POLYMORPHISM IN COELENTERATA

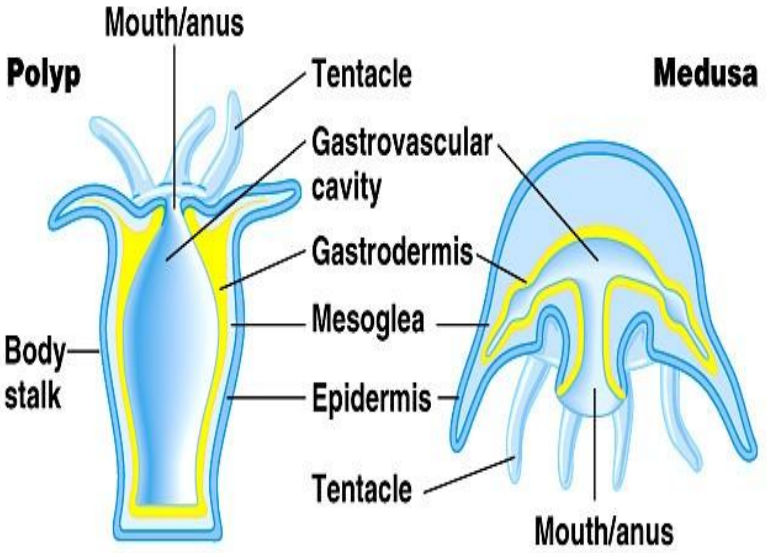
(GR: POLYS = MANY, MORPHE = FORM)

- **Occurence in the same population of more than one type** of individual, which differ in form and function is known as Polymorphism. Polymorphism denotes division of labor among the zooids of the individual.
- Polymorphism is one of the characteristics feature of Coelenterate animals.
- In coelenterata or in **hydrozoa** which may be single or colonial, here occur two main types of individuals or zooids-**Polyp** and **medusae**.

- Polymorphism (Gr., poly = many; morphe = form) is the occurrence of several different types of individuals or zooids in a single species during its life cycle or as members of the colony, the members perform different functions so that there is a division of labour amongst the members.
- Coelenterata are noted for their polymorphism, but the various types are reducible to either a polypoid or medusoid type. The polyp and medusa occur in a number of morphological variations. However, polymorphism may be defined as the representation of a single organism by more than one kind of individuals or zooids which differ in their form and function.

- **Polyp:** A polyp has a **tubular body** with a mouth surrounded by tentacles at one end. Other end is blind and usually attached by a pedal disc to the substratum.

- **Medusa:** A medusae has a **bowl or umbrella shaped** body with marginal tentacles and centrally located mouth or manubrium.



(a) Sea anemone: a polyp

(b) Jelly: a medusa

PATTERNS OF POLYMORPHISM:

Degree of polymorphism varies greatly in different groups of hydrozoa.

1. **Dimorphic:** Simplest and commonest pattern of polymorphsm is exhibited by many hydrozoan colonies like **Obelia, Tubularia** etc.,

   They have two types of individuals or zooid namely:

Gastrozooids or hydranths are connected for feeding

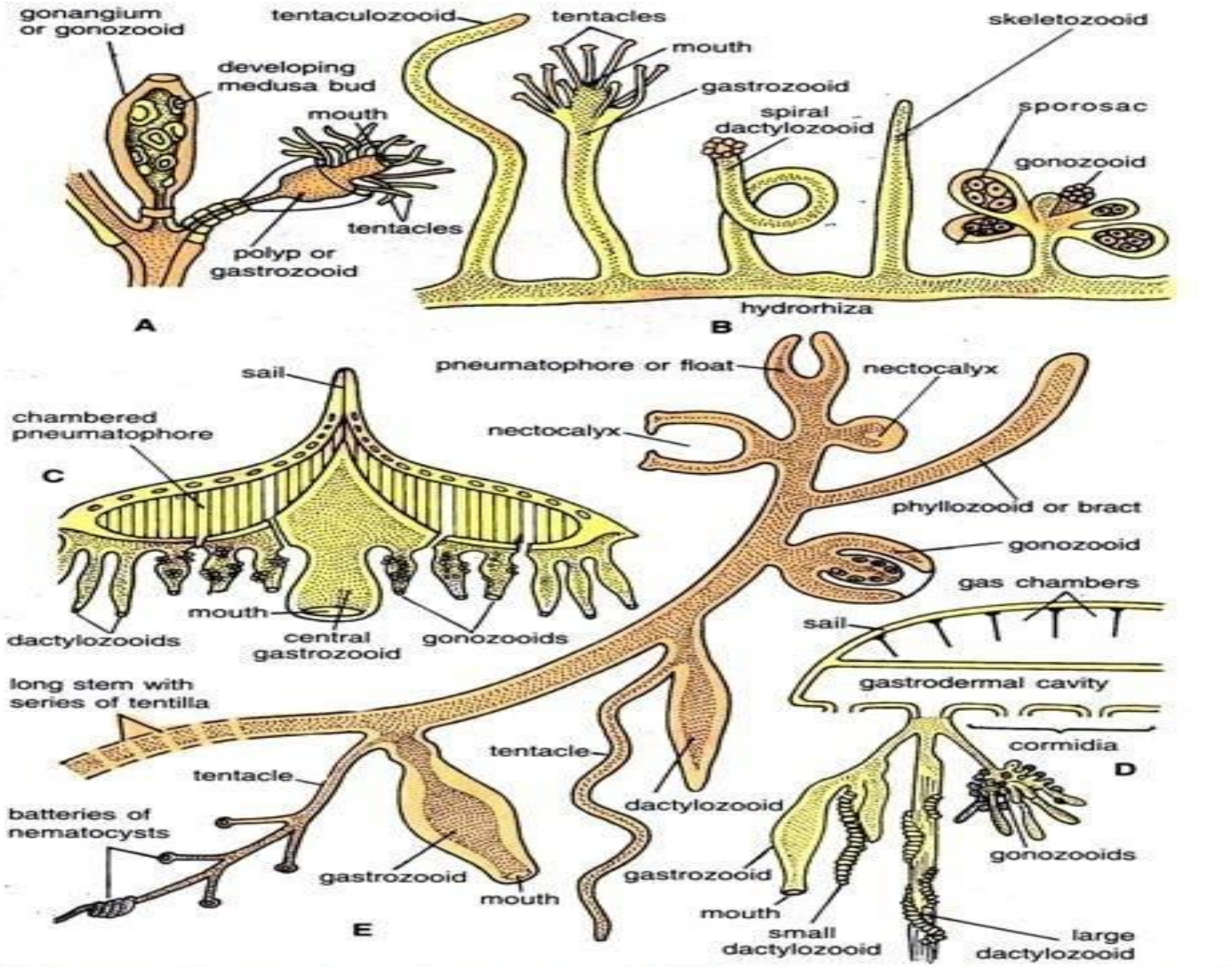
Gonazooids or blastostyles with asexual budding forming sexual **medusae or gonophores.**

