POLYMORPHISM

Q.1. Write an essay on polymorphism in coelenterates.
(Gorakhpur 1991; Meerut 92; Agra 91; Avadh 88, 91; Bundelkhand 89; Kanpur 92, 93, 94, 96; Kurukshetra 95)

Write an account of polymorphism in Siphonophora.

Definition

Polymorphism (*G. Poly* = many, *morph* = form) is a phenomenon in which an organism has more than one types of individuals and each one is specialised to perform a different vital function.

Polymorhphism in Coelenterates

Coelenterates are basically colonial forms. The individuals of a colony are called **zooids.** These zooids are specialised to carry out different functions and accordingly have different shape and structure. The zooids are basically of two types–**polyps** and **medusae.**

1. Polyps are cylindrical, sessile and fixed forms. These have mouth, tentacles, and a wide gastrovascular cavity. These feed the colony. So these are also named as **nutritive zooids** or **gastrozooids or trophozooids.**

2. **Medusae** are umbrella-shaped or bell-shaped, free swimming forms. These bear **gonads** and help in sexual reproduction. Therefore, these are called **sexual zooids** or **gonophores.** Medusae can be derived from polyps.

Polymorphism is more evident in class Hydrozoa. Individuals of class Scyphozoa are medusoid forms. The polyp stage is short and represented by hydratuba.

Types of Polymorphism

Depending upon the types of zooids, a hydrozoan colony may be :

1. **Dimorphic** with 2 types of zooids.
2. **Trimorphic** with 3 types of zooids
3. **Polymorphic** with more than three types of zooids

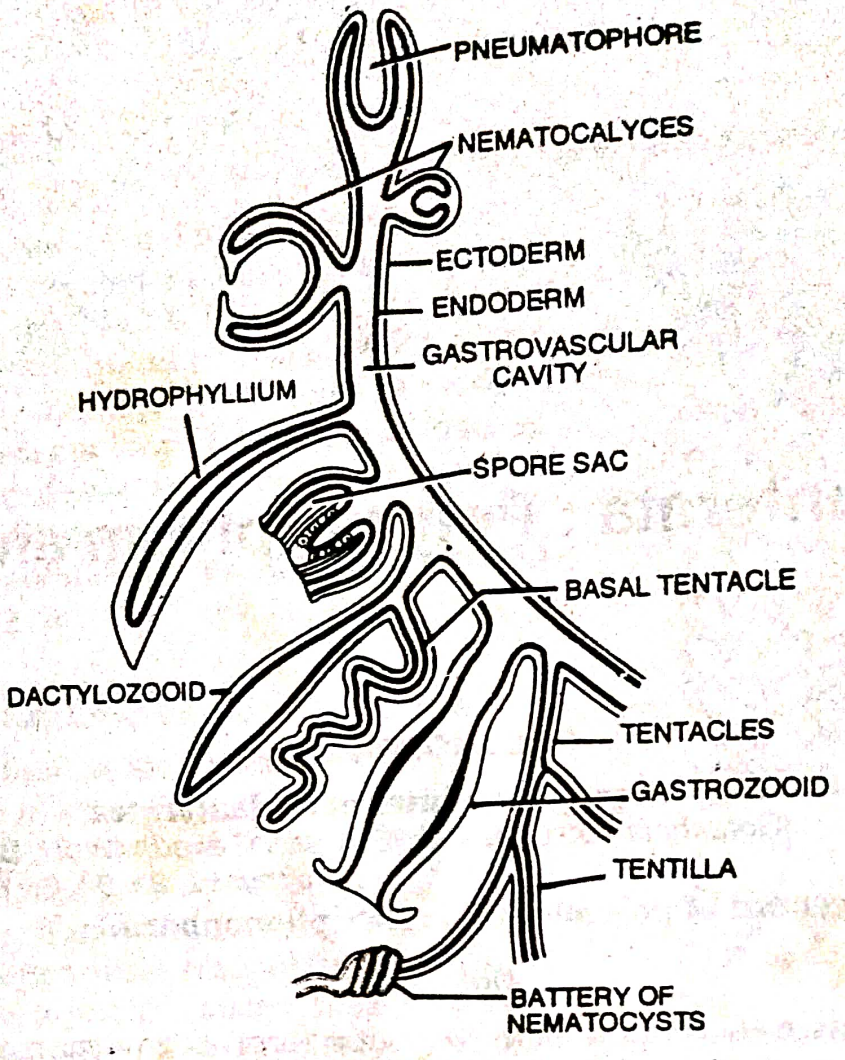

Fig. 1. Generalised diagram of a siphonophore.

