CHAPTER 4

Reproduction and Reproductive Systems

Introduction

Reproduction is one of the characteristics of all living things. It is the ability of an orgnism to give rise to a like young one (same species)and by so doing sustain the existence of that species of organisms from generation to generation.

Reproduction can be **asexual** or **sexual.** Asexual reproduction involves only one parent, which gives rise to a daughter individual (usually identical to the parent) by means of mitotic cell division. In smaller organisms, e.g. bacteria, hydra, asexual reproduction includes binary fission, fragmentation, budding etc. In plants, it involves the development of a new individual plant from the specialized organs known as **perennating Organs,** e.g. corm, suckers, rhizomes, runners, tubers etc.

Sexual reproduction on the other hand involves the fusion of male and female gametes to form a zygote, a single cell that marks the beginning of life. The female gamete is the ovum or egg, while the male gamete is the sperm. These are secreted in the reproductive organs known as the **gonads;** the male gonad is the testis while the female gonad is the ovary.

In most higher animals and angiosperms the sexes are seperate. These organisms are said to be unisexual. Some animals possess both male and female reproductive organs in one individual. These are said to be bisexuals or hermaphrodites; but cross fertilization still occurs in such.

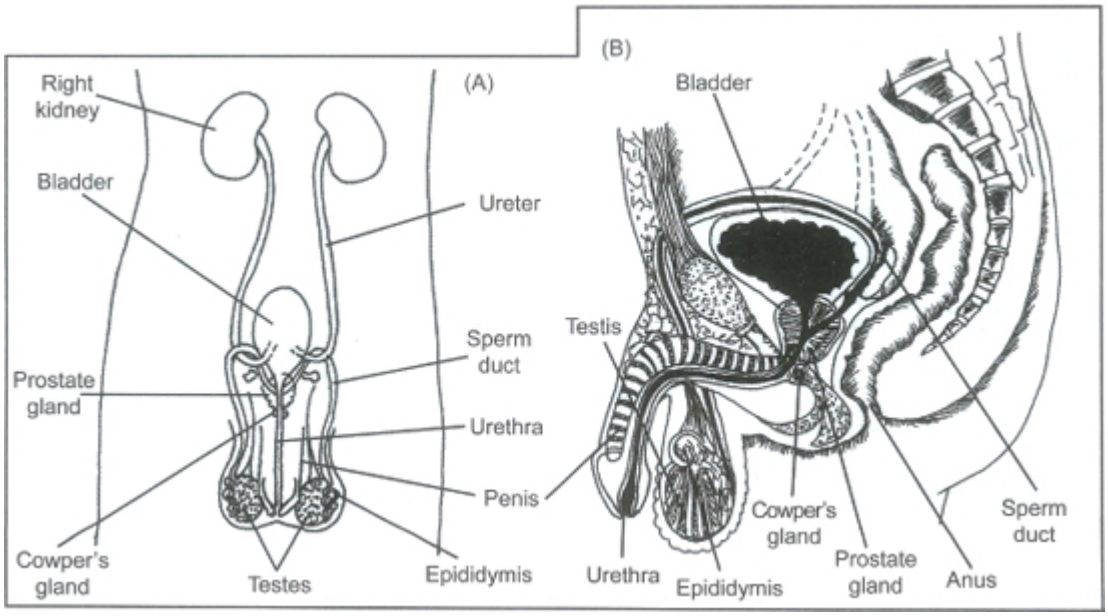

Fig. 4.1 Human male reproductive organs A. Front view. B. Side view

Reproductive System in Animals

This is the system in organisms that plays essential roles in reproductive processes. In unicellular organims, the entire cell serves as the gamete. In simple multicellular organisms (e.g. Hydra), the reproductive system is one and simple. In higher animals and angiosperms, the reproductive systems are well-developed.

Reproductive Systems in Fishes

Bony Fishes

A typical example of bony fish is the Tilapia while the shark is an example of cartilagenous fishes. The male reproductive system of bony fishes consists of the two elongated testes suspended in the abdominal region. The testes join posteriorly into a simple duct which open at the genital opening (cloaca) (see Fig. 4.2a).

In the female bony fish, the ovaries are contained in a sac-like structure suspended in the abdominal region. The ovaries are connected in a single duct which leads to the genital opening (see Fig. 4.2b).

Activity 4.1

Examine and draw a dissected vertebrate. Indicate the male and female reproductive organs.

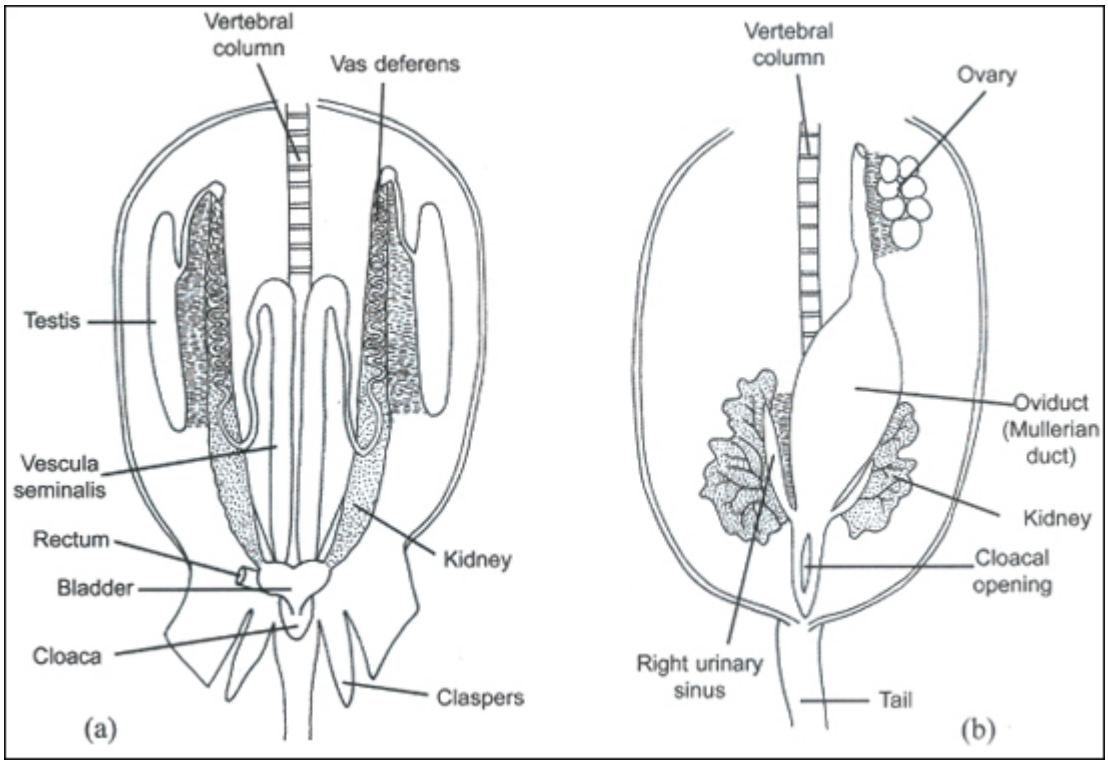

Fig. 4.2 Reproductive system of male and female skate

Cartilagenous Fishes (e.g. Shark)

Structure of male reproductive system in a shark (see Fig. 4.3).

In the cartilagenous fish (e.g. shark), the male reproductive system consists of the testes, vasa efferentia, vas deferens, urino genital papilla, clasper and other inclusions that enhance reproduction. The testes are normally long cylindrical organs. Each testis is made of so many separate swellings within which sperm cells are formed. The sperm cells formed pass through many ducts known as vasa efferentia located in the anterior region of the testis. The sperm enters the vas deferens from the vasa efferentia. The seminal vesicle stores the sperm from where it is released in the process of copulation. The siphon is a muscular sac found on the ventral side beneath the skin and it communicates with the two grooved claspers by small channels. These pairs of claspers are similar to the penis in higher vertebrates.

Activity 4.2

Compare the male reproductive system with that of the female from Activity 4.1

The female reproductive system comprises of the right and left ovaries. The eggs in various stages of development can be seen in the ovaries. There is a pair of oviducts and along the length of each oviduct, is a swollen portion known as the oviduct gland. The shark pushes its clasper into the oviducts of the female shark during mating and squeezes out seminal fluid which contains sperm cells from the urinogenital papilla into the clasper groove while the siphon produces

a current of water that washes the sperm cells from the clasper grooves into the oviduct.

