

HOW DO ORGANISMS REPRODUCE

REPRODUCTION — is the process of formation of new young ones of similar types by the grown up individuals.

— it is not an essential life process because it is not necessary for survival of life but lot of resources and energy are spent by an individual in order to take part in reproduction as it is important for the continuity of life.

DO ORGANISMS CREATE EXACT COPY OF THEMSELVES.

— Deoxyribonucleic acid (DNA) functions as blueprint of life as it stores all the informations for inheritance of features from parent to next generation. DNA is the information source of making proteins. If the information is changed, different protein will be made which will eventually lead to altered body design.

DNA is normally contained in chromatin of nucleus that form chromosomes at the time of cell division. Prior to cell division, DNA replicates so as to form two copies which remain attached in the form of two chromatids of a chromosome. Cellular machinery also grows because DNA or chromosome alone cannot maintain life processes. At the time of cell division, chromatids (or DNA copies) separate, along with division of cellular apparatus to form two daughter cells. The two daughter cells should normally be exact replicas of parent cell. However, it is not always possible as no biochemical reaction is absolutely reliable. Therefore, it is always expected that copying of DNA have some variations at each time. As a result, DNA copy generated will be similar but may not be identical to the original. Some of the changes may be so drastic that the new DNA is unable to work in the cellular apparatus it inherits. Such a daughter cell will die. In others, the changes result in small variations in structure and functioning of the cell though they remain largely similar to parent cells. This inbuilt tendency of variation during reproduction is the basis of evolution.

THE IMPORTANCE OF VARIATION — Normally each population is adapted to live, feed and prosper in a particular niche or ecological space. Reproduction maintain the body design features and functions suitable to that particular niche. However, due to environmental

changes, there can be some alternations in the niche. If it is drastically altered, the population could be wiped out. However, variations present in some individuals in the population may enable those individuals to survive, multiply and later form the population equal to previous one.

For example, bacteria living in temperate water will die, if the temperature of water is increased. However, some bacteria may have variations for resistance to heat and they would survive and multiply. Variation is thus useful for the survival of species over time.

TYPES OF REPRODUCTION — two types → asexual and sexual reproduction.

1. ASEXUAL REPRODUCTION — used by simple organisms.

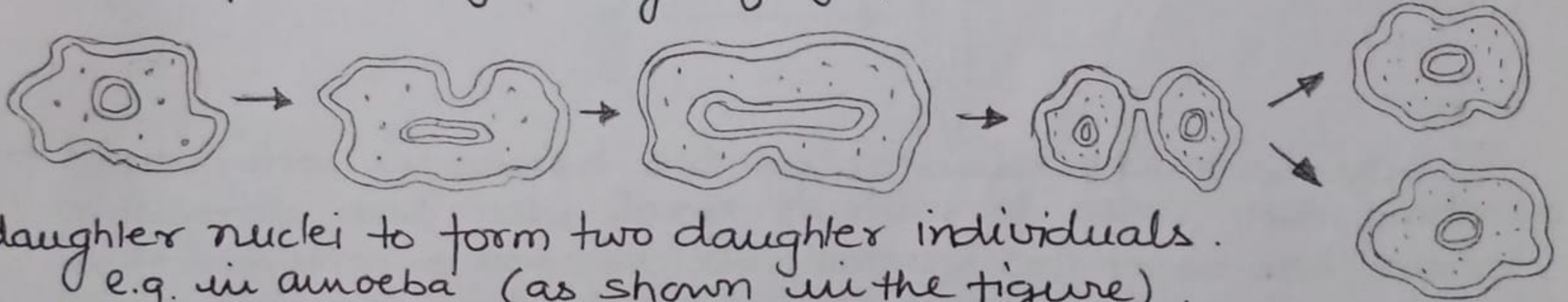
- no formation and fusion of gametes.
- rapid method of multiplication.
- young individuals are genetically similar to the parent with the exception of occasional mutations.

TYPES OF ASEXUAL REPRODUCTION —

(i) FISSION — occurs in unicellular organisms.
- it is of two types - binary fission and multiple fission.

(a) BINARY FISSION — means splitting into two.
- occurs under favourable conditions.

- first nucleus or nuclear matter elongates and then divides into two.
- it is followed by cleavage of cytoplasm in between the two



daughter nuclei to form two daughter individuals.

e.g. in amoeba (as shown in the figure).

