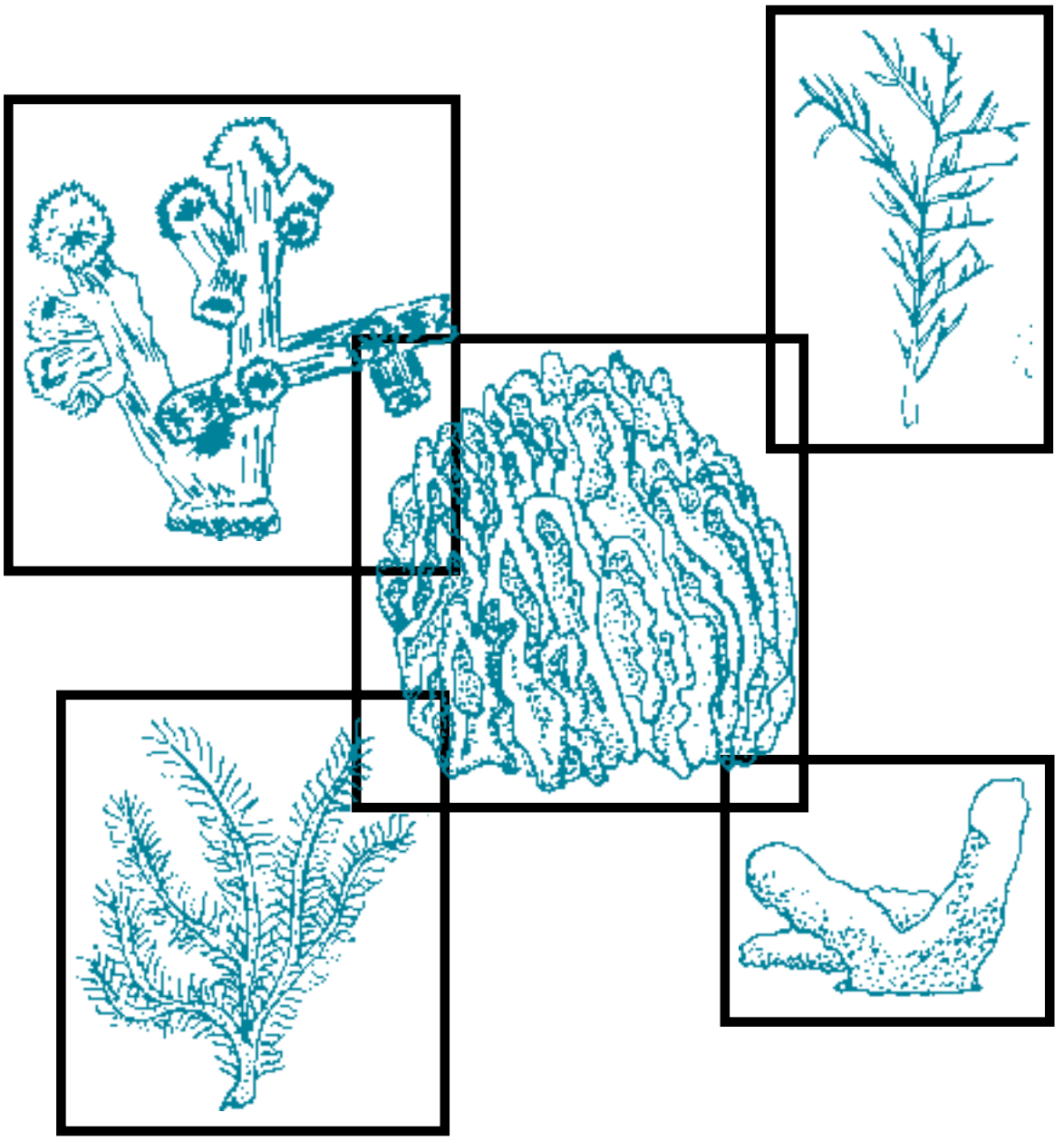


About corals

1. When I first saw a coral, I thought that it was a plant. Is that right ?

I am not surprised. Most first-time visitors to a reef tend to think of the corals as plants because they remain fixed to rocks, are colourful to look at, and many of the branched ones resemble small trees.