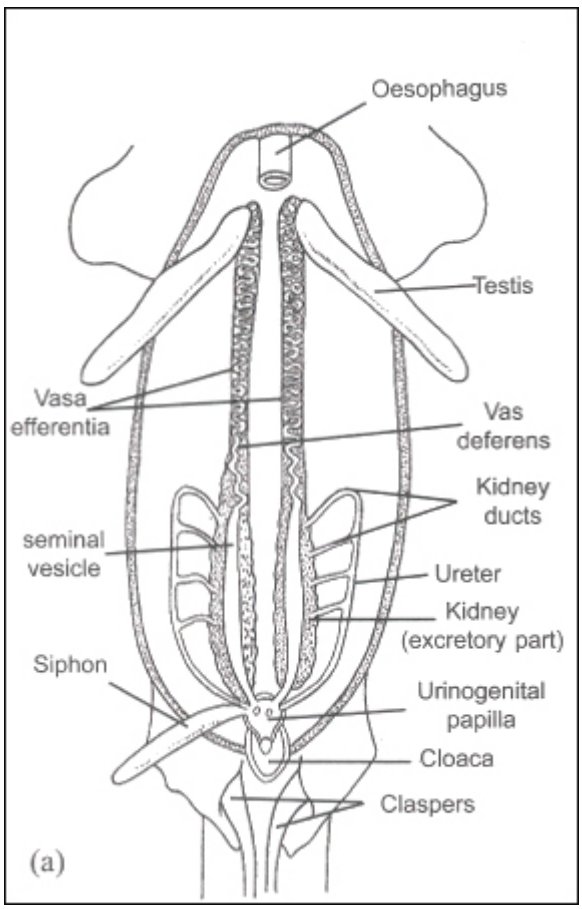

Fig. 4.3 Structure of the male reproductive system in shark

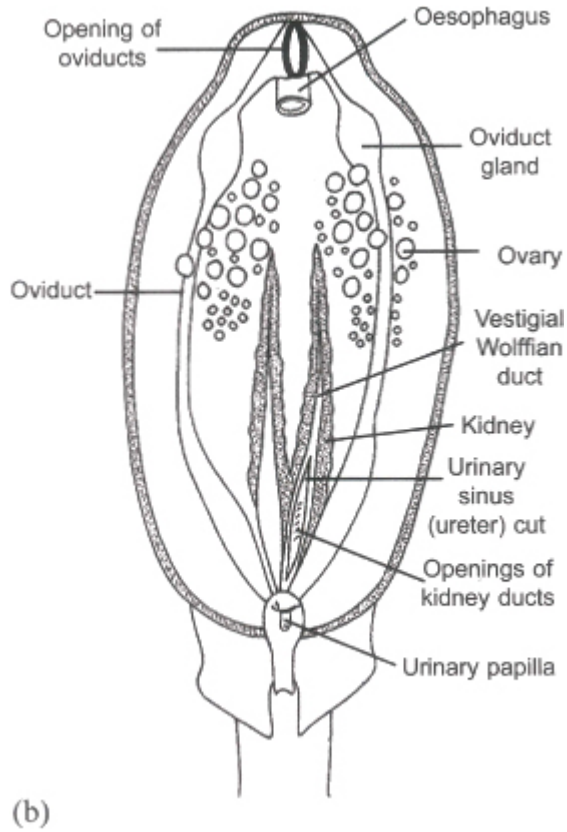

Fig. 4.4 Structure of the reproductive system female shark

Reproductive Systems in Reptiles

In a typical male reptile (e.g. Agama lizard), two ovoid testes are located in the abdominal region. Tiny vessels emerge from the testes where the sperm cells are led to the epididymis. These vessels are known as vasa efferentia. Each epididymis passes over the ventral side of the kidney on its side and opens into the posterior chamber near the two protrusible penes (see Fig. 4.5a). Two rudimentary and cylindrical hemipenes emerge from the cloacal chamber.

In the female Lizard the ovaries are located at the two sides of the abdomen with the right ovary anterior to the left (see Fig. 4.5b). The oviducts open into the cloaca. The eggs are released into the abdominal space from where they are moved on by the action of cilia into the wide opening of each oviduct.

During mating, the male penis penetrates through the female cloaca into the opening of the oviduct while the seminal fluid that contains the sperm is released into the oviduct.

Activity

Dissect the female Agama lizard showing clearly the reproductive organs.

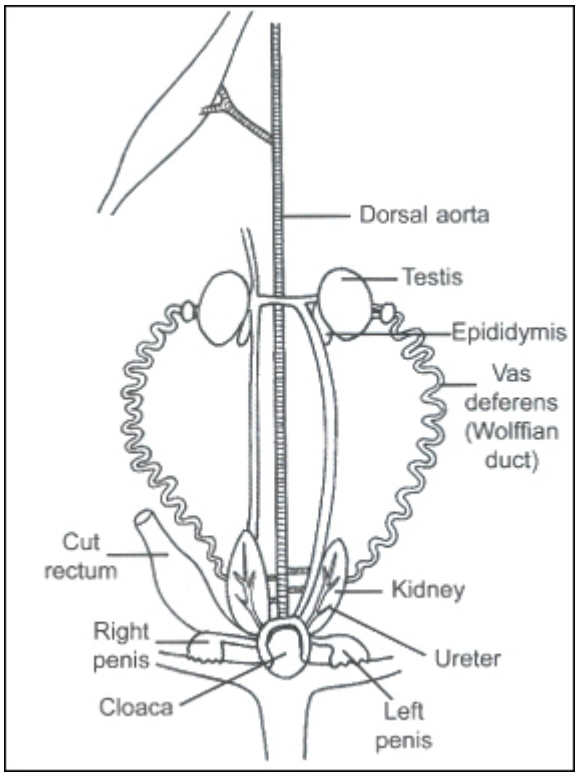

Fig 4.5 (a) Structure of the male reproductive system of Agama lizard

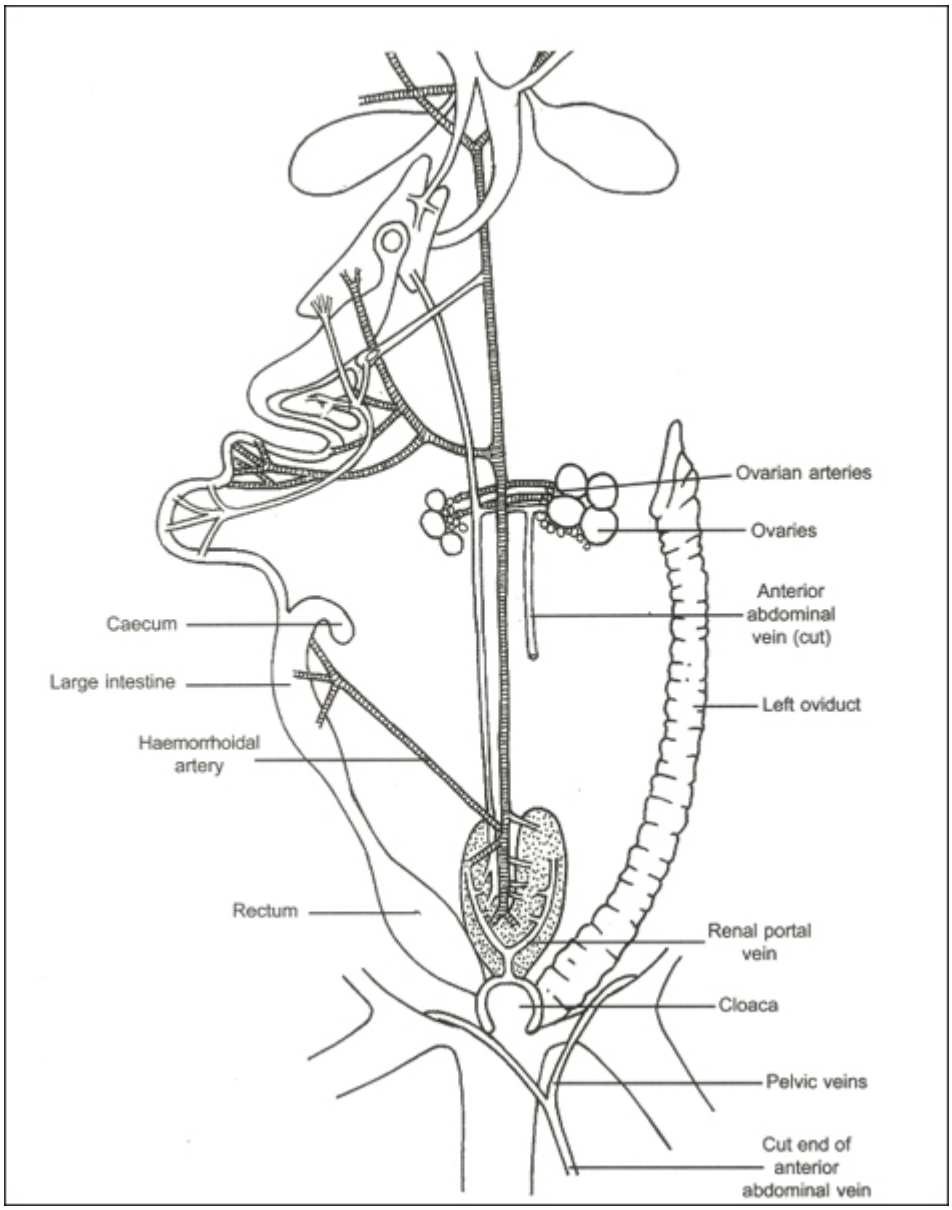

Fig. 4.5 (b) Structure of the female reproductive system of Agama lizard

Reproductive systems in birds

Male: The cock has a pair of testes near the kidneys. A sperm duct runs down from each testis and opens into the cloaca. A cock lacks penis. Therefore, sperm cells accumulate at the wide posterior end of the sperm duct. During mating, sperm cells are transferred from the male into the female as the cloacae come in contact.

