CHAPTER

18 Reproduction

Animation.18: reproduction
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Every species of organisms can reproduce new individuals of that species. In organisms, methods of reproduction are varied and some are quite complex. It is very important to the survival of a species or a population. Reproduction is the mechanism that- produces new generations and maintains a species-population.

Reproduction is of two types, asexual reproduction and sexual reproduction. Asexual reproduction requires only a single parental organism which gives rise to offspring by mitotic cell division, during which the total chromosomes content of the cell is exactly replicated and passed on to daugher cells, so that the offspring are genetically identical to the parent. Methods of asexual reproduction are fission, sporulation, budding, vegetative propagation, artificial propagation, parthenogenesis and apomixis etc.

Sexual reproduction usually involves two parents. A fertilized egg is produced through the union of meiotically produced specialized sex cells (egg and sperm) from each parent. Meiosis or reduction division gives rise to gametes (gametogenesis) in which not only the chromosome number is halved (haploid) but reshuffling of genes leads to recombination of genes. This not only maintains the chromosome number in a species but also produces genetic variations, an important factor in the survival and adaptation of a species or a population (Fig. 18.1).

In plants, if there isalternationof generations namely a diploid sporophyte and a haploid gametophyte, meiosis occurs during spore formation (sporogenesis).

In asexual reproduction, although increase in number of genetically alike individuals from a parent is very rapid but this is not an adaptive method and may at some stage jeopardize the survival of a species. Man has favoured this type of reproduction for his own needs, commonly in plants but now tissue culture technique in plants and cloning in animals are being adopted for producing organisms of valuable characteristics, without a change in their genetic make up. Cloning has been practised successfully but its disadvantages like rapid aging and low resistance to environmental stress and diseases are still the limitations for commercial ventures. Also it is still not being accepted socially and morally in general.

REPRODUCTION IN PLANTS

In plants both sexual and asexual reproduction are foun. In asexual reproduction layering, grafting, budding etc. are the artificial modes.

In sexual reproduction, plants have **diplohaplontic life cycle** with alternating diploid sporophyte and haploid gametophyte generations. If the two generations are vegetatively similar, such alternation of generations is referred to as isomorphic, and if they are dissimilar it is called heteromorphic.

Evolution of pollen tube is an important step in land adaptation by the spermatophytes. Pollen tube acts as vehicle for male gametes for their safe transport to female gamete in ovule in hostile land environment. Evolution of pollen tube is parallel to the evolution of seed and is a tool of success for seed plants.

Seed plants are predominatly present all around us due to their better sexual reproduction, modification of flower and infloresence for pollination, involving gamete transfer by pollen tubes,food storage for developing embryo, protection by seed coats and dispersal with the help of fruit formation (angiosperms). Seeds are capable of enduring unfavourable conditions in dormant form (seed dormancy) and as soon as, conditions become favourable for establishing the seedling, it germinates.

Animation 181:Reproduction
Source & Credit: Ameoba Sisters

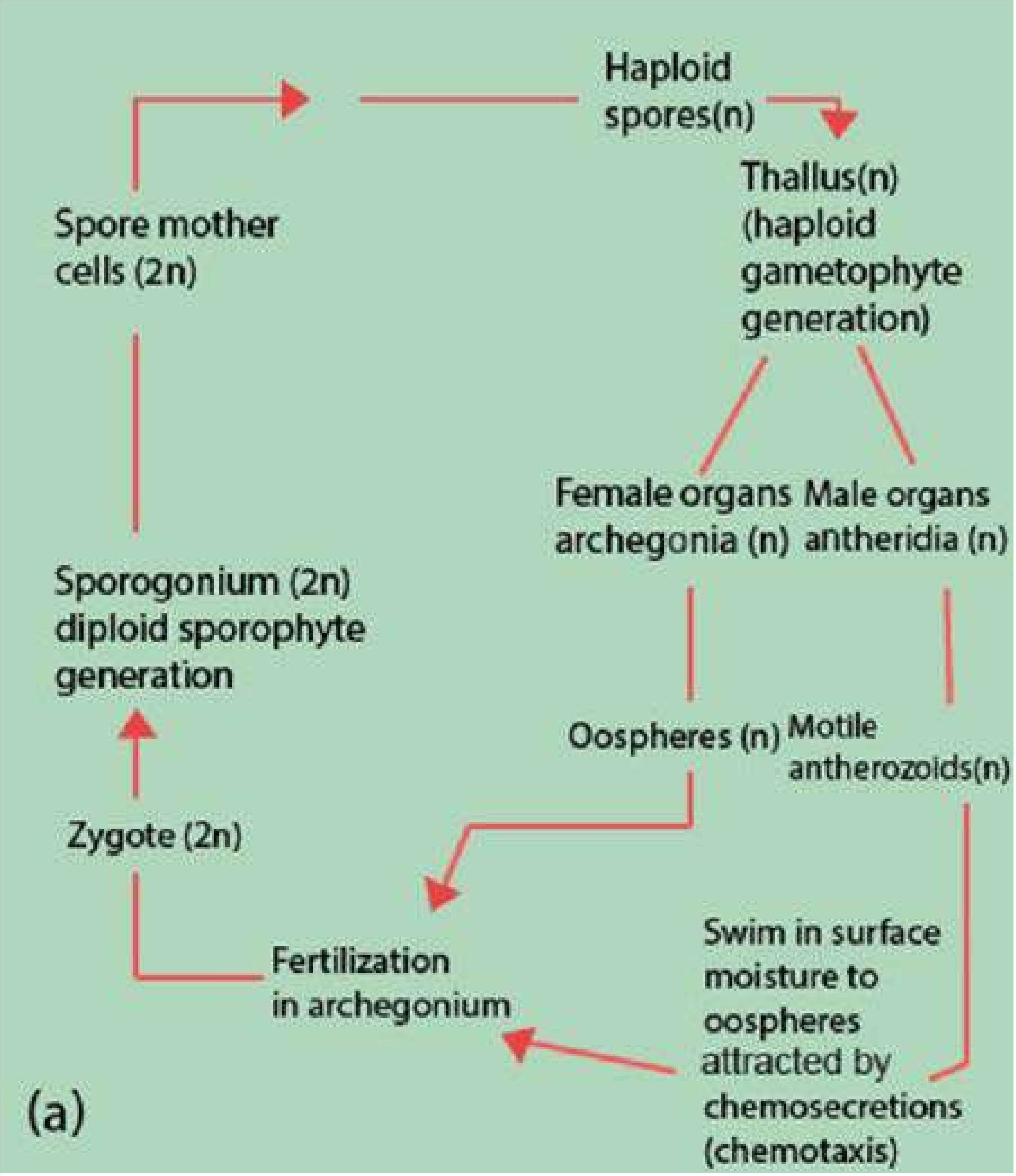


Fig. 18.1 (a) Bryophyte life cycle. Note that the sporophyte is completely dependent upon the gametophyte.

