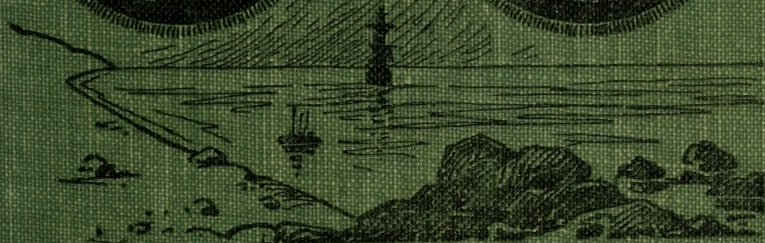


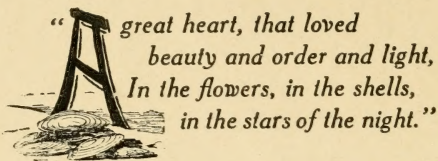
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SHELLS
AND
SEA-LIFE

BY
JOSIAH KEEP





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Josiah Keep
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Mills College, 1885-1911

Gift of
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No.-----

Wells College, Wells.

My dear Dr. Dall,

Jan. 24, 1912.

It gives me pleasure to send
by this mail a copy of Shells & Sea Life. It is one
which Mr. Kepp had freely used, but I have erased
his marks, & do not think it is injured.

I also enclosed one of the extra pictures the printer
sent me, thinking you might like to attach it to
one of the books.

Thanking you for your kindly
interest in me, I remain, very sincerely yours,
Annelia C. Kepp.

COLLEGE FOUNDER DEAD.

Mrs. Susan Lincoln Mills Succumbs
at Age of Eighty-Seven. *1912*

OAKLAND, Cal., December 13.—Susan Lincoln Mills, founder of Mills College, the first college for women on the Pacific coast, died here last night at her home, on College campus. Less than a month ago she celebrated her eighty-seventh birthday anniversary.

Mrs. Mills was born in Massachusetts in 1825. She was graduated from Mount Holyoke Seminary in 1845, where she taught until 1849. With her husband, the Rev. Cyrus T. Mills, she went to Benicia, Cal., in 1855 and purchased a young ladies' seminary. In 1871 the present site was obtained.

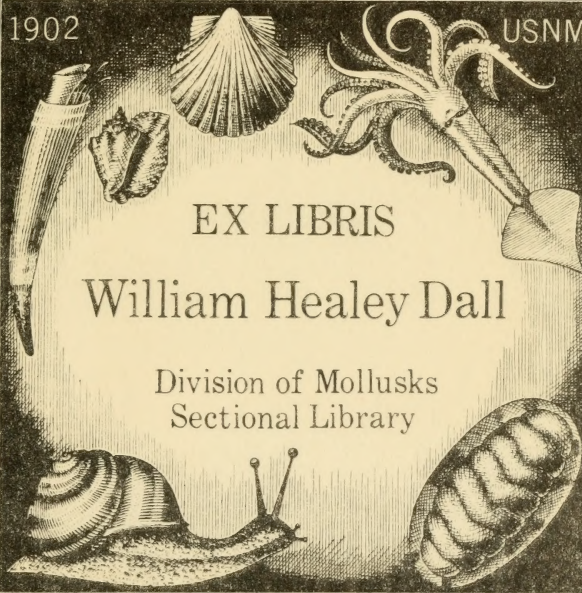
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SOME CREATURES OF THE SEA.

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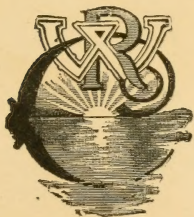
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JOSIAH KEEP, A.M.

PROFESSOR OF NATURAL SCIENCE, MILLS COLLEGE

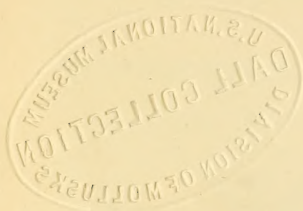
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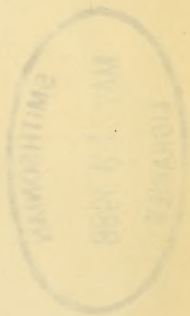


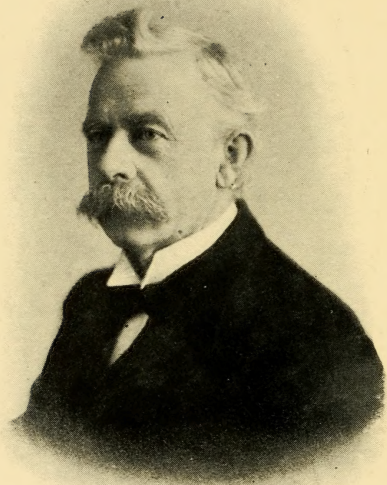
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1901



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Josiah Keep.

PREFACE.

It is well for young people to get acquainted with the creatures which are living all around them. Birds and bees and squirrels are near neighbors to a great many of us, and they will prove good neighbors or bad neighbors, to a large degree, in accordance with our treatment of them. The same is true of many creatures that are not so well known as birds and bees. It may be necessary, at times, to restrict their numbers, and always to define the limits which they must not pass; and yet, how many people in this world live on bad terms with their neighbors, both brute and human, because they do not take the trouble to become acquainted with their good qualities.

A warm, generous heart is a source of pleasure which cannot be overestimated; and a narrow, cruel spirit is a source of untold grief, not only to its possessor, but also to those with whom he comes in contact. The true teacher has a great mission. It is not merely to impart knowledge; far higher than that, it is to develop life,—life that is pure, truthful, honest, loving, and happy. For such a great work the teacher needs all possible aids.

We seldom love that of which we have but slight knowledge. It is the aim of this book to assist the teacher in developing the interest of the pupils in a class of animals which is not so commonly studied or so well known as some other classes. If the interest can be awakened, good results are pretty sure to follow.

The author's book on WEST COAST SHELLS has been considerably circulated and has been freely consulted by some of our young people. It cannot, however, be extensively used in the classroom, where a smaller and cheaper book would be

appropriate. It is the author's hope that this little volume may give to many children a better knowledge of the life of mollusks than they would be apt to obtain otherwise, and that even dead and dry shells may awaken trains of thought, and restore, as it were, the life of the creatures which once inhabited them.

The mollusks which live on the land and in fresh water have been mentioned, since very many children will have a chance to study these, who can seldom or never visit the seashore. The later chapters of the book are devoted largely to the other forms of sea-life which a visitor to the beach would be most likely to meet. It is hoped that this may make the book useful, in some degree, as a kind of guide to those who are not familiar with the abundant forms of life, some of which they will be sure to encounter.

But few Latin names are given in the text, though they are not to be feared, and children may easily become accustomed to them; they seem, however, more appropriate in the List of Figures, which should be freely consulted. A few simple directions concerning the collection and preservation of specimens have been added, in the belief that they might sometimes prove useful.

Acknowledgments are especially due to MISS LAURA M. MELLE for drawings of shells, and to MISS ALICE B. TABOR for the initial letters and most of the other drawings in the book; also to MESSRS. J. K. OLIVER and C. BARLOW for photographs of marine scenery.

In conclusion, it is hoped that this volume may take a prominent place in that instructive series of readers which is giving to the children of this Coast such choice and fresh themes.

JOSIAH KEEP.

MILLS COLLEGE, CALIFORNIA, February 6, 1901.

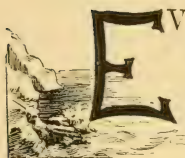
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THE CREATURES OF THE SEA.



EVERY boy or girl who goes to school, and is able to read this book, knows that California is bounded on the west by the Pacific Ocean. And perhaps more than half of all the boys and girls who live in the Pacific states, and have reached the age of thirteen years, have seen with their own eyes at least a small portion of that great body of salt water which rolls and splashes against our Western shore.

A great many have stood on the beach and watched the long lines of breakers come tumbling in as if they were anxious to drown everybody who is looking at them. Others have never been to the open beach, but have seen the more quiet waters of a bay or inlet connecting with the ocean. And still others have spent all their short lifetime on the moun-

REFERENCE TOPICS.

- The breakers.
- The tides.
- The coast-line.
- Deep-sea creatures.
- A dredge.
- Lobster-catching.
- Seaside resorts.
- Coral islands.
- The Greek language.
- Geology.

tains or in the valleys, away from the salt water, and have never yet had a chance to visit the coast.

I hope they may, one of these days, and I feel pretty sure that they will. I had never seen the ocean when I was thirteen, but since I became a man I have seen it often, and have learned to love it very much.

Suppose you try to find out what per cent of the members of your class have seen the broad ocean, what per cent have seen only a bay, and what per cent have never seen either. That will be a good practical problem in percentage. Of course, the sum of the three answers should equal one hundred, no matter what the size of the class may be.

The line where the land and the ocean meet is a place where a great many creatures live. It is a pretty broad line in some places, for the tides rise and fall twice a day, and the shore at high tide may lie half a mile from the low tide-line.

And then beyond this line there is a space where the water is not very deep, though the bottom is always covered, and this region of shallow water is one which abounds in living things, both animal and vegetable. Then comes the deep sea, where living things are less common. One reason

is, that it affords no resting-place for creatures that do not like to be swimming about continually, while another reason is, that there is a lack of food in very deep water.

It is true that some strange creatures are occasionally brought up from great depths, but the cold, black abyss of the deep sea will probably always remain a place of mystery, while the shallow rim of the ocean will be better and better known as the years go by and new explorations are made. Perhaps some of you may help make them.

We may say, then, that the whole shore-line of California, Oregon, and Washington is the home of countless animals. And by shore-line we will include all that space which reaches from the spray-splashed rocks on the land side, out to water which is too deep to be readily explored by the dredge.

All sorts of creatures live in this sea-coast region. First, there are the fishes in abundance, ranging in size from the sharks that are as long as a good-sized house, down to the smallest rock-fishes that have just been hatched from the egg.

Occasionally a whale comes blowing around, or some smaller creatures of the same class, like the grampus and the porpoise. There are seals, with



SUMMER SCENE BY THE SEASIDE.

finny hands and fat sides, and round heads with bright eyes, which are ever looking out for fish for their Friday dinners—and every day is Friday to the seal.

And we must not forget the birds, for there are thousands of them,—ducks and gulls, and divers and murre, shags and sand-pipers, and herons and pelicans; birds that dive, birds that swim, and birds that spend most of their time on the wing. O yes, the sea-coast is a wonderful place for birds, for the waves give them food in abundance.

And down in the water and along the beach are all kinds of funny creatures, some with many legs and some without any. There are crabs and lobsters, shrimps and sand-fleas, barnacles and starfishes; sea-urchins that cannot run, and sea-cucumbers that are not good for pickles; sea-worms and sea-slugs and sea-pens and sea-hares and sea-anemones, and sea-almost-everything, except sea-boys and sea-girls, and in summer they are there too.

Besides all these there are hydroids and jelly-fishes, and corals and sponges, and squids and cuttles, and limpets and clams, and a hundred kinds of creeping snails. It would take you a lifetime to learn all that is now known about these creatures, and then there would be plenty left for the next

generation to discover and investigate. Two things seem sure: that they are all having what is to them a happy existence, and that they are all living in the places which they seem best fitted to inhabit.

Out of all this throng of life we may each select one particular kind, and seek to know them more thoroughly than we do the rest. I have selected the Mollusks, because they have beautiful shells and interesting habits, and because they may be found in so many and so diverse situations. Besides, there are a great many mollusks which do not now live in the ocean, though perhaps their remote ancestors did, away back in the dim past.

But at this time we have land mollusks and fresh-water mollusks in abundance, besides the many marine forms. So it is not necessary for you to go to the seaside to gather living mollusks, and if you happen to live off in the valleys or in the mountains, you will be pretty sure to find some of them, and to have a chance to study their forms and their habits.

There are three classes of mollusks which live along the sea-shore, and each of these classes is further divided into many genera and species. The first class includes all those creatures which resemble the squid and the cuttle-fish. They have a

prominent head, with big, staring eyes, and a beak like a parrot's, which is surrounded by a circle of arms or tentacles, set with many hooks or suckers. While they sometimes crawl on the bottom of the sea, most of them can swim freely, if they wish to, and they have a comical habit of pouring out a quantity of black ink to darken the water when they wish to hide or escape from some enemy. They are called Céph-al-o-pods, from two Greek words meaning head and foot, because they sometimes use the arms on their heads as organs for walking.

The second class have very small eyes set on little stalks, and their mouths have neither beaks nor suckers, but a curious tongue clothed with very numerous little hooked teeth. They cannot swim, but they lie flat on the rocks, and creep along very slowly by means of little muscles in a disk or foot which forms the lower part of the body. When they stop moving they can hold on like a sucker, and so they can resist the force of the waves.

They are called Gás-ter-o-pods, because they creep, as it were, upon their stomachs. All the snails belong to this class. Most of the Gastero-pods are protected by a single shell, usually spiral in shape, though there are plenty of slugs, both

on the land and in the sea, that have no shells whatsoever.

The third class of mollusks have no heads at all, though they all have mouths and lips, and a few of them have eyes also. They live within a pair of shells, which they can open or close at will. Most of them dig burrows with a fleshy foot shaped like a hatchet, and hence they are called Pél-e-cy-pods, meaning hatchet-footed creatures.

Besides these three classes there are certain other mollusks which are seldom seen in these times, though long before man lived on the earth they were very numerous. We need not think of them now, but when you study geology you will learn a great deal about them, for very many of their shells are found preserved in the rocks.

As for the three long Greek names, they are all very proper to know, but for our purposes suppose we call the three classes Swimmers, Creepers, and Bivalves; for the Cephalopods swim, the Gastropods creep, and the Pelecypods have double shells.

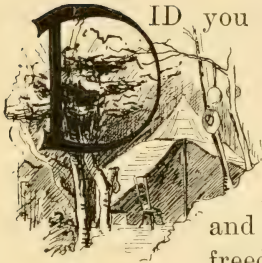
Now, leaving the Swimmers to take care of themselves in the ocean waves, we may group all of the Creepers and Bivalves into three great divisions, according to their favorite places of habitation. We will name them Rock-lovers, Sand-dwellers, and Mudsills.

Some may think that the name "mudsill" is a term of reproach. Well, it is sometimes used so, in reference to men; for no man likes to be compared to a log sunk in the mud; but with mollusks it is different. They are fitted for the mud, they get their food there, and they have never been known to complain of their location, or to be ashamed of their lowly home.

BLACKBOARD WORDS.

barnacles (bär'nä-klz), **hydroids** (hī'droids), **mollusk** (mö'l'lusk), **cephalopod** (sē'äl-ō-pōd), **gasteropod** (gäs'tēr-ō-pōd), **pelecypod** (pēl'ī-sī-pōd), **particular** (pä-r'tik'ū-lär), **tentacles** (tēn'tä-klz), **prominent** (pröm'ī-nēnt), **genera** (jēn'ē-rä), the plural of **genus** (jē'nūs); **species** (spē'shēz), **abyss** (ä-bīs').

A GROUP OF ROCK-LOVERS.



DID you ever go camping in the summer? Did you and your friends ever get tired of living in one place all the year, and decide to take a tent and go out to some shady spot and have fun and fresh air and freedom for a little while? I hope so, for there is nothing quite so good as a few days of tent life to brighten up all the rest of the year.

Perhaps your tent was near a mountain stream, where you could watch the speckled trout in the deep holes; perhaps it was in the woods, where there were great trees watching over you, that had been growing for centuries; perhaps it was by the seashore, where you could lie awake at night and hear the waves pounding away

REFERENCE TOPICS.

Summer camping.
Granite rocks.
"Sweet home."
Color protection.
Volcanoes.
Tide limits.
The horned owl.
Air suction.

on the granite rocks or breaking into foam on the sandy beach; perhaps it was in a field, or even in a back yard; but anywhere under a tent there is a charm which you cannot get anywhere else.

Now, there is a whole group of mollusks that live in tents all their lives, and they always pitch their tents on the rocks. And each tent is just big enough for one camper to live in; and if the camper grows, why, he builds on to the edge of his tent, and keeps it just big enough to cover him whenever he settles down for a good night's rest.

When you went camping you set up poles, and spread the tent-cloth over them, and fastened it all down with ropes and pins. But our little mollusk campers make their tents of shell, and they are so stiff and firm that there is no need of poles and ropes to keep them spread.

You used to come out of your tent in the morning and rush down to the brook to wash your hands and face. Our little campers get up too, but they always carry their tents with them, on their backs; and as for washing their faces, they never need to be troubled with that duty, for they live in the water most of their lives, and they get their faces washed with clear, cold water, whether they wish it or not.

These little campers are called limpets, and

their coverings are sometimes called saucer-shells; for some of their empty tents, when turned over, might be used for little shallow dishes, like very small saucers. On the coast of Mexico there are some that are large enough for mush-bowls, but they do not grow so large in our part of the ocean.

A few of the tents have a kind of chimney-hole at the top, and the creature that lives in such a shell is called a keyhole limpet. Although the opening looks like a keyhole, there is no lock connected with it, but only a fold of the animal's mantle, and it really serves as a kind of chimney or ventilating-flue for keeping the tent sweet and clean. In those limpets which have no chimney to the shell, all the circulation of water must be carried on under the raised edges of the tent.

Most of these little campers have a pleasant habit of pitching their tents in the same spot every night, however much they may have wandered during the day. Home is home, even if it is only a little flat spot on the side of a huge cliff. And so I trust you have found, whenever you have been camping, that the best part of it all was the coming home again.

Of course our limpets get hungry and must search for their food, but, fortunately, it consists

chiefly of the soft vegetable matter that is found so abundantly on the sides of the rocks which furnish them with a camping-ground. With their little tongues they can easily rasp off food enough to satisfy their appetites, after which they have plenty of time for rest and meditation.

Some limpets camp on the stems of the big seaweeds, and have a jolly time rocking back and forth as the weeds are swayed and tossed by the waves. But most of them prefer a solid foundation, especially selecting those rocks which are left bare a part of the day, when the tide is low.

A few, like the one in the picture (Figure 1), creep up so high that they are seldom covered with water, and seem to prefer the occasional splashing of the spray to a real all-over bath. Perhaps you have known children who were inclined to sympathize with them.

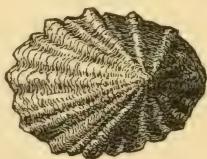


Figure 1.

The color of this little limpet's tent is a mottled gray, and as he generally lives on granite rocks, it is sometimes difficult to distinguish his shell from a little knob of rock. You will be surprised to notice how many creatures in this world are protected in some degree by the likeness of their covering to their surroundings.

There are brown shells on brown seaweeds, gray shells on gray rocks, dust-colored squirrels and rabbits in dusty fields, bright-winged butterflies on brilliant flowers, green caterpillars on green leaves, and funny little owls about the color of twilight.

There are three or four fine keyhole limpets to be found on our coast. The most common one (Figure 2) is shaped like a mountain with a crater at the top. You often find the white shells with red stripes running down the sides, looking for all the world like streams of red-hot lava. And so this limpet is called *Fissurella volcano*, or the Volcano shell.

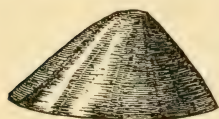


Figure 2.

Figure 3 is a good picture of the Rough Keyhole Limpet, while Figure 4 is a rather small picture of a very pretty white shell which sometimes grows as large as your hand, and is known as the Giant Keyhole Limpet. Figure 5 represents the Spotted Keyhole Limpet, which is no bigger than the nail of your smallest finger. Its Latin name, however, is as long as your longest

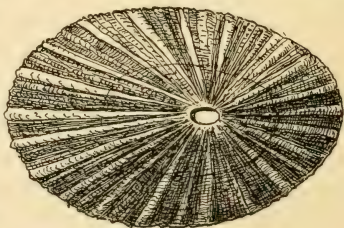


Figure 3.

finger, so I will not give it here, but will advise those of you who wish to look it up to study the List of Figures at the end of this book, or to consult the books on shells in your school library.

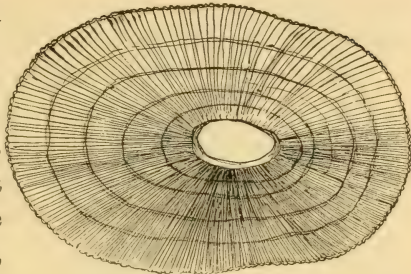


Figure 4.

The shell is too small to be of much use as a tent to the little creature that carries it, since it covers only a small portion of his back. There are a few other kinds, not commonly found, and for a description of these I would also refer you to the books on shells.



Figure 5.

Of the common limpets,—those that have no chimney-holes,—there are so many kinds that it is sometimes very difficult to be sure of the right name. Figures 1 and 6 show the shape of the Ribbed Limpet, which is gray in color and lives on the highest cliffs. Most of the specimens of it that you find will be smaller than the picture.

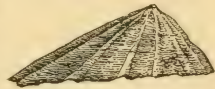


Figure 6.

On the rocks between the tide limits, you may find a number of different kinds; some like Figure 7,—the Plate Limpet,—others

like Figure 8,—the Shield Limpet,—and still others like Figure 9, in which the point of the shell is almost at one end, like the nose of a mask, and it is therefore called the Mask Limpet.

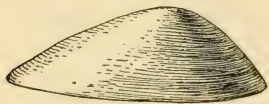


Figure 7.

All of these are of a dark color on the outside and lighter within, but there is one pretty little tent, that you will be very likely to find, that is pure white all over. It is a round shell, like Figure 10, and looks like a little snowclad peak of a mountain. It is often called the White Cap, and its Latin name is *Acmæa mitra*.

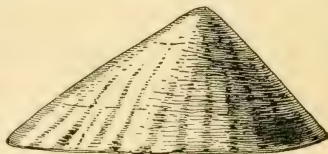


Figure 8.



Figure 9.

Inside the shells of all the limpets there are sometimes curious markings, which show where the flesh of the mollusk was attached to the hard covering. Sometimes these markings greatly resemble the outline of a horned owl, as is shown in Figure 11,—the Great Owl Shell. It is the largest of all of our limpets, and is frequently found as big as the bowl of a kitchen spoon.



Figure 10.

Here we must leave our great family of campers that carry their tents with them. They have many enemies, as the crabs and starfishes, and to guard against being eaten alive they hold on to the rock very firmly with their broad foot, and pull down their strong shelly tent, and thus they live safely, because they are well protected.