Female: A typical adult female of birds (e.g pigeon) possess only the left ovary which is located anterior to the kidney. Follicle of different sizes are found in the ovary (see Fig. 4.6). The left oviduct is big (large) with a wide mouth, thick-walled funnel and a coiled duct that leads into the urodaeum. The absence of one oviduct (right oviduct) could be as a result of the large size of the egg.

Activity 4.4

Dissect a male bird (pigeon) indicating the urinogenital system.

The mammalian reproductive system

Male: This reproductive system consists of the following organs (see Fig. 4.7a):

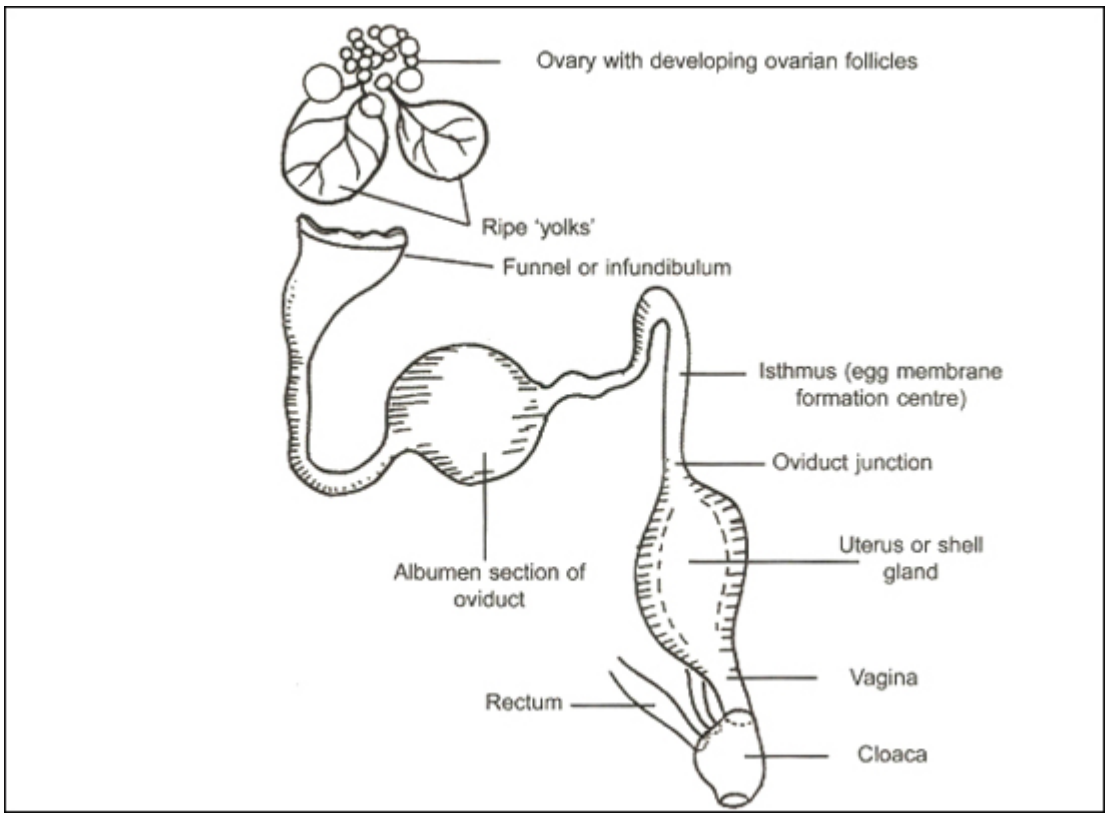

Fig. 4.6 Female reproductive system of bird

The testes: The testes are two ovoid structures situated in the scrotal sac. The testes are internal in some mammals (e.g cats) and external in most mammals (e.g man, goat). In humans, the testes are suspended in the posterior end of the abdominal cavity, and would have descended into the scrotum at birth. They require temperature range of below 35Â°C to function effectively. The testes contain coiled tubules called **seminiferous tubules.** These contain actively dividing cells that produce sperm cells.

The semniferous tubules continue and emerge into a spongy structure called the **epididymis** atop the testes. This structure stores sperm produced in the testes.

Vas Deferens: This is also called the sperm duct. It is a continuation of the epididymis. It serves as the pathway through which sperm cells run from the epididymis and opens to the urethra.

Penis: This is a rudimentary and sensitive urinogenital organ. It consists of spongy erectile tissue. Blood flows into the dilated erectile tissue when stimulated. The flow of blood into the tissue contributes to

its turgidity, hence, the erection of the penis on stimulation. The penis is covered with a sensitive skin called **glans penis** and a retractible foreskin called the **prepuce.** This can be surgically removed during circumcision.

The male reproductive system also consists of certain other accessories and glands whose secretions play important roles in reproduction. These include, the **prostate gland** whose secretion helps to energize and transport the sperm; the **Cowperâ€™s gland** whose secretion helps to normalise the alkaline concentration of the sperm so as to neutralize acidic matters along the wall of the urethra.

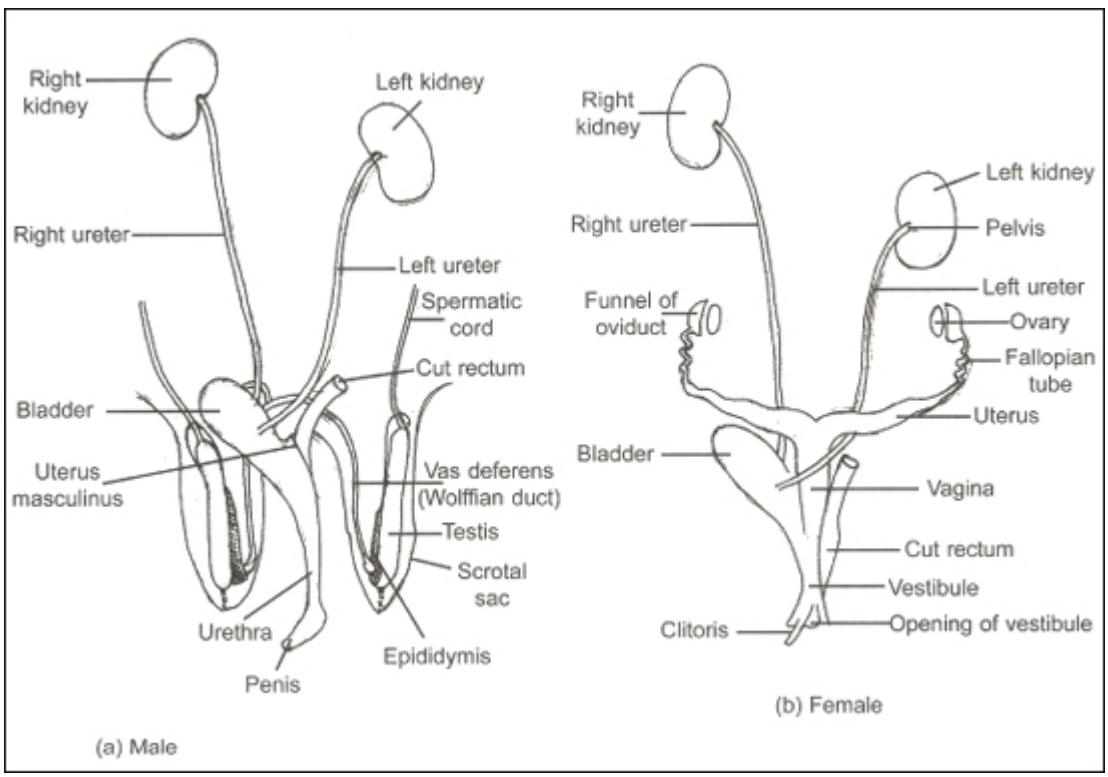

Fig. 4.7 Structure of male and female reproductive system of a mammal (guinea pig)

