

Bio-Film Removal:

Bio-films can be removed mechanically, chemically or "naturally."

Mechanical removal using vacuums, wall brushes, scrub brushes, filter cleaners, etc., physically remove the bio-film from visible places.

Visible places would be the filter cartridge itself, filter tank, vinyl liner, water line, ladder treads, pool surfaces, skimmer baskets, etc. You can physically handle the object that needs to be cleaned.

Brushing breaks up and lifts the bio-film off from its cozy environs enabling the chlorine to kill it and the filter to remove it. Be careful however to regularly physically & chemically clean the filter to remove the accumulations of "filtered" bio-films from the filter media - whether it be sand, DE or cartridge.

Chemical removal. In hard to reach places like pool plumbing lines & inside heaters, bio-films need to be removed Chemically. This is where so much bio-film (and about 99% of the bacteria) accumulates and thrives. Bio-film is left alone. It has all that it needs - a surface, moisture, and nutrients floating by.

Bio-films don't need sunlight - it's not algae so sunlight is not needed. Bio-films do need "warm" water - 90° F - or better for optimal growth, but as long as it's not cold, the bio-film will survive and proliferate.

Chemical removal of bio-film in salt-chlorine systems is especially important. The chlorine producing cell is very susceptible to scale and bio-film build up.

Natural removal is accomplished using certain enzymes, natural acids and even sphagnum moss.

Natural enzymes (Natural Chemistry® Pool Perfect, Pool First Aid, etc.) "eat up" much of the nutrients and other waste that contribute to bio-film growth thereby stunting it. As bio-films become more resistant and more proliferate, a new arsenal of products must be considered & used.

Newer products such as **AquaFinesse™** Pool Pucks are added to the pool skimmer and quite rapidly remove the bio-film from hidden surfaces. AquaFinesse™ products have been successfully used in the European market and in industrial applications for several years.

As with the physical removal products, loosened & removed bio-film particles are filtered out of the water then removed from the system entirely. After initial application, the filter becomes rapidly clogged as it traps all of that used bio-film. All filters must be chemically cleaned to restore them to a good working condition.

If bio-film removal has never been done before, it may be necessary or advantageous to replace the filter media - especially in older swimming pools. These products are completely compatible with all pool care chemical systems (chlorine, bromine, biguanides, ionizers. salt).

PoolNaturally™ utilizes a species of sphagnum moss that actively neutralizes the "stuff" that contributes to bio-film as well as algal growth. The result is clear, "clean" & well balanced water as found in many ponds & lakes where sphagnum moss grows.

Pool Bio-Films. What they are. How to treat them.

**Important information
for all swimming pool
owners who want to
treat the root causes of
pool water quality issues.**



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What is a bio-film?

A bio-film is a large quantity of bacteria that is living in and as a vast colony in the microscopic world. In the "big" world, you could call a coral reef a "bio-film."

Bio-films in swimming pools lead to cloudy water, algae blooms, scale build-up on the heater (prevents efficient heating), and even corrosion (certain bio-films can have a pH of about 1.0 - very acidic) of any metal surface of the pool system including heaters, filters, rails, ladders, etc.

Bio-films are everywhere. Pools, spas, bathrooms, kitchens, the funky look to your patio furniture, on your teeth (plaque is a bio-film). Bio-films are self-perpetuating and difficult to remove. Worst of all, bio-films love virtually any surface, especially wet or damp. However, even after drying out, the bio-film will not necessarily be dead but simply dormant. Bio-films are resistant to chlorine, bromine and other sanitizers. Bio-films can have a slight tinge of color (pinkish / brown).