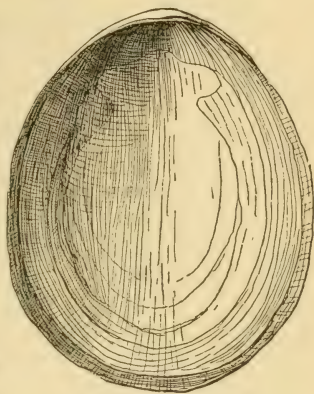
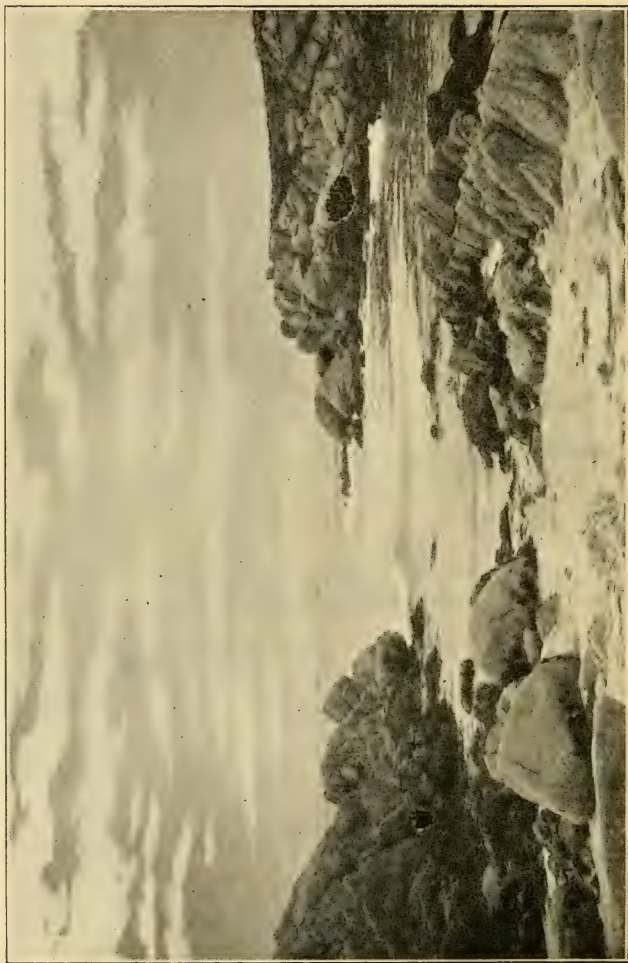


Figure 11.

BLACKBOARD WORDS.

centuries (sĕn'tū-rĭz), **ventilating** (vĕn'tĭ-lāt-ĭng), **especially** (ĕs-pĕsh'āl-ly), **sympathize** (sĭm'pā-thĭz), **distinguish** (dĭs-tĭn'guĭsh), **Fissurella** (fĭs-shū-rĕl'lā), **specimens** (spĕs'ĭ-mĕnz), **fortunately** (fōr'tū-nāt-ly).



A SCENE ON THE COAST OF CALIFORNIA.

THE SEA.

I.

O, THE broad blue sea,
It has charms for me ;
For I love to stand
On its rim of sand,
And look far off where its great waves rise,
As if they were mounting up into the skies ;
Then see them break into foamy spray,
Leaving patches of snow as they melt away

II.

O, the broad blue sea,
It has charms for me ;
For I love to hear
Its music so clear,
When the thundering bass of its breakers roars,
As its billows dash on the rock-bound shores,
And the wavelets answer with melody sweet,
As they die on the sands that lie at my feet.

III.

O, the broad blue sea,
It has charms for me ;
For I love to explore
The caves of its shore,
To gather its mosses and pebbles and shells,
To note the rich bower where the fair sea-nymph dwells ;
While from each living creature there rises a call
To praise the great Giver of life unto all.

IV.

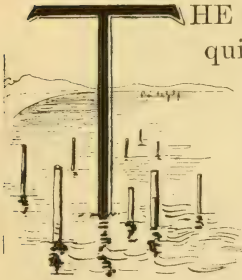
O, the broad blue sea,
It has charms for me ;
 For I love to dream
 Of islands that seem
Like beautiful regions far out in the west,
Where frosts never blight, and all nature is blest ;
 Till I long to set sail, with the red setting sun,
 And find on their shores a new life begun.

V.

O, the broad blue sea,
It has charms for me ;
 For I love to believe
 That I yet shall perceive
New sources of power revealed by its waves,
New lessons of wisdom and life in its caves ;
 And the voice of the sea shall grow sweeter each day,
 Till the voices of earth shall all fade away.

EASTERN OYSTERS.

I. HOW THEIR CALIFORNIA HOME WAS PREPARED.



THE water of San Francisco Bay is quite deep in the central portions, but along the edges there are extensive mud-flats. Parts of these flats are exposed to the air as often as the tide falls even a moderate amount; and whenever there is an unusually low tide, hundreds of acres of the dark, muddy surface may be seen by any one who walks along the shore.

The material from which these mud-flats have been constructed has largely been brought down from central California by those muddy rivers, the Sacramento and the San Joaquin. These, in their turn, have received their load from

REFERENCE TOPICS.

San Francisco Bay.
Rivers of California.
Placer-mining.
Results of mining.
Crossing the bar.
Puget Sound.
Transcontinental rail-roads.
Canned oysters.
Destructive fishes.
Cattle-raising.

three sources: first, from the muddy rills which in times of rain run down from the fields which lie along the river banks; second, from brooks and creeks extending far inland, which in the rainy season receive the washings of the country through which they flow; and third, from the gold mines in the mountains.

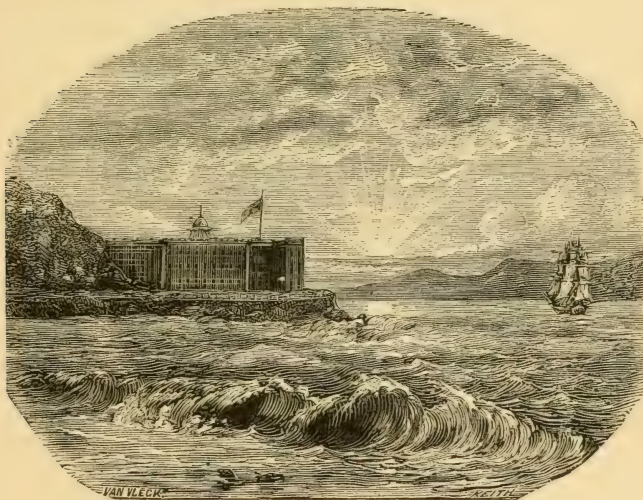
Formerly, many gold mines were worked by turning great streams of water from huge hose-pipes upon banks of gravel, in which were small pieces of the precious metal. The water and gravel and gold would then all rush together down a long trough, or flume, in the bottom of which were contrivances to catch the gold.

The stones and the heavier parts of the gravel would soon settle in the bed of the stream which flowed away from the flume, but the lighter portions would travel on and on with the water, till the current became so slow that the mud preferred to settle.

So much mud and gravel was brought down from the mines, that some of the smaller rivers became clogged and overflowed their banks, and at length a law was passed, forbidding the working of "hydraulic mines," unless the miners would keep their refuse at home.

As this was almost impossible, most of these

mines ceased to be worked, and the miners paid more attention to getting gold directly from the rocks. And so the gravel banks are waiting for some process which will allow men to secure the gold without washing away the country also.



THE GOLDEN GATE.

When the muddy water of the rivers reaches the bay, it meets the sea-water coming in from the ocean, through the Golden Gate. This must happen twice a day, when the tide is rising, and at such times the flow of the rivers is stopped.

The water then spreads out to the sides, and much of the mud settles on the great flats.

Then the tide falls, and the water in the center of the bay goes rushing out through the strait into the ocean. All the mud it carries now quickly settles, for mud and salt do not like each other, and besides, the motion of the river is stopped by the ocean, and it must lay down its burden. The mud and sand at this point form a great horse-shoe-shaped bar, making the water shallow, and causing much trouble for ships when the waves are high.

But at present we are not concerned about the bar, nor the rough waves which make passengers so sick when they go over it in the steamers.



Figure 12.

We are thinking of the great mud-flats which are left bare at low tide. These flats are the home of distinguished visitors from the East, and we will now proceed to make their acquaintance.

II. WHO THEY ARE, AND HOW THEY CAME HERE.

A great many years ago there were plenty of large oysters living in the sea off the coast of California. Some of them were very large indeed, — so big that a ten-year-old boy would not want to carry one very far without resting. The shells would be almost as long as one of his arms and a good deal thicker than his fist, and what a time he would have in trying to open one of them.

But all of that kind of oysters have been dead for thousands of years; possibly they were all dead before there was a man upon the earth. Yet we now find their shells in the rocks, high up on the coast mountains, in the western part of Fresno County, and in other localities.

Long, long ago, the ocean waves must have rolled over those places, and the great oysters had a happy life; but there came a change, and the ocean beach was slowly lifted up, and changed into a range of mountains, while the sea crept away to the westward.

Well, after this age there came another one, and the oysters of the new age were far smaller than those of the old one. In fact, they were little fellows, with thin shells about as large as the petals of a big rose. The meats were good eating,

but so small that a man needed about a hundred to make a good meal.

These "native" oysters now live all along our coast, being especially good in the northern parts, about Puget Sound. In some parts of San Francisco Bay their shells wash up on the shore and are gathered in great quantities. They are sold for making walks, for feeding to chickens, and for other purposes.

As soon as the railroad from California to the East had been built over the mountains and across the plains, there was a chance to bring live oysters from the Atlantic coast and plant them in the shallow waters of the bay. Young oysters can be conveniently packed in barrels, and if they are kept moist and cool, they will live for a week or more, and that is long enough to bring them on the cars from one ocean to the other.

When they arrive in Oakland, they are at once put upon rafts and taken to the places which have been well fenced to keep out the big fishes that like oysters as well as we do. Then a man on the raft takes up a shovelful of little oysters, and sows them into the water as a farmer sows grain.

In this way large spaces were planted with Eastern oysters. The water was not very deep, and in some parts of the beds the oysters would

be left bare at low tide, but they did not care, for in a little while they would be covered again with water, and could open their shells again without danger of drying up.

After living three or four years in our bay, the little oysters have grown from the size of a dime or a silver quarter to be as large as one of your hands, and now it is time for them to be taken to market.

So a man goes out on a raft, and with a pair of tongs shaped like two rakes hinged together he gathers the oysters from the bottom of the bay and piles them up on the raft. In many cases a number of shells have grown together, but they are easily separated by a light hammer, and then the oysters are sorted and put in different piles, according to their size.

The largest ones are put into boxes and sent to the city markets, where they are sold for forty or fifty cents a dozen. A second size are sold for less, while those that are too small for the market are thrown back into the water and allowed to live a year or two more. Perhaps you will ask why all of them are not kept till they will fetch the highest price in the city markets.

There are two answers that might be given. In the first place, the oyster-men have been to great

expense in bringing the young oysters from the Atlantic, and they are anxious to get their money back as soon as possible. And in the second place, oysters, like many other creatures, have a habit of dying after they have lived a few years, and the owners would prefer to sell a hundred dozen this year at thirty cents a dozen, rather than run the risk of having only fifty dozen live ones two years hence, worth even fifty cents a dozen.

Besides, the oyster has several enemies, some of which are likely to break in upon the beds and cause great destruction. One of these enemies is the starfish, of which we will speak later, and another is a big triangular fish with a huge mouth that is so armed with teeth that he can crush an oyster's shell and suck out the delicate meat. This fish is called the Ray, and since he has a sharp, bony thorn on his back, the boys call him a sting-ray, or more commonly, a stingaree.

To keep these fishes out of the "oyster-pasture," a close fence is made by driving poles or stakes into the mud. This fence must extend entirely around the portion of the bay which is to be planted, and the stakes must be so close together that the fishes cannot get through. They must be

examined frequently, for a single broken stake might let in enough enemies in one night to cause great destruction.

And so you see the oyster lives in a kind of prison; but the defenses are not to keep him in, but rather to keep his enemies out. Even then the starfishes may creep in between the stakes, but they move slowly, and when they are found they are slaughtered without mercy.

There are just two other enemies to oysters that we will mention at this time. Since neither of them are alive, they cannot be destroyed by killing. In this they differ from the starfish. Their names are frost and mud.

Frost comes on cold winter nights, and mud comes in the time of very heavy rains. Frost never does any harm unless a very low tide comes with it, leaving the tender oysters exposed to the cold night air. Then the poor things are liable to shiver for a while, and then go to sleep, never to wake up again. But this enemy is not much feared in California.

With mud the case is different, for if the oyster-grounds are too near the inlet of a brook, it is possible that in times of freshet a great quantity of soil will be brought down from the land and spread over the bottom of the bay, burying the

unfortunate bivalves out of sight. They are helpless creatures, and cannot dig their way out, as clams might do, and so they are liable to perish before the oyster-men are able to go to their assistance.

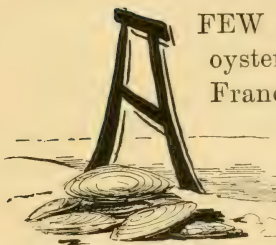
So you see that the raising of oysters, like the raising of cattle, is attended with much expense and many difficulties; and though their food costs nothing,—for they eat the little living particles that exist in sea-water,—still it is not probable that they will ever be very cheap on this coast.

This seems all the more true, since young oysters are continually being brought from the East, instead of being raised here at home. It is thought that the very young oysters, which come from the tiny eggs of the old ones, mostly perish in the cold waters of the bay before they get a good start in life, and so the traffic in “Eastern oysters” is likely to go on for many years.

BLACKBOARD WORDS.

extensive (ĕx-tĕn'sĭv), **material** (má-tĕ'rĭ-ăl), **contrivances** (kŏn-trĭv'ăn-sĕz), **acquaintance** (ăk-quănt'ăns), **conveniently** (kŏn-vĕn'yĕnt-ly), **triangular** (trĭ-ăn'gŭ-lăr), **particles** (păr'tĭ-klz), **continually** (kŏn-tĭn'ŭ-ăl-ly), **slaughter** (slă'tĕr).

THE SOFT-SHELLED CLAM.



FEW years after the first Eastern oysters had been planted in San Francisco Bay, a man who studies shells was much surprised to find a new clam living near them. There were only a few specimens of the strange clam, and these were not very large, but they were examined with much care. They greatly resembled the clams of Rhode Island, which are so much prized in that state, but as they were supposed to be somewhat different, they were given a new name. This name was selected in honor of Mr. Henry Hemphill, a gentleman who has collected and studied our Western shells very extensively.

The first shells were found in November, 1874, but in a few years they began to be very common, and then it was found that

REFERENCE TOPICS.

Rhode Island clams.
Latin names.
The microscope.
Oxygen.
Cost of oysters.
"Happy as a clam."
Importations by rail.

a mistake had been made, and that the clam was not new at all. It was only the soft-shelled clam of the Atlantic.

It is almost certain that a few had been brought with the young oysters, and that they had multiplied rapidly and spread to other parts of the bay. Figure 13 is a picture of the inside of one of the shells. Its Latin name is *Mya arenaria*.

Since that time they have increased exceedingly, and have gone wherever they could find good

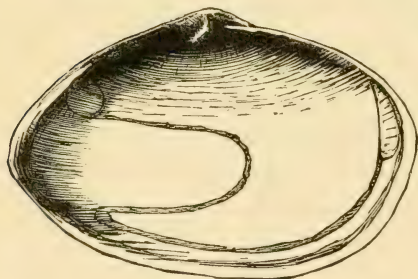


Figure 13.

ground to live in, and now millions of them inhabit the great mud-flats which are laid bare by the fall of the tides.

The young oysters, as we have learned in the last chapter, are tender creatures, and most of them seem to perish before they get their shells. But it is not so with the clams. Their young ones seem to delight in the cool waters of the bay, and they speedily find a good field of mud, and begin to grow and dig and build a good pair of shells.

The habits of the clam are very different from those of the oyster. At first they are very much alike, being tiny, swimming bodies, without shells, and too small to be seen without a strong microscope. At length the little oyster settles on an old shell or a stake, turns upon his side, and begins to form a pair of shells, one of which becomes attached to the support.

This spot is his home, and of his own accord he never leaves it so long as he lives. He has no foot to dig with and no pipe to breathe through; so he lives by opening his shells in the water, and letting it pass over his gills, which gather any

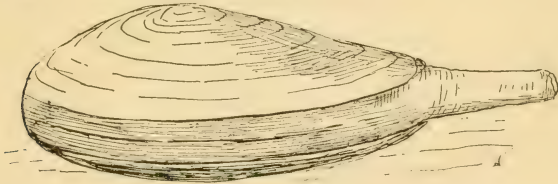


Figure 14.

particles of floating food. If an enemy comes, he can close his shells, and that is all that he can do.

But with the clam it is very different. His first instinct is to dig a hole and get down out of the way of all his enemies. His little tongue-shaped foot is the organ which he uses as a spade, and in a little while he is safely out of sight.

But safety is not enough. A band of robbers may be perfectly safe in a deep cave, but they cannot stay there always, unless they are willing to starve. So our little clam must have communication with the sea, and must get fresh supplies from that great source of food.

But he cannot conveniently come up out of his burrow, for he is getting bigger every day, and the hole by which he entered is too small to let him out. However, he has no need to come out, for he has two slender tubes attached to his body, though they are grown together so as to look like one.

When the tide is out, he lies snug and quiet at the bottom of his burrow, just waiting. By and by he hears a faint splashing, and soon a cool bath of salt water comes running down his little burrow. He is happy now, for he knows that the tide has risen, and that his quarters are well concealed by the flowing water. So he sends up the two tubes, or siphons as they are named, though some people call them his neck, and opens their ends in the clear water at the surface of the mud.

Now, on his gills are thousands of very minute hairs, called cilia, and he sets these cilia to lashing in such a direction that the water is pulled down one tube and forced up the other. What a

grand contrivance! for with the water there comes down a small amount of air also, which had been dissolved by the foamy waves. This air passes over his gills, which are really a series of fine tubes containing the creature's blood, and as it passes, the blood absorbs the rich oxygen of the air, and thus becomes purified.

But the gills also collect the food-particles which are in the water, and roll them along to one end, where they are gathered together by the four white lips, and pressed into the mouth, that is ever ready to receive them. What a happy creature is the clam! And yet, I do not think his happiness is of a very high order. Do you?

The enemies that ever threaten the oyster can never harm the clam. The starfish cannot reach him; the sting-ray cannot bite him; he has no fear of mud, for he lives in it; and as for frost, he is too deeply buried for it to touch him.

HENRY HEMPHILL, who now lives in San Diego, California, has made remarkable collections of shells. He is a mason by trade, and did not begin to gather shells till he was of adult years, when he picked up a few for a scientific friend. Mr. Hemphill began to get interested in the subject, and at length devoted most of his time to the work of exploring the shores and the mountains for their shells. He spent two winters in Florida, collecting for the government. He has also explored the mountains of Utah and Idaho very extensively, searching for snails, of which he has found many species and varieties.

He is very methodical in his work, and his specimens are beautifully cleaned and prepared for the museum. He has probably gathered more shells than any other man now living.

His chief enemies are men; for they are not slow in finding out his places of retreat, and with shovels they quickly uncover his hiding-place and gather him into their baskets. His flesh, though not quite so delicate as that of the oyster, is very palatable, and a well-made clam chowder is a dish not to be despised.

Another point in his favor is his cheapness. Comparatively few people can afford to eat oysters freely, on account of the expense, and no one can enter the inclosures and gather them, without permission from the owners of the tide-lands. But clams can be found almost anywhere along the borders of the bay, and in most places any one is allowed to dig them out whenever the tide is low.

And so we see that the railroad has been instrumental in introducing not only the aristocratic oyster, that is eaten chiefly by the rich, but also the humble clam, which now daily furnishes a large quantity of cheap and nutritious food.

BLACKBOARD WORDS.

extensively (ĕx-tĕn'sĭv-ly), **Mya** (mĭ'a), **arenaria** (ă-rĕ-nă'rĭ-a), **microscope** (mĭ'krō-skōp), **communication** (kōm-nū-nĭ-kă'shŭn), **conveniently** (kōn-vĕn'yĕnt-ly), **concealed** (kōn-sĕld'), **palatable** (pă'lăt-ă-bl), **aristocratic** (ă-rĭs'tō-krăt-ĭk), **nutritious** (nū-trĭsh'ŭs), **cilia** (sĭl'ĭ-ă).

SNAILS AND SLUGS.



HERE is an old proverb that a lazy boy is as slow as a snail. The proverb is true, but the snail is not to blame. The blame should all fall upon the lazy boy. The snail is slow because he has no feet like the lizard, no bones and scales like the snake, and no wings like the bee. When he moves, he must glide along the surface on which he is resting, without walking, swimming, or flying.

Under his body is a flat, muscular organ, sometimes called the foot, and on this organ he rests while he is making his slow progress along the ground. As you look at him from above, the wonder is that he can move at all. But if you put him on a moist pane of glass and look through to this curious foot, you will be surprised to see the movements of the hundreds of

REFERENCE TOPICS.

Nature of muscles.
What countries have warm, moist climates?
Dry climates?
Why names are in Latin.
Habits of the blue jay.
Kindness towards animals.

little muscles which stretch from one side to the other.

When he is moving, those muscles in front contract first, making his body a little longer; then those farther back, and so on to the very end. You may see half a dozen waves of muscle at one time, one behind the other, and all of them slowly urging the little body onward. You will probably cease to think of the snail as slow or lazy, and will be pleased to see how rapid and perfect are the movements of the parts of this strange foot.

The snail loves a moist, warm climate. His progress is too slow to make it safe for him to undertake a long journey in the daytime, when the sun is shining brightly, and so he does most of his traveling at night, when there is no danger of his being dried up *en route*. For you see he cannot carry a canteen along with him, like the camel, but must depend on local supplies of moisture.

For this reason he prefers the winter climate of California to that of the summer, except in the mountains, where snows lie deep for months at a time. In such places, however, you do not often find many snails, for the climate is too cold in winter and too dry in summer to favor their rapid

increase. Most warm, well-watered islands, as the West Indies, abound with snails.

But in spite of our dry summers a good many snails manage to exist in California, especially in the neighborhood of the ocean, where the incoming fogs keep their soft bodies moist and healthy. If a dry time come, they creep into some sheltered spot, like a crack in a stump, or get under a friendly old board. Then they retreat into their shells, and spin a heavy curtain across the entrance, to keep out the dry air and to protect themselves from troublesome intruders. They are cunning fellows, these snails.

There are two kinds of creatures that are commonly called snails: those that have shells and those that have none. Of these, the former are the true snails, while those without shells are properly called slugs. The latter are more hardy than the snails, and in some parts of California they are so numerous that they become quite disagreeable. The big yellow ones are often as long as a new lead pencil and three times as far through. Figure 15 shows the appearance of one of these yellow slugs.



Figure 15.

They are very fond of orange-peel, and may often be found contentedly gnawing a piece that has been thrown down beside some path. They will also drink milk from a saucer. But, while they enjoy the aromatic orange-peel, they are nearly as willing to feast on the remains of a dead comrade; so you see their tastes are not fastidious.

There are other slugs, much smaller in size, and usually of a dark color. Some of these lurk in the soil of flower-beds, and come up at night to



Figure 16.

eat the young sweet peas or pansies, but are gone again before you come out in the morning to lament over your misfortune. Lay down some pieces of old board among your flowers, and you may be able to trap the spoilers.

All of the true snails have pretty spiral shells, which they carry around with them wherever they go, as is shown in Figure 16. A part of the body always remains inside the shell; but when the animal is moving or feeding, the greater part of the body is outside, and the place which it once occupied is filled with air. You can find a little hole in the soft ring around the opening of the shell, where the air goes in and out, as need may require.

Most of the snail-shells which you find near our coast are of a brownish color, and many of them are marked by darker bands running spirally along with the whorls, or turns of the shell. One of the finest of these shells is shown in Figure 17. It is found in Ore-

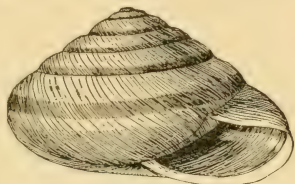


Figure 17.

gon and Washington, chiefly in the western portions, and it extends as far east as the Cascade Mountains. The Latin name is *Helix fidelis*, and we can translate it as the "Faithful snail."

