

16

Human Sexual Reproductive System

The human sexual system is made up of parts that help to pass on hereditary information (the transfer of genetic information from one generation to another). That is, to produce offspring. It requires both male and female reproductive systems to produce sperms and egg cells respectively. The nuclei of a sperm and egg fuse together to produce the next generation. Fusion of the male and female sex cells is known as fertilisation.

- Types of reproduction (16.1)
- Puberty (16.2)
- Male and female reproductive systems (16.3)
- The egg and the sperm (16.4)
- The menstrual cycle (16.5)
- Fertilisation, implantation, amnion, placenta and umbilical cord (16.6) **Extension Knowledge**
- Birth control and the world population (16.7)
- Sexually transmitted infections (STI) (16.8)



Scan the QR code with your mobile device to access the online resources available.

<https://eph.page.link/8914972>

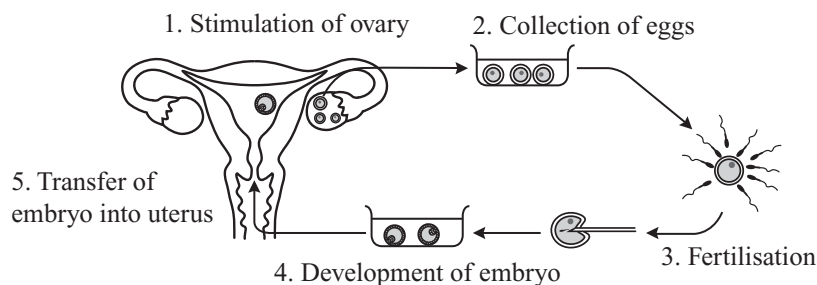


Figure 16.1 In some individuals, natural fertilisation is difficult and they may turn to assisted reproduction to help them produce their offspring. One example of assisted reproduction is in-vitro fertilisation (IVF). In IVF, sperms and eggs are collected and fusion takes place in a petri-dish. Fertilised eggs are then transplanted into the mother's uterus for the embryo to develop into a foetus.

16.1 Types of Reproduction

1. There are two types of reproduction: sexual and asexual reproduction.
2. Asexual reproduction results in the production of genetically identical offspring from one parent.
3. Examples of asexual reproduction includes budding of yeasts and binary fission in bacteria. Animals such as the whipped-tail lizards also undergo asexual reproduction, producing genetically identical female lizards.
4. The benefit of asexual reproduction is that genes encoding for advantageous traits are passed down to the next generation.
5. However, any changes in the environment may lead to the species being wiped out as there is little variation in the population, since they are all genetically identical.
6. Sexual reproduction involves fusion of nuclei of sperm and egg cell to form a zygote and produces genetically dissimilar offspring.
7. Sexual reproduction increases variation in the population and increases the chances of the population surviving in the event of an environmental change.

Note

A chromosome is a thread-like structure made up of proteins and a long DNA molecule within a cell nucleus. Most organisms that reproduce asexually are haploid (having a single set of chromosomes). Sexually producing organisms are diploid (having two sets of chromosomes, one from each parent).

16.2 Puberty

1. Puberty is the time in life when a boy or a girl becomes sexually mature.
2. Puberty occurs between ages 10 and 14 for girls and between ages 12 and 16 for boys.
3. Puberty causes **physical changes** and affects boys and girls differently.
4. The physical changes in boys:
 - (a) Facial, body and pubic hair grows.
 - (b) Reproductive organs grow larger.
 - (c) Testes begin to produce male hormone and sperms.
 - (d) Shoulders grow wider and the body becomes more muscular.
 - (e) Voice cracks and becomes deeper.

5. The physical changes in girls:
 - (a) Hair grows in the armpit and pubic regions.
 - (b) Menstruation begins; ovaries begin to release eggs.
 - (c) Hips become rounder and wider.
 - (d) Breasts develop.

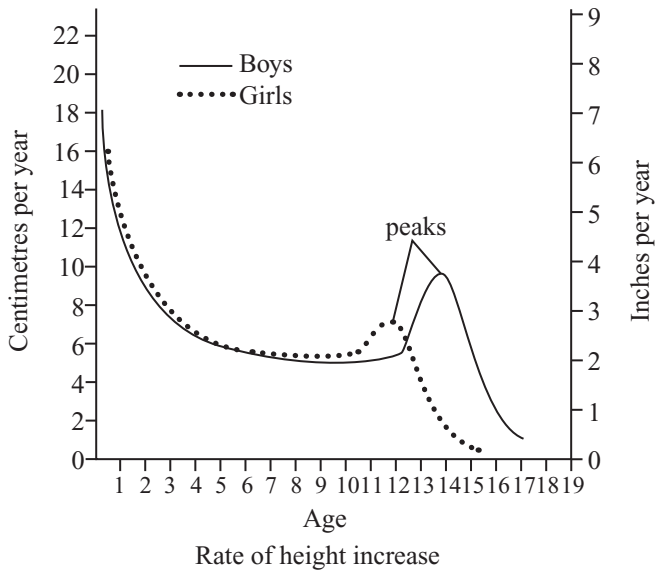


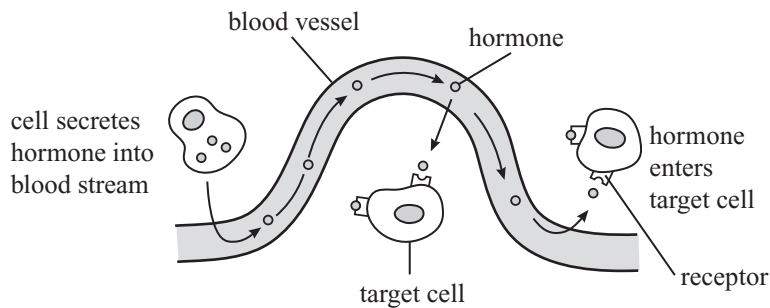
Figure 16.2 During puberty growth spurt, boys gain up to about 10 cm per year while girls gain up to about 7 cm per year.

