



DEPARTMENT OF EDUCATION

GRADE 11

BIOLOGY

MODULE 6



REPRODUCTION



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# **GRADE 11**

## **BIOLOGY**

### **UNIT MODULE 6**

#### **REPRODUCTION**

**IN THIS MODULE YOU WILL LEARN ABOUT:**

**11.6.1: REPRODUCTION AND FERTILISATION**

**11.6.2: SEXUAL CHARACTERISTICS IN HUMANS**

**11.6.3: FAMILY PLANNING METHODS**

**11.6.4: SEXUALLY TRANSMITTED DISEASES**



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**DIANA TEIT AKIS**  
PRINCIPAL



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## SECRETARY'S MESSAGE

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Achieving a better future by individual students and their families, communities or the nation as a whole, depends on the kind of curriculum and the way it is delivered.

This course is a part of the new Flexible, Open and Distance Education curriculum. The learning outcomes are student-centred and allows for them to be demonstrated and assessed.

It maintains the rationale, goals, aims and principles of the national curriculum and identifies the knowledge, skills, attitudes and values that students should achieve.

This is a provision by Flexible, Open and Distance Education as an alternative pathway of formal education.

The course promotes Papua New Guinea values and beliefs which are found in our Constitution, Government Policies and Reports. It is developed in line with the National Education Plan (2005 - 2014) and addresses an increase in the number of school leavers affected by the lack of access into secondary and higher educational institutions.

Flexible, Open and Distance Education curriculum is guided by the Department of Education's Mission which is fivefold:

- To facilitate and promote the integral development of every individual
- To develop and encourage an education system satisfies the requirements of Papua New Guinea and its people
- To establish, preserve and improve standards of education throughout Papua New Guinea
- To make the benefits of such education available as widely as possible to all of the people
- To make the education accessible to the poor and physically, mentally and socially handicapped as well as to those who are educationally disadvantaged.

The college is enhanced to provide alternative and comparable pathways for students and adults to complete their education through a one system, many pathways and same outcomes.

It is our vision that Papua New Guineans' harness all appropriate and affordable technologies to pursue this program.

I commend all those teachers, curriculum writers, university lecturers and many others who have contributed in developing this course.

**UKE KOMBRA, PhD**  
Secretary for Education



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## MODULE 11.6: REPRODUCTION

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### Introduction

Organisms grow and die. No known living organism can live forever. If the species is to survive, it must continually produce offspring. They must reproduce.

**Reproduction** is the process of generating new offspring. Organisms produce new offspring to replace those that have died. If you are an organism, you will need to reproduce. Otherwise, there will be no more of your species. The species will die. You may have heard of endangered animals. There are also endangered plants. These endangered species have very few individuals left and scientists/naturalists are working together to make sure the species do not become extinct.



### Learning Outcomes

**After going through this module, you are expected to:**

- identify and describe the different types of reproduction.
- explain the process of pollination and fertilisation.
- state the function of the different parts of a flower.
- describe the male and female reproductive system.
- give the function of the different parts of human reproductive system.
- describe menstrual cycle.
- enumerate the different methods of Family Planning.
- identify the different sexually transmitted diseases in Papua New Guinea.



### Time Frame

Suggested allotment time: **6 weeks**

If you set an average of three (3) hours per day, you should be able to complete the module comfortably by the end of the assigned week. Try to do all the learning activities and compare your answers with the ones provided at the end of the module. If you do not get a particular activity right in the first attempt, you should not get discouraged but instead, go back and attempt it again. If you still do not get it right after several attempts then you should seek help from your friend or even your tutor.

**DO NOT LEAVE ANY QUESTION UNANSWERED**



## Terminology

<b>Abstinence</b>	Not having sexual intercourse.
<b>Amenorrhea</b>	Lack of menstruation due to low body fat, stress or medical problems.
<b>Anabolic steroids</b>	The familiar name for synthetic substances related to the male sex hormones (example, testosterone). They promote the growth of skeletal muscle in both males and females and the development of male sexual characteristics.
<b>Androgens</b>	Male sex hormone that promotes the development and maintenance of the male sex characteristics, for example, testosterone.
<b>Antibodies</b>	Blood proteins that bind to and destroy infectious antigens such as bacteria and viruses.
<b>Artificial propagation</b>	Producing new plants asexually by methods which humans have invented.
<b>Asexual reproduction</b>	Producing offspring from one parent.
<b>Asymptomatic infection</b>	Infection that is present without the affected person experiencing symptoms.
<b>Bacterial STIs</b>	Sexually Transmitted Infections such as gonorrhoea, syphilis, and chlamydia; can be treated with antibiotics.
<b>Body fluids</b>	Primarily semen, vaginal fluid, saliva, and blood.
<b>Cervix</b>	The tightly constricted opening from the vagina into the uterus.
<b>Condom</b>	A closed tube that covers the penis during sex, providing a barrier to semen and infectious agents such as bacteria and viruses.





<b>Corpus luteum</b>	The structure that develops from a matured follicle that has released its egg. The corpus luteum produces progesterone and some estrogen. If pregnancy does not occur, the corpus luteum degenerates.
<b>Cowper's gland</b>	A gland secreting fluids to form semen.
<b>Ductus deferens</b>	A smooth muscle tube that carries the semen from the epididymis to the penis.
<b>Dysmenorrhoea</b>	Severe menstrual cramps.
<b>Egg [ovum (singular), ova (plural),</b>	The female gamete that contributes half of the chromosomes to the zygote in sexual reproduction.
<b>Ejaculation</b>	The release of semen from penis.
<b>Ejaculatory duct</b>	A tube from the duct deferens to the penis.
<b>Embryo</b>	The offspring in the period of development from the cleavage of the zygote to the ninth week, when the embryo becomes a fetus.
<b>Endometrial lining</b>	The lining of the uterus that is thickened monthly to allow implantation of an embryo. It is shed in menstruation if fertilisation does not occur.
<b>Endometrium</b>	The lining of the uterus that is developed under the influence of estrogen from days 1 to 14, becoming thick and engorged with blood to accept an implanting embryo should fertilisation take place.
<b>Epididymis</b>	A cap on each testicle where sperm are matured and stored prior to ejaculation.
<b>Estrogen</b>	A female steroid sex hormone secreted by the developing follicle prior to ovulation and the corpus luteum after ovulation. Estrogen develops the endometrium and female secondary sex characteristics.
<b>Fertility</b>	The ability to produce gametes and reproduce.



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<b>Fertilisation</b>	The fusion of the male gamete (the pollen nucleus in plants) with the female gamete (the ovule nucleus in plants).
<b>Foetus</b>	An unborn or unhatched vertebrate especially after attaining the basic structural plan of its kind; specifically : a developing human from usually two months after conception to birth.
<b>Follicles</b>	Specialized cells that surrounds and nurtures the developing ova in the ovary and that secrete estrogen and progesterone.
<b>Follicle-stimulating hormone (FSH)</b>	A hormone produced by the anterior pituitary which causes spermatogenesis in males.
<b>Follicular stage</b>	The first 14 days of the menstrual cycle in which the follicle is developing a mature ovum for ovulation and the endometrium is building in preparation for implantation of a possible embryo.
<b>Fraternal (dizygotic) twins</b>	Twins produced when two different eggs are fertilised by two different sperm; not identical and may be of different genders.
<b>Gamete</b>	A haploid cell made during meiosis that participates in fertilisation to make a zygote.
<b>Gametogenesis</b>	The process of creating gametes from somatic cells that includes meiosis
<b>Gender</b>	The sex of an organism.
<b>Genitalia</b>	External and internal sex organs.
<b>Germination</b>	The start of growth in a seed.
<b>Gestation</b>	The period of pregnancy.
<b>Gonadotropin releasing hormone</b>	A hormone produced by the hypothalamus; stimulates the anterior pituitary to produce FSH and LH.
<b>Gonads</b>	Sex organs that produce gametes (sperm or egg); testes in males and ovaries in females.



<b>Hormone replacement therapy</b>	Combinations of estrogen and progesterone prescribed to decrease hot flashes and other discomforts that may come with menopause.
<b>Impotence</b>	Inability to sustain an erection.
<b>Infertility</b>	The inability to reproduce.
<b>Interstitial cells</b>	Tightly packed testosterone-secreting cells that surround the seminiferous tubules in the testes.
<b>Luteal stage</b>	The period of the menstrual cycle after ovulation (days 15 to 28), when the old follicle forms a corpus luteum that secretes progesterone and estrogen to maintain the endometrium.
<b>Luteinizing hormone (LH)</b>	A reproductive hormone produced by the anterior pituitary; causes the release of testosterone in males. In females, LH triggers ovulation, stimulates the formation of the corpus luteum, and acts with FSH to stimulate estrogen production.
<b>Menarche</b>	A female's first menstrual cycle.
<b>Menopause</b>	The time in a woman's life, at approximately age 50, when the production of estrogen and progesterone decreases, resulting in the cessation of menstrual cycles, reproductive function, and limited loss of secondary sex characteristics.
<b>Menstrual cycle</b>	The female reproductive cycle of producing an egg and developing then shedding the endometrium every 28 days on average.
<b>Menstruation</b>	The monthly shedding of the endometrial lining.
<b>Nectar</b>	A sweet liquid produced from flowers.
<b>Ovarian cycle</b>	The 28-day cycle of ovum development, in the following order: primary follicle, developing a mature follicle ovulation of the egg formation and disintegration of the corpus luteum



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<b>Ovarian cysts</b>	Fluid-filled swellings on the ovary.
<b>Ovarian hormone</b>	Estrogen secreted from the pre-ovulatory follicle and estrogen/progesterone secreted from the corpus luteum.
<b>Ovaries</b>	The paired female gonads that produce eggs secrete progesterone and estrogen hormones.
<b>Oviduct (Fallopian tube)</b>	The cilia-lined tube of smooth muscle that carries the ovulated egg from each ovary to the uterus.
<b>Ovulation</b>	The release of the mature ovum from the follicle of the ovary into the oviduct.
<b>PAP smear</b>	A screening test used to detect pre-cancerous and cancerous changes in the cervix due to human papillomavirus (HPV).
<b>Pituitary hormone</b>	FSH and LH secreted from the anterior pituitary.
<b>Pollen grains</b>	Tiny cells within which male gametes are produced in seed bearing plants.
<b>Pollination</b>	The transfer of pollen grains from the anther to the stigma.
<b>Primary sex characteristics</b>	Structures in the male or female that is essential for reproduction.
<b>Progesterone</b>	A female steroid sex hormone secreted by the corpus luteum after ovulation Progesterone helps estrogen maintain the developed endometrium until menstruation.
<b>Prostate gland</b>	A muscle-like gland secreting alkaline fluid to neutralize the acids in urine
<b>Puberty</b>	The period when reproductive abilities begin.
<b>Safe sex</b>	The use of a barrier, such as a condom, during sex to prevent transmission of infection.
<b>Scrotum</b>	A pouch of skin located below the penis that holds the testes.



<b>Secondary sex characteristics</b>	Characteristics that distinguish male from female, but are not required for reproduction.
<b>Semen</b>	The ejaculated liquid that contains sperm, plus the secretions of the seminal vesicles, prostate, and Cowper's gland.
<b>Seminal vesicles</b>	Glands producing a fluid containing fructose, which supplies energy for use by sperm.
<b>Seminiferous tubules</b>	Coiled, hollow tubes in the testes where sperm are produced.
<b>Sex characteristics</b>	Structures and characteristics that differentiate one gender from the other.
<b>Sperm</b>	The male gamete. In sexual reproduction, the haploid sperm contributes half the chromosomes to the zygote; the egg contributes the other half.
<b>Spermatogenesis</b>	The process of sperm production in males.
<b>Spermatozoa</b>	Mature sperm stored in the epididymis.
<b>STD</b>	A sexually transmitted disease caused by bacteria, fungus, or virus.
<b>Stem cell transplant</b>	Transplant of a donor's stem cells from sources such as bone marrow or umbilical cord blood; used to treat cancers of the blood and bone marrow.
<b>STI</b>	Sexually transmitted infection due to bacteria, fungus, or viruses; may not cause symptoms but is still contagious.
<b>Testes</b>	Paired male gonads that produce sperm and secrete testosterone.
<b>Testicles</b>	A pair of male gonads producing sperm and testosterone; also called testes.
<b>Testosterone</b>	Male sex hormone secreted by interstitial cells of the testes; results in male primary and secondary sex characteristics.



<b>Ultrasound</b>	A medical diagnostic technique in which high-frequency sound waves are bounced off body structures to obtain an image.
<b>Urethra</b>	The tube leading from the bladder to the penis. The urethra may carry either urine or semen.
<b>Uterine cycle</b>	The 28-day cycle of shedding of the old endometrium (menstruation) and development of a new one.
<b>Uterus</b>	The reproductive organ in which embryonic and fetal development occurs.
<b>Vagina</b>	The muscular tube that leads from the uterus to the external environment.
<b>Viral STIs</b>	Examples are HIV, HPV, and hepatitis; more problematic, possibly incurable because they cannot be treated with antibiotics.



### 11.6.1 Reproduction and Fertilisation

#### Different types of reproduction

Reproduction can be achieved in two ways:

1. **Asexual**
2. **Sexual reproduction**

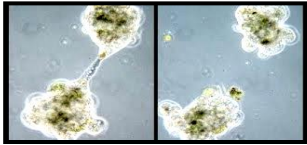
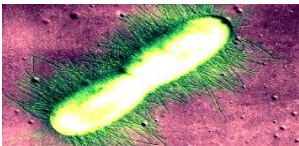
Many plants are able to propagate themselves using asexual reproduction. Asexual reproduction produces plants that are genetically identical to the parent plant because no mixing of male and female gametes takes place.

Traditionally, these plants survive well under stable environmental conditions when compared with plants produced from sexual reproduction because they carry genes identical to those of their parents.

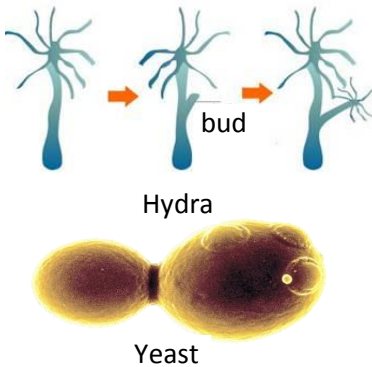
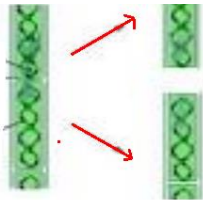

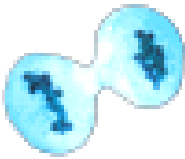

#### What is asexual reproduction?

**Asexual reproduction is the process by which genetically identical offspring are produced from one parent.**

There are seven main forms of asexual reproduction.

Type of Asexual Reproduction	Description
Binary fission (splitting)	<p>Unicellular organism such as bacteria and amoeba divide into two or more parts each and lead a separate existence.</p> <div style="text-align: center;"><p>Amoeba</p><p>Bacteria</p></div>



<p>Budding</p>	<p>Hydra and yeast develop outgrowths and these buds later detach from the parent and develop into independent organisms.</p>	 <p>Hydra</p> <p>Yeast</p>
<p>Fragmentation</p>	<p>A filamentous alga such as Spirogyra breaks off into fragments, with each portion regenerating the missing parts to form new individuals.</p>	 <p>Fragmentation in Spirogyra</p>
<p>Sporulation</p>	<p>Bacteria, algae, fungi, ferns, and mosses develop unicellular bodies called spores which detach from parent and develop into new individuals.</p>	 <p>Fern</p>
<p>Cloning</p>	<p>Mitotic division that results in a development of a clone with the exact genetic make - up.</p>	
<p>Parthenogenesis</p>	<p>The development of a female gamete to produce identical offspring without fertilisation. This is common in aphids and bees.</p>	 <p>Aphid (insect) produces clones of themselves and gives live birth</p>





Vegetative Propagation	<p>Vegetative propagation is the separation of a part of the parent plant, which can then develop into a new plant. Almost any part of the plant may be modified to become the organ for vegetative propagation. There are two types of vegetative propagation.</p> <ol style="list-style-type: none"><li>1. <b>Natural vegetative reproduction</b></li><li>2. <b>Artificial vegetative reproduction</b></li></ol>
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We have just identified the different types of asexual reproduction as shown on the previous table. Now let us further describe and give examples of these types.

