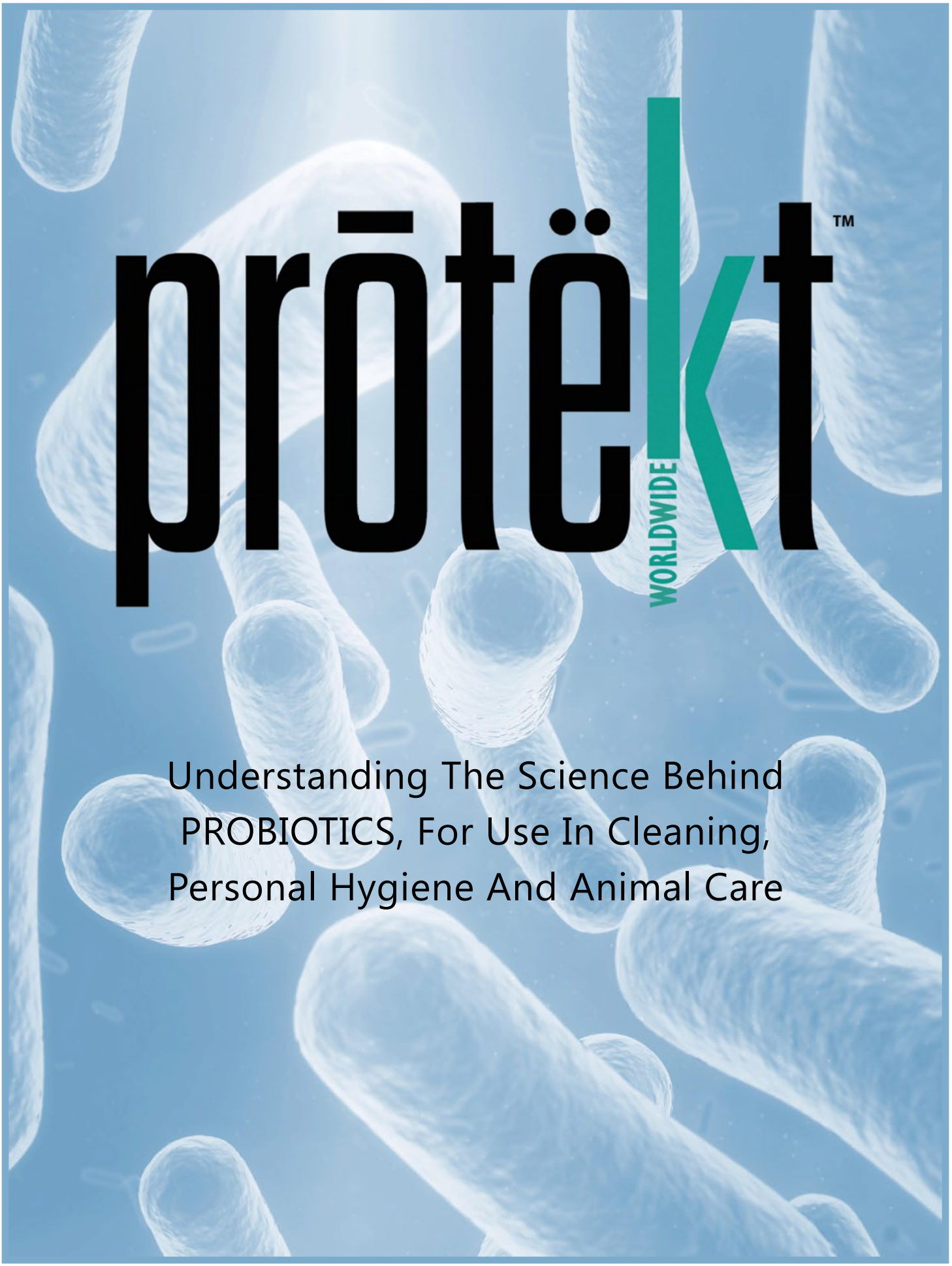


Understanding The Science Behind PROBIOTICS, For Use In Cleaning, Personal Hygiene And Animal Care

INTRODUCTION

Over the last few years, the frequency of headlines addressing super bugs, diseases and reduced effectiveness of antibiotics continues to increase: They speak of dangerous drug-resistant super bugs, harder-to-treat diseases, antibiotics becoming less effective and the fact that human and animal well-being are under serious microbial threats.