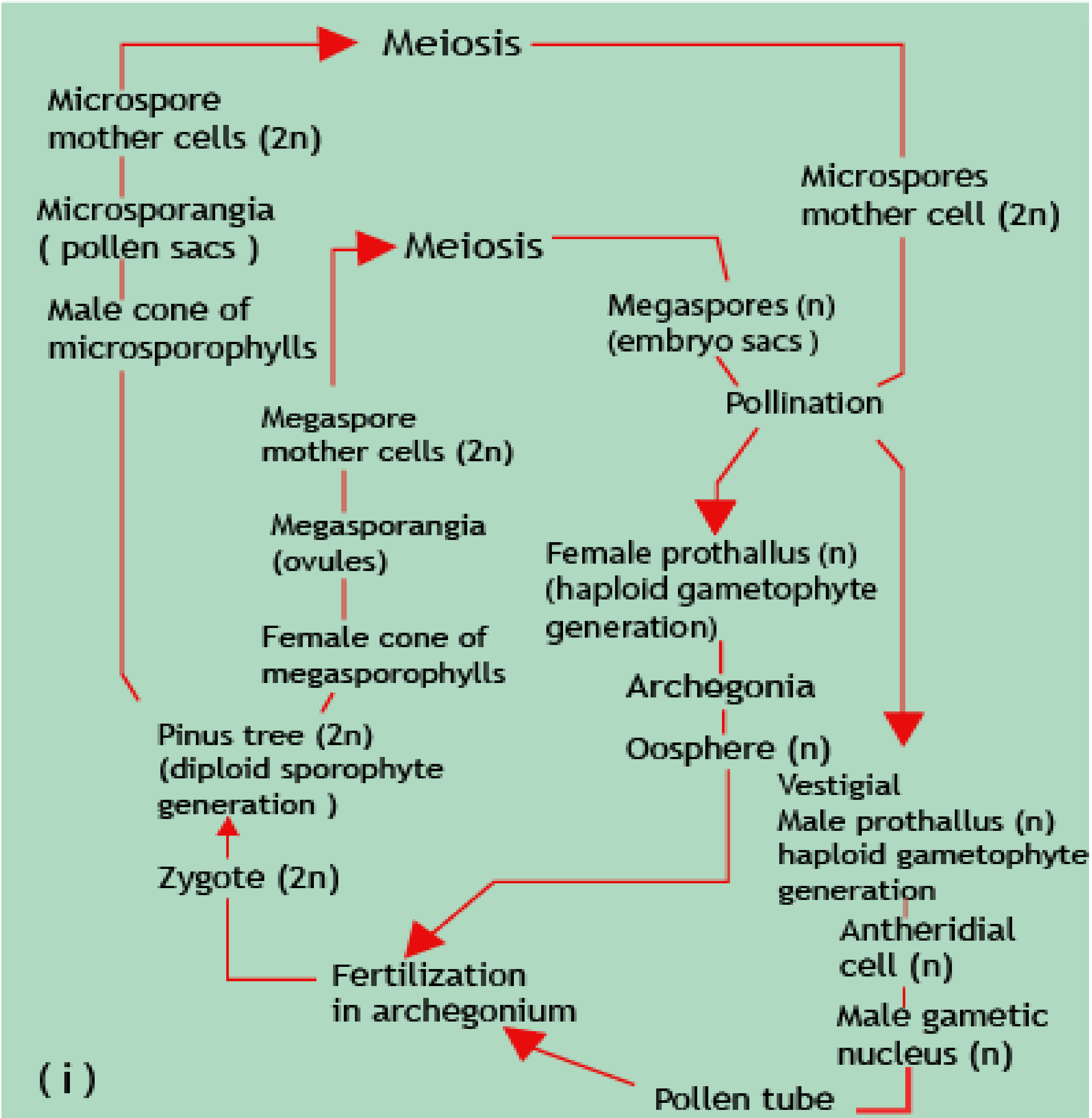
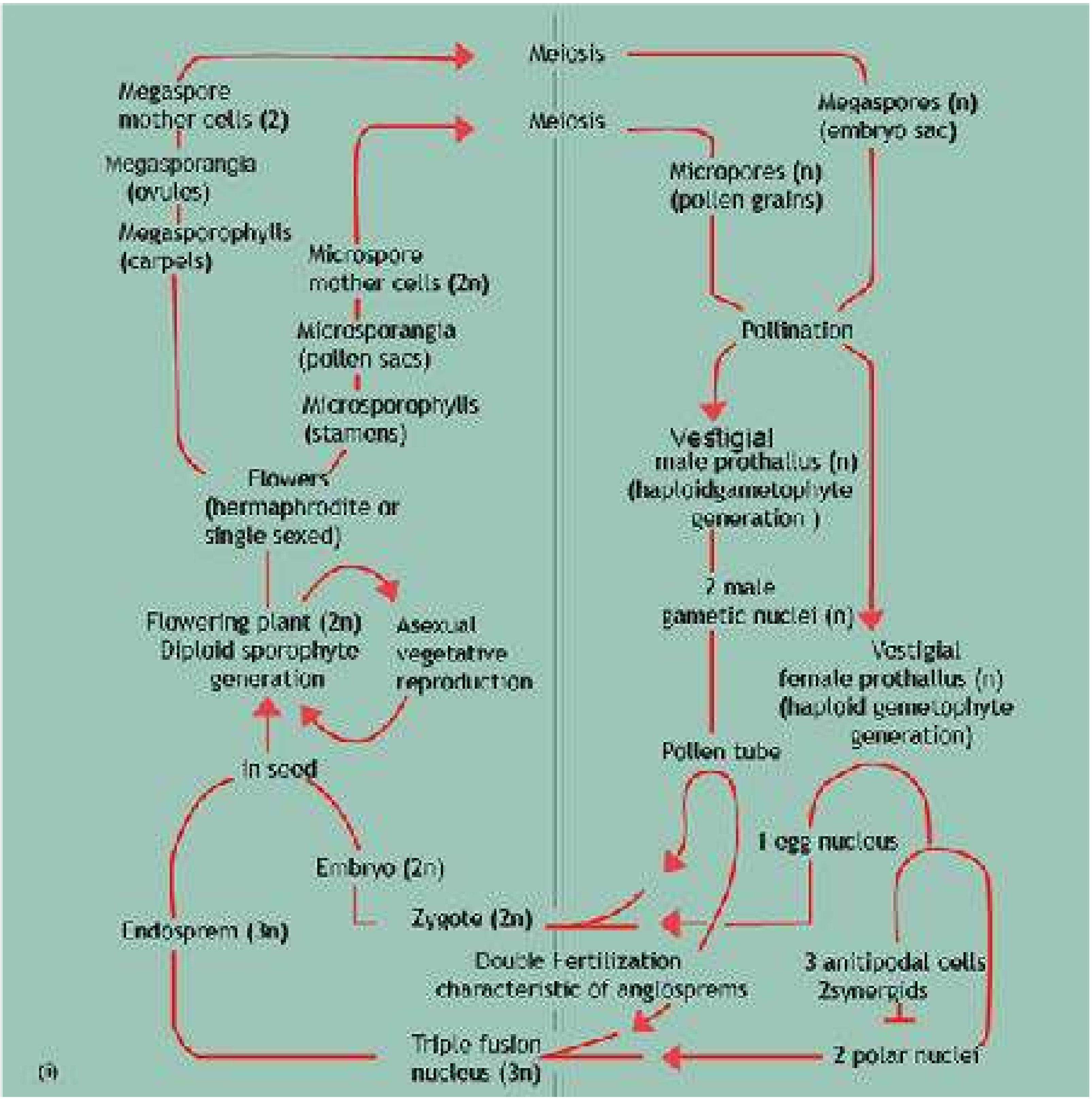


Fig. 18.1 (b) Spermatophyte life cycles (i) Gymnosperm life cycle, Pinus sylvestris (Class Pinatae). (ii) Angiosperm life cycle.



18.1 (ii) Angiosperm life cycle

Parthenocarpy

In some cases, fruit development proceeds without fertilization and thus no seed formation takes place e.g. banana, pineapples and some varieties of oranges and grapes. Such development is called parthenocarpy. It is due to hormonal imbalance; usually high auxin levels occur in these ovaries. Parthenocarpy is sometime artificially induced for commercial purposes, by adding auxins in tomato, peppers etc.

Seed Dormancy

It is the special condition of rest, which enables an embryo to survive long periods of unfavourable environmental conditions, such as water scarcity or low temperature. During this period of rest the embryo ceases or limits its growth. This is of great survival importance to the plant in that it prevents the dormant seed from germinating in response to conditions such as a warm spell in winter. Germination or resumption of normal growth by a dormant embryo requires certain, very precise combinations of environmental cues, to avoid any accidental stimulus which may prove fatal later on.

Fruit set and Fruit ripening

Germinating pollen grain is not only an important structure for safe transfer of gametes and insurance for fertilization but also a rich source of auxins as well as commonly stimulating the tissues of the style and ovary to produce more auxin. This auxin is necessary for ‘fruit set’, i.e. retention of the ovary, which becomes the fruit after fertilization. Without it abscission of flowers normally occurs, leading to low fruit yields. After fertilization, the ovary and the ripe seeds continue to produce auxins which stimulate fruit development. Developing seeds are not only a rich source of auxins and gibberellins, but also of cytokinins.

These growth substances are mainly associated with development of the embryo and accumulation of food reserves in the seed and some times in the pericarp (fruit wall).

Fruit ripening is often accompanied by a burst of respiratory activity called the climacteric. This is associated with ethane production, which helps in ripening of the fruit.

Photoperiodism

Apart from photosynthesis and phototropic responses, another very important way in which light exerts its influence on living organisms is through variations in day length called photoperiod. In plants, photoperiod and temperature affect flowering, fruit and seed production, bud and seed dormancy, leaf fall and germination.

Photoperiod affects flowering, when shoot meristems start producing floral buds instead of leaves and lateral buds.

Effect of photoperiodism was first studied in 1920 by Garner and Allard. They studied that tobacco plant flowers only after exposure to a series of short days. Tobacco plant naturally flowers under same conditions, in autumn, but flowering could be induced by conditions artificially to short days exposing. With further studies they were able to classify flowering plants into long-day plants, which require long days for flowering and day-neutral plants flower without being influenced by photoperiod.