This phenomenon is termed as **dimorphism.**

2. **Trimorphic:** Besides **gastrozooids** and **gonozooids** they also possess a third type individuals the **dactylozooids.**

3. Polymorphic: Animals having more than three types of individuals are called polymorphic. some what greater degree of polymorphism is found in the encrusting colony of Hydractinia with five types of polyps each performing a specialized function.

1. **Gastrozooids - feeding**
2. **Dactylozooids - protection.**
3. **Tentaculozooids - Sensory cells**
4. **Skeletozooids - Spiny projections of chitin**
5. **Gonozooids - Reproductive individuals.**



Polymorphic colonies of Hydrozoa. A—*Obelia* ; B—*Hydractinia* ; C—*Velella* ; D—*Physalia showing a single cormidium*; E—Generalised calycophoran Siphonophora showing a single cormidium.

POLYPOID ZOOIDS ARE :

1. Gastro zooids
2. Dactylo zooids
3. Gono zooids

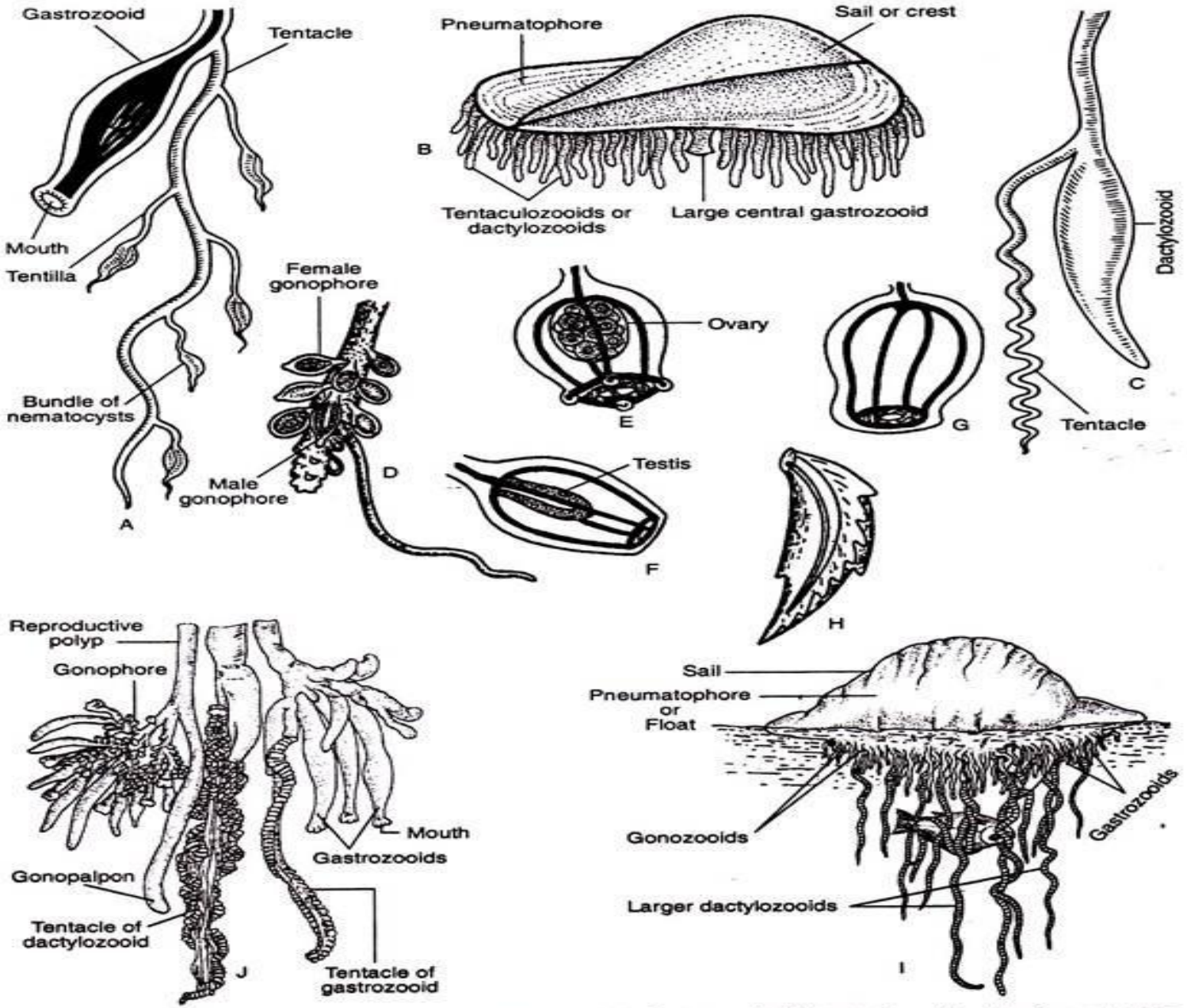


Fig. 12.34: Different types of zooids (after various sources). A. Gastrozooid with tentacle and bundle of nematocysts. B. Central gastrozooid of *Velella*. C. Dactylozooid with tentacle. D. Gonozooid. E. Female gonophore (medusoid form). F. Male gonophore (medusoid form). G. Nectophore or swimming bell. H. Bract or hydrophyllium. I. *Physalia*, Portuguese man-of-war, showing the pneumatophore or float. J. Part of *Physalia*.