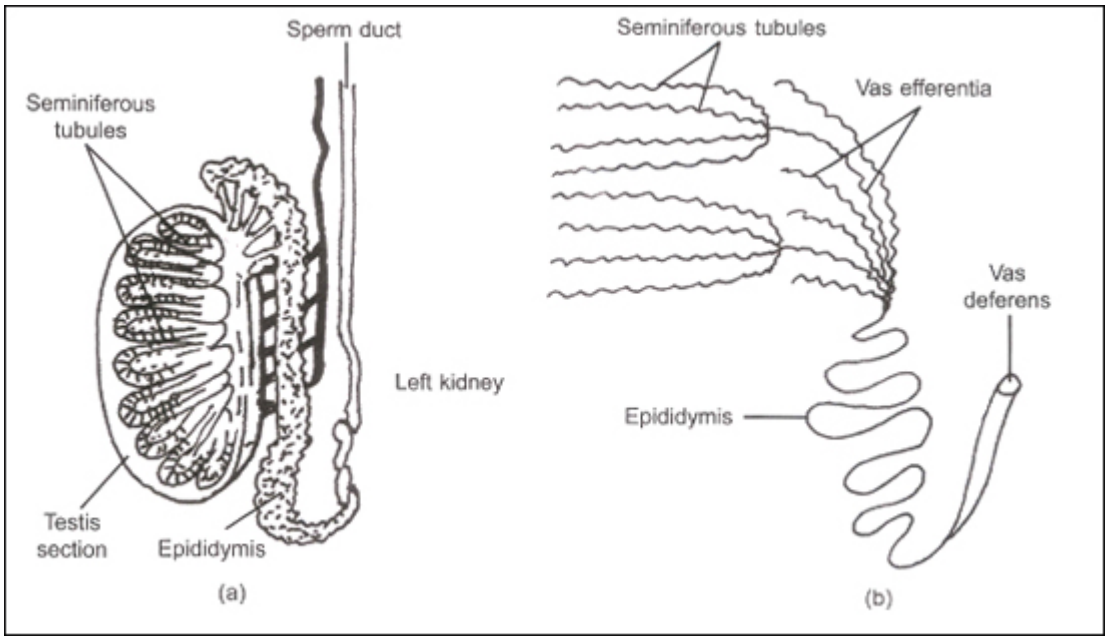

Fig. 4.8 (a) Longitudinal section of a testis
(b) Diagrammatic representation of the arrangement of tubules in the testis.

Note: The mixture of sperm and these secretion is known as the semen.

Female: The female reproductive system consists of the following organs (see Fig. 4.9):

Ovary: The female mammal has two ovaries each located below the kidneys on both sides. The ovaries contain several thousands of potential eggs called **primary oocytes.** They are covered by a layer called **germinal epithelium.** The ovaries produce the female gamete, i.e. ovum (plural–ova). Matured ovum is secreted approximately once in every 28 days. The shedding of a mature egg is known as â€œovulationâ€.

Oviduct: The released egg is received by a funnel-shaped structure known as the **Fallopian funnel**,which opens to the oviduct or Fallopian tube, a pathway for the passage of ovum. Fertilization occurs in this structure. The oviduct opens to the uterus.

Uterus (womb): This is a muscular structure usually paired, with one connected to each fallopian tube; it may be single, as in man. It is connected to the exterior via the vagina. It has a glandular lining membrane for nourishing the embryo in the early stages of development. It also has smooth muscles in its wall which greatly increases in number during pregnancy. Its contraction ultimately expels the foetus and its placenta.

Cervix: This lies at the ventral end of the uterus. It closes after fertilization to avoid further entrance of sperm and foreign bodies.

Vagina: This part serves as the receptor of sperm cell ejaculated by

the male. It opens posteriorly to the vulva. There is a film of connective tissue that covers the vaginal opening called **hymen**. This tissue can be easily removed by sexual activities or physical exercises.

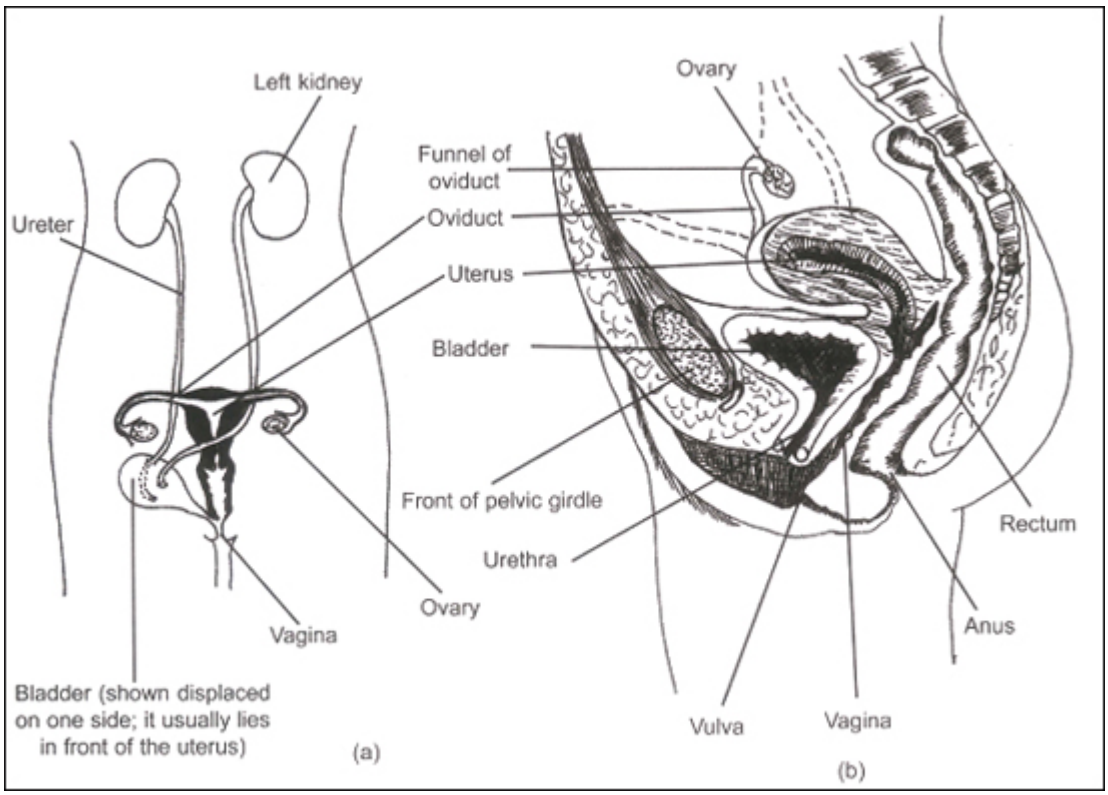

Fig. 4.9 (a) Front view and (b) Side view of the human female reproductive system

Clitoris: This is a rod-like rudimentary structure that is analogous to the penis in the male. It is sensitive and erectile and does not play a serious role in reproduction other than arousal.

Note: The urinary and reproductive passages of human females are seperate and they open seperately to the exterior in an external genitalia called the vulva. Hence, urinogenital organs are present in all mammals, except in female humans.

Structure of mammalian gametes

The mammalian gametes (Figs. 4.10 and 4.11) are the male gametes called sperm cell (spermtozoon) and the female gametes called eggs or ova. Each gamete is unicellular.

Male gametes

The human male gamete (Fig. 4.10) is shaped like a tadpole and consists of a head (about 3 micrometres wide) with a nucleus and a tail or flagellum. The whole sperm, including the tail, with which it moves inside the seminal fluid, is about 60 micrometres long. A sperm cell is microscopic and is usually smaller than an egg (ovum) (Fig. 4.11).

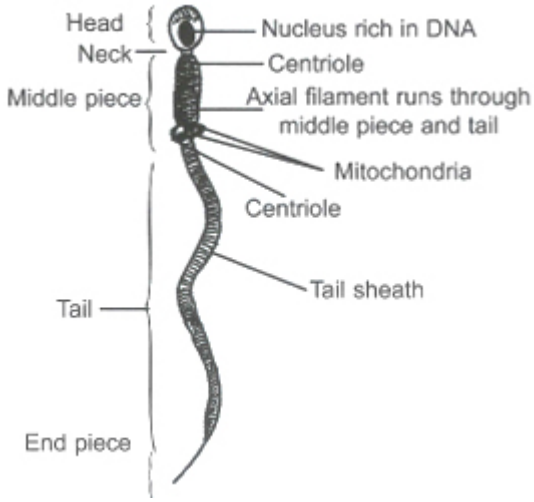

Fig. 4.10 Structure of a human sperm cell cell

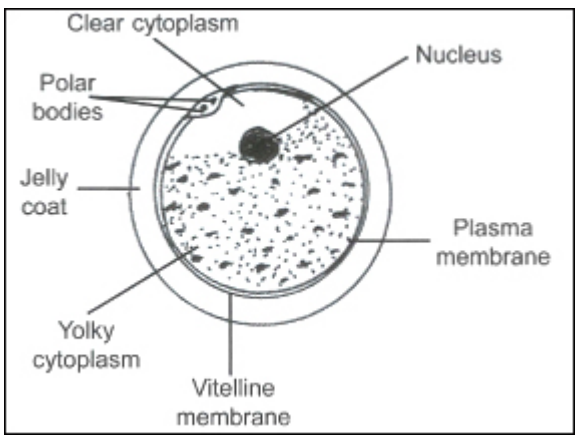

Fig. 4.11 A generalized animal egg (ovum)

Female gametes

The human female gametes are also microscopic but are larger than the sperm cell. Each ovum is about 0.1mm in diameter. It consists of the cytoplasm, a nucleus in the centre, granules and yolk droplets (see Fig. 4.11). The yolk provides a source of nourishment for the embryo, at least, in its early stages of development.

