



REPRODUCTION

You are well aware that a family continues generation after generation and also that organisms produce their own kind. This process of reproducing one's own kind ensures the continuance of the variety of organisms that inhabit the earth. Reproduction is a characteristic feature of every living being and has its own role to play in the body just like the other biological processes such as respiration, circulation, nutrition and others.

In this lesson, you shall learn how new organisms gain life, grow and become ready to give rise to another generation of similar individuals. You shall also learn the importance of reproductive health and hygiene so as to prevent the spread of sexually transmitted diseases. This will enable you to make correct choices at the appropriate time.



OBJECTIVES

After completing this lesson you will be able to:

- *appreciate that reproduction is a characteristic feature of organisms for the continuance of their species and that asexual and sexual reproduction are the two different modes of reproduction;*
- *identify the different types of asexual reproduction in organisms;*
- *identify the sex organs and describe in brief the process of reproduction in flowering plants;*
- *state facts about reproduction in animals with special emphasis on human reproduction;*
- *identify the changes in the human body upon reaching puberty and emphasize importance of reproductive health and hygiene;*
- *identify the major organs of reproduction in humans (both male and female), state their location in the body and relate each organ with its function;*

- mention the reproductive events leading to pregnancy and parturition, and express concern regarding negative consequences of adolescent pregnancy;
- demonstrate awareness regarding the prevention and transmission of Sexually Transmitted Diseases (STDs) and Reproductive Tract Infections (RTIs) caused by microbes;
- express awareness of increase in population growth and suggest methods of population control.
- understand modes of transmission and prevention of Human Immuno Deficiency Virus (HIV)/Acquired Immuno Deficiency Syndrome (AIDS) and utilize this information in making safe informed choices.

24.1 REPRODUCTION

You must have heard from your parents what a joyful event it was when you were born! Your parents, elder relatives or family friends might have told you how happy they were to see you take your first steps! And then, as an infant, how you got frightened when a dog barked! Ask your parents about your infancy and childhood. They would certainly remember many anecdotes of the past while you as a teenager are now busy understanding changes within yourself as you grow into an adult. Note the changes as you progressed from infancy to childhood and thence to adolescence.



ACTIVITY 24.1

As you do so, make an album of your photographs from infancy to date. If there are no photographs, collect pictures of infants and growing children to get an idea of how changes take place in the body as one grows up.

As you read this lesson, you shall begin to realize that a naturally occurring feature of all organisms is to grow up. Microbes, plants, animals all need to grow up to an extent when they are able to perpetuate their own species. Thus, the species lives on from one generation to the next. The biological process involved in the perpetuation of species is called reproduction. **Reproduction may be defined as the biological process by which organisms give rise to their own kind.** Reproduction may occur in two ways:

- Asexual reproduction



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Species: a group into which animals, plants etc. that are able to breed with each other are placed and identified by a Latin name. The members of the group look similar and behave in the same way because they possess the same genes e.g. The Asians, the Europeans, the Africans are all human beings belonging to the species scientifically named *Homo sapiens*.



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Offspring:

The young ones of living organisms

— Sexual reproduction

Bacterial and protozoan offspring may be produced by single individuals. This is termed **asexual reproduction**. Certain animals and many plants reproduce asexually as shown in figures 24.1 to 24.3. When two individuals are involved in reproduction, it is termed **sexual reproduction**. In sexual reproduction, male gamete fuses with female gamete to mark the beginning of a new individual. This is a more common mode of reproduction in plants and animals.

24.2 ASEQUAL REPRODUCTION

Reproduction by single individuals takes place in many ways in lower organisms like bacteria and protozoa and some algae. In plants, asexual reproduction is by vegetative propagation. Animals like sponges and hydra reproduce both asexually and sexually.

(i) Asexual reproduction in lower organisms

Asexual reproduction is of various types:

(a) Binary fission: A cell may divide to give rise to two individuals and lose its own identity as in binary fission that takes place in amoeba and bacteria (figure 24.1).

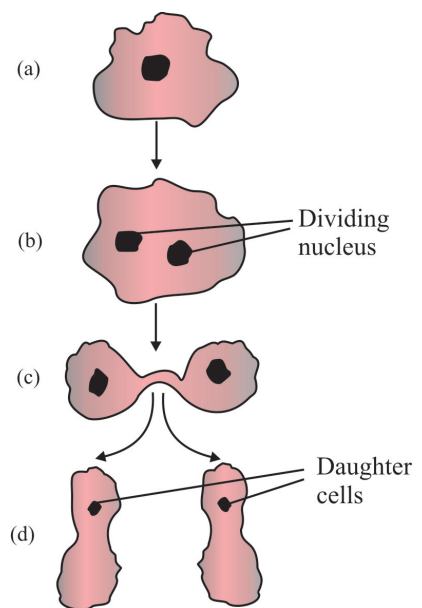


Fig. 24.1 Binary Fission in Amoeba

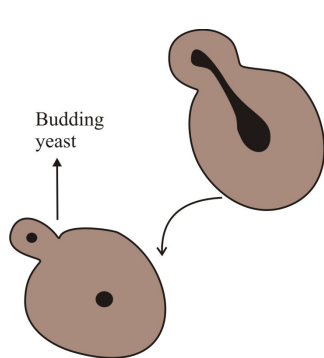


Fig. 24.2: Budding in Yeast

(b) Budding: In budding, a bud forms from the body of the mother cell and remains attached to it. The parental nucleus elongates and then divides into two, one of which moves into the bud. Example: yeast (figure 24.2).

In animals like sponges and hydra which are multicellular; a bud arises from some part of the body, enlarges and then detaches from the parent body after all its body parts have been formed (figure 24.3).

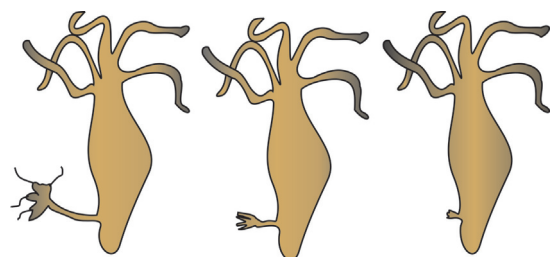


Fig. 24.3: Budding in Hydra

(c) Spore formation: The cytoplasm and nucleus of algae such as *Chlamydomonas* divide

Multicellular:

organism made up of many cells.

successively to form 4 to 8 spores. Spores are also formed for reproduction in fungus, moss and fern. Spores are single cells which upon their release from the parent plant develop into new individuals (figure 24.4).

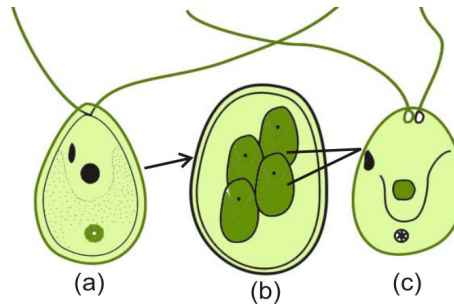


Fig. 24.4 Spore formation in *Chlamydomonas*

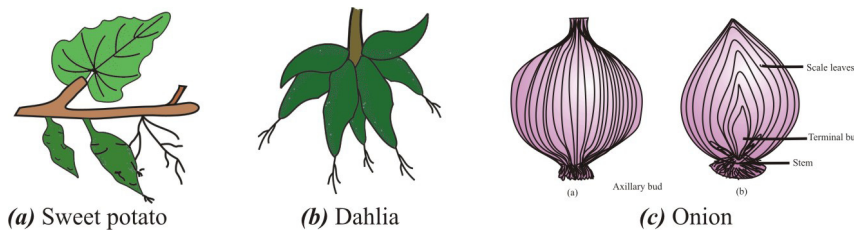
(ii) Asexual reproduction in plants

Vegetative Propagation: In nature, new plants may arise from root, stem or leaves that is from the vegetative parts of the plant as shown in fig. 24.5 (a to h). This form of asexual reproduction in plants is termed **vegetative propagation**.

