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REPRODUCTION SYSTEM – ORGANISMS, PLANTS & ANIMALS

Introduction

- A basic occurrence in reproduction is the creation of a DNA copy; to produce copies of the DNA, cells use chemical reactions.
- The DNA in the cell nucleus is actually the information source for creating proteins. Likewise, if the information is changed here, then different proteins will be created. And, these different proteins will eventually lead to altered the body designs.
- DNA copies that generated would be similar, but may not be identical to the original. And, because of these variations, the new born cells are slightly different.
- Further, the consistency of DNA copying during reproduction process is significant for the maintenance of body design and features.

Modes of Reproduction Used by Cell Organisms

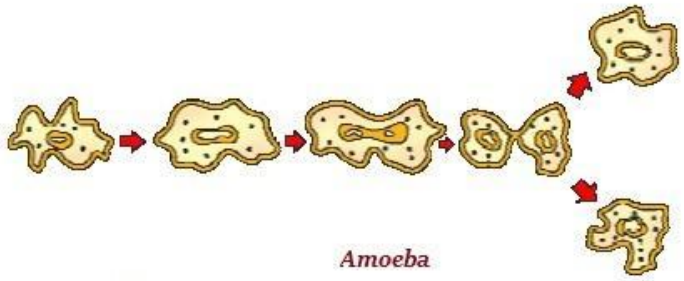
- The modes by which various Cell Organisms reproduce depend on their body designs. However, it is broadly categorized as –
    - **Asexual Reproduction**
    - **Sexual Reproduction**

Asexual Reproduction

- Asexual Reproduction can be studied through the following different sub-categories –
    - **Fission**
    - **Fragmentation**
    - **Regeneration**
    - **Budding**
    - **Vegetative Propagation**
    - **Spore Formation**

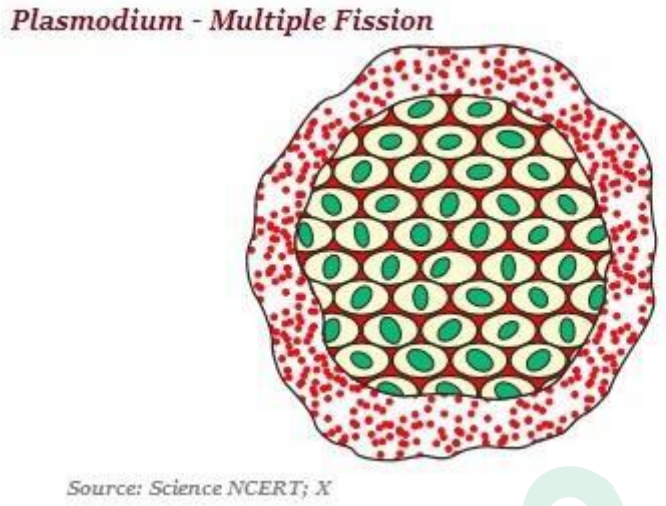
Fission

- In some unicellular organisms such as Amoeba, the cell split into two cells during the cell division and produce two new organisms (see the image given below).
- It is also known as **binary fission**.



Source: Science NCERT; X

- Many bacteria and protozoa simply split into two equal halves during their cell division and produce two identical organisms.
- Remember, some other single-celled organisms, such as Plasmodium (the malarial parasite), divide into many daughter cells simultaneously, known as **multiple fission** (see the image given below).

