons were chosen as guards to the harem of ancient kings. Hijrahs, wherever they exist (for instance in Hyderabad), perpetuate their tribe by recruiting boys to their fold, and later cutting off their genitals. This is performed by their own barber surgeons. A large dose of opium is used as dope and the operation is performed. Hot oil is used to dress the raw area. When the wound heals, on cursory examination, the external genitals resemble those of the female due to hormonal imbalance. Their voice becomes feminine, distribution of fat tends to be of the female type and they develop breasts. They grow long hair, part their hair like women, and wear ornaments and dress like other women. They are a source of pleasure to vulgar youth.

While investigating cases of sodomy, both the active and passive agents (partners) must be examined.

### 3.4.3 Common Clinical Findings in a Case of Sodomy: In an active agent:

The genital findings are:

- (a) The frenum may be torn, (injury)
- (b) The glans penis may show evidence of friction or inflammation and

#### In a Passive Individual (Catamite):

The following Anal findings are seen:

(All the below mentioned signs may not be generally observed among the Habitual Persons).

- (a) The anal hair may be matted, because of the presence of semen and blood.
- (b) Defecation may be painful.
- (c) Victim complains of pain when his/her anus is examined.
- (d) Skin becomes thickened in a habitual catamite.
- (e) Injury to the anus also can be observed.
- (f) Venereal disease may be noticed.

**3.4.4 INCEST:** Incest refers to coitus between persons who are within forbidden degrees of marital relationship. Ex - coitus between a father and his daughter is an example of incest. Such coital relationship is said to be incestuous. If a father or brother is HIV positive the infection may spread to the daughter or sister respectively and vice versa.

**3.4.5 Buccal Coitus (ORAL SEX):** Buccal Coitus, as the term suggests is sexual intercourse through the mouth and is usually practised by adult males on young children. The male partner keeps his penis in the mouth of his sexual partner (Male or Female).

If the Gums are not Healthy, Ulcers in the mouth, Gingivitis & Bleeding Gums can result. The semen of HIV positive Agent is harmful and risk of transmission is more. In Oral Coitus passive individual is if HIV positive her saliva may not have risk of transmitting the virus but if her/his Oral Hygiene is not good and having ulcers, there is a risk of spread of infection. If penis is having injuries and ulcers, the risk of spreading of infection will be more.

**3.4.5 Masturbation:** It is a Sexual - Self - satisfaction Procedure. Generally it is practiced by both sexes. It is harmless and there will be no risk of HIV infection. It is the best way of satisfying the sexual desire. Self stimulation of the genitalia for erotic (sexual) pleasure, often resulting in orgasm. It is an absolutely safe practice and can be encouraged. It helps in controlling sexual assaults & altered sexual behaviours in the community.

### 3.5 Summary:

Both the sexual partners shall get sexual stimulation to participate in sexual act for successful coitus. Human physiology of sex is a little bit different when compared with animal behavior. Animals go by their instinctive nature and no psychological barriers play much role. Whereas Human physiology will be partially regulated by Psycho Social inhibitory mechanisms. But once the sexual stimulus prevails the intellectual inhibitions will be vanished. Hence persons under the influence of Alcohol and narcotics act accordingly with instinctive inherited influences, That is why we hear about Father molesting his Daughter etc. the fear of disease also vanishes if the sexual desires overcome the psychological inhibitory mechanisms

Stages of sexual acts are more or less same in both sexes. Female desires may reach peak at the time of ovulation.

Students shall understand issues and should not get any hatred against the persons who indulge in strange and non acceptable sexual relations.

Every altered activity of sex is under the influences of genetic, Hormonal and psychic influences. Hence counselor should understand and interact with compassion.

### 3.6 Key Words:

Sensory end organs

Sexual drive

Erection

Parasympathetic Nervous System

Sympathetic Nervous System

Female Climax  
Resolution  
Sodomy  
Buggery  
Catamite  
Incest  
Commercial Sex Worker  
Buccal Coitus  
Masturbation

### 3.7 Self Assessment Questions:

1. How does a Male develop sexual desire? Explain the Role of breasts in initiating internal reflex mechanisms.
2. Write briefly on penile erection.

#### Write Short Notes On:

Female erection & Lubrication  
Female orgasm  
Resolution  
Incest  
Masturbation

### 3.8 Suggested Books:

Essentials of Medical Physiology	-	Sembhulingam, 2nd Edi., 2002
Text Book of Physiology (Vol I, II)	-	AK. Jain, 2nd Edit., 2002
Fundamentals of Medical Physiology	-	L P R., 3rd Edit., 2003
Viva Voce in Physiology	-	Sembulingam, 1st Edi., 2003

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**Unit – IV**

## **SEXUALITY, SENSITIVE ISSUES AND RISK REDUCTION**

**4.0. Objectives:**

- (a) To enable the trainees to accept a range of sexual practices as normal.
- (b) To enable the trainees to build skills in introducing and discussing sensitive issues with clients.
- (c) To enable the trainees to build skills in discussing risk reduction.
- (d) To enable the trainees to correctly demonstrate condom use.
- (e) To enable the trainees to correctly demonstrate the use of bleach.

**Content**

- 4.1. Sexuality and Sensitive issues**
- 4.2. Guidelines On Talking About Sensitive Topics**
- 4.3. Cultural Factors Influencing Sexual Behaviour**
- 4.4. Talking About Levels Of Risk**
- 4.5. Talking About The Use Of Condoms**
- 4.6. Talking About The Use Of Bleach To Disinfect....**
- 4.7. Summary**
- 4.8. Summary Of Activities**

**4.1. SEXUALITY AND SENSITIVE ISSUES****SEXUALITY AND SEXUAL OPTIONS**

Sexual behaviour change of a client is an important component of STI and HIV counselling. Unfortunately, many counsellors find it difficult to get over being shy, embarrassed and put off dealing with the sexual issue; at other times, they are judgemental and label a sexual behaviour as not normal. Counsellors will need the essential 4 C's - Compassion, Care, Communication and Counselling - to achieve success. It is also important to have basic knowledge of sexuality and the range of sexual behaviours.

