Marine Biology Distance Learning Packet

(Litz, Peacock, and Rasner)

The following assignments are a series of items that will allow you to stay current with the material which has been presented this semester. It is expected that each student will complete the assignments individually and submit this work.

All of these assignments can be completed using the note packets provided in class or the internet.

You will be provided instructions at a later time on the proper procedures to turn in these assignments.

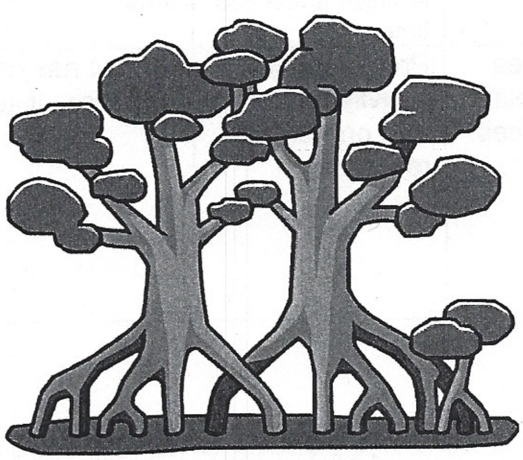
Assignments Included:

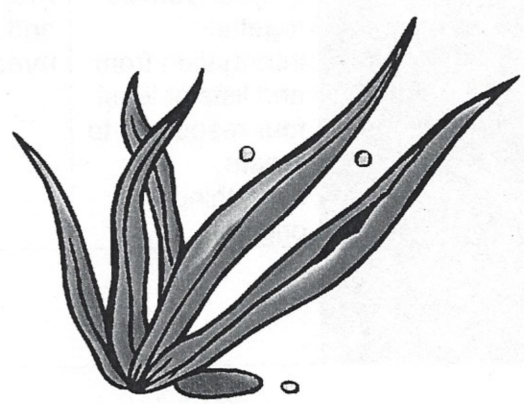
- Oceanic Environment Travel Advertisement
- Algae WebQuest
- Asexual Reproduction Article and questions
- Reproduction in Marine Organisms: Planktonic Larval Forms Article and questions
- Seaweed Adaptations: Red and Green Algae Article and questions
- Seaweed Adaptations: Brown Algae Article and questions
- Marine Flowering Plants Article and questions
- Sponges Coloring and Questions
- Review Units 1-4

Oceanic Environment Travel Advertisement

<u>Assignment</u>: Create a one-page advertisement/brochure promoting your assigned ocean environment. Think of this environment as a vacation spot for travelers. Why would someone want to travel here? What will they see (including organisms and other important features)? Which ecosystems exist within your environment? Are there any dangers that travelers must prepare for? Remember, **creativity counts!**

Topic Choices:
Mangroves https://ocean.si.edu/ocean-life/plants-algae/mangroves
Seagrass Beds https://ocean.si.edu/ocean-life/plants-algae/seagrass-and-seagrass-beds





RUBRIC

Name ________________ Pd ____ Assignment Due: ________________

	4	3	2	1
Understanding	Student demonstrated a complete and detailed understanding of the topic.	Student has a complete understanding of the information important to the topic but not in great detail.	Student has an incomplete understanding of the topic and/or misconceptions about some of the information.	Student's understanding of the topic is incomplete and many misconceptions are present.
Content Accuracy	All facts in the advertisement are accurate.	99-90% of the facts in the brochure are accurate.	89-80% of the facts in the brochure are accurate.	Fewer than 80% of the facts in the brochure are accurate.
Creativity	Presents project in a visually engaging way including the use of pictures, images, or other visual aids to display information in multiple ways.	Student devised an imaginative way to design or deliver the project. Utilizes a variety of resources to create an innovative project.	Information is somewhat "cut and paste" from one or two sources and shows little evidence of originality in design.	Assignment lacks unique ideas. Project was built entirely on sample work or "cut and paste" from sources.
Organization/Time Management	Used time exceptionally well. Work was turned in early or on time.	Used time effectively. Most work was done on time.	Some work was done on time. Monitored progress occasionally. Did not change work habits or schedule accordingly. Worked frantically to finish project on time.	Did not use time well. Little or no work was done on time. Did not monitor progress adequately. Project was not completed on time.
Research	Project weaves together information from and lists at least four resources to create something original.	Project utilizes and lists at least three resources.	Project relies heavily on and lists one or two resources.	Project has no resources listed.
TOTAL (out of 20)				

Algae Web Quest

Part I. Major Algal Types-

Use the following website to answer the questions and complete the table:
http://www.seaweed.ie/index.php (use the links on the left side of this webpage to explore different topics within seaweeds)

1. What are algae?
2. Why are seaweeds assigned to Kingdom Protista rather than Kingdom Plantae?
3. What is the most productive group of phytoplankton?
4. What is the second most productive group of phytoplankton?
5. What is meant by "productive"?
6. Sketch a typical of the division Phaeophyta. On your sketch, list, describe, and state the function of the four basic parts of seaweed.
7. What are the most important ecological roles filled by seaweeds?
8. List several types of environmental stress seaweeds encounter.
9. Describe sexual and asexual reproduction in seaweeds.
10. Upon what characteristics are seaweeds classified?

11. Complete the table below to compare green, red, and brown algae.

Algae Type	Phaeophyta	Chlorophyta	Rhodophyta
Specific Examples			
Physical Form(s)			
Major Pigment(s)			
Habitat(s)			
Human Uses			
Unique Characteristics			
Useful Substances & Their Uses			

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ASEXUAL REPRODUCTION

Sexual reproduction begins with the segregation of one-half of a cell's genetic material (chromosomes) into a sex cell, or gamete (sperm or egg). The union of sperm and egg (fertilization) restores the full complement of genetic material, creating a new individual with a combination of the genetic characteristics of the parents. Such genetic variation may result in organisms better adapted to their environments or that are able to adapt to new environmental conditions. This increased potential adaptability is one major survival advantage for species that utilize sexual reproduction. Some examples of these sexual processes are discussed in the following plates.

However, non-sexual (asexual) means of reproduction are used by many species to take advantage of favorable—and rapidly changing—environmental conditions. Great increases in numbers can be achieved more quickly by asexual than by sexual means. Five examples of asexual reproduction are presented in this plate.

Color each example of asexual reproduction as it is discussed. In the case of the sea star, both illustrated processes involve regeneration, however the example on the right also results in the asexual formation of two individuals from one (reproduction).

In the previous plate, it was explained how marine algae produce spores which asexually develop into new individuals. The single-celled diatoms and dinoflagellates (Plate 72) often reproduce asexually by simply dividing. The *turtle grass* shown here is an example of a marine flowering plant which produces new individuals by means of underground stems called *rhizomes* (Plate 18). Such *vegetative growth* also occurs as a type of asexual reproduction in many terrestrial plants.

Asexual reproduction is not always such a clearly definable phenomenon. For example, if a *sea star* loses all but one of its arms from the central disc it may gradually regrow the missing arms as shown. This process is called *regeneration*. However, if a sea star is cut evenly in two (a generally futile practice of some oystermen who hope to eliminate the predators from oyster beds), each half might regrow the missing portion. Obviously this process involves regeneration, but it must also be considered asexual reproduction since two individuals are produced from an original one without sexual activity.

