

Lesson 2

Whales

What animal has a tongue that weighs more than most cars, a heart as big as a Volkswagen Beetle, blood vessels so large that a baby could crawl through them, and spends most of its life in parts of the ocean that no man has ever seen? Why, it's the largest of God's creatures – the **blue whale**. It may surprise you to know that the blue whale, though it's the biggest creature in the entire world, is so hard to find that we know very, very little about it. In fact blue whales are among the few sea



Blue whales like this one are very hard to find, even though they are the biggest animals in creation.

creatures that don't stay near the shore – they spend most of their lives out at sea – traveling thousands and thousands of miles between the waters in which they eat (their feeding waters) and the waters in which they give birth to their young (their breeding waters).

Even though a whale can dive thousands of feet below the surface of the ocean, it must come up to breathe every now and again, or it will drown. Why? Because whales are mammals, and like you and me, they breathe oxygen from the air. Unlike many sea creatures, whales cannot breathe under water. As a result, they must come to the surface regularly so they can breathe the air. Mammals that live in the sea are often called “marine mammals,” because the word “marine” is used to refer to the sea.

Two Kinds of Whales

Whales are called **cetaceans** (see tay' shuhns), because they belong in Kingdom **Animalia**, phylum **Chordata**, class **Mammalia**, and order **Cetacea** (see tay' shah). Do you remember the taxonomy you learned about in your first zoology course? If not, you might want to review the first lesson in that book, because I will talk about it from time to time in this book.

To help you remember the word “cetacean,” I'll use it a lot in this lesson. Cetaceans are divided into two different kinds: **baleen** (buh leen') **whales** and **toothed whales**. A baleen whale has no teeth. Instead, it has long strips of bristled plates that hang from its upper mouth, like an enormous

toothbrush permanently attached to its upper lip. This structure is called baleen. Baleen whales are also called great whales – not because they are any greater than other whales, but because they are usually much, much bigger than toothed whales. In fact, when you think of the word whale, you probably imagine a huge creature. But did you know that a dolphin is a kind of whale too? Dolphins are toothed whales. And guess what toothed whales have instead of baleen? Of course! They have teeth!

All whales, both baleen whales and toothed whales, have big brains. It's no wonder they are considered the most intelligent of all marine mammals. The dolphin is so intelligent, for example, it actually plans ways to catch food that only a very skilled hunter could invent.

A Whale of a Tail

The end of a whale's tail is called a **fluke**. The whale uses its fluke to steer when it is moving through the water. It also uses its tail for power when it swims. Interestingly enough, whales move their tails up and down in order to power their swimming. What's so interesting about that? Think of how a fish swims. It swims by moving its tail from side to side. Whales, on the other hand, move their tails *up and down* in order to swim. So the way a whale swims is quite different from the way a fish swims. Of course, you already know another big difference between fishes and whales, don't you? A whale cannot breathe under water, but a fish can.



This is the fluke of a humpback whale. The whale moves its tail up and down in order to swim.

Do You Hear What I Hear?

Cetaceans can't smell very well, if at all, so they really depend on their other senses, like seeing and hearing, for finding each other and food. Interestingly enough, seeing is not the most important sense for cetaceans. Hearing is.

If you were on the other side of your neighborhood and your mom walked outside of your house to call your name, would you be able to hear her? What if she was calling your name from the parking lot of the grocery store down the street? Could you hear her? Probably not. Well, sound travels better under water than it does in air, so cetaceans can hear sounds hundreds of miles away. In fact, some cetaceans seem to be able to communicate with other cetaceans that are thousands of miles away! Isn't that amazing?

Every cetacean has its own kind of sounds. To us, they might sound like clicks, whistles, moans, or rumbles. They talk to one another a lot, especially when they are in a group swimming under the water. The most famous is the male humpback whale that sings a low, moaning song which usually lasts for 10 to 20 minutes. The male repeats this song many times each day. There are parts of the song that we cannot hear with our ears, because our ears can't hear the same range of sounds that a whale's ears can. Nevertheless, scientific instruments can be used to collect and analyze those parts of the song. Humpback whale songs can travel hundreds of miles, allowing them to communicate with groups of whales that are very far away.

All of the male humpback whales in a given group sing the same song, but that song does change over the course of a season. Because biologists don't fully understand whales, they are not certain why humpbacks sing so much, but many think that the males sing in order to find a mate. If you visit the course website I told you about in the introduction to this book, you can listen to some whale songs that scientists have recorded.

Explain all that you have learned so far about whales. Be sure to include information about their tails and their senses.

Thar She Blows!



The spout of water you see in this picture is coming from the whale's blowhole. As the whale surfaces, it exhales through its blowhole, and the water in the exhaled air turns to steam.

As I mentioned before, cetaceans must breathe air. Typically, a cetacean will breathe through its "nose." You and I can also breathe through our noses, can't we? But where is a cetacean's nose? If you search and search the front of the cetacean's face, you won't find a nose anywhere. So how does this creature breathe? Well, a whale has a "nose" on top of its head! It is called a **blowhole**. When the whale goes under the water, it can close the blowhole so water can't get in. When the whale surfaces, it opens its blowhole and exhales. As this happens, a spout of water vapor rises into the air. This gives people a way to look for whales when they surface to breathe.