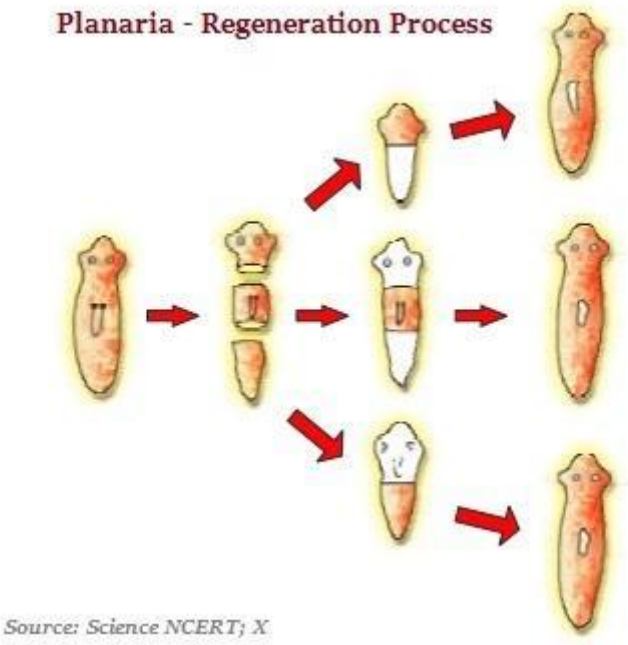


Fragmentation

- After the maturity, some multicellular organisms, such as Spirogyra, simply breaks up into smaller pieces and these pieces or fragments grow into new individuals.

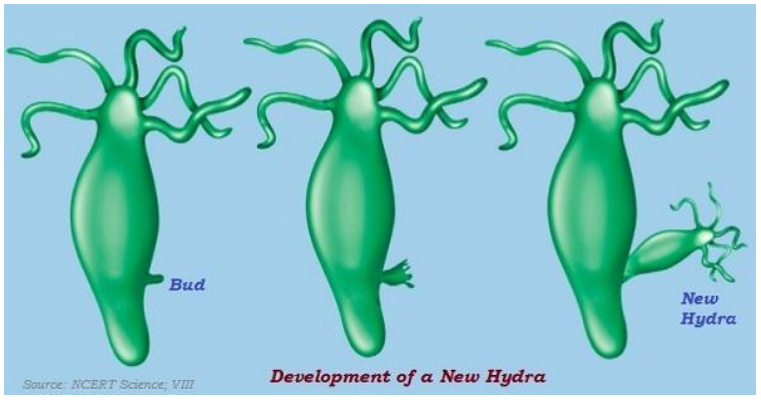
Regeneration

- Some of the organisms, such as Planaria, if its body cut or broken up into many pieces, then many of these pieces grow into complete separate individuals; the whole process is known as **regeneration**.



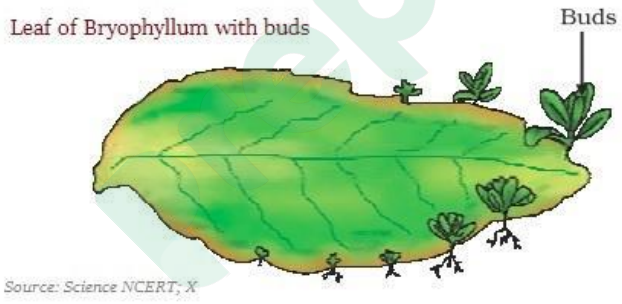
Budding

- In some organisms, such as Hydra, because of the repeated cell division at one specific place, a bud develops, which later (once fully grown) gets detached from the parent body and becomes a new independent individual (see the image given below).



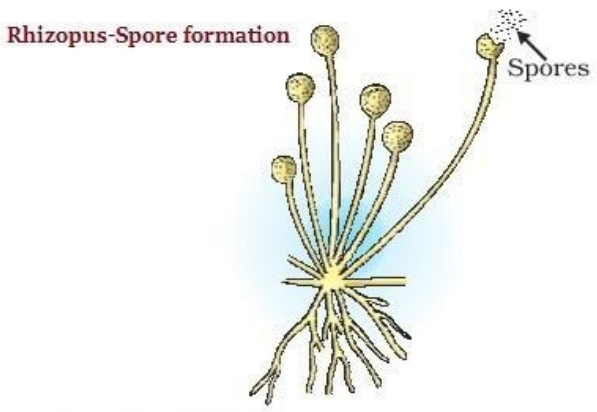
Vegetative Propagation

- Under a favorable condition, there are many plants, which parts like the root, stem, and leaves develop into new plants; such process is known as vegetative propagation (see the image given below).



