Cnidaria

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SUBJECT: ZOOLOGY

SEMESTER : 1ST (HONOURS)

PAPER: CC1(NON CHORDATES-I)

UNIT: 4

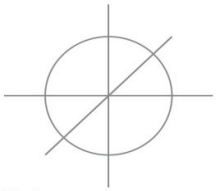
General features of phylum Cnidaria:

1. All aquatic, some freshwater, mostly marine.
2. Solitary or colonial, Sedentary or free swimming.

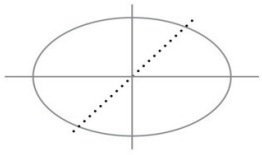
Sea anemone

Jelly fish

3.Symmetry radial or biradial about a longitudinal oral aboral axis.

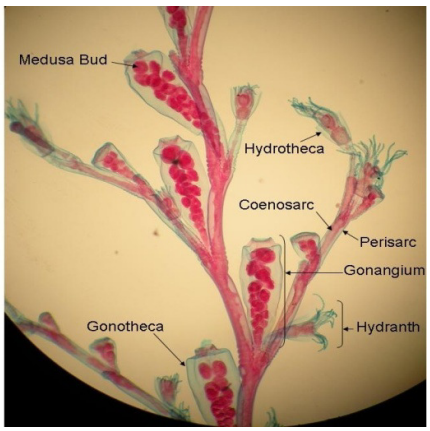


Radial symmetry can be divided equally in many planes



Biradial symmetry can be divide equally only in two planes

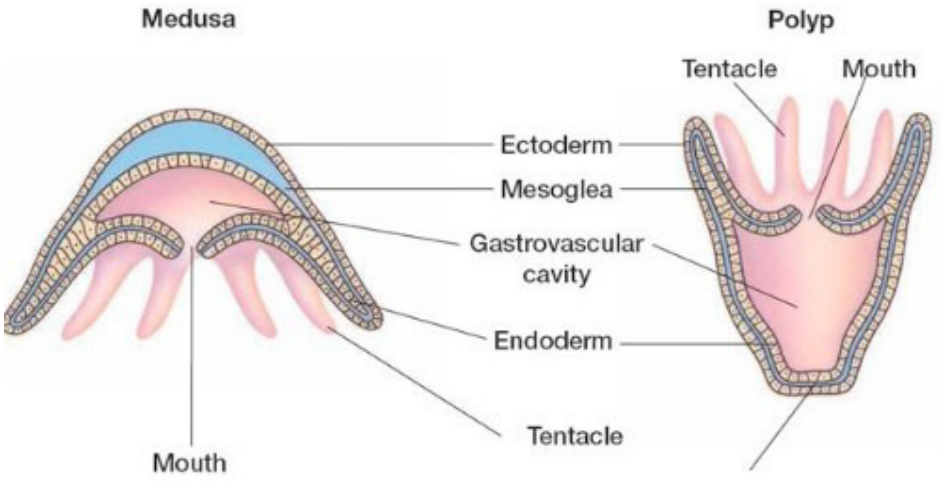
4. Body organization of cell-tissue grade.
5. Exoskeleton chitinous or calcareous.



Obelia colony

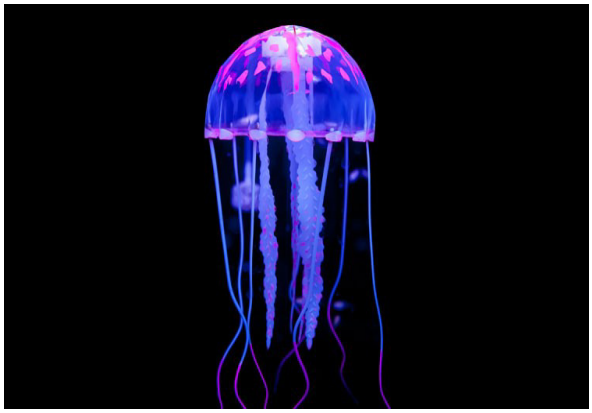
Coral

6. Body wall diploblastic with two germ layer- outer epidermis and inner gastrodermis, with gelatinous acellular mesoglea in between.