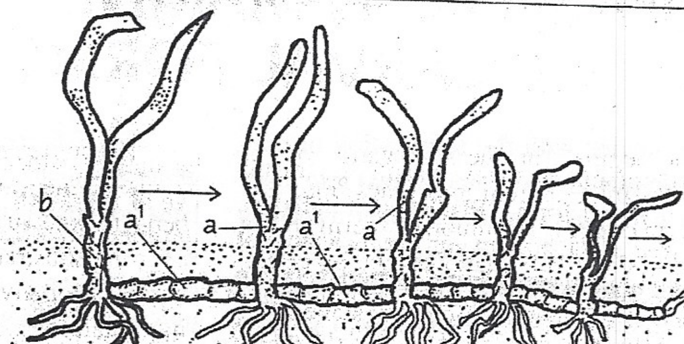
The cnidarians are masters of asexual reproduction. The white-plumed anemone *Metridium* (Plate 23) exhibits a behavior known as *pedal laceration*. As the anemone creeps over the substratum on its pedal disc, portions of the disc are occasionally torn off and left behind where they grow into small anemones. Some species, such as the aggregating anemone, reproduce by literally pulling themselves in half from top to bottom in the process of longitudinal fission (Plates 5, 96).

The ability to reproduce asexually allows a single organism to take advantage of a favorable habitat. For example, if a planktonic larval form finds a suitable site for attachment and growth, chances are excellent that others of its species would also be successful in that area. If the organism can reproduce by asexual means, it can proliferate and maximize its use of the habitat in a relatively short period of time. Such opportunistic exploitation of habitat is exemplified by corals. The coral's planula larva (Plate 76) settles on an appropriate substratum and grows into a single *polyp*. If the polyp is successful, it does not simply continue to increase in size, but instead buds off a new polyp, as illustrated. This *budding* process continues and the polyps remain attached by a common sheet of tissue (not shown, see Plate 23). Budding can eventually produce large coral heads consisting of thousands of asexually produced individuals (Plate 13).

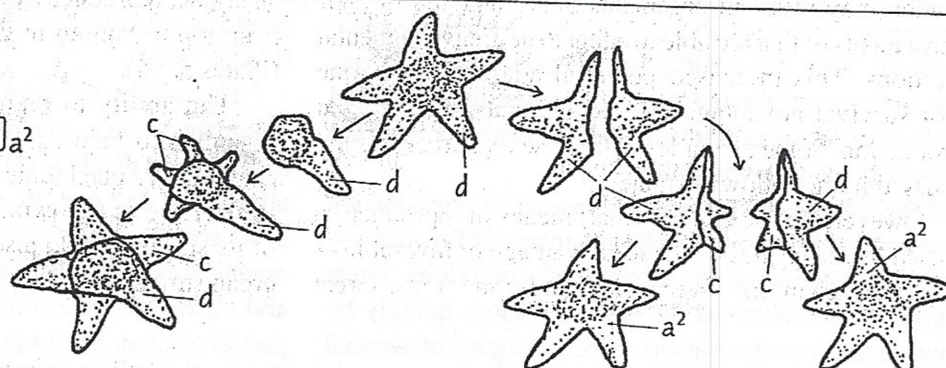
A number of marine polychaetes (*Autolytus* is shown here) utilize a variant of asexual reproduction as a preparation for sexual reproduction. For most of the year, *Autolytus* exists in a sexually unripe, but otherwise adult form called an atoke. Preparatory to breeding, the posterior portions of the atoke begin to develop as a series of sexually maturing *epitokes*, complete with head (see illustration). These remain connected until the time of breeding; there is a record of one individual having twenty-nine epitokes attached. Breeding involves the synchronous release and swarming of multitudes of epitokes of both sexes, and this occurs, in most species, on one or a few nights each year. The timing of the event is precisely linked to the lunar cycle in a manner not yet understood. Swarming takes place in surface waters, with tremendous predation by birds, fish, and humans—some epitokes are much prized in Samoa, for example (Plate 77). This asexual multiplication of reproducing individuals, together with the simultaneous shedding of gametes, seems to maximize the chance of successful reproduction.

ASEXUAL REPRODUCTION

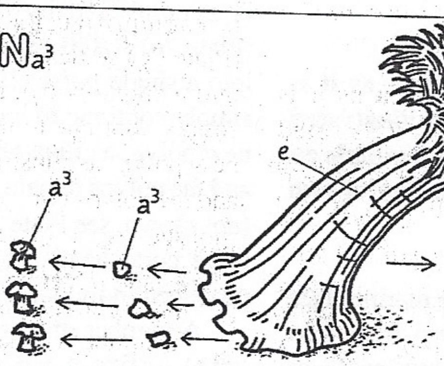
VEGETATIVE GROWTH$_a$
TURTLE GRASS$_b$
RHIZOME$_{a^1}$



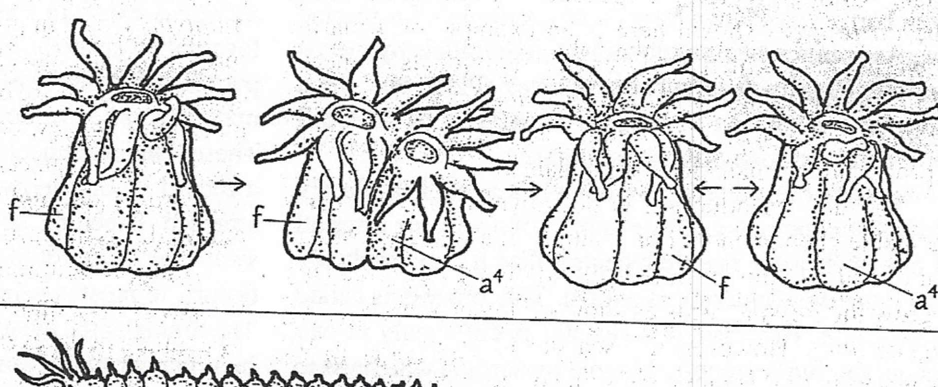
REGENERATION$_c$
ASEXUAL REPRODUCTION$_{a^2}$
SEA STAR$_d$



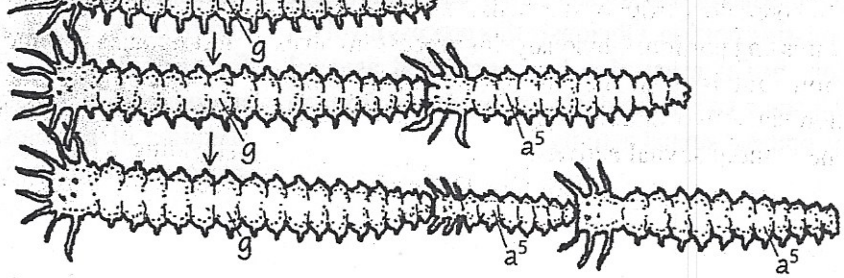
PEDAL LACERATION$_{a^3}$
METRIDIUM$_e$



BUDDING$_{a^4}$
CORAL POLYP$_f$



EPITOKE FORMATION$_{a^5}$
AUTOLYTUS$_g$



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REPRODUCTION IN MARINE ORGANISMS: PLANKTONIC LARVAL FORMS

The embryonic development of many marine organisms includes a planktonic larval form. "Planktonic" indicates that the larvae float free of the bottom and are incapable of swimming strongly enough to avoid being carried by ocean currents. The occurrence of a planktonic larval stage in the life cycles of so many different animals indicates that it must have great advantages. First, the larva has an opportunity to feed on the richest of all marine food sources—the phytoplankton (Plate 19). Second, ocean currents may transport the larva over long distances and allow dispersal to new habitats as well as replenishment of areas already occupied. Third, competition between adult and larva is virtually eliminated, as each exploits a different environment.