Note

Hormones are the chemical messengers that are secreted by specialised cells. They travel in our bloodstream to distant tissues and organs to maintain homeostasis (the state of steady internal conditions). Examples:

Insulin and glucagon are hormones secreted by the pancreas to control blood sugar level.

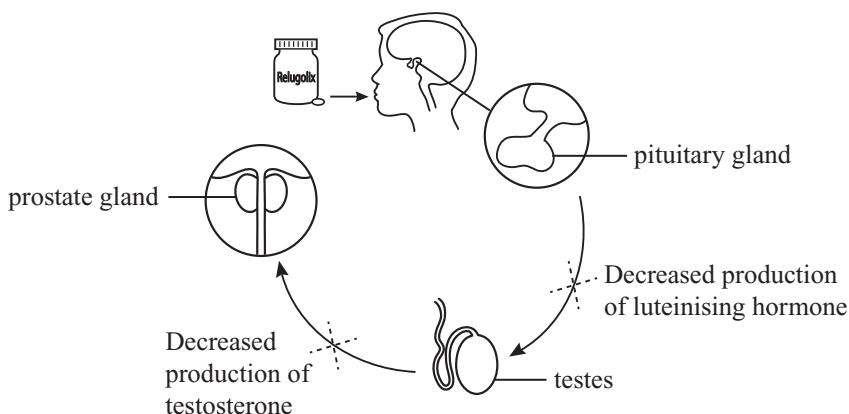
Oestrogen and progesterone are secreted by ovaries to prepare for possible pregnancy.



Hormones travel through bloodstream from secreting cells in glands to bind to receptors present on target cells.

16.3 Male and Female Reproductive Systems

One cancer that occurs among men is prostate cancer. Prostate cancer occurs in the prostate which is a small walnut-shaped gland below the bladder in men that produces the seminal fluid that nourishes and transports sperm. To treat prostate cancer, hormone therapy can be adopted. The goal of hormone therapy is to reduce levels of male hormones also called androgens (e.g. testosterone) so as to stop them from fueling the prostate cancer cells.



Science behind Healthcare

Figure 16.3 Relugolix is a drug used in the treatment of prostate cancer. It binds to receptors in the pituitary gland blocking the gland from making a type of hormone that stimulates the testicle to release testosterone.

1. Main structures of the male reproductive system:

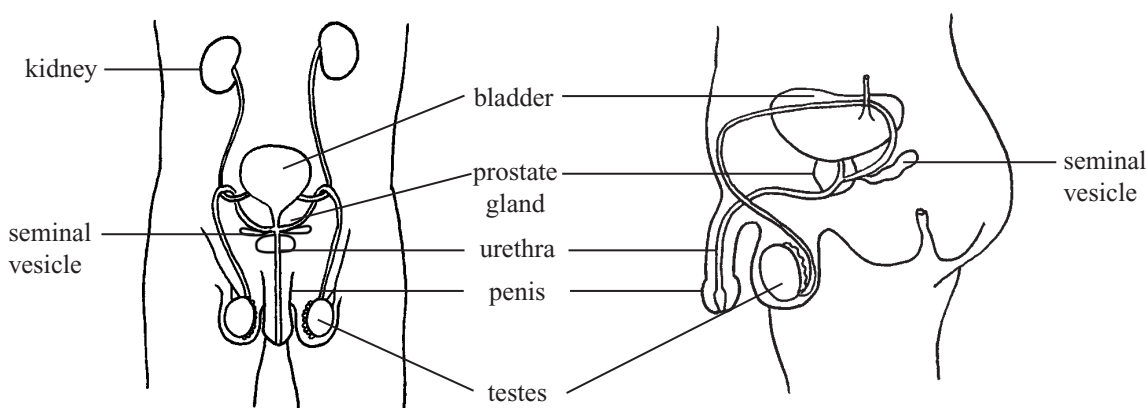


Figure 16.4 The male reproductive system (not including the kidneys which remove wastes from blood and the bladder which is a hollow organ that stores urine)

2. Functions of the parts of the male reproductive system:

Structure	Function
Scrotum	A pouch-like sac of skin that contains the testes. Holds the testes outside the body at a lower temperature for optimal sperm production
Testis	An oval-shaped organ that produces male sex hormone (called testosterone) and sperms
Sperm duct	A long muscular tube that transports mature sperms to the urethra
Urethra	A tube that carries urine from the bladder to outside of the body and expels semen
Penis	Made up of erectile tissues and blood vessels. Blood vessels fill with blood when aroused and penis becomes erect. Penis deposits semen into the vagina.
Prostate gland	Produces seminal fluid that provides nutrients to the sperms. Nutrients are required for the sperms to swim. Seminal fluid mixes with sperm to form semen.

Table 16.1 Functions of parts of the male reproductive system

3. Main structures of the female reproductive system:

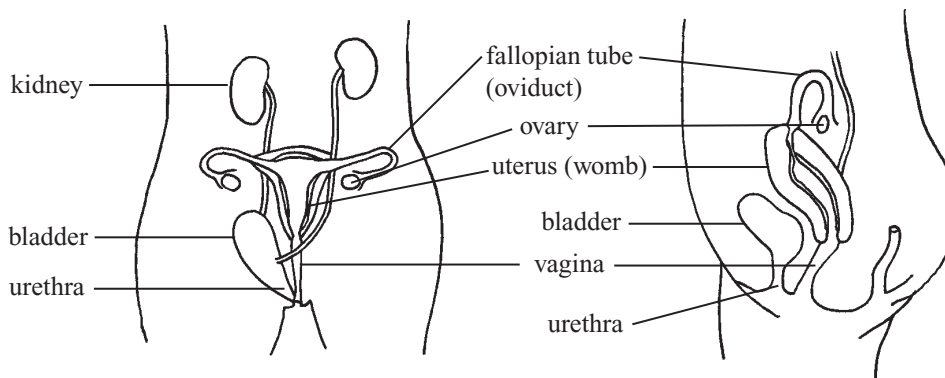


Figure 16.5 The female reproductive system (not including the bladder, kidneys and urethra)