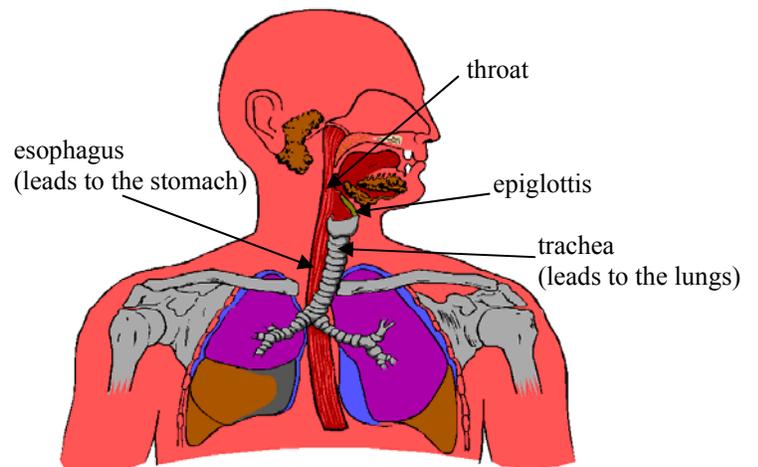
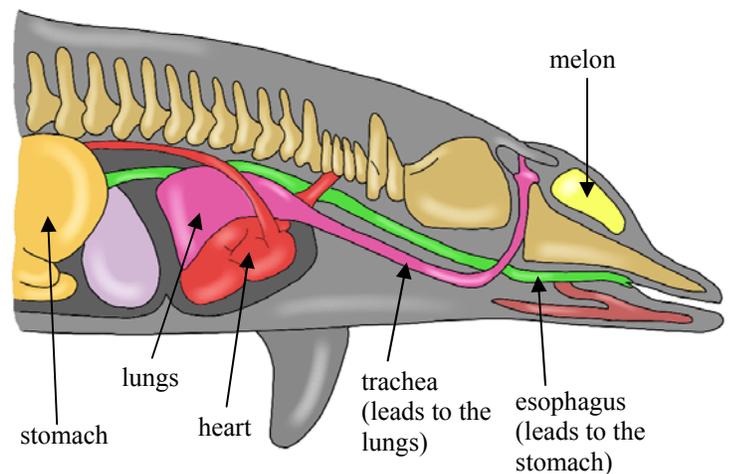
Typically, a whale will take in one breath after it reaches the surface and exhales, then it will go back down under water until it is time to breathe

again. Remember, once the whale goes under water, it closes its blowhole so that no water can get in. This breathing system is perfectly designed by God for the whale!

People who hunted whales in the early days used to say, “Thar she blows!” when a whale surfaced and blew a spout into the air. They could even tell what kind of whale it was by the size, shape, and height of the spout. Some whales, like the blue whale, have a spout that goes up more than 30 feet. It would be as high as five or more men standing on top of one another! A sperm whale’s spout could reach 15 feet. That would be like piling almost three men on top of each other. Interestingly enough, although toothed whales have only one blow hole, baleen whales usually have two.

The spouts that a whale makes when it exhales make it look like the whale is blowing out water, but it’s not. It’s blowing out air! However, because the air was warmed up so much inside the whale’s body, and because the air above the ocean is cooler than the whale’s body, the warm air turns to steam when it hits the cooler air. So, it looks like the whale is blowing water out of its hole, but it is really just warm air that turns to steam. You’ve probably done this yourself on a cold day, haven’t you? When it is really cold outside, you can “see your breath,” because the air you exhale is so warm compared to the outside temperature, it turns to steam as it leaves your body.

The whale’s breathing system is amazing, and it is even more amazing to realize that it is completely separate from the whale’s mouth. Why? Well, have you ever taken a drink and ended up coughing uncontrollably? If you have, it was because when you swallowed, some of what you were drinking got into the tube that leads to your lungs. God designed you so that your throat leads to *both* your stomach *and* your lungs. At the point where your throat ends, it splits into two tubes: your **esophagus** (ih sof’ uh gus), which leads to your stomach, and your **trachea** (tray’ kee uh), which leads to your lungs. When you eat or drink, a small flap, called your **epiglottis** (ep’ uh glot’ is) covers your trachea, keeping food and liquid from entering your lungs. However, every once in a while the epiglottis doesn’t close fully, and liquid or food gets into your trachea, and you automatically cough to try to get it out. That’s one reason you can’t really eat under water. If you took in water with every bite, there would be more chances for it to get past your epiglottis and into your trachea.



In the whale (top), the lungs are connected to the blowhole by a different tube (the trachea) from the one that connects the mouth to the stomach (the esophagus). In people, the trachea and esophagus are both connected to the mouth.

A whale, with its blowhole on top of its head, has a separate tube leading from its mouth to its stomach. This tube is not connected to its lungs at all. A whale's lungs and mouth have a totally different design from any other mammal. So, there is no danger of choking and drowning when it opens its mouth under the water to eat and swallow food. The water can only get into its lungs through the blowhole, which it closes tight when it is under the water. The only way a whale can drown is if it is prevented from reaching the surface of the water for a breath of air. This can happen if a whale is attacked by killer whales, which hold young whales down under the water to drown them.

Since a whale must come to the surface to breathe, you might wonder how it sleeps. Scientists aren't 100% sure. However, they have noticed that whales do take short naps (usually for less than an hour) at the surface of the water where they can breathe. In addition, some whales (like dolphins) can actually put some parts of the body to sleep, while the rest of the body stays awake so that the dolphin can swim to the surface to breathe.

Beach Bum

Sometimes, whales get stranded on the beach. When this happens, we say the whale is **beached**. Beached whales are helpless because they are not designed to come out of the water. Often,



This blue whale died because it was beached.

if rescuers don't find them and help them back into the water in time, they will die. Strangely enough, when a beached whale is found in time, and rescuers have spent hours carefully moving the creature back into safe waters, it will sometimes just beach itself again. Why do whales do this? We really don't know. Some scientists think whales beach themselves because they are disoriented or sick. Even more strange, sometimes entire *groups* of cetaceans beach themselves!

Once, when I was a child, my parents took me to the beach in Corpus Christi, Texas. When we arrived, we saw a dozen huge whales washed up on the beach. There they were, all these whales, dying on the beach. It was a very sad thing to see. How could an entire group of whales get beached? Once again, scientists don't really know. Some suggest that the whales in a group are so loyal to each other that when one becomes disoriented due to illness or injury and swims up on the beach, the others just follow.

Whale Moves

Whale watching is an activity that many people enjoy. Whales almost seem to perform when people come to watch them. They flip and flop and smash their tails on the surface of the water. Of course, they aren't really performing. They are just doing what they do naturally.

One whale move that delights whale watchers is called **breaching**. This is when a whale leaps into the air and then purposefully flops down on the water with an incredible splash. Sometimes it twirls in the air when it does this. Scientists aren't sure whether breaching is done for play, to clean the whale's skin of things that are stuck to it, or to communicate something.



Although you can often see whales breaching like this in the ocean, scientists aren't sure why they do it.