The production of planktonic larvae is not without expense. Many larvae never find their way to habitats that are suitable for adult life. Planktonic life is precarious. Microscopic drifting larvae may be subjected to areas of unfavorable water conditions, predators, and lack of available food. To compensate for the usually very high mortality rates among these planktonic stages, the adults produce enormous numbers (tens or hundreds of thousands per female) of small larvae. Also, the release of larvae into the plankton is generally timed to occur during or just prior to periods of high food availability (spring and summer). Such high production of larvae can sometimes backfire. If larval success is extremely high, the result may be overcrowding of the adult habitat after settling (for example, as with barnacles; Plate 97).

As mentioned above, the habitats of larvae and adults are often totally different (for example, planktonic versus bottom-dwelling), and these two life stages usually consume different foods. Thus, it is not surprising that the larval body form is often entirely unlike that of the adult, as illustrated in this plate.

Color each adult/larva pair as it is referred to in the text. Begin with the brittle star. All the larvae illustrated here are shown greatly enlarged. The setae of the nectochaete larva are drawn with fine lines which may be lightly colored over. Only a simple outline and the eye of the adult sunfish are shown. Plate 45 includes a detailed drawing of this huge fish.

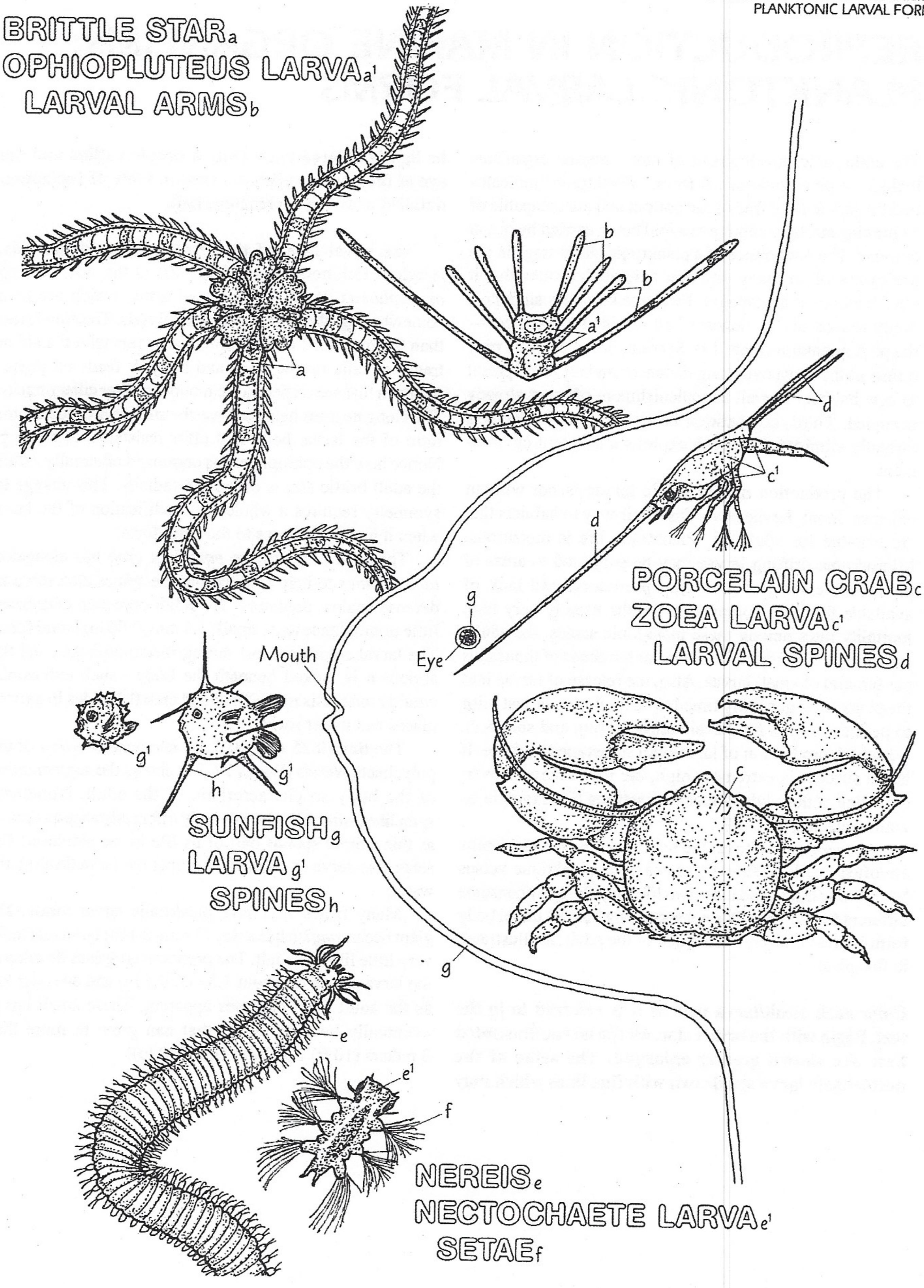
The larval form of the *brittle star*, or ophiuroids, (phylum Echinodermata, Plate 40) is the odd-looking *ophiopluteus*. It has eight *larval arms*, which are held somewhat rigidly by internal skeletal rods. The small (less than 0.5 mm, 0.02 in) ophiopluteus swims with the aid of tracks of cilia on the arms and body. It feeds on phytoplankton that are carried to the mouth by other ciliary tracks. The elongate arms help increase the surface area to volume ratio of the larval body and offer resistance to sinking. Notice how the ophiopluteus is organized bilaterally, while the adult brittle star is organized radially. This change in symmetry requires a wholesale modification of the larva when it metamorphoses to the adult form.

The *zoea larva* of the *porcelain crab* has elongated *larval spines* to help in flotation; the spines also serve as defense against predators. The adult porcelain crab bears little resemblance to its small (1.5 mm, 0.06 in) larval form. The larval spines are lost during metamorphosis, and the abdomen is tucked beneath the body—such extensions would hinder this much-flattened crab that hides in narrow places and under rocks.

The tiny (0.25 mm, 0.01 in) *nectochaete larva* of the polychaete *Nereis* (Plates 27, 77) shows the segmentation of the body so characteristic of the adult. Numerous spinelike *setae* on the larva's body offer resistance to sinking as this animal spends part of its life in the plankton. The setae also serve as paddles to propel the larva through the water.

Many fishes also have planktonic larval forms. The giant ocean *sunfish* has a tiny (3 mm, 0.1 in) larva that looks very little like the adult. The pronounced spines develop as the larva grows (at about 1.3 cm, 0.5 in) and are later lost as the adult form becomes apparent. These small larvae eventually become adults that can grow to more than 3 meters (10 ft) and 2000 kg (4400 lb)!

PLANKTONIC LARVAL FORMS



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SEAWEED ADAPTATIONS: RED AND GREEN ALGAE

The multicellular seaweeds, or macroalgae, have evolved some very important adaptations allowing them to survive in the near-shore shallow marine environments. Macroalgae are primarily limited to areas of shallow water and rocky shores; the algae need light for photosynthesis, and solid substrata for attachment sites. But the near-shore habitat poses a challenge to the algae; wave action, desiccation during low tide, and grazing by numerous herbivores are all potential threats to these plants.

Begin by coloring the sea lettuce. The illustration at the upper right shows various algae attached to a rocky surface; the other illustrations are larger drawings of the algae. As each type is mentioned in the text, color both representations. Choose greens for the green algae, pink for the coralline algae, and reds and purples for the red algae. *Smithora* is attached to green surf grass.

