METHODS OF ASEXUAL REPRODUCTION AND THEIR ENVIRONMENTAL REGULATION

ASEXUAL REPRODUCTION

- The development of new individuals without the fusion of the male and female gametes is known as asexual reproduction.
- It needs single parent to produce offspring.
- It usually includes amitotic and mitotic divisions of the nucleus and the cytoplasm in the body(somatic)cells, therefore it is known as somatogenic or blastogenic reproduction.
- No genetic variations occur in the offspring .
- It is very common in lower invertebrates

DIFFERENT METHODS OF ASEXUAL REPRODUCTION

- FISSION
- BUDDING
- GEMMULES FORMATION
- REGNERATION
- PARTHENOGENESIS

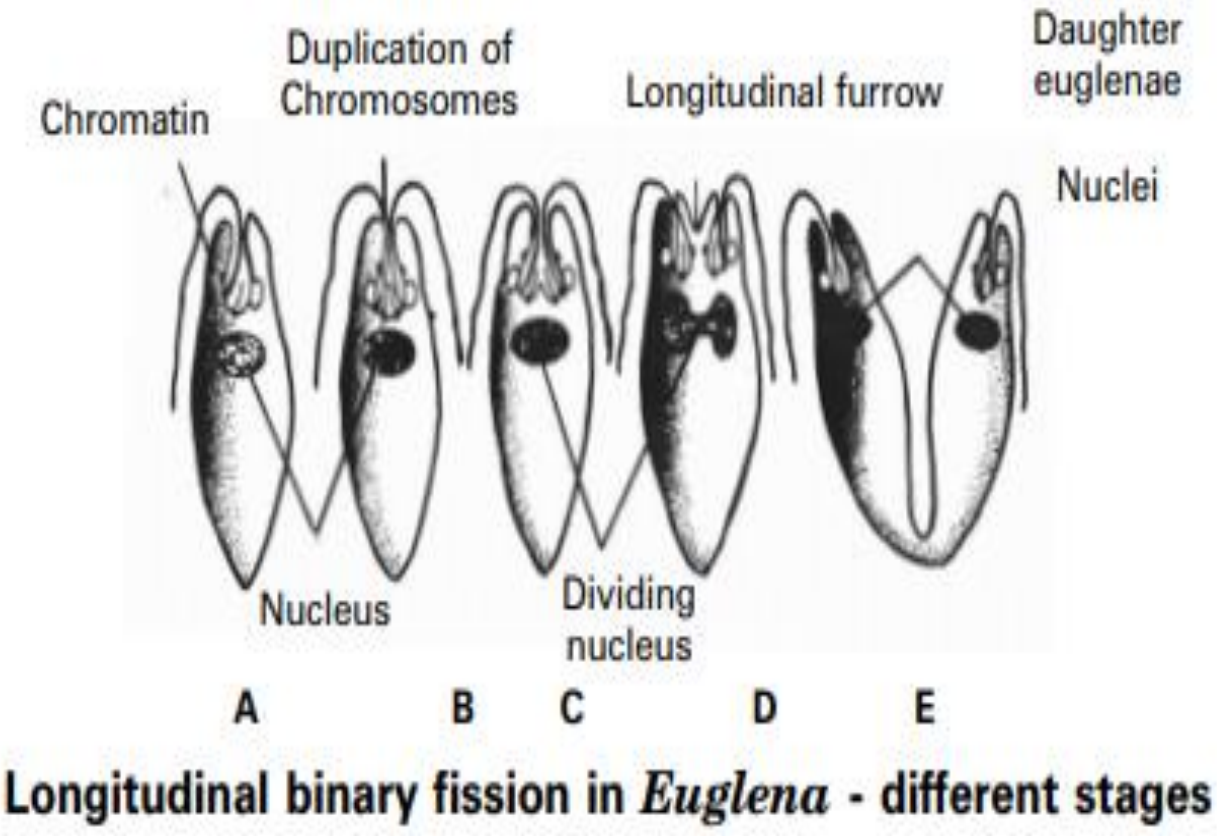
PROTOZOA

- Binary Fission-In binary fission the animal body splits or divide in such a plane that two equal and identical halves are produced. First the nucleus divides by amitotic or mitotic division and then the cytoplasm divides.
- It is the most widely occurring type of asexual reproduction of the protozoans .
- According to the plain of fission following are the types of binary fission

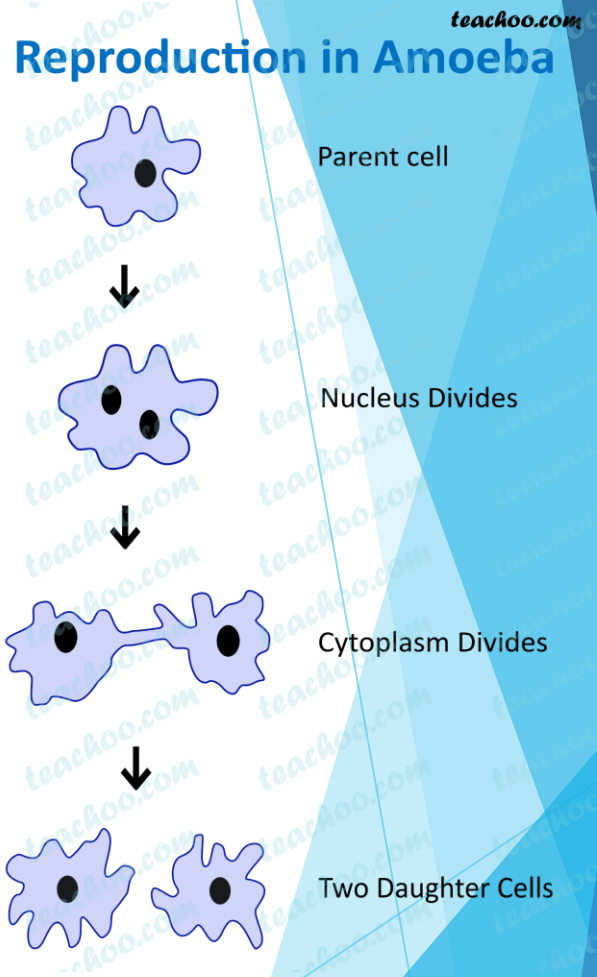
1. Simple binary fission
2. Longitudinal binary fission
3. Transverse binary fission
4. Oblique binary fission

(a) Simple binary fission–It occurs in irregular shaped organisms .The division occurs in only one plane . Example: Amoeba

