TOPIC: OBELIA:MORPHOLOGY AND LIFE HISTORY-IV

LECTURE NO:16

B.SC PART 1

ZOOLOGY(HONS.)-PAPER I-GROUP A

CHAPTER 5

DATE: 13TH MAY 2020

AUTHOR-DR.NIRMAL KUMARI

Life History of Obelia:

Fertilisation:

Fertilisation usually takes place in open sea water where the gametes are set free. Sometimes, the sperms are carried into the female medusae with water currents and there they fertilize the eggs in situ. However, the parent medusae die soon after liberating their respective gametes.

Development:

The zygote undergoes complete or holoblastic and equal cleavage to form a single-layered blastula with a blastocoele. Some cells migrate into blastocoele, eventually filling it completely to form a solid gastrula known as stereo gastrula. Its outer cell layer becomes the ectoderm and inner cell mass the endoderm.

The gastrula elongates and. its outer layer of ectoderm cells becomes ciliated, and now it is called planula. Soon, a cavity called

enteron develops in the solid endodermal cell mass by the process of delamination and the planula becomes a two-layered larva having an outer ciliated ectodermal cells and an inner layer of endodermal cells.

The planula after a short free-swimming existence settles on some solid object by its broader end. The free end forms a manubrium with a mouth and a circlet of tentacles. Thus, a simple polyp or hydrula is formed which grows a hydrorhiza from its base, from which an Obelia colony is formed by budding.

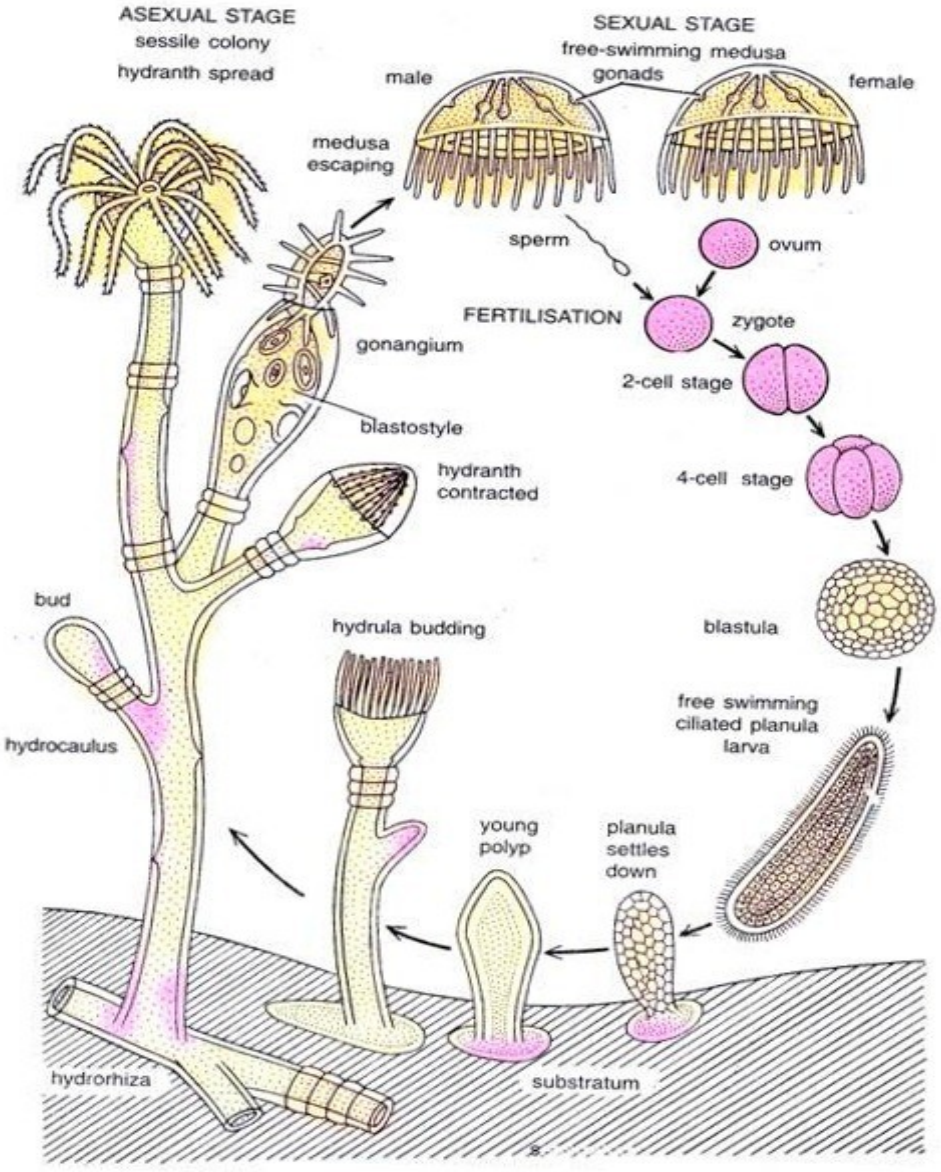

Fig. 32.11. *Obelia*. Stages in the development and life history.