The ovumâ€™s cytoplasm is surrounded by two membranes. The inner one is the plasma membrane, while the outer one is the vitelline membrane. The ovum is bounded on the outside by a jelly coat of variable thickness made up of glycoprotein.

The nuclei of the sperm cell and ovum contain chromosomes, which are thread-like materials, that carry genes. The genes are responsible for passing on the â€˜parentsâ€™ characteristics to the offspring (Chapter 10).

Similarities in mammalian reproductive systems

The male and female mammalian reproductive systems are similar in the following ways:

1. Both have gonads or sex organs (testes and ovaries)

2. Gametes are produced by their gonads.
3. Both systems have external openings.
4. Their gonads act as ductless (endocrine) glands.
5. Both systems combine to allow internal fertilization.

Table 4.1 displays the differences between the mammalian male and female reproductive organs.

Table 4.1. Differences in mammalian male and female reproductive organs

Male	***Female***
1. Testes are in scrotal sacs outside the body.	Ovaries are located inside the body.
2. Epididymis present	Epididymis absent
3. Sperm produced by testes	Eggs produced by ovaries
4. Sperm cells pass out via the urethra	Ova pass into the oviducts where they are fertilized.
5. Sperm ducts present	Sperm ducts absent
6. Seminal vesicle present	Seminal vesicle absent
7. Prostate gland present	Prostate gland absent
8. Cowperâ€™s gland present	Cowperâ€™s gland absent
9. Penis present	Penis absent
10. Oviducts absent	Oviducts present
11. Uterus absent	Uterus present
12. Vagina absent	Vagina present
13. Cervix absent	Cervix present
14. Vulva absent	Vulva present

Comparison of reproduction in vertebrates

All vertebrates begin their lives as a result of the fusion of a male and female gamete (a sperm cell and an egg/ovum). This process is called fertilization (see chapter 6).

In most fishes and amphibians, fertilization is external. In reptiles, birds and mammals, fertilization is internal. As a result, there is always some type of coition (mating) before fertilization occurs. In all vertebrates, some courtship behaviour always precede mating prior to fertilization. (See chapter 5).

Most fishes and amphibians lay their eggs (without shells) in water **(oviparity)** where they are fertilized. Most reptiles also lay eggs (oviparity) which have shells that may be soft and leathery (e.g. lizards and snakes) or hard (e.g. crocodiles). All reptiles lay their eggs on land.

Some fishes, amphibians and reptiles and most mammals are

viviparous (they do not lay eggs but give birth to well-developed young ones). Some fishes retain the eggs within their bodies where they are fertilized. The zygotes develop into young fishes and leave their parentsâ€™ bodies alive. Such fishes (e.g. guppy) are said to be **ovoviviparous.** A few mammals in Australia (e.g. the duck-billed platypus, and monotreme), are oviparous.

Many fishes experience a very high mortality rate from their eggs to the young ones (called **fries).** To compensate for such losses, the fishes lay large numbers of eggs (over a million atimes) every breeding season.

Table 4.2 Comparison of reproduction in vertebrates

Type of vertebrate	*Time of breeding*	*Mode of fertilization*	*No. of eggs laid*	*Mode of zygote growth*	*Parental care*
Fishes	Seasonal	External	Millions	Mostly oviparous	Mostly none
Amphibians	Seasonal	External	Hundreds	Mostly oviparous	None
Reptiles	Seasonal	Internal	Many	Mostly oviparous	None except Nile crocodiles
Birds	Seasonal	Internal	Few	Oviparous	Occurs for a short time
Mammals	Seasonal except in humans	Internal	None except in monotremes.	Mostly viviparous	Occurs for a long time.

There is a relatively high mortality rate of tadpoles as against those that mature to young frogs and toads. To compensate for this, most amphibians lay hundreds of eggs at once during the breeding season.

Reptiles lay fewer eggs. For example, the female *Agama* lizard lays about 20 to 70 eggs at a time. The rate of mortality among reptiles is perhaps higher among their eggs than among the young. This is because young reptiles are well-developed and able to fend for themselves by the time they are hatched.

The number of eggs laid by birds varies from species to species. While the pigeon lays either one or two eggs per breeding season, the domestic fowl can lay about 15 eggs. Most chicks are blind, naked and helpless when they are hatched. For about two weeks, such young birds remain in the nest where they are fed by their parents. This is the time that most of them (about 75%) are preyed on by predators like the hawk.

Most fishes, all amphibians and most reptiles do not show parental care for their eggs or young ones. While birds and mammals produce few offspring at a time, they protect and take care of them to a great extent. Parental care is most highly developed among mammals which protect and feed their young until they can fend for themselves. Generally, vertebrates that show external fertilization – fishes and amphibians – produce more eggs and experience higher mortality rates among their eggs and young than reptiles, birds and mammals

which show internal fertilization.

Reproduction in Plants

The major reproductive organ in the flowering plants is the flower. This contains both the male and female parts, though in some plants (e.g. pawpaw), the male and female organs appear in different individual plants. Flowers exist in different sizes, shapes, colours, patterns and arrangement.

Structurally, a flower contains whorls of different structures and forms, usually arranged in definite patterns. These whorls are: the sepals (calyx), petals (corolla), stamens (androecium) and carpels (gynoecium). They are basically classified as essential and non essential parts. A flower is **complete** if it has all the four whorls. It is **incomplete** if any of the four whorls is lacking.

The non-essential parts do not produce gametes, hence, their function in reproduction is not essential. They however play a protective role. The sepals and petals are the non-essential parts. The essential parts of the flower are the gamete-producing parts – The stamen The functions of these organs are discussed below.

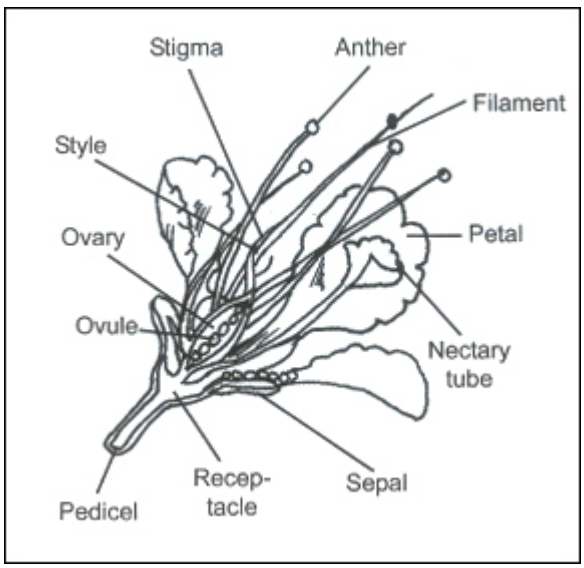

Fig. 4.12 Longitudinal section of Pride of Barbados.

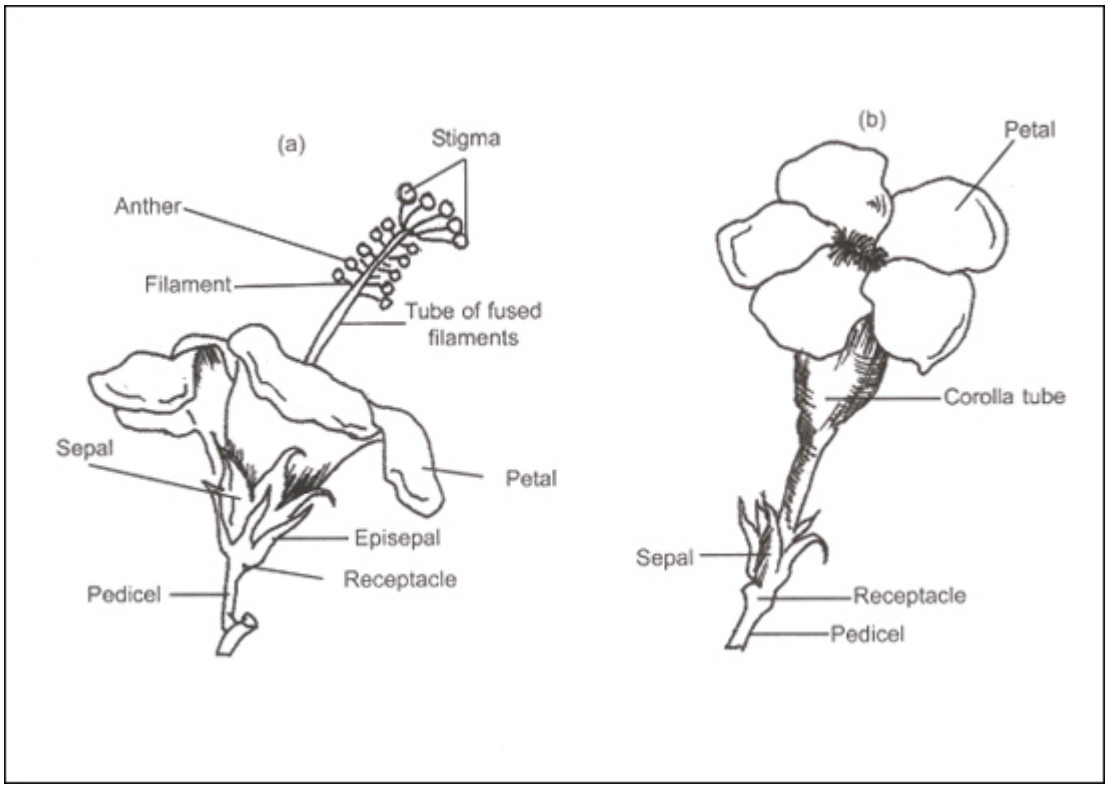

Fig. 4.13 Two flowers (a) Hibiscus (entire). (b) Allamanda (entire).