Later on, further studies indicated that it is really the length of the dark period which is critical. Thus short-day plants are really long-night plants. If they are grown in short days, but the long night is interrupted by a short light period, flowering is prevented. Long-day plants will flower in short days if the long night period is interrupted (Table 18.1)

Animation 181:Photoperiodism
Source & Credit: Leaving Blo

Table 18.1 (a) Classification of plants according to photoperiodic requirements for flowering

Short-day plants (SDPs	Long-day plants (LDPs)	Day-neutaral plants (DNPs)
Flowering induced by dark periods longer than a critical length, e.g. cocklebur 8.5 h; tobacco 10-11h. (Under natural conditions equivalent to days shorter than a critical length, e.g. cocklebur 15.5 h; tobacco 13- 14h) e.g. cocklebur (Xanthium), chrysanthemum, soyabean, tobacco, strawberry	Flowering induced by dark periods shorter than a critical length, e.g. henbane 13h. (Under natural conditions equivalent to days longer than a critical length, e.g. henbane 11 h). e.g. henbane (Hyoscyamus niger), snapdragon, cabbage, spring wheat, spring barley.	Flowering indepenedent of photoperiod. e.g. cucumber, tomato, garden pea, maize, cotton.

Table 18.1 (b) Some phytochrome-controlled responses in plants.

General process effected	Red light promotes
Photoperiodism	Stimulates flowering in long-day plants. Inhibits flowering in short-day plants. See flowering.

Further experimentation also revealed that quantity of light is also influenced by the quality of light. Cocklebur, a short day plant, will not flower if its long night is interrupted but experiments revealed that red light was effective in preventing flowering and far-red light reversed the effect of red light. It was also demonstrated that the last light treatment always determines the response. This response to light intensity and quality led to the discovery of blue pigment that is red light sensitive protein, the phytochromes.

Phytochrome exists in two forms i.e. P 660 and P 730. P 660 a quiscent form absorbs red light at a wave length of 660 nm and is converted to active P 730, P 730 absorbs far red light at 730 nm and is converted to P 660. In nature, the P 660 to P 730 conversion takes place in day light and P 730 to P 660 conversion occurs in the dark. Thus during the day a plant has P 730 phytochromes while during the night it contains more phytochromes in the form of P 660. The presence of either form provides the plants with a means of detecting whether it is in a light or dark environment. The rate at which P 730 is converted to P 660 provides the plant with a “clock” for measuring the duration of darkness.

It has been found that red light inhibits flowering the short day plants but promotes flowering in long day plants, under conditions during which flowering normally takes place. This observation led to hypothesize that the P730-P660 interconversion might be the lant time - regulator for flowering. According to this hhypothesis, p 730, converted from P 660 by the absorption of red light, would inhibit flowering in short day plants but promote flowering in long day plants. Because P 730 accumulates in the day and diminishes at night, short day plants coud flower only if the night were long enough, during which a great amount of P730 would not be completely inactivated, so that enough P 730 would remain at the end of night to promote flowering. But now it is generally agreed that the time measuring phenomenon of flowering is not totally controlled by the interconversion of P 660 to P 730. Other factors, like presence or absence of light and length of dark, or light period also play an important role in flowering. Phytochromes seems to be responsible for the detection of either light or darkness. The biological clock once stimulated causes production of florigen hormone in leaves, which travels through phloem to the floral buds, initiating flowering.

Vernalisation

Biennials and perennial plants are stimulated to flowering by exposure to low temperature. This is called **vernalisation**. The low temperature stimulus is received by the shoot apex of a mature stem or embryo of the seed but not by the leaves as in photoperiodism.

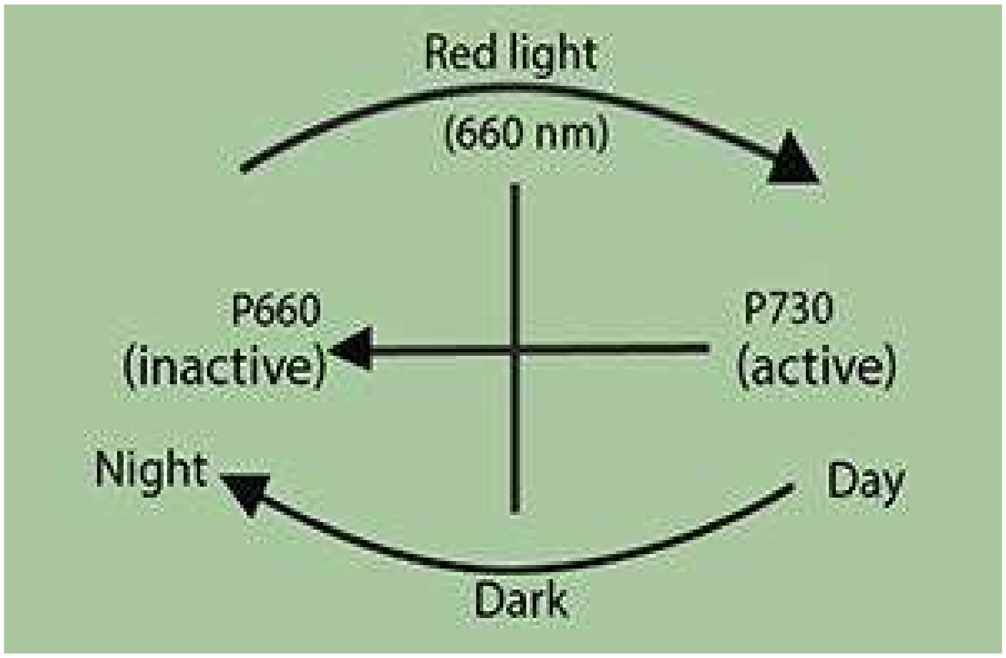
For some plants, vernalisation is an absolute requirement or in some cases it simply assists in inducing flowering. The duration of low temperature (chilling) treatment required varies from four days to three months.

Temperature around 4°C is found to be very effective. It stimulates the production of "vernalin" hormone which induces vernalisation, it is now believed that vemalin is nothing special but actually is gibberellin.

Photoperiodism and vernalisation serve to synchronise the reproductive behaviour of plants with their environment, ensuring reproduction at favourable times of year. They also ensure that members of the same species flower at the same time, encouraging cross pollination for genetic variability.

REPRODUCTION IN ANIMALS

Animals like plants also reproduce both asexually as well as sexually. But asexual reproduction is less common in animals as compared to plants. Binary fission, multiple fission (animal like protoctists) budding (Hydra) parthenogenesis, tissue culturing, cloning and identical twins are the common asexual methods of reproduction.



In honeybee males are haploid and produce sperms by mitosis.

Asexual Reproduction

Parthenogenesis is defined as the development of an egg without fertilization, ants, bees and wasps are good examples. In the honeybees, males (or drones) develop from unfertilized eggs. The queen bee, though carrying male gametes from male, has the ability to lay eggs that have not been fertilized. The sperms she receives from a drone bee are stored in a pouch closed off by a valve. The eggs may be fertilized or may not be fertilized from the stored sperms. The haploid egg develop into haploid offspring, it is called haploid parthenogensis.

In some cases e.g. in aphids, diploid parthenogenesis may occur, in which the egg- producing cells of the female, undergo a modified form of meiosis involving total non-disjuction of the chromosomes, they retain the diploid number of chromosome. Egg (diploid) develops into young females.
Parthenogenesis has the advantage of accelerating the normal reproductive rate.

TISSUE CULTURING AND CLONING

In tissue culturing technique in plants, cambium tissue excised from plants can be stimulated by the addition of nutrients, cytokinins, and IAA (indole acetic acid). These cells show continuous growth and differentiate into a new plant, genetically identical to their parents.

Tissue culture is now widely used for the rapid propagation of desired varieties or for varieties difficult to propagate by cuttings. Similar techniques have been developed for the tissue culture of animal cells.

In flowering plants, one form of parthenogenesis is called apomixis. In this a diploid cell of the ovule, either from the nucellus or megaspore, develops into a functional embryo in the absence of a male gamete. The rest of the ovule develops into the seed and the ovary into the fruit.

Organisms produced from a single cell by subculturing (cloning) are called clones. In animals and especially among vertebrates, a nucleus from the somatic cell is removed and introduced into an egg cell, whose own nucleus has been destroyed by ultra violet radiation. The egg with transplanted diploid somatic cell nucleus develops into an organism, genetically identical to the parent who has contributed the nucleus.