The green algae are abundant in freshwater environments, but are represented by relatively few marine species. One green alga of the marine intertidal zone is the thin-bladed (two cells thick) *sea lettuce*. The delicate sea lettuce loses its moisture during low tide and becomes quite crispy, yet remains alive. When the tide rises, it again absorbs water. Some species of sea lettuce occur on soft substrata in calm water habitats where the alga attaches to a shell, rock, or other object and may grow over a meter (3 ft) in length. The green alga *Cladophora* grows in small, thick tufts in the middle intertidal zone. These tufts are composed of thousands of tiny multi-branched filaments that serve to trap sand. Together the filaments and trapped sand hold precious water used for survival during low-tide exposure.

The red alga known as the *salt sac* is a medium-sized, 2.5–5 cm (1–2 in) diameter alga of the middle intertidal zones, often found in large patches. The salt sac is aptly named, for in its hollow core it holds a reservoir of sea water to keep it from drying out at low tide. These water sacs are home to a particular type of tiny copepod (crustacean).

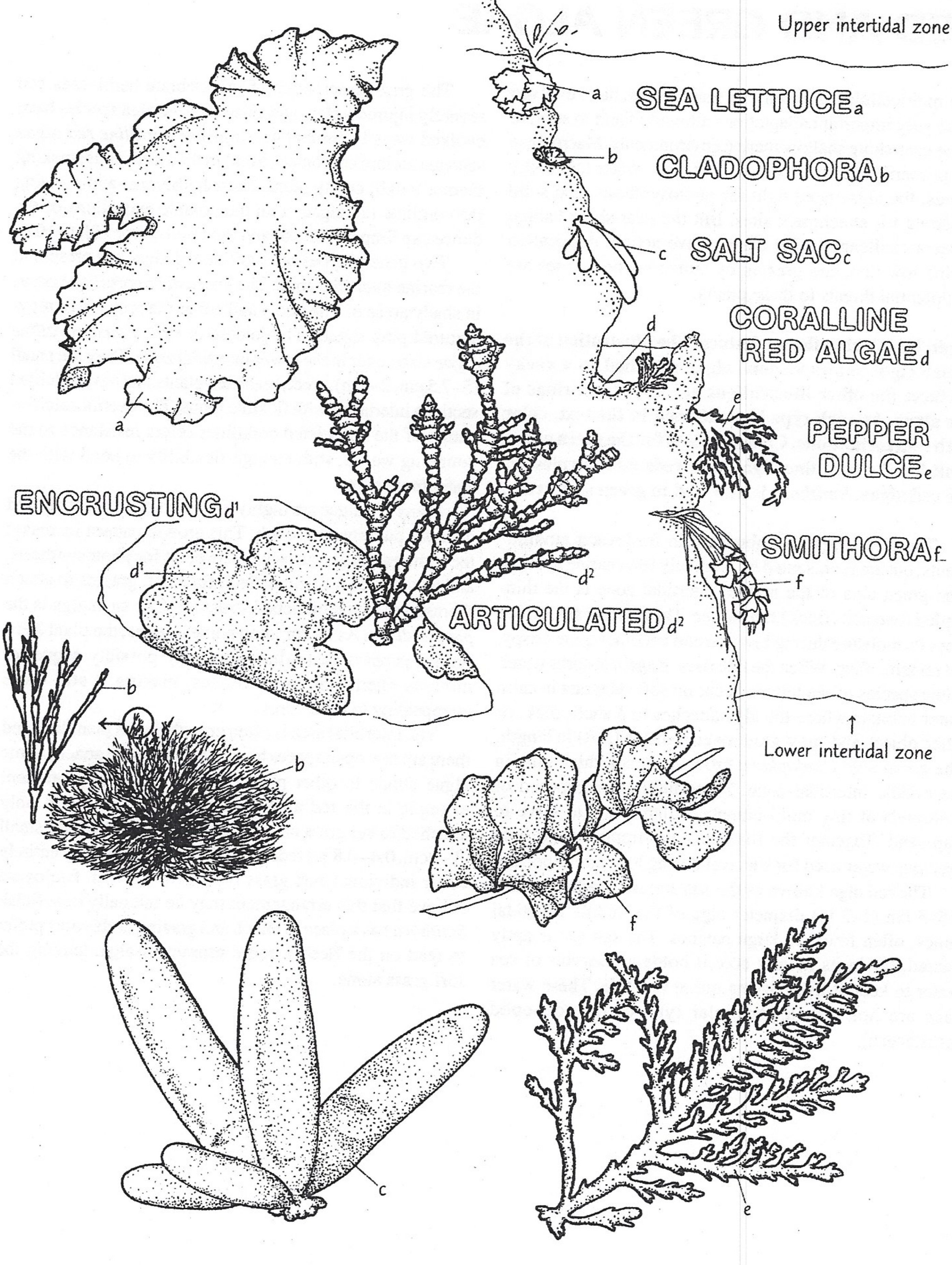
The grazing activities of invertebrate herbivores can severely injure an alga, and several of the alga species have evolved ways to combat grazing. The *coralline red algae* secrete calcium carbonate (lime) in their cell walls, making them a tough, crusty plant. Most herbivores avoid eating the coralline red algae, with the notable exceptions of the dunce cap limpet (Plate 6) and the lined chiton (Plate 107).

Two general types of coralline red algae are present in the marine intertidal zone. The *encrusting corallines* occur in shady areas of tide pools and cover the rocks in bumpy-textured pink sheets. The jointed or *articulated coralline algae* also occur in the lower intertidal zone. They are small (5–7.5 cm, 2–3 in), erect, branched plants that have calcified sections interlaced with flexible joints. The overall calcified nature of the articulated corallines offers resistance to the pounding waves, with enough flexibility to bend with the water movement.

Many red algae are highly branched, with beautiful and intricate patterns of growth. This growth pattern increases the light-gathering surface of the plant for photosynthesis, and also makes it more difficult for small grazers to attach themselves to the branched structure. One such alga is the *pepper dulce*. As its common name implies, the plant has a biting, peppery taste; the plant may possibly sequester noxious chemicals in its tissues, making it still more unappealing to herbivores.

The intertidal area is often crowded with plant life, and there are few open spaces to which an alga can attach. Some algae attach to other plants or animals. One prominent example is the red alga *Smithora*, which is found only attached to eel grass and to surf grass. *Smithora* has small (1–2 cm, 0.4–0.8 in) reddish-purple blades that may entirely cover individual surf grass blades (as shown). Biologists believe that this arrangement may be mutually beneficial. *Smithora* has a place to attach and grazing herbivores prefer to feed on the fleshly, more prominent alga, leaving the surf grass alone.

RED AND GREEN ALGAE



21 SEAWEED ADAPTATIONS: BROWN ALGAE

The brown algae are subjected to the same environmental stresses that exist for the red and green algae: damage from wave shock, desiccation, grazing by herbivores, and competition for available attachment space and for light for photosynthesis. Some brown algae are much larger than other types of algae, which is often a survival advantage. Some species have developed several other survival mechanisms as well.

Color the parts of the rockweed at the upper left. Color each brown alga as it is treated in the text. Notice the differences in relative proportions of the holdfast, stipe, and blade among these plants. The feather-boa kelp has especially long stipes and small blades.

Rockweed is a common brown alga growing in the high and middle zones of the rocky intertidal worldwide. These zones are a potentially very stressful area, being most frequently exposed to air at low tide. The rockweed is successful here because it can tolerate considerable desiccation, such an event being retarded by thick cell walls and high concentrations of polysaccharides (sugars). Rockweed does not grow structures that are readily distinguishable as stipes or blades; the entire plant is called a *thallus*. At high tide, small air bladders (not shown) along the sides of the thallus cause the alga to float up from the bottom where there is better exposure to light. The swollen tips of the thallus are reproductive structures called *receptacles*.