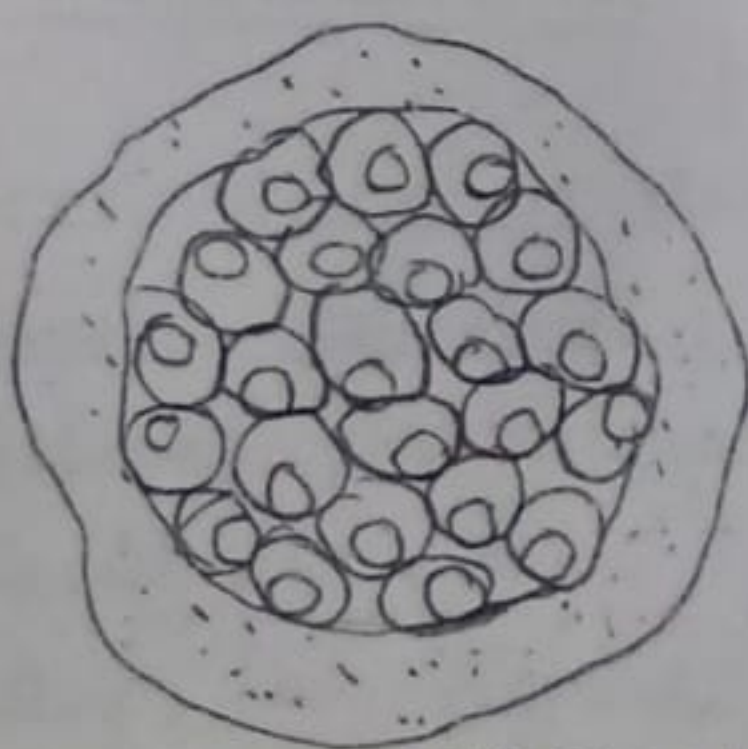
- in amoeba binary fission can occur in any plane. However, in some unicellular organisms which show more organisation of their bodies, it occurs in a definite plane e.g. in paramecium, the plane of division is transverse while it is vertical in Euglena & Leishmania.

(b) MULTIPLE FISSION — number of daughter cells are produced.
- occurs in unfavourable conditions.

- first the nucleus divides repeatedly to form a number of daughter nuclei. Cytoplasm then gather around each nucleus to form daughter cells.

- the parent cell or cyst bursts and releases the daughter cells.

e.g. malarial parasite, plasmodium.

