

UNIT

20

REACHING THE AGE OF ADOLESCENCE



Learning Objectives

After the completion of this lesson, students will be able to:

- ◆ understand the body changes that take place during adolescence.
- ◆ differentiate the secondary sexual characteristics of boys and girls.
- ◆ know about the role of hormones in reproduction.
- ◆ explain the reproductive phases of life in human.
- ◆ understand the nutritional needs of adolescents.



Introduction

Growing up is a natural process that takes place in all living organisms. All living organisms grow up to maturity which is the ability to respond to a particular environment. Maturity along with experiences produces a progressive series of changes in an organism. These series of changes are called development. Different phases of human development are called developmental stages. Human developmental stages include infancy, childhood, adolescence, adulthood, middle age and old age. Among all these stages, adolescence is the most crucial and significant period in an individual's life. It is the period of transition from childhood to adulthood. This period starts at the age of about 10 to 13 and ends at the age of 19 (commonly known as teenage). Almost all of you would have entered this period now. In this lesson you are going to study about the changes that take place in you (which are normal) as you enter the age of adolescence. You will also study about the reproductive phases of human life, reproductive health, nutritional needs of adolescents and personal hygiene during adolescence.

20.1 Adolescence and Puberty

The term adolescence is derived from the Latin word 'adolescere' meaning 'to grow' or 'grow to maturity'. During this period changes occur in height, weight, sex organs, muscle mass as well as in brain structure and function. Biologically it is a physical transition marked by the onset of puberty and termination of physical growth in an individual.

20.1.1 Puberty

Puberty is a period of few years in which rapid physical; physiological and psychological changes occur resulting in sexual maturity. We can predict the sequence of physical changes that will take place but the age of beginning of puberty varies from individual to individual. The average age for the onset of puberty is 10 or 11 for girls and 12 or 13 for boys. But, factors like genetic and biological influences, life events, socio-economic status, nutrition and diet and the amount of body fat also affect the onset and progression of puberty.



Hormones play an important role at the time of puberty. Changes in hormones during this period trigger physical and behavioural changes. Sex hormones secreted at the time of puberty activate the male and female sex glands to produce necessary secretions in the body. The male sex glands, testes release the testosterone and the female sex gland, the ovaries release the estrogen. These result in changes in the primary and secondary sexual characteristics of the male and female.

20.1.2 Body changes at Puberty

Four important changes that occur during puberty transform the body of a child into that of an adult. These changes are:

- Changes in body size
- Changes in body proportion
- Development of primary sex characteristics
- Development of secondary sex characteristics

a. Changes in body size

The first major change at the time of puberty is growth which is the increase in body height and weight. It usually begins at the age of 10 to 12 in girls and 12 to 13 in boys. It is almost complete at around the age of 17 to 19 in girls and 19 to 20 in boys. During adolescence

both boys and girls add around 23 cm to 26 cm in the height. In addition to height, they also experience significant increase in weight. But increase in weight is influenced by various factors like diet, exercise and life style. The average weight gain during this period is about 17 kg to 19 kg. During this period, increase in fat is seen in girls in contrast to muscle development in boys.

b. Changes in body proportion

Certain body areas which are small proportionately grow big. This can be seen in feet and hands. During childhood, legs grow proportionately more than the trunk. But at the time of puberty trunk also lengthens. Also, trunk broadens at the hip and shoulder thus giving the adult proportion to the body.

Activity 1

Divide the students in your class into different groups (Form separate groups for boys and girls). Measure the height and weight of all the students in each group and find out the average. Record your observations in your notebook.

c. Primary sex characteristics

Reproductive organs of boys and girls become fully functional at the time of puberty. In boys, testes grow larger followed by that



Figure 20.1 Adolescent growth



length and size of the reproductive organ increase. Similarly, female reproductive organ also grows during puberty. Thus, the size of the uterus and the weight of the ovaries increase during this time.



Testes and ovaries are called primary sex organs of the male and female respectively.

20.2 Secondary Sex Characteristics

Secondary sex characteristics are the physical features which distinguish male from female. After the progression of puberty, boys and girls become dissimilar in appearance. The secondary sex characters are regulated by the hormones the testosterone or androgen secreted by the testes of the males and estrogen secreted by the ovaries of the females. Androgens cause the growth of the larynx, muscle development, skeletal size and distribution of body and pubic hair, and stimulation of sweat glands. Estrogen and progesterone are the female sex hormones. Estrogen stimulates the development of the breast, the external genitalia, pubic and axillary hairs, and the distribution of body fat.