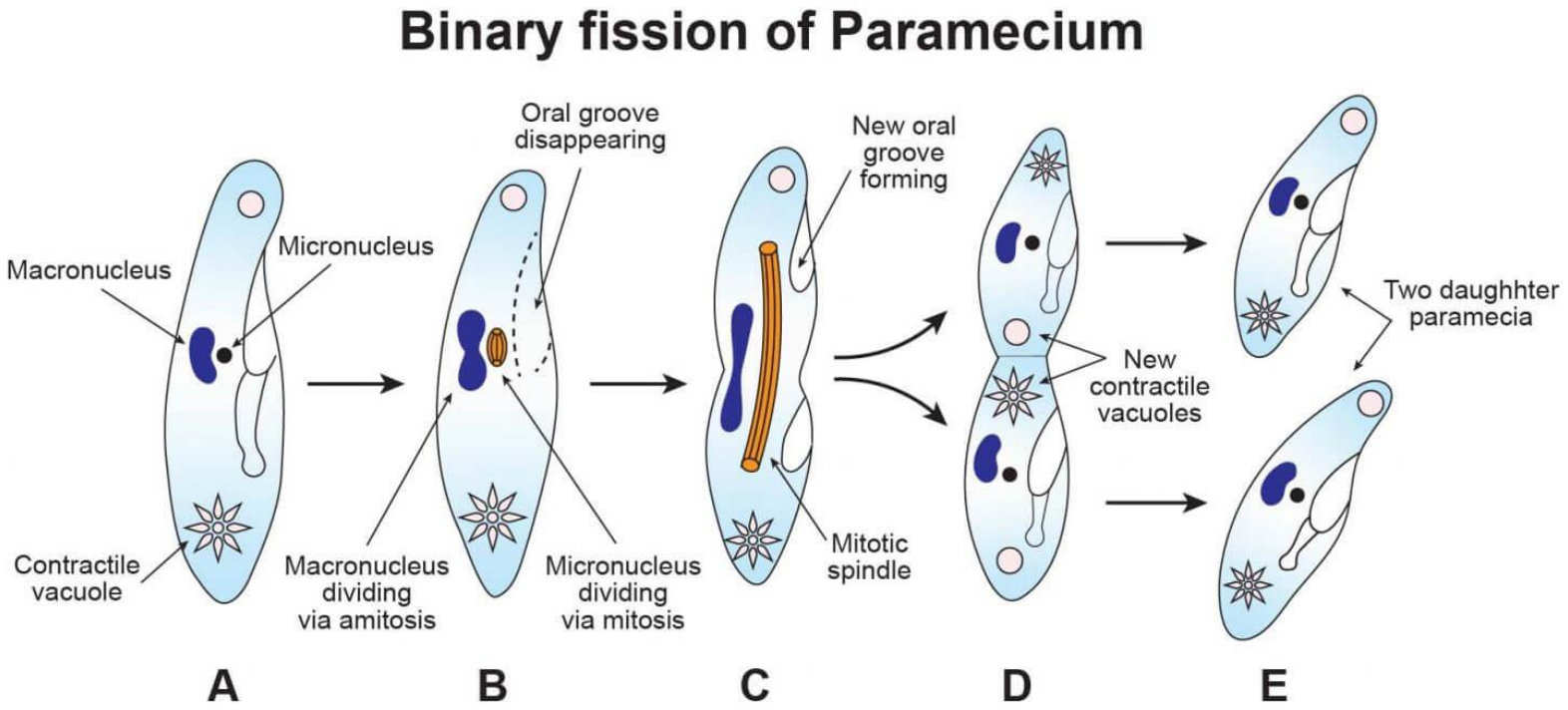
(b) Longitudinal binary fission -In longitudinal binary fission the nucleus and the cytoplasm divides in longitudinal plane. Example: Euglena



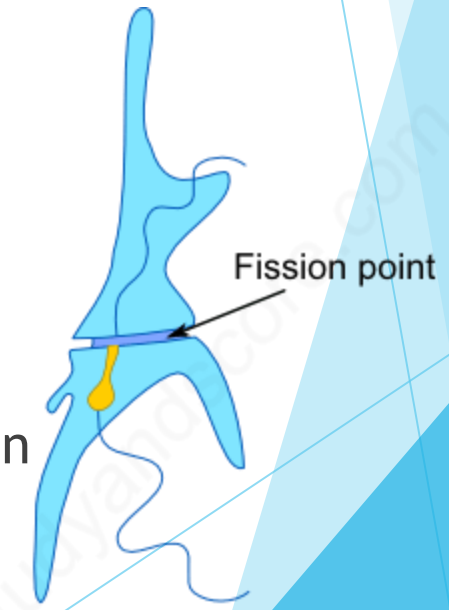
Longitudinal binary fission in *Euglena* - different stages



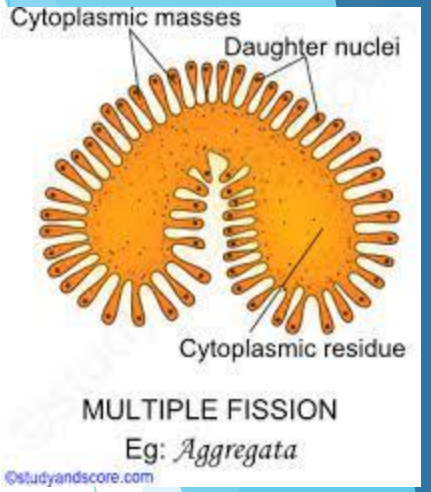
(c) Transverse binary fission- The plain of division is always transverse to longitudinal axis of the body of the organism. Example: Paramaecium



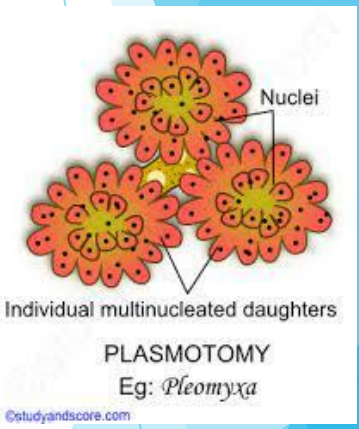
(d) Oblique binary fission-The division of the cell or the body lies at an angle to transverse axis . Example : Ceratium