In reality, a coral is a simple animal like the sea anemone we find on rocky beaches. Unlike the anemone, the coral animal is generally small and constructs a skeleton around its body for protection. A coral animal is also called a polyp.

2. Are polyp and coral the same?

No. The term coral is usually denotes the skeleton though at times the polyp is also called coral animal.

3. What does a polyp look like?

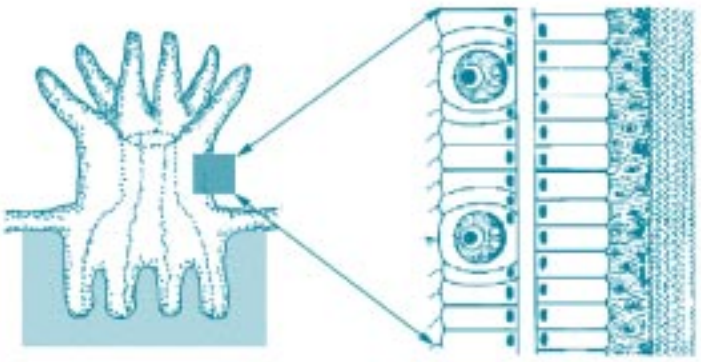
Each polyp is a hollow cylinder of tissues with tentacles and a central mouth opening at the top. In a coral colony, a thin layer of tissue joins the adjacent polyps to each other.

The central part of the cylinder has filaments called mesenteries. They serve like the stomach to absorb the food and also have gonads that produce male and female gametes (reproductive cells).

The size of the polyp ranges from about 0.5 mm to 20 mm in diameter, though there are exceptions.

4. How does the polyp make its skeleton?

The external surface of the polyp has some special cells called calicoblasts that can take dissolved calcium from seawater and construct a solid skeleton. The skeleton thus looks like a cup with side walls, a bottom and open at the top.



5. If the polyp is so small, then how come some corals look so big?

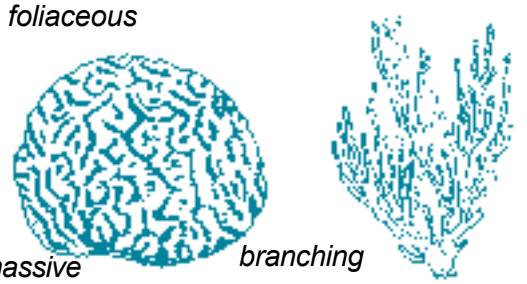
What you look at and think is a coral piece is not one coral but a number of them growing together. If you look at a coral closely you will find a lot of pores on it. Each one was the place where one individual polyp lived. Every coral colony begins as a minute skeleton of one single polyp and then keeps on growing by adding more and more individuals.

6. If all coral colonies start from a single polyp, then how come there are so many varieties?

Genetic diversity comes to play its role here. You know the tiger, the cat and the lion all belong to the same genus, yet are so different. Similarly, the shape and size of a coral colony is genetically determined.

The forms that we commonly see are:-
*massive (stone-like)
*foliaceous (leaf-like)
*branching (tree-like or flower like) and
*encrusting (coating-like).

foliaceous *encrusting*

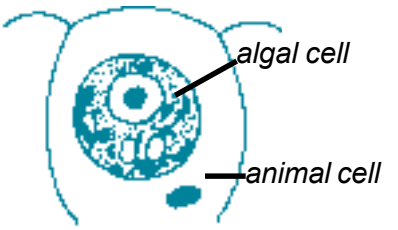


massive *branching*

At times, water depth and light may also control the shape. At greater depths, the pressure is high and the coral skeleton tends to grow more flatter. The growth forms also change because the corals are continuously on the look-out for light.

7. How does sunlight affect the growth of a coral?

Here we come to an interesting aspect of coral life. All corals that we see on a reef have microscopic plants (called Zooxanthellae) living inside their cells. These algae have chlorophyll pigments and produce organic matter by photosynthesis. For this, they need light. So the coral has to remain near the surface where the sunlight is abundant.