7. Two types of individual occur, attached polyps and free swimming medusae.

8. Mouth of polyp and bell margin of meduase often encirled by slender tentacles.

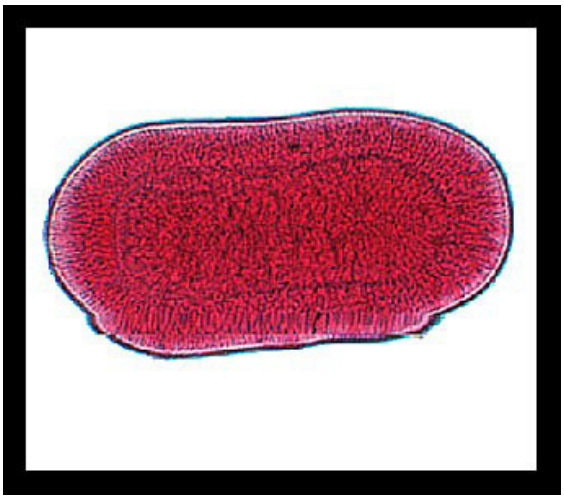


9. A single internal cavity lined with gastrodermis- called gastrovascular cavity or coelenteron is present in which mouth opens. Anus absent.

10. One or both body layer have cnidoblast cell, with peculier stinging cell oragnelle- nematocyst which serve for adhesion, food capture, offense and defense.

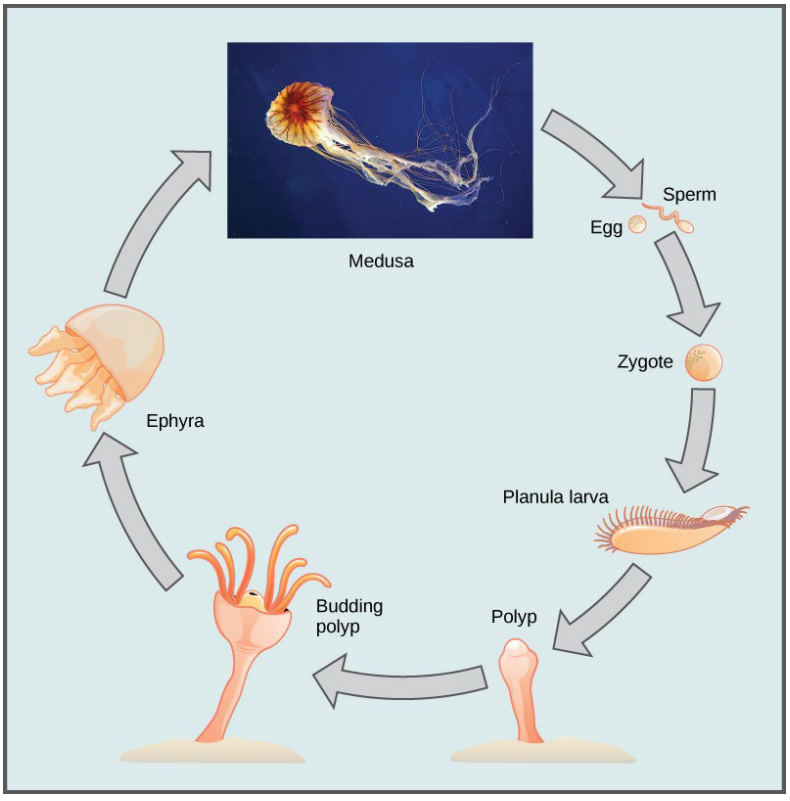
11. Asexual reproduction by budding or fission. Sexual reproduction by sperms and ova. Sexual forms monoecious or dioecious.

12. Development includes a free swimming ciliated planula larva.

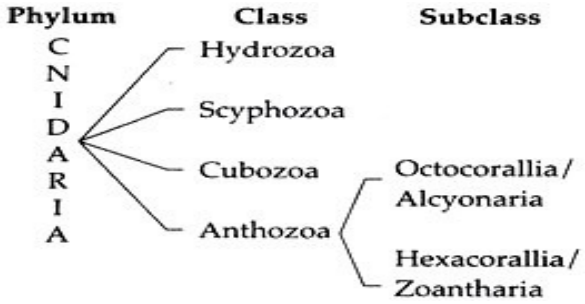


Planula larva

13. Life history illustrates a regular alternation between the asexual polypoid stage and a sexual medusoid stage- which is called metagenesis. True alternation of generations absent.