1. Dimorphism

A **dimorphic colony** like *Bougainvillea* (Hydrozoa) consists of two types of zooids :

(a) **Polyps** or gastrozooids or trophozooids.

(b) **Medusae** or sexual zooids.

Corallium, Pteroids, Pennatula, etc. (class Anthozoa) also exhibit dimorphism but they have two types of polyps :

(i) **Autozooids** for feeding the colony (gastrozooids), and

(ii) **Siphonozooids** for driving water current through the cavities of colony and bear gonads too.

These do not have free-swimming sexual medusa stage.

2. Trimorphism

A trimorphic colony like that of *Obelia* (class Hydrozoa) consists of 3 types of zooids (i.e. two types of polyps and one type of medusa). These are :

(a) **Polyps** or gastrozooids.

(b) **Blastostyles** or **blastozooids** or **gonozooids,** the modified polyps that bear and protect medusae.

(c) **Medusae** or sexual zooids.

In *Millipora*, the polyps are of three types :

(i) **Gastrozooids** or polyps or nutritive zooids.

(ii) **Dactylozooids** or protective zooids with long and knobbed tentacles.

(iii) **Medusae** or sexual zooids greatly reduced with gonads only.

3. Polymorphism

In **polymorphic colony**, both polyps and medusae occur in two or more forms and are modified to carry out different functions. The number of zooids may be four or more.

Individuals of order Siphonophora represent the most specialized Hydrozoa, attaining the highest degree of polymorphism. The polyp and medusa are differently modified to present a large variety of zooids. The polypoid zooids are of three types, viz. **gastrozooids, gonozooids** and **dactylozooids,** while medusoid zooids are of four types viz, **pneumatophores, nectocalyces, bracts** and **gonophores.**

1. Polypoid Zooids

1. Gastrozooids are the nutritive or food-ingesting individuals of the colony. These are tubular or saccular structures with a large mouth.

2. Dactylozooids are the protective polyps of the colony and are variously known as **palpons, tasters** or **feelers.** They lack mouth and their basal tentacle is unbranched. These bear numerous nematoblasts.

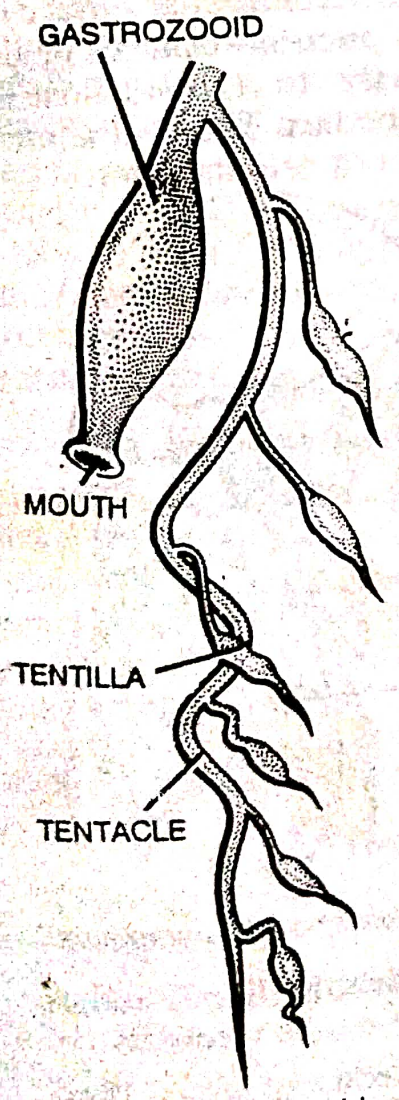

Fig. 2. Gastrozooids with tentacle and tentila.