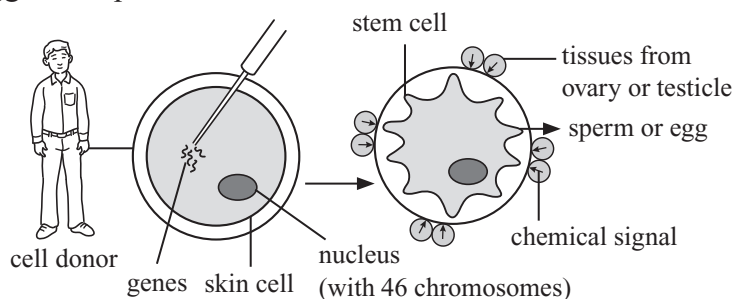
4. Functions of the parts of the female reproductive system:

Structure	Function
Ovary	Organ that holds thousands of immature eggs since birth. Releases a mature egg/ovum (ovulation) into the fallopian tube every month and produces female hormones, oestrogen and progesterone. Oestrogen causes growth and repair of the uterine lining while progesterone triggers the uterine lining to accept a fertilised egg.
Fallopian tube (oviduct)	A tube that collects the mature egg and the place where fertilisation of the egg occurs.
Uterus (womb)	Has a uterine lining onto which a fertilised egg implants itself and a place where the fertilised egg develops into a baby throughout the pregnancy.
Vagina	A passage through which a baby passes and exits during birth
Cervix	Passageway for sperms to enter the uterus and prevents bacterial infection of the uterus. Helps to hold the foetus in the uterus during pregnancy.

Table 16.2 Functions of the parts of the female reproductive system

16.4 The Egg and the Sperm

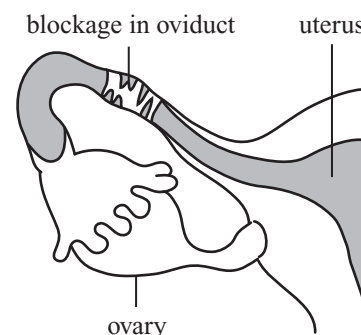
In 2007, two Japanese biologists showed that a normal human cell such as a skin cell can be turned into a stem cell. This can be done by injecting genes which generate proteins that transform the skin cell into a stem cell. These cells called iPSCs (induced pluripotent stem cells) are now being studied for growing human organs such as pancreases and kidneys outside the body for organ transplant. In principle, iPSCs should also be able to form eggs and sperm.



Science behind Healthcare

Emerging technology

Figure 16.7 A skin cell is injected with genes that transform it into a stem cell capable of becoming any kind of specialized cell, including an egg or sperm. Ovarian or testicular tissues are then used to send chemical signals to send transformation instruction that halves the number of chromosomes from 46 in the stem cell to 23.



Science behind Healthcare

Figure 16.6 When the cilia are damaged or the fallopian tube is blocked due to scar tissue, the fallopian tube will not be able to move the fertilised egg to the uterus leading to failure in achieving pregnancy. If the damage is minimal, a doctor can perform a surgery to open the fallopian tube. If the fallopian tube is blocked by a large amounts of scar tissue, then the fallopian tube may have to be removed.

1. The nucleus of a normal human cell contains **23 pairs** of chromosomes (46 chromosomes). They are called diploid cells.
2. The **egg** is the **female gamete** while the **sperm** is the **male gamete**.

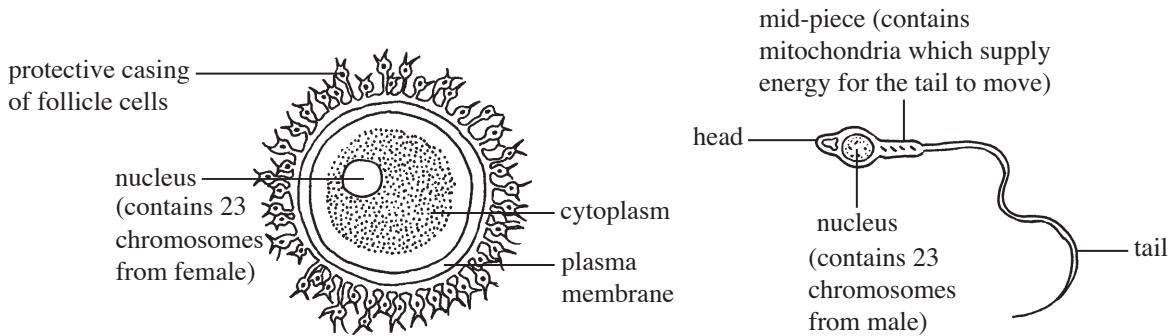


Figure 16.8 An egg cell (ovum) and a sperm cell

3. Differences between the egg and sperm:

Egg	Sperm
Only one egg is released every 28 days or per menstrual cycle.	Millions of sperms are released per ejaculation.
The egg is spherical and made up of only one part.	The sperm is made up of three parts: head, mid-piece and tail.
Egg is immotile (cannot move on its own). The luminal cells of the fallopian tube have cilia (hair-like structures) that move the egg from the ovary to the uterus.	Sperm is motile.
Egg is bigger than the sperm.	Sperm is smaller.

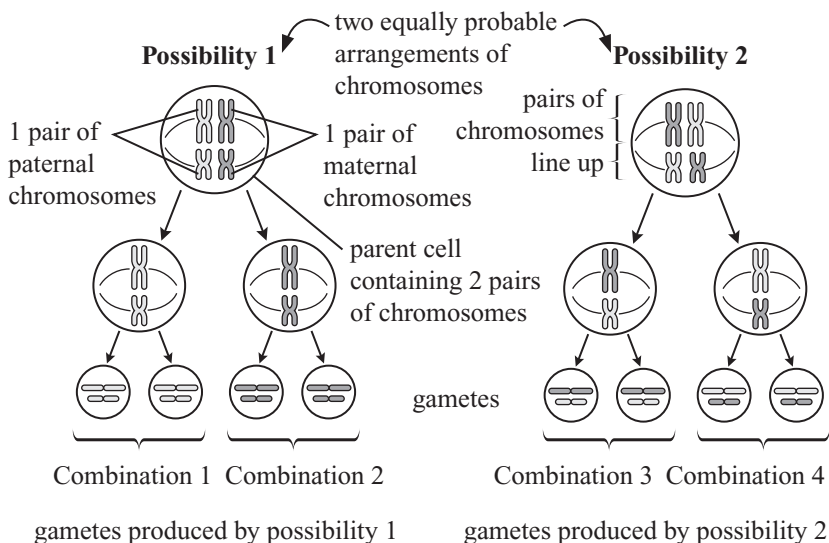
Table 16.3 Differences between egg and sperm