The very cause of those issues are due to our own cleaning and hygiene habits and behaviors; and the misunderstandings of how to effectively handle the increasingly resistant super bugs. We have been taught that in order to be clean, we must destroy all microbes with antibiotics and disinfectants in an attempt to protect ourselves from disease-carrying bacteria. The problem is that this thought process is outdated and completely *wrong*, and we desperately need a paradigm shift in how we think about "clean" for the sake of ourselves, families, animals and the environment.

At Prōtëkt Worldwide, LLC, we recognize the greatest challenge for our future wellness—in terms of hygiene, is founded in the rise of resistant micro-organisms. We understand the importance of finding a way to live WITH natural micro-organisms, instead of the mindset that we must totally destroy them. We understand, that it's about balance. With the help of our lab, developers and scientists, we are on a mission to help pioneer the development of *sustainable* cleaning products which combine efficiency, durability and sustainability; allowing us to formulate products that fight nature with nature.

Given the revolutionary essence of this technology, we understand many questions arise. We have developed this e-book to help answer some of those questions and explain the basic concepts of microbiology, the current issues we are facing and how our solutions ARE the solution to long-term sustainable products that are safe for use and environementally beneficial.

We hope you find this useful!

Team Prōtëkt

CHAPTER 1: THE SCIENCE

1. Microbiology—Microbiology is the science of micro-organisms. A microbiologist is someone who studies micro-organisms and offers solutions based on that knowledge that improves the life of humans, animals and the environment.

1.1 What are micro-organisms?—A micro-organism or microbe is an organism that is too small to be seen with the naked eye. Only when there are many, do they become visible. The most important examples of micro-organisms are viruses, bacteria, fungi, yeasts and algae. Bacteria are the most common and are about 1 micrometer in size, which is a thousandth of a millimeter (meaning, 1,000 bacteria lined up in a row would not measure more than 1 millimeter)! Micro-organisms can be found everywhere in nature. In large numbers, they occur on the skin, in the digestive tract, in the soil, in water, on surfaces and in the air.

The majority of micro-organisms are benign, useful or even necessary for humans, animals and the environment. For example, there are areas where micro-organisms are very useful:

- Digestion: Our food cannot be digested without the billions of bacteria, naturally in our guts.
- Composting: Dead material from nature (i.e., leaves, grass, dead animals) are processed by micro-organisms into the smallest nutrients and then naturally reused to form new plants or animal life.
- Food Production: Some foods can only be made using micro-organisms such as yeast for bread and wine, or bacteria for yogurt and cheeses.

There are unfortunately a number of micro-organisms that are harmful to humans, animals and/or the environment. Those microbes are called *pathogens*. Although they are the minority of the microbe world, they give micro-organisms a bad reputation. Some examples of micro-organisms that are harmful include:

- **Disease.** Different micro-organisms can cause diseases such as colds, pneumonia, flu, wound infections, tetanus, and more. Plants can be made sick by micro-organisms, as well, making them unable to flower, nbear any fruits or sometimes causing death.
- **Food Spoilage.** Bacteria is mainly the cause of spoiled or contaminated food. This is what causes colitis and diarrhea if consumed. Salmonella, E. coli, Listeria and Clostridium are some of the important forms of these bacteria.

1.2 The Microbial Community

Despite their miniscule size, micro-organisms are very smart. They work perfectly together in order to survive and thrive. The first traces of micro-organisms on Earth dates back to 3 billion years ago, so they have a lot more experience in survival than humankind.

No matter where they occur (soil, air, water, animals, plants), micro-organisms organize themselves into self-sustaining communities known as a *microbial community* or *microflora*. These communities can be very diverse and complex. Each type of micro-organism has its role and contribution to the community. Together, they have only one goal: survival of all as long as possible.