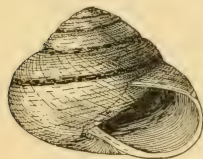


Figure 18.

Figure 18 represents a snail-shell that is found in southern California, and Figure 19 shows another that is found in the same region. This shell, however, is very different in shape and color. It is almost black, and looks like a great button. When summer comes, its owner burrows in the ground and remains concealed and asleep till the winter rains revive its dormant life.



Figure 19.

All of the snail-shells are very pretty objects for the cabinet, and live snails may be kept as

pets. They will live in boxes spread with moist earth, and as for food, they enjoy such leaves as we ourselves eat, as lettuce and cabbage.

They like to creep under a convenient piece of bark or an old board, and we must remember that they are most active at night. If you give them a large wire-covered box, they will lay eggs in the springtime, and after a few weeks you may have a fine brood of little snails.

During the summer months most of the snails either burrow in the sand or seek sheltered spots under logs or pieces of bark. They then retire into their shells as far as possible, and remain dormant till the autumn or winter rains call them out to their active life once more.

During their period of retirement they are sometimes found by hungry birds like the blue jays, which break open the brittle shells with their strong bills, and cruelly devour the sleeping occupants. I think the plumage of the blue jay is much more to be admired than his character; for he is a willful and cruel destroyer.

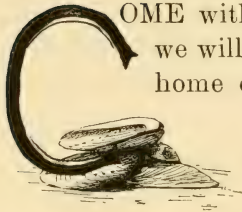
In all our dealings with animals, let us not imitate the jay; but on the other hand, let us not inflict unnecessary pain, nor take any life wantonly. And as we become acquainted with these humble

animals, we shall see much to admire and much to give us instruction.

BLACKBOARD WORDS.

muscular (müs'kū-lār), **contract** (kōn-träkt'), **intruders** (in-trūd'êrz), **fastidious** (fäs-tid'i-ūs), **Helix** (hē'lix), **fidelis** (fi-dē'lis), **retirement** (rē-tir'ment), **occupants** (ōk'kū-pāntz).

ABALONES, OR SEA-EARS.



COME with me early some morning and we will make a little excursion to the home of the abalones. We will go down to a place where the great cliffs have been pounded and broken by the waves and storms of centuries. All the softer parts of the rock have been gone for a long time, and as fast as new portions crumble, they are swept away immediately and made into sand or clay.

The harder portions of the ledge stand out, rough and stern, and through the channels between these jagged remains the water surges, cool and green. We put on our long rubber boots and wade fearlessly in where the water is not too deep, though always keeping an eye open for breakers ahead; for we

REFERENCE TOPICS.

Jagged coast-lines.
Protective organs.
Can turtles turn over?
Salt and fresh waters.
California Indians.
Shell-mounds.
Let us spare natural objects.
The "Japanese current."

know that waves are no respecters of persons, and it would be no joke to lose one's footing so near to deep water.

Here we are at last, right in the very home of the creatures that build the finest shells to be found on our coast. They are living on the rocks all about us, and we are very glad to pay them this friendly visit; for it is far from our purpose to disturb

these peaceful creatures. We only wish to see how they fare, and observe their pleasant surroundings.

We notice that they are all clinging

to the surface of the rocks, and that the soft parts of the animal are well protected by the thick, low-arched shell, on one side of which is a row of holes, which answer the same purpose as the chimney of the keyhole limpet.

We notice, in the second place, that many of these mollusks seek for some sheltered spot,

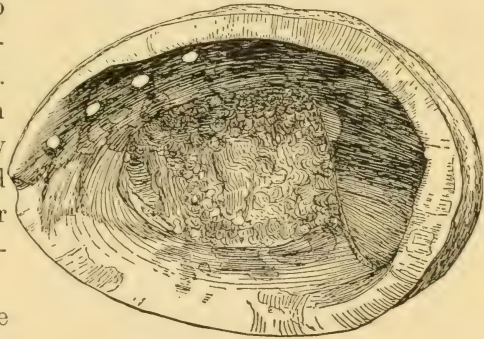


Figure 20.

especially for a deep crack in the rocks, into which they may creep and feel secure from their enemies. Others are clinging to the under side of an overhanging shelf of stone, or are wedged in between two masses of rock that are lying close together.

We will put our hands on one of those that are most exposed, and try to lift him up so that we may hold him for a little while, as we would hold a pet kitten. But he evidently is not anxious to be fondled, and only clings the tighter, and utterly refuses to accept our well-meant attentions. We cannot blame the poor fellow, for he has no means of knowing that we are unlike those who come to take his life just for the sake of getting his pretty shell.

If we insist that we must take him in our hands, whether he is willing or not, we shall be obliged to use either stratagem or force, or perhaps both combined. So we cautiously creep up to one that has his shell raised a little, and suddenly dislodge him with a chisel, or the broad blade of a table-knife.

Very likely he will fall into the water, and we shall have to roll up our sleeves and reach for him. Perhaps even then the water will be too deep, and all that we shall get will be a cool arm-

bath. But we try again, and at length we have a fine specimen in our hands. We notice his great yellow foot, which is made up of muscular fibers. It seems to be in continual motion, as if it were trying to get hold of something, which, in fact, is just what it is trying to do.

This foot has a rim of black skin, and above this is the black mantle, with numerous little feelers arranged like the threads of a fringe. The cold-blooded fellow evidently does not like the warmth of our hands, and so, after looking at him for a little while, we decide to see how he will behave when left to himself.

We put our creature down upon a mossy rock, and sit down beside him to watch his motions. To keep him from clinging tight again, we turn him on his back; but he is no more easy than a turtle would be in that position. We see him put out his stumpy head, somewhat after the manner of a turtle, though not so far from his shell, and then his great muscular foot grows long and slender, and reaches out over the side of the shell. As soon as a bit of it can feel the rock, it clings fast, shortens itself rapidly, and lo! our abalone is right side up, and is creeping away at a great rate.

The front and back parts of the single foot

shorten alternately, and the creature moves clumsily forward, his gait being ludicrously like that of an elephant.

We notice that his mouth is a little, puckered hole at the end of a short snout, that his eyes are very small and set on short stalks, and that he has two short, whip-like tentacles, or feelers, just above the eyes.

The poor fellow travels rapidly for a mollusk, perhaps two or three feet a minute, and we are very willing to allow him to reach the water and once more feel at home; for we know that all his motions will seem more graceful and natural when he is submerged, than when he is trying to work in just thin air, such as we have to breathe.

In fact, he will not live very long in the air, nor even in a jar of salt water; and as for fresh water, why, if you feel that you must take his life, the most merciful way to do it is to drop him into a pail of water from a brook or spring, just warm enough to wade in, and he will be past feeling in a very short time.

Then you can easily separate the shell from the body by thrusting the end of a broad knife between the head and the shell, and loosening the great muscle which is attached to the inside of the shell. And then you can see the beautiful

rainbow colors of which the lining of the shell seems to be made, especially at the place where you loosen the muscle.

In fact, it is to obtain these lovely pearl-lined shells that so many of these creatures are annually caught along our coasts. The small ones are neglected, but men go out in boats at low tide, when the waves are quiet, and with hooks and chisels on the ends of long poles dislodge them from their resting-places on the rocks and take them on board.

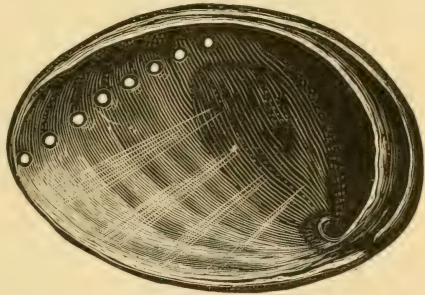


Figure 21.

Of late, regular diving-suits have been used, and in some places the poor abalones have been so hunted that stringent laws have been made to prevent their extermination.

It is not the shell alone that is valuable; the great muscular foot is also prized for food, especially by the Chinese. Probably it was also eaten by the Indians, for along our coast, where abalones abound, there may be found vast num-

bers of old shells lying on the surrounding cliffs and hills, far too high to have been cast up by the waves.

They are often mixed with charcoal, ashes, and various bones and shells, and sometimes stone tools are found near. These show that the aborigines were accustomed to come down to the seaside and gather harvests of food from its productive sands and rocks.

If you dissect the head of a large abalone, you will be surprised to see what a large ribbon of teeth you will find in its mouth, and you will understand better how it rasps its green food from the little sea-plants which grow so abundantly upon the wave-swept rocks.

But the tide is coming, and soon our friends will be covered with the cool water, much to their satisfaction. We will just glance around to see what are the conditions, and then picture to ourselves their ocean home.

When we, from the shore, can see nothing but the tops of a few black rocks standing out amid the foam of the waves, we know that at the base of those rocks the cool, clear water is gently moving in from the deep sea, or slowly passing out as the tide goes back again.

We know that a soft light comes in from above,

that the delicate sea-mosses are stretching out their feathery arms and gently waving their brilliantly colored branches.

We know that the scene is full of life and action; that graceful fishes are swimming about; that companies of crabs, clad in red and green armor, are actively marching back and forth; that brilliant sponges are drinking in their food; that corals and starfishes, and seaworms and sea-cucumbers, and dozens of other sea-creatures, are all alive and active, and that their life is going on as merrily as ours does at a May Day picnic.

Our particular friends the abalones then venture out of their cracks, and hobnob with their fellows in a sociable manner until an occasional puff of air from above warns them all that the tide is going out, and that it will behoove all that can do so to hie to safe quarters, and all the rest to veil their charms as much as possible.

And so the sea weeds and mosses lie flat on the rocks, the gorgeous worms creep into their holes, the mollusks into their shells, and the fishes swim out to sea, and when we arrive with our long rubber boots, nearly everything seems to be drooping or asleep.

But if it is so beautiful when it is at its worst,



A CHINESE SHELL-STAND NEAR CYPRESS POINT.

how lovely must be the ocean home when it is covered with water; when its plants are all growing, its fishes all swimming, and its creeping things all creeping.

It is true that we are not fitted to live in this ocean home, and it would be a very sorry thing if we should ever fall overboard and actually enter it; but as we stand on the brink of the sea we can look off and be glad to know that under the waves there is as much beauty, and perhaps as much contentment, as there is above them.

There are several different species of *Haliotis*, or abalone, some of which are rarely collected. Those which you will find on the shore, or which you will see in small collections, will probably all belong to one or more of three species. The name *Haliotis* is the Greek for "Sea-ear," and these creatures are so called because the shells somewhat resemble a huge ear.

The most common kind in southern California is the Green Abalone, shown in Figure 20. The outside of the shell is of a dull-gray color, but the inside is of beautiful greenish pearl, shaded with blue and red. The shell is rather thin, and has about six open holes. A good-sized specimen is six inches long.

The Black Abalone (Figure 21) is very common

in the vicinity of Monterey. It is commonly smaller than the other kinds, and has a dark, smooth exterior, while within it shows the rainbow colors very plainly. Sometimes as many as nine open holes can be counted.

The last kind is the Red Abalone. A good picture of the outside of a small shell is shown in Figure 22. It lives with the last species, but it

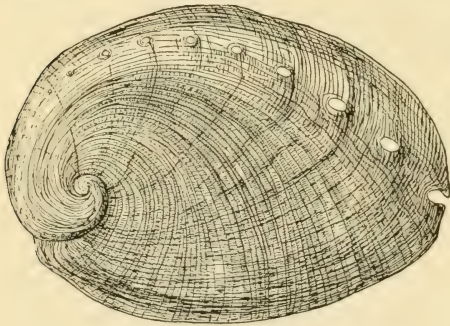


Figure 22.

grows to a much greater size, occasionally being as large as a soup-plate. It is thick and heavy when old, and is readily distinguished by its

red edges and exterior, and by its few large, open holes.

There is another kind that is found on the west coast of Vancouver Island. These shells also have a red edge, but they are very thin, and they do not grow to a great size. They very much resemble the abalones which the Japanese gather from the shores of their country, and which they

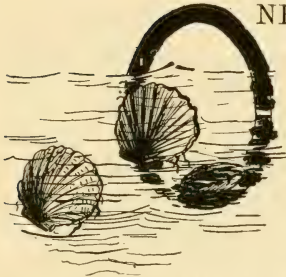
use so skillfully in making various pretty dishes and trinkets. For other rare kinds I must again refer you to the books which describe shells more fully.

BLACKBOARD WORDS.

abalone (ăb-â-lō'ney), **evidently** (ĕv'î-dĕnt-ly), **cautiously** (kă'shÿs-ly), **arranged** (ăr-rāngd'), **alternately** (ăl-tĕr'nāt-ly), **tentacles** (tĕn'tā-klz), **submerged** (sÿb-mĕrjd'), **lining** (lĭn'ing), **extermination** (ĕx-tĕr-mĭ-nā'shun), **brilliantly** (bril'yănt-ly), **behoove** (bĕ-hoov'), **Haliotis** (hăl-î-ō'tis), **Vancouver** (văn-koo'vĕr), **gorgeous** (gôr'jÿs), **aborigines** (ăb-ō-rij'î-nĕz).

THE STORY OF THE PECTEN.

(AS TOLD BY HIMSELF.)



NE bright morning in spring-time I found myself swimming with a number of my brothers and sisters in a little pool which had been left among the rocks when the tide went down. Of course I did not then understand that there was such a thing as a tide; the only thing I did know was, that I felt happy and that I could snap my two shells together and make myself dart off through the water at a great rate.

After doing this a little while, I felt tired; so I just stopped swimming, and found that I slowly settled down upon some sand that lay at the bottom of the pool. Then I opened my shells and looked out of

REFERENCE TOPICS.

The Pecten Shell.
"Air-fizz."
Best bait for fishes.
"Sea-fairies."
What is a byssus?
Dyes that fade.
Fast colors.
Shell-cabinets.

the little eyes which are in the margin of my mantle.

I could not see far, but everything about me looked so fresh and cool that I concluded to go to sleep for a little while, and then wake up and swim races with my brothers.

I do not know how long I slept, but after a hazy dream about nothing, I was awakened by hearing a rush of water over my head, or over what you, perhaps, would call my head; for to tell the truth, I never had a head and never expect to have one. But a head is not necessary, if one has eyes and ears in other parts of his body, as I have.

At any rate, I heard a great rushing sound above me, and I started up in considerable alarm and began to snap my shells vigorously. I was so light and agile that my pair of shells served me as well in the water as a pair of wings serve a bird in the air; so away I flew towards the surface of the water, which I soon found was in a state of great commotion.

The little pool in which I went to sleep was now all covered, and the waves were whirling and tossing as if they intended to mix the air and water together into a kind of soda-water fizz.

I have since learned that that was just what they were doing, and that air-fizz is just what a

great many creatures in the sea are particularly fond of, and that they make their homes where they will be pretty sure to get it fresh at least twice a day.

But I soon saw that this place where the waves were churning air was no place for me; so with a few bold snaps I shot off for deeper water. I was none too quick, for just as I had made up my mind to move, I caught sight of a big-mouthed creature, that men call a fish, coming straight for me.

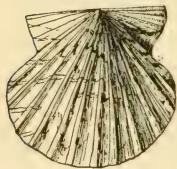


Figure 23.

He doubtless knew that the incoming tide would startle a great many helpless creatures like myself, and he had come, ready to swallow us as we were trying to make our escape.

Luckily for me, his attention was turned at that instant to a fat worm which seemed to be swimming just in front of me. His mouth closed on the worm, and in an instant more he was shooting upward as if he had been pulled by a string, and I never saw him again. Perhaps some of you may know why he disappeared so suddenly, and can guess what became of him.

I was dreadfully scared, for there were other fishes all about, and I am sure some of my poor

brothers did not escape, but I did, and in a few moments I was down in the deep water where everything is quiet and still.

That night, before I went to sleep, I spun some strong, silky threads with my one finger, and fastened myself to the stem of a great seaweed, so that I would be safe even if a great storm should arise. You can see the little notch in one of my shells, where I put out my finger and made fast my threads. It is just under one of the "ears" of the shell, and you can find it in Figure 23.

Well, I lived down in the water for a good many months, and I saw many things that you would like to see. There was a whole bed of my brothers and sisters around me, and all sorts of funny things used to come to visit us. Sometimes a big jelly-fish would swim by, looking for all the world like a glass umbrella. We seldom spoke to the jellies, for they seemed rather vain of their long trains, and we did not care to encourage them.

But they had some little cousins that were the prettiest creatures we ever saw. They have a very long Greek name, beginning with C, but we always called them "sea-fairies." They have a round body, about as big as a small marble, and it is just as clear as a diamond. They swim by means of little rows of fringes on their bodies, and some of

them have a pair of slender arms for catching food.

We always loved to have them come and tell us stories of what they saw while they were swimming near the surface,—of birds and boats and bathers, and of the funny times the boys had when they were learning to swim.

Sometimes they would coax us to reach out our

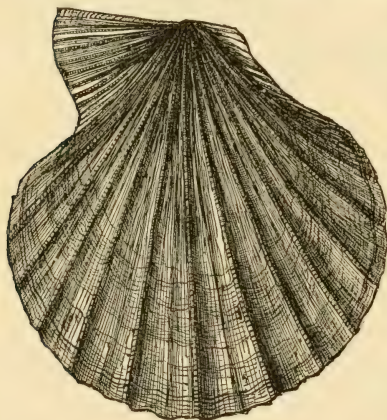


Figure 24.

little fingers and untie our cords and take a swim. We were often willing to do this in fine weather, and many a famous journey we have taken, sometimes visiting other species of pectens that have their home far out from the shore. The pic-

ture of one of these is shown in Figure 24. His color is pink, and his shell is much prettier than ours. Again, we would follow another kind, which look like Figure 25, but some of them once ventured too near a piece of marsh-land, and got stranded when the tide turned.

I grew rapidly, getting my food from little plants and animals that abound in sea-water, and as I kept enlarging my pretty shells, they never failed to cover me when I wished to be alone. I have heard that our shells have been used for many purposes by men and women, and of course the children always love to find them, and use them for spoons and dishes.

An old crab told me that one day he found a book lying open on the rocks. Of course he could not read it, for it was not written in crab language, but he did look

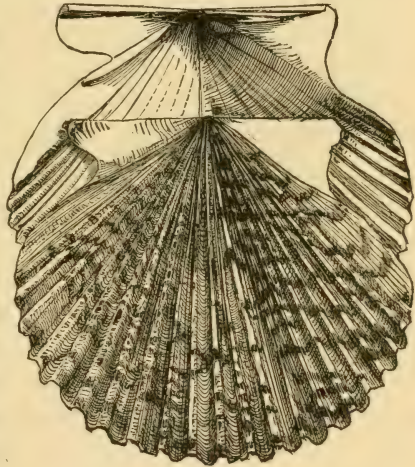


Figure 25.

at the pictures, and he declares that one of them was of a pilgrim with a shell like ours in his hat.

He also saw pictures of needle-books and pin-cushions with scallop-shells on the sides. You know that some people call us scallops, though we really prefer to be known as pecten.

But the funniest thing of all was told me by an oyster, who said his grandfather had heard a fisherman say that sometimes the meats of oysters are mixed with cracker-crumbs and butter and baked in large scallop-shells, and so when they are brought to the table they are called escalloped oysters.

And he said, too, that lately the cooks leave out the shells (for which I am very thankful), but keep the name, though somewhat shortened, and so they are called "scalloped oysters," even if they are baked in an earthen dish. And a sea-gull once told me that he had seen shells like ours carved in marble or fine wood and used for beautiful decorations.

I feel that I am growing old, and that in a little time nothing but my shells will be left; so I have been asking carefully about my ancestors and my kindred, for I want to know who have gone before me.

I find that my family is a very old one, and that we have colonies all over the world. Our flesh has always been esteemed a delicacy, and our shells have been much admired by men. But, better than that, I find that we, and a very few of our near relatives, are the only bivalves in the ocean that have the power to swim freely whenever they choose.

Some of my relatives have shells that are fully six inches across, while others are tiny little things not larger than a dime. But our oddest relative is the rock-oyster, or winter-shell, as some people call him. Figure 26 shows you how he looks, and he may be found all along the coast of California.

When his children are young, they look like little yellow-shelled pectens, and they swim about and moor themselves as we do. But after a while they grow weary of a wandering life, and then they settle down in an old abalone-shell or a hollow place in some

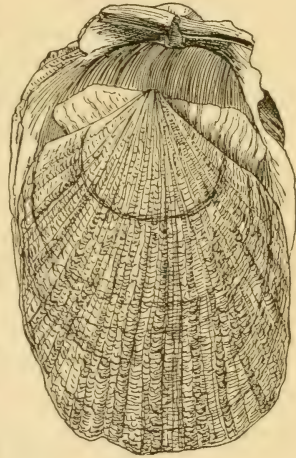


Figure 26.

rock, and cement one of their shells firmly to the new support.

As time goes by, they enlarge their shells on whatever side there is the most room, and so when they get to be old, some are long and narrow, some round and flat, while others are cramped or half doubled up.

And as soon as they settle down they close up

the finger-hole, for they have no more need to spin anchor-threads; but you can always see on the shell the place that used to be open. You can tell their shells, even if they are old and broken, for they always color the part next to the hinge with a rich purple that never fades or washes out.

But, good-by, now, for I must go, or the tide will leave me high and dry. When I am dead you may find my shells washed up on the beach. If you do find them, please put them in your cabinet with a proper label; and whenever you look at them, think of me, and of my little story about the pectens.

BLACKBOARD WORDS.

vigorously (vīg'ōr-ūs-ly), **commotion** (kōm-mō'shūn), **escalloped** (ēs-kōl'ūpt), **ancestors** (än'sēs-tērz), **colonies** (kōl'ō-nīz), **bivalves** (bī'vālvz), **delicacy** (dēl'ī-kā-sy).

MUSSELS.



NE of the most devoted rock-lovers to be found in the whole ocean is the mussel. It seems to know that it must make itself fast to a rock, and it is due to this instinct that the mussel is able to live in very rough water, and to safely keep house where many other mollusks would shortly lose their lives.

The common mussel of the Pacific coast has been known for a long time. As early as 1789, Captain George Dixon wrote home to England that he had found on our northern coast a kind of mussel very much larger than those of Europe. He wrote that he had seen one shell that was nine and one half inches in length; and he added that the natives sharpened these shells to a fine point and

REFERENCE TOPICS.

Tools made from shells.
Early voyages to this coast.
Epidermis.
Structure of wharves.
How creatures bore holes.

used them for the heads of their harpoons and fish-spears.

“The shells are wrinkled,” wrote Captain Dixon, and if you will notice Figure 27, you will see some of the wrinkles of which he speaks. This mussel is very abundant in rocky places up and down the coast. The picture represents a common-sized shell, but in places where they are not often molested, they glow much larger. The color of the shell is a rich bluish purple, sometimes mixed with white and brown.

CAPTAIN GEORGE DIXON WAS the commander of a vessel named the *Queen Charlotte*. Captain Portlock commanded a larger vessel, called the *King George*. These two vessels were sent out from England in the year 1785, to explore the northwest coast of America and establish trade relations with the natives. The scheme was very successful, and large quantities of fine furs were purchased by these captains, which they took to China and sold at a great profit. The vessels touched several times at the Sandwich Islands, which had been discovered a few years before by Captain Cook. After sailing round the world, they returned to England in 1788. An account of the voyage was published in 1789.

When they are polished, some of them are very beautiful.