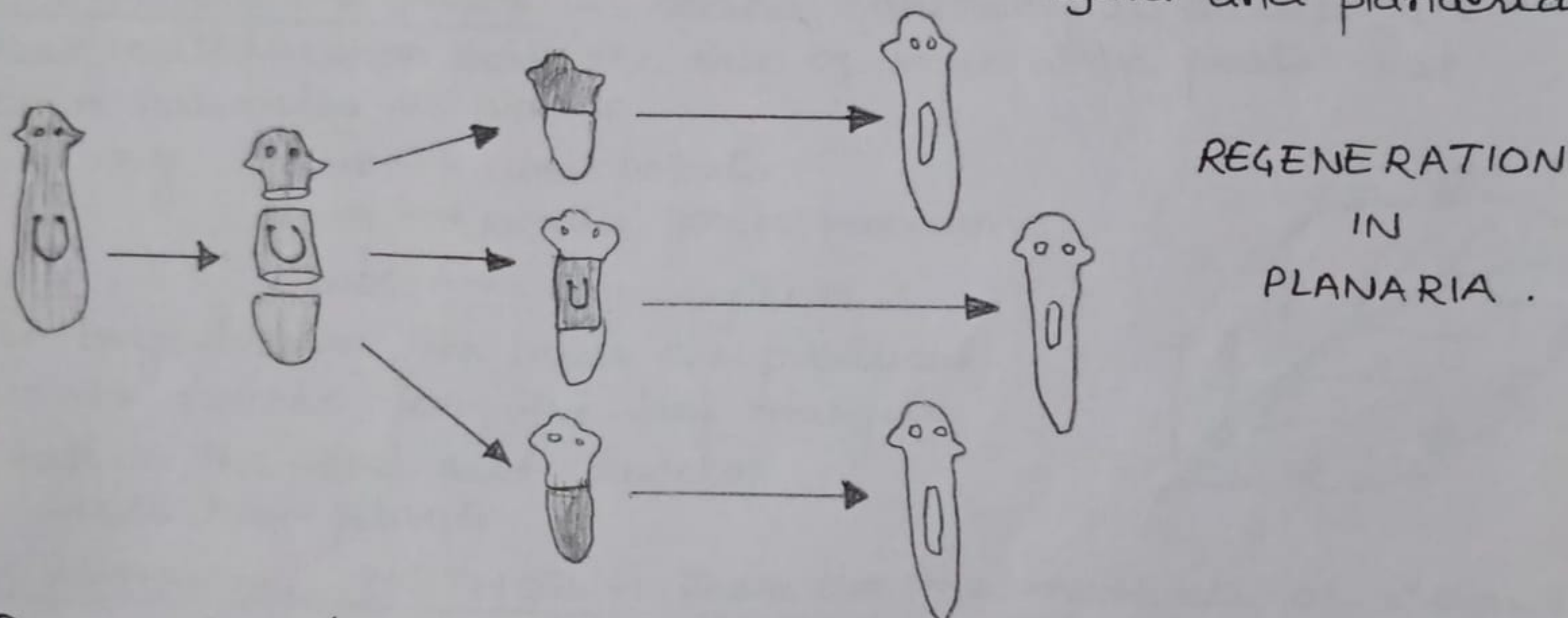


MULTIPLE FISSION
IN PLASMODIUM

2. FRAGMENTATION — occurs in organisms with relatively simple body organization e.g. Spirogyra.

- the body simply breaks up into smaller pieces or fragments upon maturation which further grow into new individuals.
- all multicellular organisms cannot be reproduced by fragmentation as these are not simply a random collection of cells. Specialized cells are organised as tissues and tissues are organised into organs which then have to be placed at definite positions in the body. Therefore, at such level cell by cell division would be impractical.

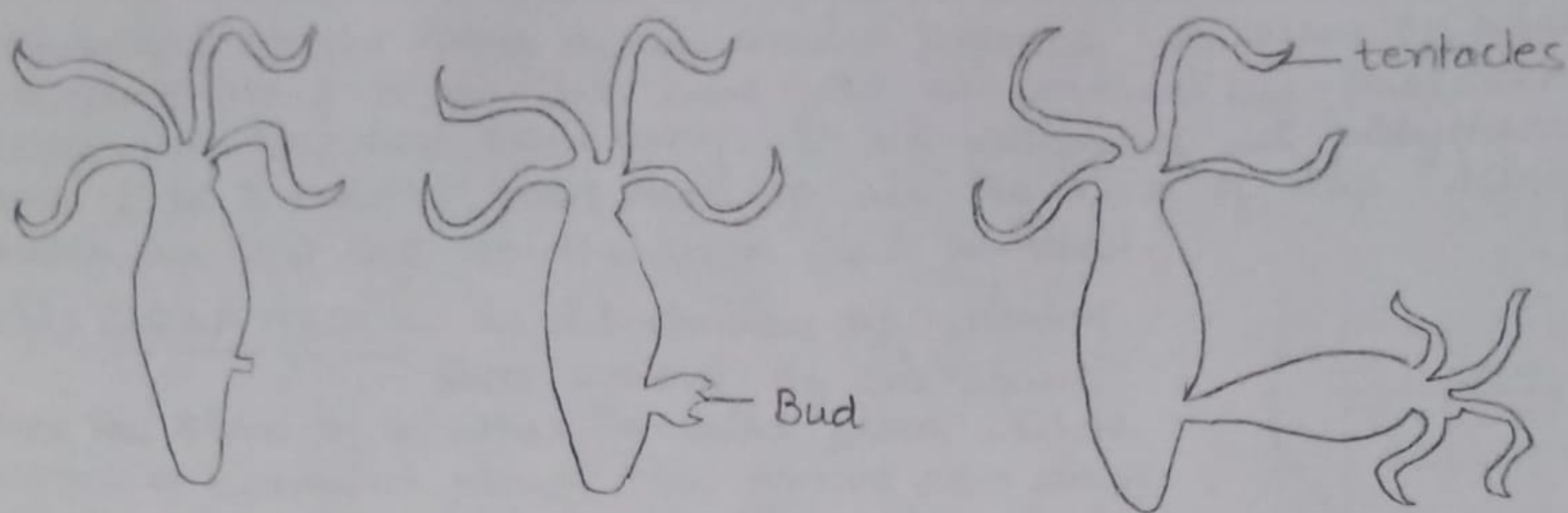
3. REGENERATION — is the ability to give rise to new individuals from their body parts. i.e. if the individual is somehow cut or broken up into many pieces, these pieces may grow into separate individuals. e.g. Hydra and Planaria.