If such a microbial community or microflora is on a solid surface (material, teeth, skin, leaves, etc.) it is called "biofilm". A well known example of biofilm is the black tile grout in a shower or kitchen floor. Biofilm consists of many different types of micro-organisms and the various substances that they produce. These substances can be used as food or as protection against external influences. So the micro-organisms house themselves in this protective layer and thrive. Unfortunately, biofilm often has adverse effects on humans. It creates visual pollution, is a source of odor, nuisance, and remains a refuge for many germs and pathogens, threatening health and wellness.

What does a microbial community need to survive?

- Nutrition: Just like every other living creature, a micro-organism cannot survive without food. The diet can be very diverse and is microscopic. Major food sources are sugars, fats and proteins, but also include other organic sources such as urine, blood and sweat. Not all micro-organisms can use all the nutrition, so they work within the biofilm collectively and exchange nutrients together for the greater good of the community.

- Moisture: Much like all other life, without drinking, no micro-organism can survive. Micro-organisms don't really *drink*, so much as they *absorb* moisture from their environment, similar to how a sponge absorbs. If there is not enough moisture present, their activity will rapidly decrease. Just as with plants, animals and humans, a micro-organism may live much longer without food than without water. Moisture is imperative to their survival.

- Safety: In order to survive the environment must also be favorable. By use of creating biofilm, the micro-organisms protect themselves against fluctuations in the environment, such as temperature, pH levels and humidity.

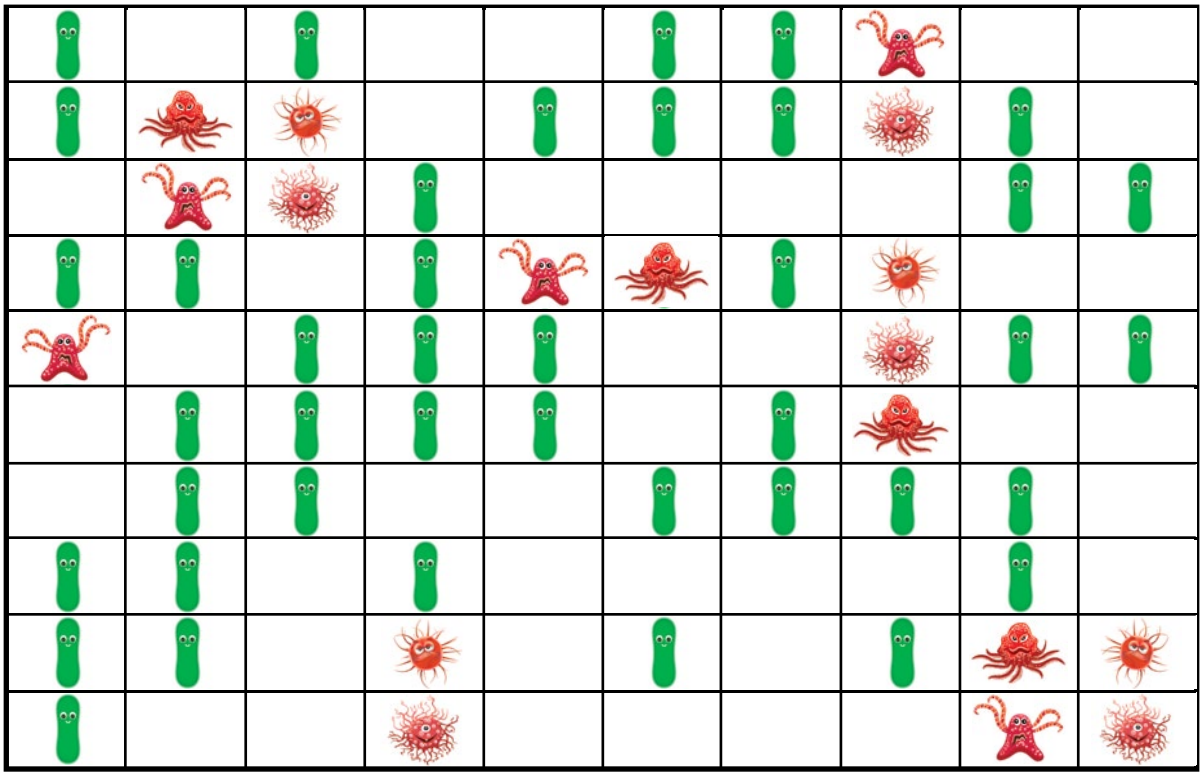
1.3 The Microbial Dynamic

The microbial community, microflora and biofilm are a combined living entity, with continuous changes depending on the conditions (humidity, power, temperature, etc.). Despite these changes, it is the aim of the microbial community to continue to exist and remain alive as long as possible. Micro-organisms do so by adapting to the circumstances and by communicating (called quorum sensing) with each other.