The cloning of desirable animals such as prize bulls, race horses etc. might be as useful as cloning of useful varieties of plants.

However, the application of the technique to humans would be open to serious moral questions. Theoretically any number of genetically identical copies of the same man or woman might be made. The use of cloned cells allows the quantitative study of the action of hormones, drugs and antibodies to be made on cells. Such a technique is a useful substitute for investigating the effect of drugs, cosmetics and pharmaceutical products on animal cells without exposing laboratory animals to these chemicals.

Cloning has the advantage that all the offspring behave similarly, but if an environmental hazard develop (like an out break of a disease), non resistant strains are present to lessen the impact. Also the degree to which environment influences clone development is not fully known and any cloned cell would have to go through all the phases of development once again including embryo, fetus, baby and child hood (in case of human beings).

IDENTICAL TWINS

In higher vertebrates including man, zygote after fertilization undergoes cleavage (cell division by mitosis). When embryo is at two celled stage, the two blastomeres, instead of remaining together, may separate and behave as two independent zygotes, each giving rise to a new individual. Both the organisms are products of mitosis, thus they have identical genetic make up and are called identical twins. They are produced mitotically (asexually).

In some cases, more than one egg is produced by the female and all these eggs are independently fertilized forming two or more zygote. These zygotes develop into new offsprings, but with different genetic combinations. Such a twins or triplets are called fraternal twins or triplets. They are produced sexually.

SEXUAL REPRODUCTION

It is thought that asexual method of reproduction is a primitive form of reproduction than the sexual reproduction. At a later stage, a mechanism have evolved leading to production and union of gametes. Meiosis and genetic recombination played a major role in the development of more complex forms of life and types of gametes, from identical gametes (isogametes) to the heterogametic stage of motile male gametes (sperms or antherozoid) and non-motile female gametes eggs (ova). Sexual reproduction has advantage over asexual reproduction which is elaborated in the following table 18.2.

Table 18.2

Asexual reproduction	Sexual reproduction (omitting bacteria)
One parent only.	Usually two parents.
No gametes are produced.	Gametes are produced. These are haploid and nuclei of two gametes fuse (fertilization) to form a diploid zygote.
Meiosis absent.	Meiosis is present at some stage in life cycle to prevent chromosome doubling in every generation.
Offsprings identical to parent.	Offsprings are not identical to parents. They show genetic variation as a result of genetic recombination
Commonly occurs in plants, less differentiated animals and micro-organisms Absent in more differentiated animals.	Occurs in the majority of plant and animal species.
Often results in rapid production of large number of offsprings.	Less rapid increase in number.

Both in animals and plants, evolution of sexual reproduction also lead to the differentiation of sexes (male or female). Organisms are either having one sex (unisexual) or both the sexes (hermaphrodite or bisexual). Advance mode of sexual reproduction has unisexuality in animals but in plants bisexuality in general is retained. Despite the bisexuality (tape worm, earthworm etc.), cross fertilization is ensured for maintaining the advantage of genetic recombination.

Fertilization is the process which leads to the union of gametes. Fertilization may occur outside the body (external fertilization) or inside the body of the female (internal fertilization).

External fertilization occurs in aquatic environment where male gametes can swim towards the female-gametes in water medium. Development is also external due to the constant / stable conditions of water (frog, fish etc.)

In terrestrial conditions, fertilization is internal. Sperms are lodged in the female body where fertilization occurs. This may lead to external development as in reptiles and birds. They lay shelled eggs to protect the developing embryo from harsh terrestrial conditions. Such animals are called oviparous.

In mammals, internal fertilization leads to internal development and development of embryo is accomplished inside the female body, which gives birth to young one - such animals are called **viviparous**.

In some mammals like duckbill platypus and spiny ant-eater internal fertilization leads to internal development of young one in a shelled egg and when development is completed, shelled egg is laid which hatches to offspring This is called ovoviviparous condition.

Viviparous and ovoviviparous animals provide more protection to their young one during development. Nourishment is provided either through stored food in the egg or through placenta by the mother.

REPRODUCTION IN MAN

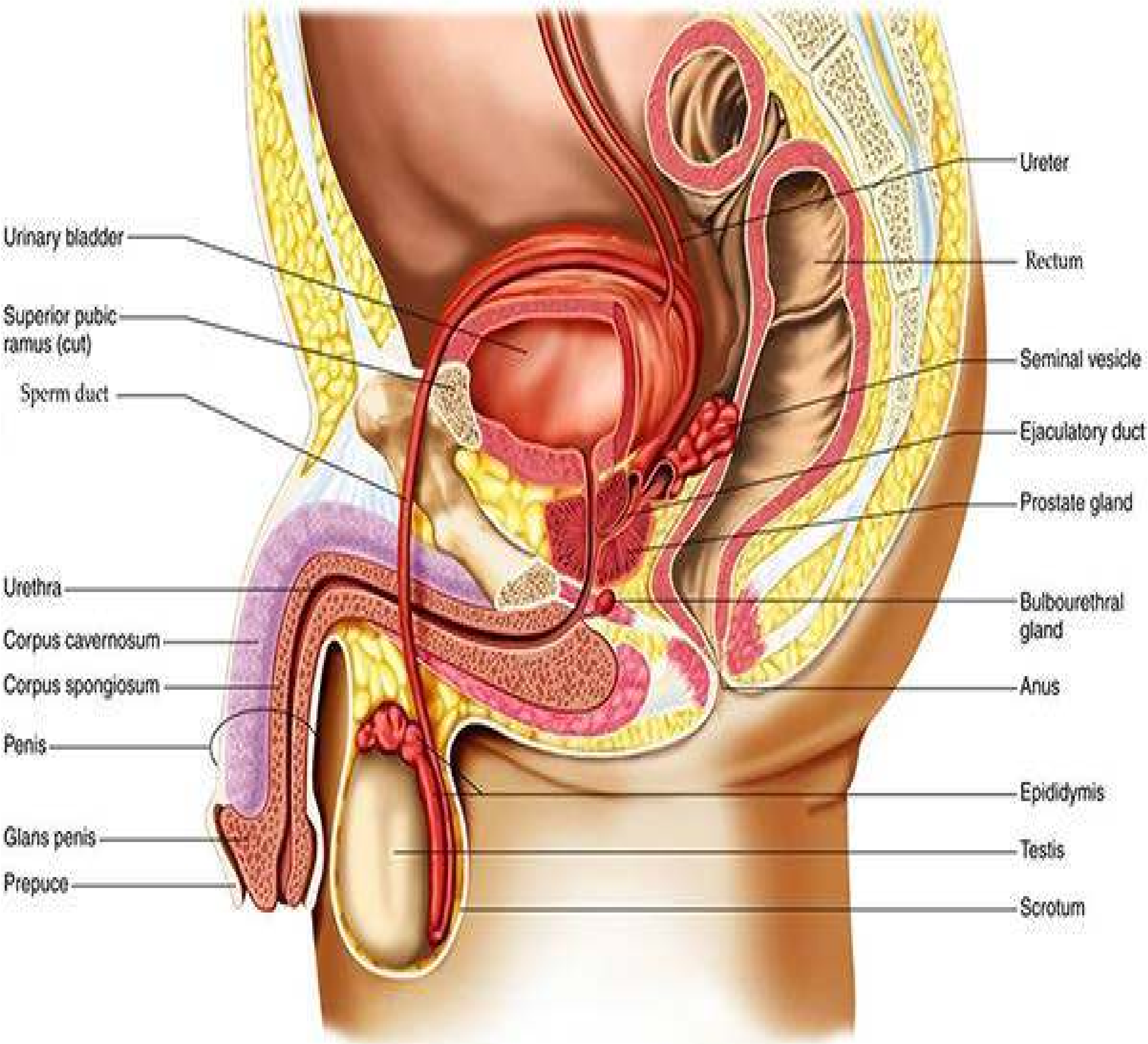
Male and female have separate reproductive systems.

(a) Male Reproductive System

Male reproductive system consists of external genitalia which consist of a pair of testes which lie outside the body, in the sac-like scrotum and male copulatory organ which is used to transfer the sperms into the female reproductive tract. Each testis consists of a highly complex duct system called seminiferous tubules, in which repeated division by the cells of the germinal epithelium produce spermatogonia. These increase in size and differentiate into primary spermatocytes which undergo meiotic division to form secondary spermatocytes and spermatids. Eventually, the spermatids differentiate into mature sperms. Fluid secreted by sertoli cells provides liquid medium, protection and nourishment to sperms while they are in tl e tubules.

