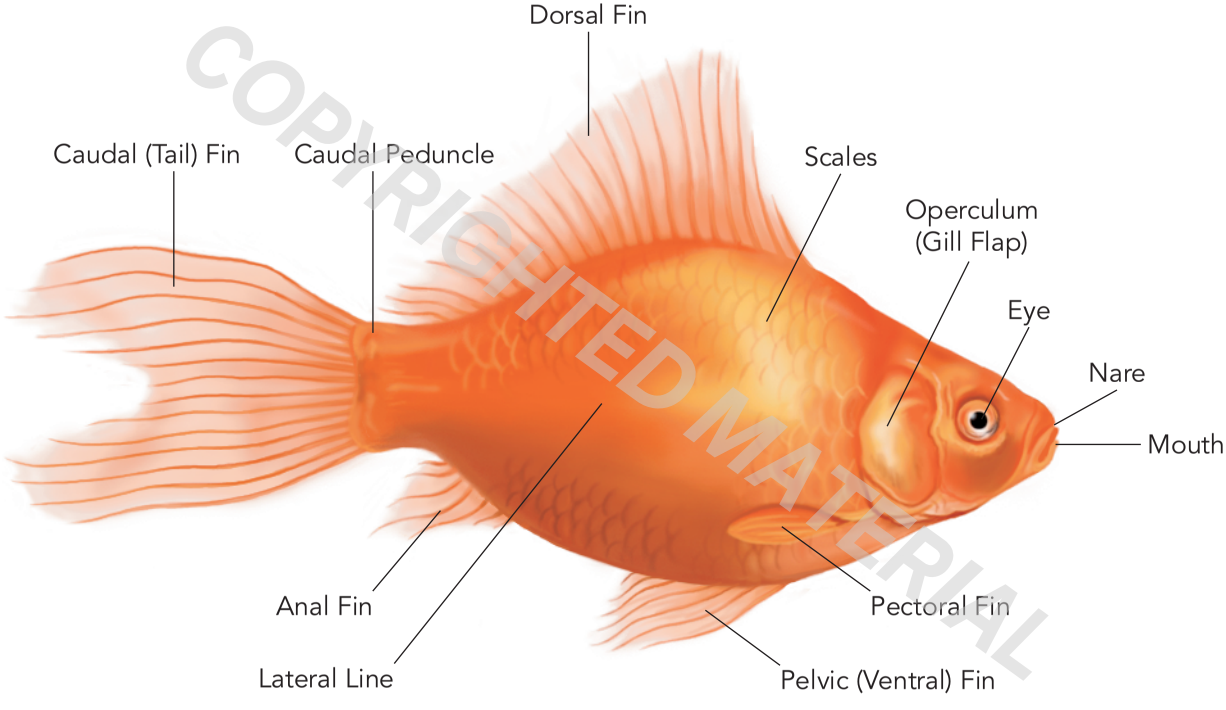
The Goldfish



Chapter 1

What Is a Goldfish?

The popular image of a goldfish in a bowl has been depicted the world over—from Chinese Ming Dynasty pottery to popular comic strips such as *Garfield*. Goldfish are the most popular domesticated aquatic life in the world, and there are more than 125 varieties—more varieties than any other fish species.

All of these varieties are thought to have been bred from a single species, the Crucian carp. These fish are long, flat-sided, and generally look like drab gray goldfish. The goldfish of today tend to be more colorful than their ancestors.

Regardless of variety, the goldfish is one of the most popular pets in the world. Goldfish don't need to be housebroken, they won't beg at the table, and they don't shed. They're flexible about the size of their aquarium, which can depend on the size of the room, and they're easy to keep.

Another great thing about goldfish is that they are a fairly hardy species and are quite adaptable. They are excellent candidates for outdoor ponds or pools in almost any climate. Given the wide range of colors, body shapes, and general disposition, there is a goldfish out there for everyone.

The History of Goldfish

For centuries, the Crucian carp and its various progeny were found only in Asia and were particularly prized in China and, some time later, in Japan. The Chinese word for goldfish is *jin yü*. Goldfish were first mentioned in China during the first Jin Dynasty (265–420). Some 500 years later, during the Song

Classifying Goldfish

Goldfish, scientifically known as *Carassius auratus*, can still be found in streams and ponds throughout Asia. In the wild, their colors are somewhat muddy and drab. The goldfish belongs to the largest family of fishes in the world, the Cyprinidae, which contains more than 2,000 species, including such common aquarium fishes as Barbs and Danios. The closest relatives of the goldfish are the Crucian carp (*Carassius carassius*) and the Koi (*Cyprinus carpio*).