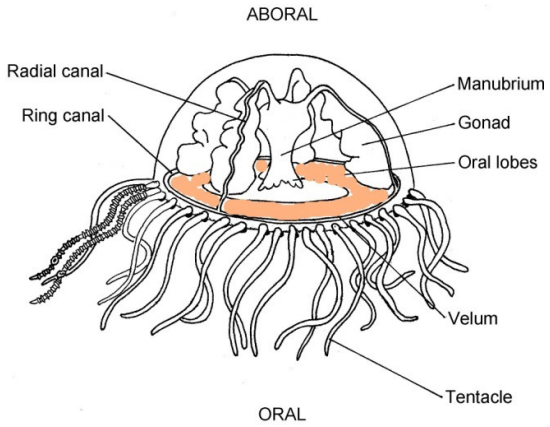
Classification of phylum Cnidaria : (Ruppert and Barnes, 1994 (6th Edn.)



Class : Hydrozoa (Greek: hydro, water serpent):

i. Individuals are either exclusively polypoid or medusoid or constituted by both forms in the life cycle.

ii. Medusa with true velum

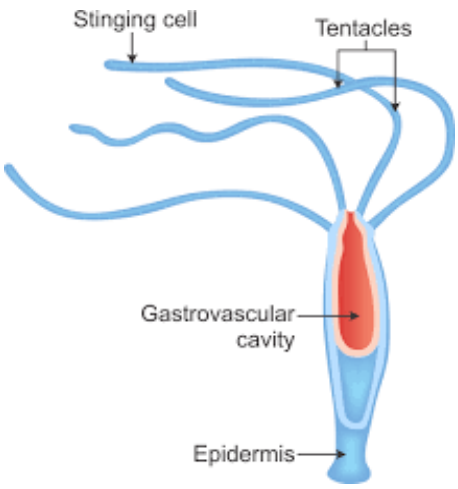


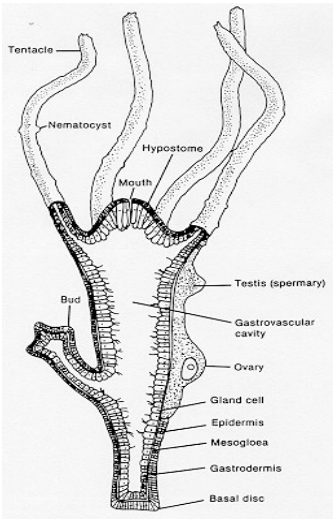
iii. Mesoglea acellular.

iv. Cnidocytes are confined to the epidermal layer.

v. Coelenteron is undivided and without stomodaeum.

vi. Gonads are usually ectodermal in origin or if endodermal, gametes do not escape through the coelenteron and mouth.

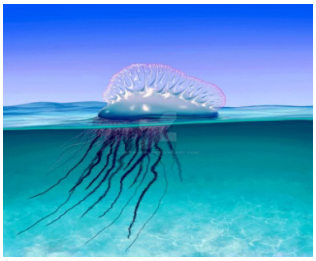




Examples:

Hydra sp *Obelia sp* *Physalia sp* *Porpita sp*






Class : Scyphozoa (Greek: skyphos, cup):

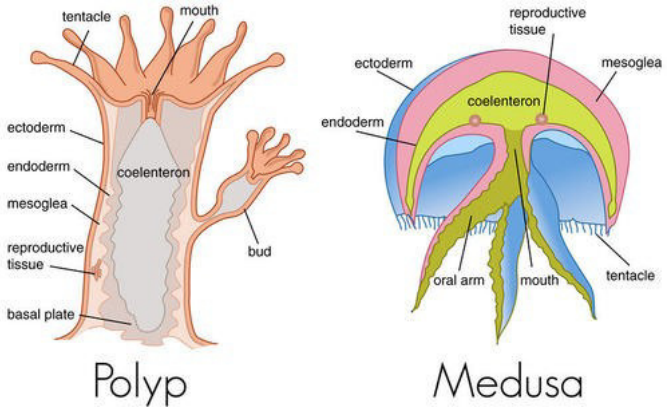
i. Medusoid form is dominant in the life cycle; polypoid form is very insignificant.

ii. Mesoglea is cellular.

iii. Some cnidocytes are endodermal.