4. The sperm has a tail that allows it to swim towards the fallopian tube. It also has mitochondria to release energy for the tail to move.
5. The head of the sperm contains an enzyme that digests the outer membrane of the egg, allowing the nucleus of the sperm to fuse with the egg.
6. Both the female and male gametes contain half the number of chromosomes of normal body cells. They are called haploid cells.
7. The fusion of the nuclei of an egg with a sperm forms a **zygote**.

8. Since offspring receives genetic information from both parents, offspring share similar characteristics with their parents.

9. **Extension Knowledge**

- The nucleus of the zygote contains 23 pairs of chromosomes, half from the egg and half from the sperm.
- The new individual that has been formed through sexual reproduction receives a unique combination of genetic information from the mother (via the egg) and the father (via the sperm).
- During formation of gametes, there can be different combination of chromosomes in each gamete.
- If there are 2 pairs of chromosomes in a human cell, there will be 4 possible combinations of chromosomes for each gamete produced (see diagram below). Normal human cell has 23 pairs of chromosomes, allowing a much greater number of possible combinations.
- Hence, siblings look different from each other as each has different genetic information.



Extension Knowledge

Figure 16.9 Two pairs ($n = 2$) of chromosomes per cell give rise to four possible combinations ($2^n = 2^2 = 4$) of genetic information for both egg and sperm. This leads to variation in the combination of chromosomes found in the haploid cells (gametes). In humans, with 23 pairs of chromosomes, there are $2^{23} = 8\,388\,608$ combinations!

Extra

Genetic disorders are diseases or conditions that can be inherited or passed down to the next generation. They may arise due to changes to a part of the DNA sequence. These changes are known as mutation. Some genetic disorders, such as Down syndrome, are due to an extra copy of a chromosome. Other genetic disorders, such as diabetes and most cases of cancer, occur from a combination of gene mutations. Some genetic disorders, such as cystic fibrosis and sickle-cell disease, occur from a single gene mutation.

Note

We have learned in Chapter 6 Cells that a gene is a segment of DNA which occupies a fixed position on a chromosome. A gene, sometimes referred to as a unit of heredity, is a sequence of nucleotides in DNA that encodes the synthesis of RNA and proteins through transcription and translation respectively. For example, a gene that codes for eye colour is transcribed to make mRNA and then translated to make the protein that forms the pigment in the eyes.

SCIENCE AROUND US

Ovarian cancer is a growth of cells that forms in one or both ovaries. One treatment method is to remove the affected ovary. Explain how removal of one or both of the ovaries affects the fertility of the patient. [4]

ANSWER

If both ovaries are removed, the female is unable to produce any eggs and therefore infertile. If one ovary is removed, fertility is reduced. One ovary can still produce eggs.

16.5 The Menstrual Cycle

- The menstrual cycle is the **process of ovulation and menstruation** in women. It typically lasts for **28 days**.
- The menstrual cycle is due to changes in levels of hormones, oestrogen and progesterone.
- The main events in the menstrual cycle:
 - Ovulation is the release of mature egg from the ovary.
 - Menstruation is the shedding of the uterine lining.

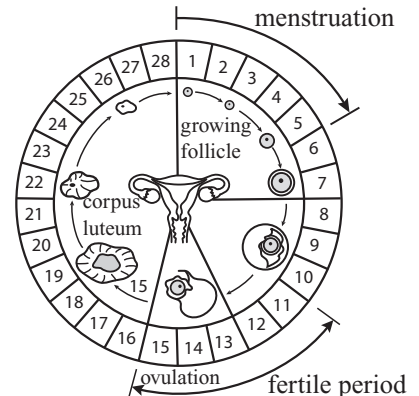


Figure 16.10 The menstrual cycle

Extra

A follicle is a small sac of fluid in the ovary that contains a developing egg or immature egg (oocyte).

Corpus luteum is the mass of cells that forms in the ovary after ovulation. It is responsible for the production of progesterone during early pregnancy.

- Events in the menstrual cycle:

Days	Event
1 to 5	Menstruation (the shedding of the uterine lining) takes place.
6 to 12	Oestrogen level increases. Uterine lining grows and repairs itself.
13 to 17	Level of oestrogen starts to drop and progesterone level starts to increase. Progesterone helps uterine lining grow and thicken. Ovulation (release of mature egg) usually takes place on day 14 but may take place earlier or later. Egg is released from one ovary into the fallopian tube. Day 11 – 15 is the fertile period because sperms deposited in the vagina during this period can fertilise the egg in the fallopian tube. Sperms can survive up to three days in the female reproductive system. Sperms deposited on day 11 can survive until day 14 to fertilise the egg. Eggs can survive for 1 day after ovulation. Sperms entering the uterus on day 15 can fertilise the egg.
18 to 28	Uterine lining is kept thick and well supplied with blood to prepare for implantation of a fertilised egg/embryo. No ovulation takes place on these days. If no implantation occurs, the level of progesterone drops and the uterine lining breaks down. The menstrual cycle starts again.

Table 16.4 Events in the menstrual cycle

5. Extension Knowledge

When oestrogen increases to a high enough level, it causes a surge in another hormone from the pituitary gland which causes an egg to be released (ovulation) from the follicle on day 14 of the menstrual cycle. As soon as the mature egg is released, the follicle forms a temporary structure called the corpus luteum which produces oestrogen and progesterone. If the egg is not fertilised, oestrogen and progesterone levels decrease, triggering the shedding of the uterine lining (menstruation).