The best way to distinguish between a carp and a goldfish is to look at the dorsal fin, which is usually straight up or concave (curved in) on the goldfish and convex (curved out) on the carp.

There are also some differences between Koi and goldfish that are easy to spot. Koi have very similar coloration, except that they have larger patches of color on the body. Also, while the Common Goldfish, which is the largest of all goldfish, rarely grows longer than 12 to 14 inches, Koi routinely grow to 18 inches and have been seen as long as almost 4 feet. But the easiest way to distinguish between goldfish and Koi is simple: Koi have small, nubbly whiskers (called barbels) on the sides of their mouth and underneath their chin. These barbels do not grow very long, but they are noticeable all the same.

How Scientists Classify Goldfish

Class:	Actinopterygii
Order:	Cypriniformes
Family:	Cyprinidae
Genus:	*Carassius*
Species:	*Auratus*

Dynasty (960–1279), it was not uncommon to have ornamental domesticated fish. These were usually kept in ponds or pools in courtyards and gardens.

The species was so popular in China, particularly in Beijing, that during the second Jin Dynasty (1115–1234) a goldfish pool was established in the capital city for commercial breeding. Goldfish reached such a height of popularity during the Ming Dynasty (1368–1644) that they were no longer a luxury for the privileged. Many courtyard gardens had ponds with ornamental goldfish, and they were even brought inside in clay pots. It was very common to keep successful breeding techniques a secret.

The big fish in this pond is a Koi and the smaller ones are goldfish.

Goldfish reached Japan in 1616, and the Japanese also became quite enamored of these beautiful fish. They quickly mastered the art of breeding them, and Koriyama, on the Japanese island of Honshu, has been one of the most famous goldfish breeding centers for more than 500 years. Japan is now the largest exporter of goldfish worldwide.

The Chinese and Japanese produced the Fantail, the Veiltail, the Globe-Eyed, and the varieties with transparent scales. Some of these varieties can be traced as far back as the late sixteenth and early seventeenth centuries.

In 1691, goldfish appeared in mainland Europe. From there they arrived in England in 1780. During the eighteenth century, as trade with the British, French, Dutch, and Portuguese flourished, goldfish became fashionable gifts and pets throughout Western Europe. By

Born in the USA

Despite there being more than 125 varieties of goldfish, the United States has only contributed one variety to this ever-popular species—the Comet. It was bred here by Hugo Murkett and the U.S. Fisheries Department around 1881. While it is the only variety bred on American shores at the time of this writing, with the numerous breeding centers around the nation, America's contribution could grow at any time.

Ornamental goldfish have been kept and bred in China for more than 1,000 years.

1850, goldfish arrived in the New World, and they were a big attraction in New York in 1865.

Keeping tropical fish became truly popular in the West after the opening of the first public aquarium at the London Zoo in 1853. The first goldfish show took place in Osaka, Japan, in 1862. The first goldfish show in the West took place in 1926 and was organized by the British Aquarists Association in London.

The Basic Goldfish Body

Although they all belong to the same species, there are more than 125 varieties of goldfish, and some look as different as cats and dogs. The Comet is the classic example of a common goldfish. The Comet's body is streamlined and tapers toward the head and the tail. The narrow section where the body meets the tail is the caudal peduncle. Regardless of variety, the caudal peduncle is almost always narrow on a goldfish, no matter how large the body. Some Fantail varieties, though, such as the Redcap and the Marigold Chinese Lionhead, have exceptionally large heads, while Moors and Veiltails, which are quite round, vary in their head shapes and sizes.

However, there are some features that are common to all goldfish—and are found in all fish. For example, although goldfish look very different from other tropical fishes, they have circulatory, respiratory, digestive, and nervous systems common to most members of this vertebrate group.

Fins

The fins are critically important appendages that enable every fish to propel itself, stabilize, maneuver, and stop. There are typically two types of fins, paired (one fin on either side of the body) and unpaired, and they are found at five places on the fish's body. To have a better idea of where these fins are located on a typical goldfish, look at the drawing on page 10.

The pectoral fins are the paired fins closest to the head. The fish uses these fins to stabilize itself, turn, maneuver, hover, and swim backwards. These fins are generally found just behind or below the gills on each side of the fish, under the midline of the body. On goldfish, the pectoral fins are different shapes on different varieties. They can be short and small, as on a Lionhead, or long and flowing, as on a Veiltail.