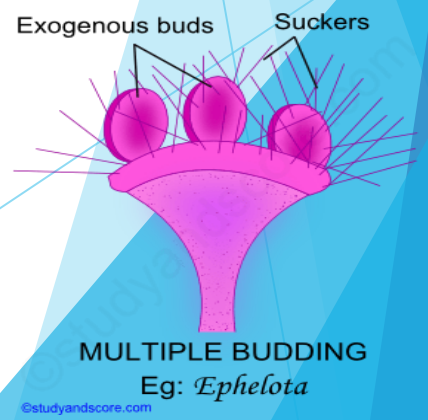
- Multiple fission-It occurs by division of parent body into many daughter organisms. The nucleus of the cell divides very rapidly into many nuclei and each daughter nucleus in later stage is surrounded by the little mass of cytoplasm and forms the asexually reproducing body Example : Aggregata



- Plasmotomy-It is the division of multinucleate protozoan into multinucleate daughter individuals by cytoplasmic division but without nuclear division. The parental nuclei are distributed among the daughter nuclei. Example: Opalina, Pleomyxa

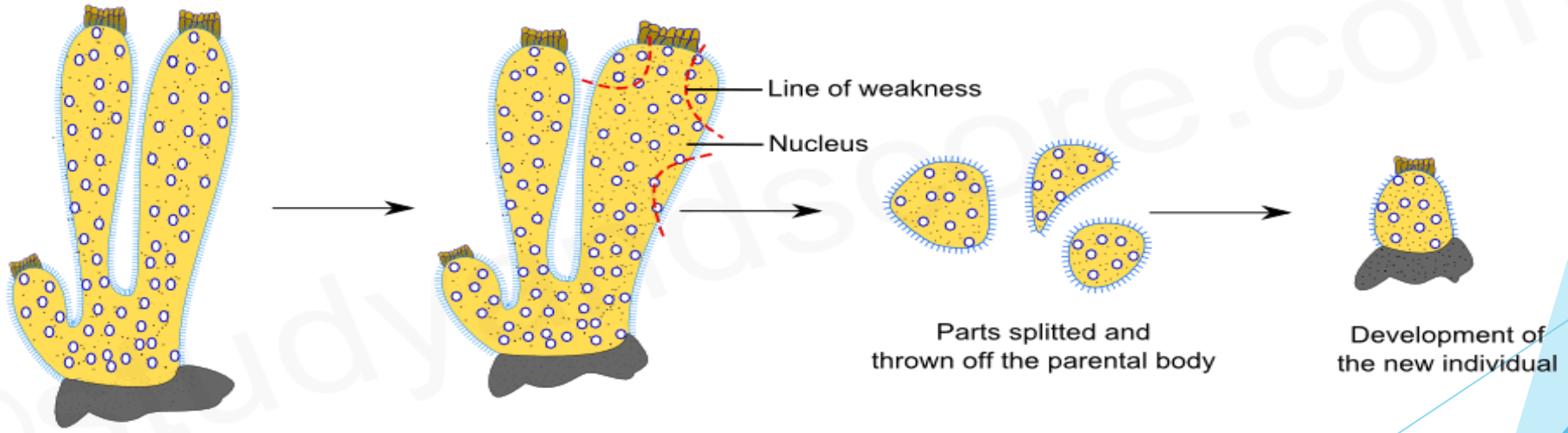


- Budding- It is common in suctorian protozoans. The bud is a smaller individual formed after nuclear division. Buds can occur either exogenously or endogenously in some protozoans. Example: Ephelota



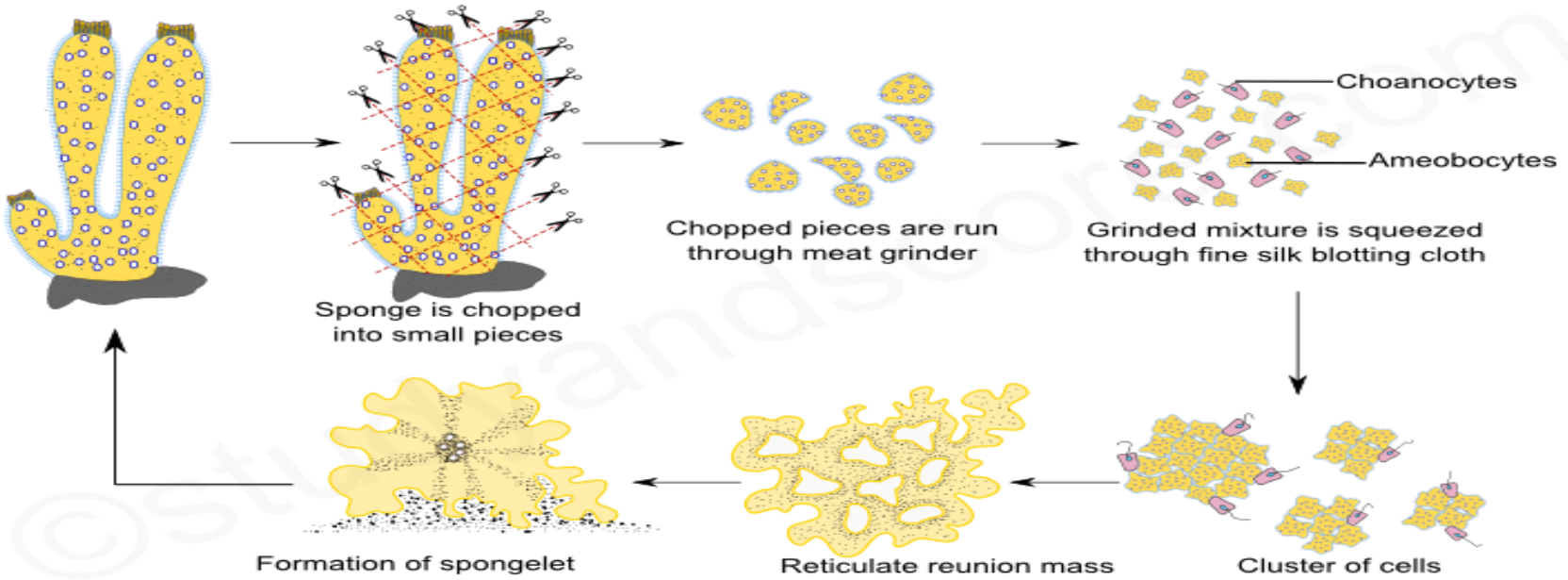
PORIFERA

- FISSION-In this type of reproduction parts of the sponge body are thrown off from the sponge body. The sponge is hypertrophied over a limited area developing a line of weakness. Along this weak line, splitting occurs and this part is thrown off. The part of parental sponge thus thrown off develops into an adult individual.