Another interesting whale move is called **spyhopping**. This is when a whale sits straight up in the water with its head positioned straight up and out of the water. It will sometimes turn around in circles as it spyhops. Scientists think this might be an effort to check out the surroundings above water.

Lobtailing is done when a whale faces downward in the water with only its fluke sticking out. It then slaps the water with a thunderous sound. Scientists think this could be done to warn other whales of danger, but they aren't sure, because it isn't consistent. **Logging** is yet another whale move. This is when a whale swims slowly at the surface of the ocean with very little movement. When a whale does this, it looks like a log in the water. Some scientists think that this is a form of rest or sleep for whales.

Though many thousands of people enjoy whale watching and find joy in the awe-inspiring antics of these great giants, it hasn't always been this way. You see, many people used to hunt whales, not to observe them, but to harm them. Let's explore the reason for this.

Whalers

Cetaceans have a thick layer of fat under their skin called **blubber** (blub' ur). In some species, the blubber can be two feet thick. That's a lot of blubber! For many years, the Eskimos of Alaska depended on the whales for their very lives. Every part of a whale was used - the bones, the blubber, and the skin - every bit. In this way, one whale could supply the Eskimo community for a long time. However, sometimes a good thing can get out of control and become a bad thing. This happened with whale hunting.

You see, whale blubber was not only used by the Eskimos. It was once an important product that every person in the civilized world wanted. This is because, way back before electricity was discovered, blubber was used as oil for lamps. If you wanted to see what you were doing after the sun

went down, you needed to light lamps, and you needed oil to do this. The oil from whale blubber had other uses as well. It was used to oil machines, for example. In addition, a smelly, gooey substance found in the intestines of a particular whale (the sperm whale) was used to make extremely expensive perfume. In the early 1900s, one sperm whale's intestines might contain several thousand dollars worth of this goop. Therefore, whales were hunted and killed so that people could make money.

The fishermen that hunted whales were called **whalers**. As time went on, whalers figured out that whales tend to travel along the same paths in the oceans during certain times of the year. You'll learn about that in a little while. Once whalers figured this out, they followed the whales as they traveled and hunted them mercilessly.

Though it brought in a lot of money, whaling was an incredibly dangerous and frightening job. In the early days of whaling, people sat in watchtowers and alerted whalers when a whale was spotted close to shore. Then the whalers set out in small boats to chase it down. When they got close enough, they threw heavy, sharp harpoons into the body of the whale. The harpoons were attached to ropes that were attached to the boat. Harpoon after harpoon was hurled into the poor whale.

Whales that were harpooned would give off warning cries that could be heard by other whales hundreds of miles away. This cautioned other whales to stay far away from that area. Some whales were able to fight back. They might pull a boat furiously through the water at breakneck speed. Other times, a hurt whale could overturn a boat by bumping it hard enough. Usually, though, the whalers would wear down the whale. Soon, hurt and exhausted, the whale did not have the strength to resist. It was then towed back to shore, where it was cut open and the blubber, intestinal substances, and other resources harvested and sold.



This drawing depicts whalers from the past doing their job.

Larger and larger boats and better equipment for hunting whales were eventually built. Soon whales had no chance of escape. Huge whaling ships could harvest many whales on a single trip to sea. In the later days of whaling, whales were hunted way out at sea. Sometimes entire whale families were found, and as many were killed as possible. Sadly, this process caused the near extinction of many whales. So now whales are protected by **conservation** (kon' sur vay' shun) **laws**.

Conservation simply means saving something. If you conserve money, you don't spend it; you save it. If you conserve whales, you save whales by keeping people from killing too many of them. Conservation laws, then, help save whales. Also, since chemists have developed many products that take the place of whale blubber, we don't need to kill whales anymore. So, the scientists who made

these products have saved cetaceans from extinction! Maybe one day you will be a scientist who discovers a substance that will save an animal from extinction.

Can you name the moves that a whale makes? What else have you learned so far?

Migration

Many cetaceans migrate incredible distances every year. They often summer in cool waters like those in the polar regions (areas near the North or South Pole), where there's plenty of food. So every summer, many thousands of cetaceans head to the cool waters, eating tons of food each day, which increases their stores of blubber. They'll need this extra blubber for the winter, when they head to the warmer waters near the equator to have their young. You see, in these tropical waters, there isn't a lot of food that whales like, so they generally don't eat the entire time they are there, which can be months. After they have their young and the weather begins to show signs of spring, they head back to the polar regions to eat again.

Every year, it's the same routine – head to the polar regions for the summer and towards the equator for the winter. Most whales make their trips in groups, called **pods** or **herds**. Some mother whales that are bringing their newborns to their feeding grounds must travel alone because the calf is too slow to keep up with the pod.

Explain all that you have learned about how a whale breathes, whale beachings, and migration.

Don't Have a Calf

Like all mammals, whales give birth to live young, called **calves**. They don't lay eggs. Animals that give birth to live young are called **viviparous** (vye vip' ur us) animals. Usually the calf is born tail first. Once it is born, the mother (or another adult) immediately guides it to the surface for a breath of air. Soon, the calf is adjusted and ready to drink its mother's milk. The mother's milk glands are hidden in a little pocket of skin near the mother's tail. The calf latches onto the mother and drinks as she swims about the ocean. Whales are great mothers, caring for their young every waking moment. They become very attached to their calves, helping them swim, breathe, and grow up to be a big whale.



This sperm whale calf is swimming alongside its mother.

Soon after the calf is born, the mother and her young join other whales on their journey back to their feeding grounds. It's a long way. When you were small and went places where there was a lot of walking, did you ever ride "piggy back" on your mom or dad so you could rest? Often the calf tires and must be held up above the water on the mother's back as she continues the journey. It's like a piggy back ride for the calf.

On the migration back up to the feeding grounds, the mother doesn't eat on the entire journey, but the calf will drink milk from its mother the entire time. This weakens the mother, who is living off the food she ate the summer before. This makes the journey to colder water a slow trip for the mother and her calf. Sometimes the mother and her calf can't keep up with the pod and are left to make the journey alone. This is a dangerous trip for them, for killer whales are looking for just such an opportunity. When killer whales see a mother and its calf, they are sure the calf will be easy prey, for a mother can only defend its calf for so long before it tires of the fight. If the mother and calf make it back to the feeding grounds, they'll be safe, because the food will restore their energy and they'll have the company and protection of the pod.

