

Axolotl

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Natural History

Axolotls (*Ambystoma mexicanum*) are aquatic salamanders native to two singular lake systems in Mexico City. They are critically endangered in the wild due to habitat loss and pollution, but are abundant in captivity due to their popularity as laboratory animals. Unlike most salamanders, axolotls remain fully aquatic their entire lives instead of just as juveniles. Their ecology is largely unknown, but we know they are native to high altitude, cold water lakes. Axolotls are also known as Mexican walking fish, but this is a misnomer because they are aquatic amphibians.

Characteristics and Behavior

Axolotls have a unique characteristic called “neoteny” where they retain juvenile traits. Young salamanders have external gills, webbed feet, and body fins that regress as they mature. Axolotls, however, maintain these traits throughout their life. While they do have lungs, they are completely aquatic. These salamanders are common lab animals because of their limb and organ regenerative abilities. Interestingly, axolotls are also thought to be 1000x more resistant to cancer than mammals. Wild axolotls are grey-brown in color, but other morphs exist in captivity including melanistic (black), leucistic (white), gold, and other combinations. Axolotls are cute, unique, and somewhat mysterious amphibians that can make great pets for the intermediate keeper. Their care isn't particularly complex, but the nitrogen cycle and tank cycling can be daunting to inexperienced keepers. Axolotls are very curious and appear to recognize their owners as food providers. It is common for these salamanders to actively swim toward people outside their tank. They are surprisingly interactive, but should never be handled as being taken out of the water is extremely stressful.

Lifespan

10-12 years.

Adult Size

10-12 inches.

Housing

A 20gal tank should be considered the minimum size for an axolotl because they are messy animals. Axolotls are completely aquatic and their housing should reflect this. No land portion is needed in their enclosure, nor will it be utilized. Axolotl aquariums should be fitted with a lid, as axolotls are known to jump out of enclosures. Axolotls require a canister filter plus a spray bar to spread out waterflow because they do not tolerate distinct water flow. Axolotls also need an aquarium thermometer to monitor temperature. Small gravel should be avoided because axolotls eat food by hovering their prey and anything that can fit in their mouth can be swallowed can cause an impaction. Aquarium safe sand or large pebbles (bigger than the animal's head) should be used. Axolotls love to hide so plants (live or fake), caves, rocks, logs, and other cover should be added to provide enrichment and security. Axolotls should be housed alone as they can be aggressive toward each other, and they should not be housed with live fish because fish can nip at their gills.

Like other aquatic animals, axolotls need to have their tank cycled before they are added to the enclosure. To understand cycling, one needs to understand the nitrogen cycle. Decaying food, plant matter, waste, or organisms release ammonia in the water, which is extremely toxic to aquatic animals. The way to counteract this is to build up the "good" bacteria. Nitrifying bacteria convert ammonia to nitrites, then nitrites to nitrates, which are much less toxic than ammonia or nitrites. Nitrates are then kept at a reasonable level with water changes +/- live plants. Cycling needs to be done before the animal is added to ensure water parameters are safe for the animal. A 20-30% water change with dechlorinated water should be done weekly after the animal has been added. The filter should never be scrubbed clean, as nitrifying bacteria live here as well. To clean out the filter, tank water can be run through to wash out any debris. Other maintenance should be done based on brand recommendations.

Cycling: The tank should be completely set up prior to adding the animal, then dechlorinated water can be added (dechlorinators can be purchased at pet stores or online). The filter should be turned on, and live nitrifying bacteria should be added. Ammonia should then be added every day until an ammonia test kit reads 0 ammonia, 0 nitrite, and some nitrates. There are multiple sources of nitrifying bacteria and ammonia. Substrate can be added from an already cycled tank, or fish food, raw fish, or 100% ammonia. Both ammonia and nitrifying bacteria can be purchased from most pet stores or online. Cycling can take weeks to months. Improper cycling is the cause of a disease called "new tank syndrome", where toxic compounds build up in the tank and cause illness. Cycling is also the reason that full water changes should never be done. If all of the water is removed, all of the "good" bacteria are removed as well.

pH: This is a measure of how acidic or basic the water is. 7.0 is neutral; lower is acidic, higher is basic. 7.4-7.6 is the optimal range for axolotls, but 6.5-8 can be tolerated.

Nitrate: This is the end product of the nitrogen cycle. Axolotls should have a nitrate level of <40 ppm.

KH: This is the carbonate hardness or alkalinity, which measures the water's ability to neutralize an acid. The name carbonate hardness comes from carbonate and bicarbonate, which are the primary components of alkalinity. This is important for stabilizing pH and providing energy for nitrifying bacteria. The KH for axolotls should be 3-8deg (53-143ppm).

GH: This is the general hardness, which measures hard minerals in water (i.e. calcium and magnesium). Axolotls need a GH of 7-14deg (125-250ppm).

Salinity: This is the salt level in the water. Ideally, salinity should be 0% but axolotls can tolerate up to 15%.

Ammonia and nitrites should be 0. Weekly-biweekly water tests should be done to ensure your axolotl's water parameters are within acceptable limits. Water testing kits can be bought at most pet stores or online.

Lighting

It is unclear if axolotls benefit from UVB lighting. Other amphibians and reptiles require UVB to synthesize vitamin D3 in their skin. Vitamin D3 is needed for calcium absorption and prevention of metabolic bone disease. Axolotls spend a lot of their time at the bottom of a lake, and are generally sensitive to bright light. Therefore, most keepers don't recommend UVB light for axolotls. However, there is evidence that other amphibians suffer from poor calcium absorption and metabolic bone disease from a lack of UVB light. If UV is available, a maximum UVI of 1-2 may be provided. If UV is being provided, it is important to turn this light off at night and ensure that there are plenty of plants and other hides available for the axolotl to choose to get away from the light. The lamp should cover no more than $\frac{1}{3}$ of the animal's enclosure. Any lighting for plants should also be turned off at night to provide a normal day/night cycle.

Heat

Axolotls need a temperature range of 62-64F. They can tolerate up to 70F, but heat stress will occur over 74F. An aquarium safe thermometer should be provided.

Feeding

Axolotls are carnivores that eat invertebrates and small fish in the wild. They ingest their prey via sucking, not biting, so food should be small enough to fit in their mouth. Nightcrawlers, blackworms, brine shrimp, Repashy grub pie, and sinking pellets (University of Kentucky provides a good product) are all staple foods that should be rotated to provide enrichment and prevent nutritional deficiency. Bloodworms, bits of fish, red meat, hornworms, calciworms, or shrimp can all also be provided on occasion. Live fish should be avoided because of disease transmission and also because they like to nibble on an axolotl's gills. The equivalent of 2 worms should be fed to adults every 2-3 days, with juveniles (under 6 months) being fed every day.

Sexing

Males tend to have cloacal bulges and are generally more elongated with longer tails. Females tend to be rounder.

Zoonosis

Axolotls do not appear to be a significant health risk to humans.

Health

Axolotls should not be taken out of water for handling as this is very stressful. If an axolotl needs to be handled, vinyl gloves should be worn as bare human hands have salts and oils that can be harmful to amphibian skin. Axolotls tend to be hardy but can suffer from ammonia poisoning, other water quality issues, substrate impactions, and are known to have their gills regress if exposed to betadine. If an axolotl is sick, a water sample should be brought in along with your animal. Amphibians are voracious eaters, so loss of appetite should be considered a red flag. Skin lesions and gill damage are also signs of illness.

Sources and Further Reading:

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