



# “How To” Series: Understanding Bacteria & Enzymes And How They Work - Safely

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In this “How To Series,” we want to help make it easier to understand how naturally safe, beneficial bacteria and enzymes work to provide quality water conditions in lakes, streams, ponds, backyard water features, and koi ponds.

We will take the mystery out of some of the myths that surround the understanding of how beneficial bacteria and enzymes work.

There are several reasons why many have a hard time getting their heads around what beneficial bacteria and enzymes are and how they work as nature designed them to do:

1. An unfamiliar world of identifying terminology.
2. Being able to visualize something we can not see without a microscope to understand how the bacteria and enzymes work.
3. The numerous myths created by those who “fear” the word bacteria, not understanding that these same bacteria are found naturally in nature and are extremely necessary and beneficial to life. Even our bodies are full of beneficial bacteria.
4. Believing those who play on the above misunderstandings to advance a uniformed position and/or promote the sale of a product.



**Microbes** are living single-cell organisms too small to be seen without a microscope and thus referred to as **microorganisms**, including **bacteria**, protozoa, algae and fungi.

**Enzymes are produced by bacteria!** Microorganisms, like bacteria, grow and reproduce by eating available contaminants. They produce enzymes that break down the food so that the bacteria can digest it.

**Think of it this way: Bacteria can’t digest the whole apple, so the bacteria creates enzymes to turn the apple into applesauce that they can digest.**

**Bacteria can reproduce very quickly, but enzymes cannot duplicate themselves.** They are only produced by bacteria as a biochemical catalysis.

**Here’s the most exciting fact of all** – There are hundreds of natural beneficial bacteria in nature, each one specializing in what they target to digest and each one producing their own enzymes. **Since the bacteria strains that specialize in digesting toxins and decomposing organic matter in lakes and ponds are already found in nature and are safe**, producers can cultivate them safely and provide them as beneficial treatments to aid in water quality.

# Understanding Bacteria & Enzymes



## DID YOU KNOW?

**Each strain of bacteria has a specialty or food source they target to digest.** Bacteria that require high levels of oxygen to be most active are known as **Aerobic**, which makes them ideal for maintaining a healthy ecological balance for excellent water quality. Nitrifying bacteria digests inorganic and nitrogen. They effectively digest nutrient pollution, allowing for lower levels of nitrogen and counter algae growth naturally. There are also **Heterotrophic** strains of bacteria that are **Anaerobic**, meaning they can be very active in low levels of oxygen, making them great for digesting muck.

**ALL EasyPro® Pond and Lake Treatments are categorized as BSL-1 and are eco-friendly.**

## Biological Safety Levels (BSL)

Biosafety Levels were established by the United States Centers for Disease Control. The (CDC) issued criteria to categorize each strain of microorganism into a specific level of containment.

- **BSL-1:** Safest. Not known to cause disease in plants, animals or other organisms.
- **BSL-2:** Moderate risk of infections.
- **BSL-3:** Agents are known to cause disease.
- **BSL-4:** Cause severe and fatal disease: epidemics

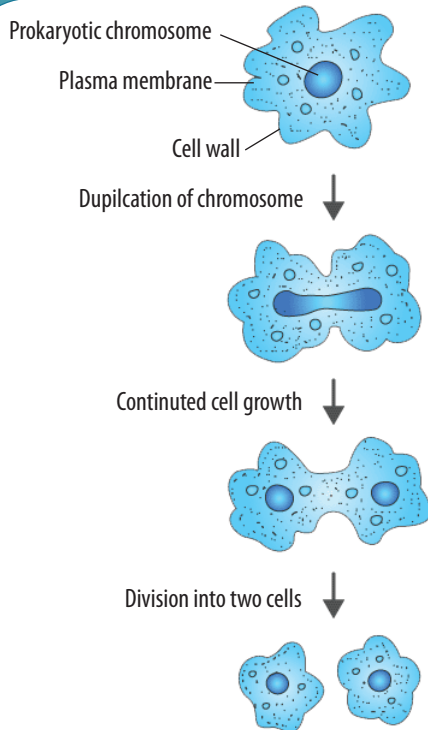
## Bacteria Growth - How and How Fast

Given the optimal conditions (oxygen, water temperature and food source), bacteria tend to replicate every few minutes in a logarithmic pattern. Replication time varies with species and environmental conditions the bacteria are exposed to. For example, ideal water conditions are 55 degrees and a pH between 5.5 and 8.5.

Let's assume that it takes a species of bacteria 20 minutes to replicate. In 20 minutes, one cell will divide and become two new cells. After 20 minutes, those two cells become four cells, and after 60 minutes there will be eight cells.

Between 6 and 7 hours the number of cells pass the 1 million mark, and after 12 hours, there are nearly 70 billion cells.

Keep in mind that water treatment products deliver millions of bacteria to the application at the start, so the numbers are even larger. One million cells will divide and become 2 million cells in 20 minutes. Four hours later, they will reach 1 billion. Twelve hours, in ideal conditions, the numbers are in the quadrillions. At the same time, during the replication process, each bacteria will be creating its own enzymes.