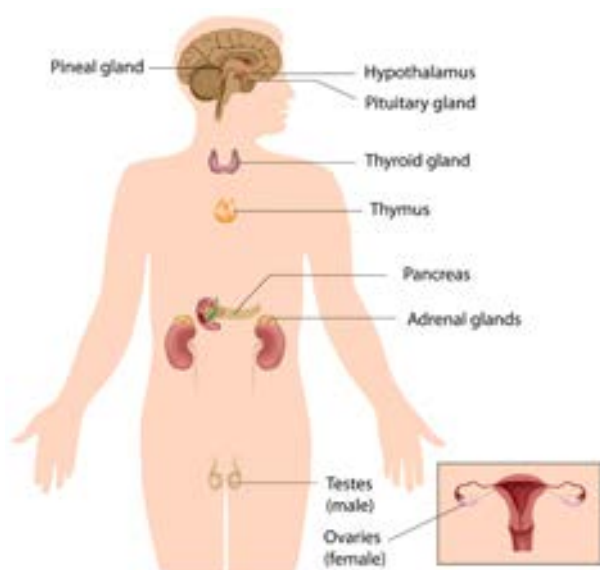


Figure 20.2 The endocrine system

20.2.1 Secondary Sex Characteristics of Boys

The following are the secondary sex characteristics of boys.

a. Hair

Immediately after the development of primary sex characteristics, pubic hair appears followed by axillary and facial hair.

b. Skin

The skin becomes coarse and the pores in the skin enlarge.

c. Glands

The oil producing glands in the skin enlarge and due to this acne may appear on the faces.

d. Muscle

The strength of the muscle increases and it gives shape to arms, legs and shoulders.

e. Voice

During this period voice changes occur and the voice becomes husky. Then its pitch drops and the volume increases.



At puberty, the growth of the larynx is larger in boys than that of girls. The growing voice box in boys can be seen as a protruding part of the throat called Adam's apple, so that the voice becomes deep and harsh. This is caused mainly by male hormone (regulatory chemicals) during adolescence. As a result of this, muscles (chords) attached to the cartilage get loosened and thickened. When air passes through these loosened and thickened chords a hoarse sound is produced. In girls larynx is hardly visible from outside because of its small size and the voice becomes high pitched.

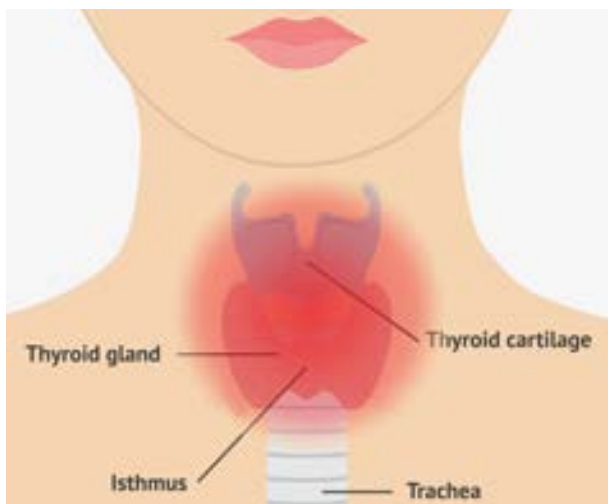


Figure 20.3 Adam's apple

20.2.2 Secondary Sex Characteristics of Girls

Girls show the following secondary sex characteristics at the time of puberty.

a. Hips

Due to the enlargement of the pelvic bone and the development of subcutaneous fat, the hip becomes wider and rounder.

b. Breast

After the enlargement of hips, the breasts begin to develop during this time.

c. Hair

Pubic hair appears followed by axillary and body hair on the limbs.

d. Muscles

Increase in muscles takes place which gives shape to shoulders, arms and legs.

e. Voice

Voice becomes shrill and voice breaks are rare among girls.

f. Skin

The skin becomes coarser and the pores enlarge as in the case of boys.

g. Gland

Oil producing glands become active causing acne on the face.



The secretions of sweat and sebaceous or subcutaneous glands (Oil glands) are very active during adolescence. Many adolescent boys and girls get pimples on face because of increased activity of these glands in the skin. Owing to extra secretions sometimes a distinctive odour is also produced from the bodies.