**• What is Sexuality?**

It actually refers to gender - male or female - but has been relegated to imply "doing" something, such as intercourse/orgasm, or to the vagina, penis – the genitals. Sexuality is a more complex phenomenon which is difficult to define but perhaps easy to understand. Sexuality refers to the total sexual makeup of an individual. Sexuality includes sex, sexual behaviour, sexual intercourse. It is expressed in many physical ways. It is not confined to sexual intercourse but includes touching, talking, embracing, fantasizing, kissing, caressing or just holding hands. In addition to covering the physical aspects, sexuality also encompasses feelings, attitudes, values and preferences. It involves a lot of caring and sharing. Understanding sexuality is important for safer sex behaviour.

**• What Exactly is Normal?**

Today it is recognised that there are many variations of sexual behaviour. No two people behave exactly the same way sexually. On the other hand, we all like to think that how we act and how we think about sex is "normal". In reality, our thinking has been conditioned by culture, tradition,



society and our own emotions and experiences. The example may be given of homosexuality. A range of responses are expressed by different people about this: "They are unnatural"; "Should not be tolerated"; "It is abnormal"; if found in a workplace "They should be ostracised or sacked"; "It is an alternative sexual behaviour and homosexuals are as good as heterosexuals".

Whatever may be the beliefs or personal views, counsellors must be non-judgemental in viewing the client as a person requiring compassion, care and help to practice safer sex rather than concentrating on changing the sexual orientation of the person.

Certain criteria to evaluate what is "normal" in a relationship could be:

(1) *Consent* between the two partners to enact what gives them mutual pleasure,

e.g. oral sex, variations in coital positions, anal sex;

(2) Any sexual activity that does not cause physical or mental harm;

(3) It should be a private affair - not public;

(4) The activity should not be exclusive (while keeping in mind that penile - vaginal insertion is the usual and necessary one for procreating), e.g. one partner insisting that only oral sex should be done.

The spectrum of sexual behaviours is wide. Some those connected with sexual behaviour in the context of STDs and HIV/AIDS infection are mentioned:

(1) **Abstinence:** Keeping away from sex. Culturally, in India and other parts of the region, a good number of young people believe that sexual intercourse should only be done after marriage. Virginity is still prized. While recommending safer sex, those wishing to practice abstinence should be encouraged. Definitely, they should be made knowledgeable of the consequences of unprotected sexual intercourse.

(2) **Masturbation:** Means stimulating one's own genitals to reach orgasm. Most males masturbate with their hands, while some rub their penis against the surface of the bed, or use some object. Females also masturbate in the same way. Masturbation is still a taboo topic. Men masturbate more readily than women but few view it in a positive light. Now, masturbation can be considered as one of the satisfactory and harmless ways to achieve sexual satisfaction. The only harm it does is the guilty feelings it may produce in those who are riddled with the many misconceptions regarding masturbation. Many may reject the myths, the taboos and the "don'ts" about masturbation but still feel anxious, uncomfortable or guilty about it. It is important that while attempting to change a client's behaviour, he/she must be made to understand the value of masturbation as a safer sex procedure.

(3) **Nocturnal emissions:** If a male does not have any other method of sexual outlet, he will experience "wet dreams" or nocturnal emissions. The person will have a dream with erotic content during which ejaculation will occur. This is perfectly normal.

(4) **Oral sex:** Using the mouth in any way on portions of the body is referred to as oral sex, but most people believe it is specifically using the mouth on the partner's genitals. "Fellatio" is when the female uses her mouth on the partner's genitals. "Cunnilingus" is when the male uses his mouth to stimulate the female's vagina. When HIV infection is a possibility or if infections in the mouth are present, oral sex should be avoided or the male may wear a condom while engaging in fellatio.

**(5) Homosexuality:** Persons who choose to share their bodies sexually with persons of the same gender are called homosexuals. In a male-male relationship, the person may be termed homosexual or gay. In a female-female relationship the person is known as a lesbian. Why homosexual behaviour is preferred by some is still debated. The term "alternative sexuality" is becoming a more acceptable term. Attitudes towards homosexuality are changing although there is still a great deal of antagonism, contempt, anger and misunderstanding among people. Health professionals are now coming to accept homosexuality more as a sexual variation than as an illness. Sometimes, homosexual experiences may be situational as occurs in prisons, some boarding schools and colleges. The person may participate voluntarily or be forced even when he/she usually prefers heterosexual intercourse. Bisexuals are persons who are sexually attracted to both men and women.

Homosexual behaviour is dangerous only if penetrative anal sex occurs. Fine injuries or ruptures around the anus help the meeting of HIV infected blood or semen with the blood of the uninfected partner. Oral sex which is a popular sexual activity with homosexuals can be unsafe if a partner has mouth, vaginal or penile lesions. Condom *usage on every occasion* is a must. Often behaviour like "cruising", where a person goes out to find an unknown partner or stranger in a train, exhibition etc. is very unsafe behaviour and the dangers should always be explained to the client. On counsellors and sexuality. A few final words for counsellors on sexuality

- they should be comfortable and familiar with the terminology of human anatomy, physiology and sexual behaviour;
- they should understand the basic underlying processes of reproductive and sexual physiology;
- **they need to appreciate the range and** variety of sexual expression in the human culture;
- **they must recognize** the social implications of human sexual behaviour and the relative nature of these implications in different societies;
- they have to work at being able to deal candidly with their own sexuality in relation to oneself and others, and reflect on the related moral and ethical dilemmas.

#### **4.2. GUIDELINES ON TALKING ABOUT SENSITIVE TOPICS**

It is necessary for counsellors to obtain an understanding, or history of the behaviour which may have exposed the client to HIV infection or AIDS. This means that counsellors must be able to gather and interpret information about very private - and sometimes illegal or socially condemned - behaviour. There is no simple formula for getting people to talk about topics such as their own sexual activities, drug injecting or responses to infection from blood transfusion. Effective discussion of sensitive topics will depend in large part upon the ability of the counsellor to:

- gear his/her communication to the emotional and intellectual level of the client;
- make the client feel safe, secure and accepted by establishing a supportive relationship; and
- demonstrate his/her own ease in talking about topics usually avoided in ordinary social life or in medical consultations.

Whatever approach a counsellor uses, it will require skill, tact and sensitivity towards the client. With some clients, counselling can be a process which develops gradually and may need to be eased into slowly. Early on, a rapport will need to be established, together with an overall atmosphere that helps the client to develop a feeling of safety and trust, without which the counselling process will not be completely successful. The counsellor's style must therefore be *reassuring, confident and direct*, but considerate of the client's feelings and fears and acknowledging the client's difficulty.