(Fig. 18.2 a,b, Fig. 18.3). The sperms are then transferred to the main duct of the male reproductive tract, the vas deferens, which forms highly convoluted epididymis. The sperms then pass through the urinogenital duct and ‘are discharged out.

Animation 181:Sexual reproduction in plants
Source & Credit: Leaving Blo


Urinary bladder
Superior pubic ramus (cut)
Sperm duct
Urethra
Corpus cavernosum
Corpus spongiosum
Penis
Glans penis
Prepuce
Ureter
Rectum
Seminal vesicle
Ejaculatory duct
Prostate gland
Bulbourethral gland
Anus
Epididymis
Testis
Scrotum

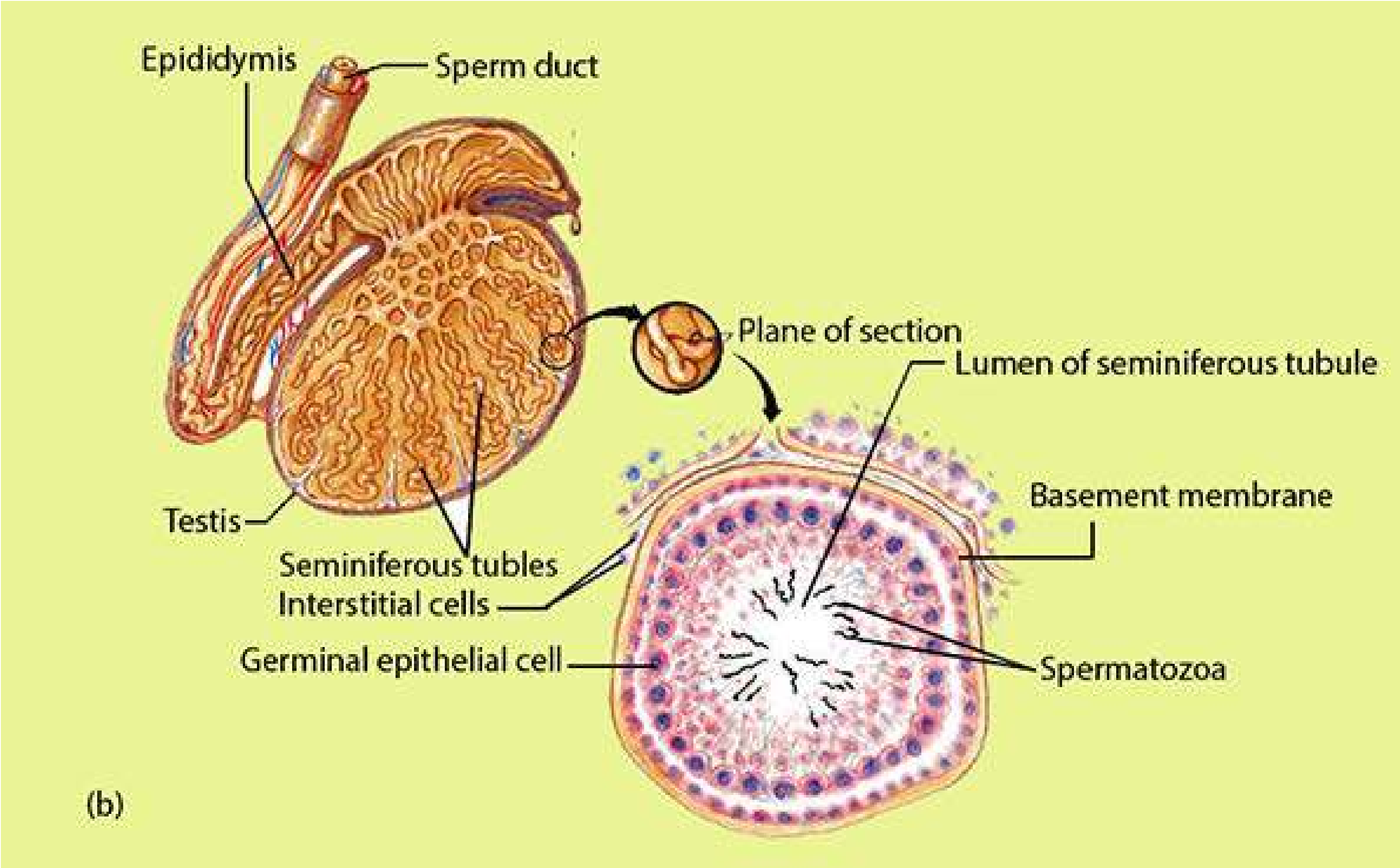


Fig. 18.2 The human male reproductive system
The male reproductive system consists of two testes that produce sperms, ducts that carry the sperms, and various glands.