The large brown algae known as kelp are common subtidally and in the low intertidal zone, where the wave action is most severe. The feather-boa kelp has long (10 meters, 33 ft), supple, strap-like *stipes* that wash back and forth with the movement of the water. The stipes sometimes snap off during storms, leaving the large *holdfast* behind. The holdfast resembles a mound of intertwined roots and anchors the kelp. It can persist over a winter, and in the spring, new stipes will sprout.

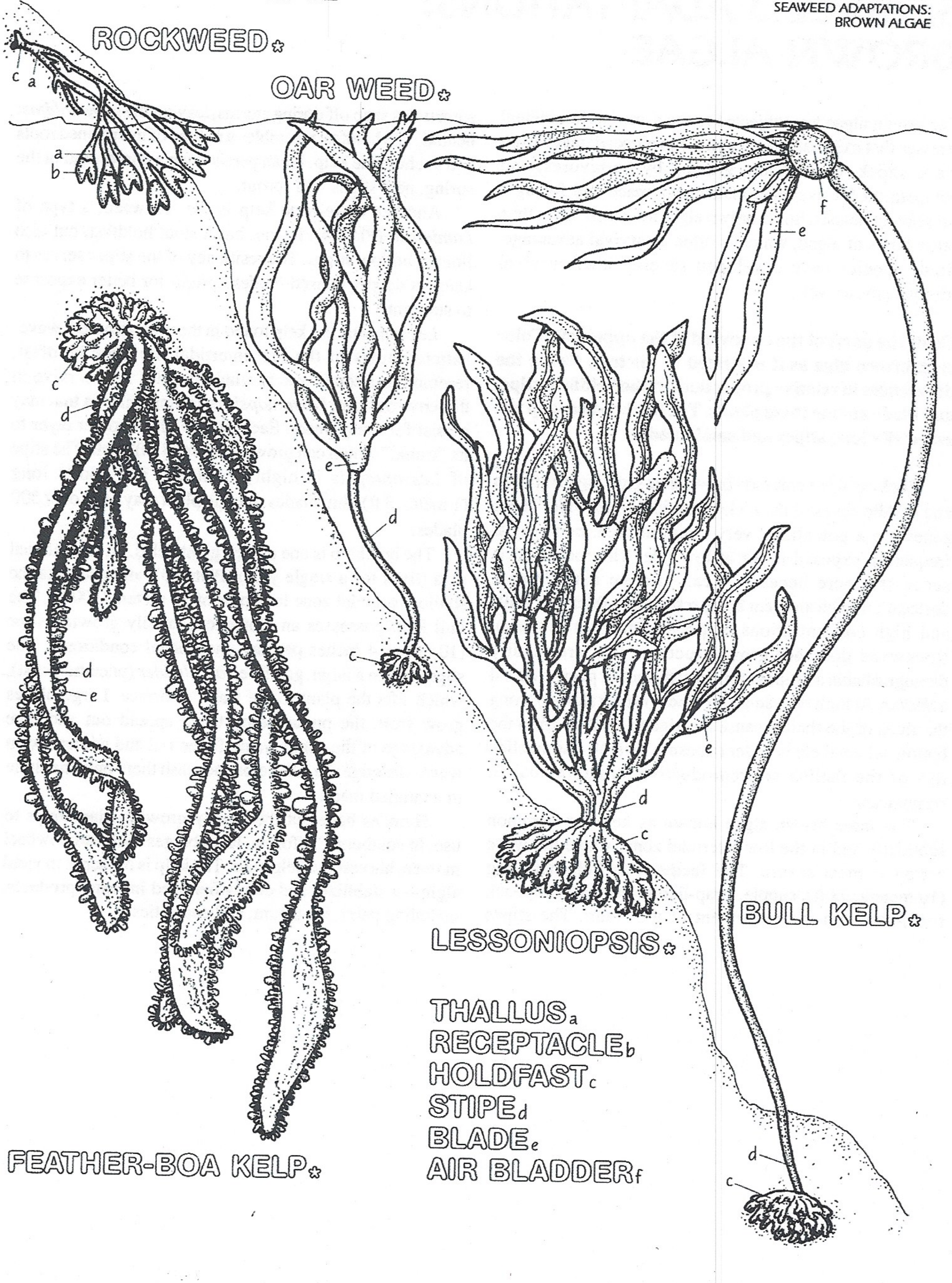
Another wave-zone kelp is the oar weed, a type of *Laminaria* (Plate 4). It, too, has a stout holdfast, but also limber, hollow stipes. The resiliency of the stipes serves to keep its deeply incised *blades* upright for better exposure to sunlight.

Lessoniopsis is a kelp found in the most exposed, wave-battered areas of the low intertidal. Its huge holdfast, resembling a thick woody trunk, enables it to survive in this environment. *Lessoniopsis* is a perennial alga that may persist for many years. Each year it adds another layer to its "trunk," which can grow to 20 cm (8 in) thick. The stipe of *Lessoniopsis* is highly branched and sports long (1 meter, 3 ft), thin blades. A large plant may have over 500 blades.

The bull kelp is one of the "giant kelps." It is an annual alga (lives for a single year) (Plate 73), and occupies the shallow subtidal zone to depths of 30 meters (100 ft). The bull kelp possesses an elongated, rapidly growing stipe (10 cm or 4 inches per day under ideal conditions). The stipe ends in a large, gas-filled *air bladder* (pneumatocyst), which lifts the plant to the water's surface. Large blades grow from the pneumatocyst and spread out and take advantage of the sunlit water. In the fall and winter, storm waves dislodge the bull kelps and wash them onto the shore in a tangled mass.

Humans have put the rapidly growing giant kelps to use. In southern California, large barges with paddlewheel mowers harvest the kelp beds. The kelp is rendered to yield algin—a stabilizer and emulsifier used in many products, including paint, ice cream, and cosmetics.

BROWN ALGAE


ROCKWEED*
OAR WEED*
FEATHER-BOA KELP*
LESSONIOPSIS*
BULL KELP*
THALLUS a
RECEPTACLE b
HOLDFAST c
STIPE d
BLADE e
AIR BLADDER f

18
MARINE FLOWERING PLANTS

Most flowering plants become metabolically stressed if exposed to sea water, as they are incapable of dealing with the high salt content. This metabolic stress ultimately results in the death of the plant.

A few species of land plants have, however, successfully invaded and adapted to sea-water environments, flourishing in a variety of marine habitats. Unlike algae, land plants can grow only where they can absorb nutrients through their roots. These higher plants also need nearly direct sunlight, so they can only tolerate relatively shallow waters (1–30 meters, 3–100 ft).

Color the red mangrove, starting with the prop roots at the lower right. Notice the junction of the trunk and roots at the high-tide mark. Color the entire leaf mass green. Color the falling seed and new root protruding from it, and notice the four young leaves emerging from the seed.

One of the largest flowering plants to flourish in the marine environment is the red mangrove. These plants occur in tropical and semitropical regions from Florida to South America and reach tree size (1–3 plus meters, 3–10 plus ft). The mangrove grows best in the mud bottoms of estuaries, coastal lagoons, and near the mouths of large rivers, where silt is deposited. The mangrove remains stationary in the unstable mud bottom by sinking a mass of large, arching *prop roots* deep into the mud. The prop roots divide off from the *trunk* at the high-tide level; the roots proliferate and trap more sediment, raising the substratum level. This, in turn, creates more space where the mangrove can grow, and, in this way, the mangrove colony expands toward the sea.

