

## The Nitrogen Cycle

Every new aquarium set-up goes through a process of establishing beneficial bacterial colonies. This process is generally known as the nitrogen cycle, but is also called nitrification, the start-up cycle and/or the break-in cycle. As you know, your aquarium is a closed environment so all of the waste excreted from your fish and uneaten food accumulates in your aquarium. The nitrogen cycle converts these wastes to safer by-products. The fluctuations you have noticed in your aquarium water quality recently are likely the result of this cycle.

### Stage 1:

The cycle begins when you add fish to the aquarium. All uneaten, decayed food and waste generated by the fish breaks down to form ionized or unionized ammonia. The ionized form, Ammonium ( $\text{NH}_4$ ), is present if the pH is below 7, and is not toxic to fish. The unionized form, Ammonia ( $\text{NH}_3$ ), is present if the pH is 7 or above, and is highly toxic to fish. These ammonia levels will increase for about 2 weeks until the second stage of the cycle begins. (The Freshwater Master Test Kit's ammonia test gives a combined reading of Ammonium ( $\text{NH}_4$ ) and Ammonia ( $\text{NH}_3$ ).)

### Stage 2:

During the second stage of the nitrogen cycle aerobic bacteria called *nitrosomonas* grow to sufficient quantities in the filter to convert the ammonia to toxic nitrite. (Nitrite destroys the hemoglobin in the fish's blood and eventually prevents the blood from carrying oxygen) As this happens, the ammonia levels will quickly begin to drop as the nitrite levels slowly increase. These nitrite levels will continue to increase for about 2 weeks until aerobic bacteria called *nitrobacters* grow to sufficient quantities in the filter to convert the nitrite to less toxic nitrate.

If your current water quality testing indicates high nitrites, the nitrobacters are still establishing themselves in your filter media, gravel and hydro-sponge.

### **Stage 3:**

The conversion of nitrites to nitrates is Stage 3 of the nitrogen cycle. Again, as the nitrite levels quickly decrease due to the work of *nitrobacters*, the nitrate levels will slowly increase. Once your tank has reached this point (about 5-6 weeks total), it is said to have "cycled". All you need to do now, is to perform your regular partial water changes in order to keep a moderately low nitrate level. If this practice is followed routinely, you should have no problems maintaining your biological filter.

What not to do during the nitrogen cycle:

- Don't change the filter media – the beneficial bacteria are growing there. Don't disturb them until they have become well established. (You may need to clear debris from the filter sponge once a week--do this in dechlorinated water.)

- Don't overfeed the fish – when in doubt underfeed your fish.

Remember that anything going into the tank will produce waste one way or another.

*by Emily Gates, Pennsylvania Council of Trout Unlimited in consultation with [this reference](#)*

### Stage 4:

Many TIC tanks now use [MicrobeLift Special Blend](#), which further converts nitrates into nitrogen gas, which then bubbles out of the tank. Some water changes and vacuuming are still advisable, but on the whole nitrate levels are lower and more manageable with this product.