The pelvic fins are also paired; different fish have them in very different places. In some fish, these fins are under the fish toward the rear. In others, like the goldfish, the pelvic fins are closer to the head under the pectorals. The pelvic

Every fish has fins to propel itself, stabilize, maneuver, and stop. This is a Fantail.

fins act as brakes and also aid in stabilizing and turning the fish. In some varieties of goldfish, the pelvic fins may be elongated, as on a Veiltail Ryunkin.

The dorsal fin is an unpaired fin rising directly from the top of the middle of the fish's back. It is made of rigid spines and soft rays webbed with a membrane. The dorsal fin helps stabilize the fish right-side up and keeps it moving straight. When a goldfish is healthy, this fin stands straight up. Some varieties of goldfish, such as the Celestial, have no dorsal fin, and consequently have more difficulty swimming.

The anal fin protrudes from the bottom of the body, just in front of the tail. This unpaired fin works in concert with the dorsal fin to stabilize the fish. On some varieties of goldfish, the anal fin aids in propulsion and turning in small spaces. In some of the fancy varieties, the anal fin splits into a set of paired fins that are actually joined together where they meet the body. In the fancier varieties, the anal fin is so exaggerated that it is not very useful, and consequently these fish are bad swimmers.

The caudal, or tail, fin is an unpaired fin largely responsible for propelling the fish forward. It can also act as a brake, but is much more helpful in turning. There are three types of caudal fins: the single tail fin, the veiltail, and the fantail. The single tail fin is obvious and can be found on the common goldfish. The fantail is the most common of the fancy varieties and is a pair of forked tails joined at the caudal peduncle. The veiltail is a beautiful, large tail that has no indentations or forks and ends in a straight line; it is generally very long and elegant.

Scales

The body of a goldfish is covered with overlapping scales that are made of a hard, bony substance. They protect the fish's skin, reducing the chance of injuries or infection. The scales of a fish are translucent, like glass, and lack color; the color of the goldfish comes from pigment cells in the deeper dermal layer of skin. The forward end of each scale is attached to the dermis—the skin. The scales overlap like shingles on a house, providing a solid wall of protection.

The scales are covered by epidermal tissue that has numerous glands that secrete mucus and produce the slimy texture we normally attribute to fish. The mucous coating not only protects the fish against injury and infection, but also helps reduce friction between the body and the water, enabling the fish to swim more easily.

Much like tree rings, for each season of growth in a goldfish (a growth season is approximately one year, provided there is a six- to eight-week drop in temperature), the goldfish develops a ring on its scales. These rings are called circuli. The number of rings on the scale determines the age of the fish.

Scale Types

Goldfish can be characterized based on four scale types:

- **Metallic.** Fish with metallic scales have a shiny, scaly exterior, such as is seen in the Comet. These scales contain a crystalline substance called guanine, which is responsible for the sheen; the more guanine, the shinier the scale.
- **Matte.** Matte scales lack guanine almost entirely and have no reflective surfaces anywhere on the fish's body. Instead, they have a flat or skinlike look to them. Truly matte-type goldfish are typically not available commercially because they lack intensive coloration and are not as hardy as other fish. Matte fish are sometimes referred to as scaleless. This is incorrect—there is no such thing as a scaleless goldfish.
- **Nacreous.** When both metallic and matte scales are found on a goldfish, it is known as nacreous. Some individual scales, or whole sections of the body, might have a metallic-type finish, while others might have a matte-type finish.
- **Calico.** This category classifies any goldfish with three or more colors appearing anywhere on the body. Technically, this is not a scale type because scales do not have color, but it is often used to refer to goldfish with multiple colors. Many experts believe calico goldfish are really part of the nacreous group.

This Ryunkin goldfish has nacreous scales and a round body type.

Sleep and Color

If there is quiet time in your home, usually at night, you may find your fish resting at the bottom of the tank among some rocks or plants. Occasionally, the pectoral or tail fins will move to keep the fish balanced. Since they have no eyelids, many people think the fish are always awake. Wrong! They're asleep.

Goldfish tend to lose some color and luster when they're sleeping. But don't worry—it comes right back when they wake up. In fact, to grow to their potential and have their best color, goldfish should have room to exercise and time to sleep. Goldfish need their rest, just like you, so turn the aquarium and room lights off during the evening hours and let your fish sleep. If you don't turn the light off, the fish will sleep for shorter periods of time or largely go without, which could result in shorter lifespan, less color, and less active fish.

Color

The coloration of a goldfish, or any fish for that matter, depends on a wide variety of factors. Of course, genetics plays a part. Water composition, temperature, and diet also greatly affect a fish's chromatophores (pigment cells). There are two types of chromatophores, melanophores and xanthophores. Orange goldfish have an abundance of xanthophores and an absence of melanophores, while the blue or black varieties, such as the Black Moor, have an abundance of melanophores and lack xanthophores.