Table 24.1: Modes of vegetative propagation with examples

Mode of reproduction	Specialised plant part	Examples
(A) Natural Methods	Adventitious roots	Sweet potato, Dahlia
(a) Roots (fig. 24.5 a&b)		
(b) Stem	(a) Runner (fig. 24.5g) (b) Sucker (fig. 24.5h) (c) Bulb (fig. 24.5c) (d) Tuber (fig. 24.5d) (e) Rhizome (fig. 24.5e) (f) Adventitious buds (fig. 24.5f)	Lawn grass, Chrysanthemum Onion Potato, Canna Ginger <i>Bryophyllum</i>
(c) Leaves		
(B) Artificial Methods (fig. 24.6 a to c)		Rose, Money Plant Jasmine, Grapevine Citrus, Mango Orchid, Chrysanthemum, Asparagus.
(a) Cutting		
(b) Layering		
(c) Grafting		

New plants may be formed from roots (fig. 24.5 a,b) or stem (24.5 c,d,e) or leaves (fig. 24.5f) or when a stem grows to a distance and then enters soil and strikes roots to form a new plant (fig. 24.5 g,h)





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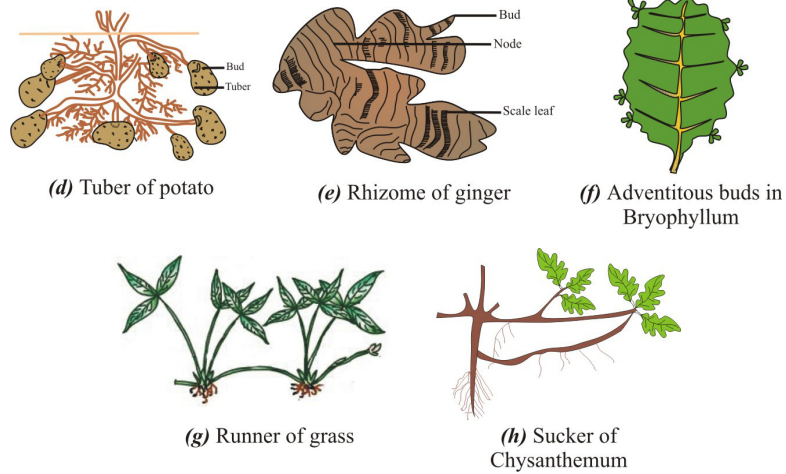


Fig. 24.5 (a to h) Natural vegetative propagation in plants

(iii) Artificial propagation in plants

Humans have taken hints from natural methods of vegetative propagation to grow many plants through artificial propagation. Fig. 24.6 shows the various methods by which farmers and nursery owners multiply desired plants using the method of artificial propagation.

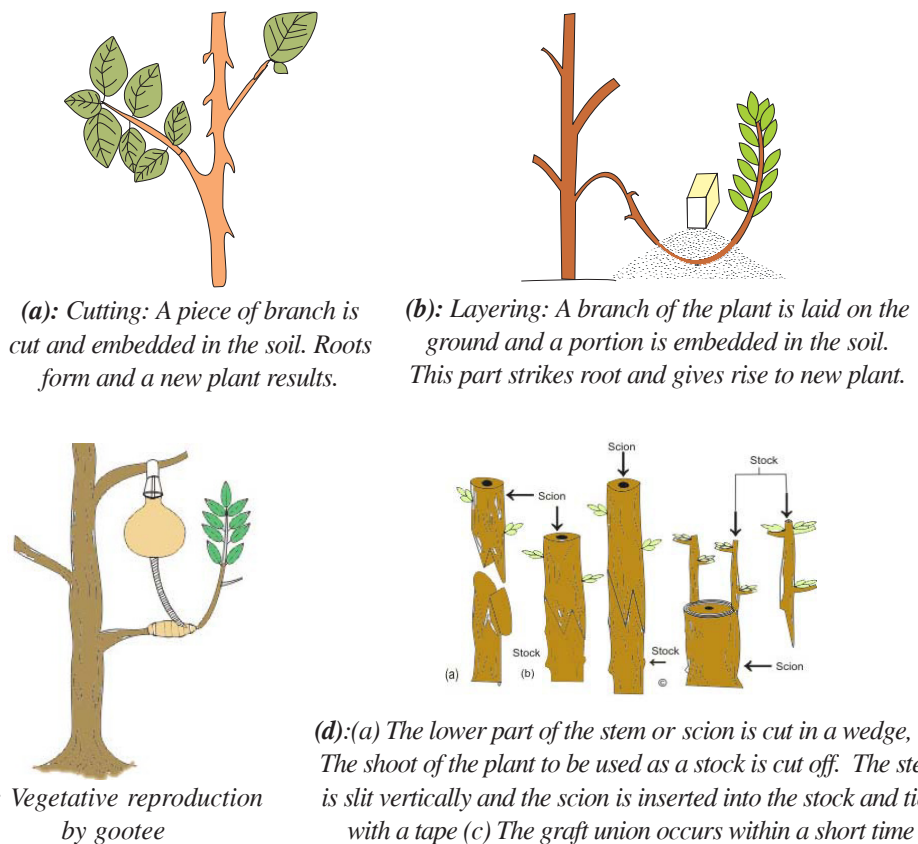


Fig. 24.6 (a to d): Artificial vegetative propagation in plants



ACTIVITY 24.2

1. Take a branch from a champa tree or a money plant. Grow it. Observe how the branch produces a full fledged plant.

2. You may even try to grow some grass picked up from the wild. What do you find? Under which conditions does the grass reproduce to form a carpet of grass? Write your observations in the space provided below:

(iv) Other methods of asexual propagation

In the laboratories, researchers have raised offspring from single parent through **tissue culture**. Dolly was a sheep, an exact copy of her mother, raised through **cloning**.

(a) Micropropagation

Researchers have standardized the methods of **tissue culture**. Every living cell or every part of a plant has been found to be **totipotent**, that is, it has the potential to give rise to more plants. Can you explain why? Try and answer after you have finished reading this lesson and can understand that all the cells of an individual arise from a single cell, the zygote and hence all cells have the same genes. Genes control growth, development and all the life processes.

From a piece of plant, say root of carrot, or a leaf, cells can now be cultured in adequate nutrient solution to form an undifferentiated mass of cells called **callus** which can then give rise to new plantlets. The raising of plants through tissue culture is termed **micropropagation**. (figure 24.7)

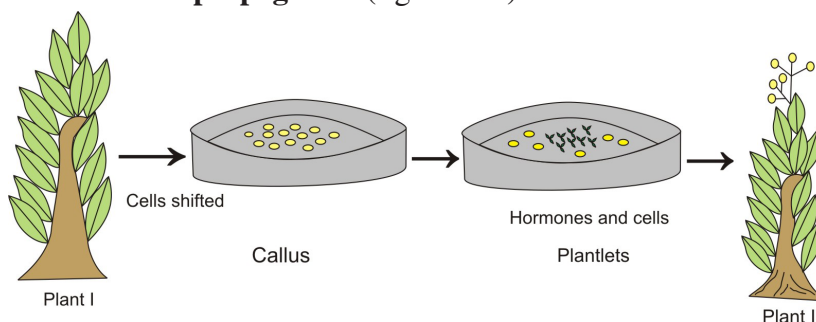


Fig. 24.7 Steps of Micropropagation (a) Leaf taken from a plant (b) Cells form undifferentiated mass (callus) (c) Hormones and nutrients added to cells (d) New plant grows from callus



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Surrogate mother:

A female animal in whose womb an embryo from another female of the same kind is developing.