### Asexual reproduction in single-celled organisms

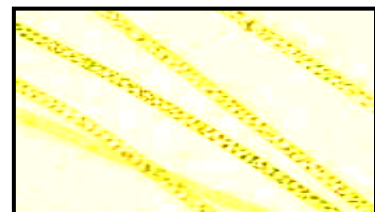


Budding in yeast

Smaller mother cell (bud) grows into new cell  
Large mother cell

Single-celled organisms which use asexual reproduction can do so very rapidly simply by dividing into two equal halves. This is called binary fission. In yeasts the cell does not divide equally in two halves; instead, there is a large mother cell and a smaller daughter cell. This is called budding.

Some of the simple algae, such as Spirogyra shown on the right, grow in long threads called filaments. They grow longer each time a cell in the filament divides. If, however, the filament is broken into pieces, each part can grow into a new plant.

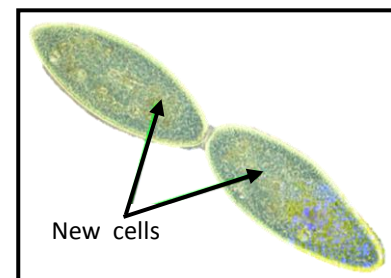


Spirogyra

Binary fission and budding are rapid ways of reproducing.

For example, if conditions are good, the cell Paramecium can divide, grow, and divide again in the space of 8 hours.

One of the best places to look for Paramecia is in a flower vase which has had the same water in it for a few days. The clean water becomes cloudy because of the millions of micro-organisms swimming in it, all of them produced by asexual reproduction within a few days.



Binary fission in Paramecium as seen under the microscope



### Regeneration in vertebrates and invertebrates

**Parthenogenesis** is a type of asexual reproduction in which a female gamete or egg cell develops into an individual without fertilisation. Animals including most kinds of wasps, bees, and ants that have no sex chromosomes reproduce by this process. Also salamanders, stick insects, ticks, aphids, mites and cicadas. Some reptiles and fish are also capable of reproducing in this manner.

See few examples below



Bynoe gecko



Komodo dragon



Warramaba virgo grasshopper



Bonnethead shark

In insects, parthenogenesis is common among **honeybees**. In a hive of domesticated honeybees, the queen bee is the only fertile female, but the female worker bees, through parthenogenesis, produce male drones to mate with the queen. Additionally, some parasitic bacteria can induce parthenogenesis in insects.



Honeybee

### Vegetative reproduction

The word 'vegetative' refers to plant organs consisting of the roots, stem (trunk, branches, twigs) and leaves.

There are two methods of propagating plants vegetatively: **natural and artificial**.

#### 1. Natural vegetative reproduction

The natural method of vegetative propagation utilizes plant organs other than the seed and spore which, even without the involvement of man, serve as plants' means of maintaining their species.



These plant organs include the: bulbs, cloves, corms, tubers and tuberous roots, rhizomes, runners or stolons.



Onion bulb produce by sprouting an additional bulb at the side and a new plant develops.



The storage root of carrot and radish can provide food for the new plant.



Bryophyllum reproduces vegetatively by means of its leaves.



The rhizome (storage stem) of a ginger can grow into a new plant.



Creeping buttercup stolons



Strawberry plants produce stolons.

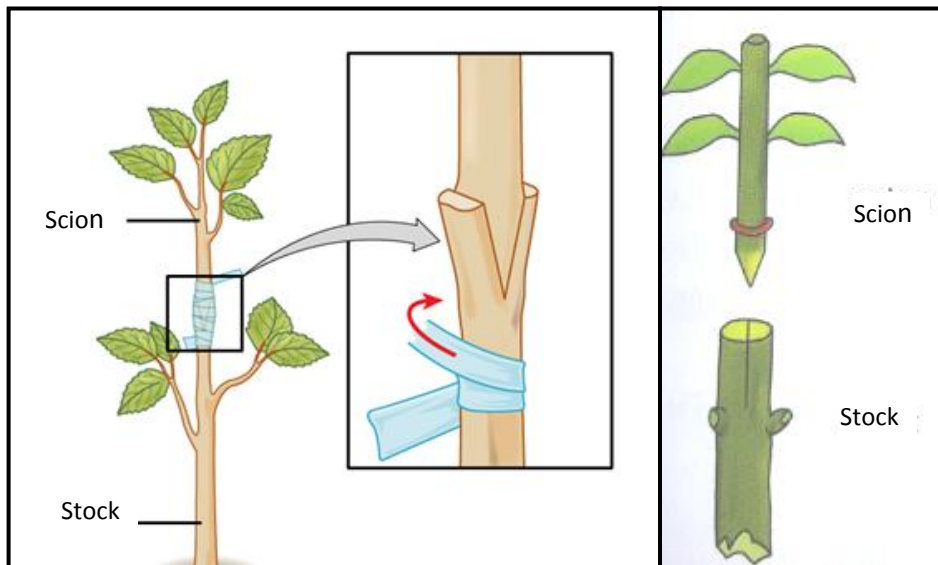
**Runners properly called “stolons” are also horizontal stems growing from the parent plant, but they grow above ground. When their terminal buds touch the ground they take root and produce new plants.**



## 2. Artificial vegetative reproduction

Artificial methods of asexual reproduction are frequently used to give rise to new and sometimes novel, plants. They include grafting, cutting, layering, marcotting and micro propagation.

**Grafting** is an artificial method of asexual reproduction used to produce plants combining favourable stem and root characteristics. The stem of the plant to be grafted is known as the **scion**. The root is called the **stock**.



Grafting



Preparation of scions

Preparation of stock

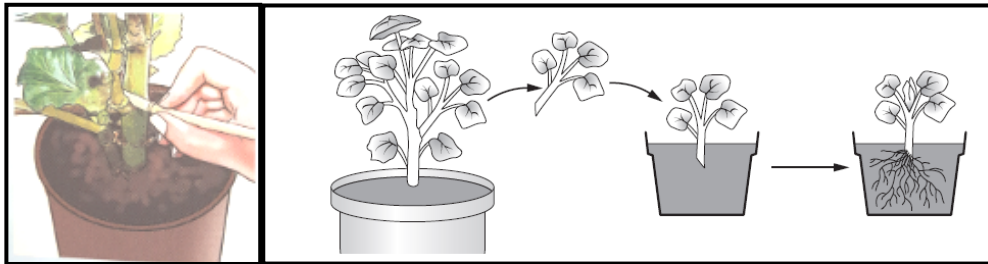
Insertion of scions /graft union

Finished Bridge/ wrapped and waxed



### Cutting

Plants such as hibiscus and Aibika are propagated through stem cuttings where a portion of the stem containing nodes and internodes is placed in moist soil and allowed to root. In some species, stems can start producing a root even when placed only in water. For example, leaves of crotons or target will root if kept undisturbed in water for several weeks.



Plants propagated through stem cutting



Aibika plant



Hibiscus plant

### Layering or runner

A method in which a stem attached to the plant is bent and covered with soil. Young stems that can be bent easily without any injury are the preferred plant for this method.

Jasmine and bougainvillea (paper flower) can be propagated this way. In some plants, a modified form of layering known as **air layering** is used.

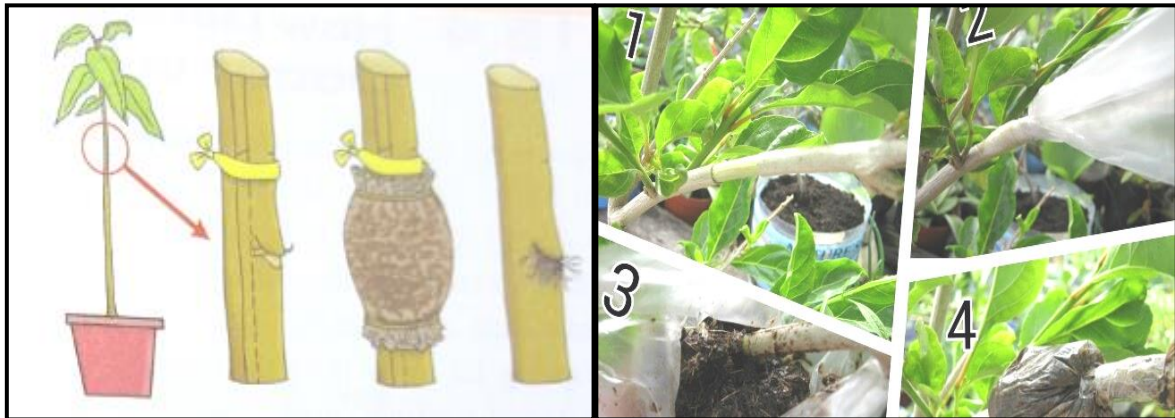
A portion of the bark or outermost covering of the stem is removed and covered with moss, which is then taped. Some gardeners also apply rooting hormone. After some time, roots will appear. This portion of the plant can be removed and transplanted into a separate pot.



Bougainvillea air layering



**Marcotting or air layering** is similar to layering. However, instead of placing the ringed section in the soil on the ground, a layer of soil is just wrapped around the ringed section without pulling it to the ground. First, you must cut out the outer layer of the mother plant or rather the bark. Next, scrape of the colorless, sticky residue underneath the bark. Wrap the exposed part with damp sphagnum moss and wrap with a piece of plastic and tie it with some wire at the end. Fruit plants such as rambutans are propagated this way.



Marcotting or air layering

**Advantages and disadvantages of asexual reproduction:**

Asexual reproduction can be very advantageous to certain animals.

1. Animals that remain in one particular place and are unable to look for mates would need to reproduce asexually.
2. Numerous offspring can be produced without "costing" the parent a great amount of energy or time.
3. Environments that are stable and experience very little change are the best places for organisms that reproduce asexually.

**Disadvantage**

A disadvantage of this type of reproduction is the lack of genetic variation. All of the organisms are genetically identical and therefore share the same weaknesses and if the stable environment changes, the consequences could be deadly to all of the individuals.

**What is sexual reproduction?**

Sexual reproduction is the process involving the fusion of two nuclei to form a zygote and the production of genetically dissimilar offspring.

It increases variation within the species resulting in an increased likelihood of producing some offspring that will adapt to environmental changes. Each offspring receives a different mixture of genes from both parents.



## Sexual reproduction in flowering plants

Look at the flowers of different plants.



Frangipani



Bougainvillea



Rose



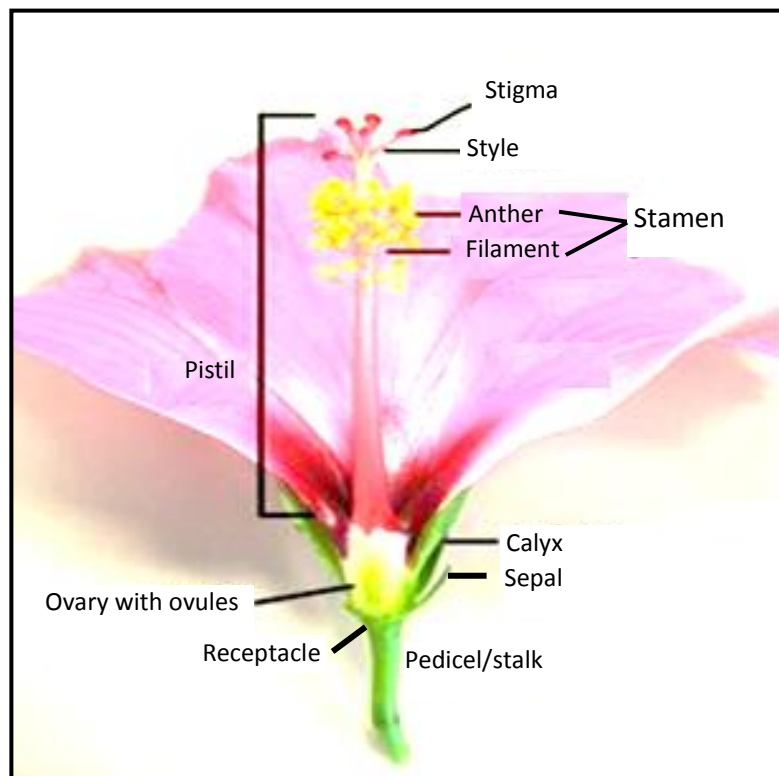
Hibiscus

Flowers come in different colors, shapes and sizes. However, they have one common function: they bear the sexual reproductive parts which produce the male and female gametes. During sexual reproduction, the male gametes (sex cells) come in contact with the female gametes and fuses with it. This will result in the formation of fruits and seeds which are able to grow into new plants.

## The Process of Reproduction in Flowering Plants

How does sexual reproduction occur in flowering plants?

Let us look at and study the structure of a typical flower.



Parts of Hibiscus flower



A typical flower in general consists of the following parts:

1. **Pedice**l/stalk is a flower stalk that holds and supports the flower.
2. **Receptacle** is the swollen end of the pedicel. It is where the other structure is attached
3. **Sepals** are small, green leaf like structures. All the sepals together form the **calyx**. It encloses and protects the inner parts of the flower when it is still a bud.
4. **Petals** are usually larger than the sepals. They are brightly colored to attract insects for pollination. All the petals together form the **corolla**.
5. **Stamen** is the male reproductive parts of a flower. Each stamen is made up of an **anther** that produces the pollen grain and the filament that supports the anther.
6. **Carpel** or the pistil is the female reproductive part of a flower. Each carpel is made up of an **ovary** contains one or more ovules, **style**, attached at the top end of an ovary and **stigma** is a sticky structure at the tip of the style that receives pollen grains.

Flowers are the organs of sexual reproduction in plants. If you can name the parts of the flower, the process of fertilisation is easy to understand.

Flowers have the following important structures and functions as listed on the table below.

Structure	Function
Sepals	Protect the unopened flower bud.
Petals	May be brightly colored to attract insects.
Stamens	The male parts of a flower consisting of the anther held up on the filament.
Anthers	Produce male sex cells (pollen grains).
Stigma	The top of the female part of the flower which collects pollen grains.
Ovary	Produces the female sex cells (ovules).
Pedicels	Produce sugary nectar which attracts insects.

**It is now time to complete your Practical Activity 6 in your Assessment Book 6 before going on to the next topic.**

### Sexual reproduction in flowering plants

As you have learned the parts of the flower, let us now study pollination. Pollen grains must be transferred from the anthers to the stigmas to allow the fusion of male and female gametes. This is accomplished by pollination.

### What is pollination?

Pollination is the transfer of pollen from a male reproductive structure (anther) to a female reproductive structure (stigma) by a vector such as wind or insects



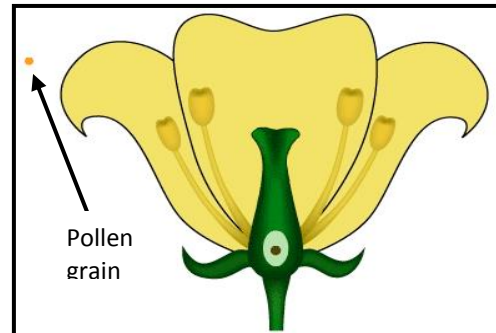


### How do pollen grains get transferred?

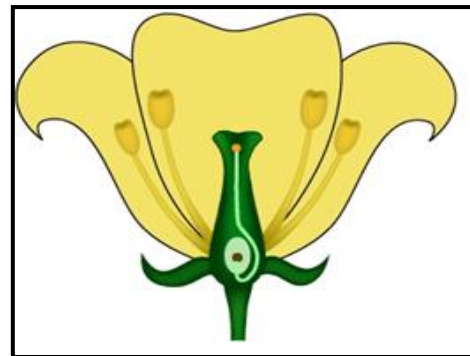
Birds, insects or wind transfer pollens. When a bird or an insect visits the flower for its nectar, it picks up pollen grains from the anther. At the same time they may deposit pollen grains on the stigma.