For example, suppose one has a surface that provides adequate nutrition, moisture and space with a microbial community of up to 100 micro-organisms.

The present micro-organisms interact with each other to ensure that they do not exceed their limitations, generally allowing a bit to remain open to ensure they do not have a space or food problem within the community. The diagram below demonstrates such a surface:

DIAGRAM 1 (Total 100: 42 good, 18 bad, 40 empty)



The surface is covered with harmless micro-organisms (green), harmful micro-organisms (red) and some spaces that serve as room to grow and spread (blank).

Since micro-organisms have an average life span of only a few days, there is a process of continuous dying and growing of micro-organisms, and the overall microbial community remains fairly constant. Without human influence, that constant results in a microbial ecosystem or *natural microflora balance.*

In the next chapter, we show you the influence of chemical cleaning and disinfection on that microbial balance.

CHAPTER 2: THE EFFECTS OF CHEMICAL CLEANING AND DISINFECTION

2. Chemical Cleaning and disinfection

Because the detection of micro-organisms was mainly linked with diseases, humankind had the idea that all micro-organisms are dangerous. Besides the search for resources to fight the diseases (antibiotics), more attention was also given to our hygiene and our environment. Therefore, products were designed to clean and disinfect, in order to kill all microbial life forms.

2.1 Cleaning and disinfection

There is an important difference between cleaning and disinfection, as well as between surfaces and our bodies.

- **Cleaning:** The removal of dirt on a surface (material or our skin). The standard way this is done is with soaps (or detergents).
- **Disinfection:** To make a surface free of micro-organisms by eliminating them. This is performed with biocides (or disinfectants).
- **Soaps and chemical biocides:** Fully chemical in composition, wherein the biocides contain an active substance which is bactericidal. Today, soaps and biocides are sometimes *combined* within a product that both cleans and kills.
- **The ultimate goal** of cleaning and disinfection is to ensure that no micro-organisms nor their food source (= dirt) remain present.

2.2 The resistance problem

The use of detergents and disinfectants initially appeared to work well and one could easily make a surface free of dirt and micro-organisms by using them. However, because of their long time on earth, micro-organisms learned quickly to adapt to changing circumstances for survival.

Over several decades after the introduction of disinfectants, the micro-organisms found ways to circumvent this threat, which is what we call resistance, today. This is to say that the micro-organisms become increasingly aware of how to survive an attack of disinfectants. The efficiency of

disinfectants is therefore diminished, making them less and less effective as time goes on.

Also in terms of cleaning, there is a growing problem. One of the mechanisms used by the micro-organisms to defend themselves against these chemical attacks is through the formation of increasingly persistent biofilms. This ensures that cleaning agents (soaps, detergents) are no longer able to remove the dirt on surfaces, because the dirt is often trapped in biofilms that are impermeable to soaps.