Table 20.1 Secondary sex characteristics in boys and girls.

Girls	Boys
Height and weight increase.	Height and weight increase.
Fatty and subcutaneous tissues develop.	Muscles develop.
Hip broadens.	Shoulder broadens.
Hair grows in arm pits and pubic area.	Hair grows in the arm pits and pubic area, and facial hair also appears.
Voice becomes shrill.	Voice break takes place due to lengthening of vocal cord and enlarging of larynx.
Breast develops.	Size of the penis increases.



Activity 2

Answer the following questions.

- Has your voice changed?
- Are there pimples or acne on your face?
- Do you feel that some changes have taken place in your body?

These changes are normal in your development. Discuss with your teacher or counsellor in your school and clarify your doubts.



20.3 Role of Hormones in Reproduction

The primary hormones that regulate reproduction are the steroids such as androgens, estrogens and progesterone which have masculinizing, feminizing and gestational effects respectively. These hormones are secreted from the gonads which are regulated by the anterior pituitary (adenohypophysis). In male and female, reproductive behaviour and reproduction are mainly under the control of LH (Luteinizing Hormone) and FSH (Follicle Stimulating Hormone). LH stimulates the testes to produce androgens, the male sex hormone. Sperms are then actively produced. In man sperm production starts at sexual puberty and may continue throughout his life.

Follicle Stimulating Hormone (FSH)

FSH in the female influences the development of the Graafian follicle and secretion of estrogens. In the male it is necessary for the development of seminiferous tubules, and for spermatogenesis.

Luteinizing Hormone (LH)

In the female, it is the hormone necessary for ovulation, and the secretion of the luteal hormone progesterone, and for the final maturation of the Graafian follicle. In the male it stimulates the interstitial (Leydig) cells of testes and the secretion of testosterone, and is referred to as the Interstitial Cell Stimulating Hormone (ICSH).



Estrogen is not a single hormone but a collection of related steroid hormones.

Prolactin (PRL) or Lactogenic Hormone

The main function of this hormone is milk secretion during lactation.

Oxytocin Hormone

Oxytocin causes expulsion of milk from the breast and it is also involved in the contraction of smooth muscles of uterus during child birth.

20.4 Reproductive phase of life in Human

Reproduction is more important for the continuation of human race. The phase in an individual's life during which there is production of gametes is called reproductive phase.



In females, the reproductive phase of life begins at puberty (10 to 12 years of age) and generally lasts till the age of approximately 45 to 50 years, and in males, it is from the age of 13 to life long. The reproductive age may vary from person to person. The following are the reproductive phases in the life of a female.

Menarche

The first menstrual flow begins at puberty and is termed menarche. The ova begin to mature with the onset of puberty. It is the beginning of adolescence, during which mental and emotional maturation occurs and physical growth becomes pronounced.

Ovulation

Ovulation occurs approximately 14 days before the next ovarian cycle commences. Thus in a 28 days cycle ovulation occurs about day 14. One ovum matures and is released by one of the ovaries once in about 28 to 30 days. The release of ovum from the ovary is called ovulation. During this period, the wall of the uterus becomes thick so as to receive the fertilized egg. This results in pregnancy.

Pregnancy

After ovulation the ovum reaches the fallopian tube and fertilization takes place.

The fertilized egg undergoes development and it is implanted in the uterus. The corpus luteum continues to grow and produces large amount of progesterone. This results in pregnancy. Normally, it lasts for 280 days, at the end of which parturition takes place.

Menstruation

If the ovum is not fertilized, the corpus luteum begins to degenerate and the production of hormones progesterone and estrogen ceases. The unfertilized egg and the thickened lining of the uterus along with its blood vessels are shed off. This causes bleeding in woman's reproductive tract which is called menstruation. Menstruation occurs once in about 28 to 30 days. It takes about 3 to 5 days. In some cases, initially menstrual cycle may be irregular. It takes some time to become regular. If it remains irregular for over a year, then it is better to consult a doctor.

Menopause

Menopause marks the end of the reproductive phase of a woman's life. At 45 to 50 years of age, the menstrual cycle stops. Stoppage of menstruation is termed as 'menopause'. During menopause psychological symptoms such as anxiety, irritability, fatigue and loss of concentration may occur. Menopause may be induced by surgical removal of the ovaries, or by pelvic irradiation in a woman of any age.