How Do Goldfish Swim?

The back-and-forth movement of the caudal fin provides the goldfish with forward motion. The fish literally pulls its tail from one side of its body to the other. By going back and forth, the tail pushes the water behind it, thus creating thrust and pushing the fish forward. By bending the tail in subtle ways, the fish can also steer.

The fish stops by reversing the tail motion, quickly. All other fins immediately become rigid. Sometimes the pectoral fins are instrumental in backing up or when a sudden stop is needed, much like a thruster rocket on a spaceship.

The tail fin propels the fish forward, and the swim bladder enables the fish to rise or sink in the water.

Swim Bladder

The swim bladder is a gas-filled sac that helps a fish rise or fall in its watery environment. Goldfish actually have two swim bladders, one directly in front of the other. These compartments contain oxygen, carbon dioxide, and nitrogen.

By inflating and deflating its swim bladder, the goldfish controls its buoyancy. This also helps the fish stabilize and hover comfortably. Some of the more elaborate varieties of goldfish are top-heavy, and as a result will always swim at an angle. For example, the Lionhead has a smaller forward sac, causing its head to thrust slightly downward.

How Do Goldfish Breathe?

Goldfish, like all fish, need oxygen to live. Since they live in the water, they do not breathe air as we do. Instead of lungs, they have gills. Most fish have four gills on each side of the head protected by a single gill flap, or operculum. When a fish breathes, water is taken into the mouth and passed over the gills and out the operculum. As water passes over the membranes and filaments of the gills, oxygen is taken into the blood and carbon dioxide is excreted. Large amounts of ammonia are also excreted by the gills. To accomplish this, the gills have a very high number of blood vessels that deliver the oxygen to the rest of the fish via the circulatory system.

When there is not enough oxygen in the water, fish rise to just below the surface, where oxygen concentrations are greatest. These fish are actually trying to avoid suffocation. This occurs most often in the well-known goldfish bowl. We will talk about the dangers and problems of the goldfish bowl in chapter 4.

A Goldfish's Senses

Goldfish have five senses that they use to eat, avoid predators, communicate, and reproduce. Their senses are specially adapted to their underwater life.

Smell

A goldfish, like all fishes, has nostrils called nares. But, unlike us, goldfish cannot breathe through their nose. Their nares, located above the mouth and in front of or below the eyes, allow water to pass into and out of the olfactory organs. Water flows through the nares and into the olfactory pits, where odors are perceived and communicated to the brain via a large nerve. For goldfish, the sense of smell is particularly important in detecting prey and mates.

Touch

Fish have a special sensory organ called the lateral line system that enables them to detect movement in the water. The lateral line is easily visible along the side of the goldfish. It is a series of pits and grooves containing sensory cells that detect water displacement. This system helps the goldfish detect other fish and avoid obstacles.

Hearing

Water is a much more efficient conductor of sound than air. Therefore, sound carries much farther and faster in water than in air. The goldfish, like most fish, does not have external ears, but rather an inner ear structure consisting of the sacculus and the lagena, which house the sensory components of hearing, the otoliths. Sound vibrations pass through the water, through the fish, and reverberate in the otoliths of the inner ear. This gives a goldfish its sense of hearing and, like our own inner ear, its sense of balance. We know for sure that fish make sounds during eating, fighting, and mating, so hearing is essential for goldfish survival.

A fish's eyes are much like our own, except they lack eyelids. Most fish are nearsighted.

Sight

The eyes of most fish are similar to our own, except that they lack eyelids and their irises open and close much more slowly. Rapid changes in light intensity therefore tend to shock a fish—a fact you should keep in mind. Gradual changes in light enable the fish to accommodate and avoid temporary blindness.

The location of the spherical lenses of fish eyes renders most fish nearsighted. This is not a great handicap, since visibility in ponds and lakes is not always very good. Goldfish are able to detect color and, since their eyes are on either side of their heads, they have monocular vision as opposed to binocular vision like us.

The eyes are efficient at spotting food and dangers, including other fish. Highly developed goldfish varieties, which have bubble eyes or telescope eyes, are thought to see only upward. The Bubble Eye variety, which has large fluid sacs underneath its eyes, is thought to suffer vision loss as well. Despite this, these varieties of goldfish, when maintained with ordinary care, suffer no great problems when housed with other goldfish of the same type.

Taste

Most of a goldfish's tastebuds are located on the lips and all over the mouth. There are even taste buds on the outsides of the lips. Goldfish have no tongue. Taste in fish is especially helpful in identifying both food and noxious substances.