The rest of this lesson will focus on each of the different kinds of whales. Keep reading if you are curious about creatures like porpoises, dolphins, killer whales, humpback whales, and unicorns. Wait a minute...did I say unicorns? Yes, I did. To find out what I mean, you'll have to read on.

Toothed Whales

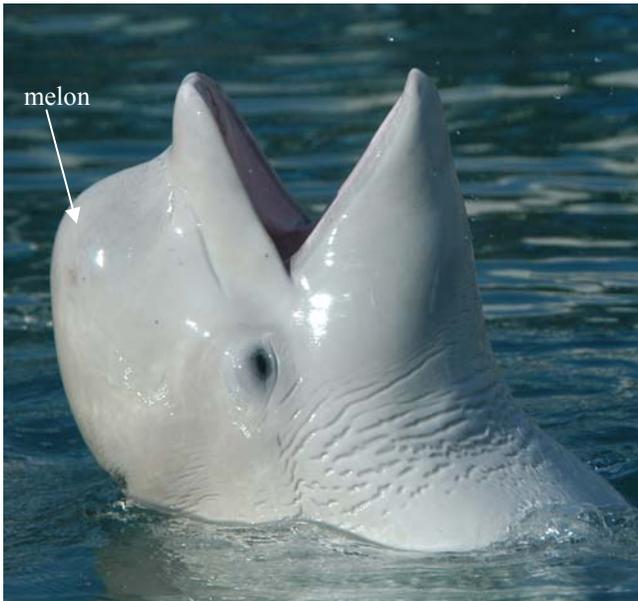
Do you remember that there are two kinds of whales: toothed whales and baleen whales? Well, we are going to take a moment to learn about a few of God's beautiful and delightful toothed whales, and then we'll discuss baleen whales.

Do you remember what makes a toothed whale a toothed whale? Did you say teeth? You're right of course! As I mentioned, some toothed whales have a few teeth, some have several hundred. These teeth look like upside down ice cream cones – we call them cone shaped. But whales don't use these teeth to chew, because they don't chew. They just swallow. A whale uses its teeth to hold its prey while preparing to swallow it. Smaller prey are tossed into the air and swallowed whole. You can watch this happen at large aquarium shows when animal trainers toss fish to dolphins or killer whales.



Notice how this whale's teeth look like upside down ice cream cones.

Echoes to Locate



This beluga whale has a very pronounced melon. To see where the melon is on the inside of the whale, look at the drawing on page 22.

Most toothed whales have a **melon**. No, they don't have a piece of fruit. What they have is a protruding, rounded forehead that contains a structure called a melon. It is used for **echolocation** (ek' oh loh kay' shun). Do you remember learning about echolocation when you studied bats? Well, just as bats use echolocation to "see" in the dark, toothed whales use echolocation to "see" under water. Scientists believe toothed whales are the only whales that have this ability. We sometimes call echolocation **sonar**, because scientists have made an echolocation system for ships and submarines that is called sonar. Even though ships and submarines use manmade sonar, whales use God-made sonar – which is far better!

How does echolocation work? Well, toothed whales make special sounds that are sent out through the melon. The sounds bounce off things in the sea and come back to the whale. God designed parts of the toothed whale's body to receive the returning sound, which is called an **echo**. God also gave the whale's brain the ability to use the echoes to determine the size, shape, location, and composition of the object very precisely. It's an amazing ability! The toothed whale can tell if there is a school of fish up ahead, or a wall, or a boat. It knows how far down the ocean floor is, how far away the shore is, and even if sharks are nearby. This special gift of echolocation enables dolphins to know where they are going and to "see" what is all around them.

Try This!

Roll two pieces of cardstock or poster paper (8½ x 11 works well) into two megaphones. Use tape to keep each of the megaphones from unraveling. Have one person talk through the megaphone towards a wall in your house. At the same time, have another person place the small end of the other megaphone next to his ear, standing at a slight angle to the wall, listening. Try listening both with and without the megaphone. What happens? Some objects reflect sounds well, while others don't. Try this on different objects, like a metal refrigerator, a wooden cabinet, and a brick wall. Do you notice a difference? Can you see how a toothed whale uses sound to determine what kind of object is near?



When you roll a piece of paper into a cone, you can use it as a megaphone.

Dolphins

There are a lot of different kinds of toothed whales, and I want to talk about several of them. I'll start with what I think is the most delightful animal in the ocean – the dolphin. Dolphins have a long history of interacting with humans. People love them because they are playful, intelligent, and always seem to be smiling. Many stories told in both ancient and recent history talk about dolphins saving people from drowning at sea and bringing them safely to shore. Scientists aren't sure whether dolphins do this because they actually want to save a person or because of instinct.



The bottlenose dolphins in this pod look after one another.

Why do scientists think dolphins save drowning people by instinct? Well, if a dolphin behaves like it might be drowning, another dolphin will push it up to the surface of the water so it can breathe. An injured dolphin is hoisted on the back of a fellow dolphin and carried to shallow waters where it is able to breathe and recover. Since dolphins do this to their drowning dolphin friends, it would seem natural that they would know how to save a drowning person as well. So, do you think a

dolphin saves a man from drowning because it is an instinct, or because it purposefully wants to save the drowning man?

Dolphins swim in pods; an extremely large pod is called a **herd**. They are very social and help one another fight off predators, like sharks. They can kill large sharks by ramming them over and over again with their pointed beaks and their melons. They even babysit for the moms that need to leave their calves to hunt for food.

Dolphins are extremely intelligent, perhaps some of the most intelligent animals that God created. They prepare and carry out complex plans for trapping food. For example, they often hunt for halibut, a type of fish that lies on the sand at the bottom of the ocean. To hunt these fish, dolphins will line up in shallow water, and one member of the pod will disturb the halibut resting on the sand. The startled fish will jump out of the sand – right into the line of waiting dolphins' mouths! A pod of dolphins will sometimes circle a school of fish, continuously swimming around them to form a barrier that keeps the fish from escaping. Then one by one, the dolphins pick off each fish in the circle. Dolphins may also send out high-pitched sonar sounds that stun prey so it can then be gobbled up.