- Regeneration is carried out by specialized cells which proliferate and make large number of cells, then undergo differentiation giving rise to various cell types and tissues. These changes take place in an organised way.
- Regeneration however, is not similar to reproduction because organism will not depend upon being cut or broken for its reproduction.
- Higher animals have limited power of regeneration e.g. tail in lizard, arm in starfish.

4. BUDDING — in this one or more outgrowths develop from the body of an organism due to repeated cell division in regenerative cells at a specific site. These buds develop into tiny individuals. These on maturation detach from the parent body and become new independent individuals.

e.g. — hydra (multicellular) and yeast (unicellular)



BUDDING IN HYDRA

5. VEGETATIVE PROPAGATION — is the formation of new plants from the vegetative parts of the plant like leaves, roots stem, buds etc.

— It is of two types:—

(a) NATURAL METHODS — occurs naturally in plants i.e. plant multiplication with the help of vegetative parts that occur naturally in plants.

- e.g. roots → sweet potato
- stem → potato, ginger, turmeric
- leaves. → Bryophyllum.

— In Bryophyllum, the buds are produced in the notches along the leaf margin fall on the soil and develop into new plants



(b) ARTIFICIAL METHOD — These are the methods of rapid multiplication with the help of vegetative parts which have been developed by horticulturists.

(i) CUTTING — Small pieces of stems, roots or leaves are cut off from the plants and placed in the moist soil in their natural position for forming new plants.
e.g. Bougainvillea, Sugarcane etc.

(ii) LAYERING — In this a branch of plant is pulled towards the ground and a part of it is covered with the moist soil. leaving the tip of branch exposed above the ground. After some time new roots develop from the part of the branch buried in the soil.

The branch is then cut off from the parent plant and it grows to become a new plant.

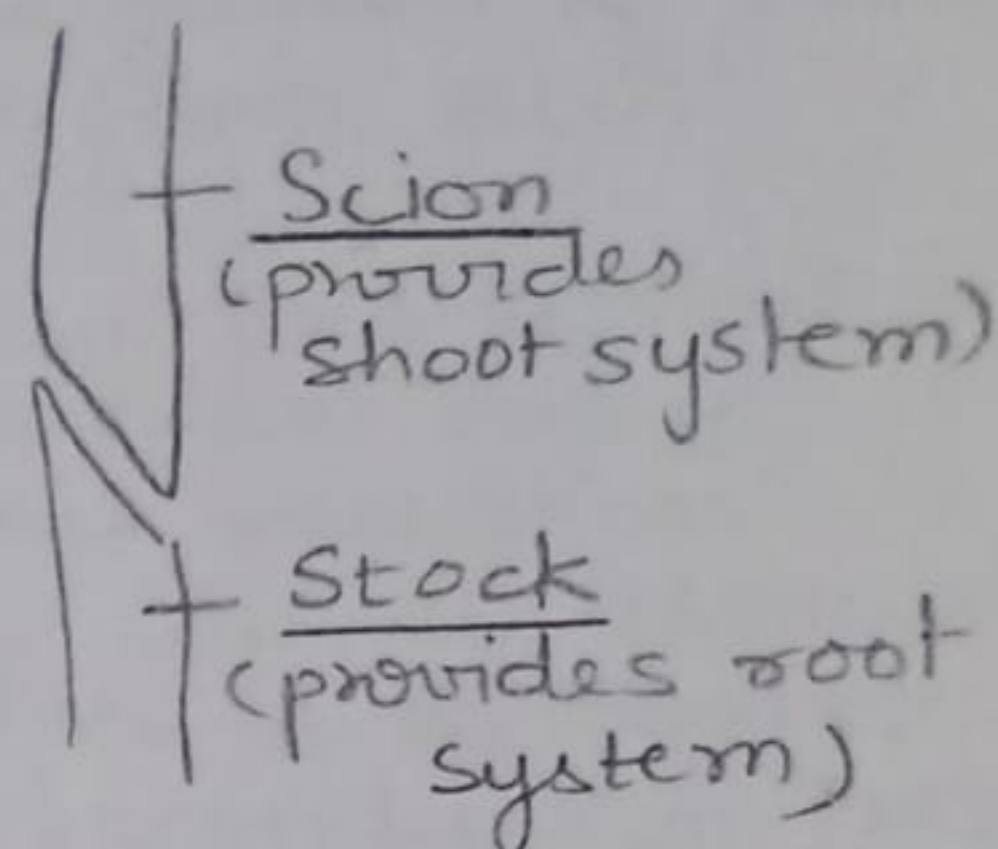
e.g. Jasmine plant, Grape Vine

— When branches do not occur near the ground, air layering can be



performed at the base of an aerial branch. A ring of bark is removed for 2-5 cm. The bare area is covered by moistened clay mixed with hay and cowdung. It is wrapped in polythene. Within 1 to 3 months roots develop in the area of the ring. The branch is now cut at the base and planted.