Mangrove roots are the habitat for a myriad of attached algae and animals such as sea squirts, sponges, and sea anemones. The lattice-work of roots also offers protected nursery areas to young reef fishes and spiny lobsters. The mangrove *leaves* fall into the water and decompose, providing a detrital food source for many animals residing near the mangrove, and others further out to sea.

Seeds of the red mangrove sprout and begin to grow before they fall from the tree. A long (36 cm, 14 in), slender root emerges from the seed, and several leaves may also grow. If the seed falls at low tide, it may poke, dart-like, into the soft mud near the parent plant, and continue to grow. Seeds that fall during high tide float upright in the water and may be carried far from the parent plant. When the tide recedes, if the seed has been left on the mudflat with the root facing downward, it will be "drilled" into the mud by the jostling of small waves, thus beginning a new colony of mangroves.

Now color the turtle grass and the surf grass. Note that the grasses' stems receive shades of the same color as the mangrove's trunk, and the blades receive shades of the same color as the mangrove's leaves. These structures are homologous (same origin) and have the same function in these higher plants.

The flowering plants known as sea grasses can grow completely submerged. Various sea grass species occur from the intertidal zone to depths of 30 meters (100 ft). Turtle grass is found in eastern Florida, along the Gulf of Mexico, and in the Caribbean, where it thrives on soft bottoms of mud, shell, or sand. Once established, turtle grass proliferates by extending underground *stems* (rhizomes) from which leafy *blades* grow. Turtle grass forms extensive shallow-water meadows, which are frequented by numerous juvenile reef fishes. At night, parrotfish and sea turtles come into these meadows to feed. The stems and *roots* of turtle grass bind the substratum, which permits the colonization of burrowing animals, such as sipunculid worms and sea cucumbers (Plates 25, 41).

Unlike most sea grasses, which require quiet waters, surf grass grows in the wave-swept rocky intertidal zone of temperate waters. Surf grass seeds possess two stiff, bristled, pointed projections. If the seed lodges on an alga, it can germinate and send out tenacious roots to grab hold of the substratum. The surf grass roots trap sediment, and a patch of long, thin, bright green blades may develop in a tide pool or at the low-tide line. This creates an environment that shelters many species of worms and other small creatures.