The following specific guidelines on talking about sensitive topics will be useful to counsellors:

(1) Ask direct questions so as to be clear about what is worrying the client, and what he/she wants and expects from the counsellor.

**Example:** What do you want from me (this clinic, hospital, etc.) right now? What made you decide to come here now?

(2) Establish the reasons for the client's concern or belief that he/she is infected or at risk of infection.

**Example:** You tell me that you are afraid you have AIDS. Tell me what you know about the ways in which people become infected. In which of these ways are you most at risk?

(3) Anticipate a certain degree of embarrassment at discussing sex; point out that you realize that people do not usually discuss it in such depth.

**Example:** We do not usually talk very openly about sex in our country. But, now, since you believe you may have been at risk of infection, you and I must determine the degree of risk. To do that, I have to ask some very specific questions. Most people feel a bit embarrassed by these questions, and you may too. For example, I need to know how many sexual partners you have had over the past six months.

*(4) Explain clearly why you must enquire into sexual practices and drug injecting - that it is in order to determine precisely what the client needs to do to prevent becoming infected or passing the infection on to others.*

**Example:** HIV is transmitted in a number of quite specific ways. You know that sharing needles is dangerous for you and for others. What can you do to keep yourself free of infection, or to protect other people?

(5) Explain why you are asking questions about all forms of transmission.

**Example:** Sometimes people are offended when I ask about practices that seem strange or even repulsive because they are not common in this area. But, people travel, and sometimes experiment, so we must make sure that all the possible risks are covered. In such interviewing, the counsellor should use the formal expression first (e.g. vaginal intercourse). If it is not understood, the slang expression should be used and the client asked which one is preferred. The client must not feel that the counsellor is making any moral judgement on any sexual behaviour or other risk behaviour.

The counsellor should check frequently to make sure that the client understands what is being said - for instance, by asking the client to repeat in his/her own words what the counsellor has been saying. The counsellor should also ensure by asking the questions given below that everyone being counselled for the prevention of HIV infection receives and understands the following 3 essential messages:

'There is no cure for HIV infection. Prevention is the only defence at the present time.

**Questions:** How do you think that HIV infection is spread? If you want to stay free of infection, what changes will you have to make? Changes of this kind are difficult for most people - what can

we do to help you make them and not fall back into the old ways? What will you tell others (spouse, partner) about why you are changing your sexual behaviour?

**HIV can be transmitted through vaginal and anal sex; sharing needles; and contaminated blood.** ‘

**Questions:** What do you think people find most difficult when they give up (whatever the risk behaviour is)? What do you think might be hardest for you? When you say you do some risky things, what do you mean? ‘HIV transmission can be prevented only through abstinence, or sex without exposure to blood, semen or vaginal, cervical fluids. To lessen the risk of sexual transmission, men should use a condom each time and from start to finish. Women should ensure that their partner uses one. The more sexual partners, the greater the risk of exposure. Drug injectors should not share with anyone else syringes or other drug-related instruments that pierce the skin.

**Questions:** Do you think it is possible for you and your spouse/partner to abstain from sex? Have you tried condoms? When you and your spouse/partner talk about condoms, how comfortable is each one of you? What do you know about the best way to use a condom? The client should be given time and information with which to discuss appropriate means of infection control and avoidance (see Module V I for “Practical Information for People with HIV Infection and Disease”). This information must be communicated in a language and terms that the client understands. The counsellor will need to try different versions and to vary it for individual cases.

**Clients may be given a pamphlet** or leaflet containing information on HIV transmission, prevention and condom use. If they cannot read, the counselor should go over the details, using questions to doublecheck that the information is being understood. Clients who can read and write should be encouraged to make notes and take them home. Follow-up questions might also be used.

### **4.3. CULTURAL FACTORS INFLUENCING SEXUAL BEHAVIOUR**

It is important to note that, in some cultures, the absence of penetrative sex is the same as not having had sex at all - suggestions for safer sexual practices may therefore not be well received in many cultural settings. In these cases, it must be reiterated that the only *completely* safe behaviour is a monogamous long-lasting relationship in which neither partner is infected with HIV. The counsellor should anticipate that some of this information may be met with embarrassment, laughter, turning away, or even anger depending on the cultural context. On religious grounds, for example, a person might become angry with a counsellor who mentions masturbation. As always, the counselor should respect the client's beliefs, but point out that everyone is entitled to complete information, whether or not a decision is made to act on it.

### **4.4. TALKING ABOUT LEVELS OF RISK**

The risk associated with some sexual practices has not been definitely established. The counsellor must be as certain as possible that the client understands the relative degree of risk involved. In discussing these levels of risk, it will once again be necessary for the counsellor to engage the client in talking about taboo topics or unfamiliar practices. Messages about relative degrees

of risk will be most clearly understood after information about safer sex has been given and its implications discussed.

#### 4.5. TALKING ABOUT THE USE OF CONDOMS

The counsellor must emphasize to clients of both sexes the importance of consistent use of condoms. Even if there is strong resistance to the use of condoms, clients must be helped to assess realistically the risks to themselves, and others of not using them if they have been at risk of infection or intend to practice unsafe sexual or other behaviour.

The counsellor should be forthright in telling clients that condoms need getting used to, and that they will need to practice putting them on. Clients also need to be told that condoms are not foolproof against tearing or leakage, and must be put on carefully and properly.

**Instructions for condom users** - For maximum protection against HIV infection, condoms must be used correctly. Make sure that you understand and follow these instructions:

- Use a new condom every time you have intercourse. Check the expiry date before use.
- Always put the condom on the erect penis before intercourse begins.
- In putting on the condom, squeeze the nipple or empty space at the end of the condom in order to remove the air. Do not pull the condom tightly against the tip of the penis; leave the small empty space (one or two centimetres) at the end of the condom to hold the semen.
- Unroll the condom all the way to the base of the penis.
- If the condom tears during intercourse, withdraw the penis immediately and put on a new condom.
- After ejaculation, withdraw the penis while it is still erect. Hold the rim of the condom as you withdraw, so that the condom does not slip off.
- Remove the condom carefully so that seminal fluid does not spill out. Dispose of used condoms in a closed receptacle for waste.
- If a lubricant is desired, use a water-based one, since petroleum jelly may damage condoms.
- Do not use saliva as a lubricant - it is ineffective and may lead to breaking of the condom.
- Store condoms away from excessive heat, light, and moisture, as these cause them to deteriorate and perhaps break. Do not keep them in the glove compartment of cars or wallet for long periods of time.
- Condoms that are sticky or brittle or otherwise damaged should not be used. These instructions may prove difficult to follow by even the well educated. It is preferable that counsellors become conversant with them and explain them in simple language. Use of simple graphic material (adapted to the culture) is recommended. Consider adapting the culturally appropriate graphics already in use by family planning associations in your area.