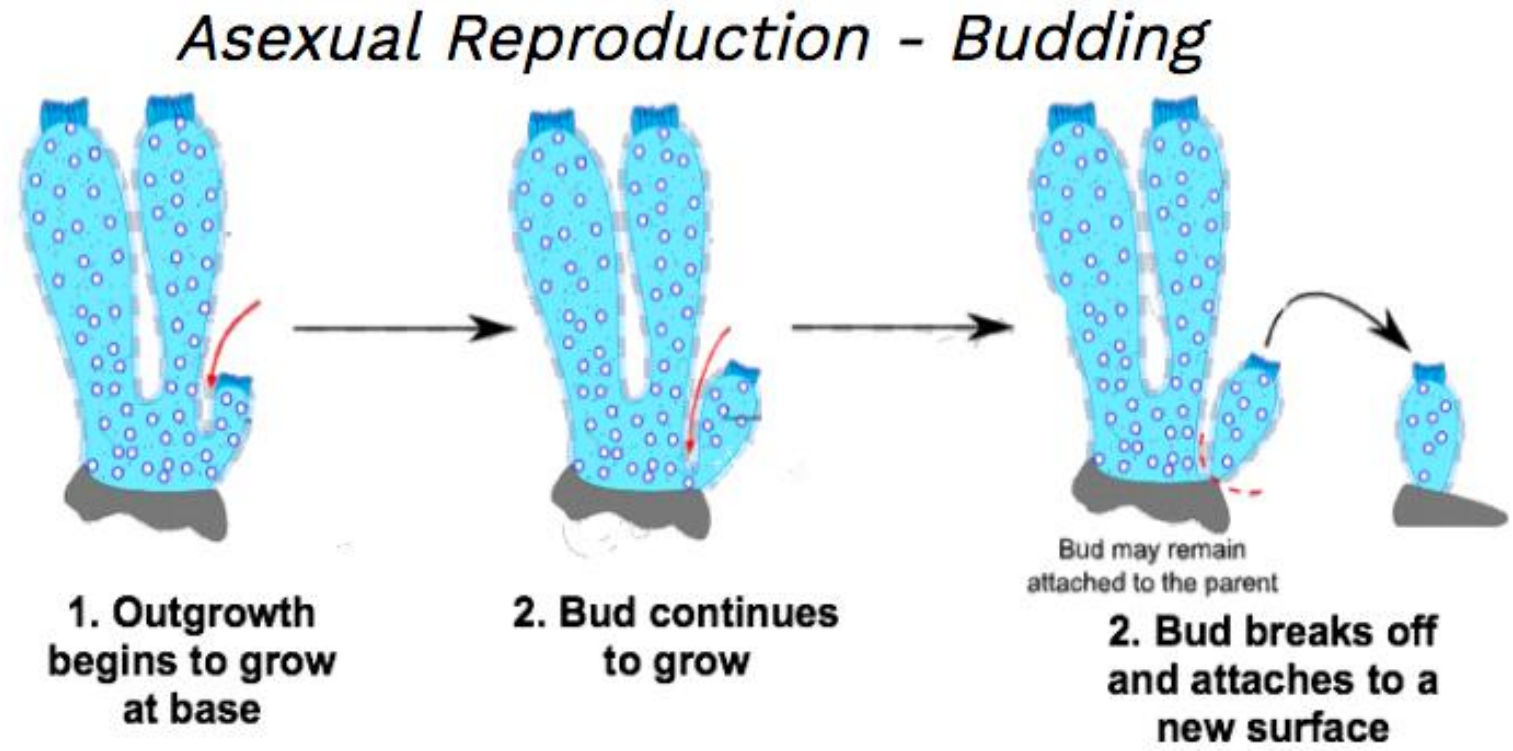


ASEXUAL REPRODUCTION: FISSION

- REGENERATION-Sponges have tremendous ability to repair injuries and to restore lost parts by a process called regeneration. Their epithelial tissue regenerates readily whereas highly differentiated tissue such as muscle or nerve tissue have limited power of regeneration.



- BUDDING- An outgrowth from the sponge body wall may arise either at the base or near the attached end to form bud. This bud is the result of bulging of pinacoderm. The bud so formed grows in size, breaks off an osculum at its distal end and thus becomes an adult individual.



- FORMATION OF GEMMULES –They are internal buds formed within the sponge body. Gemmules eventually get detached when the parent sponge is decayed . A gemmule is a small, round, hard ball consisting of internal mass of food laden archaeocytes surrounded by chitinous double membrane.