(b) Cloning

A clone is the genetic copy of the parent. The sheep Dolly, when born was an exact copy of her mother. Her mother’s udder cell nucleus was transferred into the egg of a “surrogate mother”, after removing the nucleus. Dolly’s mother provided her genes while the surrogate mother provided the womb (Fig. 24.8) for Dolly to develop from an embryo to a full fledged individual.

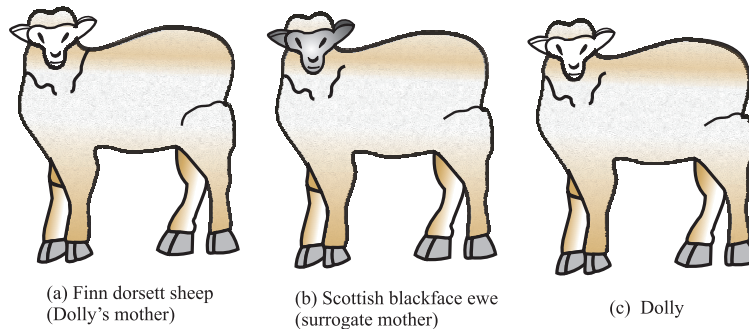
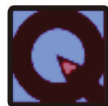


Fig. 24.8 Cloning of the Sheep Dolly



INTEXT QUESTIONS 24.1

1. Define reproduction.

2. State one point of difference between asexual and sexual reproduction.

3. Why is binary fission considered to be an asexual form of reproduction?

4. Define vegetative propagation with the help of an example.

5. Define the following (i) callus (ii) clone

24.3 SEXUAL REPRODUCTION IN PLANTS

You already know that sexual reproduction requires fusion of male and female gametes. We shall now understand how sexual reproduction takes place in flowering plants.

(i) Sexual reproduction in plants

The reproductive organ of flowering plants is the flower (Fig. 24.9). **Stamens (Androecium)** which produce pollen are the male part. **Pollen grains** contains male sex cells. There may be several stamens in each flower. Each stamen (**Androecium**) has two parts. The upper part is known as **anther** which bears pollen. It is held on the lower part called **filament**.

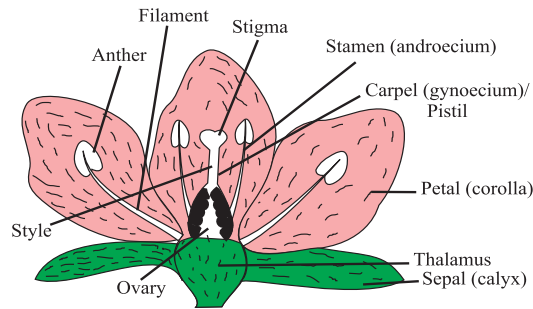


Fig. 24.9 TS of a Typical Flower

The **pistil (Gynoecium)** is the female part and its basal part is the ovary carrying eggs or ovules or female sex cells. The parts of the pistil are the stigma, style and ovary. In most plants, each flower bears both male and female parts. They are termed **bisexual**. In some plants there are male flowers with only androecium and female flowers bearing only gynoecium. They are **unisexual**.

**ACTIVITY 24.3**

- Procure a wilted flower and look for the stamen and pistil. Identify the different parts and then check the terms for these parts in the pictures given in your book.

- Do you think we should pluck flowers from the plants?
State 'Yes' or 'No' choosing points from the following
 - look nice on plants
 - are living
 - where will butterflies go? Provide food for the butterflies
 - are organs of reproduction?

- What do you think will happen if we pluck all the flowers that bloom on a plant?
Write your answer in the space provided below:

(ii) Pollination and fertilisation

For fusion of their nuclei, pollen and ovule are brought together by several agencies like the wind, water, and insects. This transfer of pollen grain from anther to the stigma of a flower is called **pollination**. **Self pollination** is when pollen



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of a flower falls on its own stigma and fertilizes the ovule. **In Cross pollination** pollen from one flower falls on the stigma of another flower of a different plant of the same species and then fertilizes the ovule of that flower. Agents like wind, water or insects help to transfer pollen from one flower to another.

For **fertilization or fusion of nuclei of pollen and ovule**, pollen is brought by any pollinating agent mentioned above, on the stigma of the pistil. Each pollen grain forms a pollen tube and pollen grain nucleus reaches the ovule as pollen tube pushes through the pistil (Figure 24.10). The fertilized ovules develop into seeds which are capable of germinating into seedlings and new plants (Fig. 24.11).

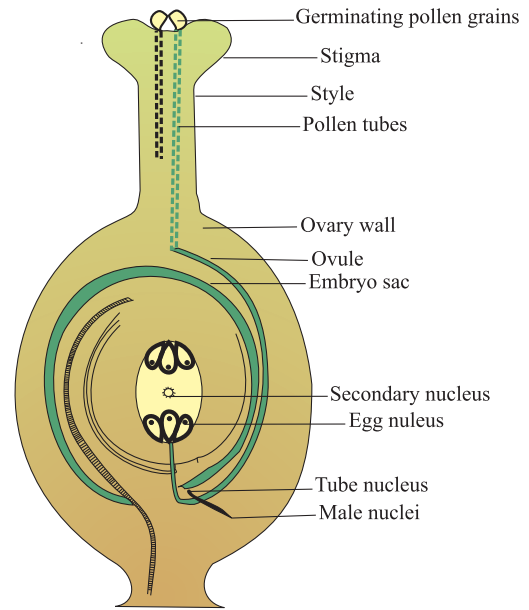


Fig 24.10: Fertilization in Plants

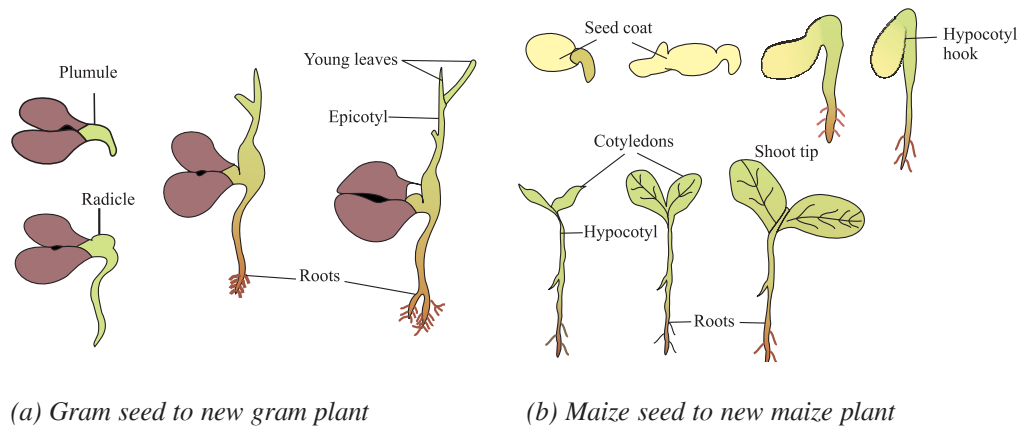
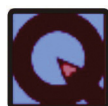


Fig. 24.11 : Seed germination in (a) gram and (b) maize

Once seeds are formed, they get dispersed or are carried away from the parent plant and then germinate under favourable conditions.