Like all of the bivalve mollusks, the young mussels are sent out into the ocean as tiny swimming things that would soon perish if they did not quickly find a place of refuge. They find this most commonly on the face of a rock, for they have a wonderful power of spinning a set of strong, horny threads, called a

byssus, and fastening themselves firmly to the solid support.

And so you can often find the side of a ledge that faces the sea almost covered with mussel-shells, set as closely as they can lie, and all so firmly anchored by the horny threads that you can hardly pull off one shell at a time.

When the tide comes in, you can see why they need these strong anchor-chains, for the waves will sweep up and down the face of the ledge, washing away everything that is not fastened in the securest manner.

But this dashing of the waves is just what the mussels enjoy. They know that they cannot be torn off; so they just open their shells and breathe in the refreshing salt foam, which purifies their sluggish blood and brings to their mouths an abundance of food. What care they for the howl of the tempest or the dash of the breakers? They have "built their house upon a rock," and the storm cannot harm them.

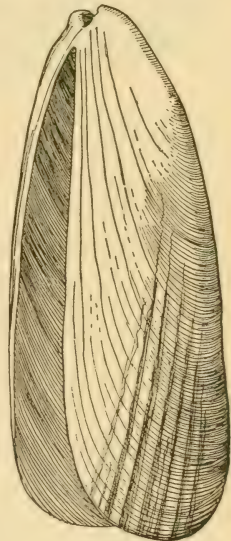


Figure 27.

If you examine the organs of a mussel, you will find that the flesh is of a bright orange color. There are four gills, two on each side, looking like delicate ribbons. These gills are the organs by which it breathes, and they also help gather its food. The outside of the shell is covered with a horny skin, brown or black in color; this is apt

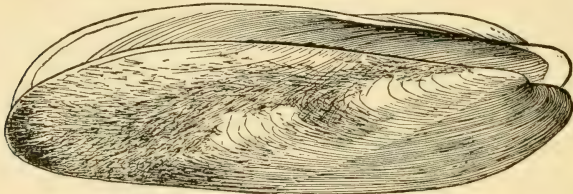


Figure 28.

to peel off from the older parts of the shell, showing the purple and white beneath.

Mussels are sometimes gathered by men for food, and they make excellent bait for fishing. It sometimes happens, however, that their flesh seems to be poisonous to men, and this fact should make one careful about eating too many, until they have been tested. At most times they have a delicious flavor.

Besides the common mussel, there are several others which have similar habits. One of these lives in San Francisco Bay, and attaches itself to the piles which support the wharves. Its shells are small and smooth. Another kind is known as the Horse-mussel. One of these is

shown in Figure 28. The shell is thin and delicate, and you notice that the umbo, or shoulder, is not quite at one end, as in the true mussel.

Figure 29 shows the shape of another small mussel, which sometimes lives under stones. Its shell is full of wrinkles. But the oddest of the whole family of mussels is the Pea-pod Shell, shown in Figure 30. This mussel is not content



Figure 29.

with fastening itself by threads, but it also bores a deep hole into the very rock, creeping inside as it grows, and leaving only a little opening for the water to come and go.

As the shell grows larger, the creature bores deeper, and thus it passes its life safely, though



Figure 30.

how little it knows of what is going on

in the great world! Are you not thankful that you are not a mussel?

BLACKBOARD WORDS.

byssus (bis'-sūs). A group of threads which hold a shell to a rock.

securest (sē-kūr'est). In the safest and surest manner.

delicious (dē-lish'ūs). Having a fine flavor.

harpoon (här-pōon'). A spear to which a cord is attached.

It is used for catching whales and seals.

THE SEA-SHELL'S ANSWER.

I.

O, SING me a song, lovely child of the sea,
For my heart seeks to fathom thy deep mystery ;
And I long for the story thy cold lips could tell
Of the forces which made thee a beautiful shell.

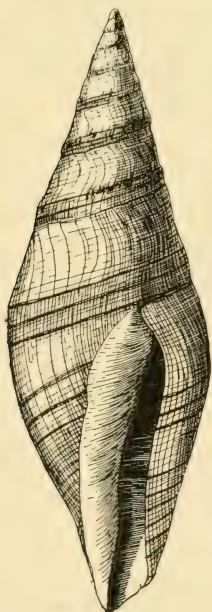


Figure 31.

II.

O, sing of the life that fashioned thy
form
With such wonderful grace, and with
colors so warm
Has dyed thy pure marbles, that radiant
they shine,
Like imprisoned sunbeams ; say, was
that life thine ?

III.

Did thy frail mollusk know, as he fash-
ioned his cell,
He was building a palace within which
to dwell ?
Did his cold heart beat quicker as each
added line
Made thy beauty more perfect ? Was
his joy like mine ?

IV.

Then the fair shell replied : Long ago it was said
That the skeptic would doubt though one rose from the dead.
Your questions are right, and the answers are plain,
But approach me with faith, or your search will be vain.

V.

Seek for what is revealed, nor with less be content ;
For with every fair form a true message is sent.
Could the dull mollusk see what to you is so plain?
Or could beautiful lines bring to him aught of gain?


VI.

Lo, a Power divine in all nature is found ;
A Power omniscient, unfailing, profound ;
A great Heart, that loves beauty, and order, and light,
In the flowers, in the shells, in the stars of the night.

VII.

And this Power divine, this Heart wondrous kind,
Bids us work out a message to each human mind.
So we build as He guides us ; and happy is he
Who can read God's great thoughts in the shells of the sea.

FRESH-WATER MOLLUSKS.

UPPOSE we take a summer ride together and visit the mountains. You can leave the great city when the sun is getting low in the west, and cross the bay in a ferry-boat. I will join you at Oakland pier, where the Oregon express train stands waiting, with its great engine puffing and blowing like an uneasy giant. We show our tickets and take our place in the proper car; the bell rings, and we are off.

We fly through Berkeley, leaving the groups of colleges on the right, follow up the east coast of the bay, and at Port Costa our train is loaded upon the great boat and ferried over to Benicia.

It is time to go to bed now, so we prepare to spend the night. We travel two miles while undressing, another mile while we are getting settled in our berths; but in a space of three

REFERENCE TOPICS.

Great ferry-boats.
Sleeping-cars.
Mount Shasta.
Glaciers.
Rivers come from mountains.
Spare the forests.
Pearl buttons.
Summer vacations.

miles more we are sound asleep, and dreaming of bells and whistles and other things that make a big noise.

At Sacramento our train stops, and as we sleepily glance out of the window we see electric lights and loads of trunks, and hear the watchman strike the wheels of our car to tell whether they are sound or cracked. Then we settle back and feel so sleepy that we care but little about the other attractions of Sacramento.



Fig. 32.

Pretty soon we know that we are moving again; but that is all we do know till we rouse with a feeling that it must be near morning. We look out of the window, rising upon one elbow to do so, and we find that it is already quite light, and that we are rapidly passing by bushes, and rocks, and grain-fields; and in a little while our train stops at Redding.



Fig. 33.

We hastily dress, take a sniff of fresh air, and are off again. And now what a beautiful ride is before us. We are just entering the upper valley of the Sacramento River, and all the way is full of interest. We have left the broad plains, and now the mountains begin to close in around us.

The river, that, farther down, was wide and still,

is here a rushing stream, hurrying along over black rocks, making here a cascade and there a sand-bar, and playing hide-and-seek with the railroad as it dodges first to the right side of the track and then to the left.

Beside the water grow the willows, and the pink azalias, and the sweet syringas. On every little island and all along the banks are the broad-leaved saxifrages, giving the river a tropical aspect. In the still pools we sometimes think we see a big speckled trout.

On and on we go, our puffing engine turning this way and that, to avoid a hill on one side and to cross a bridge on the other. As we look ahead as far as possible, we catch a glimpse of something wonderfully white and wonderfully large, like a great cloud in the sky.

Was it a cloud, we wonder; for it could not have been—for surely we are not near Shasta yet. But it was Shasta, all the same; and as we go on, we see it again, and know that we are really nearing that magnificent old snowy volcano.

At Mossbrae Falls the water from its melting snows are fairly bursting out of the fern-clad rocks; while from the Soda Springs we take a draught of a delicious liquid fresh from nature's laboratory.

And now the railroad leaves the river, for the cañon is too deep and too narrow for river and road both, and the train creeps upward over the crookedest line in the country, till we stop at Sisson, right at the foot of the grand old mountain.



Fig. 34.

It is almost noon now, and the sun is shining full on the great white fields of snow that lie above the line of green woods. Here we will stop and stay for a few weeks, and every day we shall be getting better acquainted with Mount Shasta.

We will watch it in the morning, and at sunset, and by moonlight. We will gather flowers at its base and explore its green forests, and even climb far up into the perpetual winter of its glaciers.

Then we shall begin to understand that if there were no Shasta, there would be no Sacramento, and that from those vast fields of snow and ice come the pure streams of water which all the summer long flow joyously down to the parched valleys, carrying health and prosperity as they go.



Figure 35.

“But what,” you may ask, “has all this to do with shells?” In one sense it has everything to do with them; for the melting snows fill the

springs, and the springs fill the streams, and the streams fill the lakes and the rivers, and in the streams and lakes and rivers live the fresh-water mollusks which we are to study. So you see the mountains really give them their home.



Figure 36.

And some of them live very near the mountain. About a mile beyond Sisson a great spring bursts out from the foot of a dry hill which is itself at the foot of the great mountain. The water from this spring is as cold as ice and as clear as crystal, and there is so much that it quickly forms a beautiful stream several yards wide.

Great firs and cedars grow along its banks, red lilies and blue monk's-hoods bloom beside its waters, while ferns and sedges bathe their roots below, and grow up green, fresh, and graceful above.

And in such a beautiful home, right in the very source of the great river, live hundreds of little black water-snails, their smooth shells shaped like Figure 32, though many of them are larger than the picture. In Oregon you find another species, with wrinkled shells like the one shown in Figure 33,



Figure 37.

In many brooks you can find lively little creatures with thin, horn-colored shells like Figure 34. Notice that the opening is on the left side, while almost all shells open on the right.

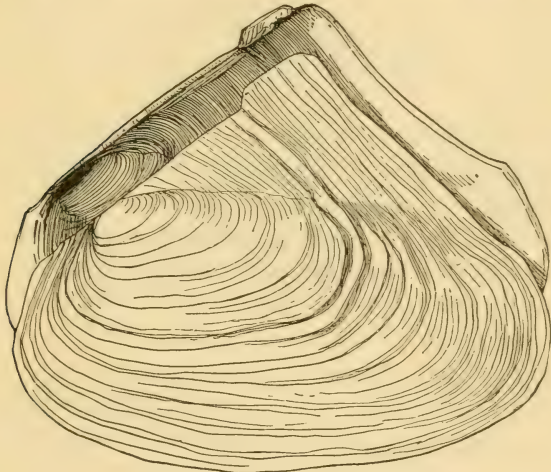


Figure 38.

Again, you may find shells that are rolled up in a flat coil, like Figure 35.

The name of these flat snails is *Planorbis*. In some lakes, or even some ponds, there are also creatures with thin shells shaped like Figure 36 or Figure 37. These are the pond-snails, called *Limnæa*, and they are found all over the world.

But besides all these creeping water-snails, and many others like them that I have not mentioned, there is another kind of mollusks with bivalve shells, which are sometimes found living half-buried in the sandy bottoms of rivers and lakes. They are often called "Fresh-water Mussels," though they are very different from the mussels of the sea.

Two species, of about the natural size, are shown in Figures 38 and 39. Those of you who live near a lake or a stream may be able to find some of them, or perhaps other kinds. I have been told that they live abundantly in the Sacramento River, after it leaves the mountains and becomes quiet.

Most of their shells on this coast are rather thin and brittle, on account of the lack of limestone in our mountains; but in the Mississippi Valley they are very numerous and strong, and inside these "Unio" shells are sometimes found beautiful pearls. Great numbers of these shells are now gathered and made into buttons and other articles of pearl.

There are also many small bivalves living in some streams. Some of their full-grown shells are not so large as a pea, but the little mollusks living within them are active fellows, and

climb the stems of water-plants with the greatest ease.

So, you see, wherever may be your home, or wherever you go for your summer vacation, by

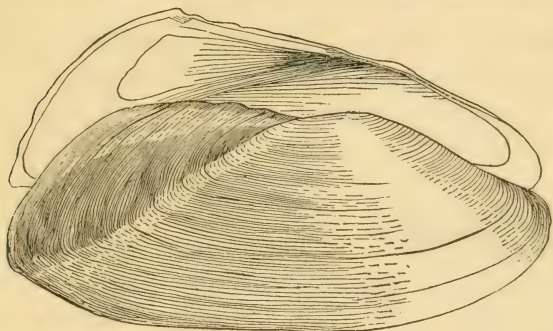


Figure 39.

the mountain or the river or the sea, you may expect to find some of these forms of life. As you study their habits and examine their shells, you will better understand what a wonderful place is this old world in which we live.

BLACKBOARD WORDS.

hastily (hās'tī-ly), **azalia** (ā-zāl'ya), **syringa** (sīr-īn'ga), **magnificent** (māg-nī'fī-sēnt), **delicious** (dē-lish'ūs), **acquainted** āk-quānt'ēd), **perpetual** (pēr-pēt'ū'āl), **monk's-hood** (mūnks'hood), **Planorbis** (plān-ôr'bis), **Limnæa** (līm-nē'a), **saxifrage** (săx'ī-frāj), **Unio** (ū'nī-ō).

A GROUP OF SAND-DWELLERS.

FVERYBODY knows that olives grow on trees, and that they are used for making oil and also for pickling. They are small, smooth, oval fruits, and are green at first, but become purple when they ripen.



But perhaps there are many people who do not know that there are many ocean shells that are also called Olives. And they are called so because they, too, are small and smooth and of an olive shape. As to their color, they are never green, but some of them are purple, and almost all of them are very pretty.

The little animal that lives in these shells loves to burrow in the sand,—not very far down, but just deep enough to cover the shell, while a pipe thrust up through the sand supplies the creature with water for its gills.

REFERENCE TOPICS.

Olive-culture.
Live shells and dead shells.
Pictures on shells.
Price of clams in markets.
Long Beach.
Nature of drills.
Vegetarians.

Sometimes a great number of these olives live together, and the bed of sand will be quite alive with them; but if you go again to the same place, you may find that they have all decided to move; and though you search for an hour, you may not be able to find a single shell.

They never like to be in the air, and if you wish to find them at home, you must go when the tide is the very lowest, and then be prepared to get wet while you are searching for them. But their shells are so pretty that you ought to get at least a few for your cabinet.

The common California Olive-shell, when full-grown, is almost the size of the picture (Figure 40), and varies in color from almost pure white to a brownish purple. The animal which lives within the shell spreads out folds of soft, moist skin, or mantle, as it is called, and covers the shell most of the time, thus keeping it smooth and free from injury. But when the mollusk dies, the shell is tossed about by the waves, and gets worn and battered.



Figure 40.

This last is true of all sea-shells, and it is easy to tell what are called dead shells from those which were taken with the animal still in them,

because the former are more dull in color and more rough in appearance.

The largest Olive-shells that you see in collections and museums come from parts of the ocean which are much warmer than the water on our coast. Some of them are three or four inches long, and they are very beautiful. The largest one has

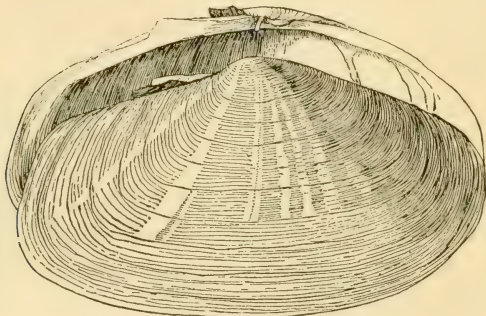


Figure 41.

markings on it, which make it look like a camp of soldiers; and so it is called the Tent-shell.

In the sand and gravel along the coast you may sometimes find other interesting shells, though they seldom live in groups, like the olives. One of the prettiest is shown in Figure 41, and is called the Red-lined Sand-shell. The shells are pure white within, and on the outside there are stripes of light red, like the rays which come up from a fine sunset.

There are also very many lines of growth. These lines are markings, showing the shape and size of the shell at all the stages of its growth. You can see some of these lines in the picture.

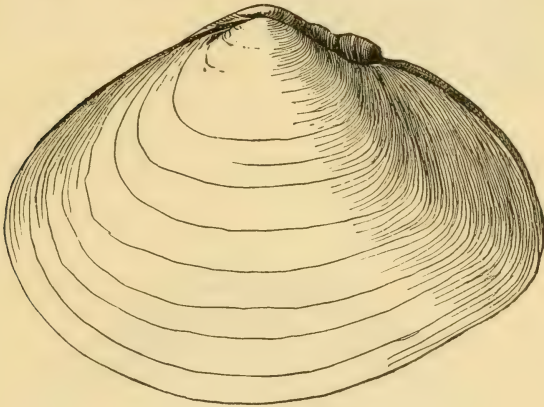


Figure 42.

The last one marks the outline of the shell; then as you go upward they are nearly the same shape, but grow smaller and smaller, till they meet at the point of the shell which is called the umbo.

In this way the simple story of the mollusk's life is written on the outside of its shell. Sometimes a valve gets injured while the mollusk is alive. If the damage is not too great, he bravely goes to work to repair it, and since he works

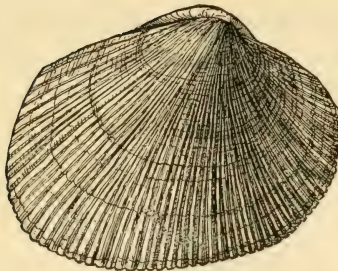


Figure 43.

within, you can see on the outside just where the break has been mended.

Another Sand-shell is shown in Figure 42. This one is pure white, and has no red lines like the last. The shell is very thin, too, but the lines of growth are quite clearly shown.

There are many others, quite similar in shape

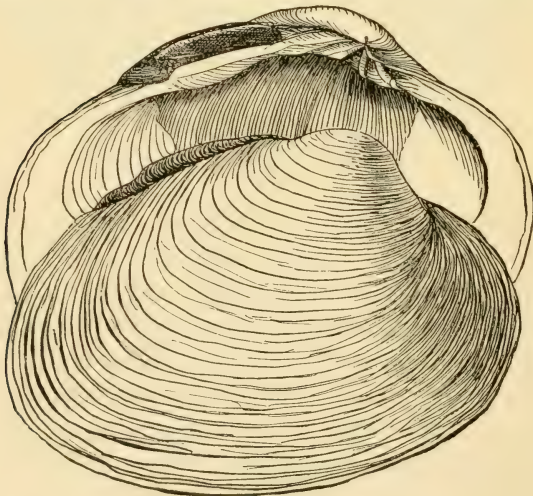


Figure 44.

and habits, but this book would be too large if we were to describe them all. I suppose every one of these clams are good for food, though you seldom find them in the markets.

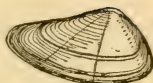


Figure 45.

But Figure 43 represents one that is always in the San Francisco markets, where it is called the Hard-shelled Clam. Other people call it the Carpet-shell, because it is thickly set with little ribs or ridges, like a piece of Brussels carpet. Many of the shells also have pretty patterns painted naturally upon their outer surface. A great many of these clams are gathered on the shores of Tomales Bay; but they live all along the coast.

Figure 44 shows another fine clam which is seldom seen in San Francisco, but which may be bought in the Portland markets; while Figure 45 gives you an idea of the little Wedge-shell, which lives so abundantly in the sand at Long Beach, in Los Angeles County. Although it is so small, it is used for food in the following manner.

A shovelful of the sand in which they live is put into a sieve, and this is shaken in the water. The sand all washes out and the shells are left. When enough have been gathered, they are again carefully washed, and then put into a kettle of boiling water.

In this way they are killed instantly, and the shells open, allowing the rich juices of the clams to come out and flavor the soup. The empty shells settle to the bottom, and now a little seasoning is all that is necessary to prepare the delicious soup for the table.

As this is the smallest mollusk that is eaten on this coast, it is proper that we should now pass on to the largest one. Figure 46, though a good-sized picture, is only one half as long as the real shell. We will call this creature the Giant Clam, though

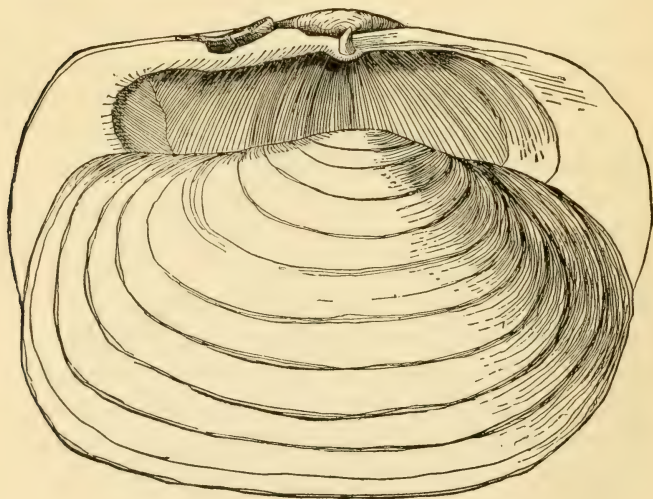


Figure 46.

it has various names in the north, where it is dug out of a very deep burrow in the sand and mud.

If you wish to know its true name, you can look at the list of Names of Figures, at the end of this book. But it is very proper to call it a giant; for when you are making soup, you must remember that it would take more than a thousand of the little Wedge-shells to furnish as much meat as is contained in a single Giant Clam.

There is just one more sand-dweller that we will think of to-day, and he is very different indeed from those we have been considering. His picture is given in Figure 47, but

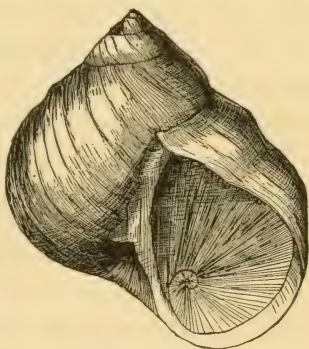


Figure 47.

that shows only the shell when the animal has gone inside and has pulled in his door, or operculum, as it is called.

The shell is so big and round that it is sometimes called the Moon-shell, though its color is not pure white, but somewhat spotted like the real moon. Sometimes it grows to a size three or four times that of the picture.

When the mollusk comes out of his shell he

takes in much water, and swells up enormously. Then he burrows along under the surface of the sand, until he finds a clam living there. The Moon-mollusk wishes to eat that clam, but the clam is not willing to be eaten, and so a strife ensues.

The clam closes his shells tightly, and the old robber cannot open them, and so Mr. Clam thinks he is safe. Alas! do not be too sure, for the old robber carries a flint drill on his tongue, and I fear that he will use it.

And, surely, he grasps the poor clam with his big foot, selects a place on the clam's shell just over the heart, and begins to bore. If he does not get scared away, he will stay till he has drilled a hole clear through,— and then it is all over with Mr. Clam.

Did you ever find clam-shells with smooth, round holes bored in them near the umbo? If so, and they are very common, you may know that Mr. Moon-shell was the culprit, and that the poor clam died a violent death. But soft, — I fear that some of us are just as guilty as the mollusk of the Moon-shell.

BLACKBOARD WORDS.

appearance (ăp-pēr'ăns), **museum** (mū-sē'ūm), **interesting** (in'tēr-ĕst-ĭng), **similar** (sĭm'ĭ-lăr), **Brussels** (brūs'sĕlz), **umbo** (ūm'bō), **operculum** (ō-pēr'cū-lŭm).