Spore Formation

- Some plants and many algae undergo sporic formation (through meiosis cell division) that leads to the formation of spores. Further, these spores grow into multicellular individuals.



Source: Science NCERT; X

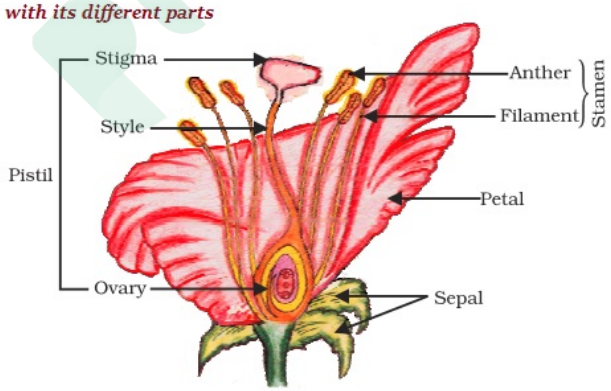
Sexual Reproduction

- The sexual mode of reproduction comprises the process of combining DNA from two different individuals.
- There are two germ-cells (responsible for producing a new organism); one is large and contains the food-stores whereas the other one is smaller and likely to be motile.
- The motile germ-cell, normally, is known as the '**male gamete**' and the germ-cell containing the stored food is known as the '**female gamete**.'

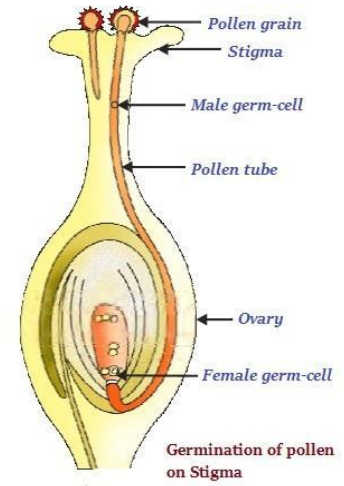
Sexual Reproduction in Flowering Plants

- As shown in the image given below, flowers have different parts, such as sepals, petals, stamens, and carpels. Among these, stamens and carpels are the reproductive parts and contain the germ-cells.

Flower with its different parts



- Stamen is the male reproductive part, which produces pollen grains (yellowish substance).
- Carpel, which is present in the center of a flower, is the female reproductive part.
- Carpel is made of three parts.
- The bottom part, which is swollen, is the **ovary**; the middle part, which is elongated, is known as the **style**; and the terminal part, which may be sticky, is known as the **stigma**.



Source: Science NCERT;X

- The ovary contains ovules and each ovule has an egg cell.
- The male germ-cell that produced by the pollen grain fuses with the female gamete present in the ovule.
- The fusion of the germ-cells or fertilization produces zygote, which is capable of growing into a new plant.
- The flower, which contains either stamens or carpels, is known as **unisexual**, such as papaya, watermelon, etc.
- The flower, which contains both stamens and carpels, is known as **bisexual**, such as Hibiscus, mustard, etc.

Reproduction in Human Beings

Male Reproductive System

- The male reproductive system produces the germ-cells; further, other part of the reproductive system delivers the produced germ-cells to the site of fertilization.
- The formation of sperms or germ-cells takes place in the testes.
- The formation of sperm typically requires a lower temperature than the normal body temperature.
- The testes secrete hormone, namely testosterone that brings changes in the appearance of boys at the time of their puberty.
- The formed sperms are then delivered through the vas deferens, which unites with a tube coming from the urinary bladder.
- The urethra, likewise, acts as a common passage for both the sperms and urine.
- The sperms are fluids that consist of mainly genetic material; it has a long tail that helps to move towards the female germ-cell.

Female Reproductive System

- The female germ-cells or eggs are produced in the ovaries.
- The egg is transported from the ovary to the womb through a thin oviduct known as **fallopian tube**.
- The two oviducts unite and form an elastic bag-like structure known as the uterus, which opens into the vagina through the cervix.