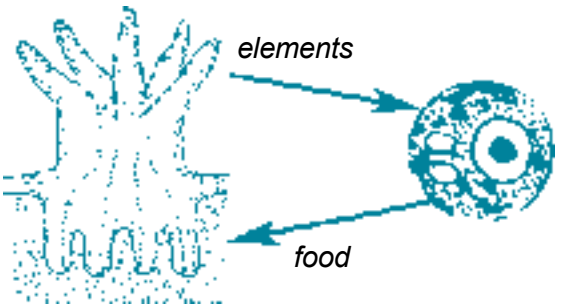
The colour of the corals, in fact, comes from the algal pigments. If the algae were not there, then the coral tissue would be a transparent layer through which we could even see the skeleton.

8. How has the coral acquired the algae and why should it tolerate them?

Nobody knows how the algae came to live inside the animal cells. In fact, these algae are also found in some clams and worms. When the algae live with the animals, both are benefited.

The algae produce organic matter by photosynthesis but

do not use all of it. Some portion of this is passed on to corals for their nourishment. The corals, like all animals, excrete nitrogen and phosphorous salts and carbon di-oxide. All these are needed for photosynthesis by algae and are readily taken up by them.



The presence of zooxanthellae also enhances coral growth. When they photosynthesize, they remove carbon di-oxide. This reduces the acidic conditions at the sites where calcium is deposited by the corals. This in turn retards calcium dissolution, thus enhancing precipitation of calcium and coral skeletal growth. The mode of living together by two organisms with mutual benefit like this is called symbiosis.

9. Interesting. Then corals do not need any other food, is that right?

No, not totally. What they can get from their algae cannot satisfy all their needs. In fact, corals are basically carnivorous. They catch tiny animals from seawater and swallow them. That is their main food. What they get from the algae is only supplementary.

Some corals can also feed on detritus (dead organicmatter) and some others can take up dissolved organic matter directly from seawater.

Corals are thus versatile in thier feeding habits. This is what helps them to survive and thrive in oceanic deserts.

10. So corals will have to move in search of food?

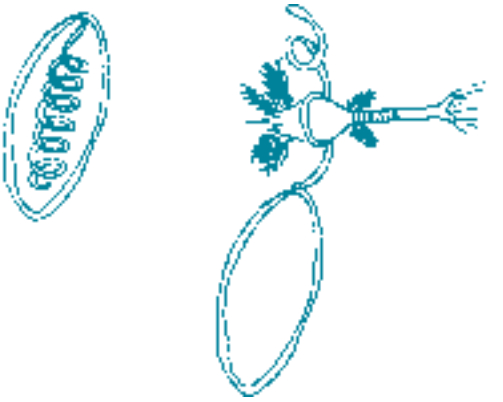
No. As their skeleton remains fixed to the rocky bases in the reef or the lagoon, the corals cannot move. Instead the food comes to them, along with the water currents.

Corals feed on tiny microscopic animals called plankton. These animals drift along with currents and when they pass close by, the corals catch them with their tentacles, sting them with their stinging cells, paralyze them by injecting venom and swallow them.

All corals are nocturnal; they become active feeders at night, when the plankton animals come to the surface layer from deep waters to where they go during daytime. If you dive in a reef at night, you'll be surprised to see how active the corals are - a totally contrasting picture from the daytime when they are withdrawn into their skeletal cavities.

11. What are these stinging cells?

All corals have cells called nematocysts in their tentacles and near the mouth. These nematocysts have a central space filled with a venomous substance, a long coil through which the venom can flow and barbs on the coil to hold the prey tight. The stinging cells come in at least 20 varieties - small, big, long, short but all have only one function.



12. Don't the corals move even for short distances?

Not the ones that are colonial and remain cemented to the bottom. Only one coral, the mushroom coral, can move for short distances. Incidentally, mushroom corals are single polyps that can grow up to 30 or 40 cm and lead a solitary life. In colonial corals, the polyps rarely exceed a cm in diameter.

13. Are there other solitary corals?

Yes, some deep-water corals are solitary. If you recall, we said that corals need light and hence they remain near the surface of the sea. These corals, having zooxanthellae, are also called hermatypic corals. They can be seen only in tropical and subtropical seas. These are the ones that form the coral reefs.

Some other corals, called ahermatypes, do not have zooxanthellae. Therefore they do not need light and can live in deep waters upto depths of 1000 or 2000 meters. These corals generally lead a solitary life and if they happen to form colonies, they are usually small with only a few individuals. The ahermatypic corals also occur in all latitudes.