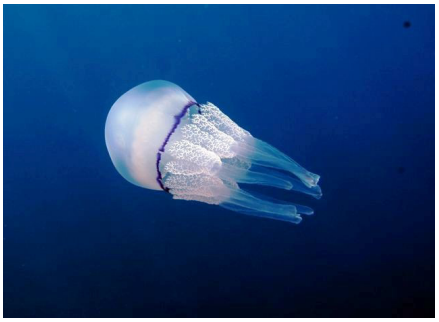
iv. Velum is absent.

v. Gonads are endodermal.



Example:

Aurelia sp *Rhizostoma sp* *Periphylla sp*


Class : Cubozoa (Greek: Cubo, cube)

i. Medusoid cnidarians with cubical bells.

ii. Body is distinctly flattened to form four sides.

iii. Bell margin simple.

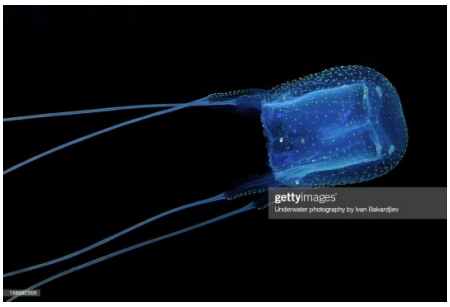
iv. Presence of velum along the margin of the medusa.

v. There are four tentacles or tentacle clusters at the four corners of the margin.

vi. Body wall possesses a type of nematocyst called stenotale.

Examples:

Carybdea sp



Chironex sp

Class Anthozoa (Greek: Anthos, flower):

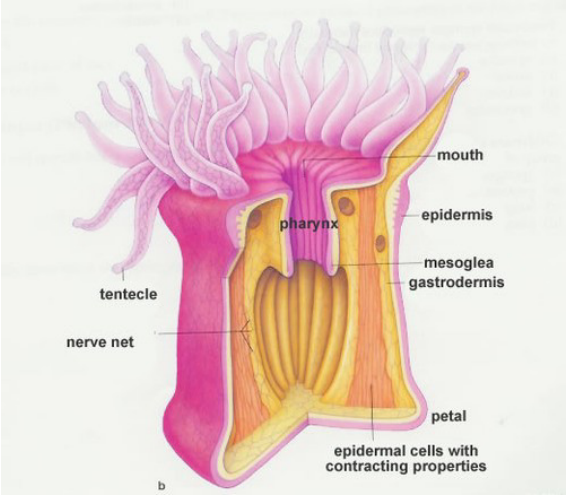
i. Exist only in the polypoid form.

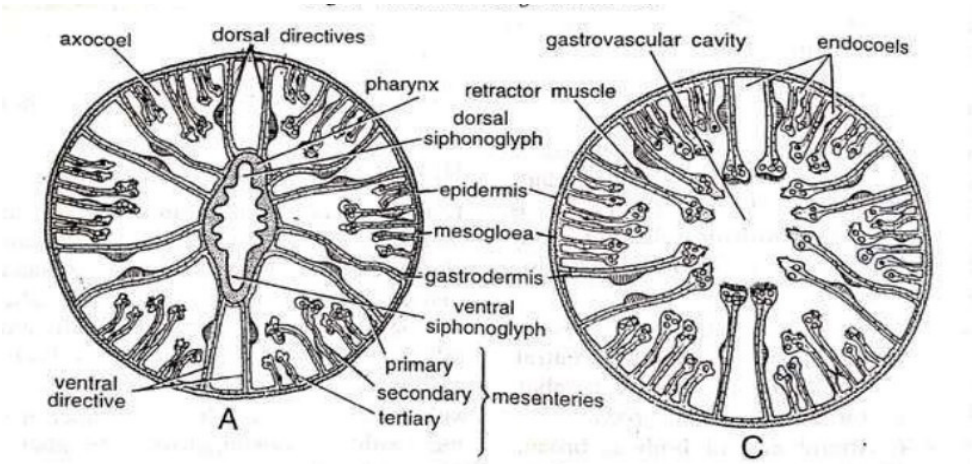
ii. Mesoglea cellular.