The free swimming planula stage in the life history of Obelia, helps in the dispersal of the species. The life history may be represented as male and female gametes → zygote → planula larva → hydrula → colony → sexual medusae → gametes → zygote and so on.

Alternation of Generations and Metagenesis of Obelia:
It is clearly evident from the life history of Obelia that there is an alternation of polypoid and medusoid generations.

The polypoid generation is asexual and produces polyps and blastostyles by asexual budding. The blastostyle also produces medusae by asexual budding. The medusae do not produce medusae but they give rise to gametes, which after fertilisation develop into a polypoid colony from which medusae are produced again by budding.

Thus, an asexual polypoid generation alternates with a sexual medusoid generation. This phenomenon is known as alternation of generations, till recently. The term alternation of generations means that the individual exists in two distinct forms, which alternate each other regularly in the life history.

One individual possesses the power to reproduce the other by asexual reproduction, which again by sexual reproduction gives rise to the next generation. Therefore, a true alternation of generations is always between a diploid asexual and haploid sexual generations, as is exhibited by fern plant.

But, in Obelia the condition is somewhat different and, therefore, objections were raised to use the term alternation of generations for it. Because, in Obelia, there are no true two generations to alternate each other. The medusae are modified zooids capable of

free swimming existence and moreover they are not produced directly from a zygote but are budded off from the blastostyle.

The gonads found in medusa are not formed in it but actually they are formed in the ectoderm of blastostyle which later on migrate into the medusa and become situated on its radial canals. Thus, it is rather difficult to distinguish between sexual and asexual generations. Hence the term metagenesis is used to replace the term alternation of generations in Obelia.

Thus, in the life history of Obelia, there is a regular alternation between fixed polypoid and free-swimming medusoid phases, both of them being diploid.

Such an alternation of generations between two diploid phases is known as metagenesis. Although, the phenomenon of metagenesis is also reported in other groups of animals but it is well represented by polymorphic hydrozoan like Obelia. Obelia shows polymorphism in which the polyps are for feeding the colony, blastostyles for budding and medusae for disseminating gametes.

Advancement of Medusa over Polyp:
Medusa exhibits many features of advancement over polyp, few of them are as follows:
1. The epidermis resembles the epithelium of higher Metazoa forming a thin, protective and sensitive layer of small cells.

2. The enormous development of mesogloea reduces the gastro vascular cavity or enteron to a system of canals and also provides lightness which helps in buoyancy.

3. The nervous system shows differentiation into two nerve rings constituting the central nervous system and nerve nets forming the peripheral nervous system.

4. The marginal sense organs present at the bases of 8 tentacles are of special advantage to the free swimming habit of the medusa.

5. The mode of sexual reproduction provides wide dispersal of the species due to its free swimming habit.

Similarities between Polyp and Medusa:
Striking as is the difference between polyp and medusa. They are strictly homologous or typically similar structures. Both of them are formed on the same pattern.

However, the features of similarity between them are listed below:
1. Both are radially symmetrical.

2. Both are diploblastic with outer epidermis (ectodermal) and inner gastro dermis (endodermal).

3. The mouth is homologous in both the cases; the mouth situated on the hypostome in polyp is homologous with the mouth situated on the manubrium of the medusa. Anus is absent in both the cases.

4. The stomach, radial canals and circular canal of medusa are homologous with the gastro-vascular cavity of the polyp. All these

are lined by gastro dermis and serve the purpose of digestion and distribution of digested food.

5. Both are carnivorous; the food is captured and ingested with the help of tentacles.

6. Digestion is extracellular as well as intracellular in both the cases.

7. The outer, exumbrellar surface of the medusa is homologous with the base of the polyp providing attachment with the parental colony.

Derivation of Medusa from Polyp:
Striking as is the difference between polyp and a medusa, they are strictly homologous structures, and the more complex medusa is readily derived from the simpler polyp-form. The apex of the umbrella of medusa corresponds with the base of a hydranth. The mouth and manubrium are also homologous structures.

Suppose the tentacular region of a polyp to be pulled out, as it were, into a disc-like form and afterwards to be bent into the form of saucer with the concavity distal, that is towards the manubrium. The result of this to be a medusa-like body with a double wall to the entire bell, the narrow space between the two layers containing a prolongation of coelenteron and being lined with gastro dermis.