A WALK ALONG THE SHORE.



CYPRESS POINT is a noted promontory on the coast of California, situated a few miles south of the old city of Monterey. It is not far from the celebrated Carmel Mission, which was founded by the Spanish fathers more than a century ago.

The Indians, for whose spiritual benefit the old church was erected, have nearly all disappeared, their descendants being so few and so scattered that they are rarely seen.

The old church was rapidly falling into ruins until a few years ago, when it was partially restored and supplied with a new roof, which will protect it for at least another century. But it stands in a hay-field, lonely and deserted, save for the visits of curious tourists and the gathering of a few neighbors when the parish

REFERENCE TOPICS.

Missions to the Indians.
Adobe houses.
Early settlement of California.
"The groves were God's first temples."
An Arab's turban.
Hermit crabs.
Sea and shore.

priest holds services within its aged walls once a year.

Beneath its floor rest the bones of Junípero Serra and his associates, who spent their lives in an earnest endeavor to bring the gospel to the degraded heathen on the west coast of America. But how changed is the scene now, and how rapidly has the surrounding country passed from the Indians to the Spaniards, and from the Spaniards to the Americans.

But out on Cypress Point there are still growing the same trees beneath which the Indians camped centuries ago, and under whose branches the reverend monks bore the bell and the crucifix as they started out on their journey northward to establish a new mission church.

Venerable old trees are these, which have withstood the buffetings of the west winds for scores and hundreds of years. Their trunks are gnarled and twisted and severe, but their tops are evergreen, though beaten by the ocean storms into floorlike flatness.

Some of them stand erect, boldly peering out over the horizon, as if anxious to catch a glimpse of some friendly ship coming in from the far west; others crouch like sleeping lions, or bring their green covering down to the very ground, like the wall of a tent.

A solemn peace pervades these ancient groves, and the light laugh is instinctively hushed as one enters their shady portals. It is not a place for mirth, much less for sadness, but for quiet, for thoughtfulness, and for peace.

Under these old trees there quietly lives a small colony of very interesting snails. We have already seen the picture of one of them in Figure 16. His ancestors were here long before mission times, but the race is fewer now than it was formerly, for the saucy jays which flutter and scold in the green branches overhead search out the poor snails in their summer hiding-places, and break the pretty shells to satisfy their gross appetites.

But we may find a few good specimens even yet, along with the broken shells, and we may trust that there are others left, too deeply buried for birds or boys to discover their place of concealment.

Leaving the silent groves, let us go down to the beach and walk along its margin on our way home. Everywhere we see the work of the waves.

Here are piles of rounded stones cast up by the winter's storms; there are tangles of seaweed, which drifted in at high tide; beyond is a long beach of smooth sand, where the waves roll up



and down all the day long, and this stretch is bounded by scarred and broken ledges which run far out into the sea, and whose presence may be known by the foam of the white breakers. Each of these conditions has its own form of life, and each seems ready to tell us its particular story.

As we approach the water, the first mollusks we meet are the little Littorines, or Shore-shells. They are clustered on the rocks, waiting for the returning tide. There are two species of littorines, looking like Figures 48 and 49, only many of them are not so large as the pictures would indicate. They are modest little shells, of a dark gray color, like the rocks on which they rest, and they are able to resist thirst and drought for a long time, as their shells are tightly shut by a close-fitting operculum.



Fig. 49.



Figure 50.

But if you put them in sea-water they quickly revive, and their little black bodies go creeping rapidly over the rocky surface, and their rough tongues rasp off the green coating which gathers on wet stones. There is also a plenty of limpets of different species, but these

we have already considered, so we pass on to a group of strong, black shells whose owners have met together on the sheltered side of a big rock. They are the Turban-shells, and there are various species of these, also,— Black Turbans, Brown Turbans, Red Turbans, and Blue Turbans, as well as others which you do not often find.

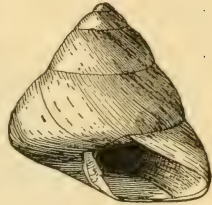


Figure 51.



Figure 52.

The Black Turbans are by far the most numerous. You see a picture of one in Figure 50. Their shells are strong and heavy, enabling them to resist the knocking of the waves. Inside, they are beautifully pearly, like the abalone. The aperture is closed by a circular, horny front door.

The little black animals are vegetable-eaters, like the littorines, and they assist greatly in keeping the rocks clean and fresh.

A little nearer the water are the Brown Turbans (Figure 51). In fact, they seldom come up far from the lower tide limits, though you may find them alive in caves

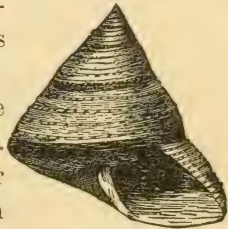


Figure 53.

and pools when the tide is low. They are much prettier than their black cousins, but they are far less numerous. The Blue Turbans (Figure 52) are even more unwilling to leave the sea; but still you may perhaps find some live ones in a rock grotto, or clinging to the long stem of some seaweed. The thin outer coat of the shell is not blue, but brown, though when it is a little worn, as around the apex of the shell, the blue pearl is seen, and a little acid brings it out very readily.

Although the living shells are seldom found, the hermit crabs often bring up the dead ones, and you might imagine by the motion that the real owner was present.

Out in the water live other mollusks related to the Turbans; but their shells are too delicate to be trusted near the rocks; so they cling to the great seaweeds, and come up to the surface in fine weather only. Their shells are thin and very beautifully colored. They are called Top-shells, and a picture of one of the prettiest is given in Figure 53.

Figure 54 shows a little Red Turban, which is not so big as a pea; while the great Wavy Top-shell shown in Figure 55 sometimes grows in southern waters as large as a quart



Fig. 54. measure.

Figure 56 is the Smooth Turban. This, also, is found in the south, and the picture represents a rather large specimen. It is of a rich brown color, with a curious green spot in the center of the whorls;

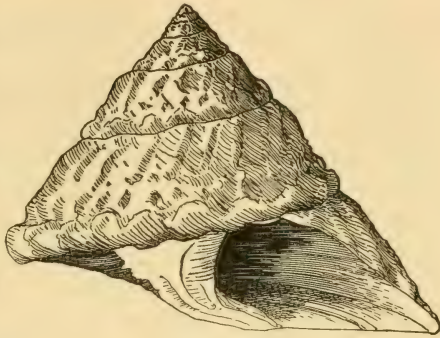


Figure 55.

the center of the whorls; it has a singular operculum, made up of rough rings.

There are other Turbans and Tops, some of which you may pick up as you walk along the beach from Cypress Point to Pacific Grove; but

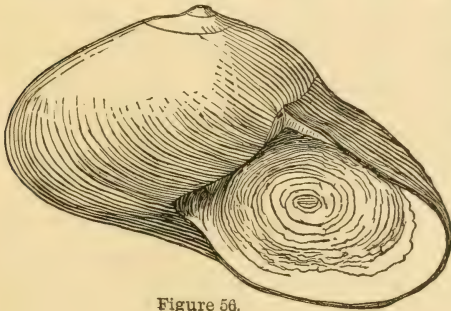


Figure 56.

whether you find these or not, you will surely see certain other mollusks, which we will consider in the next chapter.

BLACKBOARD WORDS.

interesting (in'tēr-ĕst-ing), **promontory** (prŏm'ŏn-tō-ry), **Monterey** (mŏn-tā-rā'), **descendants** (dē-sĕnd'ānts), **reverend** (rĕv'ĕr-ĕnd), **buffetings** (bŭffĕt-ing), **instinctively** (in-stĭnĕt'iv-ly), **Littorine** (lĭt'tō-rĭn), **drought** (drout), **operculum** (ō-pĕr'kŭ-lŭm), **singular** (sĭng'gŭ-lĕr).

A FEW MORE MOLLUSKS.



DURING our last walk we noticed some of the mollusks which are found living upon the rocks. In many places the seaweeds live there too, and when the tide is out you can see great patches of olive-green vegetation almost entirely covering the hard, gray rocks.

The name of the most common of these plants is *Fucus*, and of this there are several species. Most of them contain little air-sacks near their tips, which act as floats, and assist in keeping them erect when the water is over them. But when the tide is low, you find them lying flat on the surface of the rock, or hanging limp from its sides.

These seaweeds are very ancient plants, and were growing in the ocean long before there were any trees upon the land. They do a vast amount of good, purifying the water and giving

REFERENCE TOPICS.

Plants without flowers.
"Sea-cradles."
Purple dye.
What is varnish?
Uses of borers.
Our advantages.

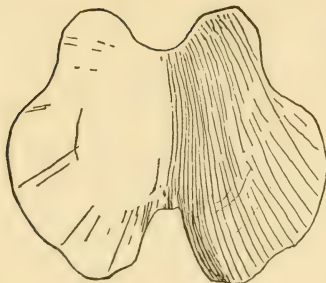


Figure 57.

food to numberless animals. Some of them are even eaten by men, and valuable chemicals are obtained from their ashes.

If you turn back some of these limp plants, you will probably find several interesting forms of

life nestling beneath them, and among these forms will probably be a number of mollusks.

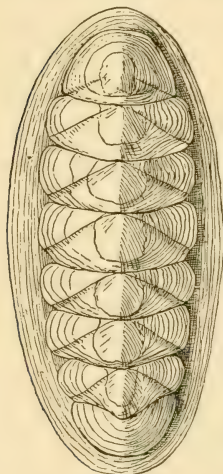


Figure 59.

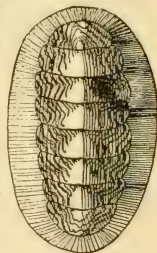


Figure 58.

The first are the Chitons (ki'tons), some of which are shown in the illustrations. Queer creatures are these

Chitons; very slow in their movements, shy in their habits, and, withal, perfectly harmless. They are generally found clinging firmly to the surface of a rock, and often they select cracks and crevices for greater safety.

If you pry one of them off with

the point of a knife, you will see that his body resembles that of a limpet, though the organs are more simple. There is a mouth at one end, a creeping and holding disk, and a muscular mantle. The poor fellow will probably curl

himself up in a ball, if you

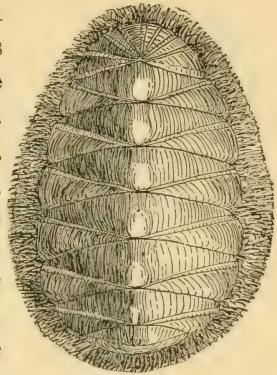


Figure 60.

do not put him back into the water, and he may strain so hard that he will break some of his shells.

I say some of his shells, for he has eight of them, always eight, arranged like the shingles on

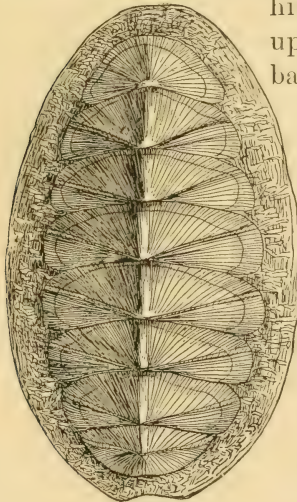


Figure 61.

the roof of a house. Among the pebbles on the beach, you can often find single shells which came from



Figure 62.



Figure 63.

the body of some dead Chiton. They look somewhat like a pair of wings, and the large white ones, like Figure 57, are often called Butterfly-shells.

The Red-lined Chiton (Figure 58) is a small creature with very beautiful shells, while the Gray Chiton (Figure 59), which is much larger, has little beauty, being of a dull, ashy color. It often lives under stones. Figure 60 shows the Mossy Chiton, which is so named from the great number of stiff hairs on the border of its mantle; while Figure 61 shows a large species with very regular shells.

Besides the Chitons, you will probably find specimens of the Purples. There are several of these, also; a



Figure 64.

picture of one of the common ones being shown in Figure 62, and another in Figure 63.



Figure 65.

Both of these pictures are somewhat too large for the common specimens, but they show very well the shape and appearance of the shells. The Purples are rather active creatures, though at low tide you will probably find them at rest.

They feed on animal matter instead of vegetable. You notice in both the pictures a little canal, or open tube, at the bottom of the shell. You can see the same plainly in Figure 64, which is the picture of another Purple. All the shells that have this canal belong to animals that are carnivorous, while those that have round openings, like Figure 56, be-

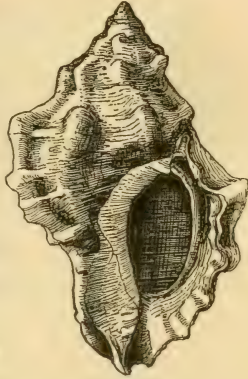


Figure 66.



Figure 67.

long mostly to herb-eating mollusks.

Purples are so called because a rich dye used to be obtained from similar mollusks that lived in the Mediterranean Sea. Perhaps you have all read of this famous dye, which was known as "Tyrian Purple."

The finest Purples of our coast live in the northern waters, where some of them are very

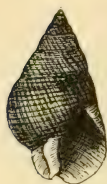


Figure 68.

large and beautiful. Figure 65 shows one of their shells. There are many shells quite similar to the Purples, some of which you may be fortunate enough to find.

One is the great Frog-shell (Figure 66). Another is Belcher's Chorus (Figure 67); and then there are many little ones, like Figures 68, 69, and 70. All of these have names and descriptions, which you can find in the books.

If you now leave the rocks and go out on the sands, you may pick up a great Heart-shell (Figure 71). I used to find broken ones abundantly, which had been washed up by the waves, out by the Cliff House, in San Francisco.



Fig. 69.

There were also many pieces of the Flat Razor-shell (Figure 72). This is a thin shell with a glossy brown covering looking like a coating of varnish. They grow abundantly on the coast of Oregon, and are the most highly esteemed of all of our clams for a delicious chowder.



Fig. 70.

Captain Dixon wrote in 1789 as follows: "At the mouth of Cook's River, lat. 59° 61', are many species of shell-fish. For a repast, our men preferred a large species

of the Solen genus, which they got in quantity, and were easily discovered by their spout-

ing up water as the men walked over the sands which they inhabited."

He gives a good picture of the shell in his book,

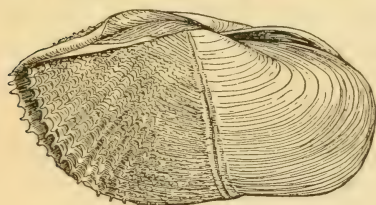


Figure 73.

which was printed more than a century ago; and so it happens that this is the first shell of our coast that was ever described and figured by the original collector. Find the place on your maps where Captain Dixon's men dug these fine Razor-clams out of the sands of the Alaskan shore.

The last shells of mollusks that we will consider in this book are those of the Piddocks. They are bivalves, and have a habit of boring holes into

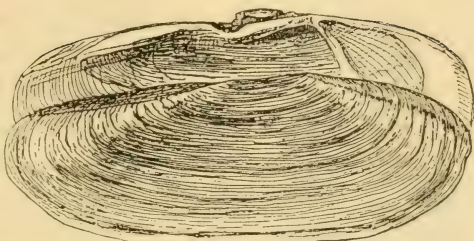


Figure 72.

He gives a good picture of the shell in his book, which was printed more than a century ago; and so it happens that this is the first shell of our coast that was ever described and fig-

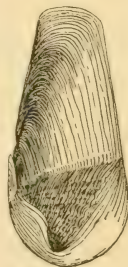


Figure 74.

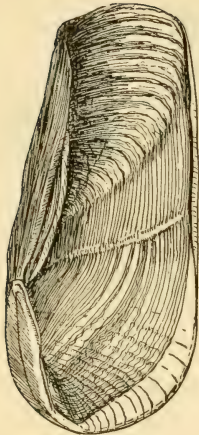


Figure 75.

almost everything. A little one called the *Teredo* bores into pieces of submerged wood, like the bottoms of ships and the piles on which wharves and bridges are built. They are very destructive, and to protect the wood it is sometimes poisoned or covered with sheets of copper.

But the common piddocks are larger than the *teredo*, though they do not bore quite so deep holes. Those that look like Fig-

ure 73 bore holes into the stiffest blue clay, from which they can be dug out by the use of a pickax.

Others, like the shells shown in Figures 74 and 75, attack harder substances, and even make their burrows in solid rock. Sometimes a reef gets so full of holes that great pieces are broken off by the waves during a storm, and rolled up on the beach. You can find such pieces at old Monterey, with the dead shells still remaining in the burrows.

When the creatures begin to bore they are very small, and as they go on, the diameter of the burrow must increase, to allow for their growth.

And so it happens that a piddock that has once made his house becomes a prisoner for life.

But what does he care! He is safe and quiet, and he can always pump in water with its food and air for his daily use, and with that he is content. But his sphere of knowledge and activity is very, very small. Are you not thankful that yours is so much larger?

BLACKBOARD WORDS.

Fucus (fū'kūs), **vegetation** (vēj-ē-tā'shūn), **ancient** (ān'shent), **chemicals** (kēm'ī-klz), **Chiton** (kī'tōn), **withal** (wīth-āl'), **carnivorous** (kār-nīv'ō-rūs), **Tyrian** (tīr'ī-ān), **chorus** (kō'rūs), **original** (ō-rīj'ī-nāl), **diameter** (dī-ām'ē-tēr), **piddock** (pid'dök).

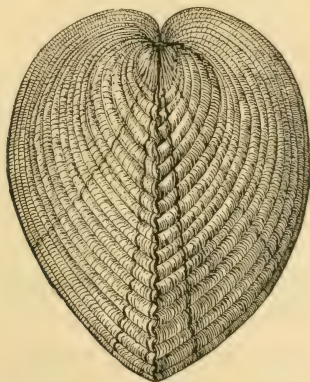


Figure 71

OTHER CREATURES WHICH LIVE IN THE SEA.

BESIDES the mollusks, there are a great number of other creatures in the sea which claim our attention. As we go down to the beach on a bright morning, perhaps the first living things which we notice are the birds. Sea-birds have a look of their own, and you would hardly mistake them for land-birds, if you were to meet them many miles inland.

While our land-birds are mostly fitted for short flights, as from tree to tree, the sea-birds go winging along over miles of waves, and perhaps alight at last on some bare rock, in the midst of a flock of their companions. Land-birds sing, at least many of them do, but sea-birds are silent, or utter a few harsh cries. Besides this, they are all fitted for swimming or wading, and many of them for diving as well.

REFERENCE TOPICS.

Why men cannot fly.
The beaks of birds.
Methods of fishing.
Difference between gills and lungs.
California whales and whale-fisheries.

The most common sea-birds about San Francisco are the Gulls. They are quite large birds, of a white or gray color, and they have quite long, naked legs and a strong beak. Nobody is allowed to shoot them near the water-front, and in consequence they have become quite tame, perching freely upon the sheds around the wharves, and following the ferry-boats between the city and the Oakland mole.

Very often some passenger will toss them bits of bread as they fly beside or over the boat. Instantly there is a rush of wings, and the mouthful is usually caught by some keen-eyed bird before it has had time to reach the water. Their intelligent looks and graceful motions are much appreciated by the throngs of passengers on the ferry-boats, and the birds seem to understand their advantage.

Other sea-birds are seen in the bay, too, but none of them are so tame as the gulls. In winter there are many flocks of Ducks, and frequently a Diver is seen thrusting his long, snaky head out of the water, glancing quickly around, and then disappearing in an instant. He seems more like a fish than a bird, for you seldom see him either swimming or flying.

Sometimes you see the Pelicans,—great birds



A NESTING COLONY OF CORMORANTS,

with exceedingly long bills, under which are hung bags to hold the fish which they catch. You would hardly expect so clumsy a bird to be an expert fisher, but if you watch his motions you will see that they are far more rapid and skillful than you would suppose.

Along the rocky sea-coast one often sees a small flock of Shags flying very swiftly in a line, just above the surface of the waves. The shag is really a species of Cormorant. Its plumage is so dark in color that at a distance it appears black, though a close examination shows a touch of green. These birds have slender bodies, strong wings, and long, sharp bills. They are expert fishers. In China, young cormorants are trained to dive for fish, and to bring them to the boat of their master.

On the salt marshes one sometimes sees a lonely Crane standing, at least a yard high. He is a great creature, with naked legs so long that when he flies they stretch out behind like two poles. On the marshes and the beaches you also see other wading birds smaller than the cranes. To these belong the Curlews and the little gray Sand-pipers.

Farther out at sea, around the rocky islands which lie along the coast, are vast numbers of other birds, one of which, the Murre, lays the

great green eggs which are sometimes collected on the Farallone Islands, and sold in the city markets, like the eggs of common fowls. Altogether, the sea-birds help very much to enliven the view and to render the sea-coast attractive.

Whenever you go to the sea-shore, you know that you are going where fishes abound, and yet you may see but very few, as most of them keep well off the shore when the tide is low. But if you are near a fishing-village, you will greatly enjoy seeing the boats come in and the catch brought on shore.

There will be Rock-cod and Flounder, and Salmon and Mackerel, besides many strange forms, all of them interesting, and many of them very bright and shining as they come out of their native element.

There are many creatures which swim in the ocean that are not fishes at all. There are the Whales, for instance. Here on the west coast we often have a chance to see whales, for they pass up and down the coast as the seasons change. In Monterey Bay I have seen many of these huge creatures swimming rapidly, and occasionally coming up to breathe.

A fish does not need to come up to breathe, for he has gills, over which the water passes, and in

which his blood is purified; but the whale has lungs, and if he did not come up for air, he would drown as surely as you would. The difference is that he can naturally hold his breath a good deal longer than you can, and he has been trained to do it ever since he was born.

There are smaller animals than the whale, which behave in nearly the same manner. Near the shore and in the bays is the black Porpoise, which grows to a length of from three to six feet. You often see them swimming in pairs, and frequently bobbing up to the surface for a breath of air.

I once watched a pair of porpoises from the deck of a ferry-boat. They would come up to breathe, and immediately sink a few feet, swimming with all their might, and fairly keeping up with the boat. I suppose they expected that something good would be thrown overboard from the cook's galley, for them to pick up. I hope they were not disappointed.

Sometimes from the shore you can see a huge Grampus, or perhaps a whole school of them swimming in a row. Their habits are like those of the whale and the porpoise, and they are midway between them in size. All of these animals have smooth skins and a fish-like form; but the

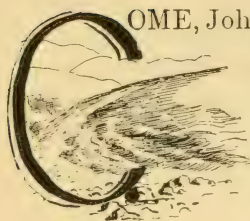
seals, which somewhat resemble them in shape, have plenty of hair.

All of these creatures are large. In another chapter we will consider some smaller creatures that are just as interesting as the fishes and the whales.

BLACKBOARD WORDS.

intelligent (in-tě'l'i-jěnt), **appreciated** (ăp-prě'shĭ-ăt-ěd),
pelican (pě'l'i-kăn), **cormorant** (kô'r'mô-rănt), **murre** (mûr),
porpoise (pô'r'pŭs).

SOME CREEPING THINGS.



COME, John and Augustus, and Mary and Pauline, get your hats, and a dipper and a pail, and some big fruit-jars. The tide is low this morning, and we will see what is alive down on the wet rocks. Scatter yourselves around, and let each one find something. Then bring them all here, and we will sit down and examine them.

Well done, John; you are the first to return, and you brought what I expected would come first, — a Starfish. Mary comes next, with a Sea-urchin; Augustus has a Sea-anemone attached to a small stone; and little Pauline has her hand full of something which I cannot just make out. But put them all

REFERENCE TOPICS.