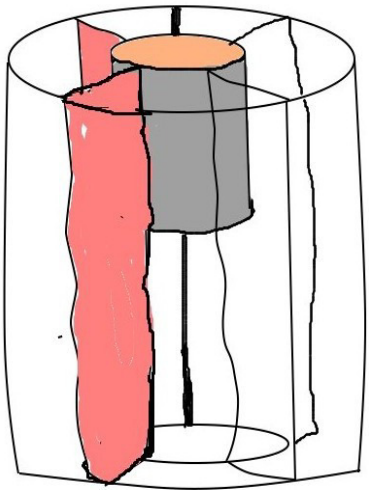
iii. Some cnidocytes are endodermal.

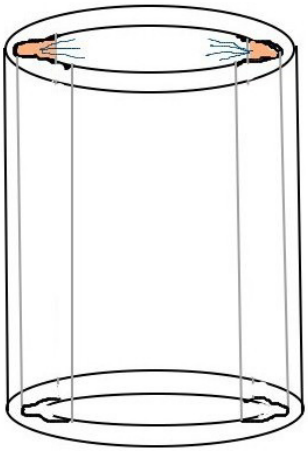
iv. Stomodaeum strongly developed.

v. Extending between the stomodaeum and the body-wall there are mesenteries.









vi. Gonads are endodermal.

Subclass Octocorallia/Alcyonaria:

i. Polyp with eight tentacles and eight septa (mesenteries).

ii. Mesenteries are complete.

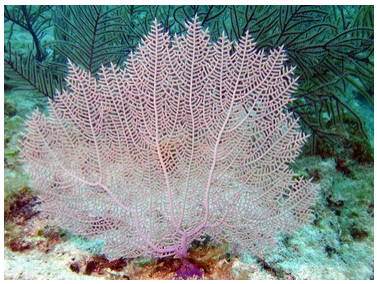
iii. Tentacles are pinnately branched.

iv. Only one ventral siphonoglyph is present.

v. Almost entirely colonial, usually connected by coenenchyme.

Examples:

Gorgonia sp (sea fan) *Pennatula sp* (Sea-pen) *Alcyonium sp*



Subclass Hexacorallia / Zoantharia:

i. Polyps with more than eight tentacles and septa, typically in cycles of 12.

ii. Tentacles are hollow and un-branched.

iii. Usually two siphonoglyphs are present.

iv. Solitary or colonial.

Examples: Sea-anemones (Adamsia, Edivardsia, Metridium)

Sea anemone

Obelia colony:

It is a branched, fixed colony. Some of the horizontal branches anchoring the colony on some support are called Hydrorhiza while other branches are vertical and known as Hydrocaulus. Each branch consists of a coenosarcs made of two cell layers enclosing the coelenteron and surrounded by a thin transparent perisarc. Colony bears three types of zooids.

a. Polyps or gastro zooids (vegetative zooids). Barrel-shaped and responsible for the nutrition of the colony. The perisarc enclosing the polyp is termed hydro theca.

b. Blastostyles or gonozooids. Club- shaped zooids, bearing the medusae buds.

c. Medusae buds. Umbrella-like reproductive zooids bearing gonads, enclosed in a gonotheca.

Life cycle :

Medusae buds are unisexual and free living at maturity. One medusa bears either four testes or four ovaries close to the four radial canals. When the gonads are ripe, ectodermal covering ruptures and the germ cells are shed in water. Fertilization occurs either in the sea water where the germ cells are set free, or the spermatozoa may be carried by water currents to the female medusae and fertilize the ova in situ. Zygote formed after fertilization, immediately undergoes cleavage. The cleavage is holoblastic and a blastula is formed. By invagination the blastula is converted into an oval, ciliated planula larva. The planula consists of an outer layer of ciliated ectoderm and an inner mass of endoderm cells enclosing a space, the rudiment of coelenteron. The planula swims freely for a brief period and settles down on some submerged substratum by one end. The proximal end gradually narrows down and a disc appears for attachment. The distal end expands and by developing a manubrium and a circlet of tentacles, it turns to a hydrula or simple polyp. The hydrula sends out lateral buds and, by a repetition of this process, it is converted into a complex obelia colony.