# Understanding Bacteria & Enzymes

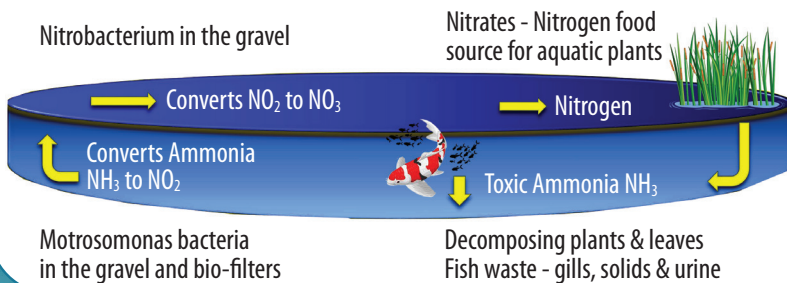
The EasyPro® eco-friendly water treatments work using what mother nature already supplies to assist in maintaining the pond's water quality and balance.

It is helpful to understand how mother nature works and then how water treatments support this ecological process.

## Maintaining a Natural Nitrogen Cycle

**Excess nitrite (NO<sub>2</sub>) prevents blood from carrying oxygen**

**Excess nitrate (NO<sub>3</sub>) helps promote algae blooms**



Decomposing plants and leaves, fish waste from solids and urine settle to the bottom of a pond. As they decompose, they create toxins like ammonia.

Natural bacteria in the gravel and bio-filtration convert ammonia to nitrites. This process lowers the oxygen levels in the pond water and nitrites are still harmful to the fish because they prevent their blood from carrying sufficient levels of oxygen. This is another good reason to utilize good aeration. If you see fish at the top of the water gasping for air, this could be one of the contributing factors.

Other natural bacteria convert the nitrites to nitrates. An elevated level of nitrates, as well as high levels of phosphates, which can come from uneaten fish food, can contribute to algae blooms.

Plants can now utilize the nitrogen as a food source and the cycle continues.

## Three Myths About Beneficial Bacteria Water Treatments debunked!

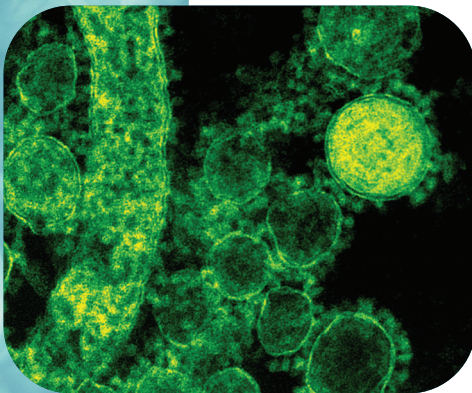
### Myth #1 - Beneficial bacteria water treatments are chemicals

This statement couldn't be further from the truth. People with limited knowledge on terminology are confusing beneficial bacteria found in healthy bodies of water with disease-causing bacteria. Or, they consider all forms of bacteria "scary." So, they say, "I don't want any chemicals in my pond."

The beneficial bacteria for water treatments are a "safe" bacteria naturally found in nature. It was already there. Beneficial pond bacteria treatments increase the levels of the most effective bacteria for ponds where needed for improved water quality.

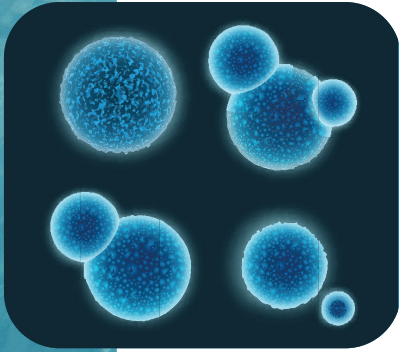
### Myth #2 - All beneficial bacteria water treatment products are the same

In the water treatment industry, there are a limited number of bacteria strains that work well in lakes, ponds, and streams. Each bacteria has a specific specialty and optimum performance conditions. Some products may boast, for example, 16 strains of bacteria, but 10 of those may have limited specialties and performance conditions. Another product with five highly effective bacteria strains may be a better product overall.



# Understanding Bacteria & Enzymes

## Three Myths About Beneficial Bacteria Water Treatments debunked!



### Myth #3 - For best results, add enzyme-rich treatments

Bacteria produces enzymes. Enzymes can not duplicate themselves. They are the protein produced by bacteria to break down the organic or inorganic matter they digest. They are all beneficial bacteria products. We do add enzymes to our blend to help speed up the process. But the majority of the enzymes will be produced by the bacteria rather than this supplement of enzymes.

## Water Treatment Products

### Pond-Vive Water Soluble Packets



Beneficial bacteria that will help consume and digest decaying organic materials. It will help improve water quality and pond health.

### Pond-Vive L Liquid



A liquid proprietary blend of enzyme producing beneficial bacteria formulated to help improve water quality and reduce sludge.

### Pond-Vive Powder



Beneficial bacteria that will help consume and digest decaying organic materials. It will help improve water quality and pond health.

### All Season Pond Bacteria



Removes ammonia, nitrites, nitrates, phosphates and sludge to maintain a healthy, balanced ecosystem.

### Seasonal Boost



The Seasonal Boost is a cold water bacteria. Use this in the first months of Spring and in the Fall to ensure a high count of beneficial bacteria.

### Sludge Remover



Designed to specifically remove organic sludge from the bottom of lakes and ponds. It will enhance water quality and remove pond odors.