Biology Notes

Topic: Sex hormones, birth control and sexually transmitted diseases

Objectives:

At the end of these topics, the students should be able to:

1. ***Identify the three main sex hormones found in humans.***
2. ***Describe the role of estrogen and progesterone in the menstrual cycle and in pregnancy.***
3. ***Describe the role of testosterone and estrogen in the development and regulation of the secondary sexual characteristics.***
4. ***Explain the meaning of birth control.***
5. ***Name the four main methods of birth control.***
6. ***Describe the social and population aspects of birth control.***
7. ***Describe the social implications of artificial insemination.***
8. ***Explain the meaning of sexually transmitted disease.***
9. ***Describe the symptoms, signs, effects and treatment of gonorrhoea and syphilis.***
10. ***Describe the methods of transmission of the human immuno-deficiency virus (HIV).***
11. ***Outline the ways in which HIV can be prevented from spreading.***

Sex hormones

A **hormone** is a chemical substance, which is produced in one part of the body and has an effect in another part. They are known as **chemical messengers** and are produced in special organs called **glands**. **Sex hormones** are a special group of hormones produced by the reproductive organs and are involved in the process of reproduction. The three main sex hormones are **estrogen**, **progesterone** and **testosterone**.

Estrogen and progesterone are the **female sex hormones**. Estrogen is produced by the ovaries and is responsible for the **development and maintenance of the female secondary sexual characteristics**. Progesterone is also produced by the ovary and is concerned with the **maintenance of pregnancy**.

Testosterone is the **male sex hormone**. It is produced by the testes and is responsible for the **development and maintenance of the male secondary sexual characteristics**.

Estrogen and progesterone in the menstrual cycle and in pregnancy.

The menstrual cycle is a series of changes which occur in the female reproductive system. The cycle normally lasts about 28 days but may vary from person to person. Both estrogen and progesterone are involved in the menstrual cycle.

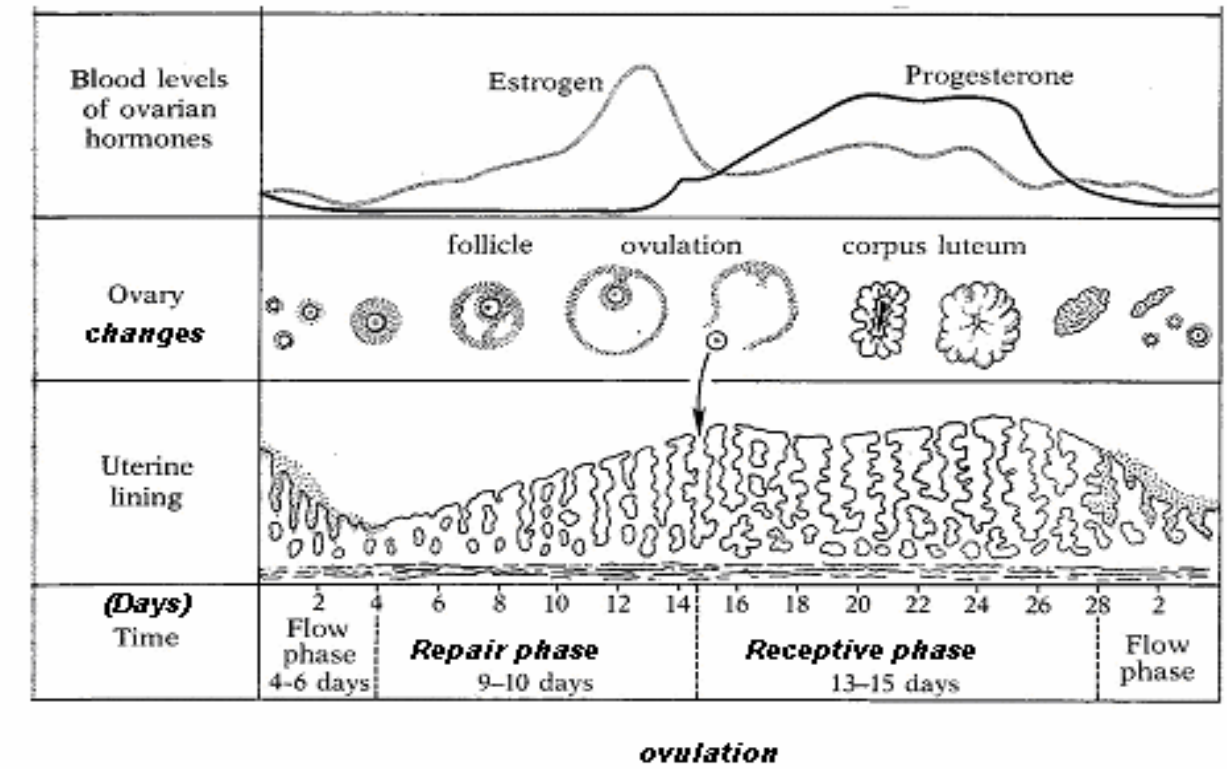
The cycle begins with **menstruation** which is when the lining of the uterus breaks down and is shed from the body. This is commonly called the ‘period’. Menstruation normally lasts for about 5 days after which the lining begins to rebuild again. Also during this time an immature egg in the ovary begins to develop. As it develops, it becomes enclosed in a protective structure called the **Graafian follicle** which gradually gets larger and becomes