### Process of pollination

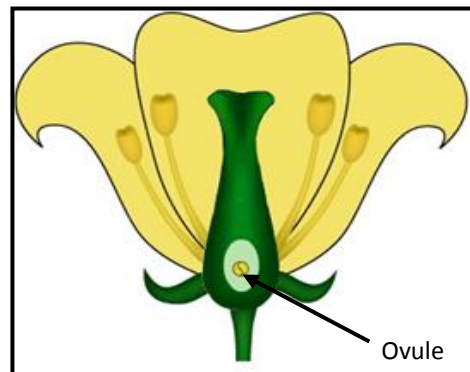
1. Pollen grain is transferred from one flower to another. This involves the transfer, either by wind or insects.



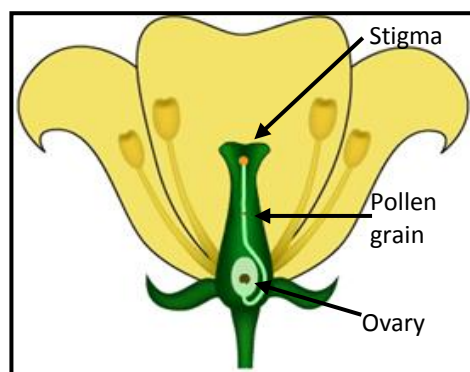
2. The pollen grain lands on the stigma and a pollen tube is grown through the style towards the ovary.



3. The nucleus of the pollen grains then passes down the tube until it reaches the ovule. The nucleus of the pollen grains fertilises the egg cell.



4. The fertilised egg cell develops into an embryo, the ovule becomes the seed and the ovary becomes the fruit.





There are two types of pollination:

### 1. Self – pollination

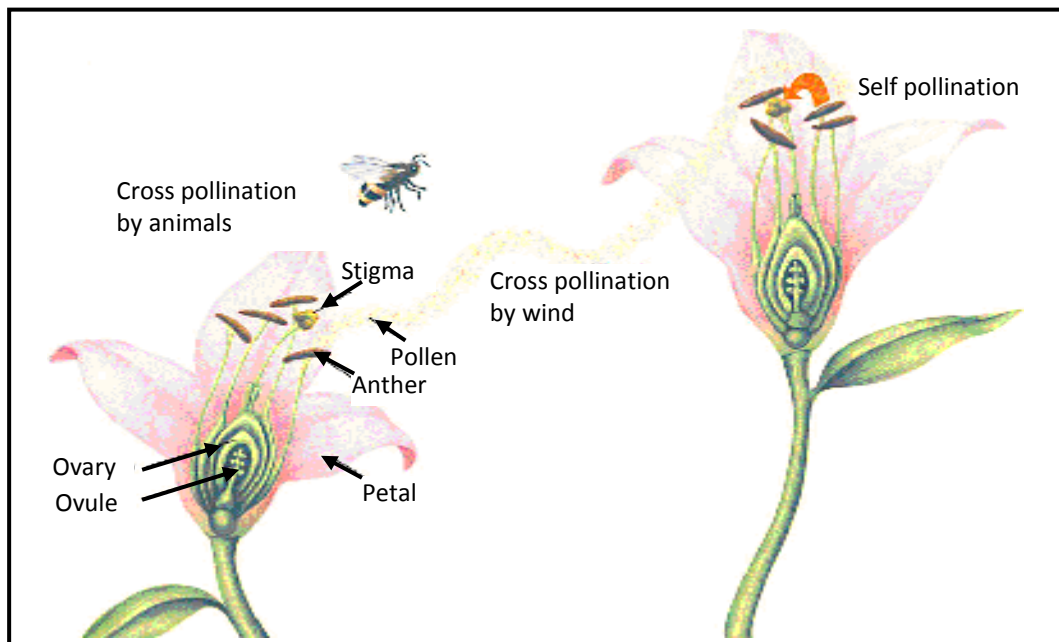
It occurs when pollen grains are transferred to the stigma of the same flower or a different flower on the same plants. New plants produced as a result of self – pollination are often weaker and less adaptable to changes in the environment.

#### Advantages of self – pollination:

- It maintains the parental characters or purity of race indefinitely.
- Self pollination is used to maintain pure lines for hybridisation experiments.
- The plant does not need to produce large number of pollen grains.
- Flowers do not develop devices for attracting insect pollinators.
- It ensures seed production. Rather it is used as fail safe device for cross-pollinated flowers.
- Self- pollination eliminates some bad recessive characters.

#### Disadvantages of Self Pollination:

- New useful characters are seldom introduced.
- Vigour and vitality of the race decreases with prolonged self pollination.
- Immunity to diseases decreases.
- Variability and hence adaptability to changed environment are reduced.



Cross pollination and self pollination in flowering plants



## 2. Cross – pollination

It occurs when pollen grains are transferred to the stigma of different plants.

### Advantages of Cross – pollination:

- The offspring usually inherit strong/superior genes or traits from both parents.
- More viable seed maybe produced.
- There is a greater variety of offspring and it increases the chances of survival of the species during changes in the environment.

### Disadvantages of Cross – pollination:

- It is highly wasteful because plants have to produce a larger number of pollen grains and other accessory structures in order to suit the various pollinating agencies.
- A factor of chance is always involved in cross-pollination.
- It is less economical.
- Some undesirable characters may creep in the race.
- The very good characters of the race are likely to be spoiled.

**TABLE OF COMPARISON FOR SELF AND CROSS POLLINATION**

Basis of comparison	Self pollination	Cross pollination
Definition	Self pollination is the transfer of pollen grains from the anther to the stigma of the same flower.	Cross pollination is the transfer of pollen grains from the anther of a flower to the stigma of a flower of a different plant of the same species.
Examples	Some legumes like peanuts. Orchids, peas and sunflowers, wheat, barley, oats, rice, tomatoes, potatoes, apricots and peaches.	Insects: Apples, grapes, plums, pears, raspberries, blackberries, strawberries, runner beans, pumpkins. Wind: grasses and dandelions
Transfer of pollen	Shed pollen directly onto stigma.	Wind, insects, water, animals
Plant differences	Smaller flowers.	Brightly coloured petals, nectar and scent, long stamens and pistils.



Most plants have special features or means to favor cross - pollination over self – pollination.

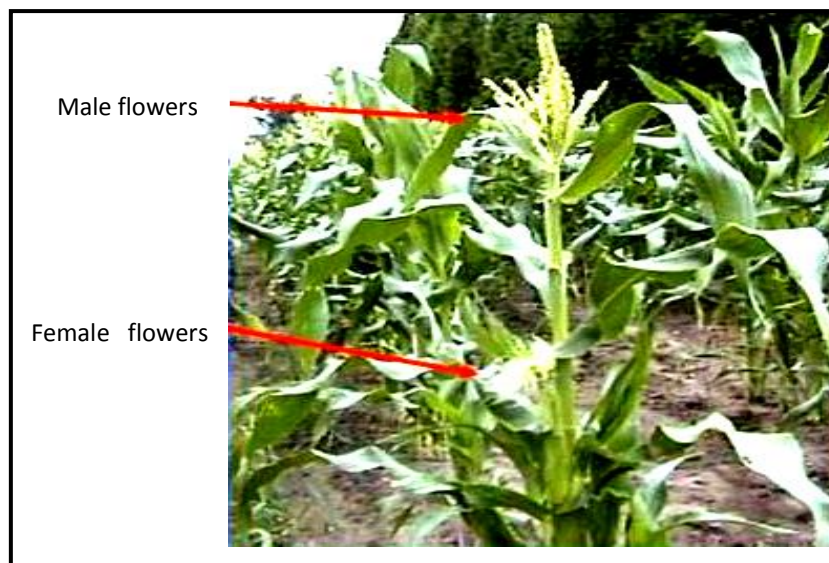
- Some plants bear male and female flowers on separate plants, making self -pollination impossible as in a papaya plant.



Female flower of a pawpaw

Male flower of a pawpaw

- Some plants bear both the male and female flowers on the same plant or like corn plants have both male and female parts on the same flower. Their anther and stigma matures at different times. They may be situated some distance away from each other. In this way, self - pollination is less likely to happen.





Corn plant

**What are the differences between Insect pollinated flowers and wind pollinated flowers?**

Insect pollinated flowers are different from wind pollinated flowers. They have no need to attract insects, wind pollinated flowers often lack color, scent, or nectar. They are usually unattractive.



The table below summarizes their differences.

Wind – Pollinated Flowers	Insect – Pollinated Flowers
<ul style="list-style-type: none"><li>• Petals are dull in color, usually yellow or pale green.</li><li>• They are unisexual with excess male flowers.</li><li>• No scent and no nectar produced.</li><li>• Stigmas are feathery and protrude outside the flower.</li><li>• Anthers dangle outside the flower so that pollen is easily released.</li><li>• Filament is long and slender so that the anthers may swing in the breeze outside the flower.</li><li>• Pollen is light and minute with smooth surfaces. Some have wing – like extensions to aid wind transport.</li><li>• Very large quantities of pollen are produced.</li></ul> 	<ul style="list-style-type: none"><li>• Petals are large and brightly colored.</li><li>• Flowers occur singly.</li><li>• They are mostly bisexual.</li><li>• Scent is produced to attract insects.</li><li>• Nectar is produced by nectar glands along with nectar guides to lead the insect to the nectar.</li><li>• Stigma lies within the corolla.</li><li>• Anther lies inside the flower to allow insects to brush against it as it collects nectar.</li><li>• Filament is strong to support insects as they visit the flower.</li><li>• Pollen grains are larger and have sticky surfaces to help them stick to insects</li><li>• Smaller quantities of pollen are produced.</li></ul> 

What happens after pollination?

### **Fertilisation**

Following pollination, fertilisation occurs.

### **What is fertilisation?**

**Fertilisation** is the fusion of male and female gametes. In flowering plants, the pollen grains are the male gametes while the egg cells are the female gametes.

### **How fertilisation takes place?**

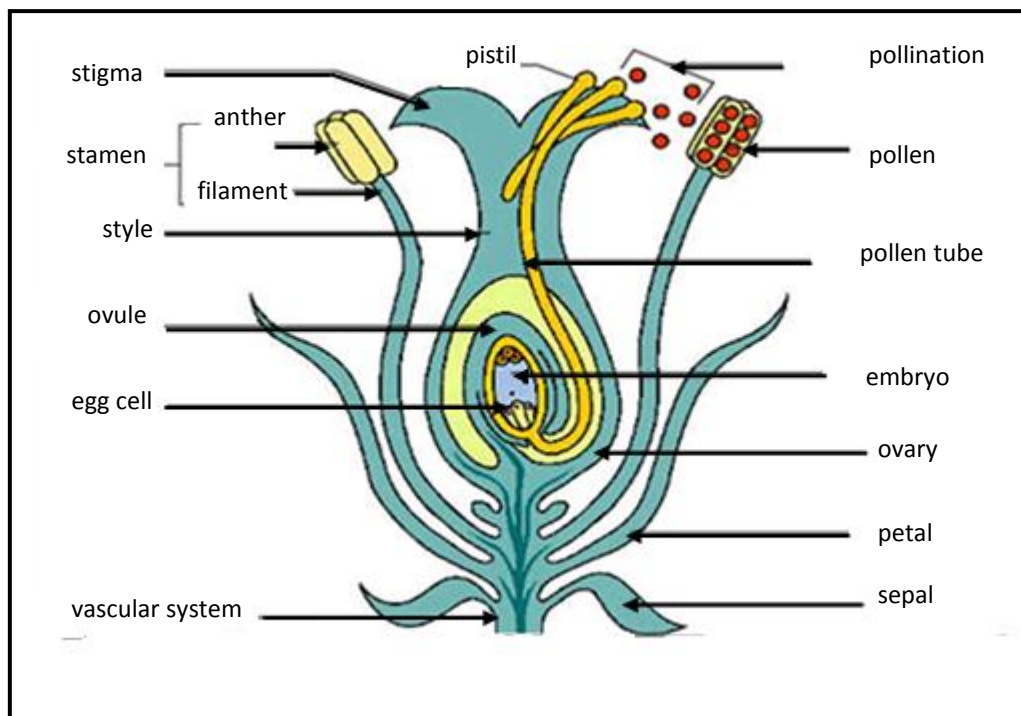
The flower is the reproductive unit of a plant, responsible for the survival of the species.



As shown in the diagram below. The **stigma** at the top has caught a pollen grain. The grain moves down the pollen tube down through the **pistil of the style**, into the **ovary**, and then upward into the center mass, called the **ovule**. The male cell carried by the pollen grain down the **pollen tube** will join the female cell in the ovule. After this fertilisation takes place, the **seed** will soon form.

### How does it happen?

- The stigma secretes a sugary fluid after a pollen grain has landed on it. This stimulates the pollen grain to germinate.
- A small tube called the pollen tube grows out from it. It secretes enzymes that digest the tissues of the stigma and style as the pollen tube grows.
- The pollen tube grows longer and longer towards the ovary, carrying with it the male gametes.
- Finally, the pollen tube reaches the ovule and enters it through a small opening called the micropyle.



Fertilisation in flowering plants

- Within the ovule, the tip of the pollen tube bursts to release the male gametes. One of the male gametes fuses with the female gamete (ovum) inside the ovule to form a zygote.
- The zygote grows and develops into a baby plant cell called the **embryo**.

**Fertilisation is the process by which the male gamete fuses with the female gamete to form a zygote.**



### What happens after fertilisation?

The following changes occur after fertilisation as shown in the table below.

Flower Parts	Development
Ovule	changes into seed
Zygote	changes into embryo containing plumule, radical, and cotyledons
Ovule stalk	changes into seed stalk
Ovary	changes into fruit
Ovary wall	changes into fruit wall (pericarp)
Stigma and style	wither or become modified for fruit dispersal
Stamen and Petals	wither and fall off.
Sepals	wither or become modified for fruit dispersal

### How are fruits and seeds dispersed?

Plants must have a mechanism to disperse their offspring far enough, away from the parent. They do not have to compete with the parent for light, water, and soil minerals. This mechanism is known as fruits and seed dispersal. The following are the variety of dispersal mechanisms:

#### 1. Internal agents (explosive action)

Fruits like balsam, rubber, acacia and other leguminous fruits literally explode, spreading or scattering seeds in different directions. These fruits enhance their explosive effect when they are ripe.



Rubber fruits



Rubber seeds



Foliage and seed pods of golden rain tree



Golden rain tree seeds



Casuarina seed pods before dropping seeds



Casuarina glauca seeds



Annatto fruits



Annatto seeds



## 2. External agents

### i. Wind

Some seeds that are light are dispersed by **wind** like the cotton. Others that are dispersed by wind, but are quite large and heavy develop wing-like structures so that, they can be carried by the wind example maple. Other plants bear their fruits as a capsule at the top of a long stalk which is easily shaken by wind example poppy.



Poppy seeds are small and light they get shaken into the wind



Cotton grass has light and fluffy extensions which catch wind easily

Maple tree seeds have "wings"

Dandelion seeds have small "parachutes" attached

### ii. Water

Coastal plants such as coconut and lotus have fruits with spongy or fibrous layers, which enclose large chambers of air. The trapped air allows them to float for a long period of time away from the parent plant.



- Coir or husk (fibrous layer)
- Outer coat (skin)
- Shell
- Copra (solid white flesh of endosperm)

Fibrous mesocarp (husk) of the coconut is filled with air spaces allowing it to float in water





### iii. Animals

There are plants that rely on a range of animals both large and small to disperse their seeds. Succulent and juicy fruits attract animals to eat them.



Orange

Mango

Tomato

Some plants develop special adaptations such as hooks, spines or sticky surfaces that cling on temporarily to the animals that pass by just like the sensitive or touch me not plant. (*Mimosa pudica*)

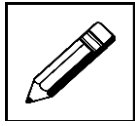


The sensitive plants have sticky surfaces



The flower heads of the *Mimosa pudica* (Touch-me-not, sleepyheads) are lovely with the lavender filaments looking like Medusa of Greek mythology

It is now time for you to complete Learning Activity 1 on the next page. Remember, learning activities are not sent in for assessment. However, this learning activity will help you complete Assignment 6 (which you will send in for assessment)

**Learning Activity 1****40 minutes****Briefly answer the following questions:**

1. Enumerate at least five main forms of asexual reproduction.

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2. Identify at least three different methods of artificial vegetative propagation.

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3. Name the two reproductive parts of a flower.

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4. Define

- a. pollination.

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- b. fertilisation.

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Thank you for completing your Learning Activity 1. Check your work. Answers are at the end of this module.