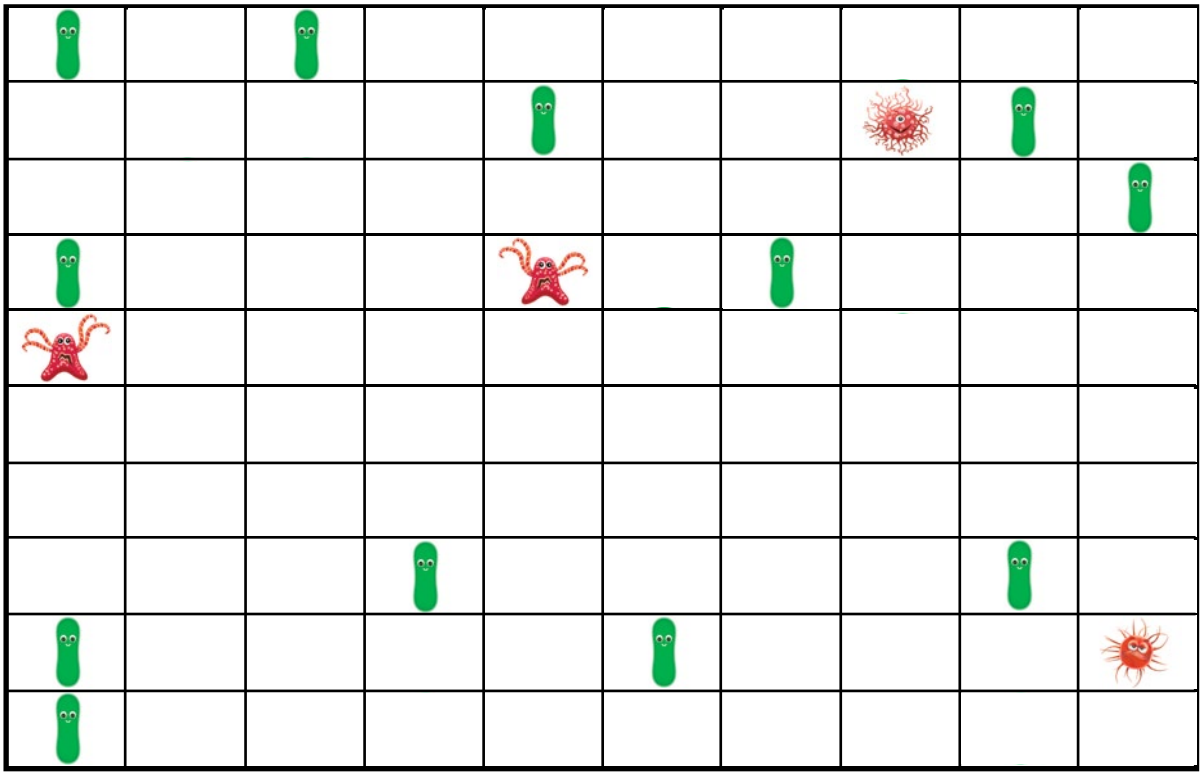
2.3 The Disinfection Paradox

However, there is a greater danger lurking behind chemical cleaning and disinfection. The impact on the microbial dynamics is the creation of *harmful* microflora.

What happens with chemical cleaning and disinfection:

Take as an example again, a surface where food, moisture and space is available to keep a microbial community of 100 micro-organisms alive. Immediately after disinfection, the micro-organism count will have fallen sharply.

DIAGRAM 2 (Total 100: 12 good, 4 bad, 84 empty)