INTEXT QUESTIONS 24.2

1. What purpose does the flower serve in a plant?

2. Give one point of difference between self pollination and cross pollination.

3. What will happen if the pistil of the flower is removed?

4. Trace the path of the pollen after it lands on the stigma.

5. What is germination of seed?



ACTIVITY 24.4

Now that you have an idea of how plants reproduce, find answers to the questions below and perform the related activities.

1. Have you seen plants growing from buildings or near walls? Think and express how this may happen. Express your views in the space provided below:

2. Grow wet seeds which take less time to germinate (e.g. gram, moong). After they have sprouted. Sow them in pots. Maintain them till they become seedlings. Maintain a record of the time period showing maximum growth, flowering and formation of seeds.

24.4 SEXUAL REPRODUCTION IN ANIMALS

As mentioned earlier (24.1 section i)) lower animals like the sponge and hydra can reproduce through asexual methods. They can, however, also reproduce sexually. In all animals, the female produces eggs and the male produces sperms. An egg and a sperm fuse to form the zygote which then develops into the embryo and the embryo into a full-fledged individual. The development may occur partially or completely, inside the egg. Such animals that lay eggs include fish, frog, reptiles and birds and are thus called **oviparous**. In mammals such as cats,



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dogs, cows and humans, the baby develops inside the mother’s womb. They are termed **viviparous**.

In tapeworms and earthworms both female and male sex organs are in the same individual. Such individuals are termed **hermaphrodite**. Sexes are separate in all other animals, and the male individual has male organs like testes etc.while the female has ovaries etc. Humans also belong to the animal kingdom. They are mammals and hence viviparous.

24.5 REPRODUCTION IN HUMANS

The period from infancy to reproductive maturity in humans includes childhood and adolescence. The pictures given below show the progression of human life through stages of infancy, childhood, adolescence, adulthood, and finally ageing.



Figure Showing different of stages of Human Life

24.5.1 Adolescence in human beings



ACTIVITY 24.5

Look at the pictures depicting stages of human life. Write down two to three sentences that come to your mind about each of these stages. Encircle with a pencil the picture showing that stage of life at which you are now. Label the appropriate stages as infancy, childhood, adolescence, adulthood and old age.



The body undergoes natural changes as one grows into the reproductive period of life. These changes begin around the age of 10-11 and last till 18 to 19 years of age. This stage of life is called **adolescence**. The time period when changes occur in humans make them capable of reproduction, is called **puberty**. Not only humans, but no organism becomes mature and capable of reproduction soon after birth and needs to reach maturity and adulthood in order to do so. The period between birth and maturity is very short in animals. Perhaps it is the longest in humans.

Read carefully the table given below wherein changes during adolescence are listed. It is important to remember that although these changes occur in all adolescents, the timing and pace of changes may differ from individual to individual. This just goes to prove that each of us is unique!

Table 24.2 shows changes at puberty. The changes are physical, physiological and psychological.

Table 24.2 Changes at puberty and adolescence

Physical Changes	Remarks
1. Increase in height <ul style="list-style-type: none"> Bones elongate Muscles develop Height increases 	It is one of the most perceptible change during adolescence. Increase in height is dependent on the genetic make up, nutritional status, and physical activity levels of an adolescent.
2. Changes in body shape <ul style="list-style-type: none"> Chest and shoulders broaden in boys Increased fat deposition below the waist (around hips) in girls 	Adequate nutrition is necessary for proper growth. Adolescents need a balanced combination of food items that provide energy (known as carbohydrates and fats), that help in growth (known as proteins) and protect from infections by enhancing immunity (known as vitamins and minerals). Depending on whether you are a vegetarian or a non-vegetarian, choose appropriately from the following five groups of food items. 1) cereals and millets, 2) vegetables and fruits, 3) milk, milk products, meat, fish, egg, 4) pulses, 5) fats and sugar <i>Please refer to the health and hygiene lesson 32 for more information on balanced diet.</i> Chips, soda, chocolates, pastries and burgers should not replace a meal and should not be consumed on a regular basis. <ul style="list-style-type: none"> Regular physical exercise helps in proper growth.
3. Changes in the voice <ul style="list-style-type: none"> In boys, voice box or larynx enlarges and is visible as the “Adam’s apple” 	<ul style="list-style-type: none"> Boys develop a deep voice. Their voice sometimes cracks when the larynx or voice box is enlarging and voice control is lost during that time. Girls develop a high pitched voice.



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<p>4. Development of sex organs In both the females and males, sex organs mature during adolescence. More details on the structure and functioning of sex organs are provided later in this lesson.</p>	<ul style="list-style-type: none"> • Girls and boys become capable of reproduction. It is important to observe proper hygiene and wash all parts of the body, including external genital organs in girls and testicles in boys. • It is normal for adolescents to feel sexual excitement and masturbate. When a boy becomes sexually excited in a dream, he may experience an erection and ejaculate in his sleep. This is known as 'wet dream' and is normal. • Breast development is one of the first signs of puberty in girls. Variation in the size and shape of breasts is normal and depends on the amount of fat stored in them. Size of the breasts is not correlated with production of milk or giving pleasure.
<p>5. Appearances of secondary sexual characters</p> <ul style="list-style-type: none"> • Axial (arm pits) hair and pubic hair appear. • Breasts develop in girls. • Facial hair begins to grow in boys. 	

? Do you know

If a female notices any change in her breasts, for example, a lump, changes in breast shape, discharge from nipples, pits or hollow in the skin around the breast, she should consult a health worker/doctor immediately

Physiological Changes	Remarks
<p>1. Increased activity of sweat and sebaceous (oil) glands</p>	<ul style="list-style-type: none"> • Overactivity of oil glands may cause acne and pimples on the face. The acne usually go away once the hormonal changes stabilize. However, these can be reduced by washing face with soap and water several times in a day, eating lots of fruits and vegetables, drinking several glasses (at least 8-10) of water everyday and avoiding fried and fat rich food items. Avoid picking pimples as they could get infected and leave scars. Consult a health worker/doctor if the acne are particularly troublesome. • Regular cleaning and washing will help prevent odour due to increased sweating.
<p>2. Increase in appetite Body requires more nutrition as it grows.</p>	<p>At adolescence, the body grows rapidly and this makes adolescents more hungry.</p>
<p>3. Increase in the level of hormones in blood Levels of growth hormone and sex hormones in blood increase.</p>	<ul style="list-style-type: none"> • The growth hormone secreted by anterior pituitary gland controls growth. • Under the influence of hormones from anterior pituitary, sex organs begin to secrete sex hormones. The testes secrete testosterone in males and ovaries secrete oestrogen and progesterone in females.



Notes

4. Menstruation

- In human females, reproductive phase begins at puberty and lasts till the age of 45 to 50 years.
- A girl is born with fixed number of ova (eggs). However, these begin to mature only at puberty. One ovum matures at a time and is released from the ovary once in 28 to 30 days. This happens under the influence of a hormone from anterior pituitary FSH or Follicle Stimulus Hormone. One ovum (egg) is shed alternately from each ovary every month.
- The egg (ovum) travels down the fallopian tube to reach the uterus.
- At the same time, the wall of the uterus under the influence of another hormone from anterior pituitary called LH or Lutenising Hormone thickens to receive fertilized egg. If there is no fertilization, the thickened lining of uterus and blood vessels are shed off and cause bleeding. This is called **menstruation** (Fig 24.12) and is also known as period.