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**The Human Reproductive System**

It is amazing how an egg cell grows and develops into a baby. How long does it take to form a full grown baby? How does sexual reproduction occur in animals?

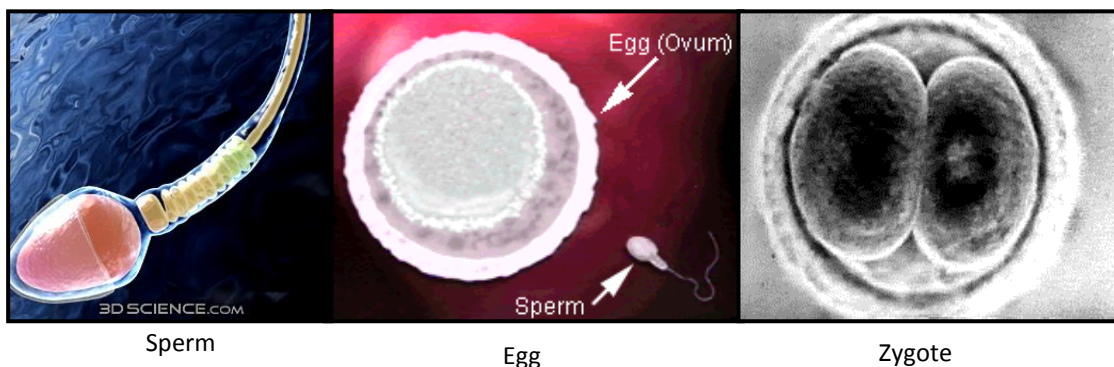
The reproductive system of humans produces new offspring. What is involved in sexual reproduction? It is the male and the female reproductive systems, which are made up of several organs.

Let us find out about the various organs and their functions in each system. The reproductive system becomes active after puberty.



During puberty the reproductive organs mature to create a fertile individual capable of reproducing. The primary sex organs produce the sex cells (egg/sperm) and sex hormones. The accessory sex organs are all the components involved in maintaining the sex cell and assisting in the process of fertilisation.

In humans, the reproductive system produces, stores, and releases specialized sex cells known as **gametes**. These cells are released to create the fusion of sperm and egg to form a zygote, the single cell from which all cells of the human body develop.



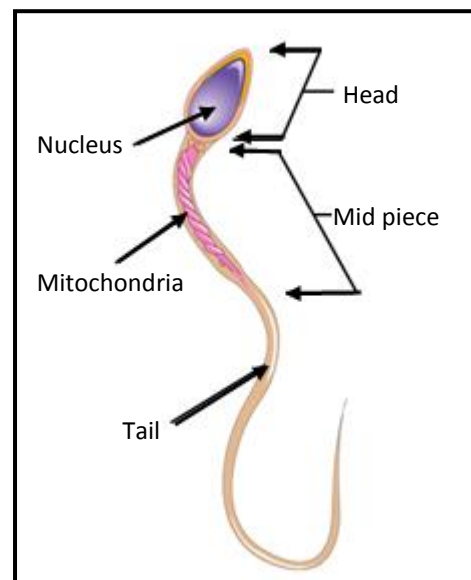
### The Male Reproductive System

The main function of the male reproductive system is to produce and deliver sperm.

A sperm cell consists of:

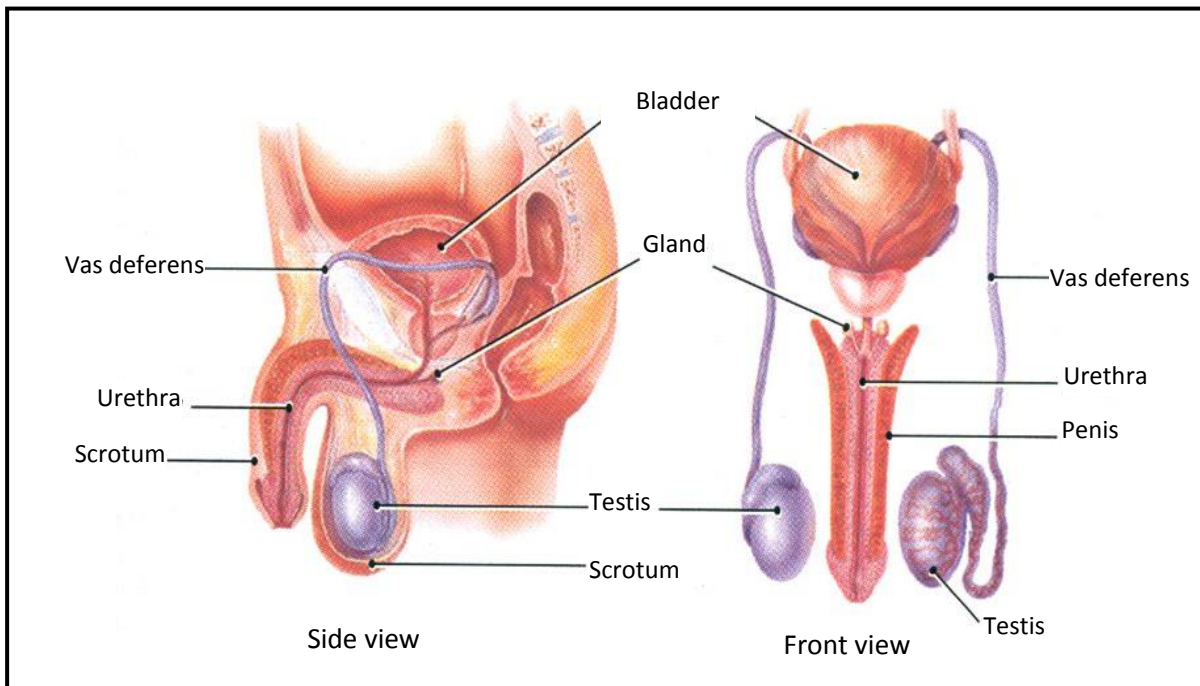
- a head, that contains the nucleus
- a mid- piece, that contains energy-releasing mitochondria
- a tail, which moves the cell forward

Release of follicle- stimulating hormone (FSH) and luteinizing hormone (LH) stimulates cells in the testes to produce testosterone. FSH and testosterone stimulate the development of sperm.



Parts of a sperm cell

The **two testes** are covered by a thin walled sac located in an external sac called the **scrotum**. It is an oval egg shaped and is about 5cm long. **Testis** (plural testes) or **gonad**- is the primary reproductive organ that produces sperm cells.

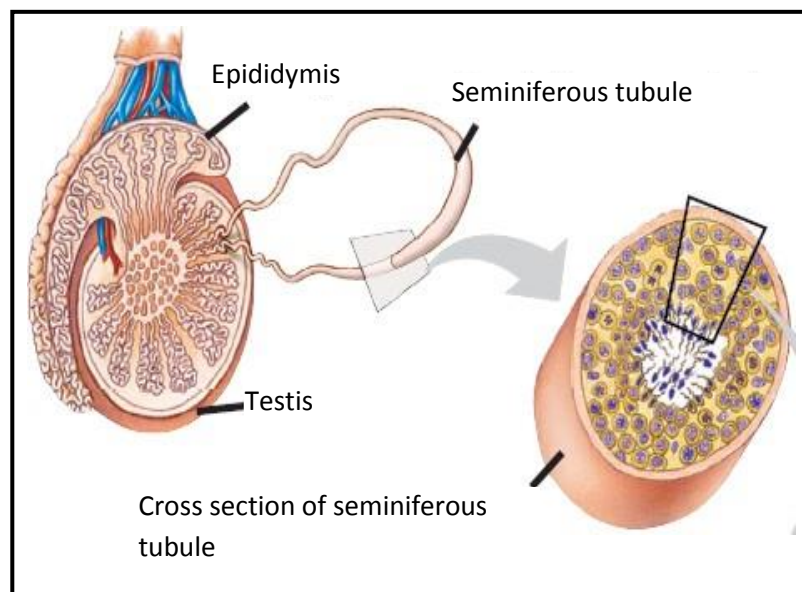


Parts of the male reproductive system

Each testis contains about 1000 **seminiferous tubules** that produce sperm. The seminiferous tubules are tightly coiled and twisted together.

Sperm are produced in the seminiferous and move into the **epididymis**, where they mature and are stored.

From there, sperm move into a tube called the **vas deferens** or **sperm duct**, which extends up from the scrotum into the abdominal cavity.



Parts of testis

**Vas deferens** or **sperm duct** is a long hollow tube where the sperm passes before it enters the urethra.



**Urethra** is a tube at the centre of the penis. It serves as the passage way of semen out of the male body. It is the tube that leads to the outside of the body through the **penis**.

**Penis** is the external male organ that deposits the sperm cell in the vagina of the female body.

**The scrotum** is a bag like muscular pouch located outside the body cavity, where it is between 1 and 3 degrees cooler than normal body temperature. The lower temperature helps sperm development.

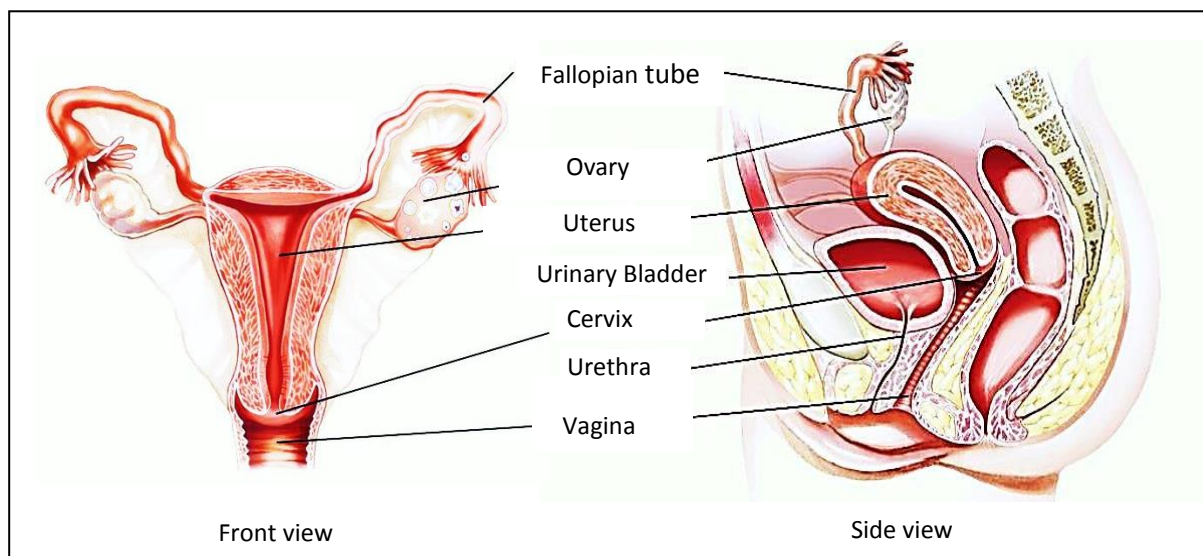
Glands lining the reproductive tract produce **seminal fluid**. Seminal fluid nourishes sperm and protects them from the acidity of the female reproductive tract. The combination of sperm and seminal fluid is called **semen**.

#### The Male Reproductive System:

The penis and the scrotum are the male's external organs. The penis is the organ of reproduction. It is also used for urination. Behind the penis is a sac-like skin that supports the testes. The testes produce billions of sperm cells. These sperm cells travel from the testes through the vas deferens, tubes circling the bladder. As the sperm cells travel through the vas deferens some glands (seminal vesicle, prostate and Cowper) provide it with lubricating fluids that enable it to move. The sperm cells plus the lubricating fluids is now called semen. The semen leaves the male body through the urethra.

#### The Female Reproductive System

Like the male organ, the female also possesses reproductive organs, which are specialized for the purpose of producing young species. Most of the organs that make up the female reproductive system are inside the body.



Parts of the female reproductive system



The **internal reproductive anatomy** includes the **uterus**, two **ovaries**, two **fallopian tubes**, the **urethra**, the **pubic bone**, and the **rectum**. The uterus contains an inner lining called the **endometrium** (which builds up and sheds monthly in response to hormonal stimulation). The lower portion of the uterus is called the **cervix**, which contains a small opening.

The ovaries are located in the lower part of the body. They alternately release a mature egg cell every month. The ovaries are partially surrounded by funnel-like openings of the fallopian tubes. The **ovaries** are the female sex organ located in the lower part of the body cavity. Each of the two ovaries is about the size and shape of an almond.

The **fallopian tube** or oviducts are tube-like structures about 4 inches long. They serve as the passage way of matured egg cell from ovary to the uterus.

The **uterus** also known as **womb** is a hollow organ. It is here where the fetus stays and develops for nine months. It is also the passage of sperm cells from the vagina to the fallopian tube. Between the uterus and vagina is a muscular ring called **cervix**. The cervix serves as the entrance to the uterus.

Most of the organs that make up the female reproductive system are inside the body. The ovaries are located in the lower part of the body. They alternately release a matured egg cell every month.

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### 11.6.2. Secondary Sexual Characteristics in Humans

Human beings are sexually active throughout life. Sexuality encompasses more than sexual behaviour. It is physical, mental, and spiritual as well. Sexuality is a core component of personality and a fundamental part of human life. The problems usually associated with sexual behaviour are real. Human sexuality also has significant meaning and value in each individual's life.

Reproductive physical maturity and the capacity for human reproduction begin during **puberty**, a period of rapid growth and change experienced by both males and females. Puberty is not an isolated event. It is a process that takes place over several years.



During puberty, the **hypothalamus** - a gland located at the base of the brain which regulates temperature, sleep, emotions, sexual function and behaviour produces **hormones** (chemicals that originate in a gland or organ and travel through the blood to another organ, stimulating it by chemical action to increase functional activity and secretions).

These hormones stimulate the **gonads**, the reproductive glands (the testes in males, ovaries in females) to produce **testosterone** (males) and **estrogen** and **progesterone** (female s).

### **Secondary Sexual Characteristics in Males and Females**

**Male puberty** generally occurs between the ages of 13-15. It is characterized by the secretion of the male hormone **testosterone**, which stimulates **spermatogenesis** (sperm production), and the development of **secondary sexual characteristics such as:**

1. Increased height and weight
2. Broadening shoulders
3. Growth of the testes and penis, pubic and facial hair growth
4. Voice deepening, and
5. Muscle development

Female puberty generally occurs between the ages of 9-13. It results in **ovulation** and **menstruation**, which involves cyclic hormonal changes in estrogens and progesterone.

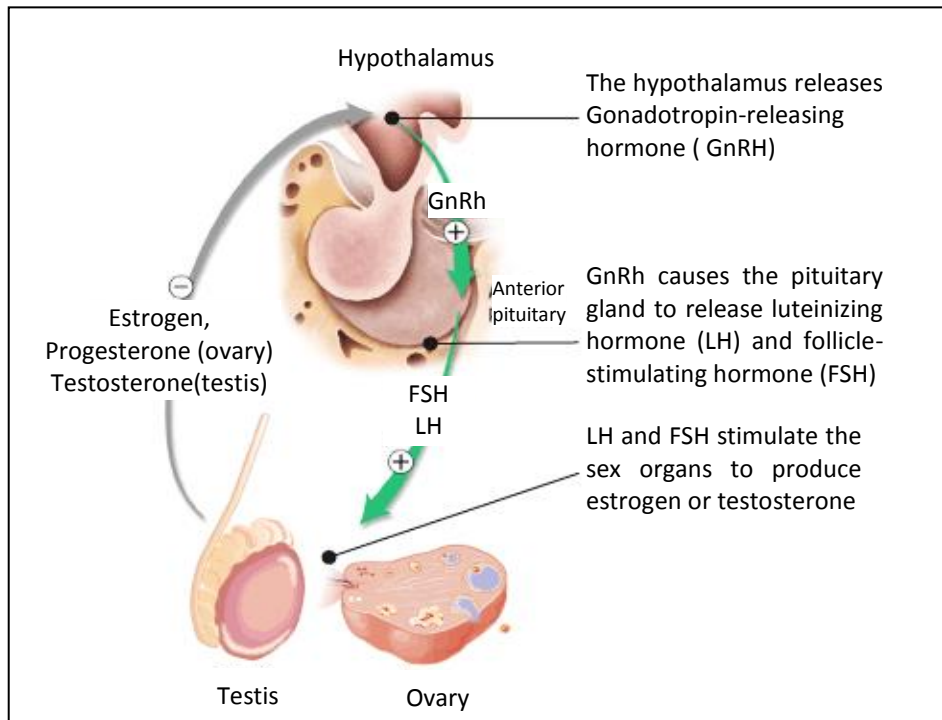
**Secondary sexual characteristics for females are:**

1. Growth of pubic and underarm hair
2. Breast enlargement
3. Vaginal and uterine growth
4. Widening hips
5. Increased height, weight and fat distribution

**Puberty** is a period of rapid growth and sexual maturation during which the reproductive system becomes fully functional. When puberty ends, reproductive organs are fully developed. Puberty usually begins between the ages of 9 and 15, and usually starts one year earlier in females than in males.