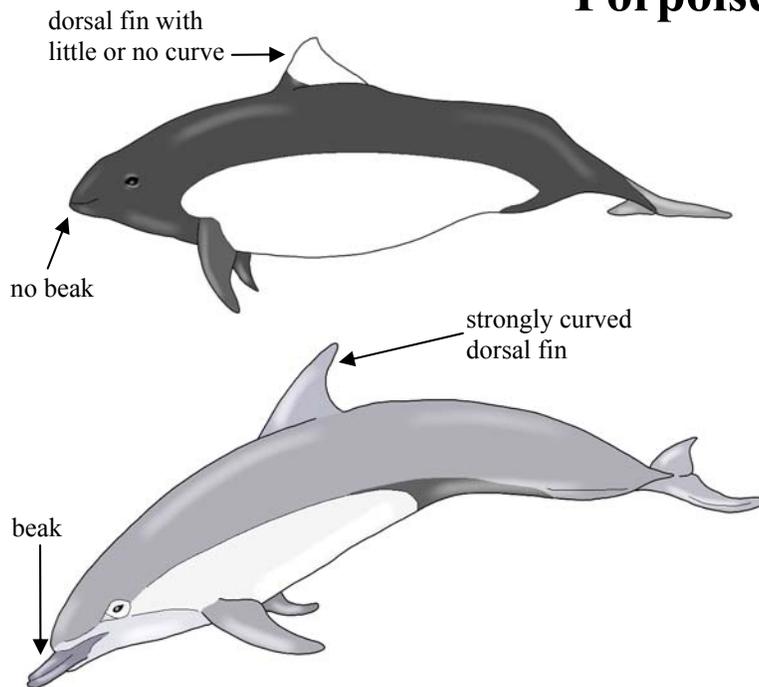
There are more than thirty different species of dolphins, and they live in a lot of different places: in the deep sea, near the coasts, and even in some rivers. They have bodies that are shaped like bullets, which allow them to swim very quickly. Even though they may weigh more than 1,000 pounds, they can leap right out of the water and into the air. When they race along near the surface and make low leaps out of the water, it is called **porpoising** (por' pus ing).



This dolphin is porpoising.

The bottlenose dolphin is the most commonly seen dolphin. It tends to stay near the coast in the warmer Atlantic waters. There can be a few hundred of them in one pod. It is also the most easily tamed dolphin and is often found in marine exhibits, like Sea World. It is gray on top and white on the bottom.

Porpoises



These two drawings illustrate the differences between a porpoise (top) and a dolphin (bottom).

Even though dolphins can engage in an activity called porpoising, there are differences between dolphins and **porpoises** (por' pus ez). In general, porpoises are smaller than dolphins. Porpoises, for example, rarely grow longer than 7 feet, while dolphins can grow longer than 10 feet. In addition, dolphins usually have a lean, sleek body, while porpoises tend to look “chubby” by comparison.

There are other ways you can tell porpoises and dolphins apart. Dolphins have beaks, while porpoises do not. A dolphin's beak is not like a bird's beak, but it is something you can identify, as shown in the drawing on the left. Many pictures

not drawn by scientists will inaccurately show a porpoise with a beak. If it has a beak, it's probably not a porpoise. Another difference between dolphins and porpoises is the shape of the dorsal fin. A dolphin's dorsal fin curves, while a porpoise's is triangular with little or no curve in it.

Killer Whales

Have you ever seen an **orca** (or' kah)? If you have seen a **killer whale**, then you've seen an orca, because they are the same animal. Orca sounds nicer than killer whale, though, doesn't it? If you have been to a large aquarium like Sea World, you have probably seen these friendly whales carrying passengers, doing tricks, and seeming unlike killers. Why, then, are they called killer whales? Well, these animals, which can reach lengths of over 30 feet, are considered the most ferocious of all the animals in the sea. Packs of fifty or more, all working together, surround and chase sharks, seals, dolphins, penguins, other whales – especially weak nursing calves – and any other hapless creatures they find innocently swimming along. First, they all chase the creature, making it tired and weak. Then one of them will move in to take a bite, with all the others quickly following. They are like the “sharks” of the whale world, but most animals fear killer whales even more than sharks! These whales have been known to kill prey even though they weren't even hungry enough to eat it. Sometimes, they hunt an animal, ferociously kill it, and then just let it drop to the bottom of the ocean.



This picture shows you the colors and markings of killer whales.

The dorsal fin of the orca can extend up to six feet above its body. That's taller than most grown men! And because a killer whale swims close to the surface, the dorsal fin can often be seen gliding through the surface of the water. This causes some people to mistake killer whales for sharks. You can usually tell killer whales by their markings. They are mostly black, with white markings on different parts of the body. It is possible, however, to mistake certain porpoises, called Dall's porpoises, for killer whales, because they have similar markings.

Killer whales, though ferocious to sharks and other creatures, are generally docile (dah' sil) and friendly towards people when kept in captivity. They are often tamed and can be trained to do tricks for audiences in marine shows. Extremely intelligent animals, killer whales have even starred in movies, such as the film titled *Free Willy*.

Beluga Whales

In the cold, icy waters off the coast of Alaska lives a whale known as the **sea canary**. Like the canaries that fly in the sky, these whales make all sorts of tweeting, squeaking, and chirping noises

which can be heard above and below the water. Although we think they do this for communication, we aren't really sure. Regardless of why they make these noises, they are a delight to individuals who witness the spectacle. These beautiful, white whales are simply called **beluga** (buh loo' guh) **whales**. The word beluga means "white one" in Russian.



Beluga whales are playful and generally friendly towards people.

whales might have a hundred in all, ranging in size from 15 to 18 feet long. The young pups are born brown or black, usually turn blue by the time they are one year old, eventually turn light yellow, and then become snow white as they mature.

Every year, the belugas travel in large pods up through Alaskan estuaries to extremely shallow waters in order to **molt**. When they molt, the outer layer of the skin peels off, revealing new white skin. In the shallow waters, they rub their bodies against the gravel floor to help get rid of the old skin.

