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REPRODUCTION IN ANIMALS



THEORY

Living beings reproduce by various means. For example, human beings and other mammals reproduce by giving birth to babies, most birds reproduce by laying eggs and most plants reproduce through seeds. The process by which living organisms produce offsprings of their own kind is called **reproduction**.

MODES OF REPRODUCTION

On the basis of modes of reproduction, reproduction is divided into two types ;

- (I) **Sexual reproduction :-** Sexual reproduction is the process that involves fusion of male and female gametes to produce zygote. It is the zygote from which new individual develops.
- (II) **Asexual reproduction :-** Asexual reproduction requires only one parent and does not involve the fusion of gametes.

I. Sexual Reproduction

Most of the animals reproduce sexually. Sexual reproduction involves the fusion of male and female gametes from reproductive organs of two different individual of different sexes. Sexual reproduction involves two parents. Each parent produces gametes. Male gametes are called **sperms** while female gametes are called **eggs**.

During fertilization, these gametes fuse to form a zygote which later develops into new individual.

- Those organisms which produce only one type of gamete are called **unisexual**, e.g. dogs, cat, fish, man, birds, reptiles.
- Those organisms which have both the male and female sex organs in their body are called **bisexual** or **hermaphrodite**, e.g. earthworm, leech, hydra.
- The process of fusion of the sperm with the ovum is called **fertilisation**.

Types of fertilisation :

- (i) **External fertilisation :** In external fertilisation the fusion of male and female gametes takes place outside the body of the female. This is commonly seen in aquatic animals such as frogs and fish. The female frog lays hundreds of eggs in the water where they are fertilised by the sperms released by the male frog.
- (ii) **Internal Fertilisation :** In internal fertilisation the fusion of male gamete with the female gamete takes place inside the body of the female. Internal fertilisation is seen in cats, dogs, cows, goats, sheep, etc.

Viviparous and Oviparous Animals :

Animals which gives birth to young ones are called **viviparous animals**. Examples : dog, cow, cat, rat, human being.

Animals which lay eggs are called **oviparous animals**. Examples : Lizard, frog, fish, snake, crow, hen, butterfly.

Sexual reproduction in Humans

In this type of reproduction formation and fusion of gametes occur.

Characteristics features :

- This reproduction involves two parents so it is biparental reproduction.
- It involves formation and fusion of gametes.
- In it meiosis occurs during gametogenesis and mitosis occurs after zygote formation. e.g. Human beings, birds etc.

Basic process of Reproduction :

It involves :

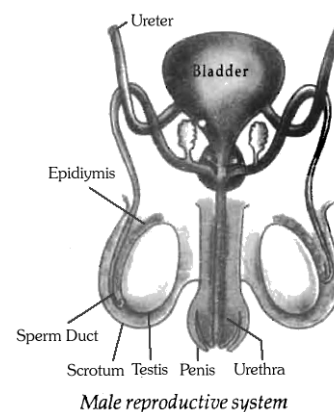
- Gametogenesis** : It is the process of formation of haploid male gamete (sperm) and female gamete (ovum). Sperm production occurs in testis and ovum production occurs in ovary.
- Fertilization** : The fusion of haploid gametes i.e. sperm and ovum to form diploid zygote is called as fertilization. This is the diploid phase.
- Embryogenesis** : Zygote undergoes mitosis and form embryo which develops into the foetus.
- Parturition** : Birth of developed young one is called as parturition.

MALE REPRODUCTIVE SYSTEM

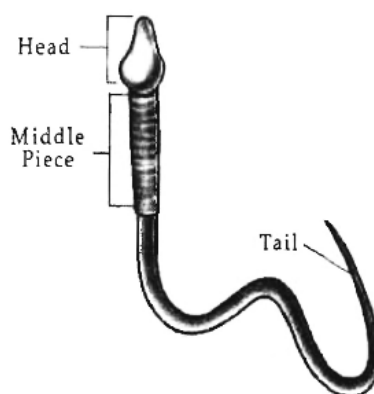
Male reproductive system consists of several organs that have two major functions. First, production of male gamete called sperm. Second, transfer of male gametes to female body.