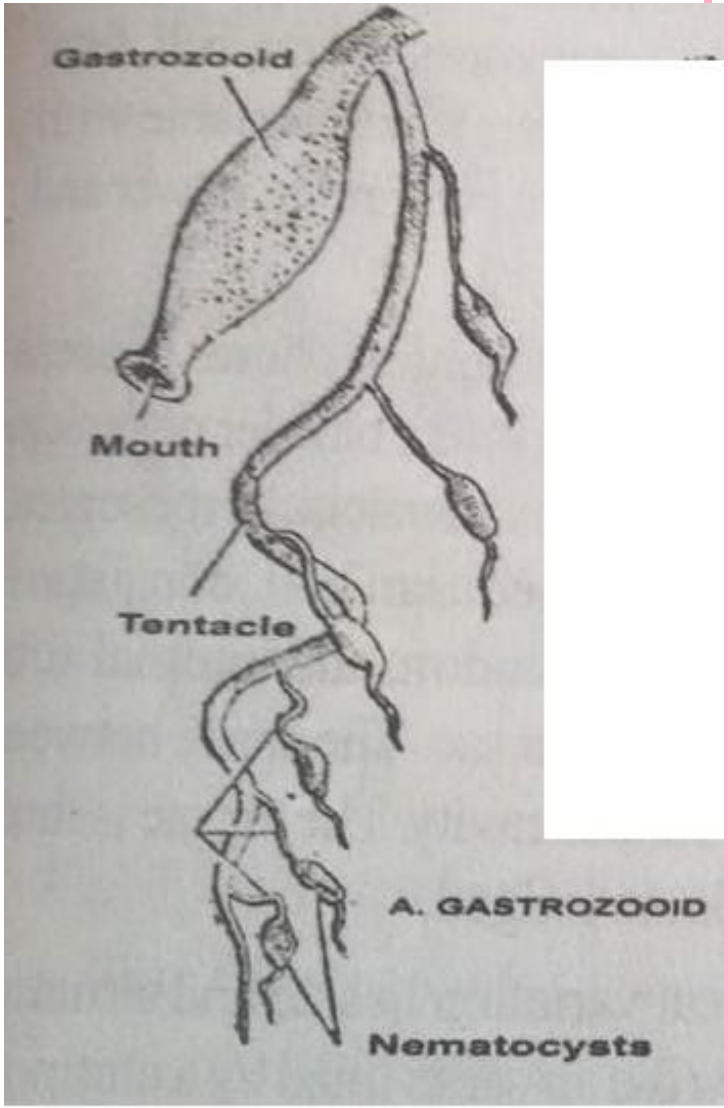
1. Gastrozooids :

The **nutritive polyps** are called gastro- zooids.

They alone take up nutrition in the colony.

A mouth is present at the tip of the hypostome. Near the base of a gastrozooid usually a single, long and contractile tentacle arises. It shows batteries of nematocysts. Lateral branches are present called tentilla.

Gastrozooids **catch the prey** and digest it. The digested food is thrown into the coenosarcal canal.



The gastrozooid exists in the following modified forms:

1. **Siphon:** It is a polyp form, but without normal tentacles. Siphon is the only member of the colony which can ingest food.
2. **Siphonozooid:** siphonozooids may remain scattered or may be limited to rachis. Usually they are located on the dorsal side of the rachis in between the leaves.

3. **Gastrozooids of Millipora:** In **Millipora** many gastropores protrude out from the polyp. Each polyp with 4-6 tentacles and cnidoblast buds .

2. Dactylo zooids :

They are called **Palpons, feelers or tasters.**

They resemble the gastrozooids.

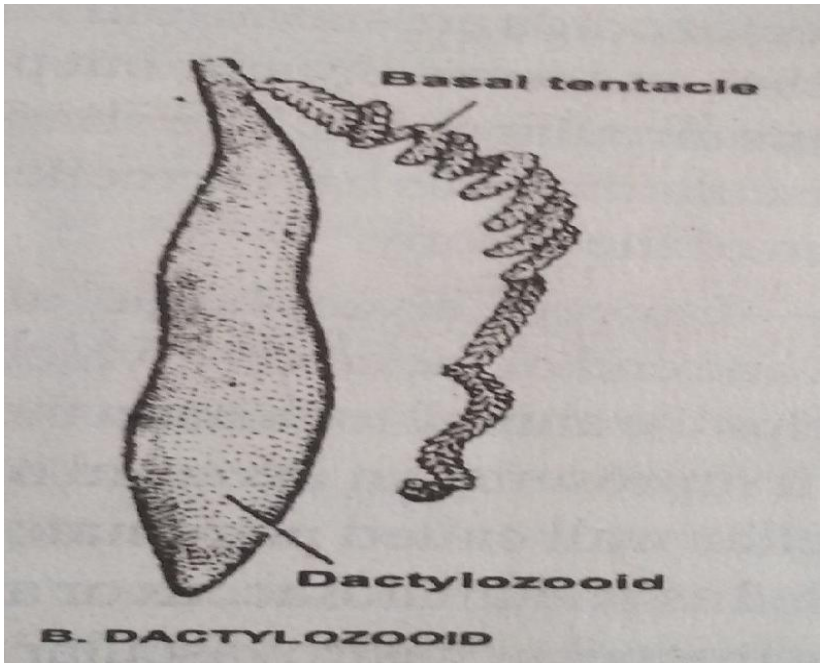
They do not show mouth. Their basal tentacle is un branched.

In Physalia, the tentacle is very long.

In velella and Porpita the margin of the colony bears long and hollow tentacles.

These zooids are **protective in function.**

They bear batteries of nematocysts.



The dactylozooids exhibit following structural variations:

1. **Tentaculozooids:** the margin of the colony bears long, hollow and tentacle-like defensive dactylozooids called tentaculo-zooids
2. **Spiral Zooids:** The spiral zooids are tubular- shaped with cnidocytes and adhe-sive cells. In Hydractinia (Fig. 12.35), the spi-ral zooids (dactylozooids) with capitate tentacles remain scattered throughout the colony.
3. **Sarcostyles or Nematophores:** The nematophores are usually with club or capitate ends, beset with nematocysts or adhesive cells or both.
4. **Palpons:**The palpons in Chondrophora consist of simple, hollow, tentacle -like bodies which spring from the margin of the body.
5. **Cyston:** In Siphonophora, a distal pore present in the dactylozooid is called the cyston. It is excretory in function.