#### 4.6. TALKING ABOUT THE USE OF BLEACH TO DISINFECT SYRINGES AND NEEDLES AND OTHER INJECTING EQUIPMENT

The counsellor must emphasize the importance of avoiding using drugs. The counsellor must also emphasize that if drug use can not be avoided, then it is important to avoid injecting drugs. If the person cannot avoid the use of injecting drugs, then give instructions not to share needles, syringes and other injecting equipment. Explain the risk of HIV transmission through sharing needles and syringes and other skin piercing instruments. If the injecting drug user cannot avoid the use of sharing needles or other injecting equipments, then instruct the person to do the following:

The first step is to flush the equipment several times with clean water to get rid of the blood or other debris stuck inside the equipment. Then, either: sterilize by boiling the injecting equipment for 20 minutes. or

use the bleach in the following manner:

- A level teaspoon of household bleach should be mixed with a litre of water.
- Put the solution into a bowl and flush *twice* the syringe and needle with the solution.
- Flush *twice* the syringe and needle with water.

#### 4.7. SUMMARY

Human sexuality is a very important aspect of people's lives and needs to be well understood by counsellors when doing HIV prevention and supportive counselling. It refers not only to sexual intercourse/ activities but also to feelings, attitudes and values. What is considered as normal by one person in one society may be considered as abnormal by someone else in another social environment. It is important for counsellors to be non-judgemental about clients' sexual preferences and orientations and keep the focus on exploring safer sex options. Some of the sexual behaviours that need special attention in connection with STIs and HIV are: abstinence, masturbation, nocturnal emissions, oral sex and homosexuality.

To obtain an understanding of the client's behaviour which led to or places him / her at risk of HIV infection, the counsellor must be able to obtain information on such sensitive topics as sexual practices and drug injecting. This can be done only through informed questioning. Questions must also be used to ensure that all clients understand the basic information on HIV infection and its prevention. Clients must be given advice on safer sexual practices, but told that the only completely safe behaviour is sexual abstinence or a monogamous long-lasting relationship. The latter is particularly important in cultures in which advice on non-penetrative or safer sexual practices is not well received. In discussing levels of risk, counsellors will again have to talk to clients about sensitive topics, and will themselves need to decide how ready they are to talk about them. The consistent use of condoms must be emphasized and instructions given on how they should be used. Importance of not sharing needles and syringes and other injecting equipment should be emphasized and the use of bleach to sterilize injecting equipment should be explained.

**Time to complete the Module: 3 hours 45 minutes.**

#### 4.8. SUMMARY OF ACTIVITIES

- (1) Large group discussion: Being comfortable with sexuality and sexual issues.
- (2) Small group work: Sexual terminology.
- (3) Small group work: Talking and thinking about sexual behaviour.
- (4) Paired exercise: Developing communication skills to discuss sensitive issues related to sexuality.
- (5) Brainstorming: Safer sex and risk reduction.
- (6) Game and Demonstration: Correct condom use.
- (7) Demonstration of use of bleach
- (8) Self assessment: Review questions.

#### Activity 1: **LARGE GROUP DISCUSSION: BEING COMFORTABLE WITH SEXUALITY AND SEXUAL ISSUES** (15 minutes)

The aim of this activity is to desensitize trainees so that they can comfortably discuss sex and sexuality in a non-judgemental way. The trainer asks trainees to suggest words or phrases that would help to define sex, *love*, *sexuality*. Next, he/she asks the group for their ideas about why it

is important for counsellors to be able to openly discuss sexual issues and sexuality. Record all these ideas on a flip chart, so that the trainees and trainer can get an overall picture of the group's inputs. End the activity by stressing the importance of a counsellor's comfort-level about sexuality and related issues in helping his/her clients to open up and deal with their concerns or dilemmas.

**Activity 2: SMALL GROUP WORK: SEXUAL TERMINOLOGY (30 minutes)**

This session is designed to practice talking about sex and sexual terminology, and to have trainees feel more comfortable referring to sexual activities. Divide trainees into small groups of 4-6 people. Distribute worksheet 1. Ask each group to come up with acceptable and slang terms for each of the given terms in their local language. After 15-20 minutes have the trainees re-assemble as a full group. Ask each group member read out one word from their group's list in the large group. By practising this skill of using acceptable sexual terms, they will reduce possible, future difficulties in talking to clients about sexual behaviours. Wrap up this session by stating that a good counsellor should be able to select the appropriate words to refer to any of these sexual terms without offending the client, and without feeling too uncomfortable.

**Activity 3: SMALL GROUP WORK: TALKING AND THINKING ABOUT SEXUAL BEHAVIOUR (40 minutes)**

This activity provides an opportunity to explore the differences between one's thoughts and feelings in different situations and to consider how one's feelings affect one's responses to different situations. Divide participants into groups of three or four people. Give each of the groups one of the listed situations and ask them to take it in turns to consider the following issues in the given situations. Allow 15 minutes for the groups' discussions. Emphasize that the trainees should not be putting themselves into a counsellor's role for this exercise but rather talking about how they react *personally*, as individuals.

**How do you feel?**

**What do you think ?**

**What do you do ?**

Next, ask one member from each group to share briefly the major points of discussions from all three angles (think, feel, do) for their situation(s). The trainer summarizes bringing out the various patterns of sexual behaviour prevalent in the community and the kind of judgements people make. The trainer further emphasizes the range of "*normality*" in sexual activity and reinforces the need to be non-judgemental. This activity should take about 40 minutes.

Situations:

- Your child has come to you and asked how babies are made.
- Your best friend has just found out that her partner is having a sexual relationship with someone else.
- A young man in a group you are talking to, asks you what an orgasm is.
- You discover your son is having sex with commercial sex workers.
- You find that when you urinate, you have a discharge.
- One of your colleagues tells you that they think they might have an STD.
- Your daughter asks you what the term "anal sex" means.
- You notice multiple needle marks on the arm of your friend; he confesses he is an IV drug user.  
(This exercise is adapted, with permission, from an IPPF Counselling and Sexuality training exercise).