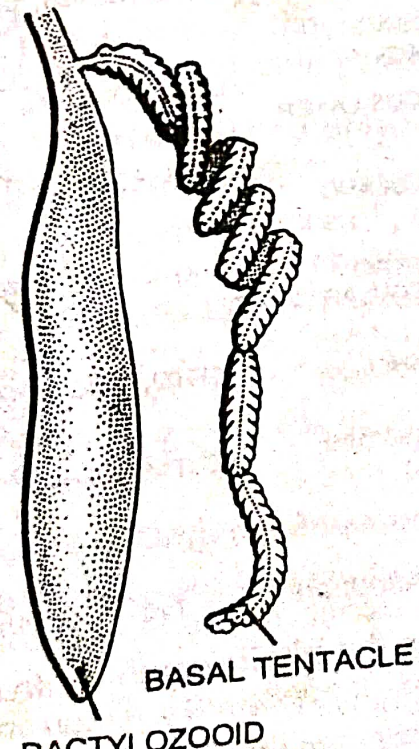

Fig. 3. Dactylozooid with tentacle

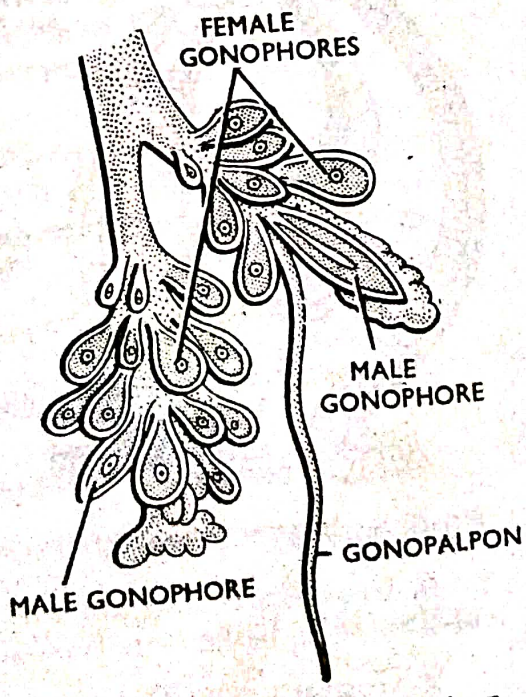

Fig. 4. Gonodendron with gonopalpon and male and female gonophores.

3. Gonozooids–They are reproductive zooids which are also known as blastostyles. They are without mouth and tenatacles. They reproduce asexually by budding and form medusae. Usually the gonozooids take the form of branched stalks, called the **gonodendra.** These bear grape-like clusters of **gonophores** and are often provided with **gonopalpons** as in *Physalina.*

2. Medusoid Zooids

4. Swimming bells–The swimming bells which are also known as **nectocalyces, nectophores** or **nectozooids** are medusoid forms with a bell, velum, four radial canals and a ring canal. But these are devoid of mouth, manubrium, tentacles and sense organs. These act as excellent swimming organs and help in the locomotion of the colony.

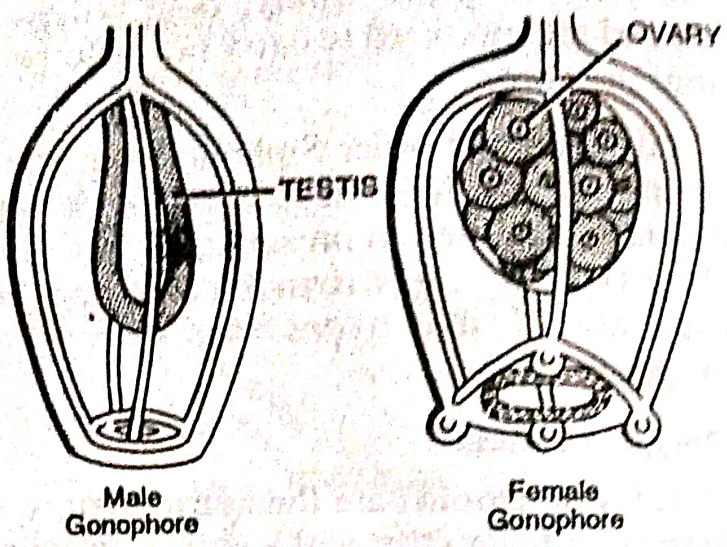

Fig. 5. Male and female gonophores.