The male reproductive organs are

1. A pair of testes (singular, testis)
2. Epididymis
3. Vas deferens
4. Urethra
5. Penis
6. Accessory sex glands
(i) Seminal vesicles, (ii) Prostate gland



1. **Testes** : Testes are located outside the abdominal cavity within a sac called scrotal sac or scrotum. Scrotum keeps the testes temperature at 2°C , lower than body temperature. The lower temperature is required for the normal development of sperms. Millions of sperms are produced by testes. Each sperm is a single cell with a head, middle piece and a tail region.



Structure of sperm

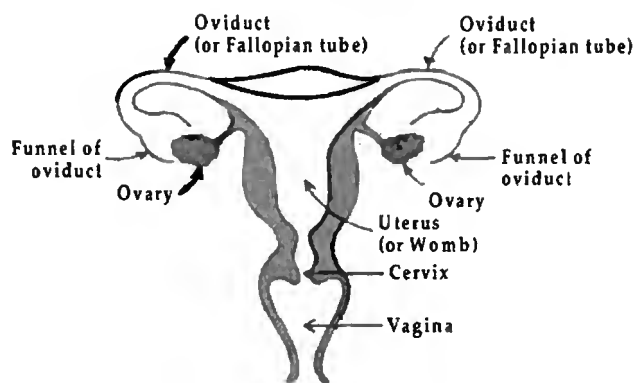
- (2) **Epididymis:** It is a long coiled tube that collects and store sperms temporarily. It helps in storage, nutrition and maturation of sperms.
- (3) **Vas deferens :** It is a tube like structure that transfers sperm from epididymis to the urethra.
- (4) **Urethra:** Urethra extends from penis to external opening. It helps in conduction of sperms, secretion of glands and carries urine from urinary bladder. The urethra, at different times carries both urine and sperms.
- (5) **Penis :** Penis is a cylindrical erectile organ. Its function is to transfer sperm into vagina of female reproductive system.
- (6) **Accessory or secondary sex glands :** The accessory gland includes seminal vesicles and prostate gland. The glands secrete fluid that lubricates the duct system and sperms. The sperm get dispersed in the fluid that makes their transportation into the female body easier. The fluid also provide nutrients in the form of fructose.

FEMALE REPRODUCTIVE SYSTEM

Female reproductive system consists of organs that play an important role in, **First**, production of female gametes called egg cells. **Second**, receive sperm for fertilization, implantation and development of foetus.

The female reproductive system includes-

- (1) A pair of ovaries
- (2) A pair of oviducts
- (3) Uterus
- (4) Vagina



Human female reproductive system

- (1) **Ovary:** Ovaries are oval shaped organs, located in the lower part of abdominal cavity.

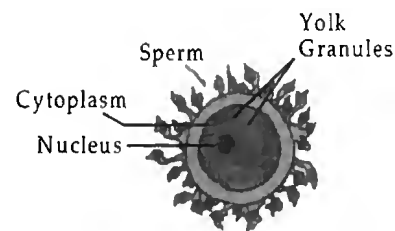
Functions of ovary:

- (A) Each ovary contains thousands of eggs called ovum. Like sperms, an egg (ovum) is also a single cell. Egg is bigger in size than sperms because egg contains a large amount of food inside it.

Structure of ovum : An ovum contains a single nucleus. The nucleus is surrounded by the cytoplasm that contains yolk.

- (B) When a girl reaches puberty it produces a hormone called oestrogen. Oestrogen causes the development of secondary sexual characters in female body.

- (2) **Oviduct (also known as fallopian tube) :** It is a tube like structure that carries egg from the ovary to the uterus.
- (3) **Uterus:** It is a hollow muscular organ that contains developing foetus. It is connected to the uterus by ligaments. The uterus opens into vagina.
- (4) **Vagina:** It is the lowermost part of female reproductive part.