The first menstrual bleeding is called **menarche**. Stoppage of menstruation at an age usually between 45 years and 55 years is termed **menopause**.

Many females have a period every 28 days. Some have them every 21 days and in others the cycle could be of 35 days. Periods usually last for 4 days but could be shorter or longer. Many adolescent girls have irregular and painful periods that settle down as girls grow up. If the problem persists, a medical doctor should be consulted.

Menstruation is not an illness. If the girl feels comfortable, she could do anything that she does normally. Some girls may get cramps and pain in the abdomen. Exercise may help to prevent the pain. Paracetamol and/ or other pain killer as suggested by a doctor may help if the pain is difficult to bear.

Girls use sanitary towels, cotton wool, clean cloth or tampons to absorb blood during their periods but it is important to change these frequently (every 6-8 hours) to prevent infection from reaching vagina. If reused, cloth should be washed with a mild detergent and dried in the sun.

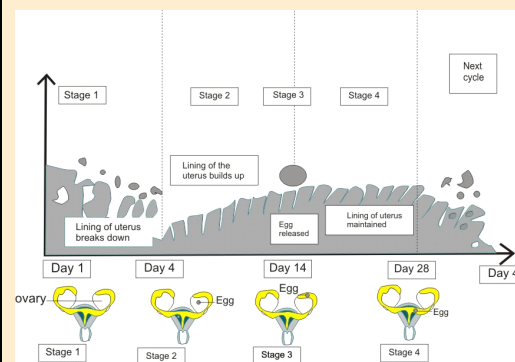


Fig. 24.12 Graphical Representation of menstrual Cycle

Adolescents may be biologically capable of reproduction but they are not ready to shoulder the responsibilities of parenthood. Adolescent girls are not physiologically mature for child bearing and many a time, both the adolescent mother and her baby suffer from complications. Adolescent parents are not likely to have good opportunities of education and livelihood and may not be able to provide for their child. Eventhough the legal age at marriage is 18 for girls and 21 for boys, child marriage is still a problem in our country. Data from the National Family Health Survey conducted in 2005-6 show that 27% young women and 3% young men in the age group of 15-19 were married at the time of the survey. Furthermore, findings from the same survey show that 30% females in the age group of 15-19 have had a live birth by the age of 19 years



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Can you reason out?

Can you give two reasons as to why menstruation does not occur during pregnancy?

Hints (i) Menstruation occurs when fertilization does not happen and the egg as well as thickened lining of uterus and blood vessels are shed off

(ii) During pregnancy, the growing foetus is attached to thickened uterine wall.

Psychological changes

Mental, emotional and intellectual maturity develops gradually:

- Adolescents are capable of abstract thinking.
- They experience mood swings.
- They become self conscious.
- Self image and identity becomes important.
- Friendship is very important to them.
- They start getting interested in one another in a sexual way.
- Opinions expressed by peer that are different from their personal beliefs could be a source of stress and anxiety as it is important for them to **fit in** with the group norms

Adolescents should definitely enjoy this phase of their lives but also invest in their future! It is important to strike the right balance!!

Initiating and nurturing friendships and positive relationships is a vital part of growing up. However, it is important that relationships are built on equality, mutual respect and love. Relationships that lack these attributes could be exploitative and cause physical, emotional and psychological harm that may prevent young people from realizing their potential. Sexuality is an important part of growing up but decisions related to sex and sexuality should be based on appropriate information, an understanding of consequences and most importantly a sense of responsibility.

Striving for independence is a very important part of adolescence. Young people need to remember that they should be able to take responsibility for their independent decisions



ACTIVITY 24.6

The following chart gives the average rate of growth in the height of boys and girls with age. The figures in columns 2 and 3, give the percentage of the height which a person has reached at age given in column 1. For example by age 11, a boy has reached 81% of his full height. These figures are only representative and there may be individual variations.

Use the table for yourself and your friends and work out how tall each of you is likely to be. Is it not fascinating that each one of you is likely to be slightly different from the other!

Age in Years	% of full height	
	Boys	Girls
8	72%	77%
9	75%	81%
10	78%	84%
11	81%	88%
12	84%	91%
13	88%	95%
14	92%	98%
15	95%	99%
16	98%	99.5%
17	99%	100%
18	100%	100%

Present height (cm)/% of full height at this age x 100

(as given in the chart)

Example:

A boy is 9 years old and 120cm tall. At the end of the growth period he is likely to be $120/75 \times 100 = 160$ cm tall.



ACTIVITY 24.7

- Have a frank and honest discussion with your friends about the kind of changes you are undergoing in your body and mind. You may find certain commonalities and some things that are unique to each of you.
- Is there a change during adolescence that makes you happy and a change that makes you nervous and anxious? Share it with your friend. You may go to



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website of NIOS and Adolescence Toll free phone number 18001809393 for more information related to these changes

- Quote at least one incident when you experienced a mood swing. In your opinion, were you able to handle it well? If not, what could you do the next time to either prevent the mood swing or manage it better.

24.6 THE ORGANS OF REPRODUCTION IN HUMANS

Reproduction in humans require two individuals - a male and a female.

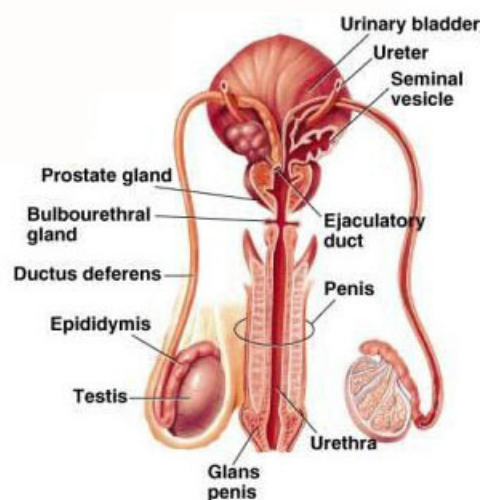


Fig. :24.13 Male Reproductive Organs

(i) The male reproductive organs

The male reproductive organs are shown in Figure 24.13. The functions of its parts are tabulated in table 24.3.

Table 24.3 Reproductive organs of human male

<i>Organ</i>	<i>Function</i>
A pair of testes	Generate Sperms
Two sperm ducts or vasa deferentia (Singular: Vas deferens)	Each arises from the testis and passes up into the body to join together and form the ejaculatory duct.
One ejaculatory duct	Is a common duct for passage of urine and sperms.
One Penis	Muscular organ which helps to transfer sperms into female body.

Do you know

The testes lie outside the body within the scrotal sac. This is to ensure that the temperature at which sperms are being produced is 2°C less than body temperature as required for sperms to stay alive.



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(ii) The Female reproductive system

The figures 24.14(a) and 24.14(b) are figures of (1) the human female reproductive system and (2) section of the female reproductive tract showing the movement of the egg released from the ovary/fertilised in the fallopian tube and zygote undergoing development till it reaches the uterus and implants in its wall for further development.

The female reproductive system is located in the lower abdomen. The organs of the female reproductive system and their functions are tabulated in Table 24.4. The ovary and oviduct are commonly found in all female animals and the uterus in those who do not lay eggs but give birth to young.