Reproductive systems of flowering plants

Gametes from one organism usually fuse with gametes from another organism of the same or related species during sexual reproduction. To enable gametes of one plant to reach those of another, flowering plants (angiosperms) have developed special mechanisms. The part of a plant modified for sexual reproduction is called the **flower.** Fertilization inside the flower often leads to the production of seeds which have the ability to germinate into new plants. (See chapter 6).

Structures and functions of a flower

Though flowers have different shapes, sizes and colours, they all have certain features (structures) in common. These features are now described and illustrated in Figs. 4.12, 4.13, 4.15 and 4.17. Atypical dicotyledonous flower has a pedicel, a receptacle, calyx, corolla, androecium and gynoecium (Figs 4.12 and 4.13).

1. **Pedicel:** This is the part which attaches the entire flower to the stem or branch.
2. **Receptacle:** It is the enlarged tip of the pedicel to which all the floral parts are attached.
3. **Calyx:** It is made up of a circular, outer most layer of leaf-like structures called sepals which are fixed to the receptable. Sepals usually protect the flower when it is in the bud stage. Usually, they are green and so, can photosynthesize. But in some plants (e.g. Pride of Barbados), they are and so, can photosynthesize. But in

some plants (e.g. Pride of Barbados), they are coloured like the petals and are said to be **petaloid.** (Fig. 4.16). As a result, they help to attract pollinators.

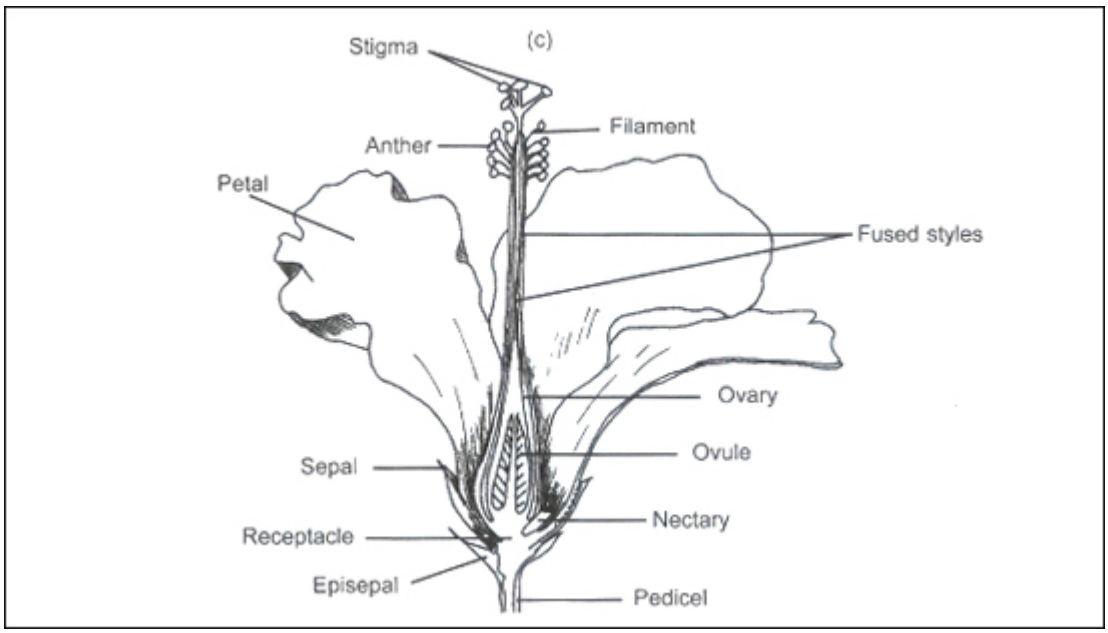

Fig. 4.13 (c) Longitudinal section of Hibiscus

Sepals may be free or separate from one another (e.g. Pride of Barbados, *Allamanda* and milk bush) or fused (partly or wholly joined together e.g. *Hibiscus* (Fig. 4.13)). The **epicalyx** is any floral whorl outside the calyx. In the *Hibiscus,* there are five narrow, green structures, the **episepals,** making up the epicalyx. The calyx of Pride of Barbados consists of five sepals, while they are five to six in *Hibiscus.*

Corolla. It consists of coloured, leaf-like structures called **petals** inside the calyx. The corolla of Pride of Barbados consists of five petals. The petals are usually the most prominent part of a flower and attract pollinators, e.g. insects and birds. Some flowers have scented petals with a nectary at the base that produces sugary nectar.

Such petals attract insects to the nectar and in the process of collecting the nectar, pollination occurs. Petals may be free e.g. *Hibiscus* and Pride of Barbados or fused e.g. *Allamanda* and milk bush (*Thevetia nerii-folia* or yellow oleander). The calyx and corolla are collectively called **perianth.**

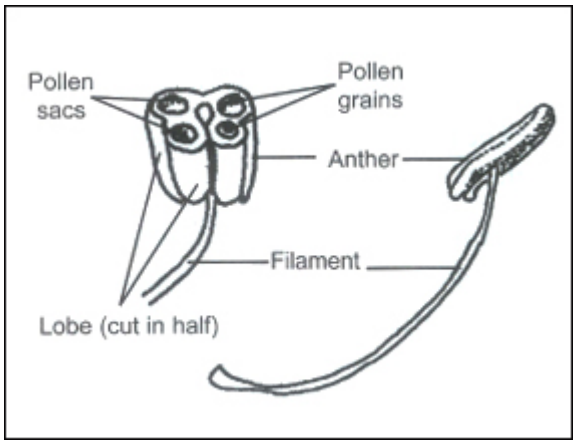

Fig. 4.14 A typical stamen.

4. **Androecium** This consists of the male organs called **stamens** that lie inside the corolla. A stamen consists of a bilobed head – the **anther,** containing **pollen grains,** and a stalk called the **filament** that bears the anther. An anther is composed of four pollen sacs containing **pollen grains** – the male gametes.

In Pride of Barbados, the androecium consists of 10 stamens while that of *Hibiscus* consists of numerous stamens.

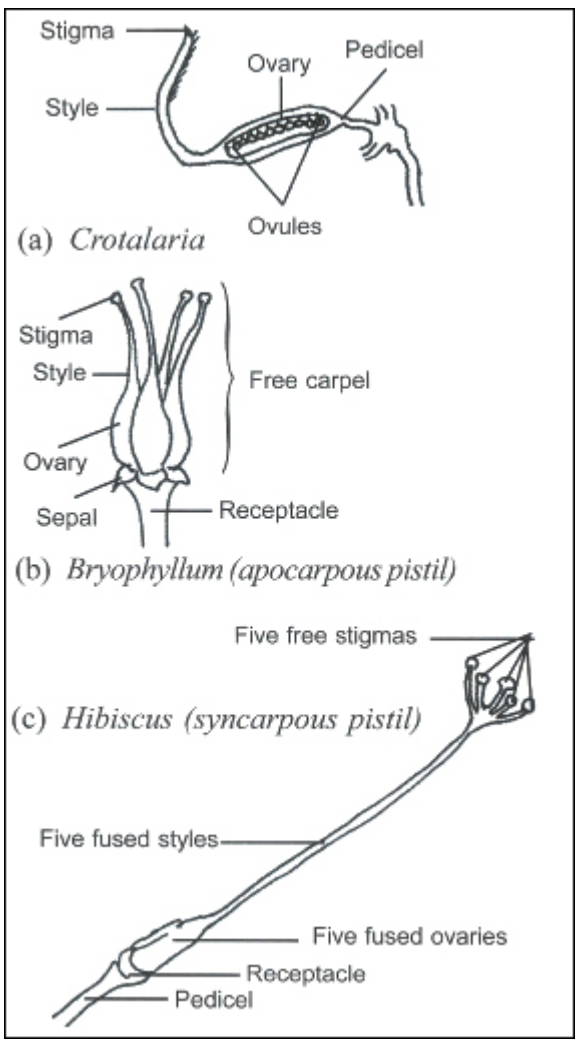

Fig. 4.15 Kinds of pistil.