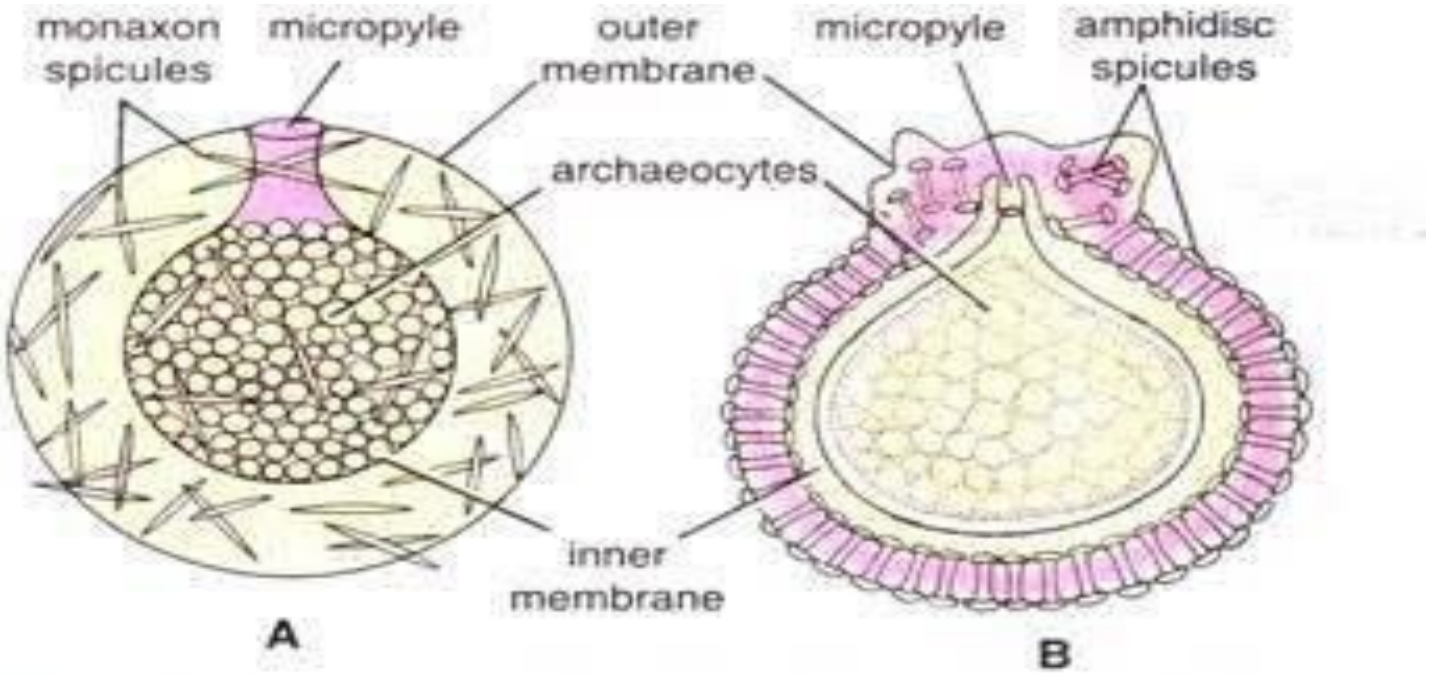
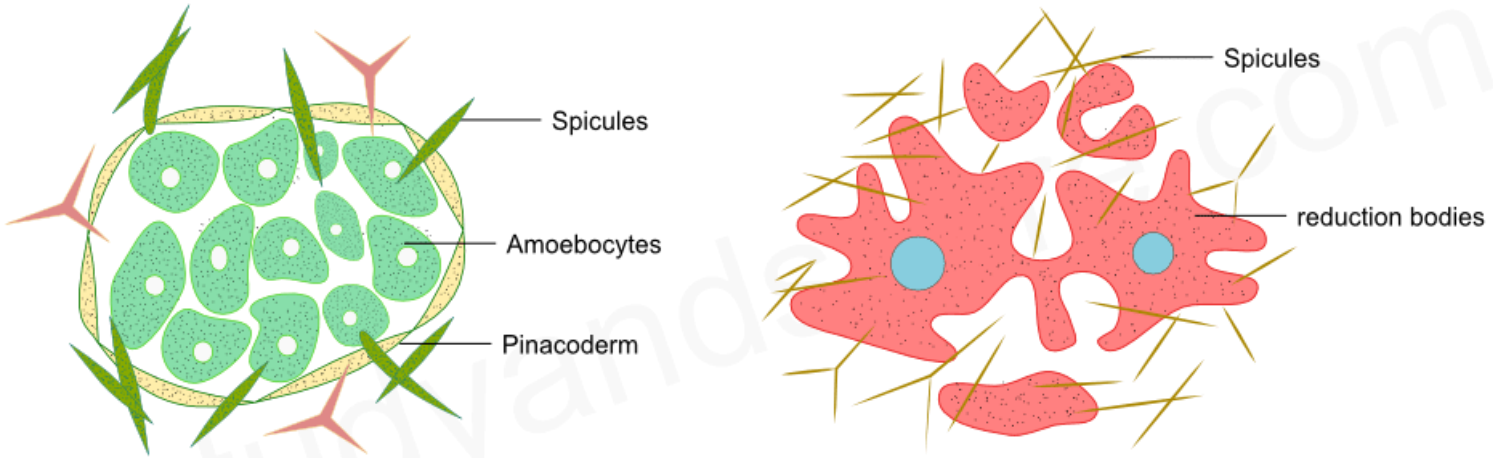


Fig. 28.14. A—Gemmule of *Spongilla*; B—Gemmule of *Ephydatia* (section).

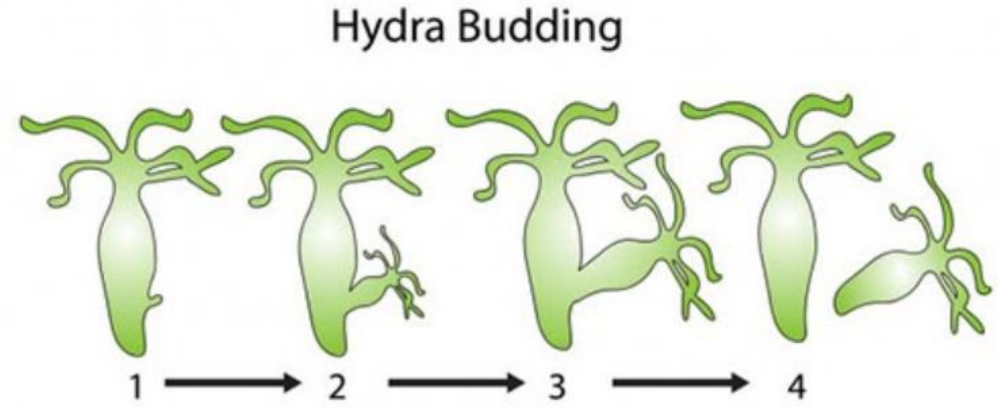
- REDUCTION BODIES- Some fresh water and marine sponges get disintegrated during adverse conditions. During unfavorable conditions, the sponge collapse leaving small rounded balls called reduction bodies.
- Each reduction body consists of internal mass of amoebocytes covered externally by pinacoderm. When the favorable conditions return, each reduction body develops into a new sponge.

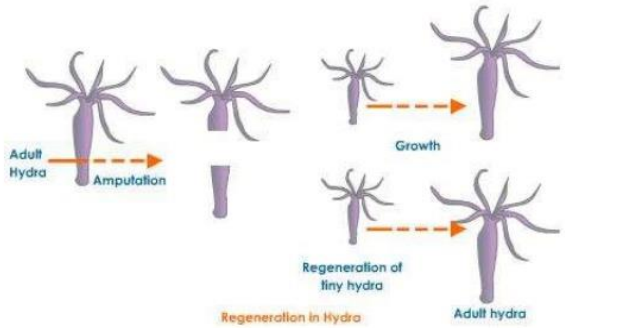


ASEXUAL REPRODUCTION: REDUCTION BODY FORMATION

COELENTERATA

- They generally reproduce asexually by budding and regeneration.
- Polyps a bud develops as a simple evagination of the body wall primarily reproduce asexually by budding, however some produce gametes whereas medusae reproduce sexually using eggs and sperm.
- All cnidarians can regenerate, allowing them to recover from injury and to reproduce asexually.
- Medusae have limited ability to regenerate, but polyps can do so from small pieces or even collection of cells.