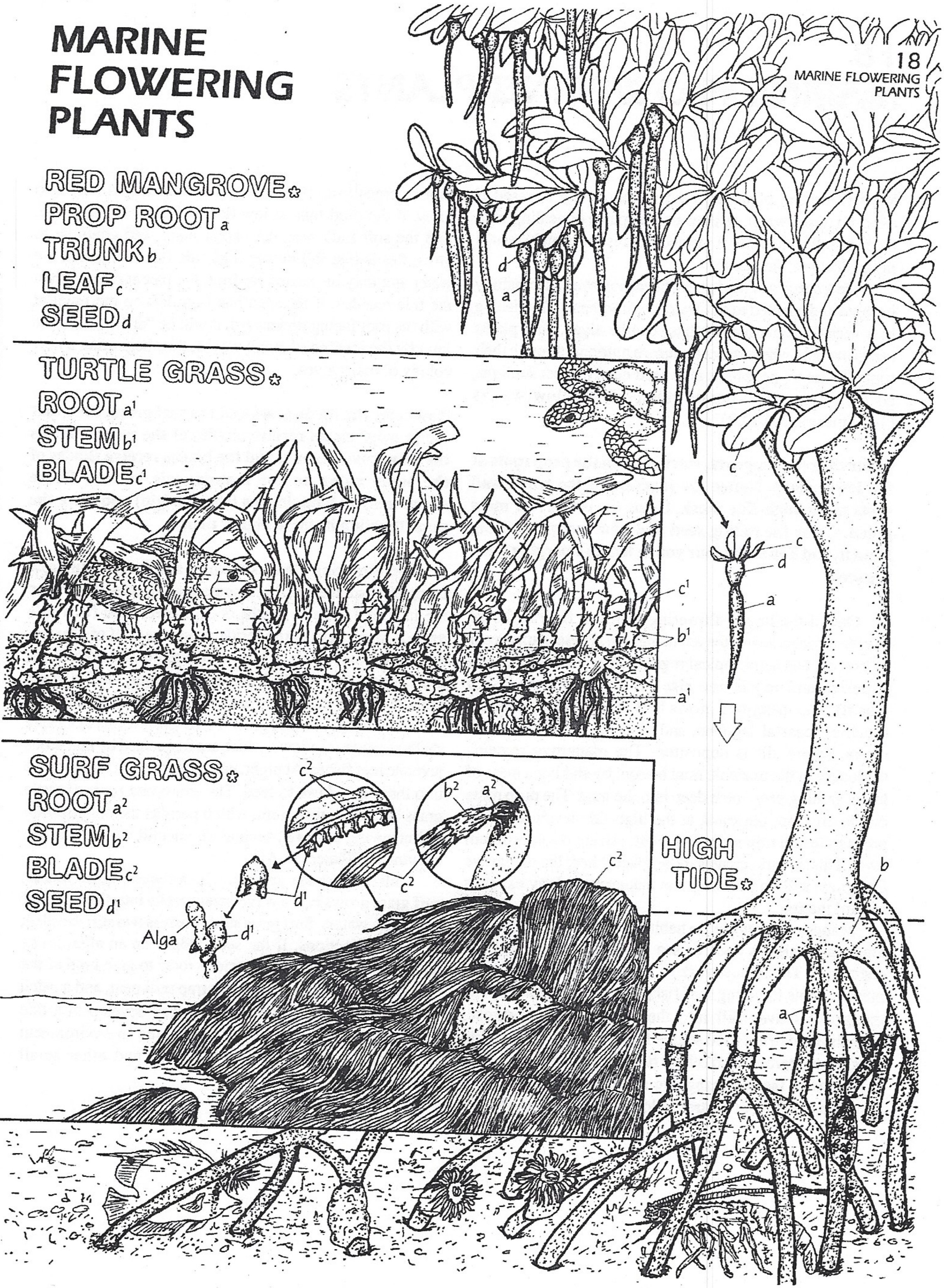
MARINE FLOWERING PLANTS

RED MANGROVE*
PROP ROOT$_a$
TRUNK$_b$
LEAF$_c$
SEED$_d$

TURTLE GRASS*
ROOT$_{a^1}$
STEM$_{b^1}$
BLADE$_{c^1}$

SURF GRASS*
ROOT$_{a^2}$
STEM$_{b^2}$
BLADE$_{c^2}$
SEED$_{d^1}$

HIGH TIDE*



Asexual Reproduction

1. Explain why it is good for a species to have genetic variation.

2. Explain the advantages of asexual reproduction.

3. Explain why **regeneration** of a starfish is a form of asexual reproduction.

4. Explain how some species of sea anemone use **pedal laceration** to reproduce asexually.

5. Explain how some sea anemones use a process called **longitudinal fission** to reproduce asexually.

6. Explain the process by which coral polyps reproduce asexually by **budding**.

7. Explain the process many species of marine polychaete worm use in order to prepare for breeding.

8. Explain what most marine polychaete worms do when they breed.

Reproduction in Marine Organisms: Planktonic Larval Forms

1. Explain what it means for an organism to be planktonic.

2. List and explain the three main reasons it is advantageous for organisms to have a planktonic larva.

3. List and explain the disadvantages of having a planktonic larval phase.

4. Explain how adults of planktonic larval species compensate for high mortality rates.

5. What dangers are associated with having a high larval success rate?

6. Explain how brittle star larvae resist sinking.

7. Explain the functions of the porcelain crab larval spines?

8. Explain the function of the setae for the *Nereis* larvae.

NAME DATE PERIOD

Seaweed Adaptations – Red and Green Algae

1. What is another name for multi-cellular seaweed?

2. Where are macroalgae found?

3. What are 3 challenges posed by the habitat of macroalgae?

4. Describe where sea lettuce is found and what happens to it during tide changes.

5. Describe Cladophora's habitat and its water saving strategy.

6. Describe salt sac and its water saving strategy.

7. What adaptation has coralline red algae developed to protect it from grazers?

8. What benefits does the calcified cell wall offer the corallines?

<u>Seaweed Adaptations: Brown Algae</u>

1. List 3 environmental stresses in brown algae.

2. Where do you find rock weed?

3. Why is rockweed successful where in its habitat?

4. In what type of zone is kelp found?

5. Describe what happens to kelp during and after storms?

6. Describe oar weed and where it is found.

7. Describe *Lessoniopsis* and where it is found.

8. Describe bull kelp and where it is found.

9. What are 3 commercial uses of giant kelp?

Name ____ Block _____ Date ____________

Marine Flowering Plants Article Questions

1. Why do most flowering plants die if exposed to sea water?

2. Where do you find red mangroves?

3. What type of environment do mangroves grow best in?

4. How do mangroves keep stable in the ever changing tidal environment?

5. What animals live in the mangrove forest?

6. What are the mangrove leaves used for?

7. Describe **IN DETAIL** how a mangrove reproduces (what happens with its seeds).

8. Describe **IN DETAIL** turtle grass beds – where they are found, what lives in them, how they grow and spread etc).

9. Where is surf grass found?

10. Describe **IN DETAIL** what surf grass looks like and how it grows.

Sponges (Coloring)

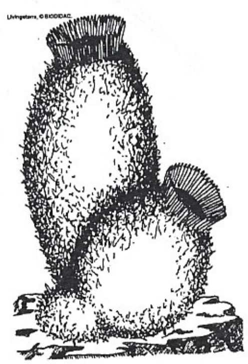
Since sponges look like plants, it is understandable why early biologists thought they were plants. Today, we know that sponges are simple, multicellular animals in the Kingdom Animalia, Phylum Porifera. This phylum is thought to represent the transition from unicellular animals to multicellular animals. Most (but not all) sponges are asymmetrical and have no definite shape. Sponges, like all animals, are eukaryotic - meaning their cells have a nucleus. Porifera in Latin means "pore-bearer" and refers to the many pores or openings in these animals. Because of these pores, a sponge can soak up and release water. At one time, real sponges were used for cleaning and bathing. Today, most are artificially made.

All adult sponges are sessile, meaning they are attached to some surface. Since they cannot move, sponges cannot pursue their food. Instead, they are filter feeders, meaning they obtain their food by straining the water for small bits of food like bacteria, algae or protozoans.

Sponges exhibit less specialization (adaptation of a cell for a particular function) of cells than most invertebrates. The primitive structure of a sponge consists of only two layers of cells separated by a non-living jelly like substance. The outer layer of the sponge is the epidermis which is made of flat cells called epithelial cells. **Color all the epithelial cells (B) of the epidermis peach or pink.**

The inner layer consists of collar cells (A) whose function is to circulate water through the sponge. They do this by swishing their flagella which pulls water through the incurrent pore - water then travels out the osculum at the top of the sponge. As water passes through the sponge in this way, cells absorb food and oxygen and waste is excreted. **Color the osculum (D) dark blue, the incurrent pores (C) light blue. Color the inside of the sponge where water circulates the same light blue as you colored the incurrent pores. Color all the collar cells (A) red.**

In the jelly-like substance between the epidermis and the collar cells are cells called archaeocytes. The job of the archaeocytes is to travel around distributing food and oxygen to the cells of the epidermis. Because of the archaeocyts, scientists believe that sponges evolved from protists. **Color all of the archaeocytes (E) green - look for them carefully.**



The body of the sponge would collapse if it did not have some type of supporting structure. Some sponges have a soft network of protein fibers called spongin. Others have tiny, hard particles called spicules. Many of these spicules also stick out of the epidermis and provide the sponge with protection. Most sponges have a combination of spicules and spongin, the ratio often determines how soft or hard the sponge is. **Search for and color all the pointy spicules (F) brown.**

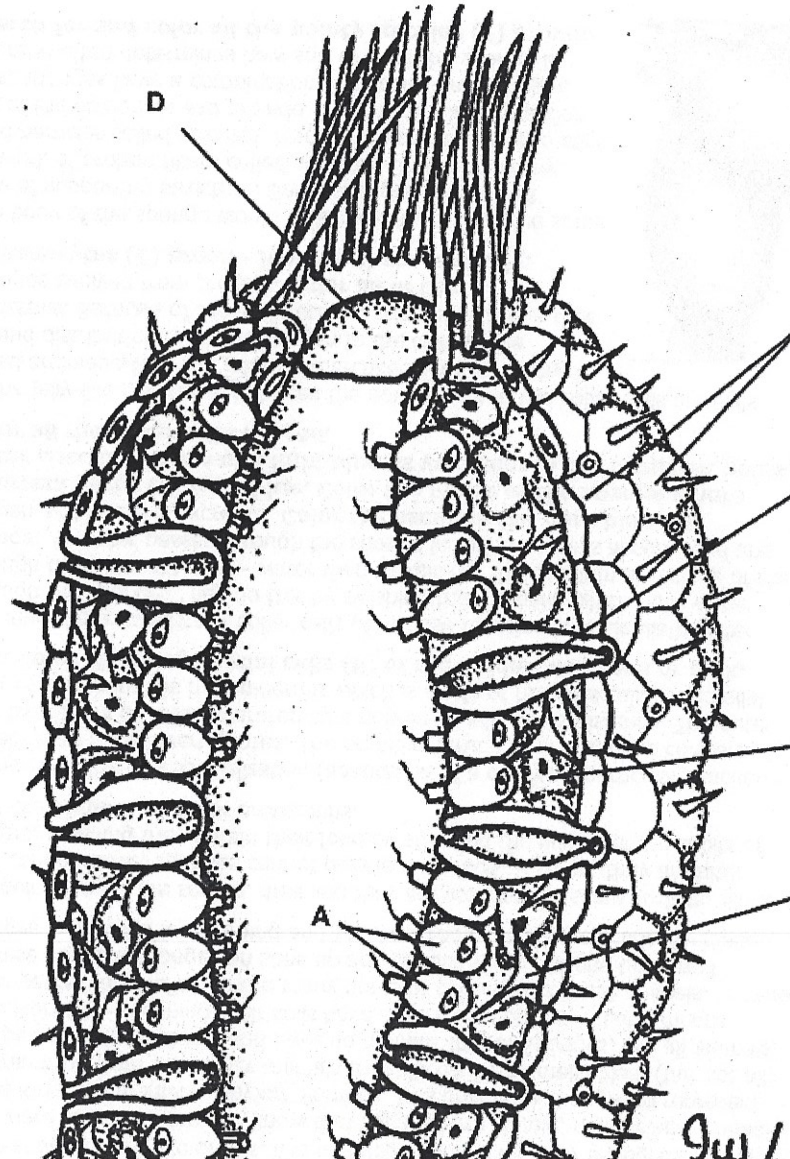
Name:_______________________________ Date:______