Now-a-days girls attain puberty at very early age. This is due to food habits. As you eat lot of junk food, the body growth increases and it looks like adults.

20.5 Menstrual Cycle

The beginning of the menstrual cycle marks the onset of puberty in human females. The menstrual cycle begins with the casting off of endometrial lining of the uterus and

bleeding. The casting of endometrium can be considered as periodic preparation for pregnancy. Menstruation occurs if an ovum released by the ovary of a woman is not fertilized during ovulation. This is described below.

1. When a girl reaches puberty at the age of about 10, the sex hormones released into her blood cause some of the ova (or egg cells) in her ovaries to become mature (or ripe).
2. Usually one mature ovum (or egg) is released from one of the ovaries into the oviduct once in every 28 days. This is called ovulation.
3. Before ovulation (or release of ovum), the inner wall of uterus becomes thick and spongy, and full of tiny blood vessels (or blood capillaries). It prepares itself to receive the fertilized ovum.
4. If the ovum does not get fertilized then the thick and soft inner lining of uterus is no longer needed and hence it breaks. So, the thick and soft inner lining of uterus along with the blood vessels and the dead ovum comes out of the vagina in the form of a bleeding called menstruation.

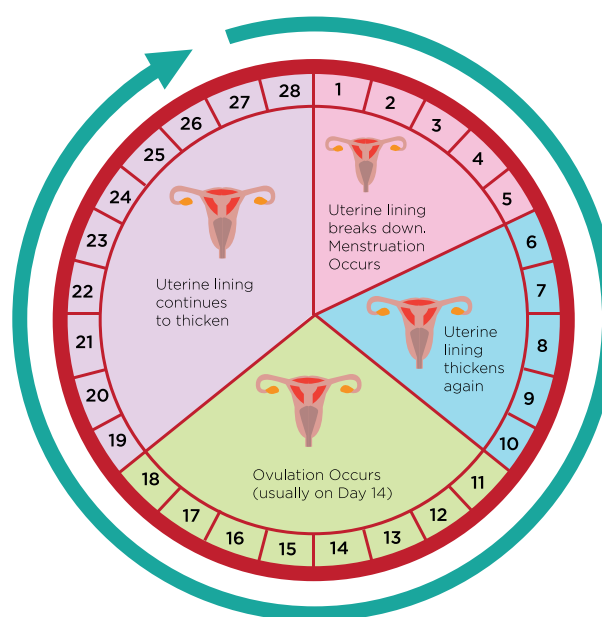


Figure 20.4 Menstrual Cycle



5. Menstruation usually occurs 14 days after ovulation and usually lasts for about 3 to 5 days.
6. After menstruation is over, the inner lining of the uterus starts building up again so that it may become ready to receive the next ovum.
7. If the ovum does not get fertilized even now, then menstruation takes place again. This cycle of menstruation is repeated again and again in women after every 28 days. The menstrual cycle is controlled by hormones.

Menstruation stops temporarily when the ovum gets fertilized and the woman gets pregnant. This is because, in this case the thick and soft lining of the uterus containing lot of blood vessels is needed for the growth and development of the fertilized ovum to form a baby. Menstruation restarts after the birth of the baby. Menstruation also stops due to nutritional deficiencies, low body weight, stress, eating disorder, excessive weight gain etc.

20.6 Reproductive Health

The physical and mental well-being of an individual is regarded as an individual's health. The World Health Organisation (WHO) has defined the reproductive health as the total well-being of behavioural, emotional, physical and social aspects of adolescence. To keep the body healthy, every human being, at any age, needs to have a diet, exercise and personal hygiene. The following are some of the measures that girls and boys need to take.

Cleanliness

1. Have bath once or twice a day, paying special attention to underarms, groins and genitals.
2. Change the underwear daily. It should be made of cotton and washed and cleaned everyday.

3. For teenagers, the increased activity of sweat glands sometimes enhances body odour. If cleanliness is not maintained there are chances of having fungal, bacterial and other infections.

Menstrual Hygiene

Girls should take special care of cleanliness during the time of menstrual cycle. Making use of disposable napkins or tampons may reduce chances of infections. First of all, girls should realize that menstruation is as natural as any regular physiological activities like breathing, drinking, eating, urinating and defecation. Girls are advised to use sanitary napkins or tampons rather than cloth. It should be changed frequently depending upon the menstrual flow. If a cloth is being used repeatedly, it should be cleaned with soap and hot water and dried in sunlight for reuse.