**Activity 4: PAIRED EXERCISE: DEVELOPING COMMUNICATION. SKILLS TO DISCUSS SENSITIVE ISSUES RELATED TO SEXUALITY (30 minutes)**

This activity builds skills among trainees for discussing sensitive issues and increases their awareness of the associated discomforts. The trainer starts by asking the group for examples of sensitive issues. Then he/she divides the group into pairs and explains the activity: "One of the pair will act as counsellor and the other as client. 'Chits' or small pieces of paper will be passed to the 'client' in each pair containing the description of a sensitive counselling scenario. The counsellor should try to help the client with his/her concern or dilemma."

Chits with the situations are distributed to all the pairs so they can begin the activity. After 10 minutes, the full group re-assembles and each of the counsellors first, and then the clients, share their experience (feelings and thoughts) with the group. The trainer concludes the session by using Overhead #1 and going over the five guidelines listed.

**Counselling Scenarios:**

- I suspect my girl friend also has other boy friends but I love her. I am afraid of AIDS but she gets very angry and tells me I do not trust her when I ask her about other boys. What can I say the next time I see her?
- Besides my wife, I have a regular girl friend. I always use a condom to avoid a pregnancy but she insists I should not use a condom during her menstruation period as she says that is a safe period. What shall I do?
- I think that my son is using drugs, but he has not talked to me about it yet. Should I bring it up?
- My wife and I have occasional anal sex and have been doing this for years. I was recently told I can get AIDS - I am now afraid and have come to you for advice.
- I am afraid of oral sex. Is it bad? Am I in danger of infection, particularly AIDS?
- I am a 17-year old boy. I have a boy friend with whom I have anal sex regularly. I do not want to stop but I am worried it may not be healthy for me.

**Activity 5: BRAINSTORMING: SAFER SEX AND RISK REDUCTION (30 minutes)**

This activity shows trainees how to identify behaviours with clients that will reduce their exposure to risk of HIV transmission. The trainer draws a line down the middle of a large sheet of paper or board and heads one side as "Good things" and the other side as "Bad things" like shown below.

**GOOD THINGS BAD THINGS**

The group offer their ideas about good things one enjoys or likes or gets and bad things or the negatives about sex. Once the paper or board is full, the trainer brings the group around to considering ways/behaviours by which the good things of sex can be kept and the bad things (risks) avoided or reduced. He/she asks trainees to summarize the major points that have been shared. Overhead #2 is shown to highlight safer sex options. The trainer repeats the same brainstorming and listing process for using drugs.

**Activity 6: GAME AND DEMONSTRATION: CORRECT CONDOM USE (45 minutes)**

This activity aims to make all trainees more experienced at discussing and demonstrating condom use. Hand out a set of the condom cards to sub-groups of three trainees. Make copies of the condom cards for each group and mix them up. Ask the groups to put the cards in order.

Each trainee needs a condom for this next part of the activity. Ask all trainees to unwrap the condom and handle it. Some trainees can try to inflate the condom. Certainly they should all stretch the condom to see how strong the condom is. After 5-10 minutes, the trainer demonstrates how to use a condom using a penis model, bottle or banana. State the steps as



you carry out the demonstration. The trainees should correct any mistakes in the order/sequencing of their cards. Then distribute condoms, models and tissue paper (for wiping lubricant off fingers) to all the trainees. Each trainee should act out teaching one of the group members how to use the condom while the other monitors (by silently reading the cards) in pairs. Each should take a turn. Then discuss how they feel about teaching condom use. In what situations might they/might they not be comfortable teaching how to use a condom? What prevents or makes people reluctant to use condoms?

**Activity 7: DEMONSTRATION OF THE USE OF BLEACH (15 minutes)**

This activity aims to provide all the trainees with experience in the correct use of bleach to disinfect needles and syringes and other injecting equipment. The trainer requires a packet of bleach, one litre container, a teaspoon, a syringe and needle, a bowl and water. The trainer demonstrates the preparation of the solution of bleach and how to flush the syringe and needle first with the bleach solution and then with water. The trainer also discusses sterilization of syringes by boiling them for 20 minutes.

**Activity 8: REVIEW QUESTIONS (15 minutes)**

Trainees fill up the worksheet 2 within 10 minutes. Trainees can discuss their answers with a partner or with the trainer.

**WORKSHEET 1: For Activity 2**

**GROUP WORK SEXUAL TERMINOLOGY**

**Technical English Acceptable/ Slang/**

**Local language Colloquial**

1. Sexual intercourse
2. Semen
3. Ejaculation
4. Penis
5. Vagina
6. Masturbation
7. Orgasm
8. Breasts
9. Anal intercourse
10. Kissing
11. Oral sex
12. Erection
13. Buttocks
14. Condom
15. Homosexual
16. Menstruation
17. Abortion
18. Incest
19. Paedophile
20. Homosexuality

**WORKSHEET2**

**REVIEW QUESTIONS**

- (1) In your own workplace or community, which of the risk practices would be most difficult to talk about?

(2) Explain the following terms:

Bisexual  
Masturbation  
Non-judgemental attitude

(2) How comfortable will you feel discussing sexual behaviour of your client if he/she is of the same sex?

• Very comfortable • Comfortable  
• Uncomfortable • Very uncomfortable

(4) How comfortable will you feel discussing sexual behaviour if your client is of a different sex?

• Very comfortable • Comfortable  
• Uncomfortable • Very uncomfortable

### **WORKSHEET 3: for Activity 6**

#### **CONDOM USE CARDS**

Carefully open the package so the condom does not tear. Do not unroll condom before putting it on. If not circumcised, pull foreskin back. Squeeze tip of condom and put it on end of hard penis. Continue squeezing tip while unrolling condom until it covers all of penis. Always put on a condom before entering partner.

After ejaculation hold rim of condom and pull penis out before penis gets soft. Slide condom off without spilling liquid (semen) inside. Tie and wrap the condom (in paper, if available) then throw in dust bin. Wash hands. Burn or bury the condom with other trash. Wash hands.

#### **OVERHEAD # 1: For Activity 4**

##### **GUIDELINES ON TALKING ABOUT SENSITIVE TOPICS**

(1) Ask direct questions so as to be clear about what is worrying the client and what he/she wants and expects from the counsellor.