hollow. It is estrogen that causes the lining of the uterus to repair itself after menstruation as well as the development of the egg (ovum) in the ovary.

At about mid-cycle (day 14), the egg is fully mature and is released from the Graafian follicle into the fallopian tube. In terms of hormone concentration in the blood, one should therefore see a gradual increase in the concentration of estrogen between days 1 and 14 of the menstrual cycle with the greatest increase occurring just before ovulation.

Following ovulation the Graafian follicle is transformed into solid object called the **corpus luteum** (yellow body). It now begins to produce progesterone while the production of estrogen sharply decreases. The production of progesterone is to prepare the uterus for pregnancy as well as to maintain it in a pregnant state during the period of **gestation**. If, however, the egg does not get fertilized (i.e. no pregnancy occurs), the **yellow body** withers away and the two hormones stop being produced: as a result the lining of the uterus breaks down and menstruation occurs.

The diagram below shows the changes in the levels of estrogen and progesterone as well as the ovary and the lining of the uterus during a typical menstrual cycle.



If, however, conception occurs, the menstrual periods stop until after the baby has been born. In fact, the sign that a woman is pregnant is that she will miss her usual 'period'. The presence of an embryo in the uterus causes the corpus luteum to continue to enlarge and to continue to produce progesterone. As a result, the lining of the uterus remains intact, and continues to thicken and build itself up. So progesterone prevents menstruation and at the same time stops any further eggs being produced by the ovaries.

Sex hormones and the secondary sexual characteristics

The primary sexual characteristics are those features that a person is born with and which distinguishes a male child from a female child i.e. the penis and the vagina. However, as a child enters puberty, at around age 11 -15, certain changes begin to take place in the body. These changes are brought about by the sex hormones and are called **secondary sexual characteristics**.

The following chart shows the various changes at puberty in males and in females.

Male secondary sexual characteristics	Female secondary sexual characteristics
Enlargement of penis	Enlargement of vagina
Growth of testes and sperm production	Growth of ovaries and egg production
Growth of pubic hair (under arm, genitals	Enlargement of uterus and the beginning of menstruation
Skin becomes more oily (acne may develop)	Skin becomes more oily (acne may develop)
Growth of hair on face and chest	Growth of pubic hair (under arm, genitals)
Broadening of shoulders	Broadening of hips
Breaking of voice	Growth of breasts
Development of muscles	

The hormone that is responsible for bringing about the changes in males is testosterone while estrogen brings about the changes in females.

Birth control

Birth control, contraception or family planning is any method used by a person to prevent pregnancy or conception. All the various methods of birth control fall into four main categories – natural, chemical, mechanical and surgical.

Natural methods include abstinence, the rhythm method and withdrawal.
Chemical methods include the use of the pill and spermicides.
Mechanical methods include the condom or sheath, diaphragm or cap and the intra-uterine device (IUD or coil).
Surgical methods involve vasectomy and tubal ligation.

The table below summarizes the main features of each method of contraception.

Type of birth control	How it works	Sex of person using this method	Relative effectiveness
Natural methods Abstinence	No form of sexual intercourse	Both sexes	100%

Rhythm method	Abstain from sexual intercourse during the fertile period i.e. days 8 – 18.	Both sexes	75%
Withdrawal method (Coitus interruptus)	Penis withdrawn from vagina before ejaculation	Male	80%

Type of birth control	**How it works**	**Sex of person using this method**	**Relative effectiveness**
Chemical methods			
Pill	Prevents ovulation from taking place. Must be taken daily without fail. Health risks if overused e.g. heart attack and stroke	Female	99%
Spermicide	Sperm destroyed in the female tract. Not very effective when used alone.	Female	70%
Mechanical methods			
Condom	A latex rubber sheath which covers the penis to prevent sperms from entering the vagina. Useful in preventing the spread of sexually transmitted diseases. Some people are allergic to latex and some argue that it reduces sensitivity during intercourse. Condoms may also break if put on incorrectly.	Male	90%
Diaphragm	A latex rubber cap which blocks the cervix to prevent sperms from entering the uterus to meet the egg. Best if used along with spermicides.	Female	85%
Intra-uterine device	A coiled device that is inserted into the uterus by a medical practitioner and remains there for up to three months. Prevents the implantation of the embryo.	Female	98%