It would be well for the teacher to have as many specimens as possible to illustrate these lessons. If the real creatures cannot be obtained, books of natural history would be desirable.

Start a small school cabinet, if it has not been done already.

Various kinds of teeth.

What is a land-urchin?

What is a land-anemone?

Other radiates.

into jars of cool salt water and we will watch them move.

And now we will talk of the starfish. In the first place, he is not a fish at all, but he surely looks like a star; and men used to call almost everything that lives in the water a fish. It is not

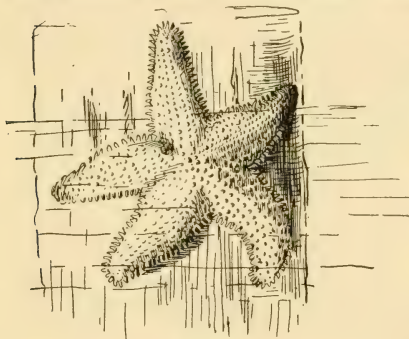


Figure 76.

easy to change old names, and starfish is a word easy to pronounce.

How many points are there to his star?

Five.

Correct; but do all starfishes have five points?

Don't know? Well, if you will watch, you will find some little ones with six points; and you may get a big, soft red one, called a sun-star, which has twenty or more. But five is the common number.

Now, what are these five points for?

They are legs, sir.

Are you sure of that? Can a starfish step off on these legs? or can he swim with them? Watch this one in the great jar of salt water. If they are legs, they must be very lame ones.

No; they are not legs, but from the under side of each of these points there are coming out a great number of little tubes. These tubes, or water-feet, act like suckers, and hold on very firmly; but when the creature wishes, he can withdraw them. And by reaching out new tubes in front and drawing in those behind, he is able to creep slowly, but very surely, up the side of the jar. In the ocean, he can creep over rocks or go where he pleases.

But what are the five points for, since they are not legs?

I will tell you. Do you see the creature's mouth in the center of his body, on the under side?

Yes, sir.

Yet he has no teeth, and so he cannot crush his food. But he can do one very curious thing. He can throw his stomach out of his mouth, and digest his food outside of his body, and then draw the stomach back again. I once saw a starfish eating a clam in that singular manner.

But what kept the clam from slipping away? — for the starfish has no hands to hold him?

Precisely; but he does have five points to his star, and he bends these points around the clam and seizes the shell with the little suckers, and then with his mouth he can do what he pleases.



SEA-URCHIN SHELLS PREPARED FOR MARKET.

But what if the clam will not open his shell?

Ah, I cannot tell you that. I only know that the stomach seems to have the power to make the shells open; how, I do not know. It is the same way with oysters as with clams; and so the oyster-men hate the starfishes, and kill them if they catch them around their oyster-beds.

Well, we have learned some things; but there are others which we do not understand.

True; but is it not often so, when we study the wonderful objects of nature? Some time we will dissect a starfish, having first killed it by putting it in fresh water, and then you will see very curious organs inside.

We will take this one home, kill it, and wash off all the salt, and then dry it for a few days in the sunshine. If we do not wash off the salt, it will gather moisture in damp weather, next winter, and may spoil. And to-morrow, see if you cannot find several other kinds to add to your collection.

Now, Mary, let us see your sea-urchin.

Why, it is climbing, too, almost like the starfish, only its suckers are very long, and it has so many long thorns sticking out all over its body.

Very true. It is classed with the starfish on that account, and they resemble each other in

other ways also. The mouths of both are in the center, and the parts of the body reach out like the spokes of a wheel. For this reason they are sometimes called Radiates.

But notice; how does the urchin differ from the starfish?

He has long thorns on his skin.

Right. They are called spines, and very curious organs they are, too. They protect the animal like a fence of bayonets, and they help him in moving, also. What else?

He has a hard shell.

That is true; while the starfish has a leathery skin with many stony points set in it. But find an old sea-urchin shell that is broken, and notice the many pieces of which the shell is made up. And as the creature grows, each of these pieces must be increased in size. What else?

The sea-urchin seems to have a set of teeth.

Good; and are they set in two jaws, like yours?

No; there are only five teeth, and they all come together in a point. Isn't it strange?

Yes; it is very strange; and when you dissect a sea-urchin you will be more and more surprised to see what a wonderful mouth he has. For he really has five jaws, with one tooth in each jaw, and as the teeth wear off, they grow down from

above, through the jaw, so as to always keep them just the right length. There is very much more about the sea-urchin which is of interest, but we cannot learn it now.

But where do sea-urchins live?

Mostly in shallow water, and especially around rocks.

And are there many kinds?

Yes; there are large ones and small ones, round ones and flat ones, and a number of species of each kind. Some have spines as thick as a pencil, while in others they are as fine as hairs.

One thing more: what do they eat?

Chiefly seaweed, but sometimes dead fishes or other animal matter.

Now we must turn to Augustus and his sea-anemone. It has opened in the jar of water, but there are plenty of closed ones on the rocks around us. Does it resemble the starfish?

Not much, only it has a mouth in the center.

But has it tube-feet to cling and walk with?

I cannot see any.

True, it has none; and it is a much simpler animal than the last two. But what has it around its mouth?

It has a row of soft tubes, looking like the petals of a flower.

Right again; and from these it gets its name. Now put your finger down to its mouth and hold it still; it will not hurt you.

Why, the creature is closing all its rays round my finger, and pulling itself together into a little bunch.

Yes; and if your finger had been a limpet or a little crab, it would have been pulled inside, through the creature's mouth, down into its stomach. And it would never have come out

alive, either; though after a time the creature would have thrown out the empty shell.

But can the anemone change its place?

Slightly; but it generally chooses its home on a rock, and stays there all its life. You will find



Figure 77.

beds of small gray ones on some rocks, so close together that they touch one another. Again, in deeper water, you will see great green ones living apart, and, when open, each one looks like a beautiful flower six or eight inches across. Their tentacles, or rays, are very sensitive, and quickly catch any unlucky creature that comes in their way.

Can we keep this creature when it is dead?

Only by putting it in some preserving fluid, like alcohol, for all of its parts are soft, and it has no shell. If you wish to preserve the sea-urchin's shell, you can either take out the mouth parts and thoroughly clean the inside, and then dry the shell with the spines on, or you can boil the whole shell in water and rub off the spines with an old brush. But what has Pauline?

It is a little starfish with five arms; but how fast they move.

No; it is not a starfish, but a Brittle-star, though the two are quite nearly related. See; it has a hard, round body, like a button, with a little mouth in the center; and these five arms are not parts of the body, as in the starfish, but are more like little whips, by which it gathers in its food. If you disturb it, some of these little arms are very apt to break off, and so the creature is called a brittle-star.

The brittle-stars which live around the beach do not grow very large, but there are many very strange and large ones which live on the bottom of the ocean, in very deep water. You can often find small ones by turning up stones when the tide is low; for they do not live on the tops and sides of rocks, like the true starfishes. There is

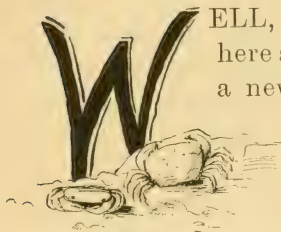
another kind, in which the arms are very much divided, like the twigs of a tree. When these arms are curled up, the creature is called a Basket-fish.

But now we will take our treasures home and come again some other day.

BLACKBOARD WORDS.

radiate (rā'dī-āt), **bayonets** (bā'ō-něts), **anemone** (ā-nēm'-ō-nē), **resemble** (rē-zēm'bl), **moisture** (mois'tūr), **alcohol** (āl'kō-höl).

ANOTHER SEASIDE TALK.



WELL, my young people, we are here again, and you have brought a new lot of creatures for us to examine together. I suppose you found them this morning at the very low tide; is it not so?

Yes; we have all been out on the rocks, lifting up seaweeds, and turning over such stones as we were able to move. We carried a trowel and a big iron spoon with us, and we dug with them, wherever the gravel was soft enough for us to do so.

And did you find more of the creatures which we were studying yesterday?

O yes; there were dozens of starfishes lying on the seaweeds and the patches of eel-grass. Some of them

REFERENCE TOPICS.

- There are interesting objects all around us.
- Advantage of many legs to the crab.
- Difference between crabs and insects.
- The crab's eyes.
- Formalin, or formaldehyde.
- Sallee is a port of Morocco.
- Pirates of North Africa.
- Great cuttle-fishes.
- Strange sea-creatures that are eaten by men.

were yellow and some purple, and there were small red ones that had no long arms, but only five corners. And we found white brittle-stars under the stones, and a good many sea-urchins, and whole beds of sea-anemones.

And one of us looked off from a rock into deeper water, and saw the bottom almost covered with big purple urchins lying with their mouths all downward. O, it is such fun to know what things are when you see them.

Yes; and you are far more likely to see them if you are acquainted with them first, for you know where to look and what to expect. It is so on the land, as well as by the sea. If you know the flowers and the trees, and even the stones, you will always have company, even if you are taking a solitary walk.

But let us see the new treasures you got this morning. Pauline, we will look at yours first, to-day, as you were last yesterday. What have you in your jar?

I have two little Crabs, that I found eating a dead limpet. It was so funny to see them walk up shyly and get large mouthfuls with their big claws. And it was not easy to catch them, either, for they can run like spiders.

True; and they resemble spiders in several

ways. What the spiders and insects are to the land, the crabs and their neighbors are to the sea. Very few crabs live on the land, and scarcely an insect lives in the ocean. How many legs has a crab?

Let me see; there are four small ones and one big one on each side; so there are ten in all.

Yes; and how many joints in each leg?

I can't tell, for he will not let me count them; but there are a good many,—at least five or six.

Very well; some time when you have a dead crab you can count them carefully. And notice then in which way the joints move,—forward and back, or up and down. But does each leg end in a spur?

There are spurs on all but the front pair, and they have big pincers.

Yes; and the crab uses them for all sorts of purposes. They are his hands, his tools, and his weapons, all in one. But can you find his eyes?

Are they not those little shining knobs on two stalks?

Yes; and the crab guards them very carefully. He has no eyelids, so when he is in danger he pulls his eyes under the edge of his shell, stalks and all. He also has a lively pair of feelers, close beside his eyes. His mouth is very funny, for he

has quite a variety of lips and jaws. He breathes by means of gills, which are hidden under his shell. Has he any tail?

I am sure I do not see any.

No; for he carries it as a frightened dog carries his. But turn him over, and you will see his jointed tail, nicely fitting into a little space just the right size for it.



Figure 78.

I hope you will get acquainted with the crabs of our coast; there are so many of them, and they are so curious. There are the green rock-crabs, the reddish-brown kelp-crabs that live among the seaweeds, and a dozen oth-

ers of various shapes, most of them of small size, which you can catch in various places along the beach.

Besides these, there are the mud-crabs, the crabs of the markets, and some very curious ones which live in deep water, and are occasionally caught by the fishermen.

How shall we preserve small crabs?—for we

cannot boil them as we do shells, and take the meats out.

No; but you can kill them in fresh water, and then cure them in dilute "Formalin," which you can get at the druggist's. Use one part of formalin to ten parts of water. You can then either leave them in this liquid, or after a time take them out and dry them. Now, what has Augustus to show us?

I have a Jelly-fish that had been left on the

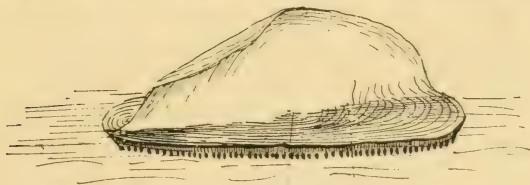


Figure 79.

sands when the tide went down. I thought that it was dead, but it seems to be moving in the jar of sea-water.

Look at it carefully and tell me what you see.

It is almost as clear as ice, and it is as soft as jelly. It is shaped like a bowl turned upside down. From the bottom of the bowl hang down four pieces, which may be lips. When it swims, it quickly makes the bowl smaller, as one might shut an umbrella, and the motion of the water

makes the bowl rise or go forward. I can find no shell, no teeth, nor anything solid about it; but there are some faint purple spots and lines inside.

Very well; you are observing finely. The jellies are very strange creatures, and their bodies are composed of but little besides water. And yet they are very much alive, have excellent appetites, and some of them are very beautiful creatures. There are many kinds, some of them growing to a great size. Others are hardly larger than peas. They have a very curious life history, for the eggs of jelly-fishes are apt to hatch out into something very different from their parents. You will learn of these changes when you study zoölogy.

One of the near neighbors of the jelly-fish is the little Sailfish, or Salleeman. Sometimes thousands of them are blown in from the sea and perish on the beach. When dry, the sailfish looks like a little oval piece of white tissue-paper, about two inches long, while standing up from this is another clear piece, which runs across cornerwise, like a little sail. When found fresh, there are short, blue fringes hanging from the oval piece, and these are like the fringes that you find on some of the jelly-fishes.

Well, John, what have you brought to-day?

I have brought the queerest starfish that I ever

saw; it is not at all like the starfish that I brought yesterday, except that it has a star with a mouth in the center. It has eight arms instead of five, and there is a big round knob in the center, and what looks like a pair of eyes. And it is so lively. Can it be a kind of starfish?

Not at all; though I do not wonder at your mistake. It is a Cuttle-fish, or Octopus. It is really a mollusk, but very different from a snail or a clam. The eight arms have suckers under them, and these arms are to seize and hold the food, much like the points of a starfish. But the cuttle has a beak, and does not have to turn himself inside out when he eats. Your cuttle is a very little one, but they have been found many feet in length, — so large, in fact, that a man would not like to meet one of them.

A near relative of the cuttle is the Squid, which has a long, slender body with a fin at the end. The head has a ring of tentacles around it, like the cuttle-fish, and the creature has two staring eyes. Great numbers of small squid are caught at night by Chinese fishermen. They go out on

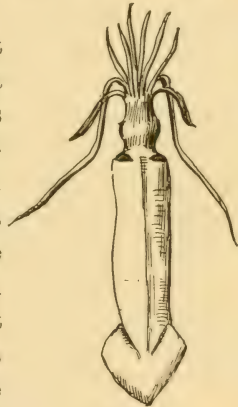


Figure 80.

still nights with great, blazing torches. When the mollusks come up to see the light, they are dipped up in scoop-nets and emptied into the boats.

The next day the Chinese lay them out on frames to dry, or even spread them on the ground and turn them with a rake. When they are quite dry, they are packed in great bags and shipped to China for food. Now, Mary, you are the last; what have you to show us?

O, I have so many things. There are worms and sponges, and so many things of which I do not know the names.

Well, well. But there goes the bell for the lecture. We will take Mary's jar with us, and this afternoon we will sit down and see what she has collected.

BLACKBOARD WORDS.

formalin (fôr'mā-līn), **zoölogy** (zō-öl'ō-gy), **salleman** (säl'lē-man), **octopus** (øk'tō-pus, or øk-tō'pūs).

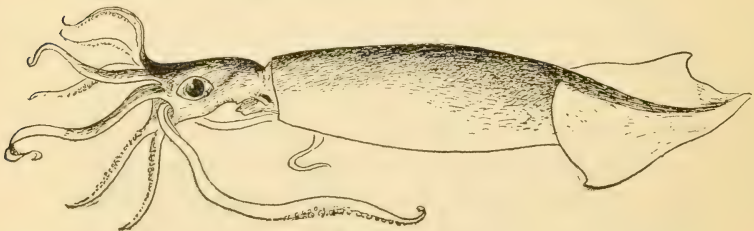


Figure 81.

SEAWORMS, SEAWEEDS. AND OTHER SEA-THINGS.



HERE we are, all together once more. And now, Mary, we will look at your wonderful jar. It may prove to be a vase full of real treasures. And first, tell me, why you put pieces of seaweed in the water.

I have heard that sea-plants help to purify the water for the animals that live in it.

You are right, though a little piece in a jar cannot do very much good. But in an aquarium, where you keep living animals, it is necessary to have a good number of growing plants to supply oxygen. Please show me what plants you have in your jar.

Thank you. This smooth green one looking somewhat like a fresh leaf of

REFERENCE TOPICS.

How to make an aquarium.

Seaweed as food.

Why are worms so much despised? They do not deserve such treatment.

Habits of earthworms.

Life history of a barnacle.

Don't be a Peltogaster!

What does "hermit" mean?

An open eye is better than an open mouth.

lettuce is the *Ulva*, or Green Laver. Some people, indeed, call it Sea-lettuce, but its true name is *Ulva*. It is very bright and cheery, and in the cool water it grows freely. Very often pieces get torn off by the waves, and then it floats or is washed ashore, but it usually grows attached to a rock.

When you gather it, chip off a little piece of the stone on which it is growing, and then it will have an anchor. Then put it in a jar of seawater and set it in the sunshine; perhaps you will be able to see little bubbles of oxygen gather on its surface.

Here is another plant, looking somewhat like the *Ulva*; but it is of a different color.

Yes, and it is called *Porphyra*, or Purple Laver. In Ireland it is called sloke, and to some extent it is gathered for food. It can be dried and afterwards boiled. It is best when gathered in winter or early spring. It is not the only seaweed that is eaten by men, by any means, and there are many things in the sea that we could eat if we were very hungry.

But now let us see the animals. Here is a sea-worm. Where did you find him, Mary?

I found him in the sand, down between two rocks. There seemed to be some hairs growing

on the sand, but when I touched them they disappeared. I was frightened at first, but I dug with my spoon and soon came to this worm. He seems to be almost covered with these hairs; but they are alive, and not like common hairs.

You are quite right; only the creature is perfectly harmless, and there is nothing about him to be afraid of. His true name is *Cirratulus*, but if you do not wish for so long a word, we may call him the Hairy Seaworm, for that means about



Figure 82.

the same. He is a burrowing worm, and much resembles his near relative, the common earthworm of our gardens. Though they seem so lowly, their internal structure is very interesting.

But why does the seaworm have long hairs, while the earthworm is smooth?

What you call hairs are not hairs at all, but little living tubes, full of blood. In fact, they are his gills, and in these his blood is purified. The earthworm does not need them, for his blood takes oxygen directly from the air, through his soft skin.

Do the seaworms swim?

Most of them do not; but some of them swim freely. You may find one that not only swims, but that has a distinct head also. From its mouth project two little black jaws, or teeth, working sidewise, by which it can seize its prey. It is rather flat, and swims with a wavy motion. It has no long gills, which might hinder its motion. Its name is Nereis, which is not a hard word to remember.

There are very many worms in the sea. One kind that you find under stones look like little brown sacks. They seem very sluggish, but if you put them in water, and are patient, they will reward you very well. Some worms live in stony tubes which they construct; when they show themselves, some of them are very beautiful. You can find these tubes on stones and shells, and even on seaweeds. But that is enough about worms for to-day. What else did you find?

Here is a strange shell that I found growing on a rock. It is white, but there are red stripes on it, and it is shaped somewhat like an acorn.

And it is called the Acorn-barnacle. When barnacles are very young, they resemble little shrimps, but they soon settle down on a rock, build a shell, and never swim again.

This shell consists of five side-pieces which are grown together, and a pair of movable ones at the top, resembling a duck's beak. When the creature is under water, it opens this beak, and throws out a scoop-net to gather food. It is very interesting to watch this curious motion.

Another barnacle has no side-pieces, but its beak is attached to a long fleshy stem, which it-



Figure 83.

self is attached at one end to a rock or a piece of floating wood. Great numbers of them may be seen clinging to the wharves, along with mussels and seaworms.

Some barnacles seem anxious to get a free ride. They will select the back of a crab or the bottom of a ship, while one kind is very partial to the skin of a whale.

The crab carries his barnacles about till he

sheds his old shell; the ship sails around, and is hindered by them, till it can be put into a dry-dock, where its barnacles can be scraped off. If there is a river near-by, it may be sailed up into fresh water, where the barnacles will die of their own accord, for they cannot live without salt.

But the poor whale cannot escape, and he must carry his unpleasant passengers all over the ocean. For, though he is big and strong, he is very helpless in some respects. It is said that whales select a lonely shore, at certain times of the year, and rub themselves against the rocks, to free their skins from the hated barnacles. I suppose they dislike barnacles as much as smaller creatures dislike fleas.

And are many creatures in the sea troubled in the same way?

O yes; there seem to be many that are thus troubled. There is a degraded kind of barnacle that attaches itself to the body of a crab and gets all its nourishment from the crab's blood. It is a very mean way of living, but the barnacle pays the penalty.

What is that, pray?

Why, he loses almost all his organs, and becomes a mere useless sack, without eyes or legs, or even digestive organs. He does no good, so

far as we know, but he helps to destroy a creature that is better than himself.

I fear there are some people in this world that are not willing to work for themselves, but prefer to get their living from others. And if one were to call such a person a *Peltogaster* (which is the name of that ugly barnacle), he would think it was a hard name; but I fear it would be a true one. Whatever you do in life, don't be a *Peltogaster*. But there is one thing more in the jar, is there not, Mary?

Yes, it is a Black Turban-shell, and I thought it was empty at first, but when I put it in water there seemed to be something in it that was alive. See, the creature has legs; so I know that it is not a mollusk.

That is good reasoning, surely; but let us see the shell.

Is it not a Black Turban?

Yes; but the mollusk that made the shell is dead, and a stranger has taken his place.

What is the name of the stranger, please?

It is the Hermit Crab, so called because he lives all alone in a little cell. The cell is anything he can find which fits his body, but usually he selects an empty shell.

This crab does not have hard plates all over

his body, like the rock-crab, but only his front is thus protected. The rest of his body is soft, and must have some covering. So he finds an empty shell and backs into it. Then he has a pair of clasps, by which he can hold on very firmly.

When he is well settled in a shell, he feels very much at home, and he will even let you pull him in pieces before he will leave it. So it is of no use to try to pull him out.

But he comes part way out, of his own accord.

Yes; he comes out far enough to use his legs, and then he runs around, carrying his house with him. But if you frighten him he will draw back very quickly, and will close up the opening of the shell with his big, hard claws.

But what if he should grow? Would not the shell be too small for him to live in?

Yes; and then he would leave it, when he had found a larger one to live in. Sometimes two crabs will fight for the possession of an empty shell, "tumbling over each other, and flinging their legs and claws with singular energy."

Although the hermit crab is so unwilling to leave his shell, it is said that he can be forced to do so by dropping him on the open arms of a sea-anemone. The poor fellow knows that it would be sure death to remain, so he hastily let:

go of the shell, and scrambles away from the dangerous place as rapidly as possible.

In the little tide-pools you can often find great numbers of hermit crabs in their borrowed shells. Some of them are very small, and live in shells not more than half an inch long. It is very interesting to throw them some bits of fresh meat and see them scramble for it.

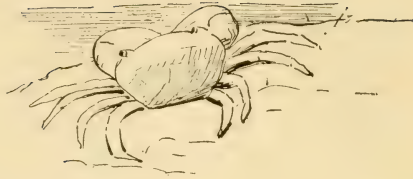
The hermit crabs are great shell-hunters, as you might suppose, and by means of their aid you are sometimes able to obtain the shells of mollusks that usually live in deeper water.

Some people who see the crabs in their shells think that they are the creatures which made the shells; but we know better, don't we?

Always keep your eyes open, and think about what you see. In this way you will gain the habit of observing, which will be very useful to you throughout your whole life.