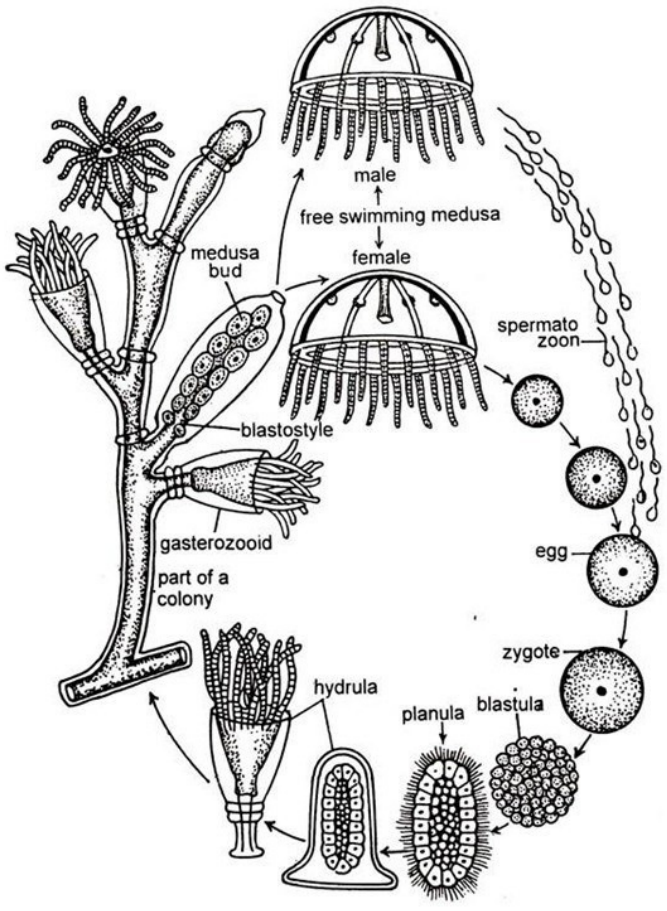


Fig. 20.16. Obelia sp. Life cycle

Metagenesis:

Alternation of generations may be defined as a phenomenon whereby in the life history of an organism, a diploid asexual phase and a haploid sexual phase regularly alternates with each other. This type of true alternation of generations is common among plants like mosses and ferns.

In Obelia, life cycle includes two clearly defind phase : a fixed polypoid diploid phase (hydroid colony) and a pelagic medusoid diploid phase. The hydroid colony is sexless, bears no gonads and develops by asexual process, i.e. by repeated budding of the hydrula. But the medusae buds, some of the zooids of the colony, develop gonads and, from their fertilized egg, new Obelia colony arises. The asexual generation is dependent on and is alternated by the sexual generation. This fact apparently seems to have given rise to the idea of alternation of generation, although is not true alternation of generation. So, a seperate name has been given which is called metagenesis.

Definition of Corals:

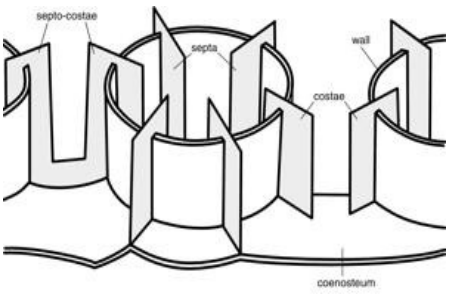
Coral is the the hard external skeleton of certain solitary and colonial marine anthozoan cnidarians; composed chiefly of calcium carbonate.