Unfortunately, beluga whales have been known to stay too long in the north, getting trapped under the moving ice sheets that begin to shift around the arctic waters when winter comes. If this happens, a beluga can drown because there isn't anywhere to surface for air. Even if it manages to surface for air through a small hole in the ice, it could be killed by a polar bear.

Try This!

Do you know what the freezing temperature of water is? It's 32 degrees (using the Fahrenheit temperature scale, which is generally used in the U.S.). This means that water freezes when it is 32 degrees or colder. Well, would you believe that the waters in which you can find beluga whales are sometimes below 32 degrees (especially in winter), but they are not frozen? How can this be? Let's find out! You will need two cups, a tablespoon, salt, and a freezer. Fill both cups with water. Add 2 tablespoons of salt to one of the cups and stir. Place both cups in the freezer. Check on them in an hour. Keep checking on them every hour to see what happens. You should see that one of the cups of water either did not freeze or took longer to freeze than the other. Which one was it? Can you figure out why? See the "Answers to the Narrative Questions" at the back of the book to learn the answer.

Narwhals

Do you remember that I mentioned unicorns before? Well, it is time to study the “unicorns of the sea.” A type of whale called the **narwhal** (nar’ wall) actually has a single, long horn that looks a lot like the horns that have been drawn on the mythical animals called unicorns. In fact, when people found the horn of a dead narwhal washed up on shore, they thought that they had found the horn of a unicorn. At one time, narwhal horns were actually sold as “magical” unicorn horns. Of



This photo of a narwhal was taken from above the surface of the ocean. Notice how long the tusk is.

course, there is no such thing as a unicorn, but the narwhal, which looks remarkably like a gray beluga whale with a horn, is another of God’s special creatures of the sea.

The narwhal’s horn, called a **tusk**, doesn’t grow out of the narwhal’s head; it actually comes right out of its mouth. It’s an extra long tooth! In fact, some narwhals have two long teeth, making them double-tusked narwhals. Usually, however, a narwhal just has one tusk, and it grows out of the left side of its mouth. A narwhal’s body can grow to be fifteen feet long, and its tusk can be more than half that length! The tusk is spiraled like a long piece of clay might look if you twisted it over and over again. This may be why drawings of unicorns always showed them with spiraled horns.

For most of history, scientists have not known what a narwhal’s tusk is used for. Some thought they used it for fighting, but there was no way to know for sure. Recently, however, scientists have learned that there are special blood vessels and nerves in a narwhal’s tusk. This tells us that the tusk may be used to collect information about the narwhal’s surroundings. What kind of information does it collect? How does it collect the information and how is it used? Scientists are still trying to figure out these things. Maybe one day you will help scientists determine exactly what a narwhal does with its tusk!

Sperm Whales

Sperm whales are the biggest of the toothed whales, able to grow up to sixty feet long. Even a newborn is almost 15 feet long the day it is born! A sperm whale’s teeth can be up to eleven inches long! Now, *that’s* a toothed whale. Do you remember that baleen whales are often called great whales because they tend to be so big? Well, because sperm whales are so big, they are also called great whales. Sperm whales are the only toothed whales that are called great whales.



Notice that this mother sperm whale and her calf have no dorsal fin and that their heads are longer than those of the other toothed whales you have seen.

The head of a sperm whale is very long, making up a large part of its body. Try to imagine if your head made up more of your body. That would look strange, wouldn't it? The huge head contains an enormous **spermaceti** (spur' muh see' tee) organ. Scientists aren't sure exactly what this organ does, but some think that it is used to focus or reflect sound. Others think it is used to make the head heavier so that the sperm whale can dive more easily.

The oil whalers could get from a sperm whale's spermaceti organ was found to be far better than what they got from whale blubber. So the sperm whales were the most hunted whales back in the days of whaling. Whalers could tell a sperm whale apart from other whales because its blowhole is positioned so that water is directed towards the front when it blows out. When a sperm whale surfaces, then, its spout does not go straight up like the spouts of most whales. Also, a sperm whale does not have a dorsal fin on its back like many other whales.

Before diving down into the deep, the sperm whale loves to lobtail with an enormous splash, then dive far below the surface of the water. Can you imagine being a whaler harpooning a sperm whale just before it dives more than a mile below the surface of the water? I'm sure a few ships were overturned in those days. Furthermore, a sperm whale can stay down under the water for more than an hour! Sperm whales are the deepest divers of all marine mammals.

Sperm whales are generally black. A white sperm whale may occasionally be born, but if so, it is usually called an **albino** (al by' no). This is the kind of animal described in the book *Moby Dick*.

Sperm whales consume huge amounts of food each day, including squid. Unlike many other whales, sperm whales don't head to the polar regions each year to find food. Instead, they can be found traveling in small pods in warmer waters year round. These pods are made up of either all females and their young or all males. All-male pods are called **bachelor pods**. Even though it was fiercely hunted in the past, the sperm whale is one of the most abundant whales in the ocean.

Explain what you have learned about toothed whales.

Baleen Whales

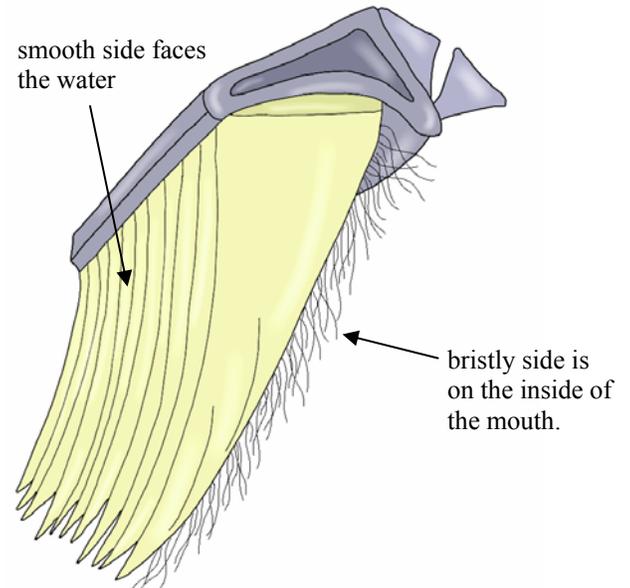
Now that you have learned about many of the toothed whales, it is time to learn about some of the baleen whales that God made. Baleen whales are the largest and most majestic creatures in the sea. They swim through the open ocean on their annual migrations, tenderly care for their young, make amazing splashes, and dive to depths unheard of by most other animals.