• Regeneration

- Strobilation- It is a special type of transverse fission known as strobilation. In the process of strobilation several transverse fissions occurs simultaneously and giving rise to number of individuals which often do not separate from each other immediately .Example: Aurelia

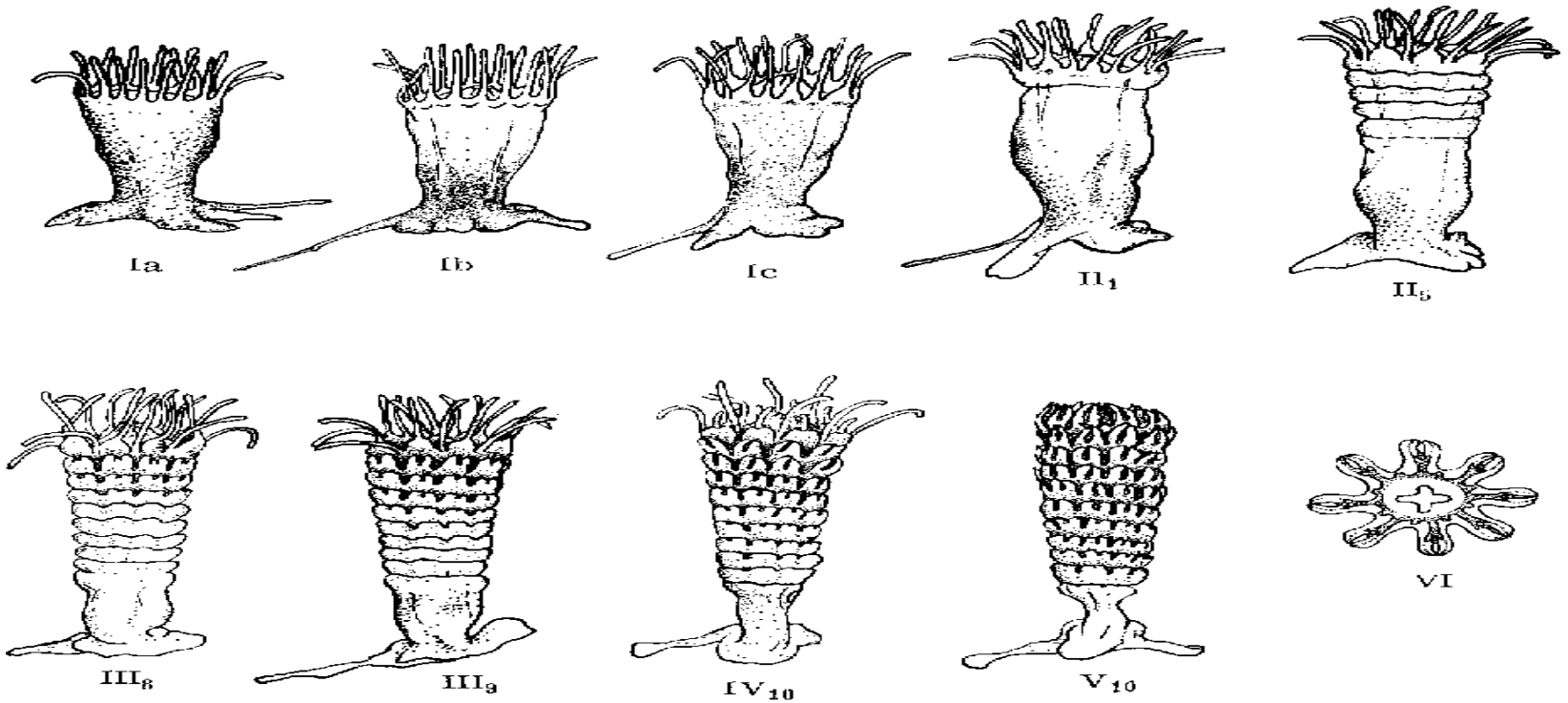
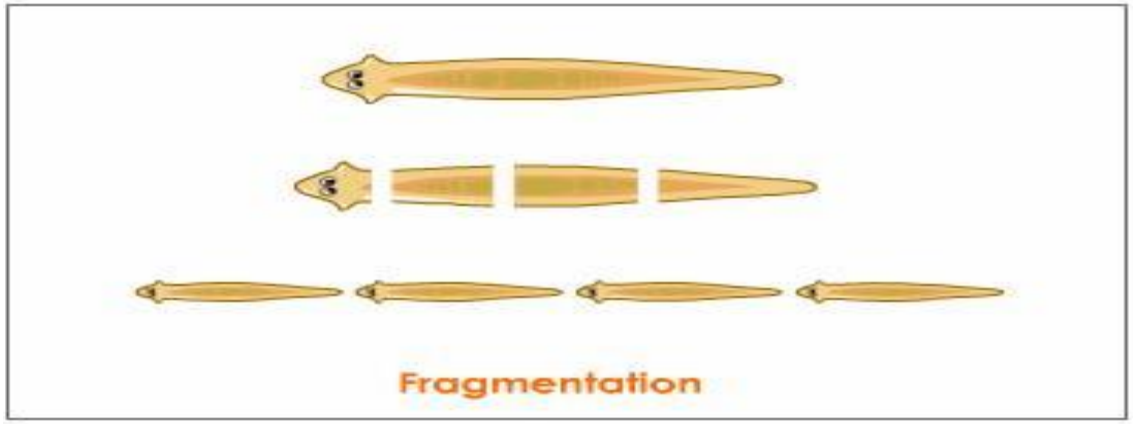


Fig. 1. Strobilation process of *Aurelia aurita*.

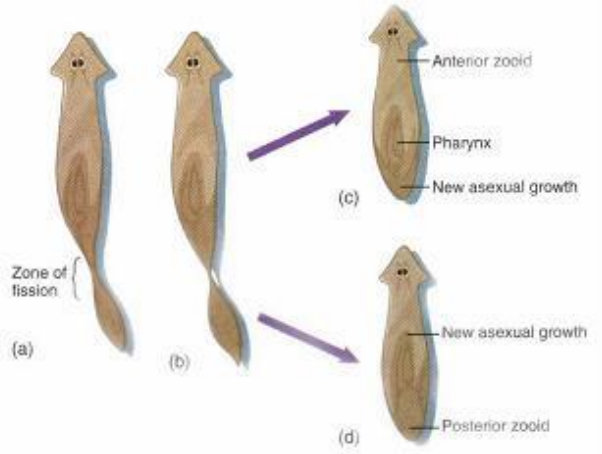
PLATYHELMINTHES

- Asexually, flatworms procreate via fragmentation ,budding and transverse fission.
- Fragmentation, also called cloning, occurs when a flatworm splits off a part of its body, allowing the separated portion to regenerate into a new worm.