(iii) GRAFTING - is a technique of joining shoot system of one plant over the stem of another related plant so as to form a composite plant that grows as a single plant. e.g. orange, lemon, apple, mango, pear etc.



ADVANTAGES OF VEGETATIVE PROPAGATION

- it is the only known method of multiplication of seedless plants.
- it gives uniform yield and genetic uniformity.
- survival rate is very high.
- quicker method of raising crops.

DISADVANTAGES OF VEGETATIVE PROPAGATION

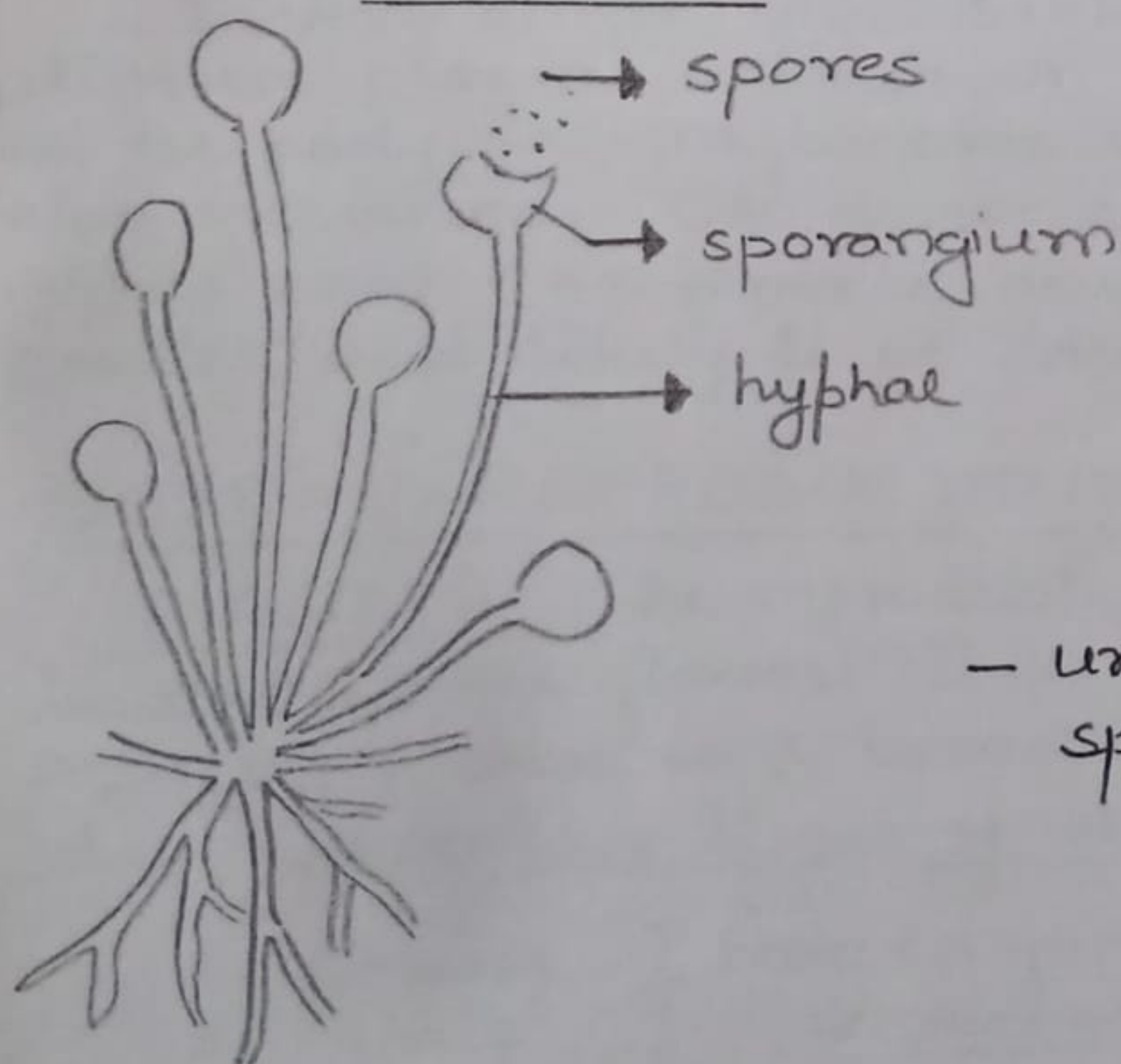
- No variation can be produced.
- Undesirable characters cannot be eliminated.
- With time vegetative propagated plants lose vigour.