You may remember that a baleen whale doesn't have teeth. Instead, it has baleen, which look like a curtain of long plates hanging from the top of the whale's mouth. In a large baleen whale, as many as 300 or more plates hang down from each side of the mouth. These plates might be 12 feet long, and a foot or more wide. Looking at them from the outside, they look like straight knives hanging down, but from the inside, they are bristly, like an enormous toothbrush.

A baleen whale uses its baleen to feed. It will suck water into its mouth through the baleen. This filters out the larger creatures in the water, allowing only smaller plankton and other creatures into the mouth.

Then, the tongue is used to push the water back out. Since the *inside* of the baleen is bristly, the small creatures that were let inside the mouth are caught in the bristles, and they are swallowed.

Why does a baleen whale pull in water through its baleen? After all, if it just opened its mouth and let everything inside, it would have bigger morsels of food, wouldn't it? Well, it turns out that these enormous, beautiful whales have small throats. Because a baleen whale can't chew its food (remember, it doesn't have teeth), it can only swallow creatures that fit down its small throat. Even the huge blue whale has a throat that is not much bigger than a grapefruit. That's a tiny throat for such a huge animal! The outside of the baleen, then, acts as a filter, allowing in only the animals that are small enough for the whale to swallow.



Each baleen plate is smooth on the outside and bristled on the inside.

Blue Whales

Though we think of dinosaurs as giant creatures, truly the largest animal that has ever lived on the earth is still alive today, roaming the vast oceans on routes largely unknown by man. Do you remember which animal that is? It's the blue whale that I talked about at the beginning of this lesson! It can reach lengths of more than 100 feet, and its head alone can be up to 25 feet long!

Even though we know some things about the blue whale, there is still a lot that we don't know. You see, we have no idea where it goes to give birth to its young. We don't know the paths it takes when it migrates. Isn't it amazing that the largest creature in the world is hard to find, hard to track, and difficult to follow? That just goes to show you how enormous the ocean really is. Even the largest animal on earth can hide from us in the ocean! Interestingly enough, when we find a blue whale, it is either alone or it is a mother with her calf. Because of this, scientists think that blue whales don't form pods. Instead, they seem to prefer to be alone.

This wonderful, mysterious whale can dive deep into the ocean, and when it surfaces, its spout can reach up to 30 feet into the air. Slate blue in color, it has striped grooves under its chin. These grooves stretch out when the whale sucks in enormous amounts of plankton-filled water.

It's simply astonishing that the largest animal in the world feeds mostly on very tiny creatures. Its favorite food is called **krill**. These inch-long, shrimp-like zooplankton swim in swarms, and blue whales feed heavily on them. In the Antarctic summer, these krill are so plentiful that they turn the waters orange with their teeming presence. A blue whale can eat *four tons* of these creatures every single day!

When summer is ending and the blue whale has eaten so much that its blubber supply has increased a lot, it makes its long migration from the polar waters where it feeds to the waters that are its breeding ground. Where are these waters? Scientists are not sure. Wherever these waters are, the blue whale will probably not eat when it arrives there. Instead, it will probably live off the blubber it built up during its feeding frenzy in the waters of Antarctica. Despite the fact that we don't know where it has its calf, we do know that the calf is about 25 feet long the day it is born. It will be about 40 feet long by the next winter!

Humpback Whales



Can you see the wavy scallops on this breaching whale's fin? They tell you that this is a humpback whale.

One of the most often seen and actively studied whales is the **humpback whale**. It's easy to identify with the warty looking bumps found on the top of its head and its twelve-foot long flippers that have a wavy, scalloped pattern along the edges. It is usually dark on top with a little dorsal fin near the rear of its back. Its underside is white.

As I told you before, humpback whales are best known for the songs that

the males sing. They are also known for their amazingly acrobatic ability to breach. They leap completely out of the water and land with a giant splash. In addition, they like to go underwater and flap their tails on the surface, spanking the water to make splashes for onlookers. As you may remember, that's called lobtailing.

Gray Whales

Gray whales love to swim in groups and play in the crashing waves near the shoreline. They are extremely social with one another and are very intelligent. Because they are friendly to humans and congregate in huge numbers just off the coast of California in the winter, they are a favorite of whale watchers. In fact, tours are taken to the islands of Baja, California to pet these gentle giants. Would you like to pet one?



This gray whale's blowhole is surrounded by barnacles and other creatures that have hitched a ride.

As baleen whales go, gray whales are kind of small, growing to be only about 45 feet long. They are easy to spot with their gray mottled color, which is actually more charcoal black than it is gray. With all the barnacles and whale lice on it, however, a gray whale does look gray. Don't feel sorry for the creature because it has lice and barnacles on its skin. As far as scientists can tell, the lice *help* the whale by feeding off of dead skin, which the whale needs to get rid of. Many types of whales have lice and/or barnacles that live on them.

Are you right handed or left handed? Did you know that whales prefer one fin over the other, just like you prefer one hand over the other? You can actually tell if the gray whale you are seeing is right handed, I mean finned, or left finned. You only need to notice which side has fewer barnacles. This is because the whale likes to dive down to the ocean floor to scoop up huge amounts of sand from the bottom, filtering out small creatures that live in it. When the whale does this, many of the barnacles on the side that rubbed along the bottom are scraped off the whale. Whichever side has the least barnacles, then, is the side the whale prefers to use when it digs up sand.

Atlantic gray whales were hunted to extinction; so the Pacific gray whale is the only type of gray whale alive today. Actually, the gray whale was much feared by whalers, and only the very bravest would hunt it. In fact, when the whalers heard that they were trailing a gray whale, they trembled with fear and wondered if this might be their last whaling adventure, or their last day on

earth! You see, a mother gray whale protects her calf so fiercely that it would actually attack whalers and overturn their boats. As a result, whalers often referred to the gray whale as the **devilfish**. Of course, a whale is not a fish. It is a mammal.