14. Does temperature promote the development of coral reefs?

Yes. The reef building corals require warm temperatures for their survival. They grow well at

temperatures greater than 20°C and can thrive even at 35°C as in the Red Sea, Persian Gulf or our Gulf of Kachchh. Some of them occur sometimes at low temperatures, even down to 10°C, but they do not form reefs. It is because of this preference for warm waters, that the greatest number of corals is found in the tropical belt, with a decrease towards the subtropical seas.

15. Are there other conditions that effect coral growth?

Yes. Several but at least 3 of them are important:

(a) Firm substratum to settle

Corals need natural surfaces like rocks, coral stones or even molluscan shells to settle and grow.We rarely find profuse coral settlement on man-made structures like jetties or tetrapods though metallic structures like hulls of sunken boats and ships favour coral settlements.

(b) Salinity:-

Seawater contains 35 g of dissolved salts per liter whereas freshwater has only a few mg of dissolved salts. This saltiness is called salinity. Corals need this salinity to grow well. At times, corals can withstand some decrease in salinity (perhaps down to 30 g of salts per liter) for sometime (a few weeks to one or two months) but not more than that.

(c) Water clarity

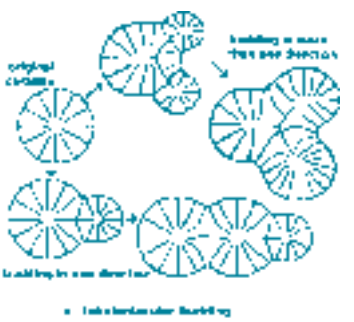
When the waters are turbid, inorganic particles keep on

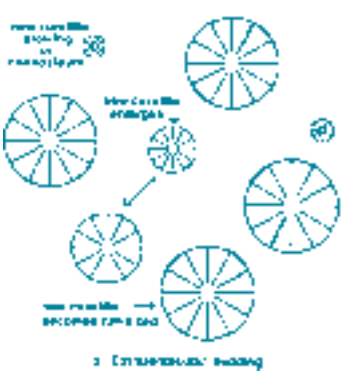
falling on corals, but the corals cannot escape from this particle rain by moving away or by closing the skeleton.
If the particle rain is less intense, corals can still clean themselves by ciliary movements but at high turbid conditions, the cleaning mechanism cannot cope and the corals eventually die of smothering.

The sedimentation also has an indirect effect - it reduces light penetration in the sea, thus reducing photosynthesis by zooxanthellae and the coral growth. This does not, however, kill the corals.

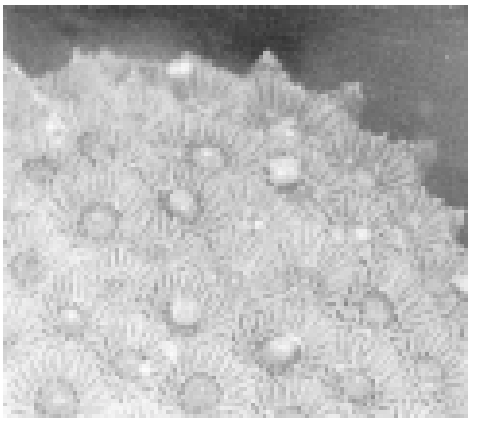
16. You said that a polyp grows into a colony by adding individuals. How does this happen?

This happens by budding, which is an asexual method of reproduction. In this case, the first polyp buds off a second one, which buds off another one and so on. The colony thus keeps growing. Budding can be either intratentacular or extratentacular, depending on the coral species: in the former, the offspring is first produced by division of a polyp within its own skeleton and then separated from the mother polyp by a skeletal wall. In the latter, the mother polyp produces a bud outside its skeleton. This bud later secrets its own skeleton.





17. Do the corals reproduce sexually also, like other animals? Are there mating rituals?



Yes, they do. Each polyp is a hermaphrodite and can produce both male and female gametes. At certain phases of the moon, the corals release synchronously the male and female gametes into the surrounding seawater. Though there are no sexual manifestations beforehand, this comes as close to as being called a mating ritual. The gametes unite and produce a larva called planula. This swims around for a few days, looking for a hard substratum to settle. Once settled, this starts reproduction by budding to form a new coral colony.