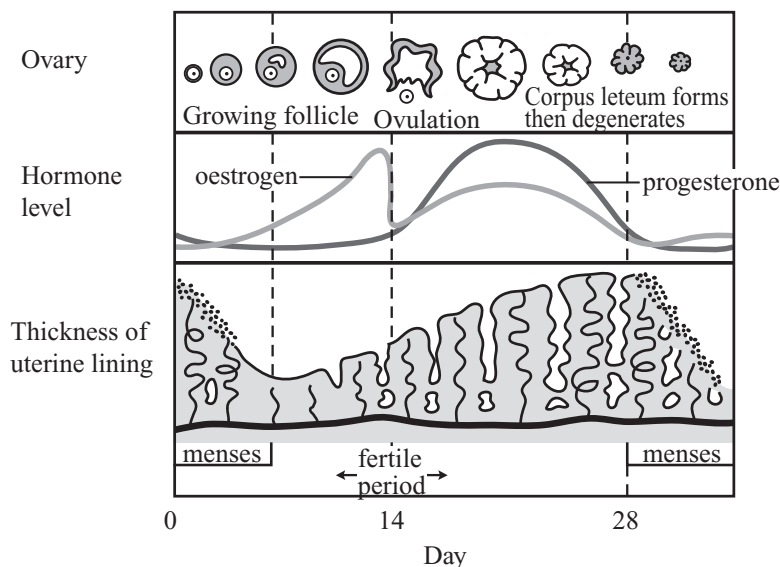
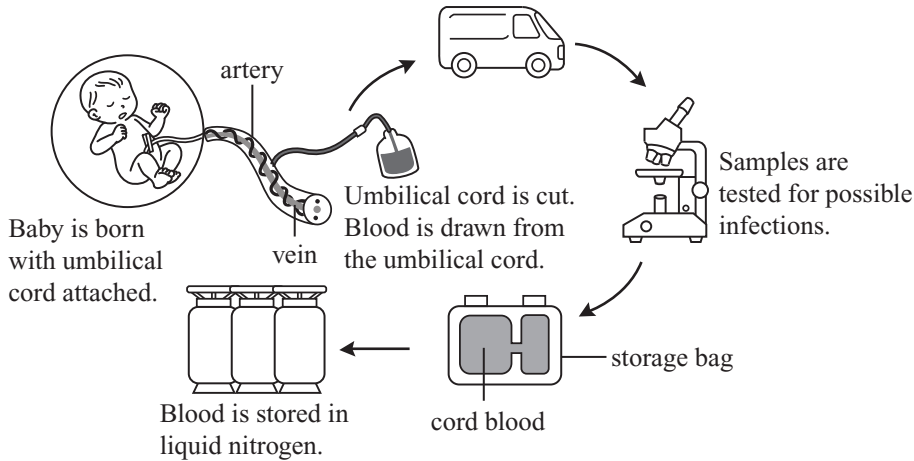

Extension Knowledge

Figure 16.11 This diagram shows the levels of oestrogen and progesterone during the menstrual cycle and the corresponding changes to the uterine lining.

16.6 Fertilisation, Implantation, Amnion, Placenta and Umbilical Cord
Extension Knowledge

The placenta, umbilical cord and cord blood are important in receiving and delivering nutrients and oxygen from the mother to the foetus during pregnancy. The umbilical cord can contain 10 times more blood stem cells than the bone marrow. Blood stem cells are immature cells that can grow and mature into red blood cells, white blood cells and platelets. The blood stem cells can potentially cure blood cancers such as leukemia and can treat genetic disorders such as sickle-cell anemia.



Science behind Healthcare

Figure 16.12 Private cord blood bank was started in the mid-1990s as knowledge of the usefulness of blood stem cells became widespread. Rather than discarding the umbilical cord, cord blood is harvested from voluntary pregnant ladies at delivery. Donating cord blood increases the probability of finding a stem cell match for patients suffering from blood cancers.

1. During ejaculation, sperms are released from the testis and moved into the sperm duct and then the urethra. As sperms pass through the prostate gland, seminal fluid mixes with the sperms to produce semen. Semen is released through the urethra.
2. Penis deposits semen in the vagina. Sperms swim up through the cervix, up the uterus and into fallopian tubes to reach the egg.
3. As soon as a sperm enters the egg, the membrane of the egg changes to prevent other sperms from entering.

(c) As the fertilised egg moves along the fallopian tube, it divides into a ball of cells known as embryo.

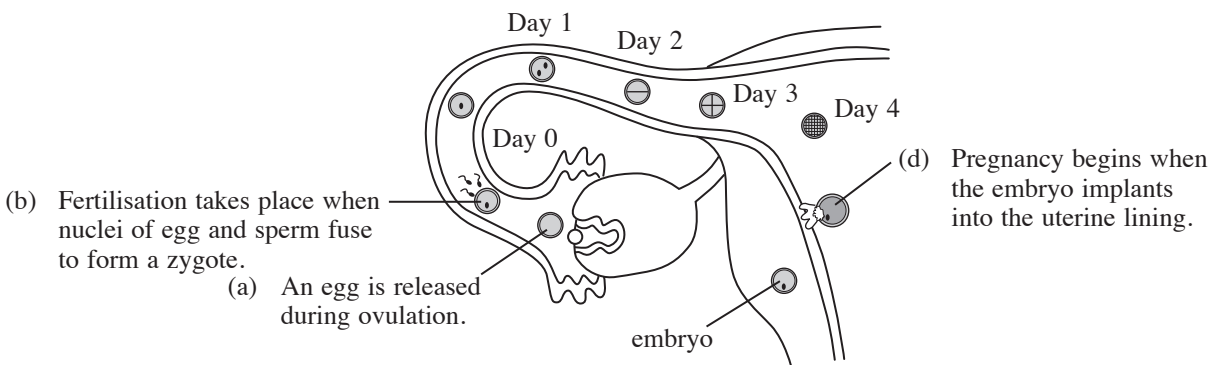


Figure 16.13 Egg transport and implantation

4. The union of the nuclei of an egg and a sperm forms a zygote (a fertilised egg) which will then develop into a new individual. This is fertilisation.
5. The zygote begins to divide into a ball of cells called the embryo as it is moved from the fallopian tube to the uterus.
6. In the uterus, the embryo embeds into the uterine lining. This is called implantation.
7. The embryo then develops into a foetus.