6. **Dactylozooid of Millepora:** long, filamentous, mouth- less dactylozooids with irregularly disposed tentacles.

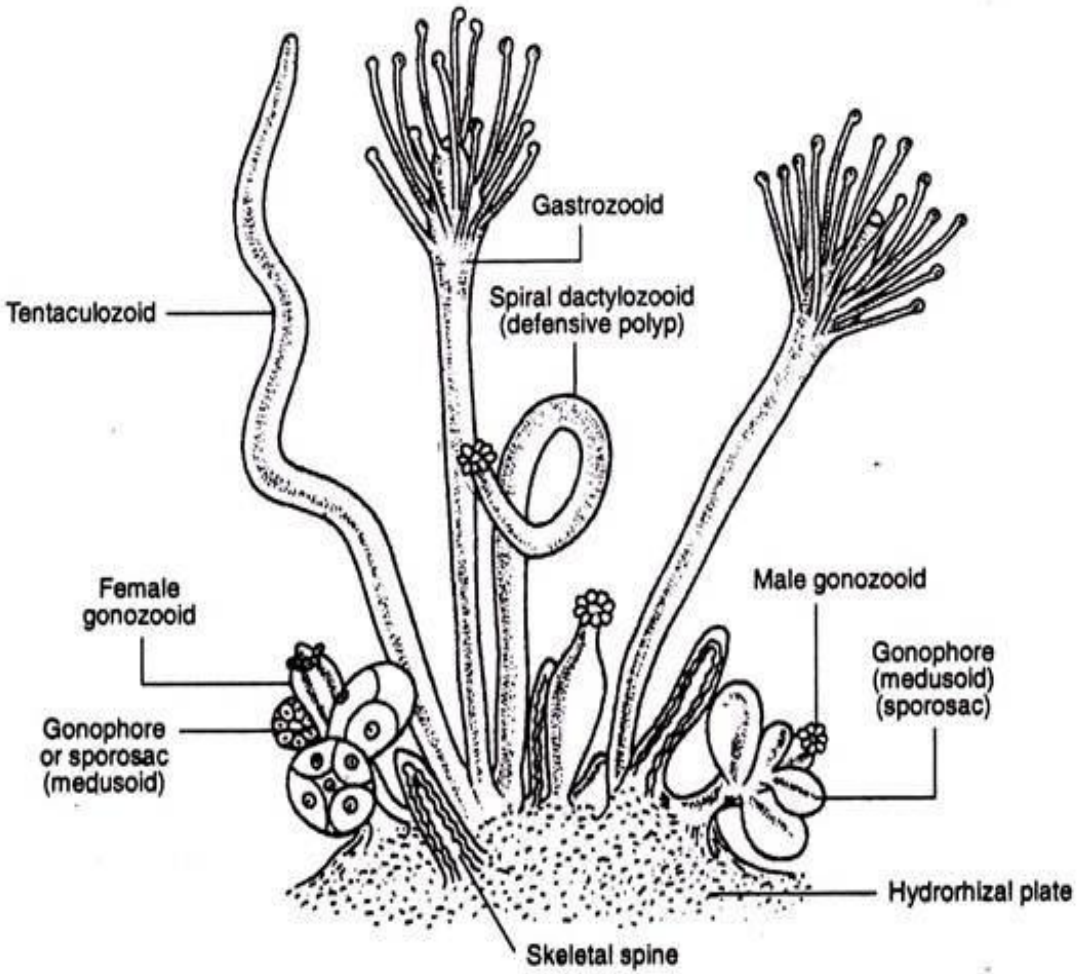


Fig. 12.35: Colony of *Hydractinia* showing gastrozooid, dactylozooid (spiral zooid), tentaculozooid and gonozooids.