(2) Establish the reasons for the client's concern or belief that he/she is infected or at risk of infection.

(3) Anticipate a certain degree of embarrassment at discussing sex; point out that you realize that people do not usually discuss it in such depth.

(4) Explain clearly why you must enquire into sexual practices and drug injecting - that it is in order to determine precisely what the client needs to do to prevent becoming infected or passing the infection on to others.

(5) Explain why you are asking questions about all the forms of transmission (viz. you are making sure that all possible risks are covered).

#### **OVERHEAD # 2: For Activity 5**

##### **SAFER SEXUAL ACTIVITIES**

Talking, writing or reading about sex

Watching sexy films and live shows

Individual masturbation

Deep kissing

Mutual masturbation

Sex with underclothes on

Sex with other parts of the body (e.g., thighs, breasts)

Penetrative oral, vaginal and anal sex using condoms

## **Unit : V**

# **INTRAUTERINE DEVELOPMENT OF HUMAN BEING**

### **Objective:**

After studying the lesson, the student will have a clear cut idea about the intrauterine development.

Till the initiation into this course, even most scientific graduates don't have clear knowledge of human development before birth.

The student will also be able to appreciate the basic aspects of human intrauterine development.

### **Structure of the lesson:**

- 5.1 Introduction**
- 5.2 First week of development**
- 5.3 Second week of development**
- 5.4 Third week of development**
- 5.5 Forth to Eight weeks of development**
- 5.6 Summary**
- 5.7 Key Words**
- 5.8 Self Assessment Questions**
- 5.9 Suggested Books**

### **5.1 Introduction:**

All living made up of millions of cells. The millions of cells segregate into groups and perform certain specific functions. They are known as organs and tissues. Like liver, spleen, brain etc., but every multi cellular organism shall start its live from one cell, known as zygote.

Zygote will be formed after union of mother cell and father cell in the fallopian tubes. From there it enters uterus attaches to its wall and multiples into new life. The science which deals the development after fertilization to new life is known as embryology. During the intra period and the process of the delivery the child will have a high risk of getting HIV virus through circulating maternal blood.

The counsellor shall have a minimum knowledge of human intra uterine growth and development to explain and to educate the risk of transmission of HIV virus to HIV positive mother.

Hence the unit 5 provides knowledge about the intra uterine development.

## 5.2 First Week of Development:

The first week of development is characterized by several significant events including fertilization, cleavage of the zygote, blastocyst formation, and implantation.

**Fertilization:** Fertilization occurs between the sperm cell and Ovum and results in the formation of Zygote. Of the about 200 million sperm introduced into the vagina, fewer than 2 million (1%) reach the cervix of the uterus and among them only about 200 reach the secondary oocyte. Fertilization normally occurs in the Fallopian tube within 12 to 24 hours after ovulation. Sperm can remain viable for about 48 hours after deposition in the vagina. Ovum is viable for only about 24 hours after ovulation. Thus, pregnancy is most likely to occur if intercourse takes place during a 3-day “window” – (from 2 days before ovulation to 1 day after ovulation).

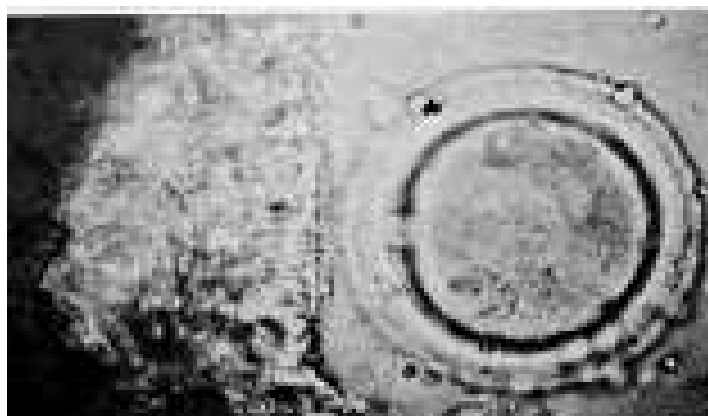
The process leading to fertilization begins when sperms swim from the vagina into the cervical canal propelled by the whip like movements of their tails (flagella). The passage of sperm, through the uterus and then to the Fallopian tube, is due to the contractions of the walls of organs through which it is passing. Sperms that reach the vicinity of the oocyte within minutes after ejaculation are not capable of fertilizing it until about seven hours later.

Only the first sperm cell to penetrate the entire zona pellucid and reach the oocyte's plasma membrane fuses with the oocyte. The fusion of a sperm with a secondary Oocyte is called **syngamy**. Once a sperm cell enters a secondary oocyte, the oocyte first must complete meiosis II.

It divides into a larger ovum (mature egg) and a smaller second polar body that fragments and disintegrates. The nucleus in the head of the sperm develops into the **male pronucleus**, and the nucleus of the fertilized ovum develops into the **female pronucleus**. The fertilized ovum now is called a **zygote**.

### First Week of Development: Cleavage of the Zygote:

After fertilization, rapid mitotic cell divisions of the zygote called **cleavage** take place.



5th day after fertilization

- **1<sup>st</sup> Day**

The first division of the zygote begins about 24 hours after fertilization and is completed about 6 hours later. I.e. the second day after fertilization,

- **2<sup>nd</sup> Day**

The second cleavage is completed and there are four cells (4 Cells).

- **3<sup>rd</sup> Day**

By the end of the third day, there will be 16 cells. The progressively smaller cells produced by cleavage are called **blastomeres**. Successive cleavages eventually produce a solid sphere of cells called the **morula**.

- **4<sup>th</sup> Day & 5<sup>th</sup> Day**

**Blastocyst Formation:**

By the end of the fourth day, the number of cells in the Morula increases as it continues to move through the uterine tube toward the uterine cavity. The morula enters the uterine cavity on day 4 or 5. At the 32 cell stage, the fluid enters the morula, collects between the blastomeres, and reorganizes them around a large fluid-filled cavity called the **blastocyst cavity**. With the formation of this cavity, the developing mass is then called the **blastocyst**. Though it now has hundreds of cells, the blastocyst is still about the same size as the original zygote.

Further rearrangement of the blastomeres results in the formation of two distinct structures; the inner cell mass and trophoblast. The **inner cell mass** is located internally and eventually develops into the embryo. The **trophoblast** is an outer superficial layer of cells that forms the wall of the blastocyst. It will ultimately develop into the foetal portion of the placenta.