Human ovum

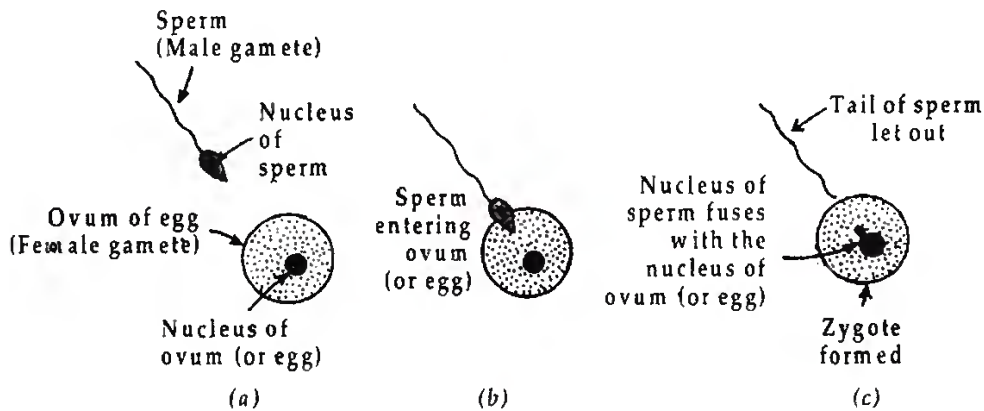
GAMETE FORMATION

Primary sex organs produce male and female gametes.

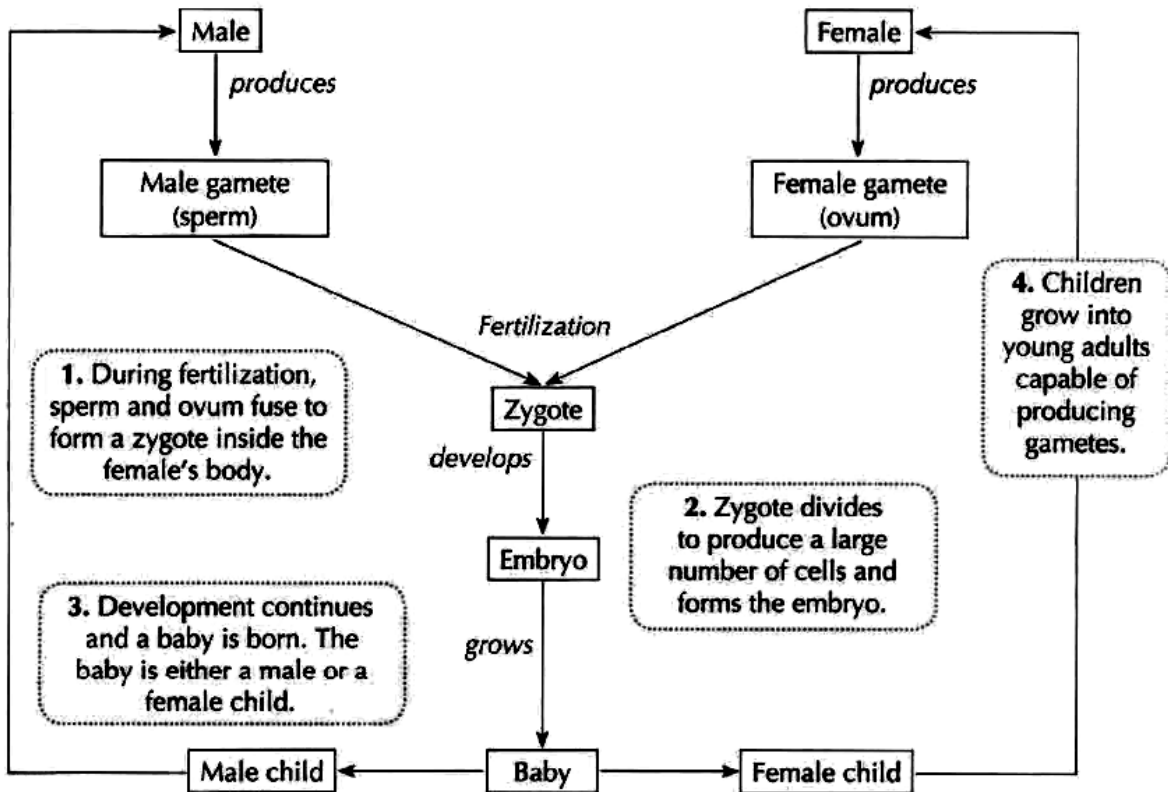
- In males the germ cells of inner layer of seminiferous tubules undergo meiosis to form haploid sperms.
- In female germ cells of lining of ovary undergo meiosis to form haploid ovum.