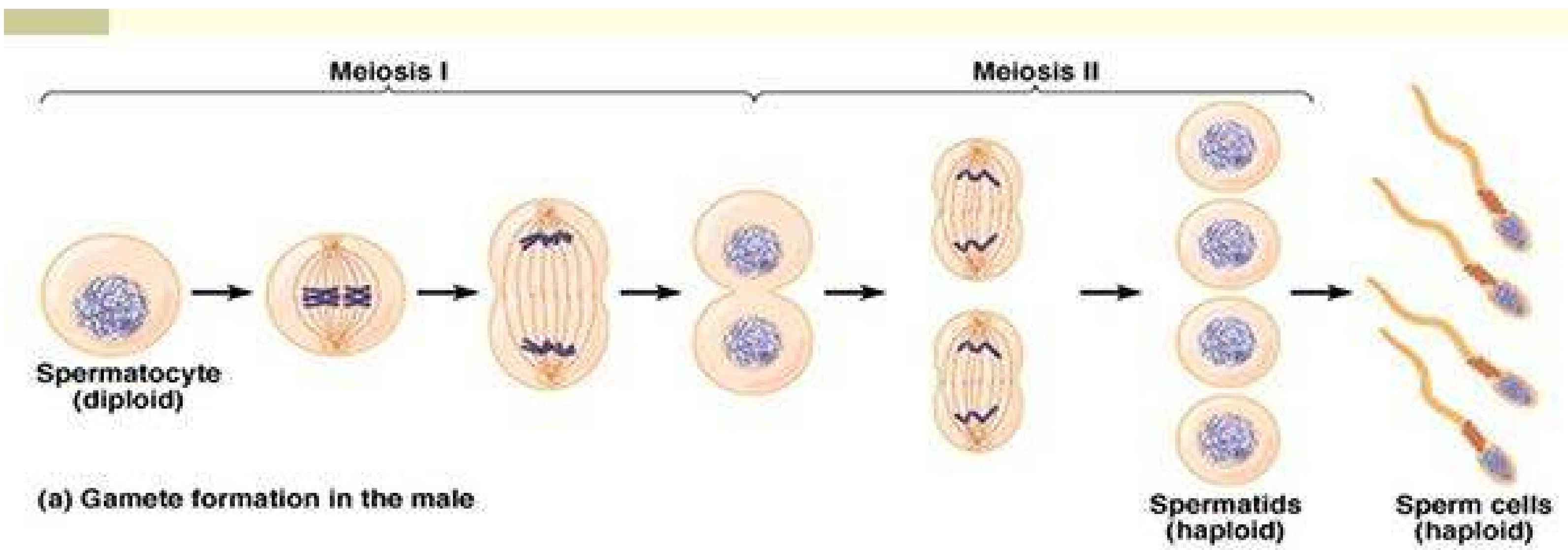


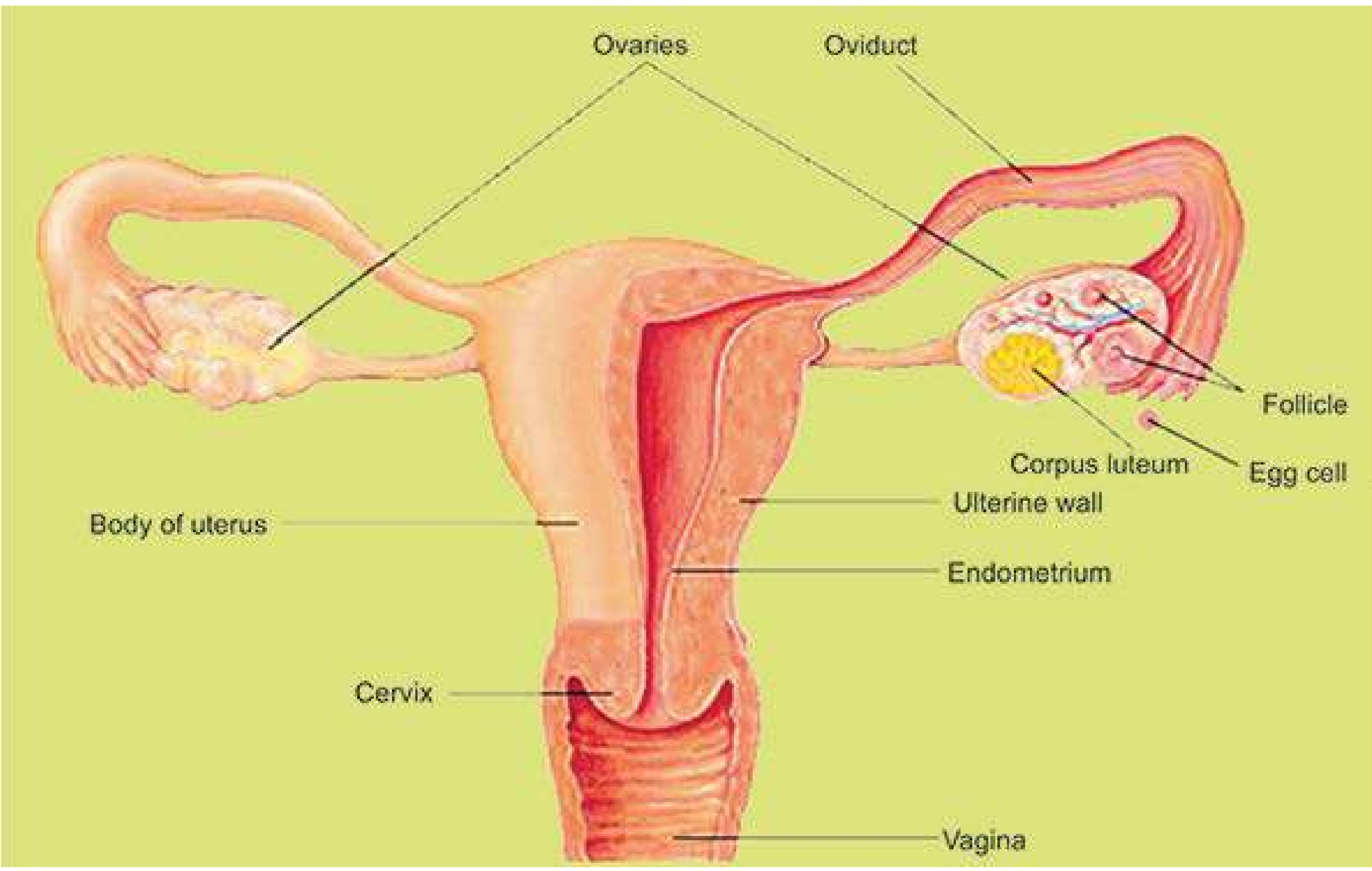
Fig. 18.3 Gamete formation

Between the seminiferous tubules are interstitial cells which secrete testesterone. This hormone is essential for the successful production of sperms and also controls the development of male secondary sexual characteristics during puberty.

(b) Female Reproductive System

The female reproductive system consists of ovaries, oviducts, uterus and the external genitalia (18.4).

A pair of ovaries lies within the body cavity of the female. Germ cells in the ovary produce many oogonia which divide mitotically to form primary oocytes. These are enclosed in groups of follicle cells. The primary oocyte divides meiotically into the haploid secondary oocyte and first polar body. Second meiotic division in the oocyte proceeds as far as metaphase but is not completed until the oocyte is fertilized by the sperm. In human only one ovum is usually discharged from the ovary at one time, this phenomenon is called ovulation.



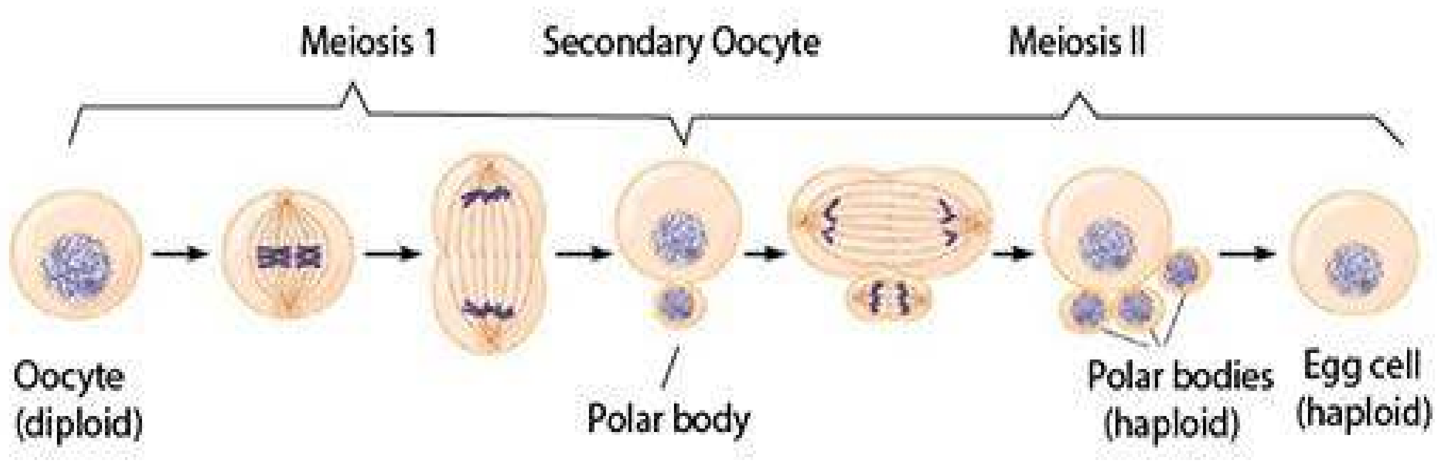


Fig.18.4 (a)The human female reproductive system (b) Gamete formation

The ovum is then transferred to the oviduct generally called fallopian tube Or uterine tube. The uterine tube opens into the uterus. The fertilization of the ovum takes place in the proximal part of the oviduct. The fertilized ovum (zygote) enters the uterus where it is implanted (conceived) and undergoes further development. A placenta is established between the uterine and foetal tissues for the exchange of oxygen,carbondioxide, waste, nutrients and other materials. Uterus opens into the vagina through cervix. Urethra and vagina have independent openings to the exterior.

Female Reproductive cycle: In females the production of egg is a cyclic activity as compared to males, where gamete production and release is a continuous process beginning at puberty and lasting throughout life.

In human females, the periodic reproductive cycle is completed in approximately 28 days and involves changes in the structure and function of the whole reproductive system. It is called the menstrual cycle and can be divided into four phases. The events of the menstrual cycle involve the ovaries (ovarian cycle) and the uterus (uterine cycle) and these are regulated by pituitary **gonadotropins.**

Primary steps in female reproductive cycles are:

1. The pituitary gland on the onset of puberty, releases follicle stimulating hormone (FSH) which stimulates the development of several primary follicles. Only one of these follicles continues to grow with its primary oocytes while the rest break down by a degenerative process known as follicle atresia.

2. The ovary, under the stimulus of FSH, also produces estrogen hormone.-This, on one hand, stimulates the endometrium (internal living of the uterus wall) and vascularizes it, and on the other hand, inhibits the secretion of FSH from pituitary gland.

3. Decrease of FSH and increase of estrogen, causes the pituitary gland to secrete luteinizing hormone (LH) which induces ovulation - the release of ovum from the follicle.