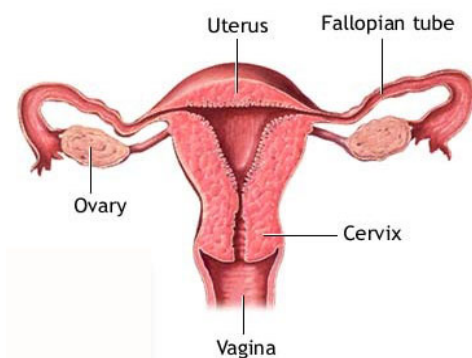


Fig. 24.14 (a) Female Reproductive Organs in Humans

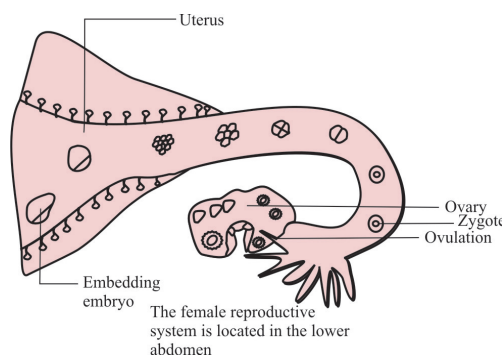


Fig. 24.14 (b) The Female Reproductive System showing the movement of fertilised egg

Table 24.4 The human female reproductive organs and their functions

<i>Organs</i>	<i>Function</i>
A pair of ovaries	Produce ova
Two fallopian tubes	Are the oviducts through which eggs pass from the ovaries into uterus
One uterus	The womb in which the embryo develops
One cervix	The opening of uterus
One vagina	Female opening



Notes



INTEXT QUESTIONS 24.3

1. Define the terms (i) adolescence (ii) puberty (iii) hermaphrodite (iv) oviparous (v) viviparous (vi) foetus

2. Name the hormones secreted by the testes and ovary.

3. Name the part of the female reproductive system where the egg gets fertilised by the sperm.
4. State the function of (i) uterus (ii) vas deferens
5. Consider the three case studies given below. Please provide your suggestions for managing these situations in 2-4 sentences each.

Case 1: Your friend, Suresh is extremely shy and withdrawn because he is growing hair at many places in his body. His voice is croaky and sometimes he gets dreams which make him feel ashamed of himself. How will you convince Suresh that what he is undergoing is absolutely normal and natural?

Case 2: Rehman, your friend, is disappointed because he is the same age as most of the friends but in comparison to others, he looks baby-faced and has no facial hair. How will you get him out of this ‘odd man out’ feeling? Suggest two ways.

Case 3: Your cousin Madhu is prevented from entering the kitchen and entering places of worship during menstruation and Madhu feels that she is being punished for something that is normal and definitely not her fault. Based on your understanding of menstrual cycle, do you think this is a correct practice? If not, please provide at least two reasons to convince your aunt to stop this practice.

6. Your friend Kiran would not look at boys during her periods as she had heard from someone that if she did so she would become pregnant.

Write a letter to Kiran that helps her realize that she is holding on to a false belief.

24.7 FERTILISATION AND EMBRYONIC DEVELOPMENT IN HUMANS

Observe figure 24.15 (a to g) carefully. It shows the steps of reproduction in humans. The figure (a) and (b) are the human gametes, **sperm, the male gamete** generated in

the testis (spermatogenesis) and **egg or ovum, the female gamete** produced in the ovary through the process of oogenesis.

- The nuclei of sperm and egg fuse inside the egg, forming the zygote. This fusion is termed **fertilisation** and takes place in the fallopian tube (the oviduct). (fig24.15 (c)).
- The fertilised egg or zygote begins to divide repeatedly and upon reaching a stage containing cells and a cavity called blastocoel, gets embedded (e) in the thickened uterine wall in which many blood capillaries have formed.



Notes

Genesis: to give birth or to generate

Gametes: Reproductive cells that fuse during fertilization to form a zygote which develops into an embryo. For example,
Male gamete = sperm
Female gamete = egg or ovule

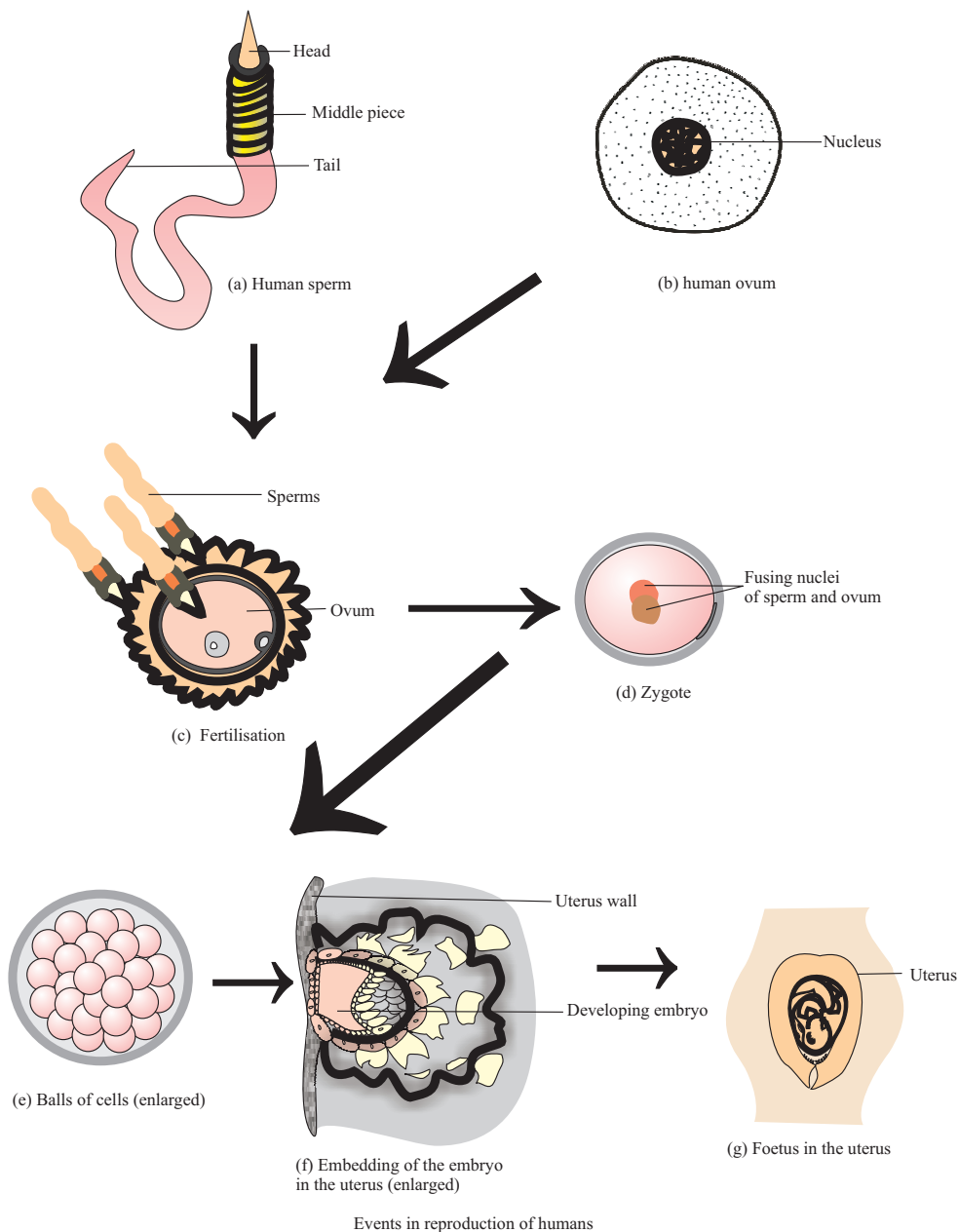
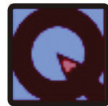


Fig. 24.15: Events in reproduction of humans



Notes

- In case fertilisation does not occur the egg disintegrates. The thickened wall of uterus along with capillaries breakdown leading to bleeding or menstrual flow (menstruation). In human female menstruation occurs every 28 to 30 days (fig. 24.12)
- The embryo, now called foetus develops (f) and (g) into a full fledged individual in 280 days inside the uterus and is born under the influence of a hormone from posterior pituitary, called oxytocin.