FERTILIZATION

Fertilization is the process where sperm (male gamete) fuses with ovum (female gametes) to form a single cell called zygote. Millions of sperms from the male are transferred into the female body. The sperms swim in the oviduct with the help of their tails and reaches the egg. When they reach egg, one of the sperms may fuse with it to form a single nucleus. Such fusion of female egg and sperm is called *fertilization*. This results in the formation of a fertilized egg or *zygote*. The *zygote* undergoes division and specific changes to grow into a new individual.



Zygote formation and development of an embryo from the zygote



Difference table between internal fertilization and external fertilization

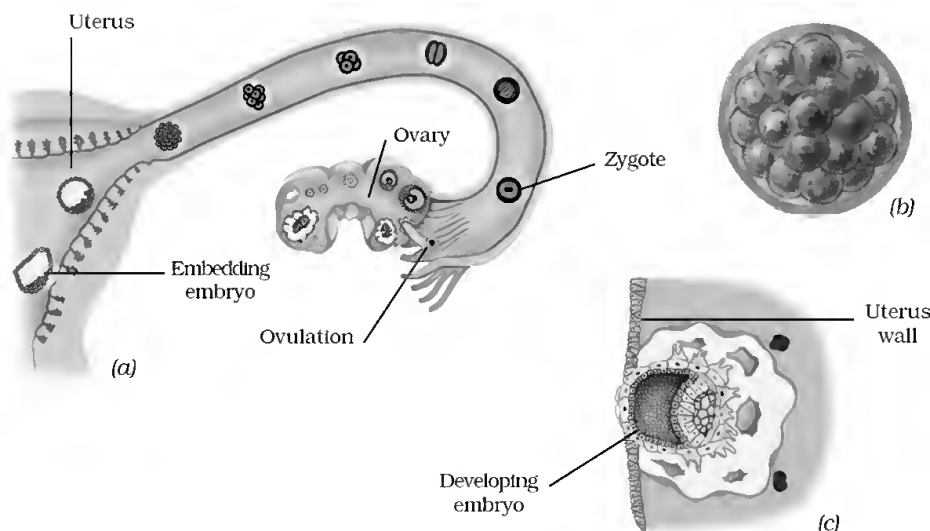
S.No.	Internal Fertilization	External Fertilization
1.	Fertilization that takes place inside the female body is called internal fertilization.	Fertilization that takes place outside the female body is called external fertilization.
2.	Small number of eggs are produced.	Large number of eggs are produced.
3.	Chance of survival of offsprings are more.	Chances of survival of offspring are less.
4.	Examples : Human, cow, hens, etc.	Examples : Fish, frog, starfish etc.

Difference table between viviparous and oviparous animals

S.No.	Oviparous animals (Egg bearing animals)	Viviparous animals (Live - bearers)
1.	Animals that lay egg outside their body.	Animals that give birth to young ones.
2.	Development of embryo does not takes place within the mother's body.	Embryos develop inside the mother's body from which it gains nourishment.
3.	<i>Examples, Chicken, frogs and butterfly.</i>	<i>Examples, Human beings, certain fishes etc.</i>

DEVELOPMENT OF EMBRYO

Fertilization results in the formation of zygote that begins to develop into an embryo. The zygote divides repeatedly to give rise to a ball of cells. The cells then begin to form group that develop into different tissues and organs of the body. This developing structure is called an *embryo*. The embryo gets embedded in the wall of uterus for further development. The close attachment of the embryo with the uterus is called *implantation* and it results in pregnancy.



(a) Zygote formation and development of an embryo from the zygote; (b) Ball of cells (enlarged); (c) Embedding of the embryo in the uterus (enlarged)

The embryo continues to develop in the uterus. An unborn baby develops 'head first', starting from the brain and head, then the main body, then the arms and legs. The stage of embryo in which body parts can be distinguished easily is called a *foetus*. The embryo / foetus grows in the mother's uterus for about nine months.

After nine months, the baby is ready to give birth to young one. The birth of the fully developed foetus is termed as *parturition*.

***In vitro* Fertilisation : Test Tube Babies**

Some women are unable to bear babies because their oviducts are blocked. This prevents the ovum from being fertilised as the sperms cannot reach the oviduct where the ovum is present. This problem can be overcome by fertilising an ovum with human sperms in the laboratory with a technology called ***in vitro* fertilisation (IVF)**.