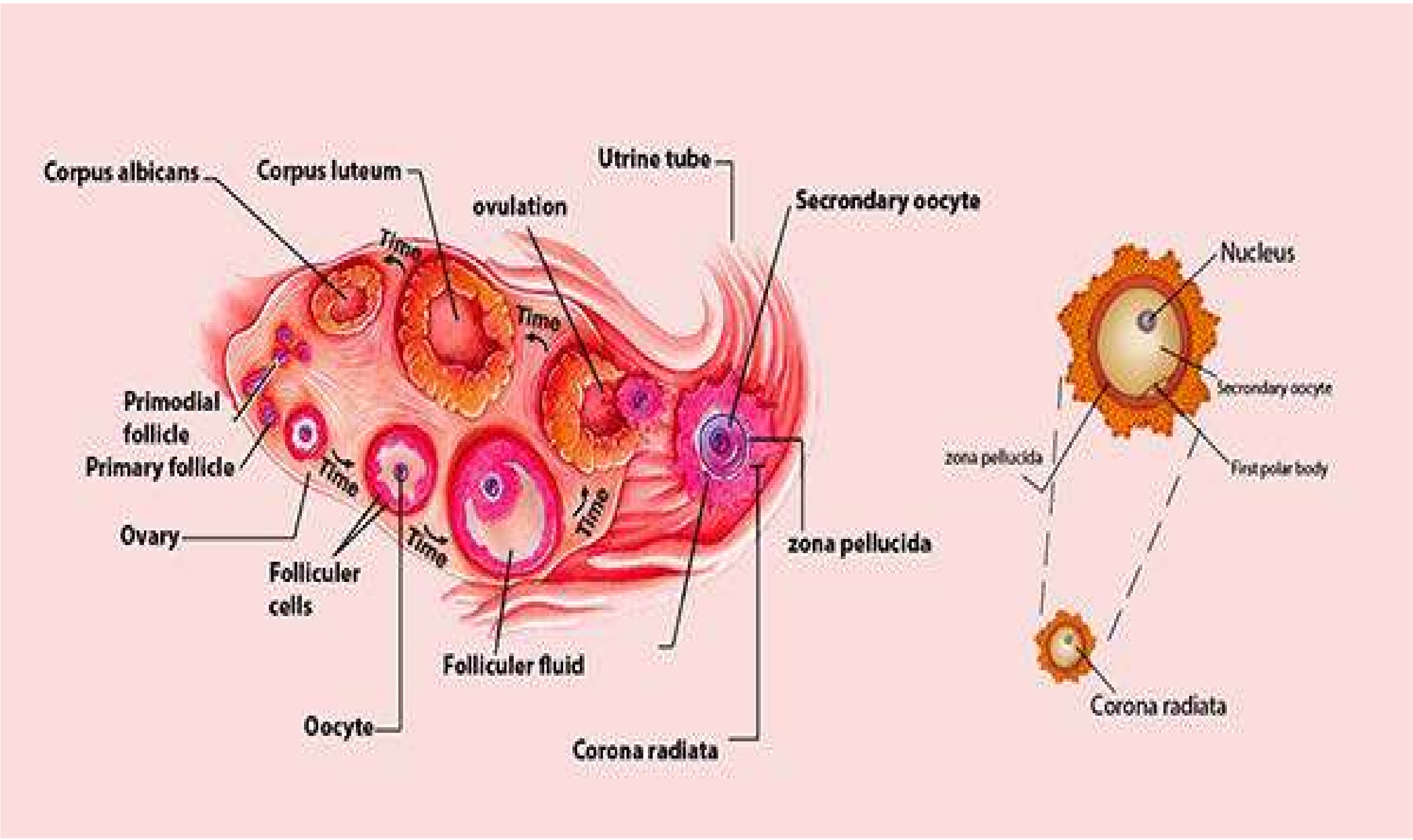
4. The follicle cells, after release of the egg. are modified to form a special structure called corpus luteum. This yellowish glandular structure starts” secreting hormone called progesterone. This hormone develops the endometrium and make it receptive for the implantation of the zygote (placenta formation).

5. If fertilization does not occur, the corpus luteum starts degenerating. The progesterone secretion diminishes and its supporting effect on the spongy endometrium is reduced, which suffers a breakdown. This causes the discharge of blood and cell debris known as menstruation. This stage usually lasts for 3 - 7 days (Fig 18.5)

Oestrous cycle is a reproductive cycle found in all female mammals except human being. In this cycle, the estrogen production prepares the uterus for conception partly and also follicle develops ova. At this stage, female needs a physical stimulus of mating for ovulation. She exhibits the desire for mating or is said to be on “heat”

The cycle is thus completed and the uterus is ready to enter into the next cycle. The human menstrual cycle generally repeats every 28 days although there is considerable variation in different individuals or even within the same individual at different times of her age. The end or complete stop of the menstrual cycle is called menupause, after which the female stops producing the ova.

Malnourishment and emotional stresses effect the female reproductive cycle, which may be disturbed. The cycle is not completed in its normal 28 days.



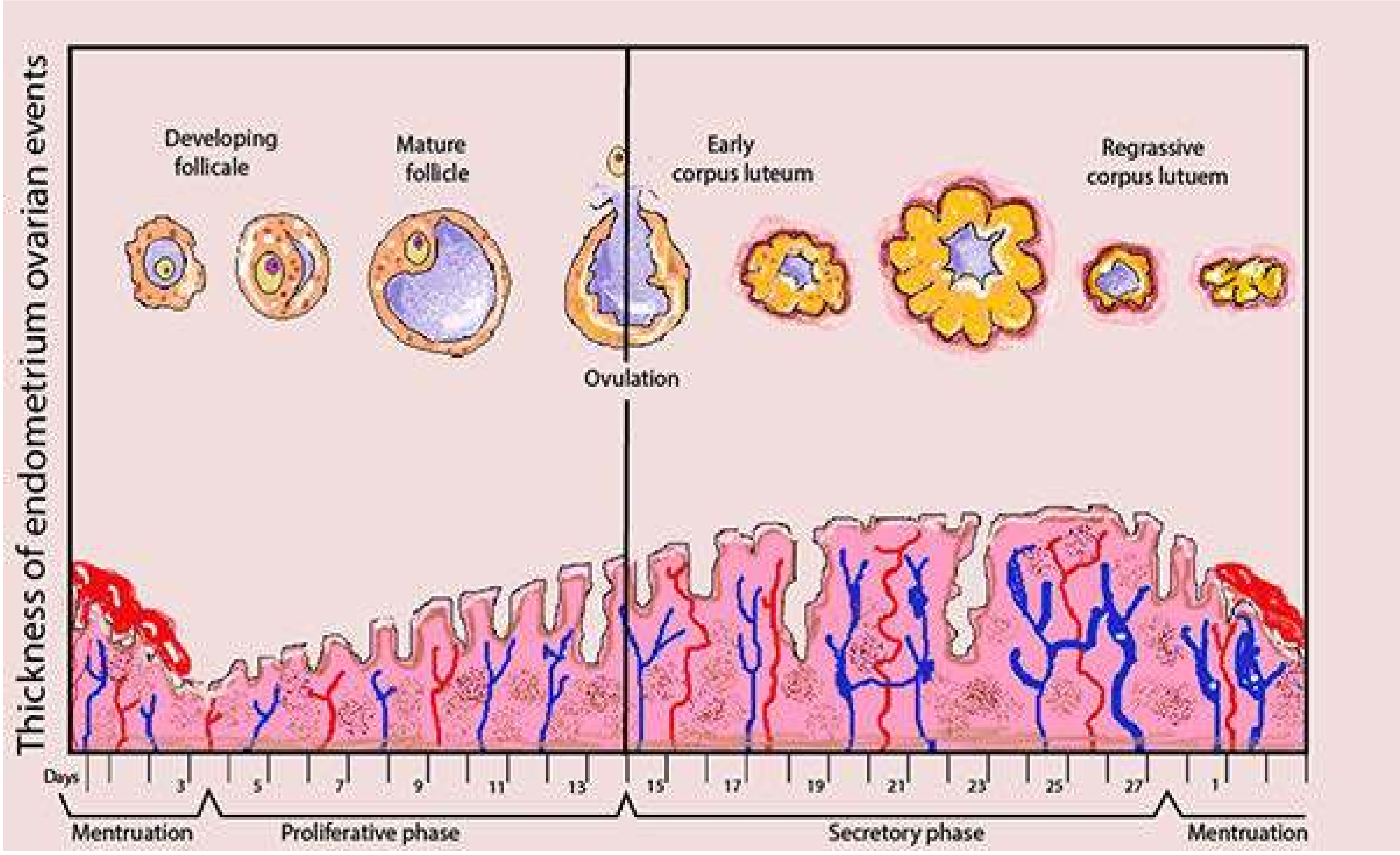


Fig. 18.5 The ovarian and uterine cycles in human female

The release of a secondary oocyte (ovulation) is timed to coincide with the thickening of the lining of the uterus. The uterine cycle in humans involves the preparation of the uterine wall to receive the embryo if fertilization occurs. Knowing how these two cycles compare, it is possible to determine when pregnancy is most likely to occur.

Birth: The total gestation period (pregnancy) is usually about 280 days.

Once the placenta is established, it starts secreting the progesterone hormone which maintains the pregnancy. Any disturbance in its secretion may lead to premature birth or miscarriage. Human embryo remains enclosed in amniotic sac filled with anmiotic fluid which is protective and shock absorpitive.

During this period, pituitary gland produces luteotropic hormone (LTH). Placenta also secretes human placental lactogen. Both these hormones stimulate mammary development in preparation for lactation.