INTEXT QUESTIONS 24.4

1. List, in a sequence the events that lead to the birth of a new individual.

2. Name the hormones responsible, for attaining reproductive maturity, and for formation and maturing of sperms and eggs in humans.

3. Given below is a list of hormones related to reproduction. List influence on functions in the space given below:

FSH, LH, Estrogen, Testosterone, Oxytocin

Hormones	function

24.8 HUMAN POPULATION

You may be aware that the population of India is more than a billion and continues to grow. In terms of numbers, India may overtake China that is currently the most populous nation of the world in the next two decades.

It is not difficult to imagine that a strong force of one billion people working together can achieve all the development goals and even more. However, India lags behind on several development indicators and needs to make systemic and consistent investments in education, health, employment and social welfare before its vast human potential can be realized. Young people like you have an important responsibility to take the country forward.



ACTIVITY 24.8

1. Suppose you are the Prime Minister of India. State three key areas in which your government will invest for improving the pace of development in the country so that the vast human potential can be realized?

2. India is struggling with issues related to a large population. On the other hand, countries like Japan and Sweden are worried that their population is not growing and are giving incentives to young people in their country to contribute towards population growth. Please fill the table below to identify the major advantages and problems that countries with large and small populations face.

India (Large Population)		Sweden (Small Population)	
Advantages	Problems	Advantages	Problems

24.8.1 Making Informed Choices about Family Size

The decisions that individuals make about the size of their families will contribute towards limiting the size of the population of the country. Decisions related to family size are motivated by people's aspirations and resources. In a large segment of Indian society, there is pressure on the young couples especially, the females to prove their fertility and bear male children. Undoubtedly, children are a valuable component of the family. However, unplanned pregnancy may compromise the health and well being of both the mother and the child. In addition, if the parents are not ready to provide for the child both in economic and emotional terms, the child may not get the opportunities for holistic growth and development.

All of us recognize that planning is an important part of decision making but it is important to have correct and appropriate information to make informed decisions. Planning the size of the family and the timing of child birth helps to achieve better quality of life as there are likely to be sufficient resources to spend on food, education, health and well being of all the members of the family. Whose decision would that be?

Some of the modern methods for preventing pregnancy, also known as '*contraception*' are outlined in Table 24.5 below. Contraceptive methods are



Notes



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broadly classified into two categories: temporary and permanent methods. With the use of temporary methods, fertility returns after stopping the use of these methods. Hence, they are appropriate to delay the birth of the first child and/ or increase birth interval between two children. Permanent methods are irreversible for all practical purposes and are appropriate for couples who have completed their families and do not want any more children. Contraceptive methods should be adopted based on the couple’s need and after consultation with a trained medical practitioner.

Table 24.5: Common Methods of Contraception

Device	Function
Temporary Methods	
Condoms in males/ Diaphragms in Females	Physical barrier that prevents sperm from meeting the egg
Intra Uterine Contraceptive Device (IUCD), for example, Copper T	Inserted in female body by medical practitioner to prevent implantation of the growing embryo.
Oral contraceptive pills	Pills interfere with ovulation and prevent release of ova from the ovaries. As a result, fertilization cannot occur. These should be started under guidance from a trained medical practitioner.
Permanent Methods	
Vasectomy in males /Tubectomy in females	Are surgical methods for tying up the tube vas deferens through which sperms travel in males and in females blocking fallopian tube preventing fertilization.

The government has established a number of health service delivery institutions at different levels where contraceptive methods are available free of cost or at heavily subsidized rates. Clients may also seek counselling services at these centres.

24.9 REPRODUCTIVE TRACT INFECTIONS AND SEXUALLY TRANSMITTED DISEASES

Reproductive Tract Infections (RTIs) refer to infections of reproductive organs. These illnesses may occur due to poor genital hygiene, for example, poor

menstrual hygiene among girls. Importantly, RTIs include the illnesses that are transmitted from one person to another during sexual contact and are known as Sexually Transmitted Diseases (STDs).

24.9.1 STDs

These infections may be transmitted during vaginal or anal intercourses, or genital skin contact. Gonorrhoea, syphilis, herpes, chlamydia, warts and chancroid are common STDs. Human Immuno-deficiency Virus (HIV) can also be transmitted through sexual contact.

Symptoms of STDs include,

- Itching or soreness of genitals or anus
- Blisters, sores, lump, rash in uro-genital areas
- Discoloured discharge that may be foul smelling from vagina in females and penis in males
- Pain during urination
- Women may also complain of pain in lower back and abdomen

Some infected persons may not show any symptoms and may pass on infection to their partners unknowingly.

Did you know that compared to men :

- women acquire STIs more easily as the disease causing organisms can stay inside the vagina for a longer time?
- women are also likely to be asymptomatic (without showing symptoms of STD) for longer periods of time after acquiring the infection?
- young women are more susceptible to acquire STDs as their vaginal mucosa is immature?

It is important to see a doctor if any of the symptoms of STDs occur. Prompt and complete treatment can cure most of the Sexually Transmitted Diseases. Untreated STDs can lead to infertility. The sexual partner of the infected person should also seek medical advice and treatment. Unless the infected individual is cured, s/he should avoid sexual intercourse. STDs can be prevented by:

- having one faithful sex partner
- having safe sex with correct and consistent use of condoms



Notes



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T-lymphocyte: A type of white blood corpuscle that defends the body against infectious agents

24.10 HIV/AIDS

Human Immunodeficiency Virus (HIV) causes Acquired Immuno-Deficiency Syndrome (AIDS). HIV is a retro virus, i.e., its genetic material is RNA. It destroys vital cells of the immune system making the body vulnerable to several infectious agents. It infects T-lymphocytes and makes thousands of copies of the virus. HIV-infected individual may remain asymptomatic for 10-15 years. Gradually, the number of T-helper cells of the immune system decrease in number to a low when the victim loses resistance against other diseases. This is the stage of full-blown AIDS.

It is estimated that across the world, 30 million adults and 3 million children below the age of 15 live with AIDS. HIV may be transmitted from one infected individual to another individual by the following mechanisms:

- Unprotected sexual intercourse
- Infected blood
- Infected syringes and needles: Injection-drug users may acquire HIV through this route by sharing infected needles. Similarly, HIV may be transmitted if infected needles are used for tattooing, acupuncture
- Infected mother to her baby in utero (in the womb), during child birth and through breast milk

As discussed under prevention of STDs, HIV transmission can be prevented by:

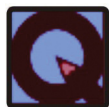
- Having one faithful sex partner
- Having safe sex with correct and consistent use of condom

In addition, HIV transmission can be prevented by:

- Using sterilized needles for blood donation or transfusion or getting injections
- Pregnant women infected with HIV should seek advice from medical practitioner on the safest mode of delivery and seek counselling regarding breast feeding the baby.