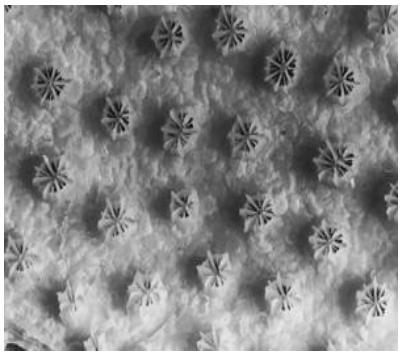
Structure:

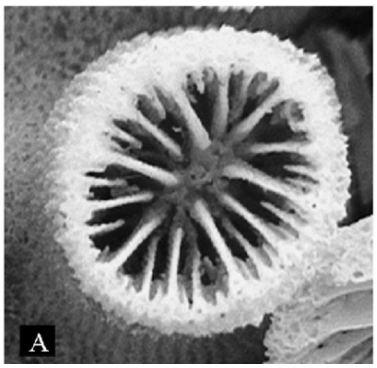
The skeleton of an individual polyp is known as the **corallite** and many corallites combine to form the skeletal mass - **corallum.** The corallite, is a tube that contains vertical plates radiating from the centre. The bottom of the cup beneath the polyp is designated as the **basal plate**. The tube itself is the corallite wall and the plates are the **septo-costae**. The tubes are joined together by horizontal plates and other structures, collectively called the **coenosteum**. Some polyps have an additional thin film of skeleton around the wall called the epitheca.

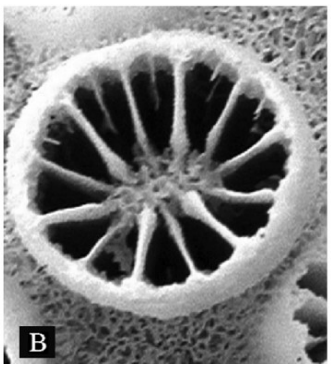
The septo-costae are the radial elements of the corallite and are divided (by the wall) into two components: the septa, which are inside the wall and the costae, which are outside the wall. Where the wall is indistinct the septo costae are single uniform elements.

Septa seldom join at the centre of the corallite. Instead, their inner margins usually have fine inward-projecting teeth which, in most corals, become intertwined forming a tangle called the columella.









Taxonomic position of corals :

Most corals belongs to class **Anthozoa** but a few are the members of class hydrozoa.

Hydrozoan coral : *Millepora sp, stylaster sp*. Etc
Anthozoan coral :

Subclass : Octocorallia (*Tubipora, Heliopora,Gorgonia, Corallum* etc.)
Subclass : Hexacorallia (*Astraea, Fungia, Madrepora* etc)

Common name	Scientific name	Common name	Scientific name
Fire coral	*Millepora sp*	Black coral	*Antipathes sp*
Stag horn coral	*Madrepora sp*	Blue coral	*Heliopora sp*
Mushroom coral	*Fungia sp*	Star coral	*Astraea sp*
Organ pipe coral	*Tubipora sp*	Brain coral	*Meandrina sp*

Brain coral

Stag horn coral

Organ pipe coral

mushroom coral

Formation of Coral:

Secretion of calcareous materials which either immediately crystallise or crystallised by the interaction with chemical substances present in sea water, transforms into a calcareous mass. The calicoblast layer forms minute nodules at the base of polyp. The nodules unite to form prototheca which becomes gradually thickened and later assumes a cup-shaped structure.

Definition of Coral Reef:

Vaughan (1917) has defined coral reef as "a ridge or mound of lime stone, the upper surface of which is near the surface of the sea and which is formed of calcium carbonate by the actions of organisms, chiefly corals."

Types of Coral Reefs:

1. Fringing Reefs:

Coral reefs lying close to the shore of some volcanic islands or part of some continent are termed fringing reefs. The fringing reefs also referred to as the shore reefs. They extend from the shore up to 1/4 miles having no navigable channel between the shore and reef. This zone of the sea is called edge or front. However, sometimes reef beds are broken to result into irregular channels called lagoon.

Such reefs are composed largely of coral sand having living and dead corals building reefs, mud and other animals. Fringing reef is very common in East Indies.