Sleep is vital to the well-being of adolescents. It can even help you to come out of the stress you experience during this period. During this period about 8 to 10 hours of sleep each night is necessary. But most teens do not have enough sleep which affects their physical and mental health.

Physical Exercise

Walking and playing in fresh air keeps the body fit and healthy. All young boys and girls should take a walk, exercise and play outdoor games. Physical activity leads to the conditions of better health, sound sleep and thereby mental peace. Mental peace promotes happiness in day to day existence.



Activity 3

Collect data on the number of students in your class who exercise regularly and who do not exercise regularly. Do you notice any difference in their fitness and health? Prepare a report on the benefits of regular exercise.

20.7 Nutritional needs of Adolescents

Adolescence is a stage of rapid growth and development. Hence a diet with proper calories and other nutrients is needed for proper growth and physical activity. Balanced diet is very much important during adolescence. Balanced diet includes proteins, carbohydrates, fats and vitamins in requisite proportions. Our Indian meal of roti / rice, dal (pulses), milk, fruits and vegetables forms a balanced food.

The nutritional deficiencies during this period not only retard the physical growth, but also impair the intellectual development and may also delay sexual maturation. A very good amount of proteins and carbohydrates is necessary during this growth period. Apart from that, adolescents need the following dietary components.

Minerals

Since there is an increase in skeletal mass and blood volume during adolescence, the body needs calcium, phosphorus and iron.

Calcium

Calcium intake needs to be increased to prevent osteoporosis in later life. It is present in milk and milk products or other equivalents.

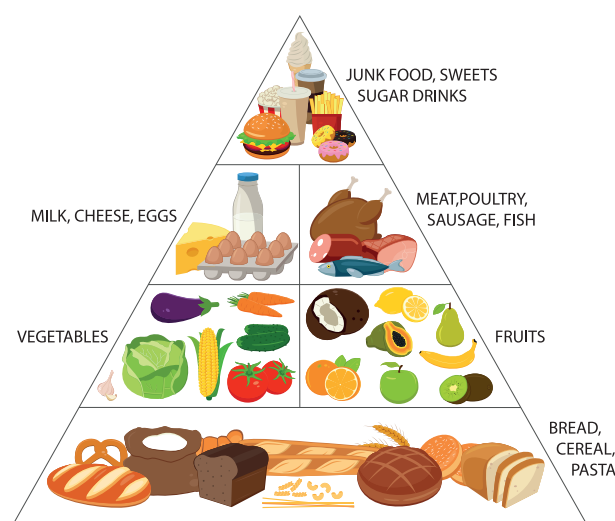


Figure 20.5 Balanced diet

Activity 4

Collect more information on balanced diet and prepare a chart. Display the chart in your class and discuss its importance.

Iodine

It helps to prevent thyroid gland related diseases.

Iron

Iron builds blood, and iron-rich foods such as green leafy vegetables, jaggery, meat, dates, fish, chicken, citrus, Indian gooseberry (Nelli) and whole pulses are good for adolescents. Lack of iron in the diet results in anemia. To make up for the loss of iron, adolescents need to have a diet rich in iron. In boys, iron deficiency occurs due to muscle spurt whereas in girls it occurs due to menstruation in addition to the muscular growth.



Women should take in more iron in their diet regularly to make up for the loss of blood during menstruation.

20.8 Personal hygiene for Adolescence

During adolescence, growing children need special attention towards diet, exercise and personal hygiene. Personal hygiene is a clear indicator of man's personality. Personal hygiene starts from the hair tip and ends down at the toes. Personal hygiene habits for the adolescence are as follows.

1. Shower or bath daily.
2. Always wash your hands before and after meals.
3. Keep finger nails clean and avoid nail polish.
4. Wash your teeth and mouth before and after each meal.

5. Avoid touching your face, nose or mouth while preparing food.
6. Avoid coughing or sneezing around food. Close your mouth by using hand kerchief while you cough in public places.
7. If you want to taste the food, use a clean spoon.
8. Change your clothes regularly and wash them cleanly, especially undergarments.
9. Do not defecate in open field. Use clean toilets for defecation.
10. If you are not well, avoid self-medication and consult a doctor.



Activity 5

Answer the following questions.

- Do you exercise regularly?
- Do you keep yourself clean?
- When do you go to bed?
- When do you get up?