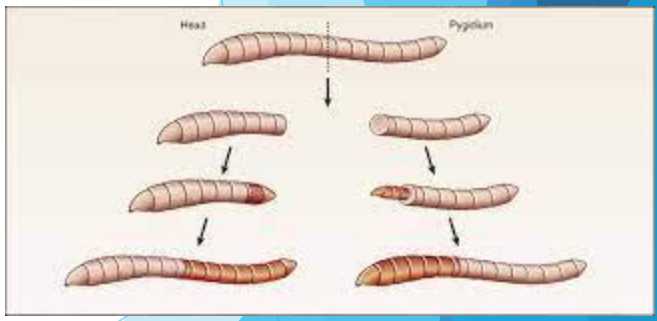
- With budding, a flatworm grows an extension from its body. This extension, or bud, becomes a new worm and separates from the original flatworm.

- The non parasitic flatworms undergo transverse fission, in which a single organism splits up into smaller fragments through transverse fission



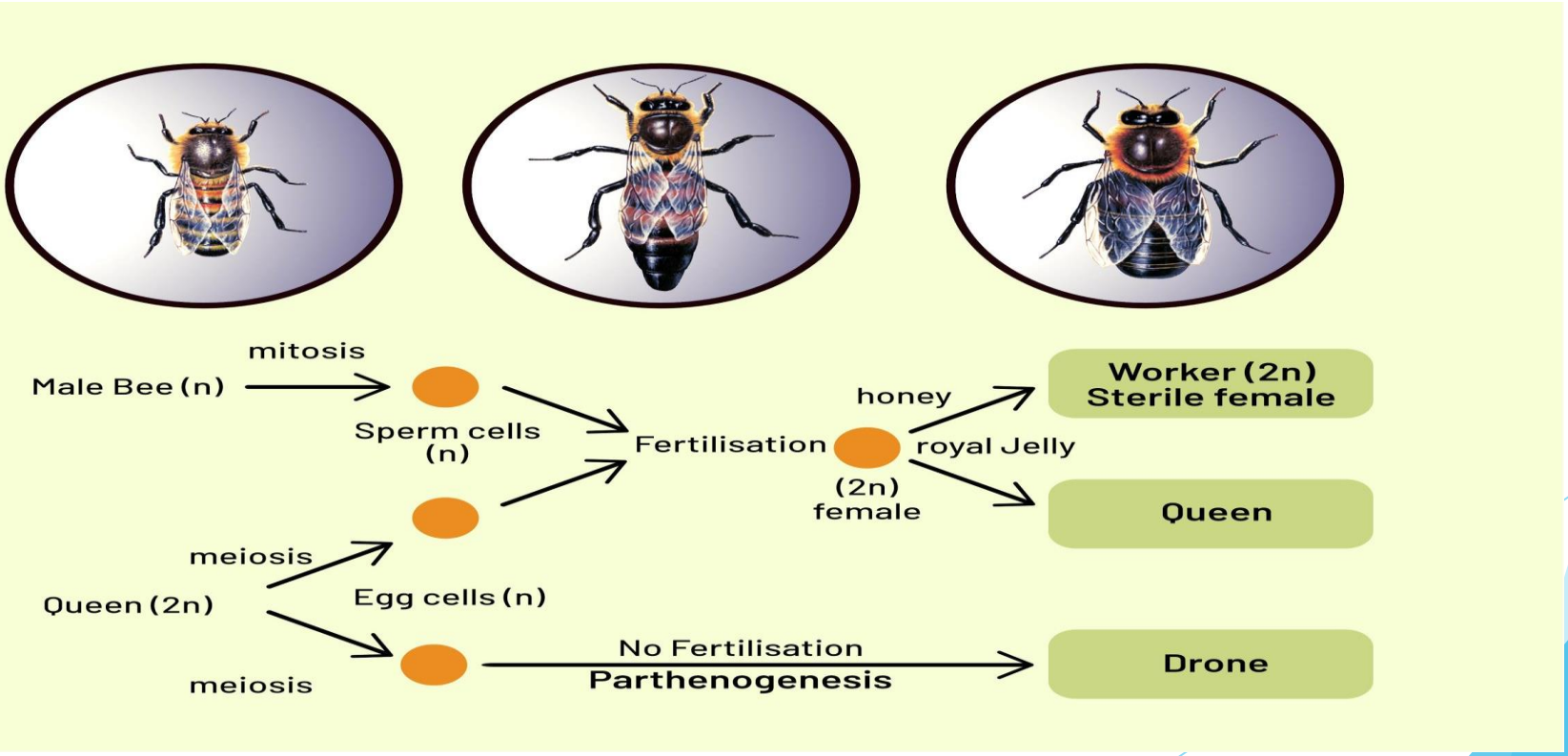
ANNELIDA

- Some species reproduce asexually by budding or by diving into two or more pieces.
- During budding the worm forms a small protrusion or bud that slowly develops into a new organism.
- When the bud has developed to a point where it can function independently of the parent, it breaks off.
- Fission differs from budding in that the parent simply splits into two pieces, and then each piece reforms the missing components to form a whole organism.
- Annelids except for leeches can regenerate after damage or fragmentation.



ARTHROPODA

- Parthenogenesis is the form of asexual reproduction where an egg develops into a complete individual without being fertilized . The resulting offspring can be either haploid or diploid depending on the process and the species . It occur in few species of insects and crustaceans. eg. aphids , wasps , bees .