From such a form the actual condition of things found in the medusa would be produced by the continuous cavity in the bell being for most part obliterated by the growing together of its walls so as to form the endodermal lamella.

The cavity would remain only along four meridional areas, the radial canals and as a circular area the circular canal close to the edge of the bell. In this way a medusa is derived completely from a polyp (Fig. 32.12).

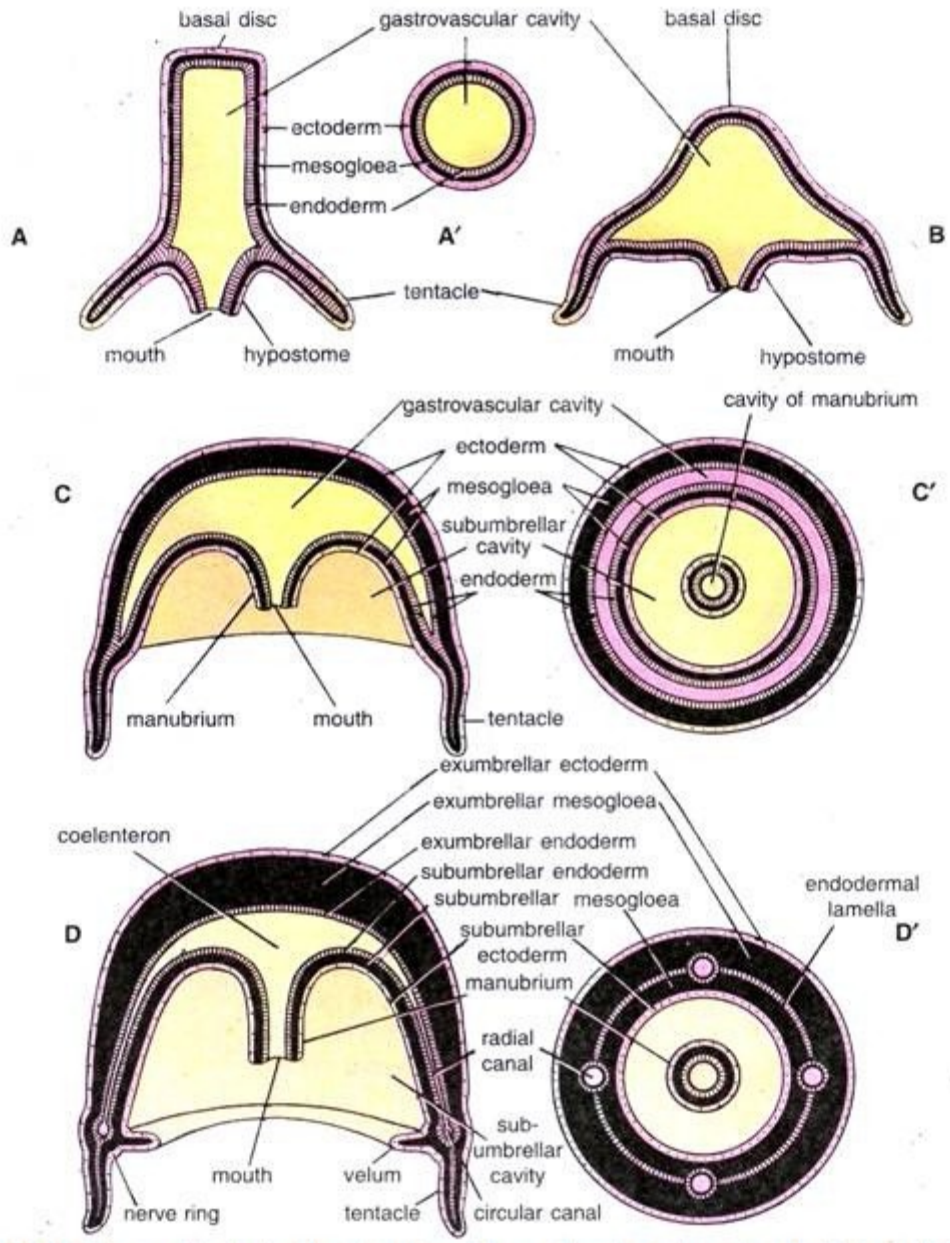

Fig. 32.12. Diagram illustrating the derivation of the medusa from the polyp. A—Polyp in L.S.; A′—Polyp in T.S.; B—Polyp form with extended tentacular region; C—Vertical and C′—Transverse section of form with tentacular region extended into the form of a bell; D—Vertical and D′—Transverse section of medusa.