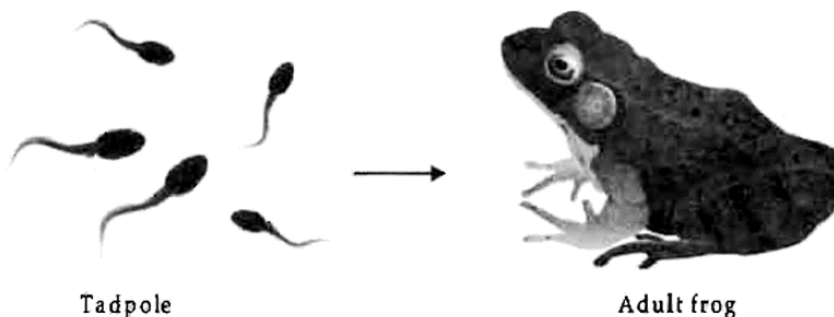
In this technique the doctor collects freshly released egg and sperms and keeps them together for a few hours for ***in vitro* fertilisation**. Here the fertilisation occurs outside the body of the female. In case fertilisation occurs, the zygote is allowed to develop for about a week. The zygote is then placed into the uterus of the mother. The embryo gets implanted and develops into a baby in about nine months. Babies born through this technique are called **test tube babies**.

- ◆ Some of the common sexually transmitted diseases are :
 - (i) **Gonorrhoea** : It is caused by bacterium *Neisseria gonorrhoea*.
 - (ii) **Syphilis** : It is caused by bacterium *Treponema pallidum*.
 - (iii) **Trichomoniasis** : It is caused by protozoan *Trichomonas vaginalis*.
 - (iv) **AIDS (Acquired Immune Deficiency Syndrome)** : It is caused by a virus called HIV (Human Immunodeficiency Virus) which suppresses the body's immune mechanism and thereby making it susceptible to any disease.
 - (v) **Wart** : It is caused by human papilloma virus (HPV).

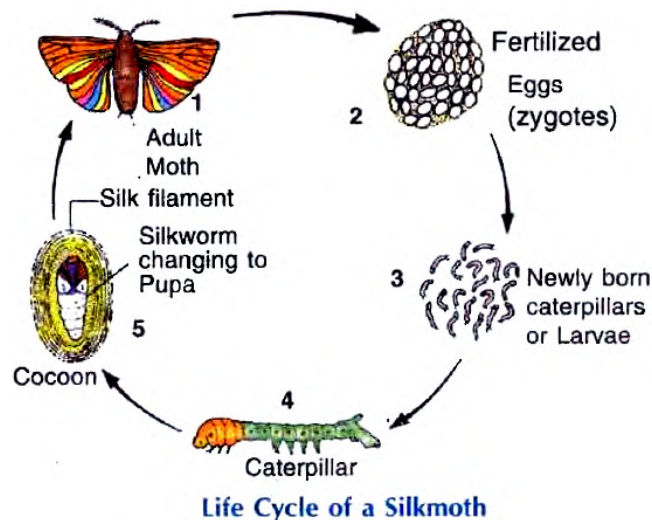
METAMORPHOSIS:

The life cycle of a frog has three distinct stages.

Eggs → Tadpole → Frog



- *Metamorphosis* is a biological process of transforming larva into an adult.
- The process involves relatively abrupt changes in the animal's structure through cell growth and development.
- Tadpoles look completely different from frog. The tadpole that emerges from the eggs contains gills, a tail and a small circular mouth. They can swim freely within the water.
- During its development, tadpole grows and undergo some abrupt changes in their structure and develops into mature frog. This process is known as *metamorphosis*.
- The metamorphosis of tadpole begins with the development of limbs, lung development and finally the absorption of tail by the body. As a result of such changes, the tadpole gradually gets transformed into frogs.
- Life cycle of silkworm : eggs → larvae or caterpillar → pupa → adult
The pupa of a silkworm looks very different from the adult moth.