SCIENCE AROUND US

Extension Knowledge

A thin uterine lining may decrease fertility.

- (a) Explain how a thin uterine lining leads to decrease in fertility. [2]
- (b) Suggest a possible treatment for a patient with this condition. Explain. [2]

ANSWER

- (a) *The embryo cannot be implanted in a thin uterine lining. The foetus may not receive sufficient nutrient.*
- (b) *Oestrogen injection. The oestrogen stimulates the thickening of the uterine lining so that the embryo can be implanted into the uterine lining or the foetus can receive enough nutrient.*

8. Amnion:
 - (a) After implantation, a membrane forms around the embryo. The membrane is filled with the amniotic fluid.
 - (b) The amniotic fluid supports and protects the embryo or foetus from impacts of sudden movements.
9. Placenta and umbilical cord:
 - (a) The placenta is a flat circular organ in the uterus that takes in oxygen and nutrients from the mother's blood for the foetus.
 - (b) The mother's blood and the foetus' blood are not in contact.
 - (c) Oxygen and nutrients (glucose, amino acids and mineral salts) in the mother's blood diffuse into the foetus' blood. Waste products (carbon dioxide and urea) in the foetus' blood diffuse into the mother's blood.
 - (d) The umbilical cord is a flexible cord-like structure, containing blood vessels, that connects the foetus to the placenta.

- (e) Drugs and alcohol taken by the mother during pregnancy negatively affects the normal development of the foetus.

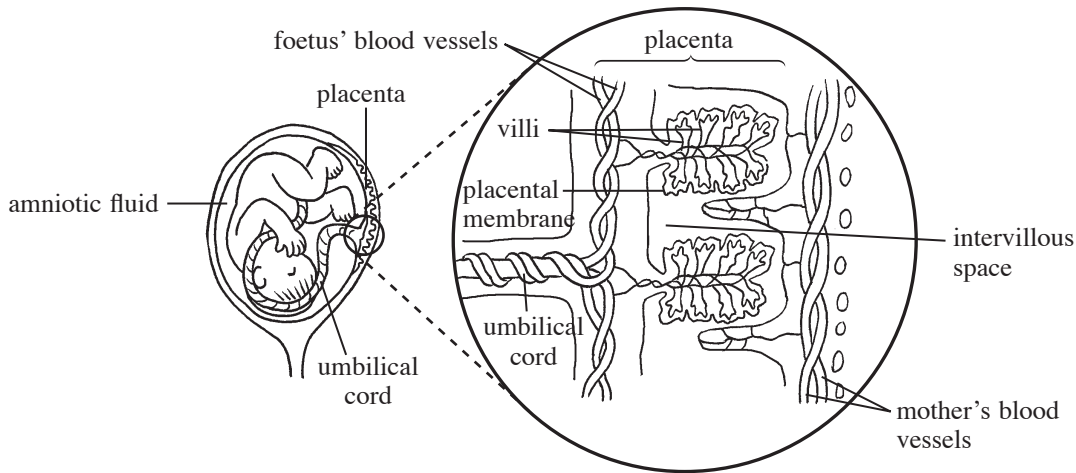
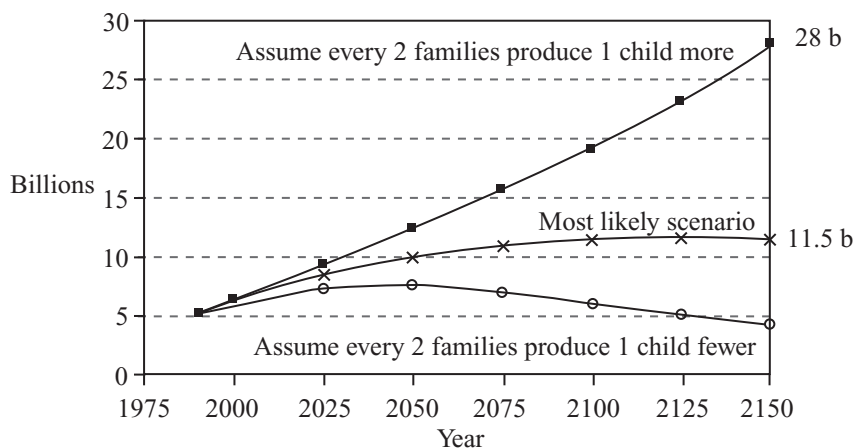


Figure 16.14 The placenta contains blood vessels that absorb nutrients and oxygen from the mother's blood.

16.7 Birth Control and the World Population

Population growth refers to the increase in the number of people in a population. The global human population growth is estimated to be around 83 million annually or 1.1% per year. The global population has grown from 1 billion in 1800 to around 7.9 billion in 2020. Hence, many governments around the world are looking into measures to ensure a sustainable population growth.



Optional for **N(A)**

Figure 16.15 The last 100 years have seen a rapid increase in world population due to medical advancements and massive increase in agricultural productivity. The graph shows three predictions of the world population until 2150.