BLACKBOARD WORDS.

aquarium (â-quā'ri-ŭm), **Ulva** (ŭl'va), **Porphyra** (pôr'fī-ra), **Cirratulus** (sīr-rāt'ŭ-lŭs), **barnacle** (bār'nā-kl), **Pelto-gaster** (pĕl-tō-gās'tēr).



THE CRABS' TEA-PARTY.

I.

A JOLLY old Crab said, one day, to his wife,
“ My dear, I ’m afraid I am wasting my life ;
For, you see, I keep getting,
Without ever giving,
And a miserly life
Is not worth the living.
So, I pray you, advise me how I should behave ;
For I wish to impart, as well as to save.”

II.

“ Mr. Crab,” said his wife, as she took a shy look,
“ I suspect you ’ve been reading some new-fangled book
For ’t is not the old custom,
In our part of the sea,
For a Crab to care much
Who his neighbors may be.
If they ’re poor, he cares not, neither cares if they ’re wealthy,
Unless he feels pleased in a way men call stealthy.”

III.

“ But, then, if you do really wish to be good,
Of course I ’ll advise you, as any wife should.

Call your neighbors together,
And give them a tea ;
’T will make them as happy
As happy can be.

And then make a speech, and present to each guest
Such a gift as you think would please him the best.”

IV.

“ You are right,” said the Crab ; “ and I give you much praise
For your kindly advice as to mending my ways.

We will have it to-morrow,
A real five-o’clock tea.
Will you wait on the table,
Or would you be free?”

“ O, I ’ll wait,” said his wife ; “ but now hurry away,
For our invitations must go out to-day.”

V.

Then off ran the Crab, as fast as a sprinter,
And carried these words to Octopus, the printer :

“ Mr. Crab and his Wife
Would most happy be
To receive you to-morrow.
Five. R. S. V. P.”

“ And, please, Mr. Printer, will they be done soon?”

“ They ’ll be ready,” said he, “ precisely at noon.”

VI.

All the afternoon long Crab went spreading the news,
And wondering if many would really refuse ;

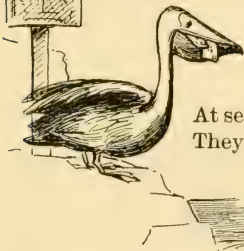
“ For,” thought he, “ some may say

That my previous dealings

Do not quite agree

With such kindly feelings.

But, I ’m sure, when a crab really tries to do better,
That no one should send him a cold-hearted letter.”



VII.

At seven, the next morning, by Pelican post,
They received of acceptances almost a host.

But some wrote regrets,

And said, “ We must beg

That you would excuse,

For we have n't a leg.”

“ Then send them a carriage, poor things,” said his wife.

“ I'll do it,” cried Crab, “ just to let them see life.”

VIII.

So he ordered his hackman, by name Mr. Shark,
To go round with his carriage (a red Noah's ark

Which a small boy had lost,

One day, on the beach),

And to bring all the creatures

That were within reach.

“ And come back precisely ten minutes to five.”

Mr. S. flapped his fins, meaning, “ Sure 's I 'm alive.”

IX.

At a quarter to five, 't would have done your heart good
To see Mistress Crab arranging the food.

There were halibut steaks,

And Irish moss pies,

And fresh-opened oysters,

And dainty squid's eyes.

With sea-lettuce for salad, and eel-grass for greens,

And toasted sea-biscuits, and salted sea-beans.

X.

The soup was of fish-fins well seasoned with kelp,
With slices of green sea-cucumber to help.

The maids laid the dishes

Of blue mussel-shell,

And the fair mistress smiled

And said, "All is well."

Then she hurried away to welcome the guests,

And to bid them be free to make their requests.

XI.

Then old Mr. Crab shook them each by the toe,—
For that is polite in Crab country, you know,—

And said he was pleased

In this simple way

To impart some of the pleasure

Which he felt that day.

Then he offered his arm to Miss Flat Razor-shell,

Who, of all the fair guests, was voted the belle.

XII.

Thus they marched to the dining-room, which, by the way,
 Was a lovely broad rock in a snug little bay;
 And they sat down by twos,
 With old Crab at the head,
 While his wife, at the foot,
 Was blushing quite red,
 For her partner, young Lobster, was praising her beauty,
 And saying he really was doing his duty.

XIII.

There were Limpet and Shrimp sitting snugly together,
 While Flounder and Toadfish looked fine as a feather;
 And prickly Sea-urchin
 And purple Starfish
 Were lovingly eating
 Out of one dish;
 And a great Abalone was sharing his plate
 With a delicate Jelly-fish, who was his mate.

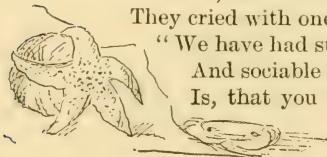
XIV.

Thus they chatted and feasted until it was time
 For them all to depart: so I'll finish my rhyme.

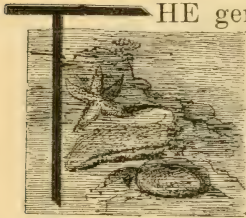
And when Mr. Crab said,
 "Now, each choose a present,"

They cried with one voice,
 "We have had such a pleasant

And sociable time, that our only request
 Is, that you and our hostess may ever be
 blest."



SOME OTHER LITTLE SEA-CREATURES.



THE general term "seaweed" is made to include a great number of living things which differ widely from one another. In the first place, it seems hardly proper to call any of them weeds, for by a weed we commonly mean a troublesome plant which grows where it should not.

The sea-plants are neither troublesome nor out of place; so when we speak of them as weeds, we use that word simply to mean plant-life, without any thought of slight or reproach.

And yet some things are classed among the seaweeds which are not plants at all, but are really animals. We surely ought to distinguish such as these from true sea-mosses.

REFERENCE TOPICS.

- The microscope and its uses.
- Alternation of generations.
- Corals and coral islands.
- Precious coral.
- Gathering and preparing of common sponges.
- Why use "new bottles"?
- Means of defense for the various animals of the sea.

It is very interesting to notice how closely some animal forms resemble the vegetable growths which are found near them. We see it on the land, sometimes, as in the case of the "walking-sticks," which look so much like the twigs of the trees on which they live. But more examples are found in the sea.

The most beautiful of our Pacific Hydroids—for that is the name of these animals that resemble plants—is the delicate Feather-moss, a picture of which is shown in the engraving. It grows in tufts attached to the rock, and pieces are often torn off by storms and thrown up on the beach with the sea-mosses. This feather-moss is often dried and used with other mosses in making wreaths and pretty sea-pictures.

But if you examine it carefully with a microscope, you will see that the feather is only a framework, and that in its edges are hundreds of tiny cups. Each of these cups once contained a little animal, called a polyp, with arms and mouth somewhat like those of a sea-anemone.

All of these little polyps are connected, and together they secrete the horny material which takes the form of a feather. Old polyps may die near the bottom and new ones grow near the tips.

If you watch carefully, you may find several

other forms of these plant-like hydroids. Some you may find growing on old shells, looking like little, stiff, brown grasses an inch or two in height. Others are quite long and slender, like threads, and they have numerous branches.

But the test for them all is the microscope, which need not be more than a pocket-lens. All of the true hydroids have little cups on their sides, looking sometimes like fine saw-teeth. And if you get a live specimen and put it in a dish of sea-water, you may be able to see the little polyps unfold their pretty arms, like the opening of a flower. But they are very shy, and at the least fright they draw back into their sheltering home.

There are very queer stories told us about these hydroids by men who have carefully studied their life-history. They seem to be



Figure 84.

closely related to the jelly-fishes, as if one came from the other; but just which is the parent and which is the child, I will not attempt to say.

There are plenty of things left in the sea yet, which are waiting for more careful study. Perhaps some of you will help read the puzzles.

Large Corals require warmer water than that which bathes our coast, and so we have no reefs and no coral islands such as those which are so numerous off the coast of Florida and throughout the tropical parts of the Pacific Ocean.

But we have true corals on our coast, most of them no larger than a lady's thimble. There is a very pretty red variety which you sometimes find growing in a rock grotto when the tide is out.

It looks like a little lump of red jelly, but when you touch it, the animal shrinks down, leaving a little hard, red, stony case, no bigger, perhaps, than a pea. This case is made up of many blades of limestone set like the spokes of a wheel.

If you chip off a piece of the stone on which the creature is growing, so as not to injure him, and put him in water, you may be able to see him come out of his stony home and open his arms, like his near relative, the sea-anemone.

In the same places you will be still more likely to find Sponges; though our sponges, like our

corals, never grow very large. The common forms may be found in sheltered places, looking like patches of velvet growing on the surface of the rock. Sometimes this velvet is bright red, and sometimes purple or yellow.

The patches will vary in size, some of them being larger than your two hands. The velvet is generally less than a quarter of an inch in thickness, and there are numerous holes in its surface, which are the breathing-pores for the sponge animals.

Sometimes you will find larger pieces of dead sponge washed up on the beach with the seaweeds. These are brown in color, or may be bleached almost white, and are of a fibrous nature, but not very tough. There are other forms of sponge in the sea, waiting for you to examine their wonderful structure.

In the rock grottoes, where we find the corals and sponges, are many other strange forms of life. One of the most common forms, as well as one of the most difficult to understand, is that of the Tunicates, or Ascidians.

Both of these names are rather long, though they each have their meaning; the first referring to a tunic, and the second to a bag, or sack. In the Bible we read that "new wine must be put

into new bottles." The Greek word for bottle, from which one name of these creatures is derived, means a leather bag; for wine was not kept in glass in Bible times, but in skins. So we may call these creatures, Sea-bottles.

Some of the sea-bottles are single, and look like a sack with two mouths, — one for the water to go in and the other for it to come out. But those most common on our rocks are compound, great numbers of them being attached together. They form a firm, leathery coating, of a gray or yellow color, which may be as thick as your hand. Its edges are rounded, and you can see that it contains many little spaces for water.

Others look like flattened tubes, an inch or two long, and as large around as a pencil. They are almost transparent, but within their bodies you can see a bent pink thread, which gives them an odd appearance. When the tide is out, they hang from the rocks like living fringes.

And when the tide is low you may find Sea-slugs in little pools or on the seaweeds. These are real mollusks, which never have shells. Some of them may be as large as your finger, while others are no bigger than a steel pen.

They are very soft to the touch, and their mantles are often beautifully colored, some being

lemon-yellow, others white with red spots, and others a beautiful blue with brown trimmings. When put into water they expand their gills and ruffles, and show their beauty to great advantage.

Sometimes you can find them strangely creeping on the surface of the water, with their bodies hanging downward, so that they really are walking on air.

These are some of the most common creatures that you will find in the sea. But you may expect also to find many others that are not mentioned in this book. Remember that each creature must have its own means of getting food and breath and of defending itself from its enemies. In each case, try to find out what these are.

BLACKBOARD WORDS.

Hydroid (hī'droid), **Tunicate** (tū'nī-kāt), **Ascidian** (ās-sīd'i-ān), **troublesome** (trūb'l-sūm), **polyp** (pōl'ip), **transparent** (trāns-pār'ēt), **leathery** (lēth'er-y).

HOW SEA-BIRDS KEEP HOUSE.



If you climb one of the hills about San Francisco or Oakland on a very clear day, you can see the ocean stretching out into the far west. Perhaps you will also see a ship just coming in from China, or a steamer just leaving for the Sandwich Islands. How small the vessels look,—like little specks on the surface of the great salt sea.

Probably there are plenty of birds flying around the ships, but they are so far away that you cannot possibly see them. But if you look closely beyond the ships, and if there is no fog, you can see two small islands which seem to rise up out of the water, just where the sea and sky come together.

These small islands are called the Farallones, and they are the home of a few men and their families,

REFERENCE TOPICS.

The horizon.
Ownership of islands.
What are rooks?
Light-houses.
Nesting of other birds.
"Home, sweet home."

one mule, some wild rabbits, and thousands of sea-birds.

The men tend the lamps of the lighthouse, which stands on the top of the largest island, the mule carries oil and provisions from the boats to the houses, the rabbits eat a coarse weed which grows among the rocks, and the birds keep house and raise their young ones.

Their housekeeping is not just what we would expect, for many of them do not take the trouble even to build a nest. Others build very slightly, of dry weeds and sea-mosses, which they must carefully guard, lest they be stolen by other birds who also wish to set up housekeeping.

The Murres are the most numerous birds on the islands, and they are the ones which make no nest at all. The mother murre lays one very large green-shelled egg on the bare rock, and at



SOUTH FARALLONE ISLAND.

once proceeds to sit upon it closely, lest it should be stolen, instead of the nest.

A few years ago great numbers of murre's eggs were gathered on these islands every summer, and



THE FARALLONE MULE.

sold in the markets at about the same price as hen's eggs. But boiled eggs never hatch, and when it was found that the number of birds was decreasing, the gathering of eggs was stopped by government officers, and now there are plenty of young murre.

But sea-gulls abound on the Farallones, as well as murre, and the gulls refuse to obey the law not to steal eggs. If the mother murre leaves her egg even for a minute, a gull pounces down and



BABY GULL IN NEST.

seizes it in his beak. The gull knows how to break an egg as well as you do; so he flies up a little way and drops the egg on a stone. The



Figure 85.

thick shell breaks, and at once Mr. Gull swoops down and begins to eat the rich contents.

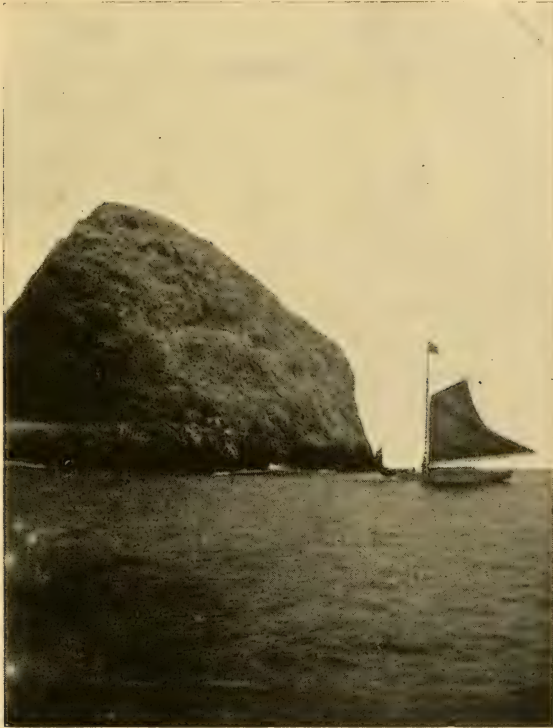
The murrets crowd together in their rookeries, as their house-keeping grounds are called, and should a gun be fired, a great cloud of birds will rise up from the rock, leaving their eggs scarcely a foot apart upon its bare surface.

The gulls build a slight nest, in which they lay several eggs, and so do the cormorants, those tall sea-birds which are so swift of wing. Mr. Taylor, who has studied the birds so much, tells us that the young cormorants have neither feathers nor down, but their skins look like black leather.

The Puffins also live on the islands. They are queer-looking birds, and have been compared to parrots. They have a sharp, hatchet-shaped beak, and funny white eyes. They lay their eggs in burrows, and defend them with much spirit.

And so the birds make their various homes on

these barren islands, and find them an excellent place for summer housekeeping. They are too far from the mainland to be often visited, and as the United States government controls them, no



SUGAR-LOAF ROCK, FARALLONE ISLANDS.

HARRY R. TAYLOR, now a newspaper-writer, lives in the city of Alameda, California. He has studied birds extensively, both those which live near the sea and those which are always found on land. He has traveled through lonely valleys and climbed rough mountains, seeking for the nests of rare birds, in order to properly study the habits of their builders, and has spent considerable time on the Farallones with the sea-birds. Mr. Taylor has written extensively on the subject of birds, and has published a delightful little book called *The Story of the Farallones*.

one is allowed to land without permission. We may be very glad that they are thus kept for the vast flocks of sea-birds.

Other creatures, as sea-lions, live in the water near the rocks, and sometimes creep up their sides, and I once saw a number of whales swimming close to the island cliffs.

The Farallones are the first land one sees when

coming in from a long voyage over the broad Pacific, and though they are rocky and barren, they then seem like the finest land in the world. They tell you that you are almost home; and how sweet that word sounds after you have sailed for thousands of miles!

The bright beam from the lighthouse warns ships in the night to keep away from the rocks, and when the fog hangs over the ocean, great steam-whistles are loudly blown.

So if you ever see the Farallones from some hilltop, or pass them while sailing, remember that they are the great home of the sea-birds.

And think that they are more than that; for they are also a guide to the sailor, showing him by night and by day just how to steer his vessel in order to reach the home-land, the land which he loves the best.

BLACKBOARD WORDS.

Farallones (fär'äl-lōnz), **murre** (mēr), **rookeries** (ruk'ēr-iz), **cormorant** (kōr'mō-rānt), **puffin** (pū'fīn), **decreasing** (dē-krēs'īng).



BIRD ROCKS.

THE SONG OF THE SEA-BIRD.

I.

THE wind is awaking,
The tall trees are shaking,
The sand on the seashore is driven like snow ;
Arouse from your resting,
'T is time to be breasting
The gale that is now leaping up from below.

II.

Up, every bold feather ;
What care we for weather ?
The sea-bird is happiest when storms round him play ;
To him the huge billows
Are like softest pillows,
And he screams with delight in the midst of the spray

III.

When the green waves come dashing,
With thunderous lashing,
Against the bold cliffs that defend the scared earth,
He wheels through the roaring,
Where foam-flakes are pouring,
And flaps his broad wings in a transport of mirth.

IV.

Then off o'er the ocean,
Where wildest commotion
Is changing its surface from plains into hills,
The sea-bird goes proudly,
And calls his mate loudly,
To follow him flying wherever he wills.

V.

To these comes another,
Who calls for his brother,
And soon a long line of swift sea-birds is seen,
Which falls, and then rises,
With many surprises,
Like the fabled sea-serpent, the broad waves between.

VI.

By darting and diving,
And artful contriving,
With the richest of sea-food the whole flock is fed ;
Then away to the nesting,
And back to the resting ;
For it's well that brave fishers should homeward be led.

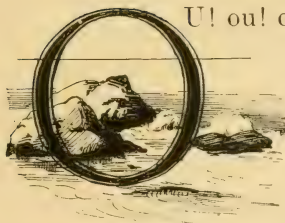
VII.

So free is our motion
O'er earth, air, and ocean,
That we range where we will, and feel never a fear.
Whate'er be the weather,
It can harm not a feather ;
So, my happy companions, I give you good cheer.



SEA-LIONS AT HOME.

SEALS AND SEA-LIONS.



U! ou! ou! ou! What a strange cry, — something between the moo of a cow and the bark of a hound. The sounds are short and quick, each one occupying less than a second of time, though they can be heard for a considerable distance along the rocky shore.

Besides these barking you can also hear deep, ugly growls, and from all of these sounds you are apt to reach the conclusion that the creature which is making all of this fuss is in a very unhappy frame of mind. Probably you are mistaken in this thought; but, then, it is not easy to tell just when a sea-lion is contented and happy.

REFERENCE TOPICS.

Why are sea-lions so called?

Meaning of Point Lobos.

History of the "Cliff House."

Golden Gate Park.

Efforts to protect seals.

Read Dr. Jordan's "Matka."

Use of seal-fur.

Cost of fur garments.

Man's selfishness is destructive.

Most wild creatures are apparently happy when they have enough to eat and a good place to sleep, and are in no danger of being disturbed. How contentedly a pussy-cat will blink and purr when she feels that all of her immediate wants have been supplied. On the whole, I believe that most creatures have a pretty good time during the greater portion of their lives. I certainly hope that this is true, and I have no patience with any one who seeks to worry or torment any living creature. You should do to others as you would be done by, even if the "others" are only dogs or birds or horses.

The sea-lion may be barking for very joy; and as for his growls, they are only his customary salutations to his neighbors when they get in his way. Sometimes he fights, to be sure; but in spite of all his quarrels, he contrives to grow very big and fat. It would take a large horse to weigh as much as a large sea-lion.

Look at the picture, and you will get a good idea of these creatures, even if you never saw them alive on any of the "seal-rocks" that are found here and there along the Pacific coast. The rocks just west of San Francisco, near the famous Cliff House, abound with sea-lions, and they lie so near the shore that the movements of

the creatures are easily seen, while their cries are heard continually.

In the picture you notice one fat fellow half-way out of the water. His eye is bright and his mouth is open. He is the one that is saying Ou! ou! ou! The others hear him, but they are not disturbed, though some of them will probably answer him back with interest.

See the huge creature that has just worked his way out of the water. He is so big and fat that he looks like an enormous sack of meal, wrinkles and all. Higher up the rocks are many others, some lazily sleeping, while others are weaving about in an uneasy manner. Soon they will begin to slip down the rocks and plunge into the sea.

The principal food of the sea-lion is fish. He is a very expert fisher, and it is to be feared that he sometimes kills more fish than he cares to eat. Many of the sea-lions along the coast have been shot during the last few years, because they are believed to impair the fishing for the men who go out in boats.

There are several different animals that are commonly known as seals. The great sea-lion is one of these; the fur-seal of the north, sometimes known as the sea-bear, is another; while the true hair-seal, that swims along our coast, is a third.

The hair-seal seldom touches land, though it may often be seen near to the shore, swimming freely, and occasionally throwing its round head out of water and looking around with its big, kindly eyes. Most of these seals are rather small, — perhaps three feet long. Their skins are covered with short, coarse hair, and are of no use as fur, though they are often tanned with the hair on and used for covering trunks and making knapsacks. These seals have no external ears.

The sea-bears, or true fur-seals, differ much from sea-lions and hair-seals. Beneath an outer coat of coarse hair they have an under coat of the softest and finest fur that you can imagine. When the skins are prepared for market, all of the coarse hairs are pulled out, and the soft fur is dyed a rich dark brown.

In the summer-time the sea-bears of the north come in from the ocean and gather on the shores of a few small islands off the coast of Alaska.

How they can find their way through hundreds of miles of waves and fogs to their old home is something that we do not understand. They surely must have powers that man does not possess.

Here they gather into families; each household consisting of a big, surly male, who comes first,

and as many of the small, gentle females as he can induce to live with him, as they come in from the sea, together with all he can steal from his neighboring lords.

Sometimes he will get thirty, and again only one or two; while many males, especially the younger ones, are obliged to keep bachelor's hall. There is no end of growling and scolding and fighting, and blood often flows freely.

For fear of thieves, the head of a family dares not leave his home, even to get a mouthful of food, and so he fasts all summer, and lives on his own fat. Sometimes a thief comes up slyly and catches up a female seal in his mouth and tries to carry her off to his home. This act enrages her master, and in the fight that follows between the two big seals the poor thing is almost torn in pieces.

The young seals are born in these households, and are cared for by their mothers until they learn how to swim and can catch food for themselves. Then all the seals begin to slip off to sea, and gradually the summer home is broken up. The males leave last, and then the islands remain lone and bare during the long winter.

While the seals are on the islands, some of the males that have no families to care for are selected by the men in charge of the station and are driven

inland, where they are killed and skinned. The natives preserve most of the flesh for food, while the skins are shipped to London. There they are tanned, plucked, and dyed, after which they are sent to different cities and made into beautiful capes, caps, and other garments.