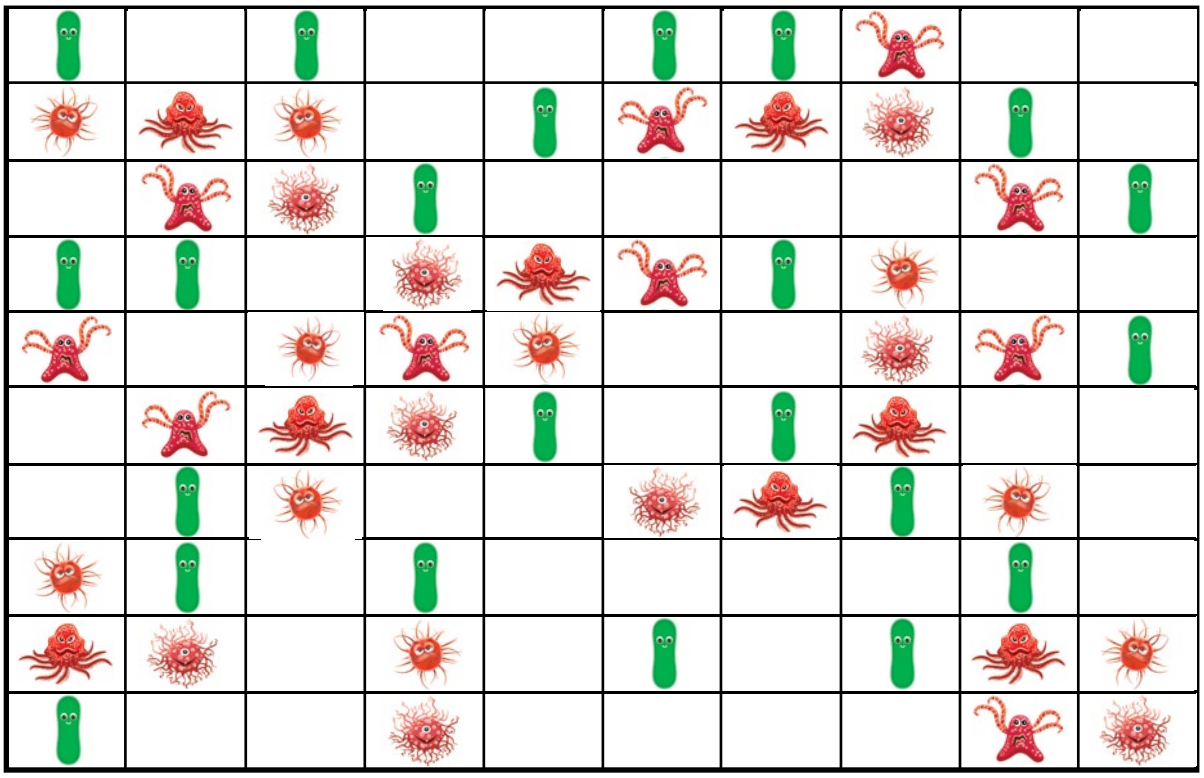


In fact, because of the resistance, a number of micro-organisms will survive disinfection, as demonstrated in DIAGRAM 2. Disinfectants have no lasting effects, so after a few minutes the survivors will begin to regrow, and are open to receive contaminants and new bad bacteria. They now suddenly have a lot of space (the vacant spots of eliminated micro-organisms), a lot of food (as eliminated, or dead micro-organisms themselves serve as a food source) and moisture (come with the disinfectants).

Since resistant harmful germs can survive a disinfection attack, they therefore, repopulate much faster. Any disinfection will result in a microbial community that contains more and more resistant harmful germs. Again, this new microbial community will stabilize itself using a safety margin to ensure that they do not over-occupy all their spaces so they can survive as long as possible.

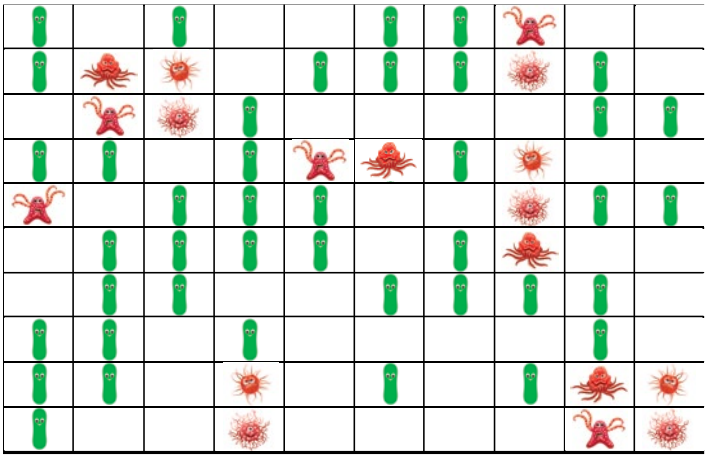
After a number of disinfections the new microbial community that has even *more* harmful microbes will look like the following diagram:

DIAGRAM 3 (Total 100: 22 good, 38 bad, 40 empty)