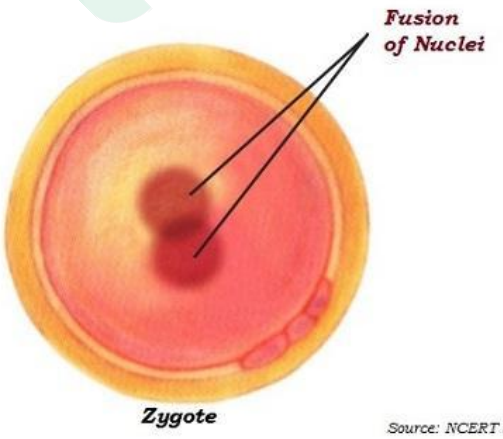
- During the sexual intercourse, most likely, the egg and the sperm (zygote) get fertilized and implanted in the lining of the uterus.
- The thickened lining (of the uterus) and richly supplied blood nourish the growing embryo (in the uterus).
- The embryo receives nutrition from the mother's blood with the help of a special tissue known as **placenta**.
- Likewise, the development of a child inside the mother's body, takes about nine months.

Reproduction in Animals

Following are the two modes of reproduction – **Sexual reproduction & Asexual reproduction**.

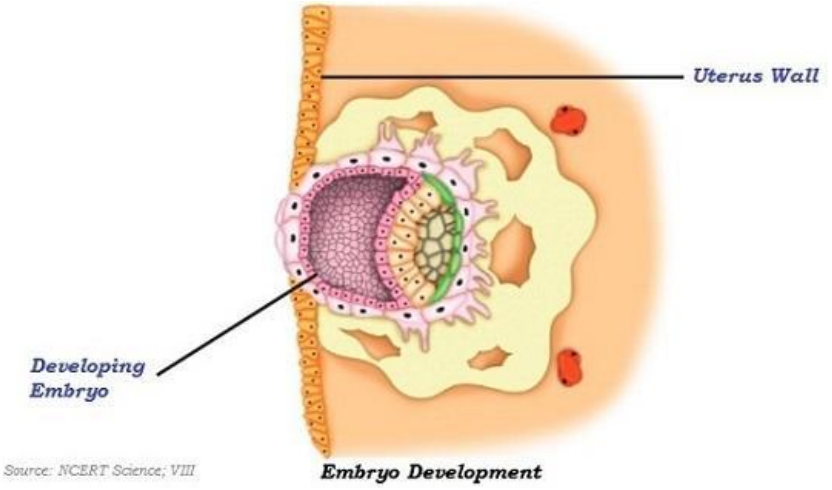
Sexual Reproduction

- In animals, males and females have different reproductive organs.
- The reproductive parts in animals produce gametes that fuse and form a zygote.
- The zygote develops into a new similar species.
- The type of reproduction through the fusion of male and female gametes is known as **sexual reproduction**.
- The male gametes, produced by testes, are known as **sperms**.
- The female gametes, produced by ovary, are known as **ova** (or eggs).
- In the process of reproduction, the first step is the **fusion** of a sperm and an ovum (egg).
- Fusion of the egg and the sperm is known as **fertilization** (as shown in the above image).
- During the fertilization, the nuclei of the sperm and the egg fuse together and form a single nucleus that result into the formation of a **fertilized egg** also known as **zygote** (shown in the image given below).