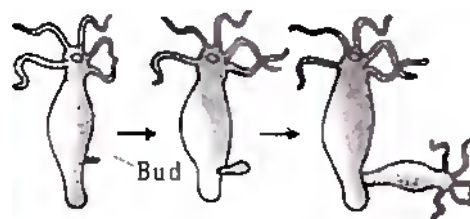
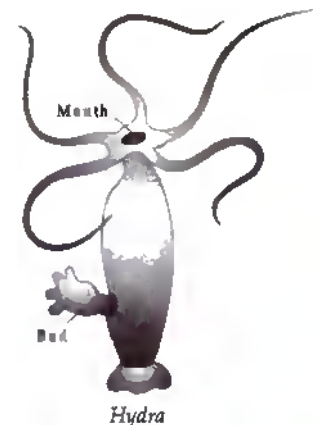
In silkworm male and female are separate. The female lays the eggs. Before laying, these eggs body of the mother (female) with the sperms from father (male), and the eggs laid are actually **zygotes**.

ASEXUAL REPRODUCTION:

Animals such as *Hydra*, *Amoeba* etc. reproduce through asexual reproduction. Asexual reproduction does not involve fusion of male and female gamete. It requires only one parent. As a result, the offspring produced are genetically identical to each other and their parent. They are actually clones. *Clones* are group of genetically identical individual.

Various mode of asexual reproduction in animals are –

- 1. Budding:** In *Hydra*, the cells divide rapidly at a specific site and develop as an out growth called bud. These buds, while still attached to the parent body, develop into smaller individuals.



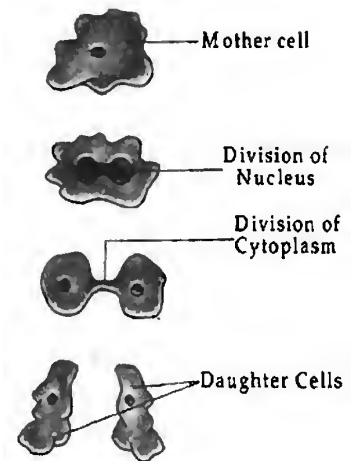
Budding in Hydra

When these individuals become mature enough, they detach from the parent body and develop as an independent individual. This type of asexual reproduction is known as *budding*. Hence, *Budding* involves the formation of new individual from the bulging of parent body. It is commonly seen in some plants, fungi and some animals such as yeast and *Hydra*.

Yeast is a single-celled organism that grows rapidly if sufficient nutrients are available to them. They reproduce through budding. When budding occurs in yeast cells, a small bulb like projection protrudes out. This projection is called bud. The bud grows and detaches from parent cell to form new yeast cell. The yeast cell grows and produces more yeast cells through the process of budding.

2. **Binary fission:** Binary fission is another type of asexual reproduction seen in bacteria and *Amoeba*. *Amoeba* is a single-celled organism. It begins the process of reproduction by the division of its nucleus into two nuclei. This is followed by the division of its body into two with each part receiving a nucleus. Finally, two *Amoebae* are produced from one *Amoeba*. The newly formed daughter *Amoeba* is genetically identical to each other and to the parent *Amoeba*.

This type of asexual reproduction in which an animal reproduces by dividing into two individuals is called *binary fission*. (bi = two; fission = division).



Binary fission in Amoeba

Advantages of asexual reproduction

- (1) Asexual reproduction is advantageous to certain animals that remains in one particular place like *Hydra*, *Planaria* and animals that are unable to look for mates.
- (2) It also produces numerous offspring without costing the parent a great amount of energy or time.

Disadvantages of asexual reproduction:

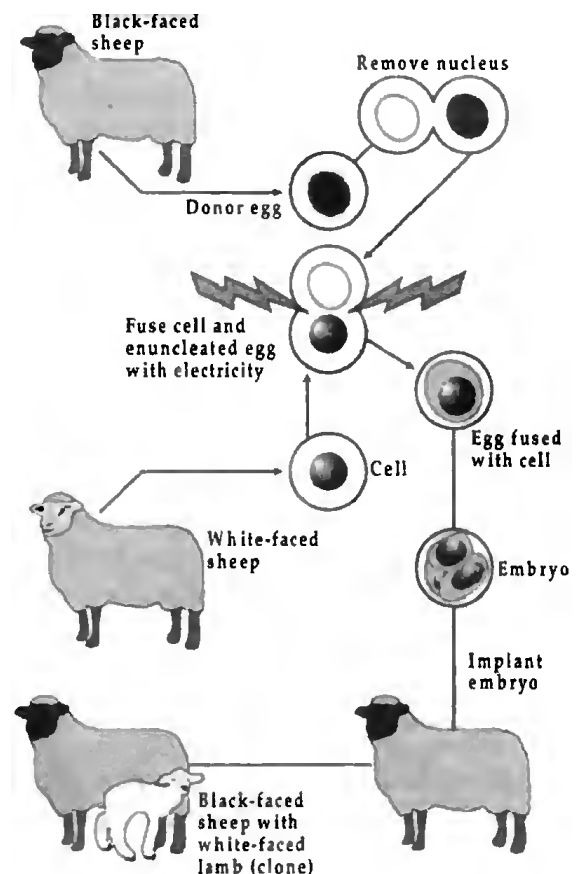
Asexual reproduction lacks genetic variation. All of the organisms that reproduce asexually are genetically identical and therefore share the same weaknesses. If the stable environments change, the consequences could be deadly to all of the individuals.

CLONING

Cloning is the process that is used to create an identical (exact) copy of a cell, tissue or a complete organism. It was successfully performed for the first time by Ian Wilmut and his colleagues at the Roslin Institute in Edinburgh, Scotland. They successfully cloned a Scottish sheep named *Dolly*. *Dolly* was born on 5th July 1996 and was the first mammal to be cloned from adult somatic cell. During the process of cloning of *Dolly*, somatic cells was collected from the mammary gland of a female Finn Dorsett sheep. Simultaneously, an egg was obtained from a Scottish black face ewe. Then they transferred the nucleus from the cell from Finn Dorsett sheep to the egg of the Scottish black face ewe. After few days, the egg with new nucleus started behaving like a normal fertilized zygote, which gradually developed into an embryo. This embryo was then surgically implanted into the uterus of a surrogate mother, which finally gave birth to a lamb called *Dolly*.

Though *Dolly* was given birth by the Scottish black face ewe, it was found to be identical to the Finn Dorsett sheep from which the nucleus was taken.

Dolly was a healthy lamb and produced several offspring of her own through sexual means. Unfortunately, *Dolly* died on 14th February 2003 due to certain lung disease.





POINTS TO REMEMBER

- *Reproduction* is the biological process through which a living organism produces offspring that are similar to themselves.
- There are two modes of *reproduction* –
 - *Sexual reproduction* - Reproduction resulting from fusion of male and female gametes.
 - *Asexual reproduction* - Reproduction in which only a single parent is involved.
- The male reproductive organs include testes, epididymis, vas deferens, urethra, penis and accessory glands like seminal vesicle and prostate gland.
- The female reproductive organs include ovaries, oviducts, uterus and vagina.
- The testes produce male gametes called sperms while the ovary produces female gametes called ova.
- The process of fusion of male and female gamete is called fertilization.
- The fertilized egg is called zygote.
- *There are two types of fertilization* –
 - *Internal fertilization* - Fertilization that takes place inside the female body is called *internal fertilization*. Eg. -Human beings, hens, cows, dogs.
 - *External fertilization* - Fertilization that takes place outside the female body is called *external fertilization*. Eg. -Frogs, fish and starfish.
- Animals such as humans, cow, etc., which give birth to young ones are called *viviparous* animals.
- Animals such as hen, frog, lizard, etc., which lay eggs are called *oviparous* animals.
- Placenta is a vascular tissue that is present in the inner lining of uterus. It is connected to foetus by umbilical cord.
- *Umbilical cord* is a cord containing blood vessels that connects the placenta with the baby.
- The process of release of an egg by an ovary is called *ovulation*.
- The process of releasing blood and mucous every month through the vagina is called menstruation. It is usually a 28 days cycle.
- The transformation of the larva into adult through drastic changes is called *metamorphosis*.
- In asexual reproduction, the offspring comes from the same parent. So they are identical to one another and to their parent.
- Clones are group of genetically identical organisms derived from a single individual by some kind of asexual reproduction.
- Budding in yeast and binary fission in *Amoeba* are two types of asexual reproduction.