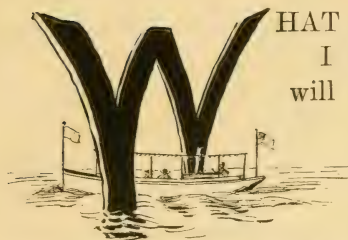
Seals are also killed from boats and ships at sea, sometimes many miles from the islands; but this is unlawful and cruel, for most of those that are thus caught are mother seals that are gathering food to provide for their young. If the mothers are killed, the pups, as they are called, will starve to death on the islands, and so the herds of seals that furnish so much beautiful fur will become smaller and smaller as the years go by.

The United States and Great Britain are trying to stop this wasteful catching of seals, but they find it difficult to prevent it altogether. Let us hope that they may be more successful in the future, and that the seals on the islands may be allowed to increase.

BLACKBOARD WORDS.

salutations (säl-ū-tā'shūnz), **knapsack** (näp'säk), **immediate** (im-mē'di-āte), **weaving** (wēv'ing), **enormous** (ē-nôr'müs), **bachelor** (bäch'ē-lôr), **enrages** (ën-rāj'ëz), **wasteful** (wäst'ful).

A WATER-TELESCOPE.



WHAT is a water-telescope?"

I suppose this question will be the first one to be asked by every boy or girl who begins to read this chapter. It is a proper question,

too, for it is always well to find out at the beginning what we are to read about.

Well, then, I will reply that it is not a telescope at all, if we use that word in its strict meaning.

A real telescope is an instrument which helps to see distant objects by making them seem nearer. The largest telescopes are used by astronomers, who wish to study the moon or the stars.

Many common telescopes are called spy-glasses, and are used in looking at dis-

REFERENCE TOPICS.

- Structure of telescopes.
- Great telescopes of the world.
- The increase of knowledge by means of the telescope.
- The sea as a great aquarium.
- The abundance of sea-life.
- Pearl-oysters and pearls.
- The beauties of the sea.

tant objects on the earth, like the trees on a mountain side. Still smaller ones are known as opera-glasses. These are not very powerful, but are convenient in a large hall, when one wishes to see the features of the speaker or singer more distinctly. But all true telescopes are used in air, and never in the water.

A water-telescope is an instrument which will assist one to see objects that are underneath the surface of water, particularly those that are at the bottom of a lake or bay.

If you go out in a boat, you know how hard it is to see the fishes that are swimming about in the water beneath you. Almost all the time there is a breeze, which makes ripples on the surface of the lake, and you know you cannot see clearly through ripples.

Even if there is no wind, the boat itself makes little waves, and though the water is only ten feet deep, it might just as well be a hundred, so far as seeing the bottom is concerned. A water-telescope destroys the ripples, and lets you look through water as if it were clear glass.

It is nothing but a box with a water-tight glass bottom. If you set this box on the water, and press it down a little, you will find that when you look into the top, you can see through the glass,

right down into the clear water beneath, just as if there were no ripples or waves at all.

Sometimes a water-telescope is made by taking the bottom out of a wooden pail and putting a circle of glass in its place. But it is generally easier to fit a pane of glass into a strong box, and then make all the cracks tight by the use of putty and paint.

The best water-telescope that I ever looked through was set in the bottom of a boat. In fact, there were four of them, set end to end, so that they ran almost from one end of the boat to the other. The boat had been built on purpose for them, and was wide and flat. In the center was an open space, or well, which had no bottom at all, though a strong curb ran around it, so that the water could not come into the boat, even when it was well loaded.

In this well were set the telescopes, which were deep, narrow boxes, just fitting the curb. Their bottoms were of clear plate glass, which was kept very clean by frequent washings with a soft sponge. There was a kind of canopy over the boat to keep off the bright light from above, for the things we wanted to see were all beneath us. There were seats along the sides of the boat for the passengers, and one cross-seat near the end

for the man who rowed us about. We each gave him twenty-five cents and took our places in the boat. Then we all looked into the boxes, and found, to our delight, that we could see the bottom as clearly as if we had been fishes ourselves.

The place was a quiet spot in Monterey Bay, where the bottom was partly rocky and partly sandy, and the cool ocean water was as clear as glass. Looking over the side of the boat, we could see little but ripples, but when we bent over the water-telescopes, it seemed as if we were right at home with the creatures of the ocean.

The seaweeds first attracted our attention: They were growing gracefully upon the rocks, some of them being bright green, like leaves of lettuce, while others were of an olive color, tall and branched, and looking almost like trees.

Some of them are, indeed, called sea-oaks, and they grow in water that is twenty feet deep, reaching from the bottom almost to the surface. Then there were fields of seagrass as green as that of the freshest lawn on the land.

This grass was a yard high or more, and we thought what a swath we could cut if we could only go down into the sea with a scythe. On this grass live many little animals, just as you see flies, and bugs, and spiders on the grass of a hay-field.

But soon we passed on a little and saw still more beautiful sights. The gray rocks beneath us were almost covered with purple sea-urchins, their straight spines standing out in every direction. Most of them were so large that you could not put one in the crown of your hat until you had taken off his spines, and they looked so happy and comfortable that you would not want to do that. With the spines on, many of them were as large as tea-kettles, and in some places they were packed on the rocks as thick as they could lie.

Again, there would be groups of little ones no bigger than your fist, but, big or little, they were all very interesting objects. And the best thing about it was that they were all at home, living just as they liked to live, in the clear, cool, and deep water of the bay, and not shut up in a glass aquarium, like a wild bird in a little cage.

Besides the sea-urchins, there were many other living creatures, such as we sometimes see from the shore, only larger and more perfect. There were sea-anemones blossomed out like great flowers; huge abalones resting on the rocks, their great shells raised slightly to let the water circulate freely; starfishes of various colors, yellow, red, and purple; and then true fishes, swimming about so gracefully, and seeming to take no notice

of the boat that was sailing right over their heads, or, more properly, over their backs.

One of these fishes had rings of black running around his light-colored body, making him look like a prisoner in San Quentin. He is very properly called the "convict-fish." He grows to be about eight or ten inches long, has a sharp nose like a pig, and always seems to be near the bottom, searching for food among the rocks. They say he is seldom caught with a hook.

Sometimes quite a large fish would swim right under our boat, and again we would see a whole school of sea-minnows, or shiners, darting away in various directions, and then coming together again, like bees in a flying swarm.

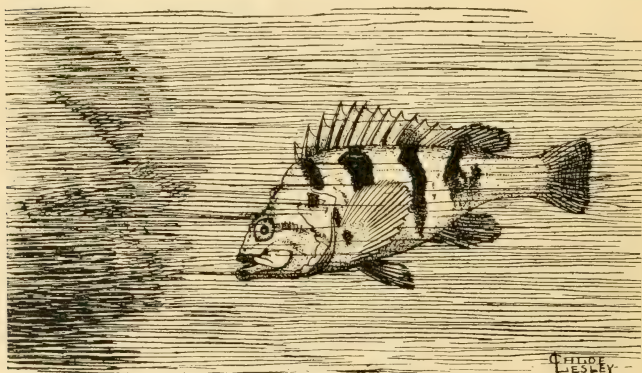


Figure 86.

We kept near the shore, as the life is more abundant there, and besides, when the water is too deep, it is hard to see what is going on beneath you. But when we saw the fishing-boats come in with their loads of beautiful silver-sided salmon, we wished that we might have had a telescope that would have shown us the wonders of the deeper sea.

When we stand on the beach and look out over the waves, we can imagine some of the wonderful things that are going on beneath them, but we cannot really see the great fishes darting here and there in pursuit of their prey, nor observe the broad pearl-oysters resting on the bottom, nor watch the hundreds of beautiful creatures that have their home far away from man's sight.

And yet we know that they are there, for sometimes the boats let down hooks and dredges and bring us up a few specimens. And so we

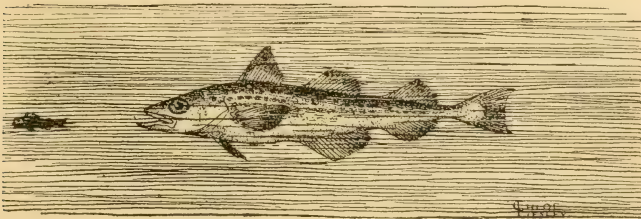


Figure 87.

picture to our minds the wonderful ocean home. We think of all that we might see there, if our eyes could only get the chance, and we try to imagine what we never can hope to behold.

But with the wonderful water-telescope we can really see a great many of the creatures that live near the shore, and they seem so much more beautiful than we had supposed, that we are ready to believe that if we could only live there, we should find the ocean as rich and interesting and as full of life as the land or the air.

I hope that you may all have a chance some time to go out in what is called the "glass-bottomed boat," and if you do, I am sure you will be surprised and pleased to observe what wonderful plants and animals live beneath the blue waves.

BLACKBOARD WORDS.

telescope (tél'ē-skōp), **astronomer** (ās-trōn'ō-mēr), **convenient** (kōn-vēn'yēnt), **concerned** (kōn-sērnd'), **canopy** (kān'ō-py), **scythe** (sīth), **shiners** (shīn'ērs), **aquarium** (ā-quā'rī-ŭm).

THE HARVEST OF THE SEA.



FROM the sea comes much merchandise. Thousands of men earn their living by helping to gather it in. Thousands more prepare it for market, transport it to convenient stations, and then expose it for sale in the stores and deliver it to buyers.

If the harvest of the sea should fail for a single year, there would be great distress in many homes, and the business world would be greatly disturbed.

The harvest of the sea may be divided into three groups; namely, mineral, vegetable, and animal products; and the last of these three is of far more value than both of the others. We will take them up in their proper order.

REFERENCE TOPICS.

- What are crystals?
- Formation of salt crystals.
- Uses of chlorine.
- Beware of swindlers.
- Iodine.
- Codfish industries.
- What fish can you watch, to find out its habits?
- The sea-otter, and its fur.
- Whalebone, and its uses.
- Diving for pearls.
- The sea as a great store-house.

The mineral product consists chiefly of salt, great quantities of which are obtained from sea-water by evaporation. California has a fine climate for this work during a part of the year, for there is no rain in summer, and the warm and dry air rapidly takes up the moisture from the salt-ponds.

Most of these ponds are located in Alameda County, on the low lands adjoining San Francisco Bay. The ponds are shallow basins that can be easily filled from the bay with the salt water that is to be evaporated by the heat of the sun.

When most of the water has evaporated and the brine has become very strong, the salt settles in crystals and is raked out and thrown up into great white piles shaped like tents, which can be seen across the marshes for a long distance. During the year 1898, Alameda County produced 87,800 tons of salt, valued at \$155,812.

Besides common salt, certain other chemical salts are obtained from sea-water, but the amount is not very great, since most of them are now found in mines and springs. From common salt, however, very valuable products are manufactured, such as soda and chloride of lime. These are used in the making of glass, soap, paper, and white cloth. So everybody uses sea-products every day.

There is said to be a trace of gold in all sea-water, and many efforts have been made to extract it profitably. A few years ago a speculator put up works on the coast of Maine for taking gold out of sea-water. He would sink his cans beneath a wharf, and pass electricity through them all night.

In the morning, when they were pulled up, they were found to contain considerable gold, and many people paid him large sums of money for a share in the business.

He took their money and soon disappeared. When he did not come back, they began to look around, and at length it was found that he had employed a diver to go down into the water, each night, and put the gold into the cans. It is not probable that the sea will be used as a gold mine again, till people have forgotten this wicked cheat.

The vegetable products of the sea consist chiefly of various kinds of mosses or seaweeds which are used for food or are employed in the arts. Some nations, as the Japanese, eat seaweeds very freely, while Americans eat them but little, though they make some use of them as medicines.

From sea-mosses we can extract much gum or mucilage, which is used by clothmakers, and the refuse can be made into a stiff pasteboard for

book-covers. From the ashes of seaweeds several valuable salts can be obtained, especially the salts of iodine.

The salt grass of the seashore is carefully saved in some countries of Europe. It is made into a coarse hay, which is used instead of straw as a packing material, especially in crates and boxes containing glass or earthenware. Perhaps you have seen it when such cases have been opened.

We now come to the animal products, and here we find a great variety. Fish, doubtless, heads the list, as by far the most valuable; and then come the other kinds of food, as oysters, clams, lobsters, and crabs, while oil, whalebone, sponge, and pearl follow on, the yield of each one being worth vast sums of money every year.

There are more kinds of fish taken from the sea than you or I could count in a long time, but a few of these are more valuable than all the rest put together. Sharks are the largest fishes, but few people care to eat their flesh, though the Chinese esteem their fins a delicacy.

But almost everybody eats salmon and cod and mackerel and herring. They are eaten fresh by those who live near the shore, while for other people they are preserved in various ways and sent all over the world.

Salmon is canned, or salted, or smoked, and it is good eating in any of these ways. Codfish is preserved in brine, and then, when it is well salted, it is spread out in the sunshine and thoroughly dried. The crisp fish are then either packed in large bales, or pieces of the best parts are made into white "bricks," which go to the kitchen and are "picked up" by the cook, freshened, and then made into delicious fishballs.

Mackerel are preserved in brine, and are often sold in small kegs, called kits. Many people consider mackerel the most delicious fish of the sea. Large herrings are always salted. Some are sold from the brine, while others are dried and smoked, and then packed in wooden boxes.

Sardines are fishes resembling small herrings. They are cleaned and cooked, and put up in flat tin boxes with olive oil. Some of the larger ones are preserved with mustard or tomato sauce.

If you live near the coast, you can get many other kinds, like smelt and rockfish and flounders and eels; and if your home is near a river or lake, you may get trout or perch or sturgeon, but these are seldom preserved by salting or canning, and must be eaten while they are fresh.

Fishing may be hard work, but it is often reckoned as sport. Here is what one man tells



A GOOD CATCH OF FISH.

about his fishing near San Diego. A number of men had gone out in a boat and had no success for a time, but at last the fish began to bite.

“Now the fun commenced in earnest; first one, then two, four, five, are hooked at a time, and rare sport it was to haul them in. For about five minutes we had all we could handle, and then for ten or fifteen minutes we would not see a sign of one. Now we are into them again, hauling away for dear life.

“Sometimes, when hauling in one or two, they would become entangled with other lines, and before we could get them in we would have one, two, or three on the remaining lines, and then there was a sad jumble of lines and struggling fish.

“Occasionally, in attempting to land the fish in the box, we missed it, and they fell down into the bottom of the boat, or our footing would be lost and we were bunched in a slippery mass, fish and all. The sloop was pitching heavily, as half a gale of wind was blowing. Wet from the waist down, we had what you might call a huge time. Having all the fish we wanted, by two P.M., although the biting was as furious as ever, we got under way to save the wind home.”

But fish do not include all of the food-products

of the sea. Think of all the creatures that man has captured for his use. Off the coast of Central America the natives catch great turtles that come up on the sandy beach to lay their eggs. In the frozen Arctic the Esquimaux live almost wholly on seals, while in the markets of our coast cities are found numerous kinds of those creatures that people call shell-fish.

In some countries sea-cucumbers are esteemed as a great delicacy, while among certain islanders of the Pacific a swimming seaworm is so highly prized that when it arrives off their coasts they drop all other employments, including fighting, and, friends and enemies together, pull off in their canoes to collect great quantities of the green "Polulu."

Comparatively little clothing is obtained from the sea, but that little is of the most expensive kind. It does not take a very large sealskin cape to be worth one hundred dollars, while a single sea-otter's pelt will fetch three fourths of that sum. Leather is made from the hides of hair-seals and walruses, while shoestrings of the strongest kind are cut from the tanned skin of the porpoise.

Oil was formerly obtained almost wholly from the blubber of whales, but in these days of petroleum not so many ships go out to hunt these great

creatures. They have little rest, however, for there is still a great demand for whalebone, which, by the way, is not bone at all, but a kind of tough fringe which grows around the whale's mouth to assist him in catching his food.

A large whale's head may contain as much as 2,500 pounds of whalebone, and the price is sometimes as high as \$3.50 a pound; so you see the capture of a full-grown whale is quite an important event.

While the whalers in the Arctic are taking off the fat blubber, the natives are rushing in with sharp knives to cut off as much of the lean meat as possible before the carcass sinks. This lean meat furnishes them a great supply of food, and we surely do not grudge them their prize.

From whales to sponges is a long step, but both are a part of the "harvest of the sea." Good sponges grow in rather warm water, like that of the West Indies and parts of the Mediterranean Sea. They are also found in the Red Sea, but none of any value grow in the Pacific Ocean.

When the sponge is torn from the rock on which it is growing, and brought to the surface, it is of a dark color, looking almost like a piece of liver. After being out of the water for a short time, the sponges die. They are then thrown into

a tank of water, where they remain a few days, till most of the flesh has decayed.

Then they are taken out, and so thoroughly cleansed and washed that nothing but the skeleton remains. This yellow, horny skeleton is what we call a sponge, but, as a matter of fact, it is what is left of a sponge after the parts that once had life have perished.

Pearls are perhaps the most precious products of the sea, and we will close our account of the harvest which man reaps from its waters by a few words concerning pearls. A good pearl is round, like a pea, and it shows mild rainbow colors upon its surface as it is turned over and over.

Pearls are found inside the shells of the pearl-oyster. They are made of the same substance as the shells themselves, and get their color and luster from the same sources.

Pearl-oysters have large, flat shells. They grow in water about fifty feet deep. The best ones come from off the coast of Ceylon, though they are found in many other parts of the ocean.

Native divers go down to the bottom, gather shells into a basket, and are drawn up again, all in the course of a minute. Like the sponges, the oysters are taken from the water and left to decay, and then the pearls are carefully gathered.

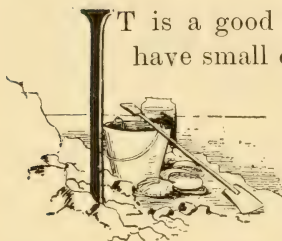
If no good pearls are found, at least the shells are left, and many of these are sold for the manufacture of mother-of-pearl objects, such as fine buttons and knife-handles.

In conclusion, let me ask you to carefully observe the objects about you for a single week. I am sure you will be surprised to find how many of them came wholly or in part from the great ocean that covers three fourths of the surface of the world in which you live.

BLACKBOARD WORDS.

polulu (pō-lū'lū), **petroleum** (pē-trō'lē-ŭm), **thoroughly** (thūr'ō-ly), **skeleton** (skēl'i-tūn), **chloride** (klō'rid or klō'rid), **iodine** (i'ō-dīn), **convenient** (kōn-vēn'yēnt), **evaporated** (ē-vāp'ō-rāt-ed), **whalebone** (hwāl'bōn), **precious** (prēsh'ūs).

HOW TO COLLECT AND PRESERVE SPECIMENS.



IT is a good thing for young people to have small cabinets, either of their own or in connection with their school-mates. Specimens are to be collected for purposes of study, and in memory of interesting places to which visits have been made.

It is always well to write good labels and to keep a record-book, giving numbers, localities, dates, and other items of interest. The specimens themselves can be kept in either boxes or bottles, and these can be stored in any convenient room or cupboard.

Large shells and other dry objects may be marked with a name or number, and laid on shelves or in proper boxes. Very small shells, seeds, etc., may be kept in little bottles, which can be bought of the druggist for a small sum.

Objects which cannot be dried must be kept in closed jars of preserving fluid. Alcohol is good,

but dilute formalin is much cheaper. About ten parts of water to one of formalin is a good mixture, though for some things it may be still weaker. Instead of jars, well-corked bottles with wide mouths may be used to contain the fluid for the smaller objects.

Most mollusks may be killed by putting them into fresh water for a time. They can then be plunged into boiling water. In a little while the flesh will be loosened, and can be taken out with a pin. The shells should then be cleaned with a brush, rinsed, and thoroughly dried. Bivalves, after cleaning, should be closed and tied with a string until they are dry, to prevent them from gaping.

Directions for drying starfishes, etc., have already been given. A bath of formalin solution, before drying, is an advantage for such objects. Remember that both alcohol and formalin are poisons, and use them accordingly. Get as many books to help you as you can afford, or consult them in the libraries.

Finally, wherever you live, try to get acquainted with all the natural objects around you. They can teach you many things; for they were all made and are all governed by Infinite Wisdom.

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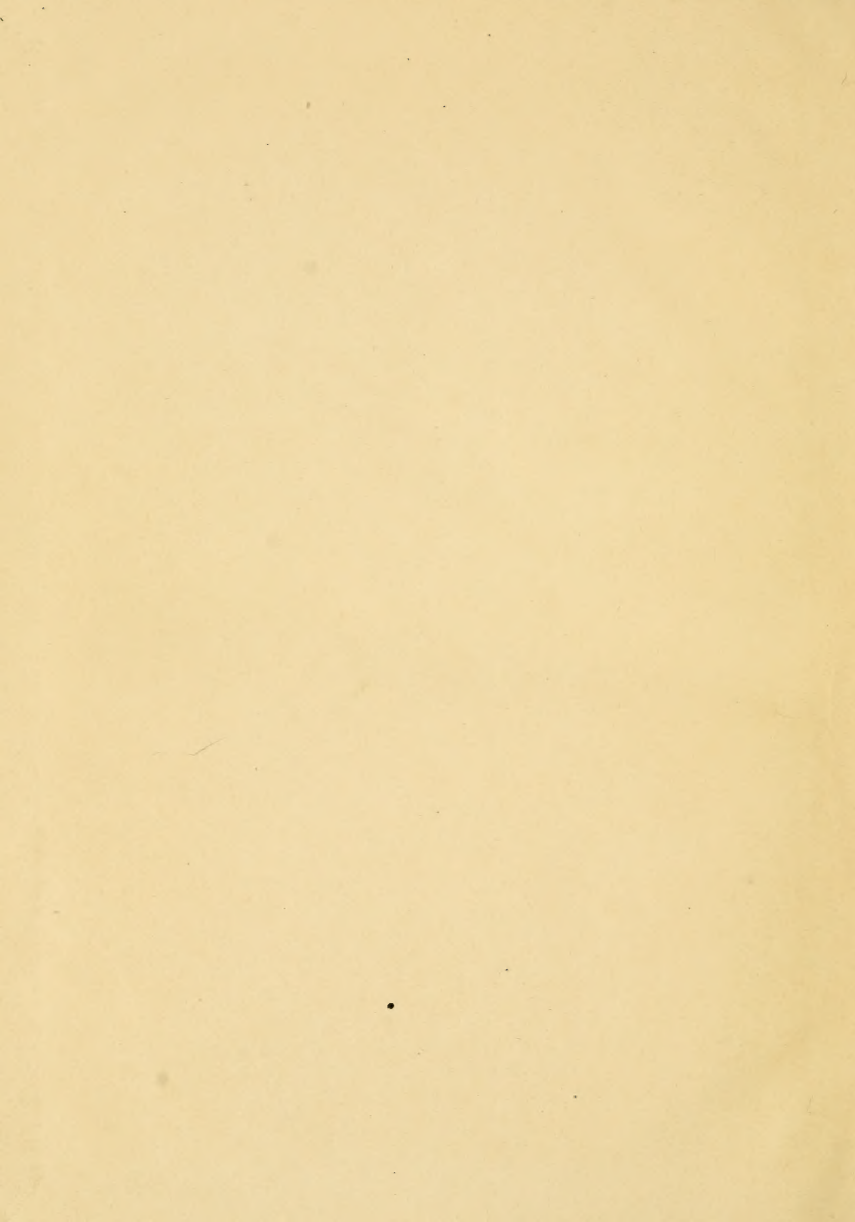
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