3. Gonozooids :

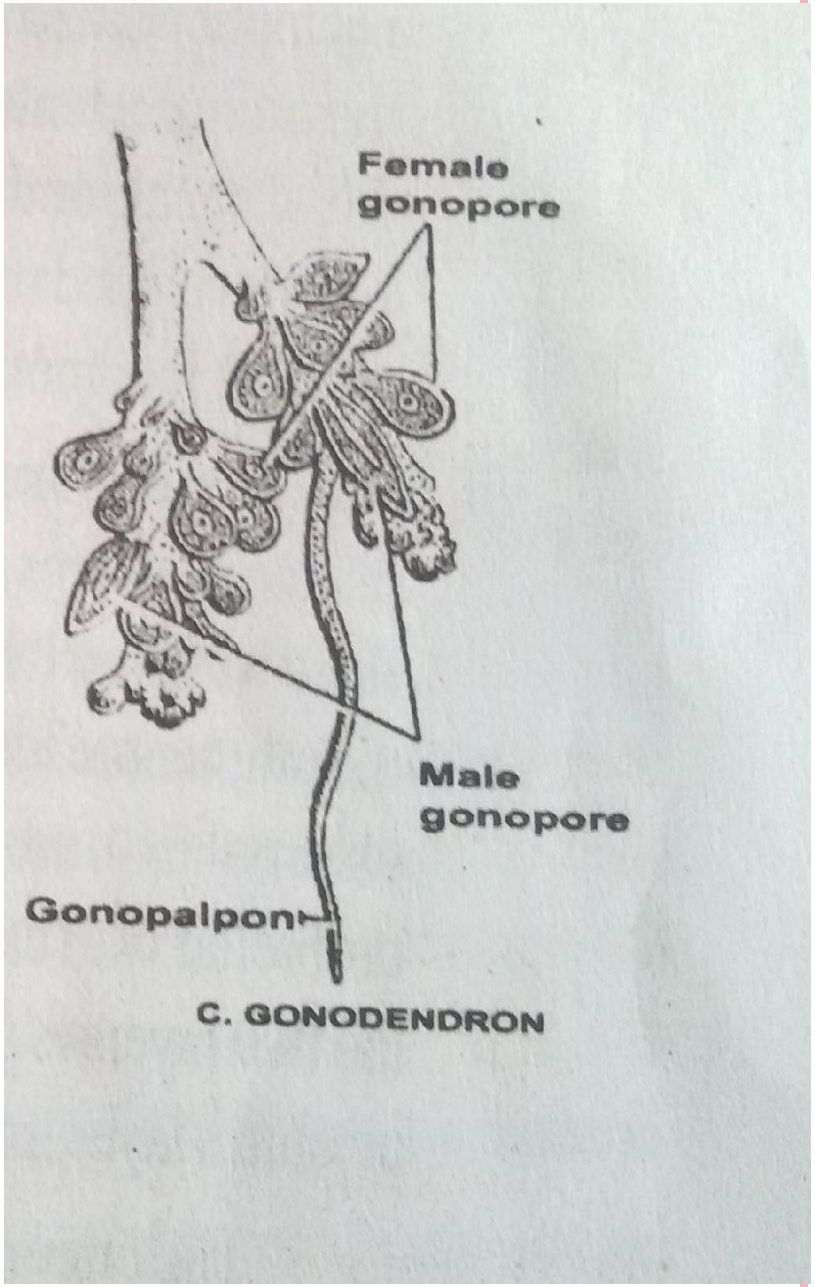
The reproductive zooids

They have no mouth.

In Physalia the gonozooid shows branched stalk, bearing clusters of gonophores (gonopalpon).

Gonozooids produce medusae called gonophores.

In Porpita and Velella dactylozooids are treated as gonodactylozooids.



Modification:

1. **Gonosiphon:**

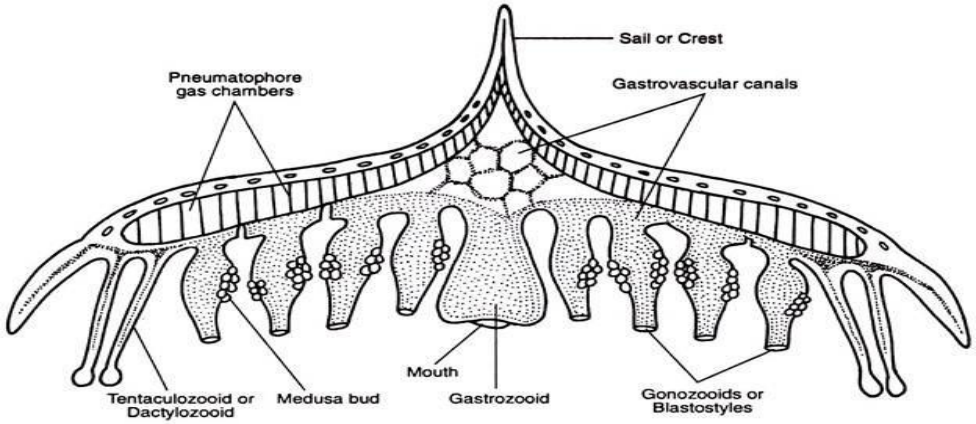


Fig. 12.36: V. S. of *Velella*.

2. **Gonodendron:** grape-like clusters of gonophores.

3. **Gonopalpon:**

Special Zooids

1) **Gonostyles or Secondary Siphono-zooids:** The gonads remain attached with the siphonozooids.

2) **Hydrorhiza:** In Obelia, the hydrorhiza acts as the organ of attachment for the whole colony.

3) **Hydrocaulus:** In Obelia, the hydro-caulus, arising from the hydrorhiza, bears different zooids and helps to convey the food matters to the different parts of the colony.