As their name suggests, Pacific gray whales are found in the Pacific Ocean. They travel from their summer feeding grounds in Alaska down to Mexico for the winter, where they bear their calves. Since they travel along the California coast, there are stations set up along the coast where you can use telescopes to watch them migrating past. Of course, you could take a tour to Baja in the winter and enjoy them up close.

Right Whales

Do you remember that whalers preferred a particular kind of whale? Which whale was it? Right – the sperm whale. Well, in addition to the sperm whale, there was another whale that they liked. They called it the **right whale**, because it was the right kind of whale to catch. Even today, we still call it by the same name.

Whalers loved this whale because it has rich stores of blubber and a long baleen. A right whale's baleen is nine feet long! In addition, right whales were easy to catch; these 100,000-pound whales were so docile and kind, they didn't fuss or fight when harpooned. This made them an easy catch for whalers.



Notice the unique mouth shape of this southern right whale.

This whale can be distinguished from others by its mouth, which is in an upside down “U.” It looks like it's frowning! Look at the picture on the left. Do you see the white growths on the whale's skin? Those are rough patches of skin that form wherever the whale has hair. They are infested with whale lice, which gives them their white color. These patches are usually found behind the blowhole, on the chin, above the eyes, and on the lower and upper jaw.

What Do You Remember?

How does a cetacean move its tail to propel itself through the water? Which is the most important sense to a whale: smelling, hearing, or seeing? What must a calf do as soon as it is born?

How does the mother help it do this? Why must a whale have a blowhole? Where do most whales spend the summer and winter? Why? What is breaching? What is lobtailing? What is spyhopping? What is logging? Why did whalers want to kill whales? Which two kinds of whales did whalers really like? How are toothed whales different from baleen whales? What kind of whale has a “horn” like a unicorn? Name a difference between dolphins and porpoises. What is the largest animal on earth?

Notebook Activities

In your notebook, write down what you have learned about the two different types of whales, whale migration, and whale behavior. Then, look through books, magazines, or on the internet for photos of different cetaceans. Paste copies of them into your notebook, and label each kind of whale underneath its picture. Review these pages so that you will be able to identify different kinds of cetaceans when you see them on shows, in books, or anywhere else.

Older Students: Research newspapers at the library or the internet to find a recent report on a beached whale. Write a speech about this news article, including information that you have learned about beached whales.

Ocean Box

Add a baleen whale and a toothed whale to your ocean box today. Remember, you can use clay to make models of them, or you can cut pictures out of magazines or print them from the internet. You can place them logging on the surface of the water, or perhaps even lobtailing or spyhopping. Be as creative as you wish. You can place part of your whale up above the box and part of it inside, as though it were half in and half out of the water. Do this by cutting the whale in half after you have made it. Then, glue one half so that it is on top of the box and the other half so it is underneath the top of the box. See the ocean box pictured on page 17 to get an idea of what I mean.



Experiment

Whales are able to communicate with one another because sound travels better through water than it does through air. We’re going to do a sound experiment today to explore how sound travels. This will enable us to understand how sound travels through certain materials better than others.

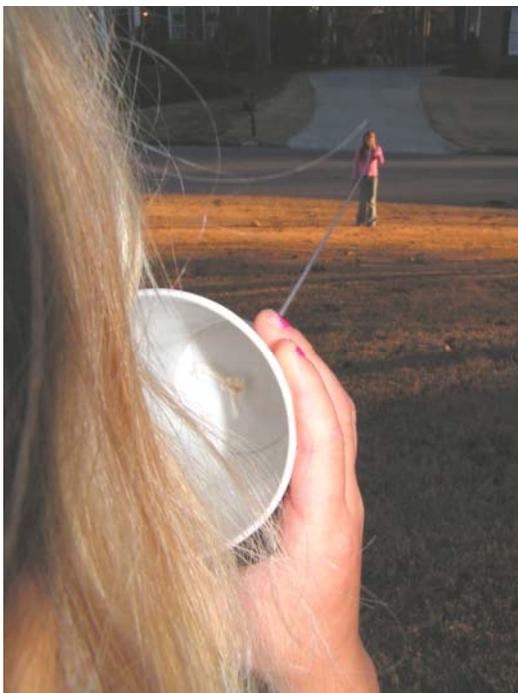
When someone or something makes a sound, it actually makes waves: sound waves which our ears feel as vibrations. In order for us to hear something, then, sound waves must travel from where the sound is made to our ears. When we speak, for example, our sound waves travel through the air around us. If they reach another person’s ears, that person hears us. When I whisper to my friend who is many feet away, she simply can’t hear me, because the sound waves die out before they reach her

ears. But if there were something that my sound waves could travel through better than they travel through air, my friend could hear my whisper even when she is many feet away. Let's see if sound travels better through air or through yarn.

You will need:

- ◆ Scientific Speculation Sheet
- ◆ Someone to help you
- ◆ 2 paper (or Styrofoam) cups
- ◆ A sharp object that can make a tiny hole in the bottom of each cup (like the tip of a straightened paper clip)
- ◆ A sharpened pencil
- ◆ 30 feet of 100% cotton yarn (Synthetics tend to stretch too much.)

1. On your Scientific Speculation Sheet, record your hypothesis: will sound travel better in air or yarn?
2. Poke a tiny hole in each cup right in the center of the bottom.
3. Use a pencil to push each end of the yarn through the hole in each cup.
4. Tie a triple knot to hold the yarn inside each cup when it is pulled tight.
5. Have your helper hold one cup while you hold the other.
6. Stand in a straight line as far away from the person as you can, pulling the line tight.
7. Have your helper speak softly to you while she holds her cup at her side. Can you hear her?



8. Have your helper speak with the same volume into her cup while you hold your cup to your ear. Can you hear your helper now?
9. Try the same thing again, but get just a little closer so the yarn is not tight. Can you hear your helper now?
10. You can experiment with strings of different lengths if you have them, seeing how long you can make your telephone before the sound waves die out. You can even experiment with different kinds of string.

You should have discovered that yarn carries sound waves a longer distance than the air. In addition, you should have found that this is only true if the string of yarn is stretched tight. Much like a tight string of yarn, ocean water can carry sound waves a long way, which is one reason cetaceans can communicate with others that are far away.