Basic Water Quality and the Nitrogen Cycle

Your aquatic animal's health is intimately related to the quality of the water they live in. The way you manage your water quality is therefore very important. This handout covers the very basics of water quality management for indoor freshwater aquariums and will be helpful for freshwater species such as goldfish, turtles and axolotls. A filter is vital for good water quality, but choosing a filter falls outside the scope of this handout and we would recommend that you liaise with a reputable aquarium shop to help you with this choice.

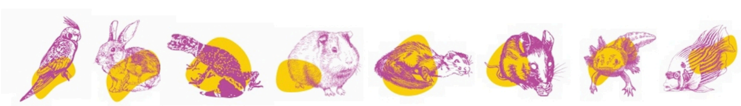
Aquatic animals excrete ammonia in their urine and faeces.
Ammonia is highly toxic and if ammonia levels in your tank become elevated (even a little bit) it can have serious health consequences for your aquatic animals. Fortunately, an appropriately managed aquarium will grow good bacteria that line the surfaces of the tank and filter medium. These nitrogen-fixing bacteria convert ammonia to nitrites, and then to nitrates. This is called the nitrogen cycle. Nitrates are generally less toxic than ammonia, but elevated nitrate levels can still make your animals sick. Nitrate levels in the tank are controlled by performing regular water changes (20-30% weekly). The filter medium can be gently cleaned in the old tank water (see below).

How to establish your nitrogen-fixing bacteria:

- Set up the aquarium with the filter and do not introduce your animals for 6 weeks. This gives the bacteria time to grow. This period is often referred to as 'cycling'.
- Bacteria can be purchased from aquarium stores to seed your aquarium.
- Filter medium can be taken from an established tank and placed in your tank, however, there is a risk of introducing disease with this practice.

How to look after your nitrogen-fixing bacteria:

- Tap water contains chlorine which kills bacteria. ALWAYS de-chlorinate tap water before using it in your aquarium. Dechlorinating solution can be purchased from aquarium stores. This applies to the water used in the initial tank set up, and to the water used for water changes.
- Clean your filter medium by gently swishing it around in the water that has been removed during a water change. If you rinse the filter medium under a tap, the



pressure of the tap water can strip the bacteria off, and the chlorine will kill them.

- Avoid thoroughly scrubbing the aquarium, as this can remove the bacteria from surfaces.
- Avoid emptying out the tank and letting it dry unless absolutely necessary. Doing this kills all the bacteria which means you have to start from scratch.

How to reduce the workload on your nitrogen-fixing bacteria:

- Reducing the workload on the nitrogen-fixing bacteria reduces the likelihood of toxic ammonia spikes occurring.
- Remove any uneaten food after a feeding session. Decaying food material can adversely affect water quality.
- If substrate is used, use an aquarium vacuum to suck out any faeces or debris that has accumulated.

How to monitor your nitrogen-fixing bacteria and the nitrogen cycle:

- Water quality testing is strongly recommended before and after each water change. Water quality test kits can be purchased from aquarium shops.
- Basic test kits usually include pH, ammonia, nitrite and nitrate. Testing the water quality allows you to identify problems before they make your aquatic animals sick and can give clues as what has led to the problem.

Regular water quality maintenance:

- In the wild, aquatic plants use animal waste as food which helps keep the water clean. Water flow also helps prevent toxic waste building up.
- In an aquarium there is unlikely to be enough plant mass to use up all the nitrates made by the nitrogen-fixing bacteria. As mentioned previously, nitrates are less toxic than ammonia, but still toxic at high levels. Weekly partial water changes of 20-30% with dechlorinated water will help keep the nitrates at an acceptable level.