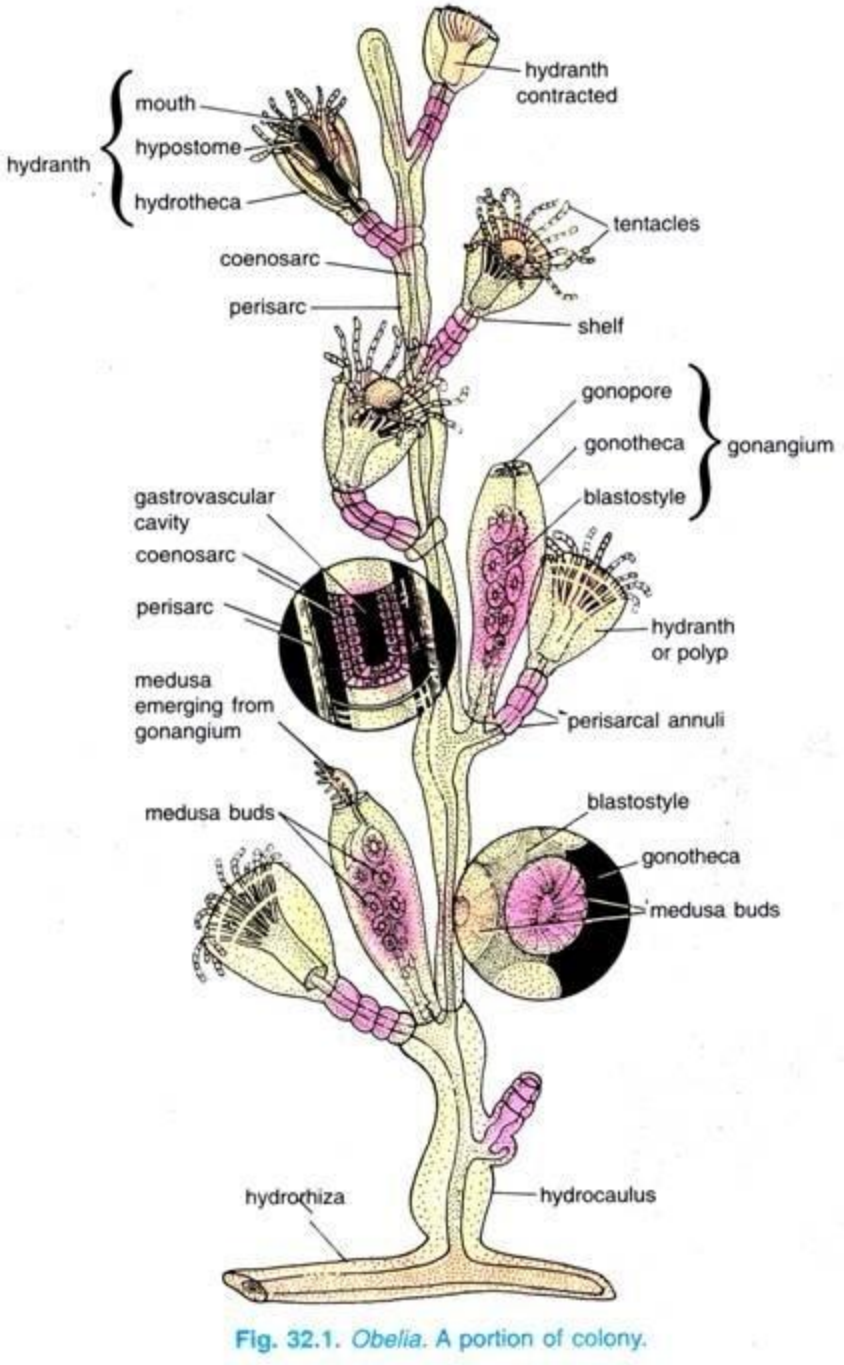


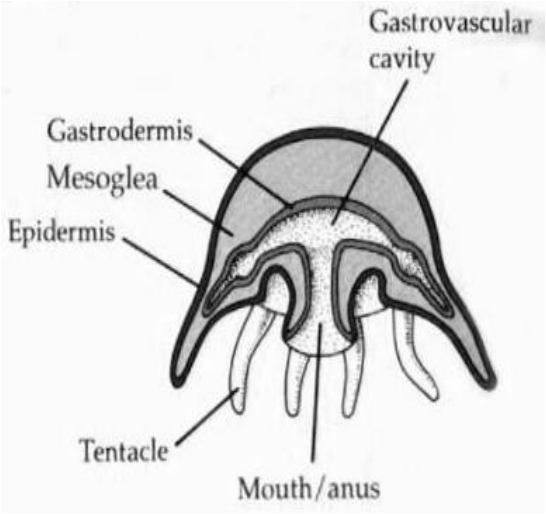
Fig. 32.1. *Obelia*. A portion of colony.

MEDUSOID FORMS :

- **Pneumatophores** :
- **Nectopore or Nectocalyx or swimming zooid:**
- **Bracts :**
- **Gonophores :**

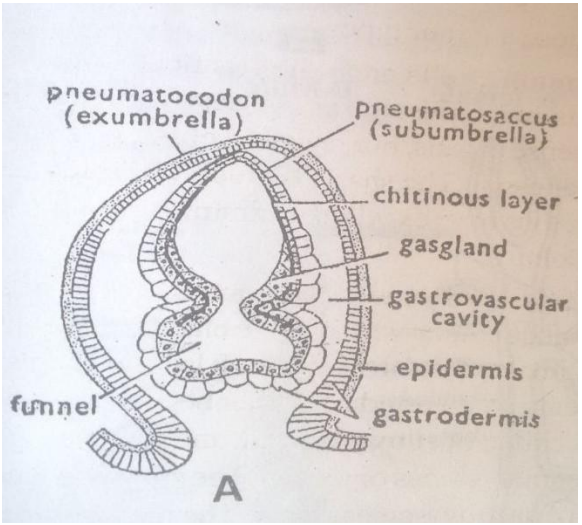
MEDUSOID FORMS :

1. **Pneumatophores** : It functions as a **float**. It is an inverted medusan bell. The walls are two layered and highly muscular. The epidermal lining becomes glandular to form a gas gland. The gas gland secretes gas into the air-sac



1) The pneumatophore is small in Halistemma.
2) The pneumatophore is very large in Physalia.
3) It is disc-shaped in porpita.

In Agalma the air sac is lined by a chitinous layer secreted by the Epidermis which is also forms a funnel shaped tricher or funnel. The epidermis forme two layers and the gas gland secretes the gas.



2. Nectopore or Nectocalyx or swimming zooid:

Nectocalyces or nectophores are bell-shaped medusoids with a velum, radial canals and circular canal, they have no mouth, manubrium, tentacles or sense organs, A nectocalyx is muscular and brings about locomotion of the colony by swimming. It is also referred to as nectophore or nectozooid.

Fig: Nectocalyx

3.Bracts : They are also known as **hydrophyllia**. They are **leaf like, helmet shaped**.

- They serve to cover and **protect other zooids of the colony.**

Fig. Bract(Hydrophyllia)