From beginning of the 3rd month of pregnancy, the human embryo is referred to as the fetus. Most of the major organs are formed by the 12th week of pregnancy and the remainder of the gestation period is taken up by growth.

It was thought that hormonal activities within the mother i.e. decrease in progesterone level onset the birth. But recent evidence suggest that there is a high degree of fetal involvement in the timing of birth. The initial stage of birth is the result of the stimuli from the fetal pituitary. The ACTH released from fetal pituitary stimulates the fetal adrenal gland to release corticosteroids, which cross the placental barrier and enter the maternal blood circulation causing a decrease in progesterone production. The reduction of progesterone level, stimulates the pituitary gland to produce oxytocin hormone. This induces labour pains, i.e. contraction of the uterus wall. The release of oxytocin occurs in "waves" during labour and provides the force to expel the fetus from the uterus.

The cervix dilates and the uterine contractions spread down over the uterus and are strongest from top to bottom. Thus, pushing the baby downward leading to the delivery of the baby. The umblical cord is ligated and baby is released from the mother.

Within 10-45 minutes after birth, the uterus contracts and separate the placenta from the wall of the uterus and placenta then passes out through the vagina. This is called after birth. Bleeding, throughout this period, is controlled by the contraction of smooth muscle fibers which completely surround all uterine blood vessels supplying the placenta. Average loss of blood is about 350 cm^3.

TEST TUBE BABIES

Recent biotechnical advantages has led to many improvements in human life. One of the important aspect is the test tube babies.

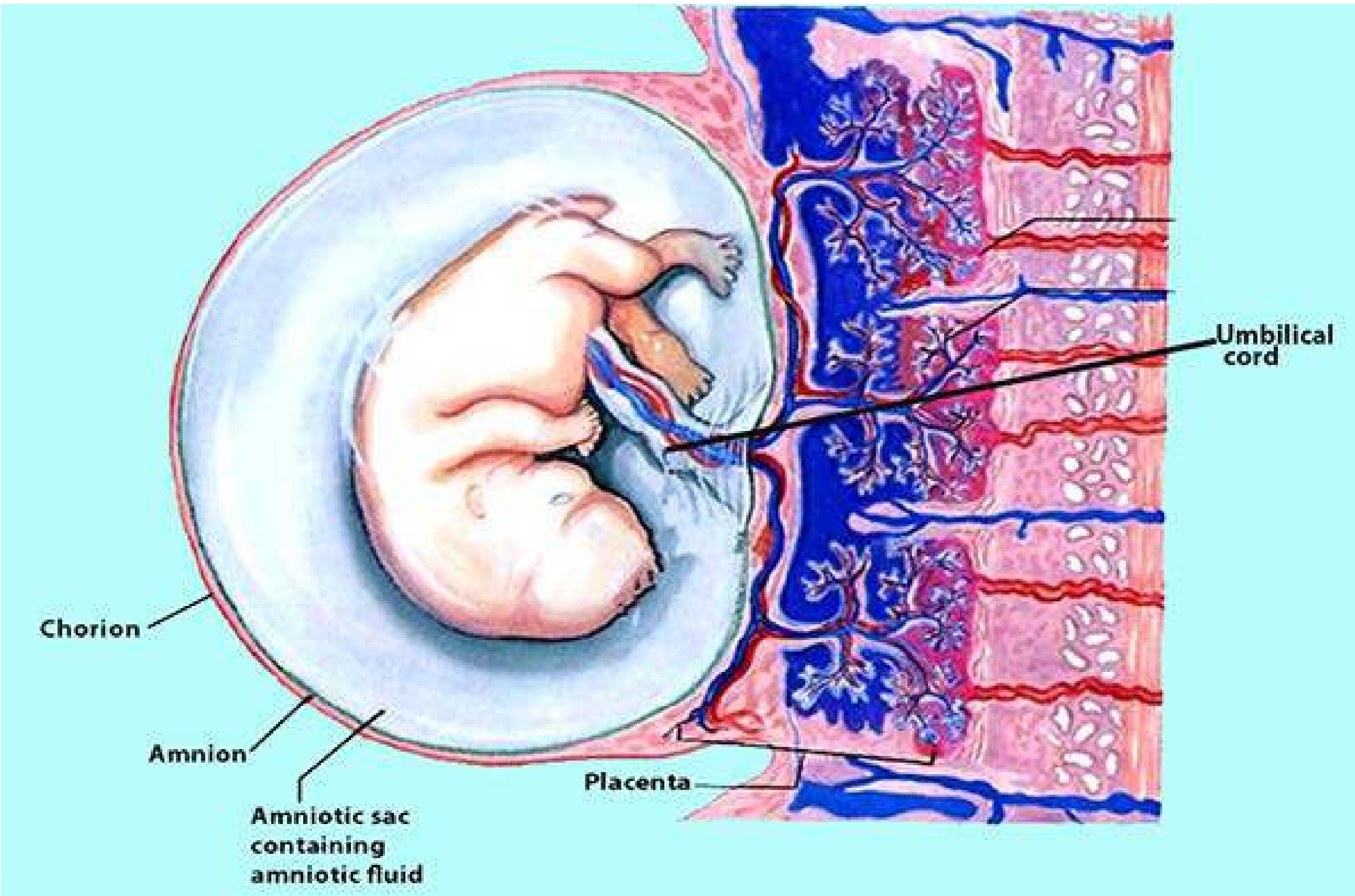


Fig. . 18.6 Placental structure
The embryonic blood vessels that supply the developing child with nutrients and remove the metabolic wastes are separated from the blood vessels of the mother. Because of this separation, the placenta can selectively filter many types of incoming materials and microorganisms.

Parents which are unable to enjoy the normal process of fertilization and birth of their offspring due to some physiological and physical abnormalities in any of the two parents are being benefited with this method.
Parental sperm and ovum is fertilized in vitro - outside the female body and then the zygote is implanted back into the mother uterus, placenta establishes and remaining development takes place in the body of the mother leading to normal birth.

SEXUALLY TRANSMITTED DISEASES (STD)

Unhealthy attitudes and low moral values sometimes lead to serious complication. The carrier may transmit this disease to their healthy partners.

(I) Gonorrhoa

It is caused by a gram positive bacterium *Neisseria gonorrhoeae*, mainly affecting the mucous membrane of urinogenital tract. New born infants may acquire serious eye infections if they pass through the infected birth canal. It is highly contagious through sexual contacts.

(ii) Syphilis

It is caused by a spirochaete, *Treponema pallidum*. It damages the reproductive organs, eyes bones joints, central nervous system, heart and skin. Sexual contact is the major source of its dissimination.

(iii) Genital Herpes

It is caused by a herpes simplex type 2 virus, most frequently transmitted by sexual contact causing infection of the genitalia. It produces genital soreness and ulcers in the infected areas. In infected pregnant woman, virus can be transmitted to infant during birth, causing damage to eyes and CNS of the infant.

AIDS (Acquired Immune Deficiency Syndrome)

You are already familiar with this dangerous disease. Sexual contact is one of the major sources of its spread.

Control : The above dreadful sexual diseases can be controlled and prevented by avoiding sexual contacts with carrier or diseased person and adopting the hygienic conditions. The treatment involves medication for a long period except AIDS at present.

Exercise

1. Fill in the blanks.

1. Asexual reproduction requires only a single ___________organism
2. Sexual reproduction usually involves _________________ parents.
3. Phytochromes are the special________ sensitive pigments
4. External fertilization occurs in________ environment.
5. ___________ and ______animals provide more protection to their young one during development
6. A placenta is established between the uterine and_________ tissues for the exchange of oxygen.
7. The reduction of progesterone level, stimulates the________gland to produce oxytocin hormone.

Q.2 Write whether the statement is true or false and write the correct statement if false.

1. Asexual reproduction involves mitotic cell division.
2. Asexually produced offspring are genetically identical to their parents.
3. Sexual reproduction involves single parent.
4. Sexually produced offspring are identical to their parent.

Q.4. Short questions

1. What changes occur in ovulation and menstruation during pregnancy?
2. What is the difference between oogenesis and spermatogenesis in humans?
3. How is a seed formed?
4. What is the importance of seed in the life cycle of a plant.

Q3. Extensive questions.

1. What structures are associated with the human female reproductive system? What are their functions?
2. What are the functions of placenta during pregnancy?
3. Describe human menstrual cycle.
4. Write notes on the following:
   (a) Parthenogenesis
   (b) Herpes Genitalia
   (c) Asexual reproduction
   (d) Seedless fruits