Puberty begins when the hypothalamus signals the pituitary to produce increased levels of two hormones that affect the gonads. These hormones are follicle-stimulating hormone (FSH) and luteinizing hormone (LH).

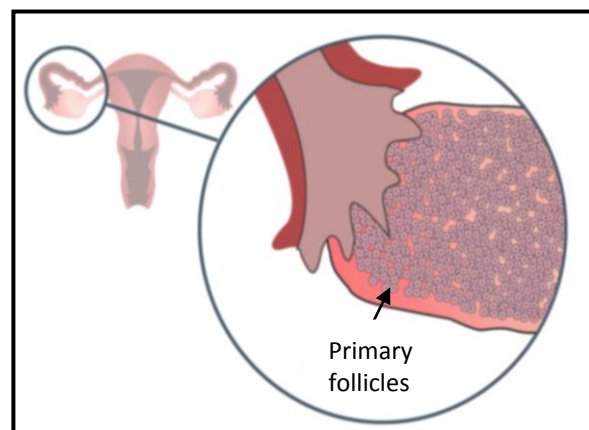


Puberty process

Most animal species have two sexes: male and female. Each sex has its own unique reproductive system. They are different in shape and structure but both are specifically designed to produce, nourish, and transport either the egg or sperm.

### Egg Development

Each ovary contains about 400,000 primary **follicles**, which are clusters of cells surrounding a single egg (only about 400 are active). The follicle helps an egg mature for release into the reproductive tract, where it can be fertilised. Eggs develop within their follicles.

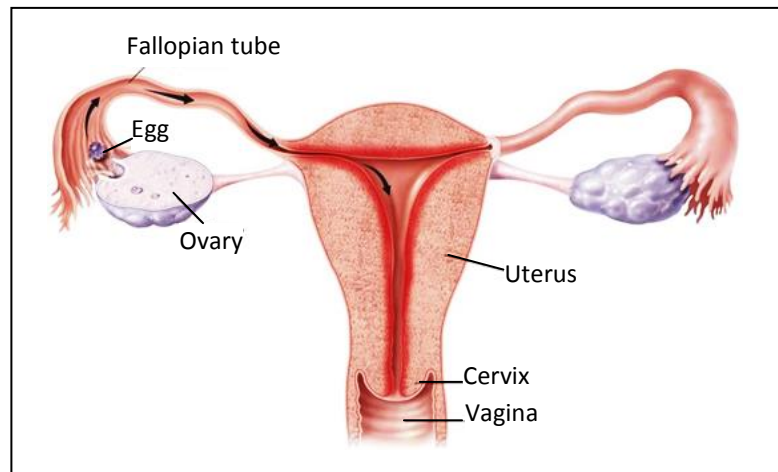






**Egg Release:** When a follicle has matured, its egg is released in a process called **ovulation**.

Once the follicle breaks open, and the egg is swept from the ovary into one of the two Fallopian tubes. While in the Fallopian tube, an egg can be fertilised. After a few days, the egg passes from the Fallopian tube into the uterus. If the egg is not fertilised it passes through the cervix, and finally out of the vagina. The vagina leads to the outside of the body.



Ovulation

## Menstrual Cycle

During the menstrual cycle, an egg develops and is released from an ovary. The uterus is prepared to receive a fertilised egg. If the egg is fertilised, it is implanted in the uterus and embryonic development begins. If the egg is not fertilised, it is discharged.

The menstrual cycle is controlled by internal feedback mechanisms between the reproductive system and the endocrine system. The cycle takes an average of twenty eight (28) days.

The menstrual cycle has four phases:

- follicular phase
- ovulation
- luteal phase
- menstruation

The **follicular phase** begins when estrogen levels in the blood are low.

The anterior pituitary secretes FSH and LH, which cause a follicle to develop to maturity. As the follicle develops, cells surrounding the egg enlarge and produce more estrogen. Estrogen causes the lining of the uterus to thicken.

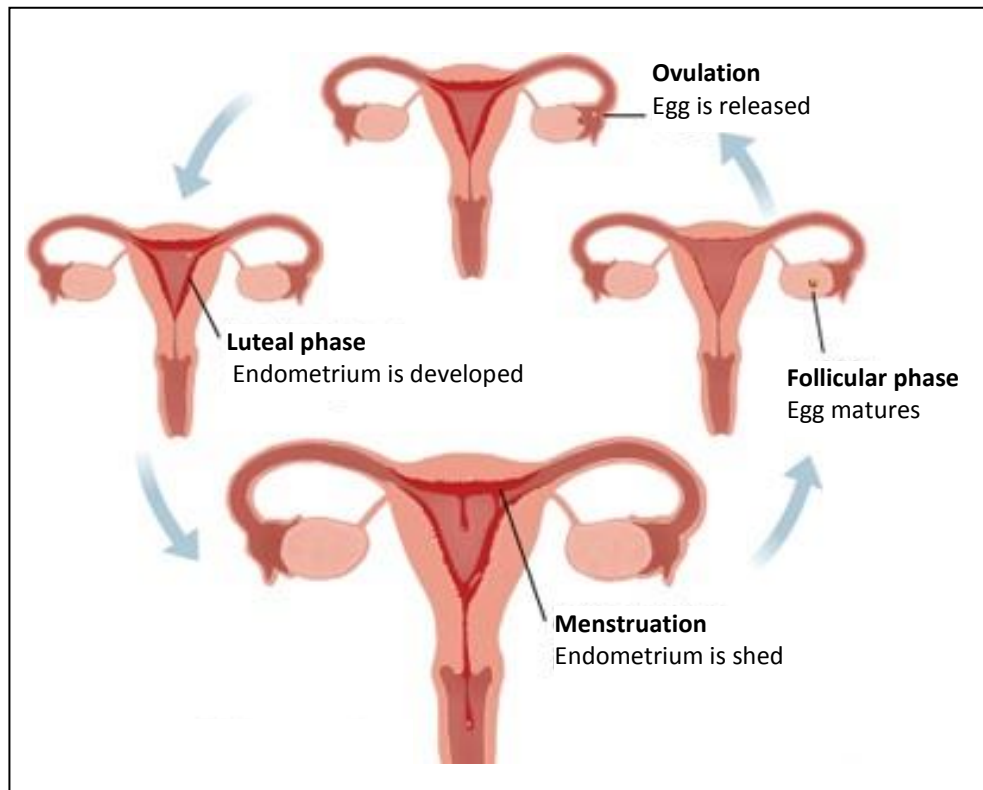
### Ovulation

This phase occurs midway through the cycle and lasts three (3) to four (4) days.

The pituitary gland produces more FSH and LH.



The release of these hormones causes the follicle to rupture. A mature egg is released into one of the Fallopian tubes.



Phases of menstrual cycle

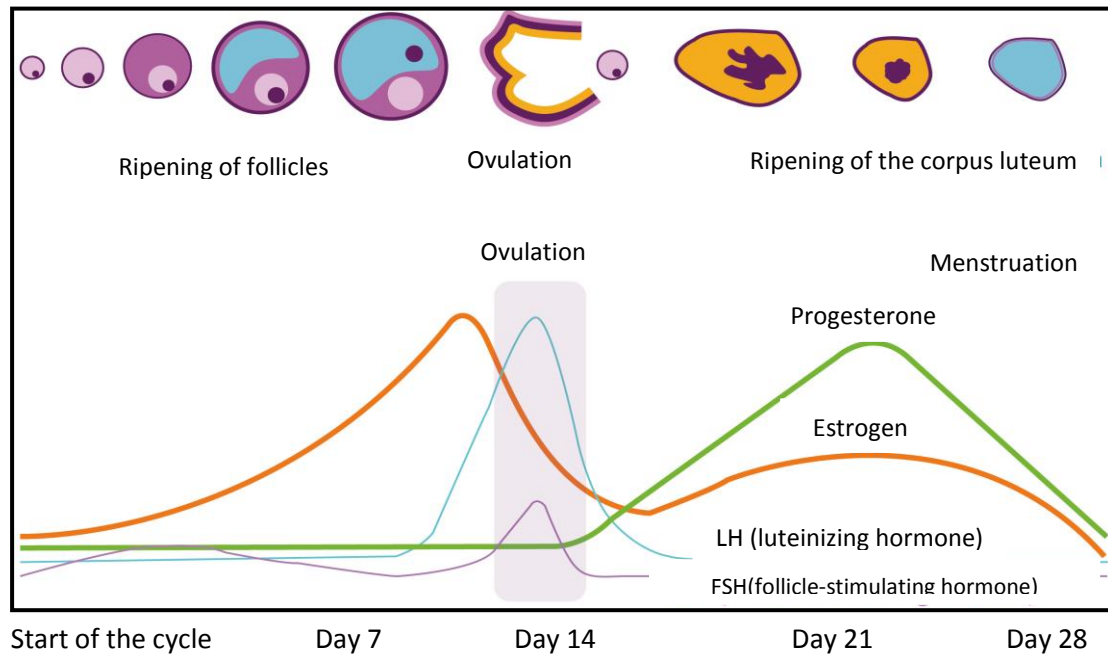
### Luteal Phase

The luteal phase begins after the egg is released. As the egg moves in the Fallopian tube, the follicle turns yellow. It is called the corpus luteum. The corpus luteum continues to release estrogen but also begins to release progesterone.

Progesterone stimulates growth and development of the blood supply and surrounding tissue. Within a few days of implantation, the uterus and the growing embryo will release hormones that keep the corpus luteum functioning for several weeks. This allows the lining of the uterus to nourish and protect the developing embryo.

### Menstruation

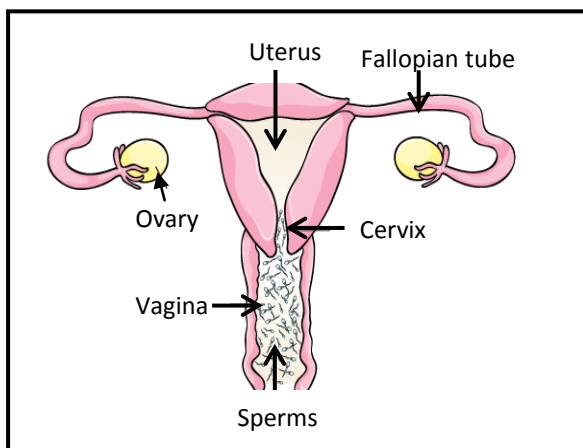
If fertilisation does not occur, the corpus luteum will begin to disintegrate. The follicle breaks down and releases less hormones, which makes the uterine lining detach. This tissue, blood, and the unfertilised egg are discharged through the vagina. This phase is menstruation, and it lasts 3–7 days.



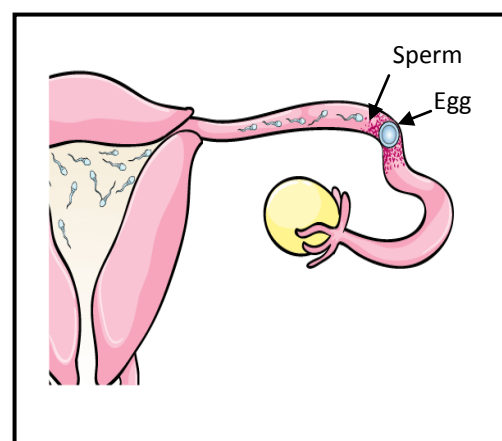
### Fertilisation and conception

The time at which a baby first begins to develop if the egg is fertilised is called **conception**. For this to take place, the male and female sex cells must join in the process of **fertilisation**.

Sperm must be released into the women's body near the time of ovulation. Sperm pass into the woman's body during sexual intercourse. When the penis moves in and out of the vagina semen is eventually ejaculated or pumped out of the penis. Ejaculation releases three (300) to five hundred (500) million of sperm. Millions of sperm are deposited in the vagina at the opening of the uterus called **cervix**.

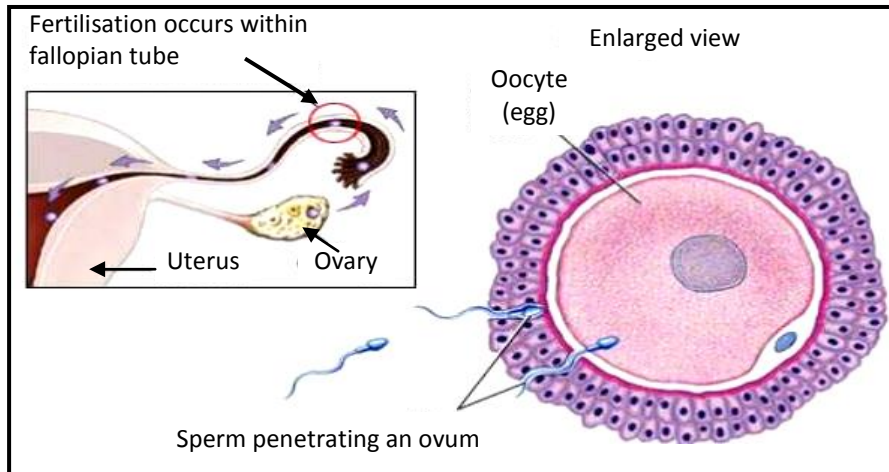


Sperms are deposited into cervix



Sperm fuses with the egg

When an egg is present in the oviduct, one of these sperm may combine with it to form fertilised egg. This leads to **pregnancy** as a result from one action.



The male gamete (sperm) fuses with the female gamete (ovum)

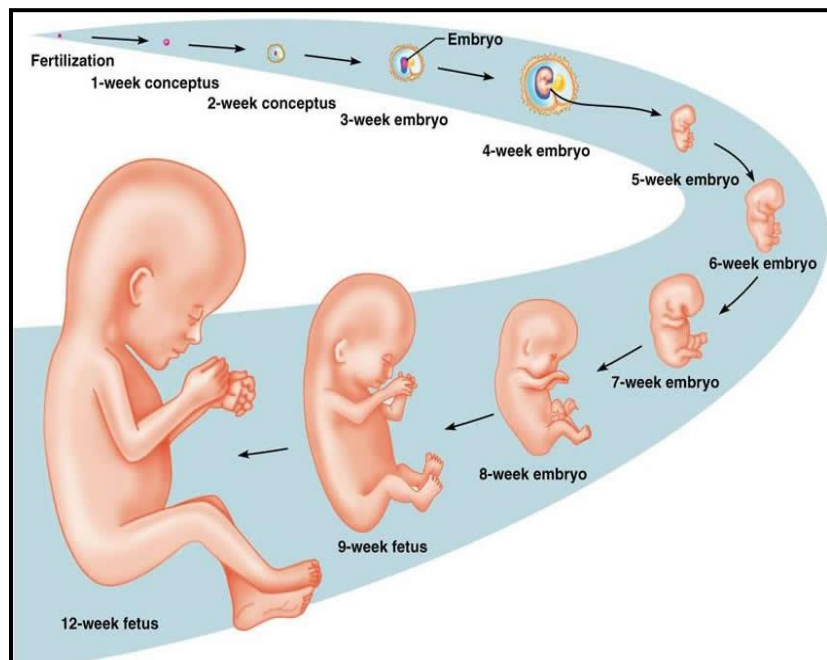
**Fertilisation is the process in which the sperm meets the egg.**

### Pregnancy and Childbirth

This section briefly describes the events that occur in the woman's body during fertilisation, pregnancy, and childbirth.

#### A. Pregnancy

Occurs once an egg is successfully fertilised and successfully implants.