4. Gonophores : Bearing **gonads**, male gonads produce sperm and female gonad produce ova

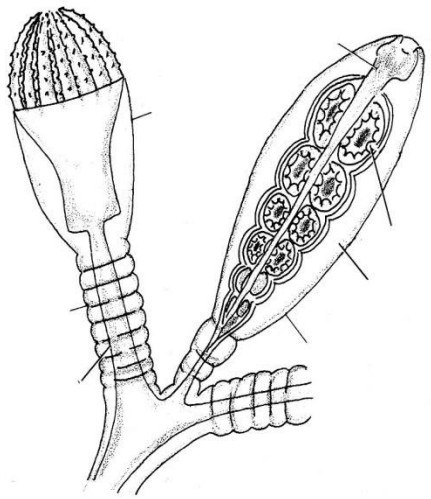


Fig: Gonophores

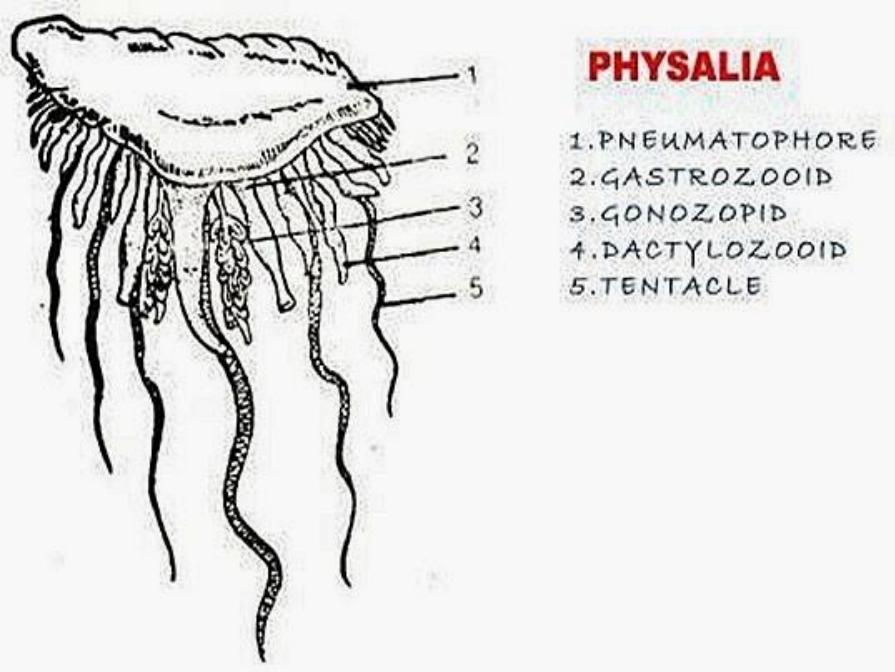
NOTABLE POLYMORPHIC COLONIES

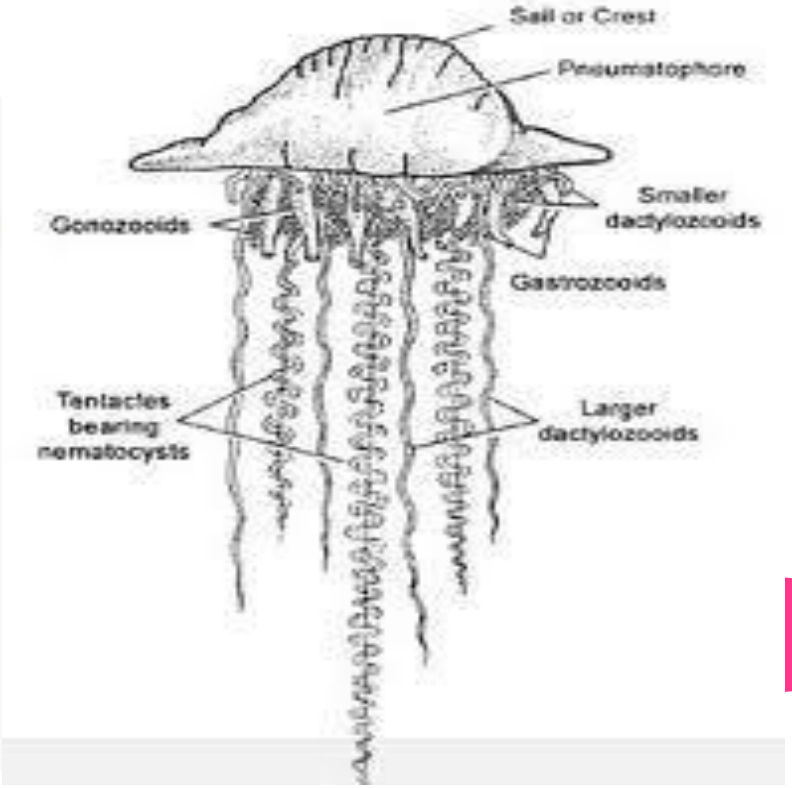
Hydrozoans exhibit remarked development of Polymorphism. Some of them are Physalia, Halistemma, Porpita

Physalia: Is commonly called as **Portuguese man of war**. This is a free floating pelagic colonial form.

The medusa is modified in to a big pneumatophore or float which floats above the water. The underside of the float has cormidia. Each cormidium consists of a small dactyl zooids with a long slender tentacle, a large dactylozooid with an enormous nematocyst bearing fishing tentacles.

A branched gonozooid with male and female gonophores is present.