Anti-retro viral therapy is available to check the progression from HIV infection to full-blown AIDS and has been shown to be effective.

You have just learnt how HIV/AIDS is transmitted. It is not transmitted through kissing, holding hands, hugging, sharing toilets, sharing clothes, food and drink, sneezing, coughing or mosquitoes. Hence, AIDS positive individuals should not be stigmatized or discriminated against.



INTEXT QUESTIONS 24.5

1. Name any four sexually transmitted diseases.

2. Name four devices which prevent fertilization in humans.

3. Expand the abbreviations (i) HIV and (ii) AIDS.



WHAT YOU HAVE LEARNT

- Reproduction is a characteristic of all living beings.
- It is the biological process of producing offspring of one's own kind.
- Reproduction may be asexual or sexual.
- In asexual reproduction offspring are produced by single individual.
- In sexual reproduction, a male individual and a female individual are needed.
- Hermaphrodites like tapeworm and earthworm have both male and female organs in same individual.
- Asexual reproduction in protozoa is by binary fission, in yeast and hydra by budding. In plants, parts like roots, stem and leaves may give rise to new plants. This is called vegetative propagation. Plants may be artificially propagated by layering, cutting, goottee etc. Recent laboratory methods are micro propagation and cloning.
- Sexual reproduction requires the fusion of male and female reproductive cells/gametes. In plants, flower is the reproductive part. Its stamens are the male part and pistil, the female part.
- The male gametes is the pollen of one plant may reach the female gamete of the same flower or same kind of flower by being transferred on the stigma of the pistil by agencies like wind, water or insects.
- Fusion of male and female gametes is called fertilisation.
- After fertilisation, ovules form seeds. Seeds can germinate into new plants.
- Reproductive maturity in humans begins during puberty in the adolescents. During adolescence, boys and girls undergo physical, physiological and psychological changes.



Notes



Notes

- Sexual reproduction in animals begins with fusion of sperm and egg (ova). Sperms develop testes, the male organ and ova in ovary, the female organ. Animals may lay eggs (oviparous) or the embryo may develop completely inside the uterus (viviparous).
- Male and female reproductive parts in humans are: Male- a pair of 2 testes, 2 vas deferentia, one ejaculatory duct passing through penis. Female: - a pair of ovaries, 2 oviducts or fallopian tubes, one uterus, one vagina opening to the outside.
- Reproductive events are under the control of hormones.
- After fertilisation, the embryo which implants in the mother's uterus becomes the foetus. Foetus completely develops in the mother's womb.
- India has the largest human population after China. Population is one of the greatest resources for the country. Planning the size of the family and the timing of child birth helps to achieve better quality of life as there are likely to be sufficient resources to spend on food, education, health and well being of all the members of the family. There are several methods of contraception that can be used based on the needs of the couple.
- Certain diseases are transmitted through sexual acts. These are sexually transmitted infections due to virus and bacteria and HIV-AIDS caused by HIV virus.



TERMINAL EXERCISES

1. Name the biological process by virtue of which a species continues from generation to generation?
2. Mention two differences between asexual and sexual modes of reproduction?
3. Mention an example for each of the following methods of reproduction.

(i) Budding	(ii) Spore formation
(iii) Binary fission	(iv) Vegetative reproduction
4. Why is vegetative reproduction considered as a type of asexual reproduction?
5. Mention the specialized parts that are responsible for vegetative mode of reproduction in the following plants

(i) Ginger	(ii) Grass
(iii) Onion	(iv) Potato



Notes

6. How is artificial vegetative propagation different from natural vegetative propagation. How is the former beneficial to humans?
7. How is a callus developed in tissue culture? Give the steps.
8. Why is it said that all living cells are totipotent? Explain.
9. Label the following parts in the given diagram
 - (i) part that produces pollen.
 - (ii) part of the flower that receives the pollen.
 - (iii) part that contains ovules.
 - (iv) the part of the flower that holds the anther.
10. Justify the following statements:
 - (i) Birds, reptiles and frogs are called 'Oviparous'.
 - (ii) Human are 'Viviparous'.
 - (iii) Earth worm is a 'hermaphrodite'.
 - (iv) The sheep 'Dolly' was a clone of her mother.
11. Trace the events after pollination that lead to seed formation
12. Identify (a) (b) (c) and (d) in the following table

Reproductive organ of Human	Function
1. Testes	1) Produces the hormone.....(a).....
2.(b).....	2) The womb in which the embryo develops
3. Cervix	3)(c).....
4.(d.).....	4) Arise from he testis and later join together to form ejaculatory duct.

13. List the physiological changes that arise at puberty in
 - human female
 - human male
14. Mention the psychological changes that are experienced by the adolescents.
15. Mention the fate of the thickened uterine lining in human of in case fertilisation does not occur.
16. Do you agree with the statement "A strong force of one billion Indians can achieve all the developmental goals and lot more"? Why/Why not?
17. Why is it that -
 - (i) Women acquire STIs more easity as compared to men?
 - (ii) Young women are more susceptible to acquire STIs as compared to men?



Notes



ANSWERS TO INTEXT QUESTIONS

24.1

1. Biological process by which organisms give rise to offspring of their own kind.
2. **Asexual** offspring produced by single individual **Sexual** two individuals are involved in producing offspring
3. Cell divides to give rise to two offspring while losing its own identity
4. New plants may arise and grow from roots, stems or leaves. e.g. *Bryophyllum*
5. (i) Undifferentiated mass of cells in culture medium (callus)
(ii) Genetic copy of the parent, e.g. Dolly – the cloned sheep.

24.2

1. It serves as reproductive organ of the plants.
2. **Self pollination** When pollen of the same flower on the stigma and then fertilizes the ovule of the same flower. **Cross pollination** Pollen from one flower falls on stigma of another flower of the same species to fertilize the ovule of The latter.
3. Fertilisation leading to seed formation for new generation of plants will not be possible.
4. Pollen grain forms a pollen tube and pollen grain nucleus reaches the ovule as pollen tube pushes through the pistil. The pollen nucleus fuses with nucleus of ovule.
5. Fertilized ovules develop into seeds which are capable of germinating into seedlings and subsequently growing into new plants.

24.3

1. (i) Stage of life at the age between 11 to 19 years when physical and physiological changes take place in the body is called adolescence.
(ii) The time period when changes occur that make human capable of reproduction.
(iii) Both male and female sex organs are in the same individual.



Notes

- (iv) Development of an embryo may occur upto an extent or upto completion inside the egg.
 - (v) Baby develops inside the mother's womb/ giving birth to young ones.
 - (vi) Developing embryo implanted in the uterus wall of the mother.
2. Testosterone and oestrogen
 3. Developing embryo
 4. (i) Embryo develops inside uterus
(ii) Sperms pass through these into ejaculatory duct
 5. Analysis case studies attempted by student incorporating knowledge gained on adolescence and puberty.

24.4

1. Human sperm and Human ovum "formation of zygote" "developing embryo" foetus in the uterus "born after development is complete"
2. FSH and LH

Hormone	Function
FSH	Egg mature
LH	Egg shed
Estrogen	Secondary sexual characters in female
Testosterone	Secondary sexual characters in male
Oxytocin	Uterine contractions for deliver the baby

24.5

1. Syphilis, Gonorrhoea, herpes, Chlamydia
2. IUCD – Copper T, Oral contraceptive pills, vasectomy in male/tubectomy in female, MTP.
3. (i) HIV – Human Immunodeficiency virus
(ii) AIDS – Acquired Immuno Deficiency Syndrome