## Development of the embryo

### One (1) month

An **embryo** forms and consisting of two layers of cells from which all her organs and body parts will develop.



### Two (2) months

The embryo is now about **the size of a kidney bean** and is constantly moving. Has distinct **slightly webbed fingers**.



### Three (3) months

By now the embryo is about 3 inches long and weighs nearly an ounce. Its tiny, unique **fingerprints** are now in place.



### Four (4) months

The embryo now a foetus is about **five (5) inches long** and weighs 5 ounces. The skeleton is starting to harden from rubbery cartilage to **bone**.



### Five (5) months

**Eyebrows and eyelids** are now in place. The foetus is now more than 10 inches long if the legs are stretched out.



**Six (6) months**

The foetus weighs about a **pound and a half**. The wrinkled skin is starting to **smooth out** as it puts on baby fat.

**Seven (7) months**

By now, the foetus weighs about **3 pounds** and is more than 15 inches long. It can open and close its eyes and **follow a light**.

**Eight (8) months**

The foetus now weighs about 4 3/4 pounds. The **layers of fat** are filling it out, making it rounder, and the **lungs** are well developed.

**Nine (9) months**

The **average baby** is more than nineteen (19) inches long and weighs nearly 7 pounds now. **Babies vary widely** in size at this stage.

**B. Childbirth** is also known as parturition.

Labor is the events prior to childbirth. When the fetus grows so much that the placenta cannot meet its nutritional needs stress hormones are released to signal the beginning of labor.

**Stages of labor:****The First Stage: Dilation of Cervix**

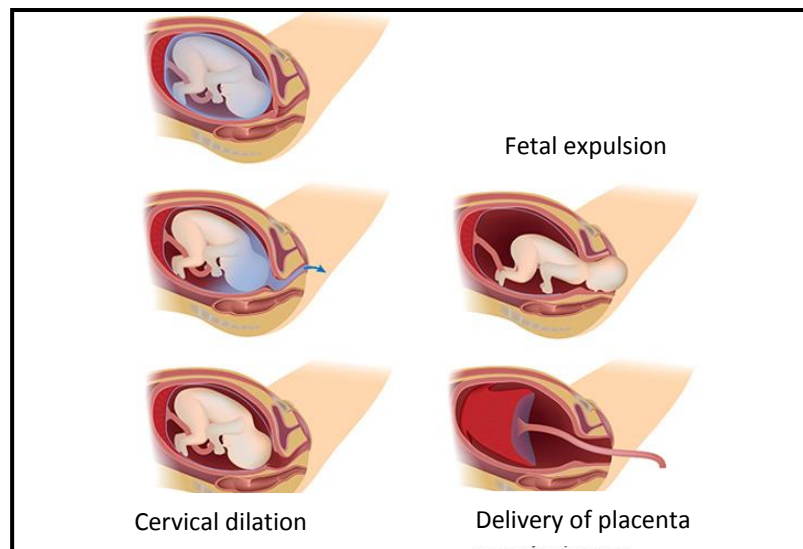
The cervix dilates, which is the connecting link between the uterus and the vagina. The dilation of cervix signals the beginning of labor. This happens in three phases:



1. **Phase One:** Cervix will first dilate from 0-4 centimeters. The duration of this stage can last from six (6) to ten (10) hours, and maybe even shorter sometimes. The experiences during this stage may be subtle or dramatic. There is no way to tell. Usually mild contractions along with the rupture of membranes are seen.
2. **Phase Two:** The cervix now dilates further from four (4) to seven (7) centimetres. This is the phase where the prep work for childbirth should usually begin. The period of dilation lasts somewhere between 3-6 hours on an average for first time moms, and may feel intense and gradual contractions, each three to five minutes apart. There may be pinkish or brownish discharge.
3. **Phase Three:** The last stage is where the cervix dilates to around ten (10) centimetres. This stage lasts from between twenty (20) minutes to two (2) hours. The contraction is intense. Nausea, shakiness, and fatigue, accompanied by a strong urge to push, along with a tingling or burning sensation in the vaginal area are experienced.

### The Second Stage – Pushing and Birth:

This stage of childbirth starts after the cervix is fully dilated. It lasts around two (2) hours for first time moms. The mother experiences an overwhelming urge to push. As she starts pushing, she may become fatigued and breathless. Intense pain is experienced around the perineal and vaginal area as the baby's head starts to protrude at the widest part of the vaginal opening.



Stages of Childbirth

**Expulsion stage:** from the time the cervix is fully dilated until the foetus leaves the mother's womb. There are strong placental contractions; this process can take up to 2 hours.

### The Third Stage – Delivery of the Placenta:

Once the baby is out into the world, the third and last stage of the delivery of the placenta follows. This period is called the afterbirth. It usually takes place a few minutes after the baby is born.



The doctor may ask the mother to push out the placenta. She may experience slight cramping and pain during this last stage of childbirth.

The doctor may also ask the mother to start feeding the baby immediately after birth to stimulate uterine contractions. This may gently massage the mother's abdomen to allow the placenta to separate and expel out.



Recently born baby

**Placental stage:** uterine contractions discharge the placenta. The umbilical cord is checked for the presence of two arteries and one vein (one indicates a heart disorder). After the baby is born, the mother delivers the placenta ("afterbirth") that detaches from the uterus.

### Feeding and care of babies

**Breast feeding** is the most nutritious option for a baby. Milk changes as baby grows. Antibodies from the mother create immunity for baby. Studies have shown correlation between breastfeeding and higher intelligence in baby. Bond with baby is stronger.

### New medical techniques in reproduction

#### 1. Artificial insemination by husband (AIH)

AIH is used when the male can produce semen, but his semen is not quite adequate to achieve fertilisation. The inadequacy of semen can be attributed to low number of active sperms or the inability of sperms to swim fast enough towards the ovum. AIH can also be used when the male is suffering from premature ejaculation.

#### 2. Artificial Insemination by Donor (AID)

AID is very similar to AIH. However, AID is used in cases where the male's semen is definitely inadequate in quantity or quality. In the Western society, some single women who wish to remain unmarried but have a child also use this method to become pregnant.

#### 3. In Vitro Fertilisation (IVF)

The first two methods were for cases where the male's sperm lacked in quality or quantity. IVF is a technique used mostly for women whose fallopian tubes are blocked and cannot be remedied by surgical procedures. Also for those who fail to conceive despite having normal fallopian tubes and when all possible causes of infertility have been excluded. "In vitro" means a test-tube.



Fertilised ovum





In IVF, one or more ova are removed from the female through a small syringe and placed in a test-tube. Then the sperm of the male is used to fertilise the ovum. After fertilisation, the ovum is allowed to develop in the test-tube till the eight-cell stage. Then it is implanted into the female's womb.

IVF may also be used in cases where the male's semen contains so few sperms that it becomes difficult for them to fertilise an ovum in the fallopian tube. By IVF, sperm of male is used to fertilise the ovum in a test-tube.

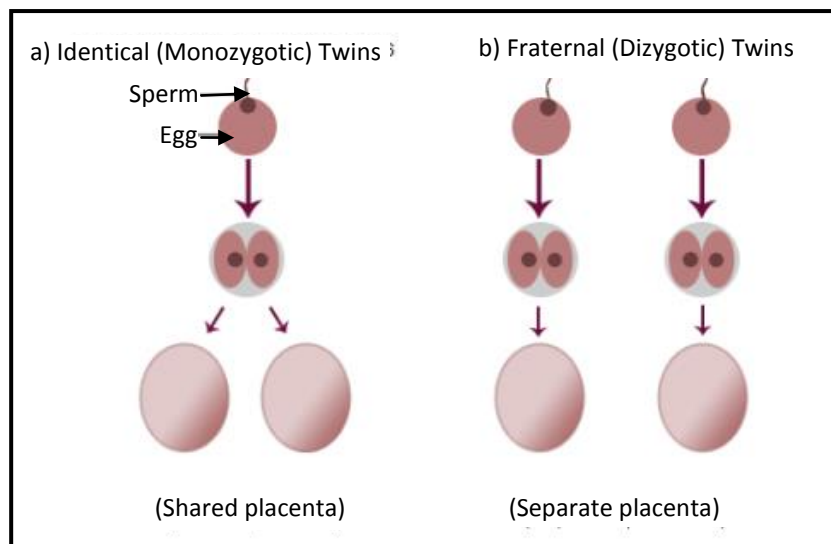
### Twins and multiple birth

A woman usually releases one egg from one ovary each month. This means that if she becomes pregnant she will give birth to one baby. However, occasionally a woman may give birth to more than one baby at a time. If a woman has two babies at once, she has twins.

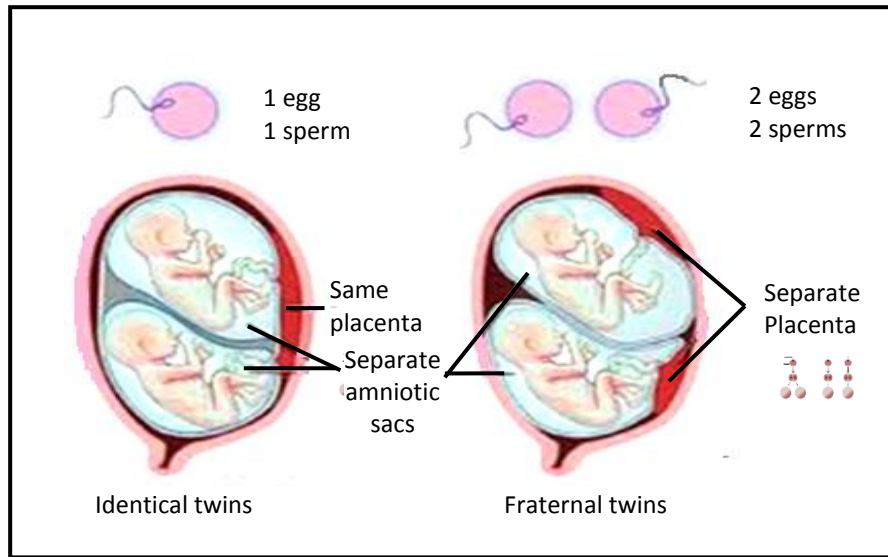
#### Two types of twins:

**Monozygotic (Identical twins)** is from one egg and is identical. One zygote, splits in two, both comes from the same fertilised egg and they share the same placenta.

**Dizygotic (Fraternal Twins)** is formed from two separate eggs that will get fertilised with two different sperm cells. More than one egg gets released during ovulation. Siblings, can be sisters, brothers, brother and sister.



Fertilisation of egg which develop into fraternal or identical twins



Growth of identical and fraternal twins in a mother's uterus

### Twin births in Papua New Guinea

**Conjoined twins** are used to be called “Siamese” twins.

Identical twins that are never completely separated during development. Sometimes are separated, depending on what is shared.

The first well known case was in Siam (old name of Thailand). Conjoined twins born to a Morobe couple in West New Britain province were kept under observation at the Kimbe General Hospital. Sources at the hospital said doctors performed a caesarean birth on August 4, 2015 at 9.05pm to safely deliver the twins, both are girls.



The identical twins Eaustina and Eaustocia Bosin wondered why they were the only children in their village who went to school. They learnt later that they were born as conjoined twins.



Eaustina (left) and Eusthocia (right) as conjoined babies  
Photo: Wayne Taylor



### 11.6.3 Family Planning Methods

- An estimated 225 million women in developing countries like to delay or stop childbearing, but do not use any method of contraception.
- Some family planning methods such as condoms can help prevent the transmission of HIV and other sexually transmitted infections.
- Family planning /contraception reduce the need for abortion, especially unsafe abortion.
- Family planning reinforces people’s rights to determine the number and spacing of their children.
- By preventing unintended pregnancy, family planning /contraception prevents deaths of mothers and children.

Family planning allows people to attain their desired number of children and determine the spacing of pregnancies. It is achieved through use of contraceptive methods and treatment of infertility.

#### **Benefits of family planning / contraception**

Promotion of family planning and ensuring access to preferred contraceptive methods for women and couples is essential to securing the well-being and autonomy of women, while supporting the health and development of communities.

##### **1. Preventing pregnancy-related health risks in women**

A woman’s ability to choose if and when to become pregnant has a direct impact on her health and well-being. Family planning allows spacing of pregnancies. It can delay pregnancies in young women at increased risk of health problems and death from early childbearing.

It prevents unintended pregnancies, including those of older women who face increased risks related to pregnancy. Family planning enables women who want to limit the size of their families to do so. Evidence suggests that women who have more than four children are at increased risk of maternal mortality. By reducing rates of unintended pregnancies, family planning also reduces the need for unsafe abortion.

##### **2. Reducing infant mortality**

Family planning can prevent closely spaced and ill-timed pregnancies and births, which contribute to some of the world’s highest infant mortality rates. Infants of mothers who die as a result of giving birth also have a greater risk of death and poor health. Family planning helps to prevent HIV/AIDS.

Family planning reduces the risk of unintended pregnancies among women living with HIV/ AIDS resulting in fewer infected babies and orphans. In addition, male and female condoms provide dual protection against unintended pregnancies and against STIs including HIV.



### 3. **Empowering people and enhancing education**

Family planning enables people to make informed choices about their sexual and reproductive health. Family planning represents an opportunity for women to pursue additional education and participate in public life, including paid employment in non-family organisations. Additionally, having smaller families allows parents to invest more in each child. Children with fewer siblings tend to stay in school longer than those with many siblings.

### 4. **Reducing adolescent pregnancies**

Pregnant adolescents are more likely to have preterm or low birth-weight babies. Babies born to adolescents have higher rates of neonatal mortality. Many adolescent girls who become pregnant have to leave school. This has long-term implications for them as individuals, their families, and communities.

### 5. **Slowing population growth**

Family planning is a key to slowing unsustainable population growth and the resulting negative impacts on the economy, environment, and national and regional development efforts.

## **Population Growth**

### **Advantages of population growth**

#### **Growing population can generate economic growth.**

- The birth of more people means there will be a greater number of parents investing in their youth.
- Increased purchases in products such as food, clothing, education-related expenses, sporting goods and toys feed the economy.
- Parents with small children purchase larger homes to make room for their children.
- The larger homes that parents with children purchase feed the construction industry economically.
- Children then grow into adults who work for pay and spend it in the economy.

### 1. **Better Economy**

- With population growth comes challenges and difficulties.
- People will be forced to come up with new ideas and ways of doing things.
- Diseases, food shortages and pollution (all disadvantages) are problems that we will be forced to solve.

### 2. **Medical, agricultural and industrial innovations**

- With humans constantly reproducing, there is no way for the human race to go extinct.

### 4. **Keeps humans from going extinct**

- A large amount of people lead to a higher chance of disagreement.



### Disadvantages of population growth

1. **Crime increase**
2. **Food and land shortages**
3. **Poverty**
4. **New Ideas and Cultures**
  - Basic supplies become more expensive because of supply and demand therefore more people steal to survive
  - As populations increase, number of people with mental illnesses increase.
  - More people get in to fights that escalate into crimes
  - People who become desperate for food and land so they may get into organised crime for money
5. **Pollution**
  - More people buy cars which will create more air pollution.
  - More people create more wastes and landfills.
  - Factories make more products because of the increase of consumers making more air pollution and garbage.
  - Only a small percentage of land can be live on and the increasing population fill up that space very quickly.
  - Food resources limited and the population grows beyond sustainability.
  - Only a small percentage of land is used for growing food and to make room for people to live on that space slowly begins to shrink.
  - Population is increasing and with limited land space, the earth becomes crowded.
  - Leading to less jobs and higher prices therefore creating poverty.

### Birth Control Methods

#### Who provides family planning /contraceptives?

It is important that family planning is widely available and easily accessible through midwives and other trained health workers to anyone who is sexually active, including adolescents.

Midwives are trained to provide (where authorized) locally available and culturally acceptable contraceptive methods. Other trained health workers, for example community health workers, also provide counseling and some family planning methods, for example pills and condoms. For methods such as sterilisation, women and men are referred to a clinician.

**Contraceptive effectiveness rates** are estimates of the probability that a pregnancy will occur during the first year of method use. **Perfect use** refers to the effectiveness of a method when it is used consistently and correctly. **Typical use** refers to the effectiveness of a method for the average person who does not always use the method correctly and consistently.