Compare your response with that of your friends. Do you think you need to change yourself? Discuss with your teacher.

Points to Remember

- Adolescence is the period of reproductive maturity which lies usually between the ages of 11 to 19 years.
- Voice of boys becomes harsh as chords of voice box get loosened and thickened during adolescence.
- Hormones are the secretions of endocrine glands without ducts which secrete them directly into the bloodstream.
- Testosterone is the male hormone and estrogen is the female hormone that bring about development of several secondary sex characters.
- The uterine wall in female prepares itself to receive the developing fertilized eggs. In case there is no fertilization, the thickened lining of the uterus wall breaks down and goes out of the body along with the blood. This is called menstruation.
- It is important to take balanced diet for the overall growth and development during adolescence.

A-Z GLOSSARY

Adam's Apple	The protruding part of the throat.
Adolescence	The period of transition from childhood to adulthood.
Gland	Group of cells which secrete hormones.
Hormones	The chemical substances secreted in the body.
Menarche	The first menstrual flow at puberty.
Menopause	The stoppage of menstruation.
Menstruation	Bleeding in the reproductive tract of women.
Ovulation	The release of ovum from the ovary.
Primary sex characters	The characters which refer to changes in sex organs.
Puberty	The period at which an organism attains sexual maturity.
Secondary sex characters	The characters which help to distinguish the male from the female.



TEXTBOOK EXERCISES



I. Choose the best answer.

- Adolescence is the period of life between _____ years of age.
a) 10 to 16 b) 11 to 17
c) 11 to 19 d) 11 to 20
- The period at which an organism attains sexual maturity is called _____.
a) puberty b) adolescence
c) growth d) maturity
- During puberty, the region below the waist become wider in _____.
a) boys b) girls
c) Both a and b d) None of these
- Adam's apple is the growth of the _____.
a) pharynx b) thyroid
c) larynx d) parathyroid
- Many adolescent boys and girls get pimples on face, due to the secretions of _____ gland.
a) sweat
b) sebaceous
c) sweat and sebaceous
d) None of these
- The sperm is produced by _____.
a) penis b) ovary c) uterus d) testes
- _____ are the chemical substances, secreted by endocrine glands.
a) Hormones b) Enzymes
c) Proteins d) Fatty acids
- Androgen production is regulated by _____.
a) GH hormone b) LH hormone
c) TSH hormone d) ACTH hormone

- During menstruation, the progesterone level is _____.
a) decreased b) increased
c) ceased d) normal
- _____ intake needs to be increased to prevent osteoporosis in later life.
a) Potassium b) Phosphorus
c) Iron d) Calcium

II. Fill in the blanks.

- _____ is secreted by the ovaries of female.
- The hormones secreted by the gonads are controlled by _____.
- Milk secretion during lactation is controlled by _____ hormone.
- The male and the female gamete fuse together and form _____.
- The first menstrual flow begins at puberty and it is termed as _____.
- _____ usually occurs 14 days after ovulation.
- _____ includes protein, carbohydrates, fats and vitamins in requisite proportion.
- _____ helps to prevent thyroid gland related diseases.
- Iron deficiency leads to _____.
- In women fertilization takes place at _____.

III. State true or false. If false, correct the statement.

- There is a sudden increase in the height of both boys and girls during puberty.

2. The release of ovum from the uterus is called ovulation.
3. During pregnancy, the corpus luteum continues to grow and produces large amount of estrogen and progesterone.
4. Making use of disposable napkins or tampons may increase the chances of infections.
5. Using clean toilets for defecation is a good practice.

IV. Match the following.

Puberty	Testosterone
Adam's apple	Muscle development
Androgen	at 45 to 50 years of age
ICSH	Sexual maturity
Menopause	Change in voice

V. Answer briefly.

1. What is adolescence?
2. List out the changes which occur during puberty.
3. What do you mean by secondary sex characteristics?
4. What is fertilization?
5. Explain Menarche.
6. Explain the process of pregnancy.
7. Explain the importance of cleanliness during the time of menstrual cycle in girls.
8. How is adolescence differ from childhood?

VI. Answer in detail.

1. What are the physical changes that occur in boys and girls during adolescence?
2. Explain the role of hormones in reproduction.