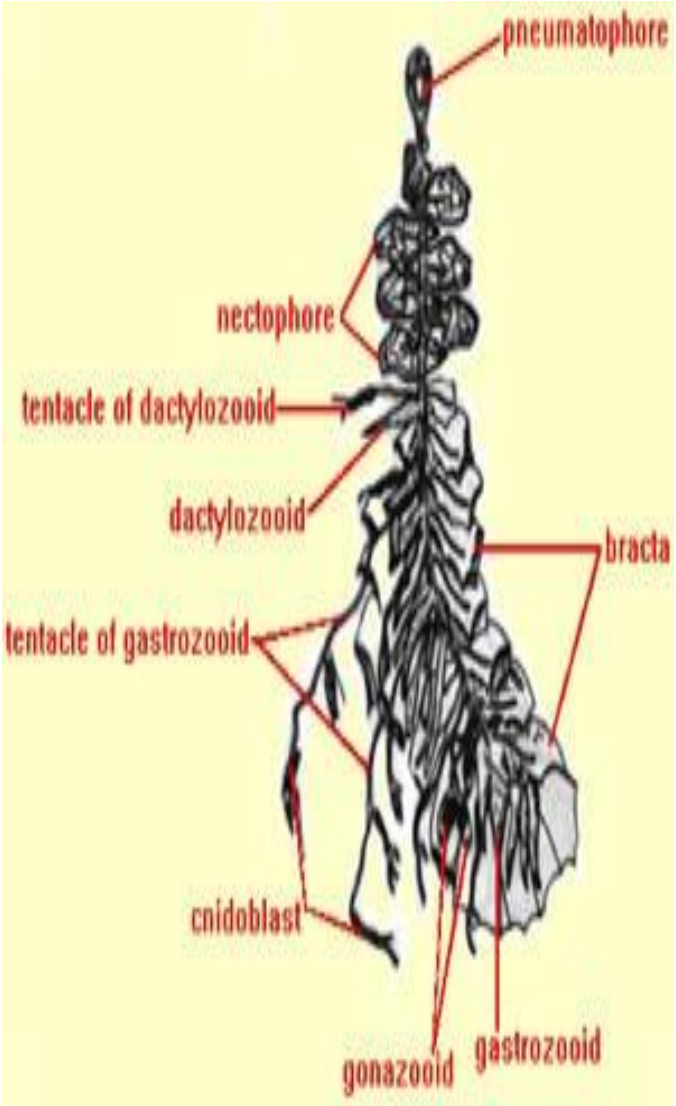




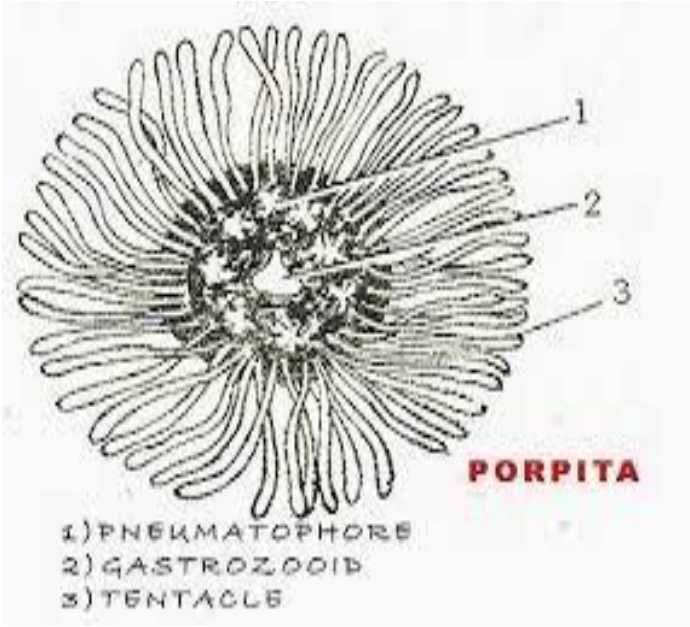
Halistemma: This is a **floating form** with long, thin peduncle

(with nodes) having different zooid. Pneumatophore is at first anterior end of peduncle and helps the animal float on the surface of the water. The bottom of the float has asmmetric medusa, which are called nectocalyces which help in locomotion.

Each nectocalyces is with nodes and bell shaped. Manubrium is absent.



Porpita: It has medusoid disc like large pnematohore and chitinous shell with many concentric gas chambers. On the ventro-central region is a single large gastrozooid which is surrounded by clusters of small gonozooids which bear sexual medusae. On the edge of it tantacle like dactylozooids armed with nematocysts.



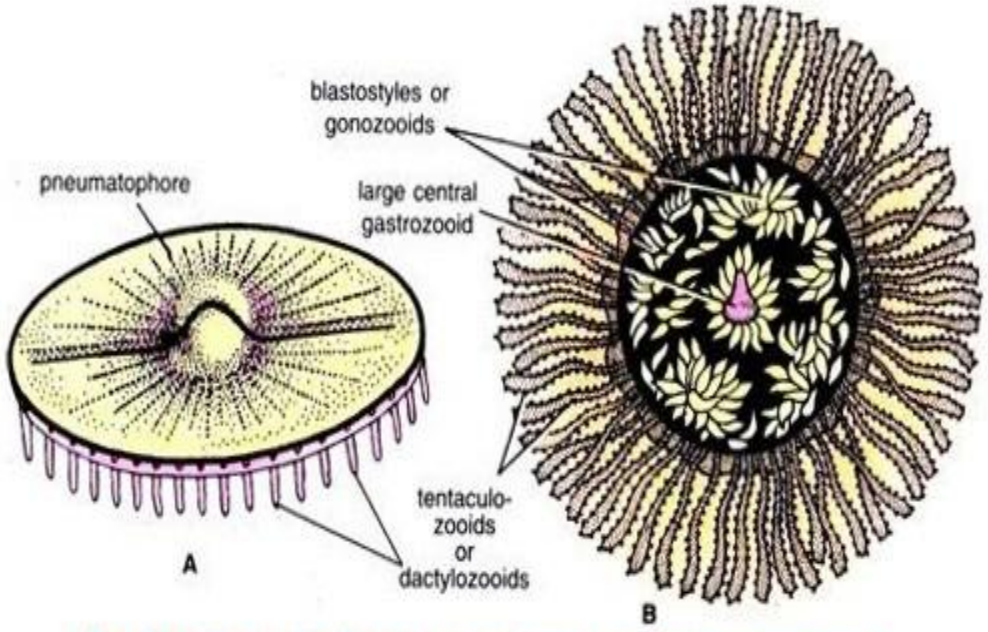


Fig. 35.6. *Porpita*. A—Colony in dorsal view; B—Colony in ventral view.

ORIGIN OF POLYMORPHISM

There are many theories to explain the origin of polymorphism in coelenterates.

Poly-organ theory: This theory was proposed by Huxley (1859), Eschscholtz (1829), E. Metschnikoff (1874) and Muller (1871).

According to this theory, a polymorphic colony is supposed to be a single medusoid zooid; its various components are regarded to be the modified organs of this medusoid zooid. The various parts of the zooid, i.e., manubrium, tentacles, umbrella, etc., multiply independently from one another and they have assumed different forms to perform different functions.

Poly-person theory: This theory was first proposed by **Leuckart (1851), Vogt (1848), Gegenbaur (1854), Kolliker (1853), Claus (1863**) and later strongly supported by E. Haeckel (1888), Balfour (1885) and Sedgewick (1888).

According to this theory colony is not a single individual but various parts of the colony are modified individuals which have changed their structure due to division of labour. They have all modified from the primitive zooid which was a polyp.

Medusa theory:

This theory was proposed by Haeckel (1888) as a compromise between the above theories. The theory says that the siphonophores formed from gastrula was a medusoid individual, from which zooids or persons appeared by budding from the subumbrella.

SIGNIFICANCE OF POLYMORPHISM

The phenomenon of polymorphism is essentially one of **division of labour** in which specific functions are assigned to different individuals. Thus, **polyps are modified for feeding, protection and asexual reproduction,** while **medusae are concerned with sexual reproduction.** This distribution of functions among diversified individuals and their subsequent modifications in coelenterates may have resulted from their initial simple organization and lack of organ specialization. Polymorphism gave the colonies competitive edge in protection and food gathering and eventual survival. polymorphism: colonies of some species have morphologically differing individuals each specialized for certain roles e.g. feeding, reproduction & defense etc.

THANK YOU