Surgical methods Vasectomy	Male vas deferens (sperm duct) cut so no sperms are released in the ejaculate. Permanent method which cannot be easily reversed.	Male	99.96%
Tubal ligation	Female fallopian tube cut so no ova can pass to meet the sperm. Permanent method which cannot be easily reversed.	Female	99.85%

Social and population aspects of birth control

Birth control helps couples to plan their family in such a way so that there is adequate spacing between births. This will go a long way in ensuring better standards of nutrition and health since parents will be able to provide more care, attention and financial support. Birth control also helps to cut down on the rate of population increase hence allowing governments to provide a better standard of living for its citizens.
There are persons, however, who are opposed to any form of birth control but are more comfortable with the natural methods. All shades of opinions exist and it is up to each person to make a value judgment as to what he or she thinks is best.

Artificial insemination

Artificial insemination (AI) is a process by which sperms from a male donor is artificially injected into a female recipient to make her conceive. This is common among infertile couples who, after all proper tests, are unable to have a baby other than by AI. There are two types of artificial insemination – the use of sperm from the husband and using the sperm from an unknown donor.

Infertility clinics, and especially those carrying out AI, are organized to maintain strict confidentiality. The name of the donor is kept secret from the recipient and that of the recipient from the donor. This may present a crisis of confidence between the donor and his future (or his present) wife. The problem for the unmarried donor is that his future wife may not be able to accept his past actions.

A baby born to a mother with sperm from an unknown donor should, at birth, be registered in the mother's name only with the father's name left blank. This implies that the child is illegitimate. However, babies born within marriages are deemed to be legitimate, and furthermore if intercourse continues within the marriage, there is no knowing whether the child is the husband's or not.

One danger of artificial insemination is that the baby may be born abnormal but this is no greater a risk than with normal babies. The screening of donors however, ensures that there is no danger from the passing on of sexually transmitted diseases. In the unlikely event of infection occurring antibiotic treatment is given.

The moral questions raised by artificial insemination by an unknown donor are numerous. They are summarized in this quotation from a leading theological expert at a symposium on artificial insemination held in London in 1972.

"It is a matter for serious concern that a new medical practice, grounded upon scientific research and upon a high value put on truth, should in fact result in, and to some extent require , deceit and uncertainty. The secrecy involved in AI obliges the practitioner, the husband and wife to conspire together to deceive the child and society as to the child's true parentage and his genetic identity. Trust is violated, credibility is undermined, and this is a serious ethical matter."

Sexually transmitted diseases

Sexually transmitted diseases (STD), also called venereal diseases (VD) are infections that are usually transmitted from one person to another by sexual intercourse. There are many disease that fall into this category but the most common are gonorrhoea, syphilis and HIV infection.

Gonorrhoea

Caused by: bacteria called Neisseria gonorrhoea
Symptoms (that which can be felt): painful or burning sensation upon urinating, painful joints, feeling of illness.
Signs (that which can be seen or measured): yellow pus-like discharge from genitals, swollen joints.
Effects: sterility, arthritis, heart disease and blindness if left untreated
Treatment: A single large injection of penicillin (an antibiotic).

Note: If a pregnant woman gets gonorhoea, her baby may become infected as it passes through the vagina during birth. As a result it may develop very sore eyes which, if untreated, can lead quickly to blindness. An antiseptic swab is therefore applied to the eyes of such babies at birth.

Syphilis

Caused by: bacteria called Treponema pallidum
Symptoms: feeling of illness
Signs: hard, red, painless ulcer/sore at site of infection which heals within a month, body rash following the disappearance of the sore, mild fever
Effects: brain damage / insanity, blindness, heart disease, deafness, death.
Treatment: with the antibiotic, penicillin.

Note: If a pregnant woman has syphilis, the germs are likely to pass across the placenta into the baby's bloodstream. As a result the baby may be born dead (stillborn) or it may be born with the disease and become crippled with it later. Nowadays all pregnant women have their blood tested to make sure that it does not contain any syphilis germs.

Human immuno-deficiency virus (HIV)

The human immuno-deficiency virus or HIV is the virus that causes Acquired Immune Deficiency Syndrome (AIDS). AIDS reduces the efficiency of the white blood cells and its resistance to infection, so a person with this condition easily becomes infected with many kinds of germ. The AIDS patient tends to get enlarged lymph nodes and also a particular kind of cancer which affects the skin.