3. Briefly describe the menstrual cycle.
4. Explain the nutritional needs of adolescence in brief.

VII. Higher Order Thinking Questions.

1. What can you suggest to your classmates to keep himself / herself clean and healthy?
2. Adolescence is the energistic stage. What health and good habits you want to develop?



REFERENCE BOOKS

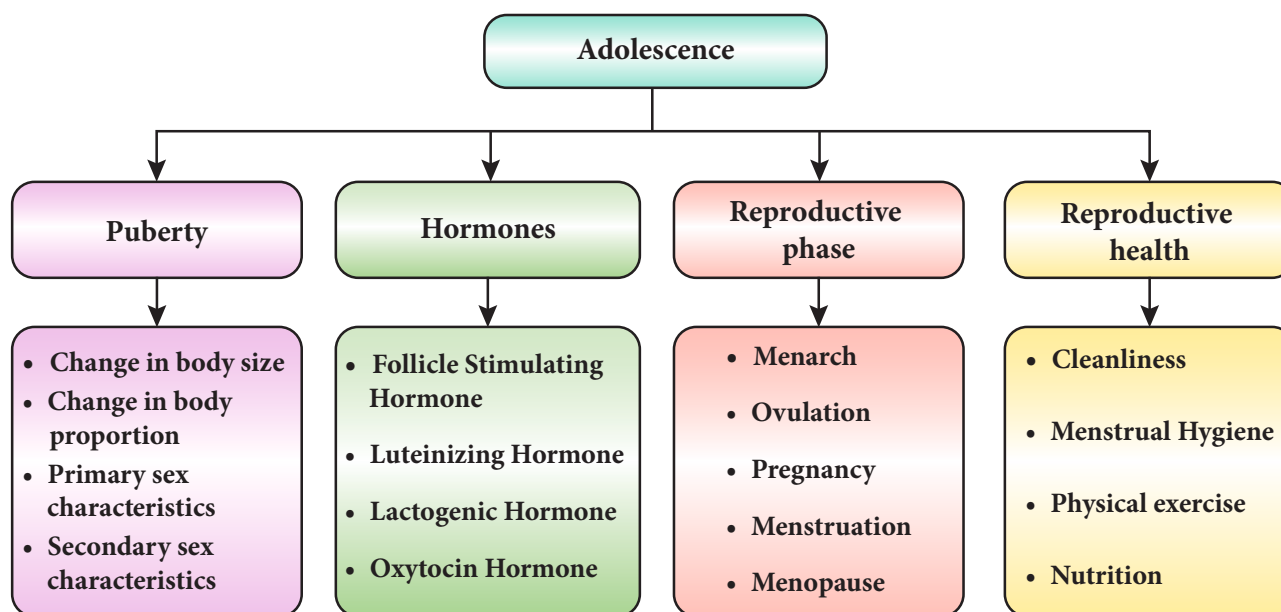
1. Animal physiology Verma P.S and Agarwal, V.K. and Tyagi B.S. S.Chand and Company, New Delhi.
2. Text book of Human Physiology. Saradha Subrahmanyam K., Madhavankutty K. and Singh H.D
3. Animal Physiology. Foundations of Modern biology series. Knut Schmidt and Nielsen.
4. K. Chinthanaiyalan (2013). Psychological effects of puberty and growth spurt in adolescents. GCTE Journal of Research and Extension in Education. Vol. 8 (2). 5 – 10.
5. Rastogi S.C. Essentials of Animal Physiology – Third Edition 2001.



INTERNET RESOURCES

1. <https://eadership.ng/2018/04/08/toilet-hygiene>
2. <https://www.boldskey.com/health/wellness/2018/world-menstrual-hygiene-day-9-basic-menstrual-hygiene-tips-122728.html>
3. <https://www.boldskey.com/health/wellness/2018/world>

Concept Map



ICT CORNER

Adolescents

Through this activity you will learn about the age of adolescents.



Step 1 Open the Browser and type the URL given below

Step 2 You will see the pop up screen. You will see the video links of hormones, menstrual cycle etc...

Step 3 Click the Hormones video link. You will see the video.

Step 4 Likewise, you can see all the videos by clicking the links



Step1



Step2



Step3



Step4

Browse in the link:

<https://www.ticklinks.com/Domain/Open-Links-Library/Course/53/SSC-TN---Class-VIII/Subject/210/Biology/Classic/All/Links/Search>

*Pictures are indicatives only.

*If browser requires, allow Flash Player or Java Script to load the page.