6. SPORE FORMATION

- occurs in simple multicellular organisms.

SPORE FORMATION IN RHIZOPUS

- spores are asexual reproductive bodies enclosed in a thick walled structure called Sporangium.



- these spores also have thick covering which help them to survive under unfavourable conditions of drought, high or low temperature etc.

- under favorable conditions, the spores then germinate into new individuals.

e.g. Rhizobium.

2. SEXUAL REPRODUCTION — is a mode of multiplication in which young ones are produced through the formation and fusion of gametes i.e. it involves the cooperation of two sexual individuals — male and female. The cell formed from the fusion of gametes is called zygote, which divides repeatedly to form new individual.

- During asexual reproduction cells divide and DNA replication takes place. At the time of replication, some variation may occur due to error in DNA copying but this variation does not usually cause any drastic change. So, in asexual reproduction offsprings are more or less similar to the parent and variation is slow. However, in sexual reproduction, two types of gametes (male and female) are formed. During the fusion of gametes there is recombination of genetic material from two parents. This leads to greater variation in the offspring. As the offspring gets more variations, it is more likely to adjust better to environmental changes.

- During sexual reproduction, the combination of DNA from two parents would result in the offspring having twice the amount of DNA. To solve this problem, sexually reproducing individuals have special germ cells (gametes) with only half the normal number of chromosomes and, therefore, half the amount of DNA compared to other cells of the body. When these germ cells from two individuals unite to form zygote, the normal chromosome number and DNA content are restored.

- In very simple organisms, the germ cells are not very different from one another or may even be similar. But as the body designs become more complex, the germ cells also specialize. One germ cell is large and contains stored food (i.e. female gamete) while the other is smaller and likely to be motile (i.e. male gamete).

SEXUAL REPRODUCTION IN FLOWERING

PLANTS — The reproductive parts of the plant are located in the flower. It is borne over a stalk called PEDICEL. There is a broad base called THALAMUS which bears four types of floral organs —