18. How long corals live?

It is a difficult question to answer. When the polyps reproduce by asexual means, the growth can be endless. Some large coral colonies have been known to be as old as 100-200 years.

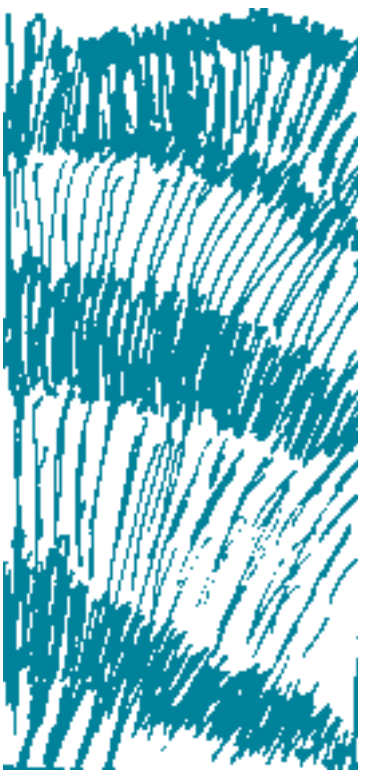
19. How fast the corals grow?

Very slowly! The massive ones like the brain corals(the ones that resemble in form the human brain) grow no more than a cm per year. This is because the calcium carbonate deposition is a slow process and the

growth occurs in all directions. The branching corals are relatively fast-growing. Some of them can grow as much as 18 to 20 cm per year but their skeletons are less dense than those of the massive ones.

20. You mentioned that some coral colonies could be more than 100 years old. If the growth of corals is so slow then how can you make out their age?

The growth of a coral is not uniform throughout the year. At certain times, when warm conditions with abundant sunlight prevail, coral grows fast. At other times, when there is heavy rain during monsoon, its growth slows down. When a coral grows fast, it deposits more calcium into the skeleton, which becomes dense. When the growth is slow, calcium deposition becomes lighter. If we x-ray a coral skeleton, these regions would appear as dark and light bands. Since seasonal changes, such as those between warm and rainy months occur generally once in a year, a dark



and light band together would correspond to one year's growth. If we take a portion of a coral colony and count the number of dark or light bands, then we will know its age.

21. What else can the bands tell us, apart from age?

While the corals deposit calcium, they also include with it a variety of materials, like metals, humic acids and some natural elements like carbon and oxygen. Among these, humic acids come from land sources and are brought into the coastal waters by river flow. So, the more the rainfall, the more humic acids come with the river flow, the more their abundance in the coral skeleton. When we look at a coral skeleton under ultra-violet light, we can see the presence of humic acids as fluorescent bands. The intensity of fluorescence thus is an index of rainfall. Knowing the age from the growth band at the location of the fluorescent band, we can deduce whether the monsoon was strong or weak - at that time.

22. Interesting. Do these bands tell us anything more?

Yes. You know, most elements have isotopes i.e. atoms that are slightly different from the most common ones. Oxygen has two isotopes: a lighter one (0_{16}) which is common and a heavier one (0_{18}). At higher temperatures the lighter isotopes escape from the seawater leaving the heavier ones behind. So if we find more heavier isotopes of oxygen in a coral skeleton at a particular growth band, then we can conclude that the sea temperature was higher in that year. If we know how much more of heavier isotopes were there, then we can even deduce how much higher

the temperature was.

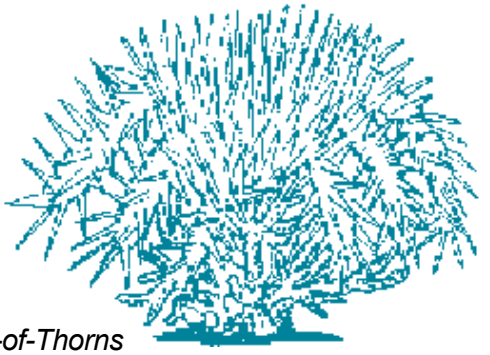
Corals can thus act as indicators of past climate changes.