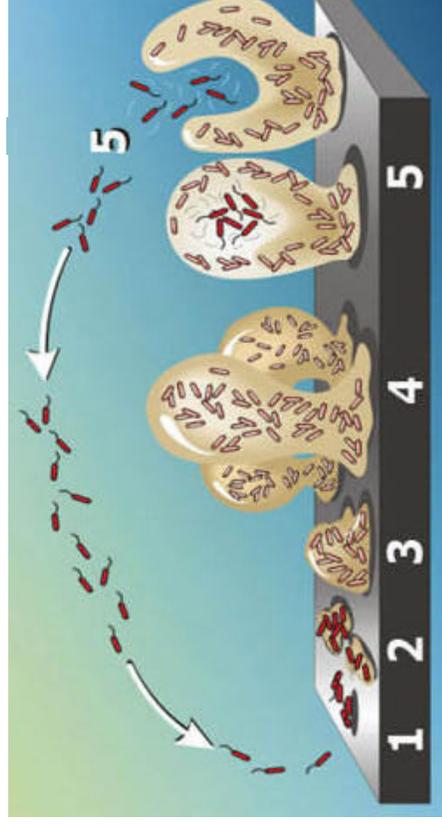
How do bio-films form?

As noted above, bio-films form on any surface. In your pool that means the liner or the pool walls, bottom, ladder rails, skimmer baskets, ladder treads, filter tank bodies, pump bodies and impellers, directional returns (eyeballs), heater plumbing & especially the piping.

There are **5 steps** in the process of forming bio-films:

Attachment - the bacteria attaches to the surface. It wants a place to call home and grow. Bacteria want to be in relationships, so they find a nice surface to settle down and join up with a few (million) of their closest friends.

Colonization takes place as bacteria multiply and divide, growing in number. According to studies, it is at this crucial point that attachment is "irreversible." The bacteria colony is there to stay unless purposefully removed. This stage is typically accomplished in a matter of minutes or hours at most.



The good news is that as the bio-film colony increases in size, it gets more "unwieldy" and begins to break apart. That is also the bad news.

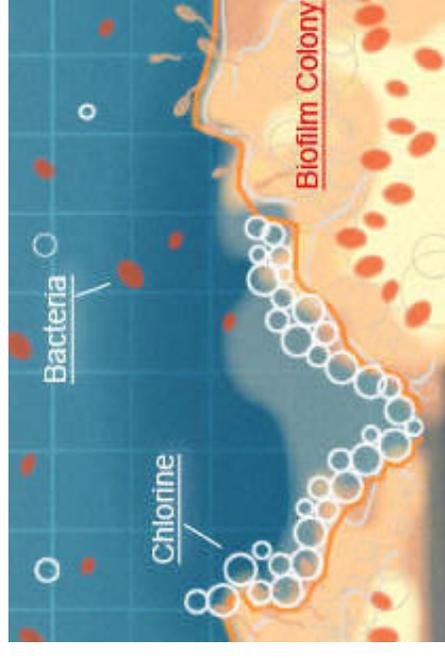
Now we come full circle to **Distribution**, where these broken parts begin to attach to other or different parts of the same surface. And the Bio-Film cycle begins all over again.

What's the Big Deal?

The big deal with Bio-films is how much bacteria they harbor. The Montana State University Center for Biofilm Engineering studies demonstrate that 99% of all bacteria in a pool is found in the Bio-Film! Only 1% is "floating" around the pool waiting to be killed. What do you do? Bio-Films are resistant to chlorine or bromine—the illustration below shows how chlorine will attach to the outer colony.

Bio-films bond with biguanides (such as BioGuard® Soft Swim® or Arch Chemical® Baquacil®). Ionizers (Nature2® or Frog®) have no effect. Ozone is ineffective.

You have to remove it. But how?



Protection stage, the bacteria colony or bio-film begins protecting itself against invasion. Invasion from environmental factors, "lethal" chemicals (such as chlorine or bromine), predators, anything that want to destroy it. In technical terms, the bacteria begins to excrete a protective coating called an "exopolysaccharide" (EPS) film. The film is sticky or slimy and very hearty. Now the bio-film is ready to experience explosive growth.

Growth of bio-films is like a coral reef, the bio-film becomes bigger and tougher. Super colonies of bio-film will actually absorb certain chemicals that were meant to destroy them.

The chlorine or bromine may kill the outer layers of the colony that are more susceptible to attack but as the chlorine or bromine is exhausted, the lower, stronger, better protected layers are able to live and multiply.