Reproduction for sponges can be accomplished both sexually and asexually. There are three ways for a sponge to reproduce asexually: budding, gemmules, and regeneration. Sponges can simply reproduce by budding, where a new sponge grows from older ones and eventually break off. **Color the adult sponge (J) pink and all the buds (G) you can find red.** Sponges can also reproduce by regeneration, where missing body parts are re-grown. People who harvest sponges often take advantage of this by breaking off pieces of their catch and throwing them back in the water, to be harvested later. Finally, sponges can reproduce by creating gemmules - which is a group of archaeocytes covered by a hard outer covering. **Color the gemmule (H) yellow.**

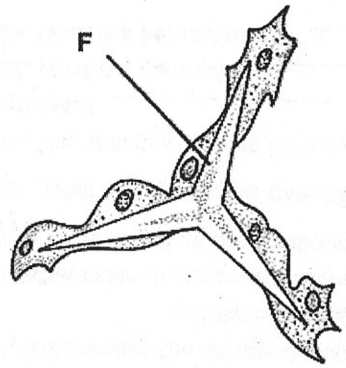
Sexual reproduction occurs when one sponge releases sperm into the water. This sperm travels to another sponge and fertilizes its eggs. The larva form will then swim to another location using its flagella where it will grow into an adult sponge. Most sponge species are hermaphrodites; they can produce both eggs and sperm.

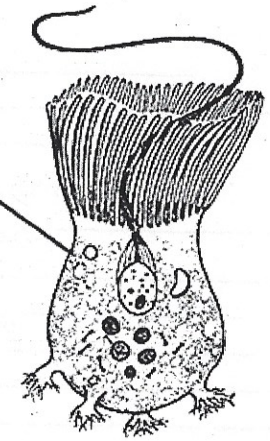
Questions:

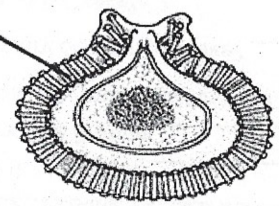
1. What did early biologists think sponges were? ______________
2. Sponges belong to the Kingdom ______________
   and the Phylum ______________
3. Sponges are [unicellular / multicellular] and [prokaryotic / eukaryotic]
4. What type of symmetry do sponges have? ______________
5. What does it mean to be "sessile"? ______________
6. How do sponges get their food? ______________
7. Water enters the sponge through the ______________
   and leaves through the ______________
8. What helps circulate water through the sponge?______________
9. What is the job of the amebocyte? ______________
10. What two substances give the sponge support? ______________
11. Tiny sponges growing from the main body of the sponge are called ______________
12. What is a gemmule? ______________
13. What is a hermaphrodite? ______________

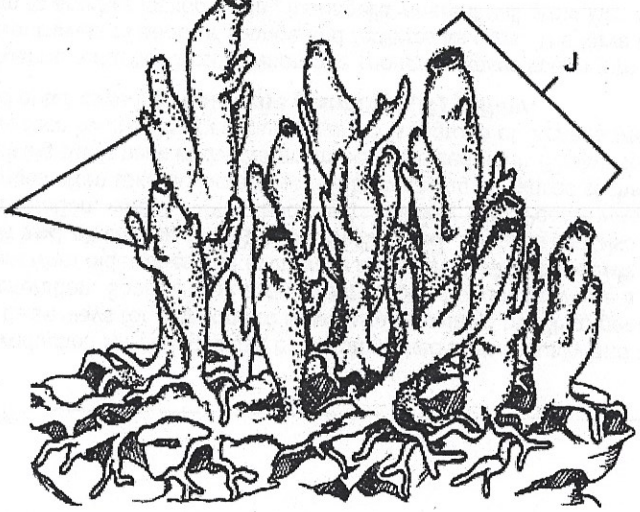


Livingstone, © BIODIDAC.









Marine Biology Review
Unit 1

1. List the 4 major ocean basins.
    a. Which one is the largest and deepest?
    b. Which one is the smallest and shallowest?
2. How old is the universe? Our solar system? Earth?
3. List all of the layers of the earth.
    a. Which one is at the center?
    b. Which one is liquid and made of metals (mainly iron)?
    c. Which one is solid and causes lithospheric plates to move?
    d. Which one is the thinnest?
4. How does oceanic crust differ from continental crust?
5. List 5 characteristics associated with mid-ocean ridges.
6. How are trenches formed?
7. List the three types of lithospheric plate boundary. Explain how they differ.
8. What was the name of the giant super continent that existed over 200 million years ago?
    a. What was the name of the single ocean that surrounded it?
    b. Which two giant continents were formed when is split in two?
9. List the two types of sediment.
    a. Which type is formed by erosion of land?
    b. Which type is formed from shell and coral?
10. List and label the parts of the continental margin?
    a. Which one is the shallowest part?
    b. Which one is the steepest?
11. How does the east coast (passive margin) margin differ from the west coast (active margin) margin?
12. What is a black smoker and how do they form?

Unit 2

13. What is a hydrogen bond?
14. Explain the importance of hydrogen bonding to the water molecule.
15. List the two most common ions found in sea water.
16. Which wavelength of light penetrates the deepest? Least?
17. Calculate the pressure acting on the following:
    a. a scuba diver at 10 m depth
    b. a fish at 35 m depth
    c. a stingray at 100m depth
18. What is a thermocline and where is it located?
19. What causes the Coriolis effect?
    a. Which direction do the gyres in the Northern Hemisphere spin?
    b. Which direction do the gyres in the Southern Hemisphere spin?
20. Explain the rule of the constant proportions.
21. Draw and label the parts of a wave.
    a. What is the highest part of a wave?
    b. What is the lowest part of a wave?
    c. What is the distance between two waves?
22. What factors cause tides?
23. How long is a full tidal cycle?
24. List the three types of tide and explain how each one is different.
25. What is a spring tide and what causes it? Neap tide?

Unit 3

26. List the 5 characteristics of living organisms.
27. List the 4 main organic compounds.
    a. Which one stores energy/provides insulation, and aids in buoyancy?
    b. Which one stores energy and can serve as a structural molecule?
    c. Which one makes up enzymes and sex hormones?
28. What is DNA?
29. Write the formula for photosynthesis.
30. Write the formula for cellular respiration.
31. What is primary production and why is it important to heterotrophs?
32. List the two most important nutrients for plant growth in the ocean.
33. Explain the importance of the cell membrane.
34. List the main differences between prokaryotes and eukaryotes..
35. List the levels of organization in order of increasing complexity- start with atoms and end with habitat.
    d. What is a community?
    e. How is it different from an ecosystem?
36. Explain the main difference between nekton, plankton, and benthic organisms.
37. Explain the difference between osmoconformers and osmoregulators.
38. List all of the methods of asexual reproduction.
39. What makes sexual reproduction different?
40. List the taxonomic levels- start with kingdom.

Unit 4

41. To what kingdom do prokaryotes belong?
42. Describe the general characteristics of decay bacteria.
43. Explain the difference between chemosynthesis and photosynthesis.
44. List the general characteristics of blue-green algae.
45. What are stromatolites and what forms them?
46. The following organisms have a shell made of:
    a. Dinoflagellates
    b. Foraminiferans
    c. Radiolarians
    d. Diatoms
47. List the general algae (not blue-green algae) characteristics.
48. List the general radiolarian characteristics.
49. List the general diatom characteristics.
50. What organisms cause red-tide?
51. What are zooxanthellae and why are they important to reef building corals?
52. Which group of protists are the dominant primary producers in polar seas? Tropical Seas?
53. What is the main difference between seaweeds and other algae?
54. Draw and label the seaweed body parts. What is the function of each part?
55. Describe the two forms of algae reproduction.
56. Compare and contrast green, red, and brown algae.