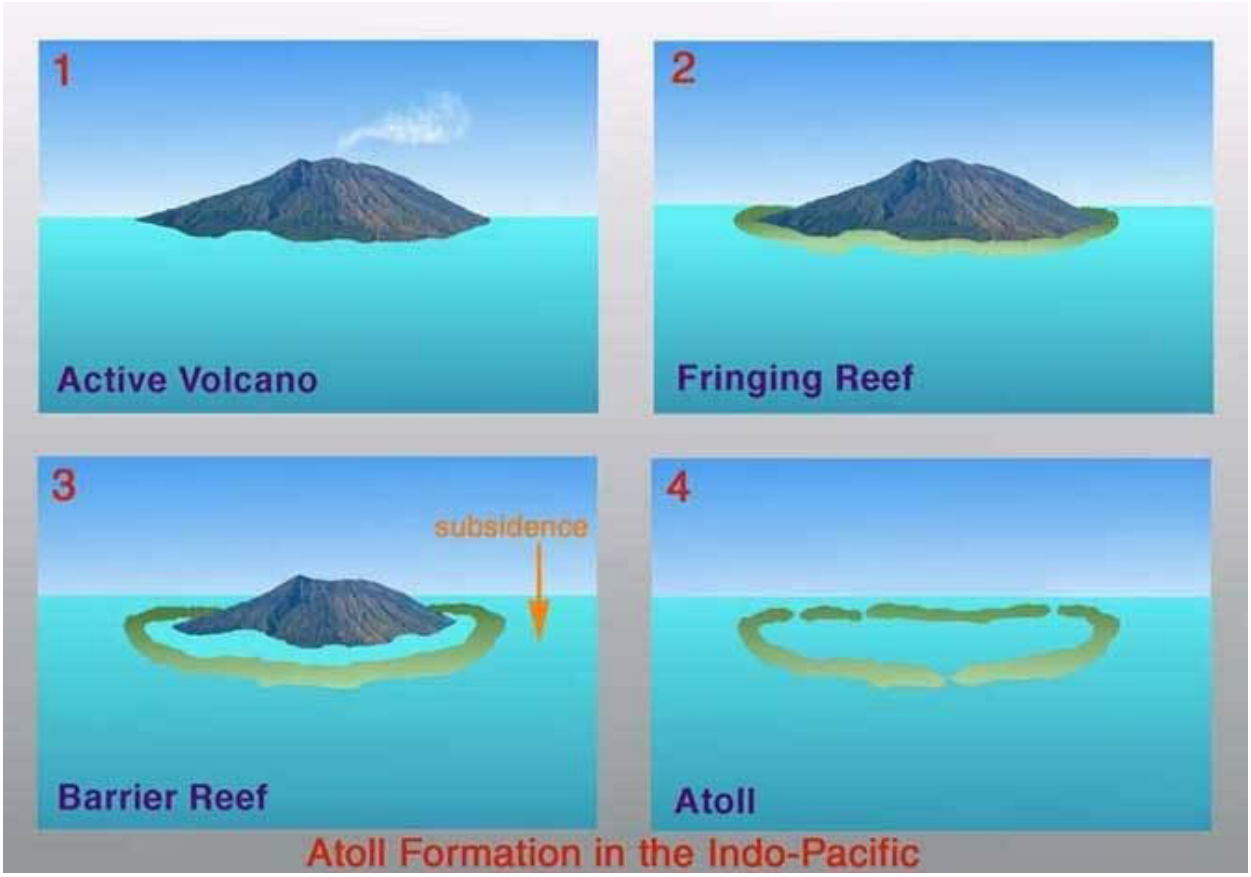
2. Barrier reefs :

The barrier reefs are like fringing reefs but they are situated in the sea nearly 1 mile to 15 miles away from the shore. Therefore, navigable channel called lagoon separates these reefs from the shore. The lagoon may be 120 to 240 feet deep, hence, it becomes navigable. The Great Barrier Reef on the north-east coast of Australia is 1,200 miles long, about 20-70 miles wide and situated nearly 90 miles away from the shore.

3. Atoll Reef:

The atoll reef, also referred to as coral island or lagoon island, is a circular or horse-shoe-shaped reef enclosing a lagoon of water which may be small or large up to 50 miles across.

Atoll reef may be broken to form channels; some suitable for navigation and other may not be suitable for it. An interesting atoll reef example is Aldabra in the Indian Ocean, about 260 miles northeast of the Malagasy Republic and 400 miles from the coast of Africa.



Fringing reef

Barrier reef

Atoll

Related questions:

1. Write the general features of phylum Cnidaria.
2. Classify the phylum cnidaria upto subclass.
3. What is metagenesis?
4. What are the different types of coral reef?

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