5. Pneumatophores–The pneumatophores or the **floats** are bladder or vesicle-like structures filled with gas, and keep the colony floating. Each pneumatophore represents an inverted medusa bell, devoid of mesogloea and consisting of an external exumbrella wall. The external exumbrellar surface is called **pneumatocodon** and inner subumbrella surface is **pneumatosaccus** or air sac. The space between the two is **gastrovascular cavity.** In *Agalma* float is simple. In *Stephalia* a part of float is modified into oval bodies. These structures are called **aurophores.** These are situated below the float or pneumatophore.

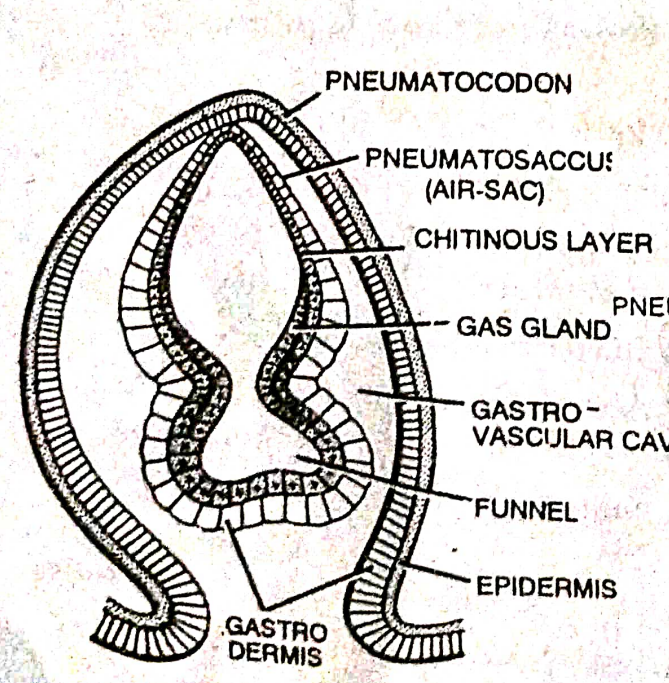

Fig. 6. Agalma : V.S. through preumatophore.

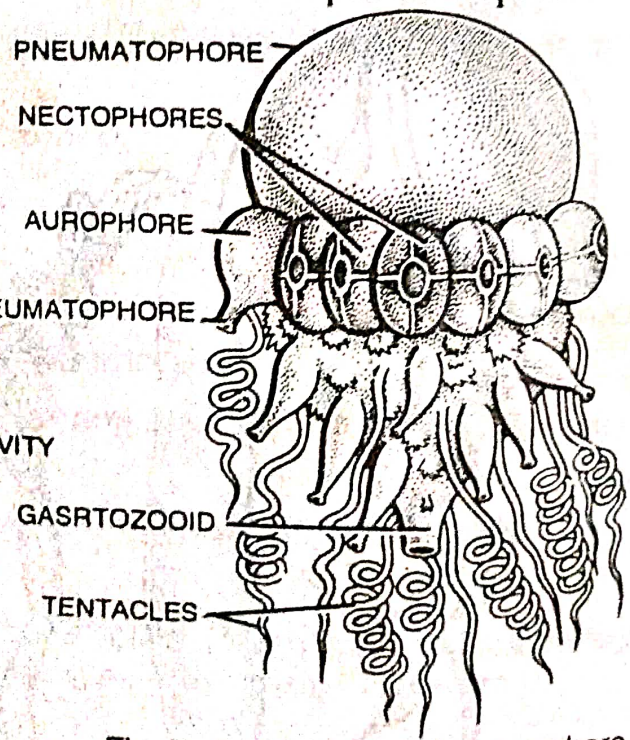

Fig. 7. *Stephalia* showing aurophore.

6. Bracts are also known as the **phyllozooids** or **hydrophyllia.** These are leaf-like, shield-like or helmet-like in appearance. These are unlike medusae.