5. **Gynoecium** or **pistil.** This is the female organ which lies in the innermost part of the flower. A pistil is made up of one or more **carpels.** Usually, a carpel consists of three parts:

   (a) the **stigma** which receives the pollen grains during pollination;

   (b) the **style** which joins the stigma to the ovary;

   (c) the **ovary** containing the ovule(s). In many flowers, the ovules form fertile seeds after fertilization.

A pistil, which consists of one carpel (e.g. *Crotalaria),* is said to be **monocarpous** (Fig. 4.15a). A pistil having more than one carpel might be apocarpous or syncarpous. In an **apocarpous** pistil, the carpels remain completely separate from one another e.g. *Bryophyllum* (fig. 4.15b) and rose. A **syncarpous** pistil is one in which all the carpels or at least their ovaries, are fused. In *Hibiscus* (Fig. 4.15c), for example, the five stigmas remain separate while the ovaries and styles of the five carpels are fused.

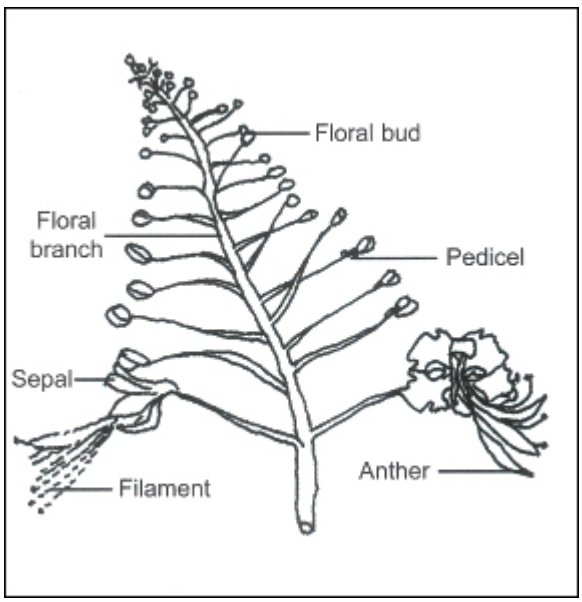

Fig. 4.16 Floral branch of Pride of Barbados showing the arrangement of mature and immature flowers.

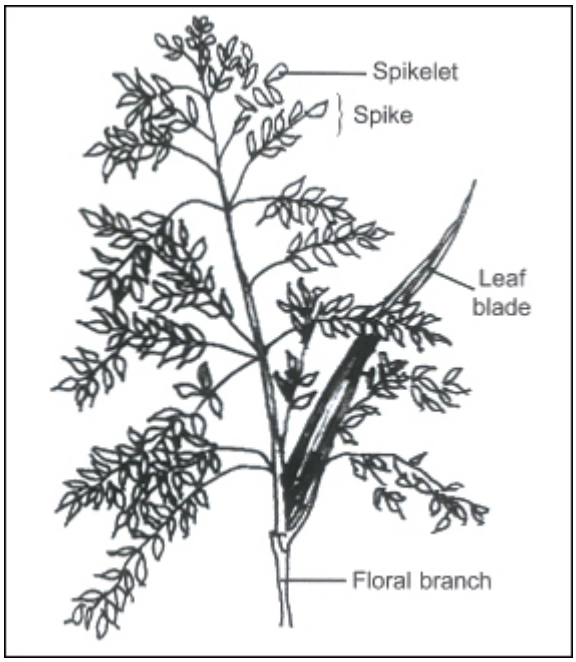

Fig. 4.17 Guinea grass inflorescence.

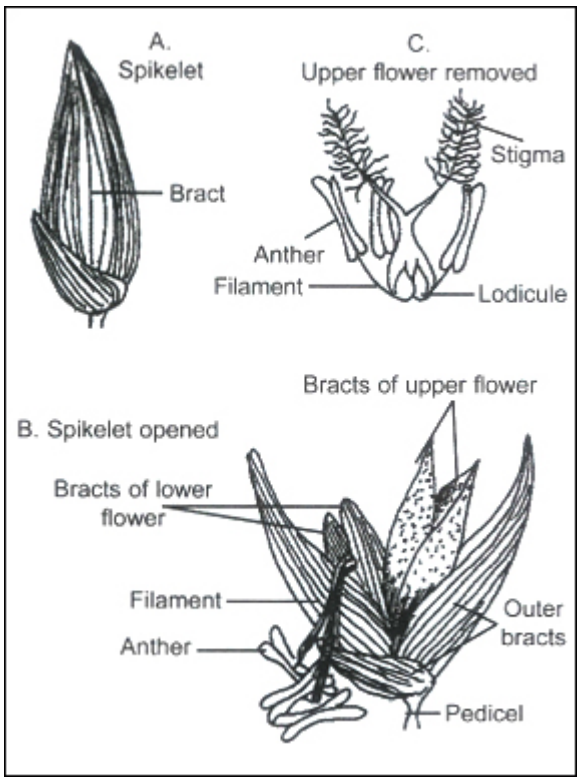

Fig. 4.18 Structure of Guinea grass spikelet.

Types of ovary

The position of an ovary in the receptacle determines how it is classified. An ovary can be inferior, superior or half inferior (Fig. 4.19).

An **inferior** ovary (Fig. 4.19A) is one in which the other floral parts arise above it on the receptacle, e.g. canna lily, guava and sunflower. These flowers are described as **epigynous.**

An ovary is **superior** (Fig. 4.19B) when it is placed above the other

floral parts on the receptacle e.g. *Crotalaria and Hibiscus.* These flowers are said to be *hypogynous.*

An ovary is **half-inferior** (Fig. 4.19C) when the ovary lies inside a cup-shaped receptacle and other floral parts appear to be attached slightly above it, e.g. rose flower. Such flowers are said to be **perigynous.**

Arrangement of floral parts

All the illustrations in Figs. 4.12-4.13 show the arrangement of the floral parts in insect-pollinated flowers. Fig. 4.16 illustrates the arrangement of the floral buds on a floral branch of Pride of Barbados while Figs. 4.17 and Fig. 4.18 show the arrangement of the floral parts in a wind pollinated flower.

Floral parts of a wind-pollinated flower

Guinea grass (Panicum maximum): This is found in the tropics. It has wind-pollinated flowers. Its inflorescence (see Fig. 4.17) is made up of long, slender branches with a pair of flowers at intervals along each branch. Each pair of flowers is enclosed within bracts to form a **spiklet** about 4mm long (see Fig. 4.18).

Within the spiklet, the lower of the two flowers is made up of three yellow stamens. The upper flower has three stamens and an ovary with two feathery purplish-red stigmas. Each flower has two tiny structures, the **lodicules,** representing **the perianth.** There are also some surrounding bracts. The two that are around the upper flower are wrinkled, pale and membranous. Those surrounding the lower flower are green.

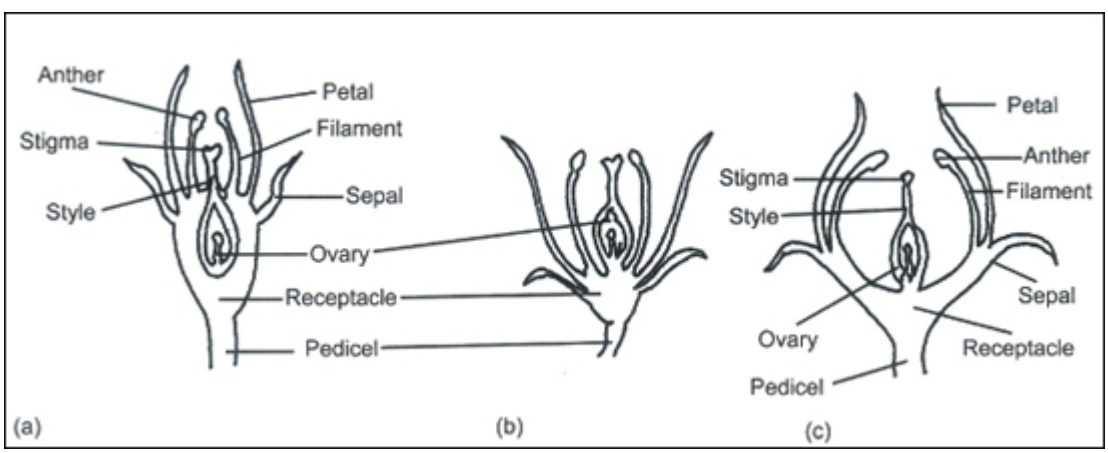

Fig. 4.19 Types of ovary

Some of the spikelets have protruding stamens, while others have stigmas. The flower is **protandrous.** Hence, flowers with ripe stigmas are slightly older than those with ripe stamens. The stamens develop within the bracts till they are ready to shed their pollen grains. The bracts then part a bit and the filaments lengthen, very rapidly within minutes. Therefore, the anthers protrude and the filaments become

very thin threads that shake with the slightest wind or breeze. The anthers burst and release a lot of tiny, light pollen grains that are easily blown about by the wind.