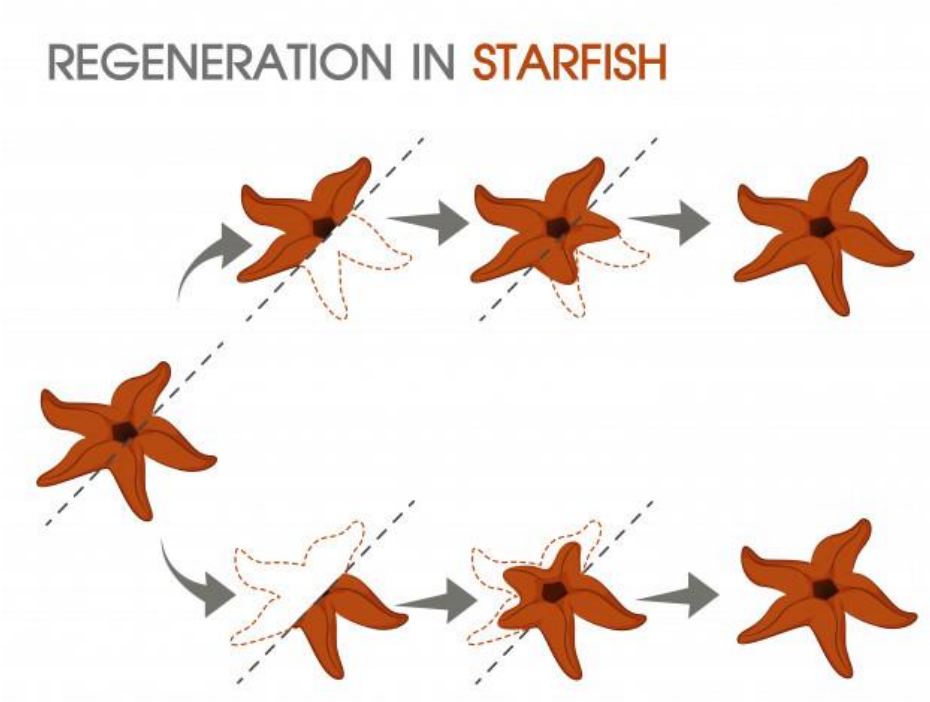


MOLLUSCA

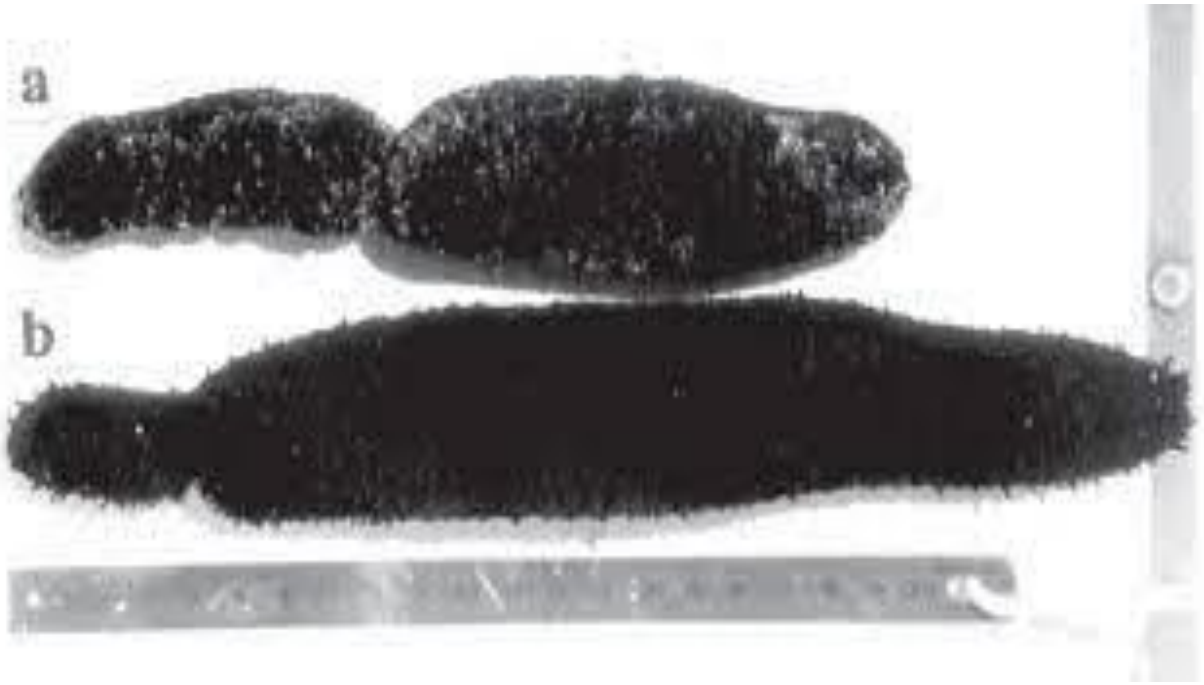
- Parthenogenesis is also found among gastropods of the subclass prosobranchia .
- During parthenogenesis, cell division allows the unfertilized female gamete to develop without auto or sexual fertilization. This results in clone or an exact replica of the parent cell.

ECHINODERMS

- Regeneration is the process by which the organisms develop or regenerate their lost or worn out parts by the proliferation of cells. It is the best means of asexual reproduction in starfishes, brittle stars and sea lilies.



- Fission is a seasonally occurring event in *sea* cucumbers which can reproduce sexually but have the ability to reproduce asexually by transverse fission.
- Cloning by transverse fission is an important means of maintenance of population size in several echinoderm species



ENVIRONMENTAL REGULATION

Environmental factors that regulate asexual reproduction are:

1. Temperature
2. Salinity
3. Light intensity
4. Food
5. Seasonal variation

- In case of aurelia (Cnidaria)

1. Temperature-The production of new buds decreases with warm temperature. High temperature accelerates the process of strobilation . Low temperature decrease the process of strobilation.

2. Light-The rate of production of new buds decreases with the stronger light intensity .The process of strobilation does not occur at very low light intensity .

3. Salinity-The population of polyp decreases with low salinity. So asexual reproduction declines at low salinity .

4. Food-When the polyps are provided with more food their production increases.

- In case of aphids and some gall wasps there is a switch between sexuality and parthenogenesis which may be triggered by the season or lack of favourable conditions. In these species asexual reproduction occurs either in spring or summer (favourable conditions) and sexual reproduction occurs either in late summer or winter (unfavourable contitions).

- Some populations of echinoderms exhibit distinctly seasonal patterns of asexual reproduction by fission. For example the individuals of the sea cucumber shows evidence of regeneration varied over the year, with fission taking place principally in the summer and regeneration occurring during the late summer, autumn and winter.
- The sea star splits most frequently in the spring and summer. It may be advantageous for individuals within this population to split in the summer, since there is a large seasonal range in sea temperature. The higher summer sea temperatures may maximize rates of regeneration, there by decreasing recovery time and thus the interval between fissions.
- There is some evidence that seasonally fluctuating factors may regulate fission cycles in case of sea star such as increase in day length may stimulate the synthesis of an endogenous chemical substance that upon reaching some threshold level either initiates fission directly or makes a sea star more responsive to external fission-inducing triggers.

- In an unstable and unpredictable environment asexually reproducing species may have disadvantage because all the offspring are genetically identical and may not have genetic variation to survive in a new or different conditions . The various environmental factors leads to elimination of various species from where the climatic conditions are not suitable for them.
- But there is an advantage that colonization of new habitats may be easier when the individuals does not need to find a mate to reproduce.

THANK YOU