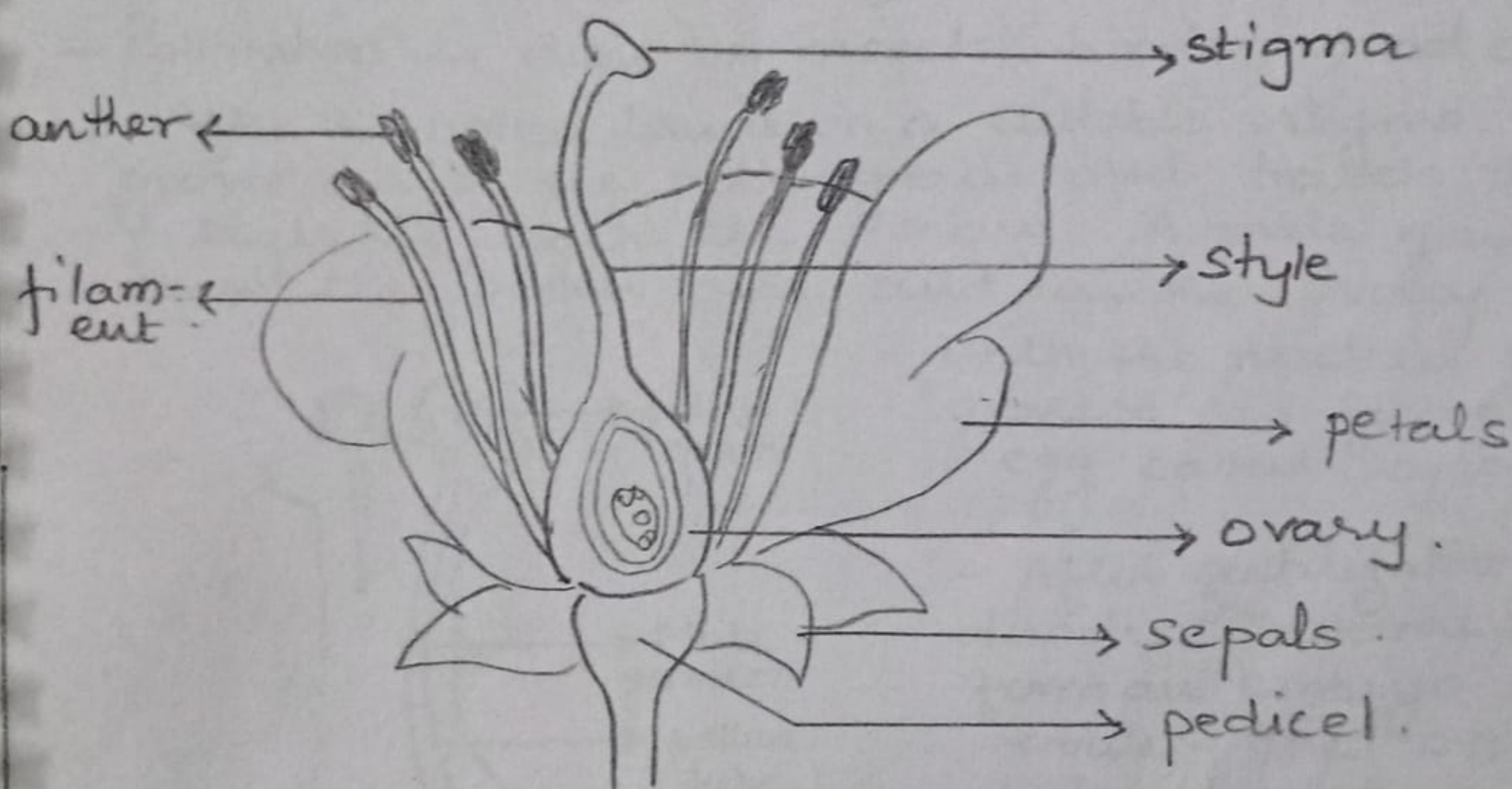
- | | |
|-----------|---|
| 1. Sepals | } have no function in sexual reproduction
⇒ <u>Accessory or nonessential floral organs</u> |
| 2. Petals | |
| 3. Stamen | } take part in reproduction
⇒ <u>essential floral organs</u> |
| 4. Carpel | |

- stamens are male reproductive organs while carpels are female reproductive organs.

- Flower
 - UNISEXUAL FLOWER - have either stamen or carpel e.g. papaya, watermelon
 - BISEXUAL FLOWER - have both stamen and carpel e.g. mustard, Hibiscus.

- SEPALS are green outermost leaf like floral organs which protect the flower in bud stage.

- PETALS are coloured (other than green) and lie above sepals. They may also be fragrant. They attract the insects to flower for pollination. They also provide protection to centrally placed reproductive organs.