- **6<sup>th</sup> Day**

**Implantation:** The blastocyst remains free within the uterine cavity for about 2 days before it attaches to the uterine wall. The endometrium is in its secretory phase. About 6 days after fertilization, the blastocyst loosely attaches to the endometrium, in a process called **implantation**.

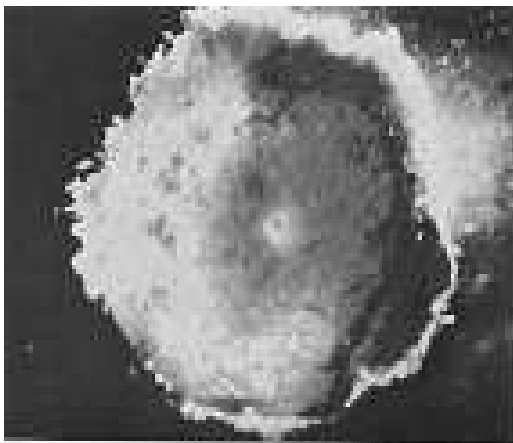
- **7<sup>th</sup> Day**

As the blastocyst implants, usually in either the posterior portion of the fundus or the body of the uterus, it orients with the inner cell mass toward the endometrium. About seven days after fertilization, the blastocyst attaches to the endometrium more firmly, endometrial glands in the vicinity enlarge, and the endometrium becomes more vascularized.

### 5.3 Second Week of Development:

- **8<sup>th</sup> Day**
  - Development of the Trophoblast
  - Development of the Bilaminar Embryonic Disc
  - Development of the Amnion
  - Development of the Yolk Sac
  - Development of the Amnion
  - Development of the Yolk Sac
- **9<sup>th</sup> Day**
  - Development of Sinusoids
- **12<sup>th</sup> Day to 14<sup>th</sup> Day**
  - Development of lacunar networks
  - Development of the Extraembryonic Coelom
  - Development of the Chorion

### 5.4 Third Week of Development:



3rd Week

- **Gastrulation:**

The formation of the **primitive streak and Formation of primitive node.**

Following formation of the primitive streak, cells of the epiblast move inward below the primitive streak and detach from the epiblast. This inward movement is called **invagination**. Formation of **endoderm, mesoderm and ectoderm.**

As the embryo develops, the endoderm ultimately becomes the epithelial lining of the gastrointestinal tract, respiratory tract, and several other organs. The mesoderm gives rise to muscle, bone and other connective tissues, and the peritoneum. The ectoderm develops into the epidermis of the skin and the nervous system. The below table provides more details about the fates of these primary germ layers.

- **16 days**

Mesodermal cells from the primitive node migrate toward the head end of the embryo and form a hollow tube of cells in the midline called the **Notochordal process**

- **17<sup>th</sup> day**

Development of paraxial mesoderm

Development of intermediate mesoderm

Development of the Intraembryonic Coelom

Development of the Cardiovascular System

- **22-24 Days,**

The notochordal process becomes a solid cylinder of cells called the **notochord**

During the third week of development, two faint depressions appear on the dorsal surface of the embryo. The structure closer to the head end is called the **oropharyngeal membrane**. The structure closer to the tail end is called the **cloacal membrane**, which degenerates in the seventh week to form the openings of the anus and urinary and reproductive tracts.

Development of neural plate

Development of neural fold

Development of neural groove

**Development of the Chorionic Villi and Placenta:** \_By the end of the second week of development, **primary chorionic villi** develop. These projections of the chorion consist of cytotrophoblast cells that invade and become surrounded by the syncytiotrophoblast of the chorion. Early in the third week, mesenchyme grows into the primary chorionic villi, forming a core of loose connective tissue. At this stage of development, the villi are called **secondary chorionic villi**. By the end of the third week, blood capillaries develop in the villi and the villi become **tertiary chorionic villi** or simply, **chorionic villi**.

Blood vessels in the chorionic villi connect to the embryonic heart by way of the umbilical vein. As a result, maternal and fetal blood vessels are in close proximity. Note, however, that maternal and fetal blood vessels do not join and the blood they carry does not normally mix.

Oxygen and nutrients in the blood of the mother's **intervillous spaces**, the spaces between chorionic villi, diffuse across the cell membranes into the capillaries of the villi. Waste products such as carbon dioxide diffuse in the opposite direction. From the capillaries of the villi, nutrients and oxygen enter the fetus through the umbilical vein. Wastes leave the fetus through the umbilical arteries, pass into the capillaries of the villi, and diffuse into the maternal blood.

A few materials, such as IgG antibodies, pass from the blood of the mother into the capillaries of the villi via transcytosis, in which endocytosis is receptor mediated.

**Placentation** is the process of forming the **placenta** the site of exchange of nutrients and wastes between the mother and fetus. The placenta also produces hormones needed to sustain the pregnancy. Recall that chorionic villi develop as outgrowths of the chorion of the fetus by the end of the second week of development and they grow into the maternally derived intervillous spaces of the decidua basalis. The placenta is unique because it develops from two separate individuals, the mother and the fetus.

By the beginning of the twelfth week, the placenta has two distinct parts:

- (1) the fetal portion formed by the chorionic villi of the chorion and
- (2) the maternal portion formed by the decidua-basalis of the endometrium.

When fully developed, the placenta is shaped like a pancake. Functionally the placenta allows oxygen and nutrients to diffuse from maternal blood into fetal blood while carbon dioxide and wastes diffuse from fetal blood into maternal blood.

The placenta also is a protective barrier because most micro organisms cannot pass through it. However, certain viruses, such as those that cause AIDS, German measles, chickenpox, measles, encephalitis and poliomyelitis can cross the placenta.

The placenta also stores nutrients such as carbohydrates, proteins, calcium and iron, which is released into fetal circulation as required and it produces several hormones that are necessary to maintain pregnancy. Many drugs, alcohol and some substances that can cause birth defects pass freely through the placenta.

The actual connection between the placenta and embryo and later the fetus, is through the **umbilical cord** which develops from the connecting stalk. The umbilical cord consists of two umbilical arteries that carry deoxygenated fetal blood to the placenta, one umbilical vein that carries oxygen and nutrients acquired from the mother's intervillous spaces into the fetus and supporting mucous connective tissue called **Wharton's jelly** derived from the allantois. A layer of amnion surrounds the entire umbilical cord and gives it a shiny appearance.