Source: NCERT Science; VIII

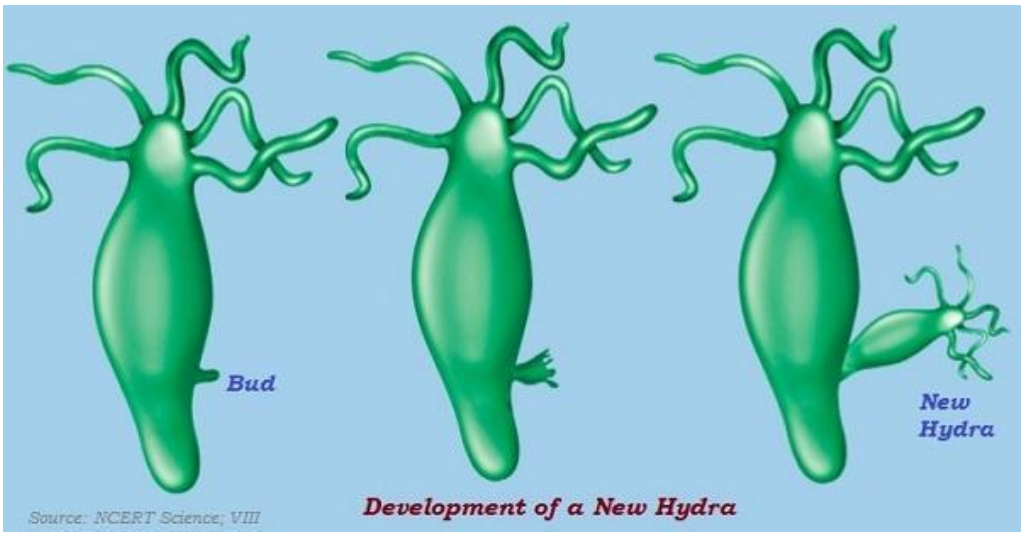
- The zygote further divides repeatedly to give rise to a ball of cells that begin to form groups. The groups develop into different tissues and organs constituting a full body. In the process, the developing structure is known as an **embryo** (shown in the image given below).



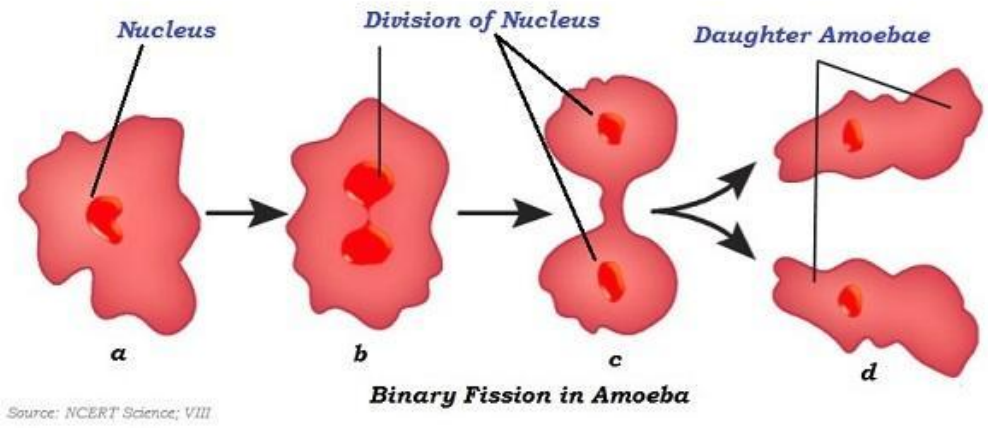
- The embryo continues to develop in the uterus and develops body parts such as head, face, ear, eyes, nose, hands, legs, toes, etc.
- The stage of the embryo in which different parts of the body develop and can be identified is known as **foetus**.
- In a defined period of time, when the development of the foetus is complete, the mother gives birth to the baby.
- The animal which gives birth to young ones is known as **viviparous** animal. E.g. Human, cow, dogs, etc.
- The organism that lays eggs is known as **oviparous** animal. E.g. all birds (except bats), lizard, etc.

Asexual Reproduction

- The type of reproduction in which only a single parent, gets divided into two new offspring, is known as **asexual reproduction**. E.g. Hydra and Amoeba.
- In hydra, the individuals develop from the buds; therefore, this type of asexual reproduction is known as **budding** (shown in the image given below).



- In amoeba, nucleus gets divided into two nuclei; therefore, such kind of asexual reproduction is known as **binary fission**.



Cloning

- Cloning is the modern science technique to produce an exact copy of a cell, any other living part, or a complete organism.
- For the first time, cloning of an animal was successfully performed by Ian Wilmut and his colleagues at the Roslin Institute in Edinburgh, Scotland.
- In 1996, they cloned successfully a sheep and named that Dolly.