Longitudinal section of a flower

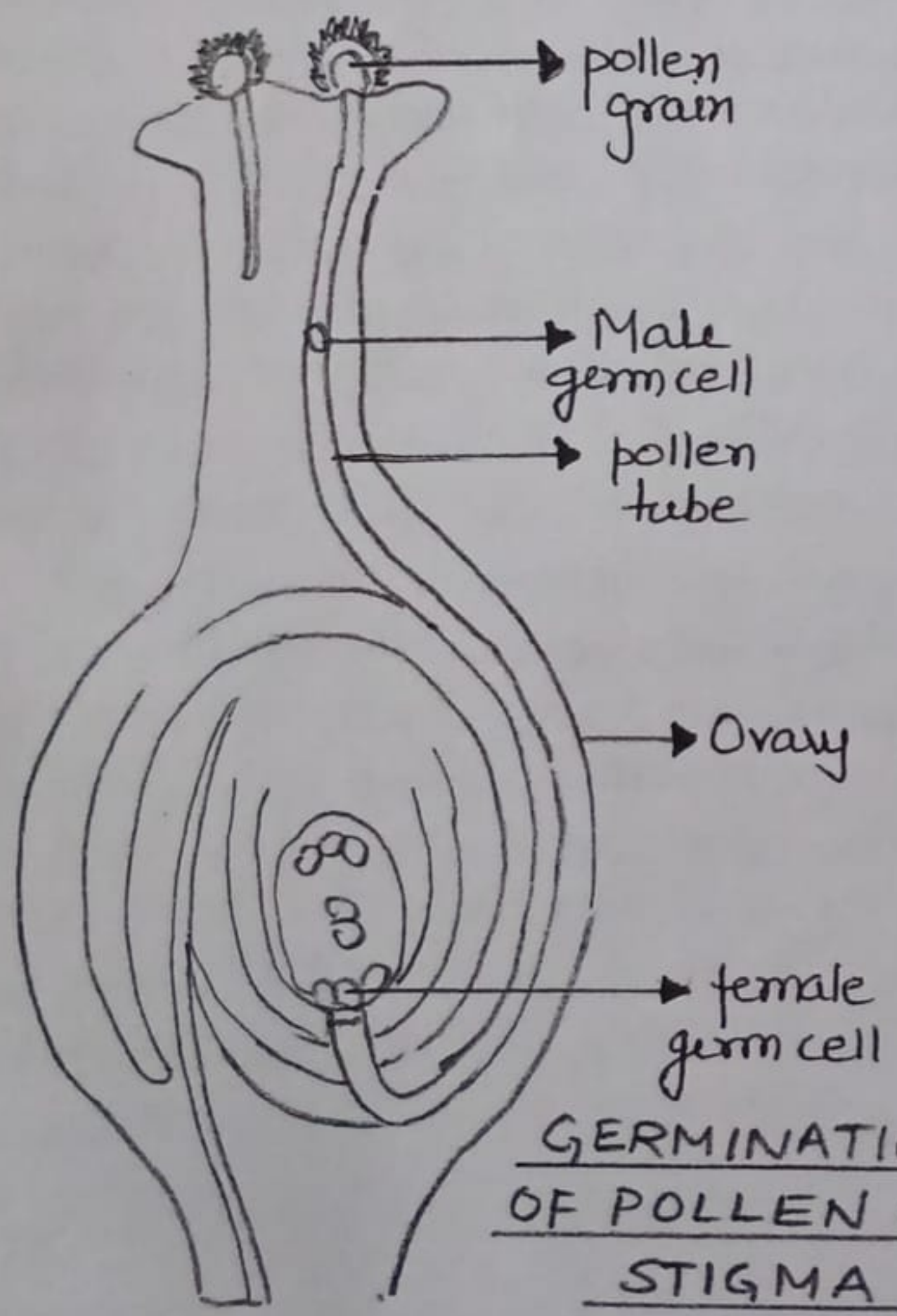
- STAMENS are male reproductive organs. Each stamen has a slender stalk called filament with a terminal knob like structure called anther. Anther produces pollens that are yellowish in colour.

- CARPEL is present at the centre of a flower and is the female reproductive part. It is made up of three parts. The swollen bottom part is the ovary, middle elongated part is style and the terminal part stigma. Stigma is sticky so that pollen grains can stick on it. The ovary contains ovules and each ovule has an egg cell. The male germ cell produced by pollen grain fuses with the female gamete present in the ovule. The fusion of germ cells (or fertilization) leads to the formation of

zygote which is capable of growing into a new plant.
 - For the formation of zygote, it is necessary that first the pollen grains from anther should be carried to stigma.
 The transfer of pollen from anther of a stamen to the stigma is called POLLINATION.

- Pollination
 - SELF POLLINATION - when the pollen grains are transferred from the anther of a flower to the stigma of the same flower (or another flower of same plant).
 - CROSS POLLINATION - when pollen grains are transferred from the anther of flower of one plant to the stigma of a flower of another similar plant.

- Pollination is done by insects, birds, wind and water.
- After the pollen lands on a suitable stigma, a tube grows out of the pollen grain and travels through the style to reach the ovary. A male gamete moves down the pollen tube and in the ovary it combines with the nucleus of the female gamete to form a fertilized egg called zygote.



- After fertilization, the zygote divides several times to form an embryo within the ovule. The ovule develops a tough coat and gradually converted into seed. The ovary grows rapidly and ripens to form fruit (with seeds inside it). The other parts of the flower like sepals, petals, stigma and style dry up and fall off.

- The embryo lies dormant in the seed. Under favourable environmental conditions

it becomes active and germinates to form a small seedling. The radicle forms the root while the plumule forms the shoot. The growing root and shoot utilize the food stored in cotyledon. This process is known as germination.