### Natural family planning methods

1. **Abstinence** means the practice of restraining oneself from indulging in sex.
2. **Fertility Awareness/Natural Family Planning**  
Fertility awareness methods rely on understanding the most likely time that ovulation will take place during the monthly cycle, so that intercourse is avoided, or a barrier method is used.  
Fertility awareness methods include:
  - Standard Days Methods
  - Calendar Rhythm Method
  - Symptothermal Method
  - Ovulation Method

The effectiveness of fertility awareness methods range from 98% with perfect use to 78% with typical use. Although an important option for women worldwide, fertility awareness methods overall are less effective than other methods. Male partners must be continuously cooperative. Physiologic changes (that is recent childbirth, current breast-feeding, early menstruation, discontinuation of other hormonal methods, approaching menopause) can affect reliability.

### Withdrawal (Coitus Interruptus)

The withdrawal method for pregnancy prevention refers to the moment a man pulls his penis out of his partner's vagina before ejaculation to avoid ejaculating the sperm.

#### Withdrawal prevents pregnancy by:

- Preventing sperm from entering the vagina (and thus the uterus and fallopian tubes) and fertilising an ovum.

#### Effectiveness

- In terms of pregnancy prevention, withdrawal effectiveness is similar to that of the male condom. Effectiveness is ninety six percent (96%) with perfect use and eighty percent (82% ) with typical use.
- Consider back-up method such as emergency contraception if ejaculation begins before withdrawal.

#### Advantages/Benefits

- Withdrawal requires no money, devices, hormones, or medical provider, making it available to anyone.

#### Disadvantages/Risks

- Provides no protection against sexually transmitted infections and HIV.
- Requires a great degree of self-control. For some men, it may be difficult to ensure that they withdraw before ejaculation has started.
- For some people, pleasure may be diminished by the interruption of sexual intercourse.



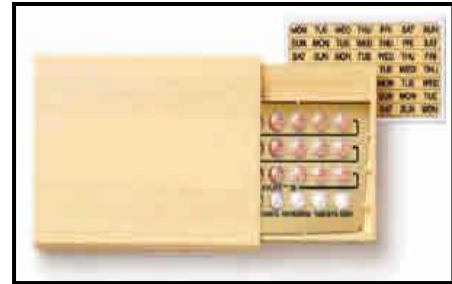
## Female contraceptive methods

### 1. Contraceptive pills

"The Pill" is one of the most popular contraceptive methods in Papua New Guinea.

It comes in two forms:

- combined oral contraceptive pill
- progestogen-only contraceptive pill



Oral contraceptive pills

Both are taken daily and are over 99% effective at preventing pregnancy when taken correctly. It

- prevents ovulation by blocking the **LH surge**.
- prevents sperm penetration by thickening the **cervical mucous**.
- delays sperm transport.
- limits the sperm's ability to fertilise the egg.

### Method Use

- The pill is taken daily at about the same time for twenty one (21) days, followed by a hormone-free period of seven (7) days, during which withdrawal bleed, that resembles menstrual period takes place (accompanied by either taking no pills or seven placebo pills).
- Other options for use of birth control pills include taking two, three, or four consecutive cycles of twenty one (21) pills (up to 84 active pills) followed by one seven-day hormone free interval.
- If more than one or two pills are missed, women should use a back-up method for the remainder of that pill pack and until they have ingested seven active pills in a row in order to remain protected from pregnancy.

**Effectiveness:** High ninety nine point seven percent (99.7% with perfect use).

### Potential Benefits/Advantages

- Not coitus dependent ( does not need to be used at the time of intercourse).
- Decreases **dysmenorrhea** (pain associated with menstruation), menstrual blood loss, and pre-menstrual symptoms.
- Reduces incidence of ovarian cysts, benign breast conditions, pelvic inflammatory disease, uterine fibroids, and iron deficiency anemia.
- Reduces risk of ectopic pregnancy,
- Reduces risk of endometrial and ovarian cancer, although not breast cancer.
- May improve acne.

### Disadvantages/Risks

- Must be taken daily around the same time. It is not a good method for people who would have trouble doing that or do not want family members to know they are using birth control.
- May be expensive for women who do not have insurance coverage for contraception or access to free or low cost services.

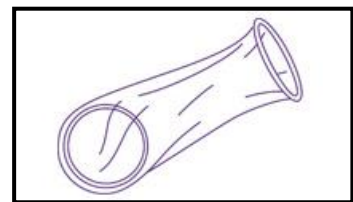


- Provides no protection against sexually transmitted infections, including HIV. Cardiovascular events, that is, heart disease, stroke, and venous thromboembolism (blood clots), although **extremely** rare, do occur at increased rates. Women with **known** risk factors for cardiovascular disease (such as smokers) are at increased risk.
- **Absolute contraindications** (medical conditions precluding use of the method) include blood clotting disorders, heart disease, uncontrolled hypertension, severe migraine headaches, and major surgery with prolonged immobilization, breast, endometrial or other estrogen related cancers.

## 2. Condom

### Female Condom

The female condom is a polyurethane sheath - one end is inserted into the vagina while the other remains outside of the vagina and provides some protection to the external genitalia. It contains a silicone lubricant. Additional lubricant is provided with each condom.



Female condom

### Female Condom Use

- Inserted up to eight (8) hours before intercourse.
- With the thumb and middle finger of one hand, squeeze the inner ring (at the closed end of the pouch) into a narrow oval. With other hand, spread the vaginal lips and insert the inner ring and the pouch into the vagina and push it gently high up into the vagina. An outer ring rests on the outer lips of the vagina. During intercourse, the penis should be guided into the pouch through the outer ring.
- Following ejaculation, the penis should be removed from the vagina, while holding onto the female condom.
- To remove condom, first twist the outer ring, and pull the condom out gently.
- Use a new condom with each act of intercourse.

### Effectiveness

- Female condom effectiveness is ninety five percent (95%) with perfect use, and eighty percent (80%) with typical use.

### Advantages/Benefits

- Dual protection against pregnancy, and STI/HIV.
- Accessible without prescription
- Causes few medical side effects
- Some people find female condoms to be more comfortable and less constricting than male condoms, as they are wider.

### Disadvantages/Risks

- Coitus dependent
- More expensive than male condoms
- Challenge to use in relationships with weak partner cooperation and/or intimate partner violence





3. **Diaphragm** is a dome-shaped rubber cup that is inserted into the vagina before sexual intercourse.

**Method Use**

- **Spermicidal** (sperm-killing) jelly is applied inside of the diaphragm before it is inserted.
- The diaphragm is inserted up to six (6) hours before intercourse. It must be left in place for six (6) hours following intercourse.
- If intercourse is repeated, additional spermicide should be inserted into the vagina with an applicator without removing the diaphragm.



Different types of diaphragm

**Effectiveness**

- Diaphragm effectiveness with perfect use is ninety percent (94%). With typical use, it is eighty percent (80%).

**Benefits/Advantages**

- There are few medical risks associated with the diaphragm

**Disadvantages/Risks**

- In rare instances, users report irritation or allergy from the spermicide.

4. **Cervical Cap**

The cervical cap is a small rubber cup that fits snugly onto the cervix.

**Method Use**

- Prior to insertion, spermicide is placed inside the cap. Additional spermicide is not needed for repeated intercourse. The cap can be left in place for up to 48 hours. Cap use longer than forty eight (48) hours is not recommended (increased risk of TSS).

**Effectiveness**

- Effectiveness of the cap is seventy four percent (74%) with perfect use and sixty percent (60%) with typical use.

**Disadvantages/Risks**

- Limited sizes of cervical caps are available in the U.S. It means that some women will not be able to be fitted for the cap. Additional sizes are available in other developed countries.

**STI Protection:** Although the latex male condom is the best method of preventing the transmission of STIs and HIV, other barrier methods such as the diaphragm and cervical cap may provide some STI/HIV protection as well. Studies in both the United States and developing countries are investigating the use of barrier methods and newly formulated microbicides (microbe killing creams or jellies) in the reduction of STI/HIV transmission risk.



## 5. Depovera

- 
- Usually injected within the first seven (7) days of menstruation, though a quick start protocol is a more promising prevention strategy.
- The woman returns for injection every eleven (11) to twelve (12) weeks ( three (3) months).
- Consider a back-up method such as condoms or emergency contraception if late for injection.

### Effectiveness

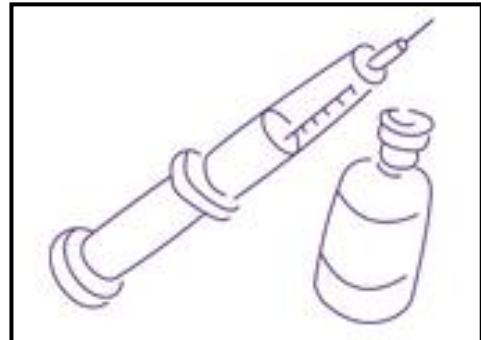
- Highly effective method of birth control (**99.7% with perfect use**).

### Benefits/Advantages

- Not coitus dependent.
- Rare cardiovascular effects of methods containing estrogen have not been demonstrated.
- Decreases dysmenorrhea and menstrual cramping.
- Reduces risk of ectopic pregnancy, anemia, endometrial cancer, uterine cancer, and pelvic inflammatory disease (PID).
- Safe option for breast-feeding women.
- Does not affect fertility long-term.

### Disadvantages/Risks

- Delay of return to baseline fertility (average is about ten (10) months) may occur. However, pregnancy risk is immediate if re-injection is late.
- Provides no protection against sexually transmitted infections including HIV.
- Unpredictable menstrual patterns, including either increased spotting and bleeding or amenorrhea (absence of menstrual periods).
- Weight gain.
- Breast tenderness.
- Decrease in bone density, which probably reverses upon discontinuation (further study of the long-term effects of Depo Provera on bone density, particularly in adolescents is needed).
- Depression in individual women but not overall.
- Inability to immediately discontinue method.
- Rare allergic reactions.



Depovera injection



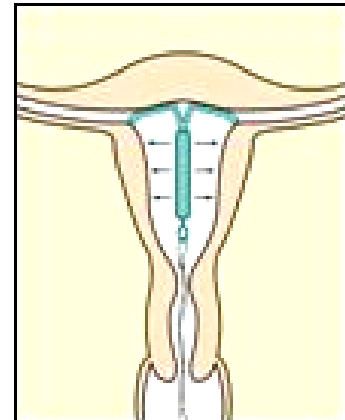
## 6. IUD

### Intrauterine Device (I.U.D)

The Intrauterine Device (I.U.D.) is a small, t-shaped device that is inserted into the uterus to provide reversible and long-term protection against pregnancy. Worldwide, approximately 106 million women use the I.U.D.

#### I.U.D. prevents pregnancy by:

- Preventing sperm from fertilising ova by affecting the way sperm move and inhibiting sperm's ability to reach and join with an ovum.
- Altering the lining of the uterus and this makes it more difficult for implantation to occur.



#### Method Use

- I.U.D.'s are inserted by a medical professional any time during the month. If medical providers are reasonably certain that the woman is not pregnant, and if current or recent upper reproductive tract infections are ruled out.
- Women must assure correct placement and check for signs of infection by going for medical follow-up six weeks following insertion.

#### Effectiveness

- Highly effective with rates ranging from 99.3-98.8%.

#### Advantages/Benefits

- Not coitus dependent
- Long term (up to 10 years with the Copper T and five years with the Mirena).

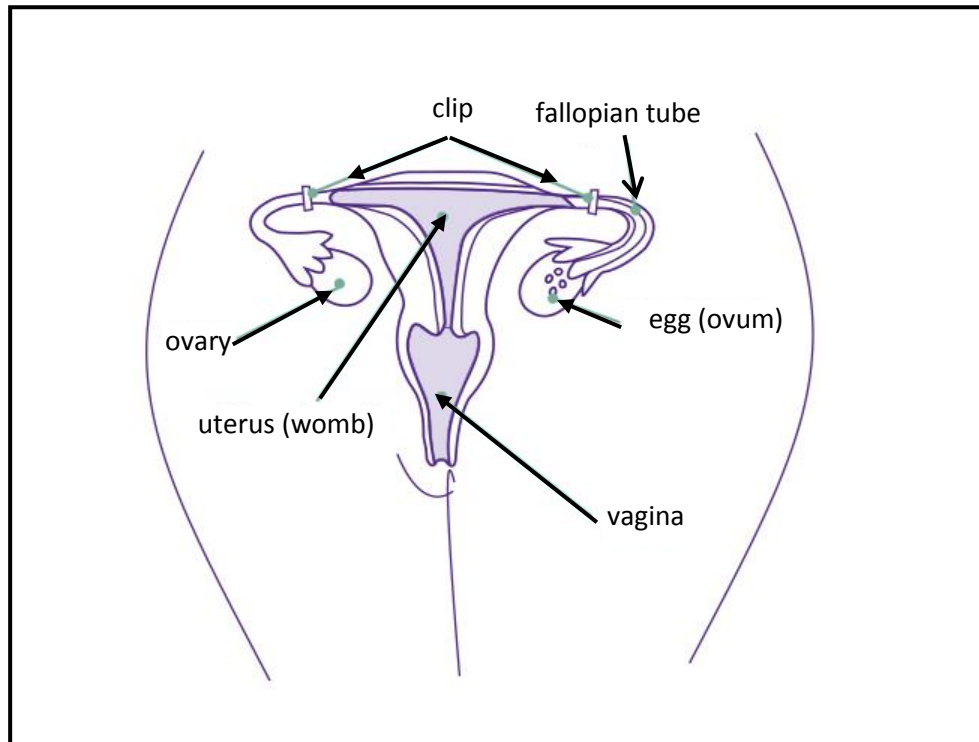
#### Disadvantages/Risks

- Provides no protection against sexually transmitted infections and HIV.
- Potential cramping and pain with insertion.
- Menstrual irregularities (that is heavier menses with the Cu T380, and irregular but light bleeding or spotting during the first few months with the Mirena)
- Expulsion (2-10%) of women will expel within the first year.
- Perforation of uterus (uncommon and usually related to the skill of person inserting device)

## 7. Tubal ligation

**Female sterilisation** is the most widely used contraceptive method. Worldwide, 21% of women aged fifteen (15) to forty nine (49) use female sterilisation, which is a surgical procedure that involves blocking or cutting the fallopian tubes to prevent fertilisation.

When a woman is sterilised, the operation is called a tubal ligation. It is a procedure to close both fallopian tubes which means that sperm cannot swim to and fertilise an egg. It is safe, with mortality rates at 1-2 deaths per 100,000 as compared to maternal mortality rates of 7.9 deaths per 100,000 live births.



Female sterilisation

### Male contraceptive methods

#### 1. Condoms

Male condoms are described below. Because it prevents pregnancy by blocking the passage of semen into the vagina, it also prevents STIs and HIV.

#### Male Condom

Male condoms are available in latex, lambskin, and polyurethane. All three materials effectively prevent pregnancy. Lambskin contains small pores that may permit the passage of bacteria and viruses. Thus they are not recommended for infection prevention.



A male condom

#### Method Use

- New condoms must be used with each act of intercourse.
- Check expiration date of the condom.
- If penis is uncircumcised, foreskin is pulled back before placing the condom.
- Gently pinch the tip of the condom to squeeze out air to allow room for the semen.
- Place condom on erect penis **before** intercourse by carefully unrolling it all the way down to the base of the penis.
- Make sure condom is being unrolled in the right direction (if condom does not unroll, it is probably in-side out).



- Use adequate lubrication (only water-based lubricants should be used with latex condoms, because oil based lubricants like creams, oils, and petroleum jelly may cause latex to tear).
- After ejaculation, withdraw the penis from the vagina before the penis becomes flaccid, and hold the rim of the condom against the base of the penis to prevent the semen from spilling.
- Do not flush condoms in toilets as they will clog plumbing.

#### Effectiveness

- Male condom effectiveness is ninety eight percent (98%) with perfect use, and eighty five (85%) with typical use.

#### Advantages/Benefits

- Provides protection against both pregnancy and STI/HIV.
- Widely accessible without a prescription.
- Causes almost no medical side effects.