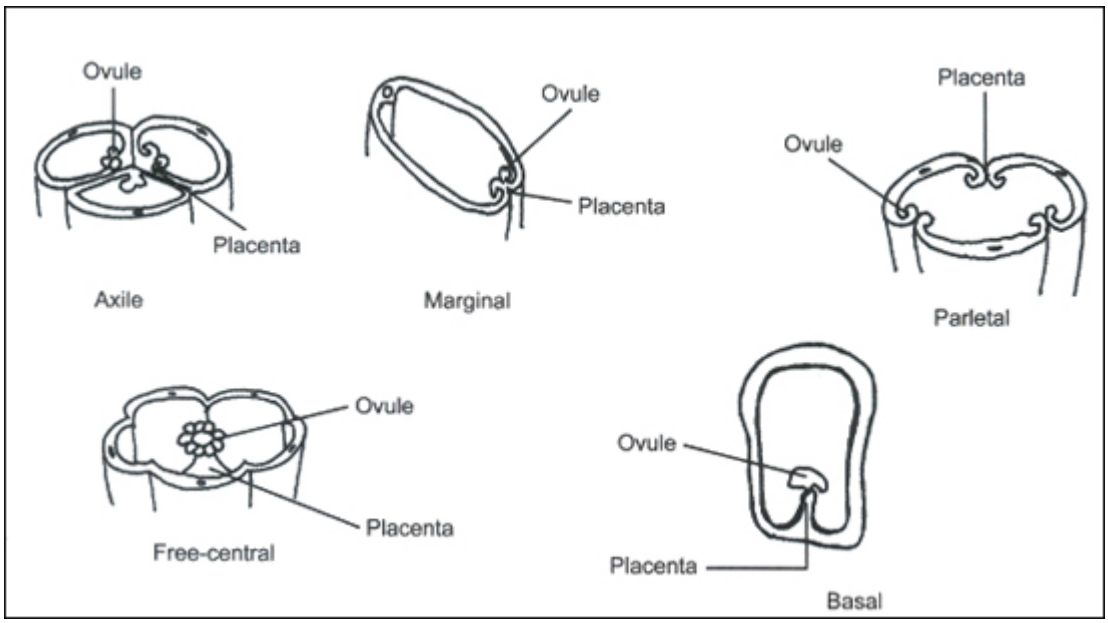

Fig. 4.20 Kinds of placentation.

Types of flower/ovary

Hypogynous flower: In this type of flower, the receptable forms a conical shape. The ovary emerges at the top of the cone while the whorls are arranged in concentric rings below the position of the ovary. Such ovary is said to be **superior.** Example is *Hibiscus.*

Perigynous flower

In this type of flower, the receptacle is cup-shaped with the ovary situated in the centre of the cup, and the whorls emerging from the edges of the cup. Example is Rose. The ovary is said to be **half-inferior.**

Epigynous flower

The ovary of these flowers fuses with the receptacle, and the whorls emerge from above the ovary. This type of ovary is said to be **inferior** as in Guava.

Kinds of placentation

Inside the ovaries, ovules are attached in various ways to the ridges of fleshy tissues, called the **placentae** (singular – placenta) by short stalks called **funicles.** The arrangement of ovules within the ovary is called **placentation.** Placentations are of various types. They include the following (Fig. 4.20):

Axile: The ovules are attached to the centre, e.g. tomato and cana lily.

Marginal: The ovules are attached along one edge of a monocarpous

ovary, e.g. Pride of Barbados, flamboyant, *Cassia* and *Crotalaria.*

Parietal: The ovules are arranged along many lines on the ovary wall, e.g. pawpaw.

Free-central: The ovules are attached to projections from the base of the ovary, e.g waterleaf.

Basal: The ovules are attached to the base of the ovary, e.g sunflower.

After fertilization, the ovary develops into a fruit while the ovules in most flowers develop into seeds. For the mechanism of reproduction see Chapter 2, Book 2, and Chapter 5 and 6 of Book 3.

Suggested Practicals

1. *Comparison of mammalian reproductive organs*
   (a) Examine a male and a female rat dissected by your teacher.
   (b) Draw and label the reproductive organs of the male and female rats.
   (c) State one difference you observe in the structures of the two specimens.
2. *Observation of mammalian sperm cells*
   (a) Your teacher will obtain a male rat and kill it for dissection. He should cut open its scrotal sac and cut the testis and suck up a little of the milky fluid into a pipette.
   (b) Put two drops of the fluid on a slide and a drop of salt solution. Put on a cover-slip.
   (c) Observe under the microscope using low power and then, high power.
   (d) Can you observe any sperm cells? Which structures shown in Fig. 4.10 can you see?
   (e) Are the sperms moving? If not, suggest some reasons for this?
3. *Examining a half-section of a flower*

You need a hand lens, sharp razor blade and flowers of Pride of Barbados.

   (a) Study Fig. 4.12 carefully, then take a flower, and beginning from the pedicel, cut the flower into two halves using a sharp razor blade.
   (b) Put the half flower on the bench and use a hand lens to examine the inside of the ovary.
   (c) Using Fig. 4.12 as a guide, make a labelled drawing of the half flower.
   (d) What can you see inside the ovary? How are they arranged? If these structures are fertilized what will they become?

Summary

1. The reproductive organs of a male mammal consists of two testes, epididymis, sperm ducts, vasa efferentia, seminal vesicles, a prostate gland, a Cowperâ€™s gland, a penis and one urethra.
2. The reproductive organs of a female mammal consists of two ovaries, oviducal funnels, oviducts, a uterus (in female humans), cervix, vagina and vulva.
3. The mammalian male and female gametes – the sperm cells and eggs (ova) – are unicellular and microscopic.
4. The sperm consists of a head with a nucleus and a tail with which it moves in the seminal fluid.
5. The ovum is larger than a sperm and consists of the cytoplasm, a nucleus, granules and yolk droplets which nourish the embryo.
6. The male and female mammalian reproductive organs are similar in some ways; both have sex organs, produce gametes, have external openings and the organs favour internal fertilization.
7. The male and female mammalian reproductive organs are different in many ways.
8. The flower is the part of a plant modified for sexual reproduction.
9. A typical insect-pollinated flower consists of a pedicel, calyx, corolla, androecium and gynoecium.
10. In wind-pollinated flowers, the flowers occur as inflorescences made up of numerous spikelets.
11. In a spikelet are a pair of flowers enclosed within bracts. The lower bract has three stamens in Guinea grass, while the upper one has three stamens, and one ovary with two feathery stigmas. Each of the flowers has two lodicules representing the perianth.
12. Most dicotyledonous flowers are insect pollinated, while most monocotyledonous flowers are wind-pollinated.

Objective Questions

1. Which of the following structures is absent in the reproductive system of a male mammal?
   A. Testes.
   B. Claspers.
   C. Prostate gland.
   D. Sperm ducts.
   E. Vasa efferentia.
2. Sperm cells in mammals are stored in the
   A. epididymis.
   B. testes
   C. scrotum.
   D. seminal vesicle.

E. Cowperâ€™s gland.

3. The female of all the following organisms have two ovaries **except** that of a
   A. frog.
   B. toad.
   C. bird.
   D. reptile.
   E. mammal.
4. Which of the following structures are not usually found in an insect-pollinated flower?
   A. Pollen grains.
   B. Lodicules.
   C. Stamens.
   D. Pistils.
   E. Stigmas.
5. Which of the following statements about the structures and functions of parts of a flower is false?
   A. The pedicel surrounds the ovary.
   B. The calyx is often green in colour.
   C. The corolla is the most prominent.
   D. The stigmas receive pollen grains.
   E. The ovules commonly form the seeds.

Essay Questions

1. By means of labelled **diagrams only,** show the structures of the reproductive organs of a male and a female mammal.
2. State the functions of each of the following mammalian reproductive organs:
   (a) scrotum
   (b) testes
   (c) vas deferens
   (d) prostate gland
   (e) uterus
   (f) Fallopian tube
3. (a) By means of labelled diagrams, describe the structures of the mammalian sperm cell and ovum.
   (b) State **four** similarities and **twelve** differences between the reproductive organs of male and female mammals.
4. (a) Make a labelled diagram of the longitudinal section of a **named** insect-pollinated flower.

(b) In a tabular form, state **four** differences in the structures of a wind pollinated flower and an insect-pollinated flower.