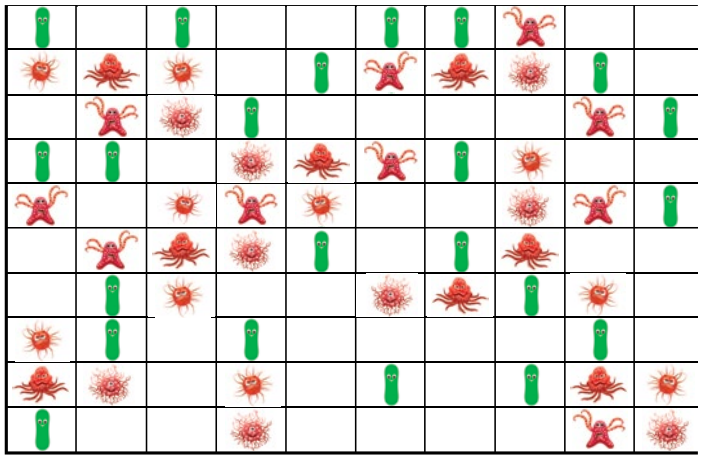


For clarification we compare the diagram of the natural microflora (DIAGRAM 1) to the diagram showing the microflora *after* disinfection (DIAGRAM 3):

Natural Microflora (Diagram 1)
(Total 100: 42 good, 18 bad, 40 empty)



Microflora After Disinfection (Diagram 3)
(Total 100: 22 good, 38 bad, 40 empty)



Both surfaces still have the same quantity of micro-organisms but the total number of harmful microbes is, because of the resistance problems, much higher when disinfection protocols are used. As we use more disinfection, more harmful microbes are found. This is the *disinfection paradox*.

CHAPTER 3: THE EFFECTS OF PROBIOTIC CLEANING AND HYGIENE

3. Probiotic Cleaning and Hygiene

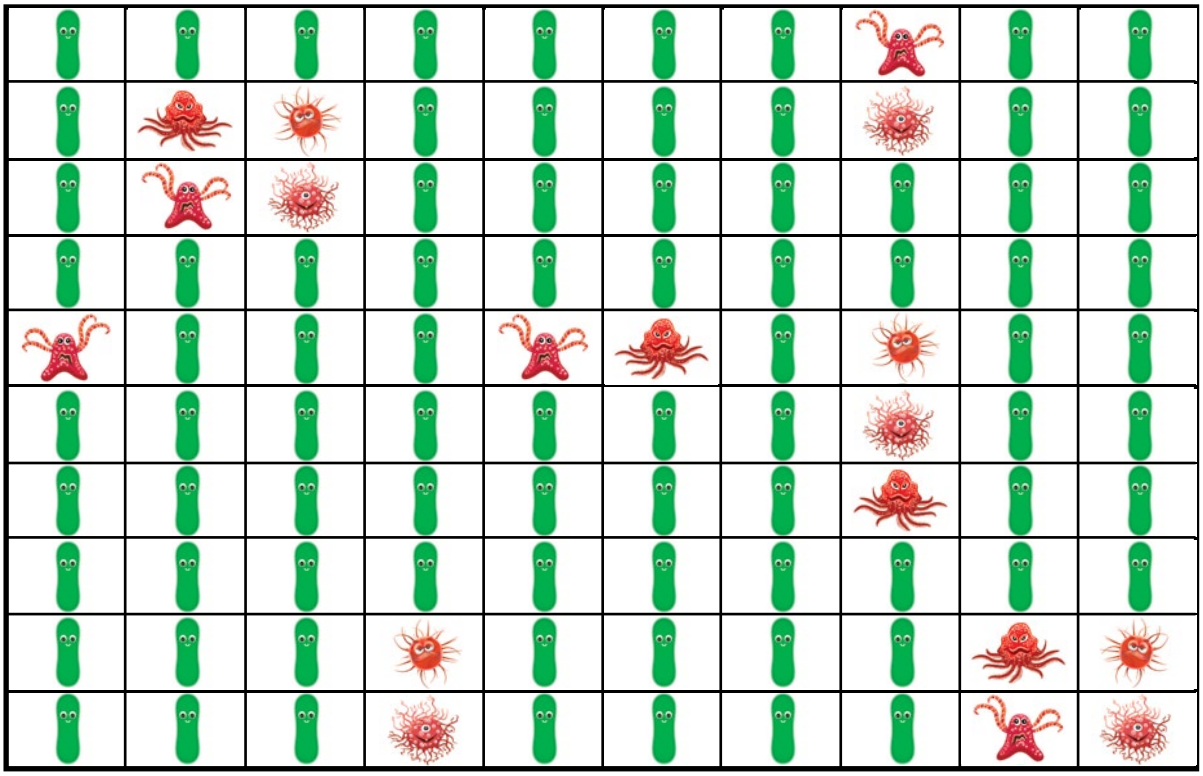
There are good micro-organisms, also known as PROBIOTICS, which are used to form and maintain a healthy microflora.