#### Disadvantages/Risks

- Coitus dependent.
- Reduced sensitivity for men however, this may be an advantage for preventing premature ejaculation.
- Some men have difficulty maintaining erections, especially when they are inexperienced condom users.
- Challenge to use in relationships where there is weak partner cooperation and/or intimate partner violence or coercion.
- Latex allergy.

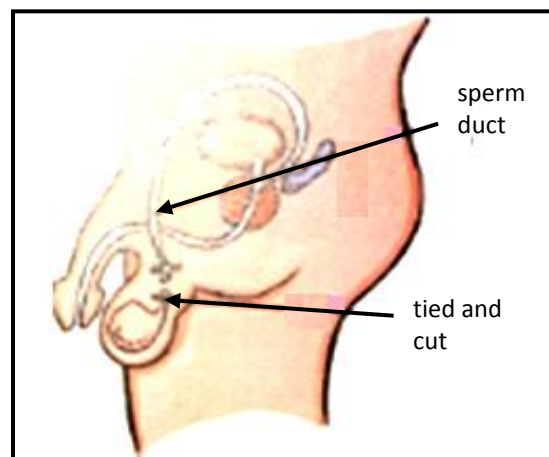
**STI Prevention:** When used consistently and correctly, condoms prevent the transmission of HIV and other sexually transmitted infections.

## 2. Vasectomy

**Male sterilisation (vasectomy)** blocks the vas deferens and therefore prevents the passage of sperm into the semen.

After having a vasectomy it takes between fifteen (15) to twenty (20) ejaculations to have sperm-free semen. Other forms of contraception should be used until semen is confirmed to be sperm-free.

**Vasectomy** is simpler and safer procedure than female sterilisation and may be reversible, though fertility return is not guaranteed.



Vasectomy



## Sexually Transmitted Diseases (STD's) in PNG

It is difficult to estimate prevalence rates for Sexually Transmitted Illnesses in PNG, but rates as high as sixty percent (60%) have been cited for some areas.

### Factors contributing to the spread of Sexually Transmitted Illnesses (STI) include:

- lack of knowledge about the symptoms of these illnesses.
- fear of being stigmatised for seeking treatment.
- lack of health services in some areas, including shortages of effective antibiotics.
- non-consensual sexual relations including forced sex, and sex with minors.
- individuals having numerous sexual partners.
- lack of availability or acceptance of condoms.

### It is generally agreed that Sexually Transmitted Diseases (STD) and HIV interact to make both problems worse:

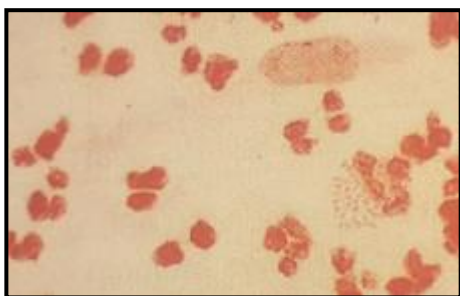
- a person who has an STD is more vulnerable to HIV infection.
- a person who is HIV positive is more vulnerable to developing an STD.
- behaviors that contribute to the spread of STDs also contribute to HIV transmission for example, having multiple partners, not using condoms.
- people are reluctant to be tested for STD's or HIV for fear of being rejected or not accepted in the society, and therefore do not access medical.

### What are sexually transmitted diseases?

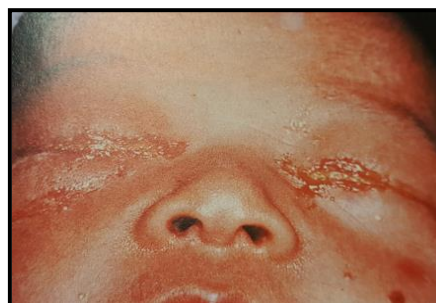
- Sexually Transmitted Diseases are illnesses that are often or usually passed on through sexual intercourse.

A number of different illnesses which are described as sexually transmitted diseases (STD).

1. **Gonorrhoea** is a sexually transmitted disease (STD) caused by bacteria that live in warm moist places such as urethra and vagina. It is the most common STD in Papua New Guinea.



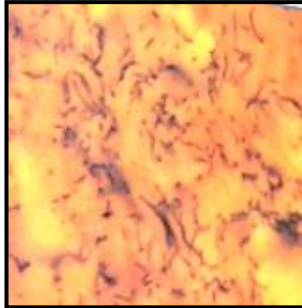
Bacteria which causes gonorrhoea



Infection of baby's eye caused by gonorrhoea bacteria



2. **Syphilis** is a sexually transmitted disease less common than gonorrhea. It is much more serious. The symptoms often go unnoticed in the early stages.



Spiral bacteria causing Syphilis



Non itchy rashes as a symptom of syphilis



Painless sore as a symptom

3. **Chlamydia** is a very common sexually transmitted disease which often has no symptoms.
4. **Genital herpes** is a sexually transmitted disease caused by a virus. It can make people more vulnerable to HIV infection, and it can make an HIV positive person more infectious.
5. **Donovanosis** is less common than gonorrhea and less serious than syphilis but causes permanent damage if not treated early.

### Treatment

Most Sexually Transmitted Diseases (STD) can be easily treated with antibiotics. Treatment is available through Sexual Health Clinics and other medical treatment facilities such as hospitals and healthcare services run by churches and non-government organisations.



## Disorders of the Human Reproductive System

**Hernia:** A structural disorder in males when the small intestine pushes through the opening where the testes descend.

**Infertility:** refers to an inability to produce young. Infertility can also refer to the biological inability of an individual to contribute to conception, or to a female who cannot carry a pregnancy to full term.

**Pelvic Inflammatory Disease:** blocked fallopian tubes in females

**Impotence:** inability for male to have an erection, caused by hormonal imbalance, stress, nerve damage.

**Vaginitis:** caused by chemical irritation, excessive heat and moisture and or bacteria, increased discharge and itching.

**Cancer:** of the testes or prostate gland (most common in males), risk increases with age, cervical cancer (most common in females)

### Tumours and Growths:

**Polyps:** fleshy growths in cervix or uterus.

**Ovarian Cyst:** fluid filled sac around the ovary.

**Fibroid tumour:** on muscle and connective tissue.

**Endometriosis:** cells of the endometrium break off and lodge in other tissues, such as the ovaries or fallopian tubes, they begin to grow, respond to hormones, bleed.

## HIV & AIDS IN PNG

PNG's first case of HIV was reported in 1987. According to UNAIDS, HIV cases in the country have increased at a rate of 30% annually since then. The National AIDS Council and the National Department of Health estimated that 46,275 people were living with HIV by the end of 2006.





Study the table below showing HIV positive cases detected in PNG.

**The table shows HIV POSITIVE CASES DETECTED in 2012 by AGE GROUPS and SEX in PNG**

Age group	Male	Female	Gender not specifies	Total
0-4 yrs	21	19	1	41
5-9 yrs	6	8	0	14
10 -14 yrs	2	5	0	7
15-19 yrs	26	186	1	213
20-24 yrs	104	415	9	528
25-29 yrs	216	399	9	624
30-34 yrs	225	308	6	539
35-39 yrs	187	204	7	398
40-44 yrs	111	103	2	216
45-49 yrs	82	38	1	121
50-54 yrs	58	28	1	87
55-59 yrs	26	7	0	33
60 yrs above	32	4	0	36
<b>TOTAL</b>	<b>1,096</b>	<b>1,724</b>	<b>37</b>	<b>2, 857</b>

**AIDS or Acquired Immune Deficiency Syndrome** is a sexually transmitted disease which is spreading very rapidly in many parts of the world.

AIDS is a very serious and dangerous disease. It is caused by a virus known as Human Immuno- deficiency Virus or HIV that attacks the immune system and makes it weak over time. There are three main ways that the virus can be spread from one person to another and these are:

1. having sexual contact with an infected person, man or woman.
2. infected blood such as in blood transfusion or in a needle or syringe.
3. from an infected mother to her baby during pregnancy or her breast milk.



The most common way in which the AIDS virus is spread is through sexual contact.

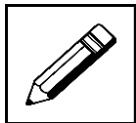
A person cannot get the AIDS virus from:

1. sharing toilets.
2. by being cough on, spat on or from hugging and kissing.
3. sharing cups or cutlery.
4. by shaking hands.
5. by mosquito bites.

Several ways to prevent the transmission of AIDS virus are:

1. do not have sex before marriage.
2. have sex only with your husband or wife.
3. if you have sex with more than one partner, always use a condom.
4. when you have an injection, always make sure that a sterilised needle and syringe is used.

It is now time for you to complete Learning Activity 2. Remember, learning activities are not sent in for assessment. However, this learning activity will help you complete Summative Test 6 (which you will send in for assessment)



## Learning Activity 2



40 minutes

**Briefly answer the following questions:**

1. What is the purpose of the human reproductive system?

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2. In the box below are parts of the reproductive system. Classify the following parts that belong to male and female reproductive systems:

**vagina, scrotum, penis, cervix, fallopian tube/oviduct, ovary, testis, uterus, vas deferens and epididymis**

Male	Female



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3. Name at least 3 Sexually Transmitted Diseases (STD).

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4. Enumerate the four phases of menstrual cycle

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Thank you for completing your Learning Activity 2. Check your work. Answers are at the end of this module.

**It is now time to complete your Practical Activity 5 in your Assessment Book 5.**

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**NOW REVISE WELL USING THE MAIN POINTS ON THE NEXT PAGE**



## SUMMARY

You will now revise this module before doing **SUMMATIVE TEST 6**. Here are the main points to help you revise. Refer back to module topics if you need more information.

- **Asexual** reproduction is the process by which genetically identical offspring are produced from one parent.
- **Sexual reproduction** is the process involving the fusion of two nuclei to form a zygote and the production of genetically dissimilar offspring.
- **Flowers have the following parts:** sepals, petals, stamen, carpel, receptacle and pedicel.
- **Pollination** is the transfer of pollen grains from anther to stigma. It can be wind or insect pollination.
- Male reproductive organs consist of **testis, scrotum, sperm duct** and **penis**
- Female reproductive organs consist of **ovary, fallopian tube, uterus, cervix** and **vagina**
- **Modern Methods of Contraception:**

Methods of Contraception for Everyone		
Injection	Norplant	Pills
IUD	Abstinence	Diaphragm and Cap
Breast-feeding	Contraceptive Pills	Natural Family Planning

Prevent AIDS and STDs	Permanent Method
Male Condom	Vasectomy
Female Condom	Tubal Ligation

### Sexually Transmitted Disease

STD	Cause
AIDS	HIV virus causes AIDS
Chlamydia	caused by bacteria, often no symptoms in female
Genital herpes	caused by virus
Gonorrhoea	Caused by bacteria

**NOW DO UNIT TEST 6 IN YOUR ASSESSMENT BOOK AND SEND IN TO THE  
PROVINCIAL COORDINATOR FOR MARKING.**



## ANSWERS TO LEARNING ACTIVITIES 1 - 2

### Learning Activity 1

1. Binary fission, budding, fragmentation, sporulation, cloning, parthenogenesis and vegetative propagation.
2. Cutting, marcotting, layering, grafting and budding.
3. Stamens and carpels
4. a. Pollination is the transfer of pollen grains from the anther to the stigma  
b. Fertilisation is the process of fusing male and female gametes to form a zygote

### Learning Activity 2

1. Human reproductive system produces, stores, and releases specialized sex cells known as gametes. These cells are released to create the fusion of sperm and egg to form a zygote, the single cell from which all cells of the human body develop.
2. Classify the following parts that belong to male and female reproductive systems:

Male	Female
scrotum	vagina
penis	cervix
testis	Fallopian tube/oviduct
vas deference	ovary
epididymis	uterus

3. AIDS, Gonorrhoea, Syphilis, Herpes, Chlamydia
4. Four phases of menstrual cycle
  - follicular phase
  - ovulation
  - luteal phase
  - menstruation



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## FODE PROVINCIAL CENTRES CONTACTS

PC NO.	FODE PROVINCIAL CENTRE	ADDRESS	PHONE/FAX	CUG PHONE (COORDINATOR)	CUG PHONE (SENIOR CLERK)
1	ALOTAU	P. O. Box 822, Alotau	6411343/6419195	72228130	72229051
2	BUKA	P. O. Box 154, Buka	9739838	72228108	72229073
3	CENTRAL	C/- FODE HQ	3419228	72228110	72229050
4	DARU	P. O. Box 68, Daru	6459033	72228146	72229047
5	GOROKA	P. O. Box 990, Goroka	5322085/5322321	72228116	72229054
6	HELA	P. O. Box 63, Tari	73197115	72228141	72229083
7	JIWAKA	c/- FODE Hagen		72228143	72229085
8	KAVIENG	P. O. Box 284, Kavieng	9842183	72228136	72229069
9	KEREMA	P. O. Box 86, Kerema	6481303	72228124	72229049
10	KIMBE	P. O. Box 328, Kimbe	9835110	72228150	72229065
11	KUNDIAWA	P. O. Box 95, Kundiawa	5351612	72228144	72229056
12	LAE	P. O. Box 4969, Lae	4725508/4721162	72228132	72229064
13	MADANG	P. O. Box 2071, Madang	4222418	72228126	72229063
14	MANUS	P. O. Box 41, Lorengau	9709251	72228128	72229080
15	MENDI	P. O. Box 237, Mendi	5491264/72895095	72228142	72229053
16	MT HAGEN	P. O. Box 418, Mt. Hagen	5421194/5423332	72228148	72229057
17	NCD	C/- FODE HQ	3230299 ext 26	72228134	72229081
18	POPONDETTA	P. O. Box 71, Popondetta	6297160/6297678	72228138	72229052
19	RABAU	P. O. Box 83, Kokopo	9400314	72228118	72229067
20	VANIMO	P. O. Box 38, Vanimo	4571175/4571438	72228140	72229060
21	WABAG	P. O. Box 259, Wabag	5471114	72228120	72229082
22	WEWAK	P. O. Box 583, Wewak	4562231/4561114	72228122	72229062

## FODE SUBJECTS AND COURSE PROGRAMMES

GRADE LEVELS	SUBJECTS/COURSES
Grades 7 and 8	1. English
	2. Mathematics
	3. Personal Development
	4. Social Science
	5. Science
	6. Making a Living
Grades 9 and 10	1. English
	2. Mathematics
	3. Personal Development
	4. Science
	5. Social Science
	6. Business Studies
	7. Design and Technology- Computing
Grades 11 and 12	1. English – Applied English/Language & Literature
	2. Mathematics – General/Advance
	3. Science – Biology/Chemistry/Physics
	4. Social Science – History/Geography/Economics
	5. Personal Development
	6. Business Studies
	7. Information & Communication Technology

### REMEMBER:

- For Grades 7 and 8, you are required to do all six (6) subjects.
- For Grades 9 and 10, you must complete five (5) subjects and one (1) optional to be certified. Business Studies and Design & Technology – Computing are optional.
- For Grades 11 and 12, you are required to complete seven (7) out of thirteen (13) subjects to be certified.

Your Provincial Coordinator or Supervisor will give you more information regarding each subject and

**Notes:** You must seek advice from your Provincial Coordinator regarding the recommended courses in each stream. Options should be discussed carefully before choosing the stream when enrolling into Grade 11. FODE will certify for the successful completion of seven subjects in Grade 12.

### GRADES 11 & 12 COURSE PROGRAMMES

No	Science	Humanities	Business
1	Applied English	Language & Literature	Language & Literature/Applied English
2	Mathematics -General/Advance	Mathematics -General/Advance	Mathematics –General/Advance
3	Personal Development	Personal Development	Personal Development
4	Biology	Biology/Physics/Chemistry	Biology/Physics/Chemistry
5	Chemistry/ Physics	Geography	Economics/Geography/History
6	Geography/History/Economics	History / Economics	Business Studies
7	ICT	ICT	ICT

### CERTIFICATE IN MATRICULATION STUDIES

No	Compulsory Courses	Optional Courses
1	English 1	<b>Science Stream:</b> Biology, Chemistry, Physics
2	English 2	<b>Social Science Stream:</b> Geography, Intro to Economics and Asia and the Modern World
3	Mathematics 1	
4	Mathematics 2	
5	History of Science & Technology	

### REMEMBER:

You must successfully complete 8 courses: 5 compulsory and 3 optional.