Methods of transmission of HIV

- having sexual intercourse with someone who has the virus
- coming into contact with infected blood through sharing of drug needles or through blood transfusion
- to a child in the womb from an infected mother
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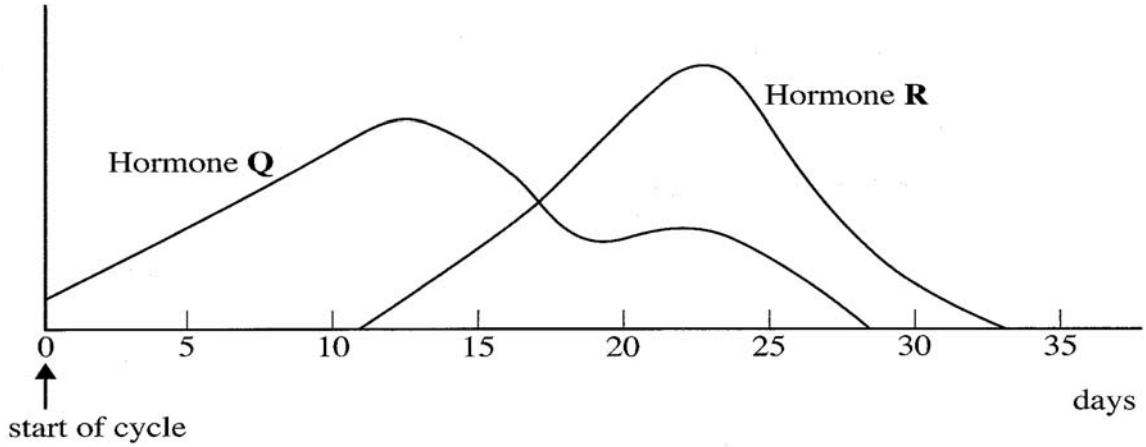
Ways to prevent the spread of HIV

- avoid sexual contact with infected persons
- use a condom during sexual intercourse
- avoid the sharing of needles if involved in drugs
- health practitioners should ensure that transfused blood is properly screened
- pregnant women should ensure that they are tested early in their pregnancy so that the necessary precautions can be taken.

Questions

1. The graph below shows the concentration of hormones in a female's body during the menstrual cycle. Copy the graph then answer the questions which follow.



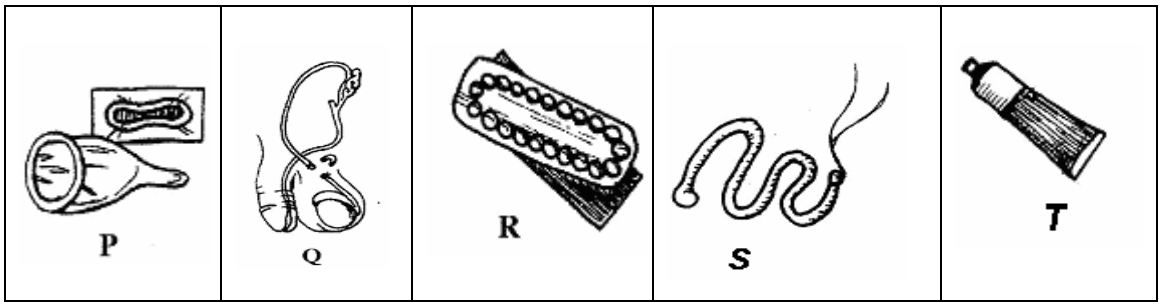
Menstrual Cycle

(a) (i) Use each of the letters given below, to identify on the graph above, any time during the month when the events indicated could take place.
P pregnancy could begin
L the lining of the uterus is repaired
C the corpus luteum shrinks (3)

(ii) Name the hormone **Q** on the graph and state ONE of its functions. (2)

(b) (i) Add a line to the graph to show how the level of hormone R would change, if fertilization took place. (1)
(ii) Explain briefly what happens to the zygote after fertilization. (2)
(iii) State TWO ways in which a woman could know she is pregnant, without taking a pregnancy test. (2)

2. The diagrams show various forms of contraceptives.



(a) (i) Name the contraceptive shown in each picture P, Q, R, S and T. (5)
(ii) Write down the letter of a method which is **surgical** and one which is **chemical**. (2)
(iii) Give ONE advantage and ONE disadvantage of method P. (2)
(b) Give the letter of the contraceptive shown which protects the individual for the longest period of time after application? (1)
(c) State another reason, other than contraception, which makes P commonly used. (1)
(d) Name TWO contraceptive devices which are made of latex (rubber). (2)
(e) Why is the rhythm method of contraception unreliable? (2)
(f) State ONE advantage and ONE disadvantage of tubular ligation (tying the tubes). (2)
(g) The table summarizes some common sexually transmitted diseases (STDs) Copy then fill in the blanks to complete the table.

STD	Caused by	Treatment
AIDS		three drug combination cocktail
Gonorrhoea	bacterium	
Syphilis		penicillin injections

(3)