23. Are there natural enemies to corals?

Yes, some fish, in particular the parrotfish, feed on corals. These have powerful teeth with which they can snip off pieces of coral skeleton along with the polyp tissues and ingest them. The butterfly fish also feed on corals but since their teeth are not as strong, they just nibble the corals.

Parrot fish

Butterfly fish



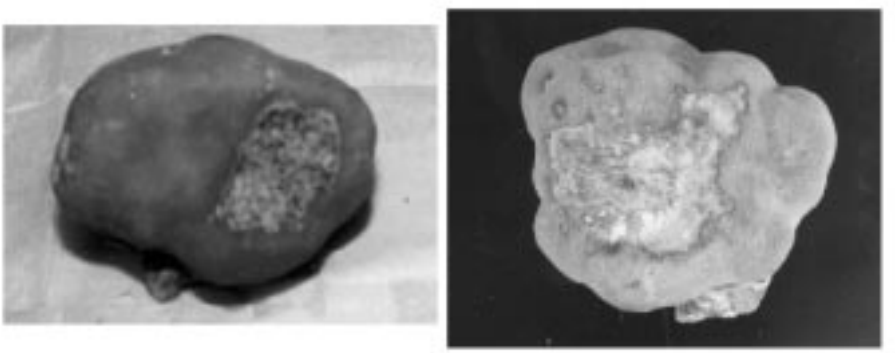
Crown-of-Thorns

There is one more predator that is more dangerous to corals. It is the crown-of-thorns starfish. It exclusively feeds on corals. Unlike the fish which bite or nibble parts of the corals, this starfish envelops the whole coral with its arms and sucks out all of the coral tissue, leaving only the

bare skeleton.

24. Do corals suffer from diseases?

Yes. At least two diseases are known so far to affect corals. The first is the black band disease, which is widely prevalent. The cause for this is infection with a bacterium. Coral tissues affected by this disease become blackish and look like a dark band among healthy tissues. The less prevalent white band disease causes the affected tissues to look like a white band around the lesion. The organism responsible for this disease is not known at present.



Recently NIO scientists recorded another disease, the pink line disease, from some corals in Lakshadweep. Though the cause for this is also not known, it is suspected that the mortality associated with the 1998 El Nino event has a role in this.

25. How many species of corals are found in the world?

At a best count, somewhere between 800 to1000 species. Nobody knows exactly how many because we don't know all of them. We may not know yet those corals that live in deeper waters or remote reef areas. Sometimes the same coral species is called by different names in different countries. However, we can safely say that at least 800 species are known so far.

26. How many coral species occur in India? Are there any corals unique to India?

206 species of corals are known from Indian reefs, with a majority of them occurring in the Andaman and Nicobar Islands. Some coral species such as *Porites mannarensis* are unique to India. This is natural because we can't expect all species to be cosmopolitan in distribution.

27. Is the precious red coral one among them?

We are so much used to the idea of red coral in jewelry, we tend to think it should be unique to India! The red coral, called *Corallum rubrum*, is not a reef coral at all. It is a stony coral without zooxanthellae. The red colour comes from natural pigmentation of the skeleton that remains even after the death of the polyp. Again, unlike the reef corals that are porous (with cavities in the skeleton), the red coral is dense and compact. So, it can be shaped or machined without breakage. That is how coral beads

are cut for jewelry. The red coral occurs only in the Mediterranean Sea and off Japan from shallow depths up to 1000 meters. They are collected by dragging wooden frames over seabed and breaking off the branches. Some fishermen from Mediterranean coasts are also known to collect them by skin diving. Like the red corals, the black corals and blue corals also retain the colour after death.

28. Are there other corals that are different from the ones we see on a reef?

Yes, there are several of them. They resemble the true corals but do not have zooxanthellae. They occur sometimes in profusion in deeper parts of the reefs. The fire coral, tree coral, wire coral, sea fan and sea fern are some such corals.

Wire Coral

Sea Fan

Sea Pen

Some cousins of the stony corals are called soft corals. These are large ones, several cm in diameter: they

lack a true skeleton but have spicules (spiny material) in their tissues which give them a leathery and tough consistency. Soft corals also occur profusely in most coral reefs. They are an interesting group of animals because several of them are sources of bioactive compounds.