1. Family planning is the planning of when to have children through the use of birth control methods.
2. Premarital sex is sexual activity practised by unmarried people.
3. Premarital sex or failure in family planning can result in unwanted pregnancies.
4. Abortion is the deliberate termination of a human pregnancy so that it does not result in the unplanned birth of a child.
5. Reasons for abortion include failure in the birth control method, inability to support a child, defects or medical problems in the foetus and pregnancy resulting from sexual abuses.
6. Natural or artificial means can be used to prevent pregnancies.
7. The natural means of birth control include:
 - (a) rhythm method—refraining from sexual intercourse during the fertile period (day 11 to day 15 of the menstrual cycle)
 - (b) abstinence—the act of not having sexual intercourse at all
8. The artificial means of birth control comprise temporary and permanent birth control methods.
9. Temporary birth control methods include:

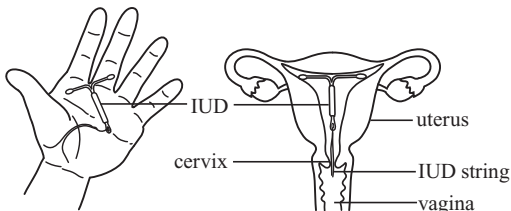
Method	Description
Oral contraceptive pill	- This pill uses two hormones—oestrogen and progesterone to prevent the ovaries from releasing an egg. - It cannot protect against sexually transmitted infections (STI).
Male condom and female condom	- The male condom is worn on the erect penis before sexual intercourse. - The female condom is a thin pouch that is placed in the vagina. - Condoms prevent fertilisation by trapping sperms.
Intra-uterine device (IUD)	- The IUD is a small T-shaped device that is placed inside the uterus, usually by a doctor or trained person. - The IUD prevents fertilised eggs from being implanted in the uterine wall. - Some IUDs may prevent fertilisation by damaging sperm. - IUDs cannot prevent STI. 

Figure 16.16 An IUD

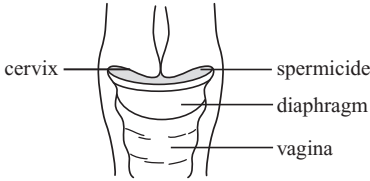
Method	Description
Diaphragm	- A small cup that is placed over the cervix before sexual intercourse. - It prevents the sperms from swimming into the uterus, preventing fertilisation.  <i>Figure 16.17 A diaphragm being used together with spermicide</i>
Spermicides	- A chemical that kills sperms. - It is usually used together with condoms and diaphragm. - Spermicides cannot prevent STI.

Table 16.5 Temporary birth control methods

10. Permanent birth control methods include:

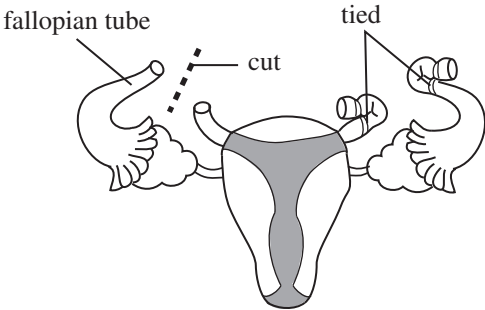
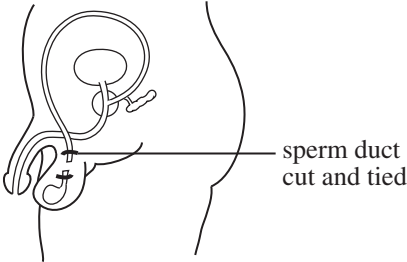
Method	Description
Tubal ligation	- Tubal ligation is a female sterilisation method in which both the woman's fallopian tubes are cut and sealed or clamped and blocked. - It prevents sperms from reaching the egg for fertilisation.  <i>Figure 16.18 Tubal ligation</i>
Vasectomy	- Vasectomy is a male sterilization method in which both the sperm ducts are severed and then tied or sealed. - It prevents sperms from entering the urethra during ejaculation.  <i>Figure 16.19 Vasectomy</i>

Table 16.6 Permanent birth control methods

11. Optional for **N(A)**

- (a) The number of people who are born each year (birth rate) has increased more than those who die (death rate). This has caused an increase in the world population, which is growing year by year.
- (b) The main reasons for the increase in the world population:
 - The tremendous development of medicines (antibiotics such as penicillin, vaccines, manufactured insulin to treat diabetes) and the various fields of healthcare (e.g. nursing, pharmacy, childbirth care, physical therapy, dialysis etc.)
 - Haber process to manufacture ammonia that is used to make nitrogen-based fertilisers increasing crop yield
 - Improved sanitation and reduction of water-borne diseases by having flush system, sewage system and better water-treatment technologies (reverse-osmosis that remove viruses and bacteria, reactive oxygen species that break down organic matter)

Extra

The United Nations laid out 17 Sustainable Development Goals. Four of the goals are:

- To ensure healthy life and promote well-being for all
- To ensure availability and sustainable management of water and sanitation for all
- To take urgent action to combat climate change and its impacts
- To protect, restore sustainable use of terrestrial ecosystems

16.8 Sexually Transmitted Infections (STI)

1. **Sexually transmitted infections** (STIs) are infections that are passed from one person to another through sexual contact.

Syphilis

2. Syphilis is a **chronic bacterial infection** that is spread through sexual contact with an infected person.

3. **Extension Knowledge**

The cause of syphilis is a bacterium called *Treponema pallidum*.

4. The table below shows the various stages of syphilis that can be seen in infected humans.

Stage	Description
Primary	Small and painless sores around the genitals or in or around the mouth that can heal without treatment within six weeks.
Secondary	Non-itchy rash on the palms and soles that can heal without treatment.
Latent	The infection lies dormant without causing any symptoms.
Tertiary	If the infection is serious, severe problems with the heart, brain and nerves can result in paralysis, blindness, deafness and even death.

Table 16.7 Stages of syphilis

5. If diagnosed at an earlier stage, syphilis can be cured with antibiotics. Penicillin is effective in treating syphilis.
6. Syphilis infection can be prevented by avoiding multiple sexual partners and using a condom during sexual intercourse.