After the birth of the baby, the placenta detaches from the uterus and is therefore termed the **afterbirth**. At this time, the umbilical cord is tied off and then severed, leaving the baby on its own. The small portion (about an inch) of the cord that remains attached to the infant begins to wither and falls off, usually within 12 to 15 days after birth. The area where the cord was attached becomes covered by a thin layer of skin and scar tissue forms. The scar is the **umbilicus** (navel).

Pharmaceutical companies use human placentas as a source of hormones, drugs and blood; portions of placentas are also used for burn coverage. The placental and umbilical cord veins can also be used in blood vessel grafts and cord blood can be frozen to provide a future source of pluripotent stem cells, for example to repopulate red bone marrow following radiotherapy for cancer.

### 5.5 Forth to Eight Weeks of Development:



## 5.6 Summary:

Summary of Changes During Embryonic and Fetal Development

<b>Time</b>	<b>Approximate size and Representative Chaves weight</b>	<b>Embryonic Period</b>
1 - 4 Weeks	0.6 cm (3/16 in)	Primary germ layers and notochord develop. Neurulation occurs. Primary brain vesicles, somites and intraembryonic coelom develop. Blood vessel formation begins and blood forms in yolk sac, allantois and chorion. Heart forms and begins to beat. Chorionic villi develop and placental formation begins. The embryo folds. The primitive gut, pharyngeal arches and limb buds develop. Eyes and ears begin to develop, tail forms and body systems begin to form.
5 - 8 Weeks	3 cm (1.25 in) 1g (1/30 oz)	Primary brain vesicles develop into secondary brain vesicles. Limbs become distinct and digits appear. Heart becomes four-chambered. Eyes are far apart and eyelids are fused. Nose develops and is flat. Face is more human-like. Ossification begins. Blood cells start to form in liver. External genitalia begin to differentiate. Tail disappears. Major blood vessels form. Many internal organs continue to develop.
<b>Fetal Period:</b>		
9 - 12 Weeks	7.5 cm (3 in) 30 g (1 oz)	Head constitutes about the length of the fetal body, and fetal length nearly doubles. Brain continues to enlarge. Face is broad, with eyes fully developed closed and widely separated. Nose develops a bridge.

		External ears develop and are low set. Ossification continues. Upper limbs almost reach final relative length but lower limbs are not as well developed. Heartbeat can be detected. Gender is distinguishable from external genitals. Urine secreted by fetus is added to amniotic fluid. Red bone marrow, thymus and spleen participate in blood cell formation. Fetus begins to move, but its movements cannot be felt yet by the mother. Body systems continue to develop.
13 - 16 Weeks	18 cm (6.5 - 7 in) 100 g (4 oz)	Head is relatively smaller than rest of body. Eyes move medially to their final positions and ears move to their final positions on the sides of the head. Lower limbs lengthen. Fetus appears even more human-like. Rapid development of body systems occurs.
17 - 20 Weeks	25 - 30 cm ( 10 - 12 in) 200 - 450 g (0.5 - 1 lb)	Head is more proportionate to the rest of the body. Eyebrows and head hair are visible. Growth slows but lower limbs continue to lengthen. Vernix caseosa (fatty secretions of sebaceous glands and dead epithelial cells) and lanugo (delicate fetal hair) cover fetus. Brown fat forms and is the site to heat production. Fetal movements are commonly felt by mother (quickening).
21 - 25 Weeks	27 - 35 cm (11 - 14 in) 550 - 800g (1.25 - 1.5 lb)	Head becomes even more proportionate to the rest of body. Weight gain is substantial and skin is pink and wrinkled. By 24 weeks, type 11 alveolar cells begin to produce surfactant.
26 - 29 Weeks	32 - 42 cm (13 - 17 in)	Head and body are more

(110 - 1350 g (2.5 - 3 lb)

proportionate and eyes are open. Toenails are visible. Body fat is 3.5% of total body mass and additional subcutaneous fat smoothes out some wrinkles.

Testes begin to descend toward scrotum at 28 to 32 weeks. Red bone marrow is major site of blood cell production. Many fetuses born prematurely during this period survive if given intensive care because lungs can provide adequate ventilation and central nervous system is developed enough to control breathing and body temperature.

**Fetal Period**

41 - 45 cm (16.5 - 18 in)

Skin is pink and smooth. Fetus

**(continued):**

2000 - 2300g (4.5 - 5 lb)

assumes upside down position.

30 - 34 Weeks

Pupillary reflex is present by 30 weeks. Body fat is 8% of total body mass. Fetuses 33 weeks and older usually survive if born prematurely.

35 - 38 Weeks

50 cm (20 in)

By 38 weeks circumference of fetal abdomen is greater than that of head. Skin is usually bluish-pink and growth slows as birth approaches. Body fat is 16% of total body mass.

3200 - 3400 g (7 - 7.5 lb)

Testes are usually in the scrotum in full-term male infants. Even after birth, an infant is not completely developed; an additional year is required, especially for complete development of the nervous system.

## 5.7 Key words:

Trophoblast  
Bilaminar embryonic disc  
Amnion  
Yolk Sac  
Chorion  
Gastrulation  
Notochord  
Placenta  
Chorionic Villi

## 5.8 Self Assessment Questions:

1. What are the functions of the trophoblast?
2. How is the bilaminar embryonic disc formed?
3. Describe the formation of the amnion, yolk sac, and chorion and explain their functions.
4. Why are sinusoids important during embryonic development?
5. What is the significance of gastrulation?
6. How do the three primary germ layers form? Why are they important?
7. What is the function of the notochord?
8. Describe how neurulation occurs. Why is it important?
9. What are the functions of somites?
10. How does the cardiovascular system develop?
11. How does the placenta form and what is its importance?
12. How does embryonic folding occur?
13. How does the primitive gut form and what is its significance?
14. What is the origin of the structures of the head and neck?
15. What are limb buds?
16. What changes occur in the limbs during the second half of the embryonic period?
17. Explain the major developmental events that occur during the embryonic period.

## 5.9 Suggested Books:

- Principles of Anatomy and Physiology - Tortora, 10<sup>th</sup> Edit., 2003  
Ross & Wilson Anatomy and Physiology - Annewaugh 10<sup>th</sup> Edit., 2006

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