7. Gonophores–The gonophores are the reproductive medusoid forms. These may occur singly on separate stalks or in clusters on polypoid gonozooids. The

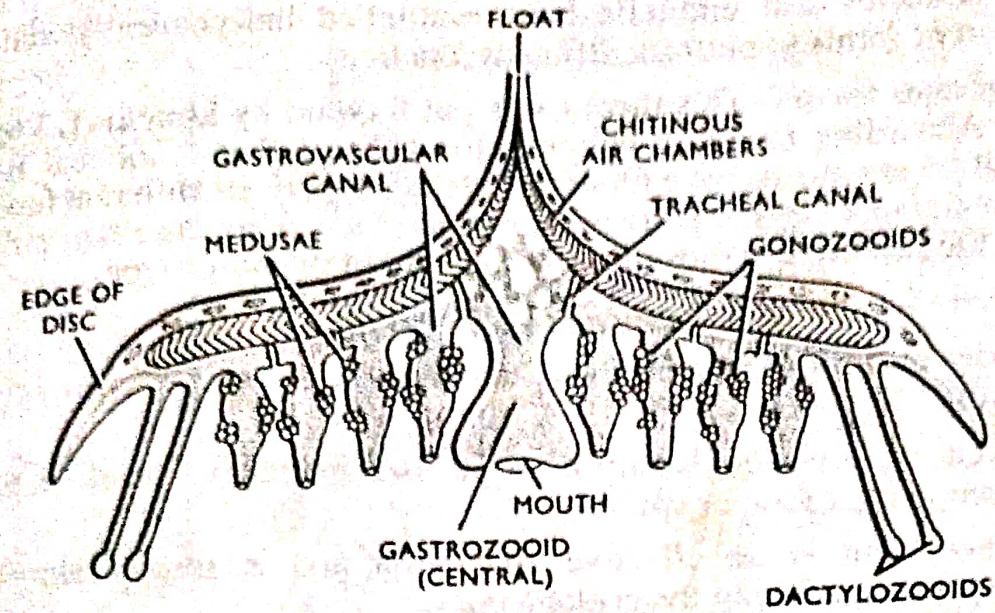

Fig. 8. A. *Velella* colony in V.S., B– Single cormidium of *Physalia.*

gonophores are dioecious but the colonies are hermaphrodite bearing both types of gonophores in the same or separate clusters.

Polymorphism and Alternation of Generations

Polymorphism is intimately associated with the life-history of organisms. In monomorphic forms as in *Hydra*, the life-cycle is simple and without any larval stage. It may be represented by the formula **polyp-egg-polyp.** With the advent of polymorphism, the reproductive powers of the organisms are divided among the different individuals of the colony. In these organisms the polyps reproduce asexually to form medusoid form, the **gonophore,** and the gonophore reproduces sexually to form the **polyp.** The life-cycle of such organisms may be represented by the formula **medusa-egg-planula-polyp.** Thus the **alternation of generations** or **metagenesis** comes into existence in the life-cycle. The asexual polypoid generation alternates with the sexual medusoid generation.

Origin of Polymorphism

After studying the polymorphism in coelenterates, the question arises whether the metagenesis is a direct consequence of polymorphism or the life-cycle of primitive coelenterate has led to polymorphism. According to one view, the original coelenterate was a polyp and through specialisation the sexual function was relegated to secondarily developed medusoid form and this led to metagenesis. According to another view, the ancestral coelenterate was a medusoid form and the polypoid generation is a persistent larval form, thus leading to polymorphism.

Theories of Origin of Polymorphism

A number of theories have been put forward by various persons regarding the relationship among various polypoid and medusoid forms.

1. Polyorgan theory–This theory was put forward by **Huxley, Eschsholtz** and **Metchinhoff**, according to which the polymorphic colony is really a single medusoid individual and the different component organisms of the colony are actually the modified organs of this medusa. The different parts of medusa like

manubrium, tentacles and umbrella have multiplied independently and have assumed different forms to perform different functions.

2. Polyperson theory–This theory was put forward by **Leuckert, Vogt** and **Gegenbaur.** According to this a polymorphic individual is a colonial form in which diversified organisms have grouped together to perform different functions. This theory maintains that the parts of a polymorphic colony are either polyps or medusae but the primitive zooids of the colony are of the polyp type.

Significance of Polymorphism

1. Provides division of labour. Every zooid of the colony performs a specific function.
2. Different types of zooids vary in shape, size and habit. Therefore, they do not compete for food or space.
3. Polymorphism is an effective adaptation and is responsible for the successful existence of the coelenterates.