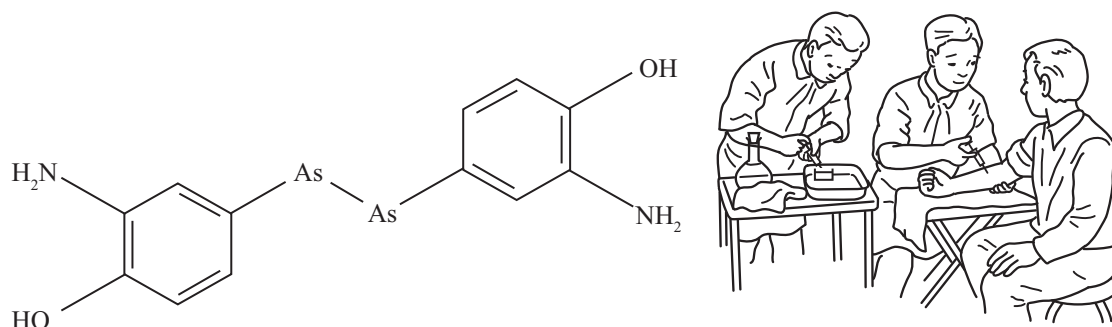


Figure 16.20 In 1910s, US soldiers were injected with arsphenamine, a synthetic arsenic organic compound (proposed structure shown in diagram) that was used as an effective treatment for syphilis until penicillin became available in the 1940s.

Gonorrhoea

7. Like syphilis, gonorrhoea is also a **chronic bacterial infection** that is spread through sexual contact with an infected person.
8. **Extension Knowledge**
The cause of gonorrhoea is a bacterium called *Neisseria gonorrhoea*.

Extra

Penicillins are a group of antibiotics used to treat a wide range of bacterial infections such as pneumonia, strep throat, syphilis and gonorrhoea. In 1928, Alexander Fleming first discovered that the *Penicillium* mould killed bacteria. To manufacture penicillins, scientists then learned to grow the mould in fermentation tanks by adding sugar.

9. Symptoms may be absent despite a gonorrhoea infection. Symptoms in both men and women include sore throat, eye pain, painful urination and painful joints. In men and women, a yellow discharge is observed from the urethra and vagina respectively.
10. One complication of gonorrhoea in women is pelvic inflammatory disease which can cause pelvic pain and infertility.
11. The best treatment for gonorrhoea is by giving injections and oral administrations of antibiotics.
12. Although medication may control the infection, damages done to the body are usually irreversible.

Acquired Immune Deficiency Syndrome (AIDS)

13. **Human Immunodeficiency Virus (HIV)** damages the infected person's immune system. As a result, the body's ability to fight against microorganisms that cause diseases is highly reduced.
14. **Acquired Immune Deficiency Syndrome (AIDS)** is the most advanced stage of HIV infection in which there is a severe loss of the body's immunity resulting in the lowering of the body's resistance to other infections.
15. Signs and symptoms of AIDS include rapid weight loss, severe diarrhoea and Kaposi's Sarcoma (a type of cancer of the blood vessels that causes lesions to grow in the skin).
16. **Extension Knowledge**
The **T-cells** (or CD4 cells) of the immune system activate other white blood cells to fight infections. HIV infects the T-cells by binding with the cells and copying itself into the cell's DNA. This causes the T-cells to produce new HIV and die.
17. HIV is mainly spread through:
 - (a) sexual intercourse with an infected person,
 - (b) blood transfusion from an infected person
 - (c) via sharing of needles and other personal belongings such as shavers and toothbrushes.
18. However, since HIV is not an airborne virus, having close contact with the AIDS patients such as touching them or attending to their medical needs will not spread the disease to the caregiver.

Extra

In the past, the treatment of gonorrhoea was fairly simple with a single injection of penicillin. The bacteria that caused gonorrhoea have become resistant to most of the antibiotics that were effective in the past. Today, the CDC (Centers for Disease Control and Prevention) recommends a single intramuscular injection of 500 mg of ceftriaxone. All sex partners must be treated too. There are increasing cases of antibiotic-resistant strains of gonorrhoea, making it difficult to treat.

19. There is no cure for AIDS at present but symptoms can be lessened using a combination of medicines.

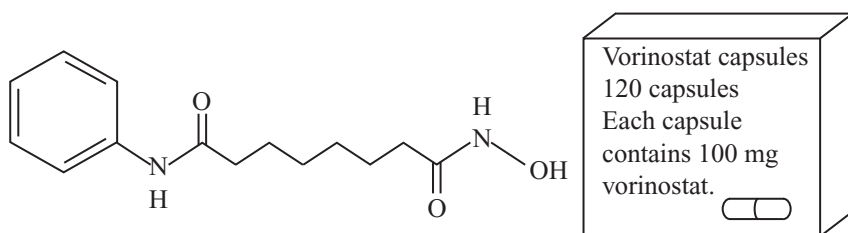
20. **Extension Knowledge**

Researchers have found that the antiviral medication (azidothymidine (AZT)) is able to reduce the replication of the virus inside the immune system. However, these medicines are often expensive.

21. Babies born to HIV-infected mothers may become infected before or during birth.
22. HIV infections can be prevented by avoiding multiple sexual partners, using a condom during sexual intercourse and avoiding the sharing of personal belongings such as needles, shavers and toothbrushes.

23. **Extension Knowledge**

Cells infected with the HIV are usually treated with antiretroviral medications (ART) to block HIV but it cannot remove it totally from a patient's body. Recently, scientists have been able to eliminate 'reservoir' cells (a group of immune system cells that are infected with HIV but are not actively producing new virus) outside the body. Currently, scientists are researching into a new approach to target the 'reservoir' cells in the body and activate the virus so as to allow the immune system to find these cells and destroy the virus.



Note

Bacteria are living cells that can live inside or outside a body, while viruses are non-living collection of molecules that need a host (plants, animals) to survive and multiply. A virus has a protein coat and a core of genetic material (RNA or DNA). Bacterial infection can be treated by antibiotics while viral infection cannot be treated by antibiotics. For most viral infections, treatment can only help with symptoms while you wait for the immune system to fight off the virus. Many viral infections can be prevented by vaccination. A vaccine typically contains a harmless form of the virus used to produce immunity to a specific disease. In some cases, it may be difficult to determine whether a bacterium or a virus is causing the symptoms. Pneumonia and diarrhea can be caused by either bacteria or viruses.

Science behind Healthcare

Figure 16.21 Vaccines are used to train the immune system to recognise 'reservoir' cells that are activated. Vorinostat, a drug (as shown in diagram), can be used to activate the 'reservoir' cells. The immune system attacks and kills the newly activated cells.