3.1 How does it work ?

Prōtëkt has developed a series of probiotic cleaners, beauty products and pet care products that provide a layer of *good* micro-organisms that remain active on the surface (including skin) *during and after* use. So, how does that solve the problem of harmful micro-organisms simply by adding a lot of extra bacteria? The microbial community through its own dynamics (as explained in section 1.3) provides the solution.

Suppose, again, a surface where food, moisture and space is available to keep a microbial community of up to 100 micro-organisms alive. Immediately after the first probiotic cleaning, the probiotics will occupy all the empty places on the surface. No other micro-organisms are killed or replaced, there is only the *addition* of good micro-organisms (probiotics) on the surface. The microbial community would then look like this:

DIAGRAM 4 (Total 100: 82 good, 18 bad, 0 empty)

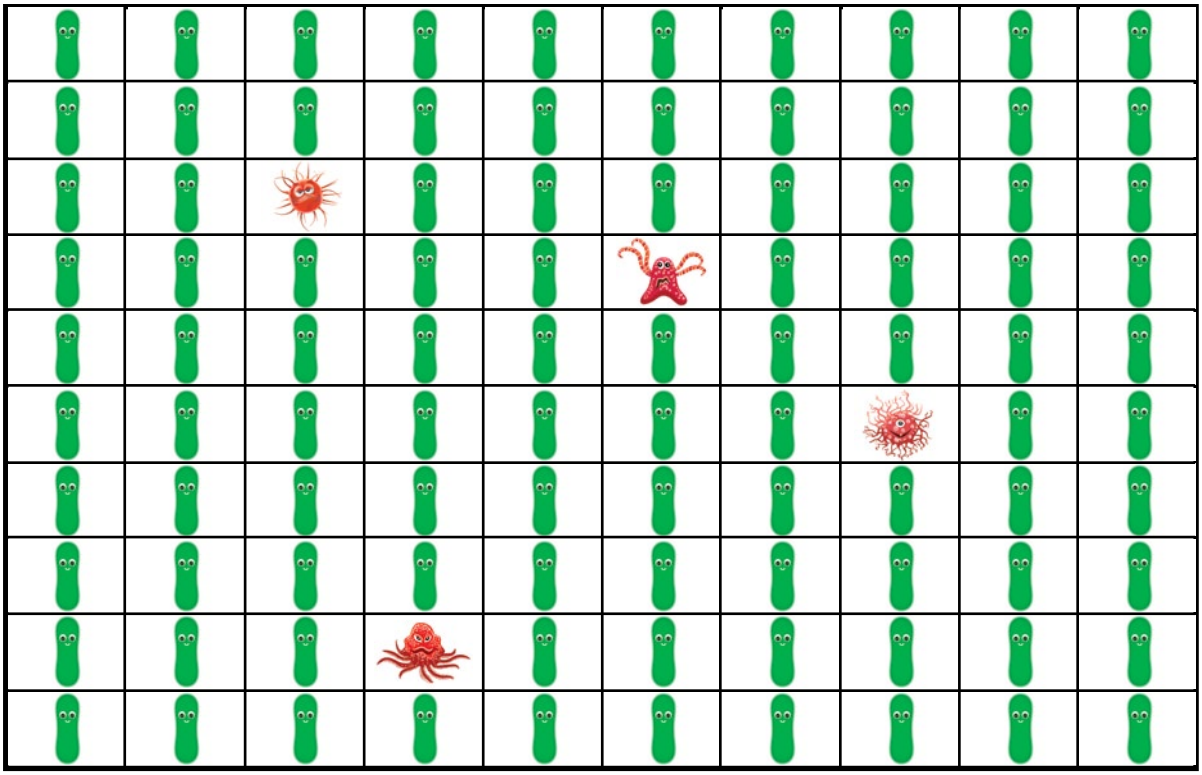


The surface is now occupied with the maximum of 100 micro-organisms. What happens next, is nothing short of revolutionary...

Since the maximum 100 micro-organisms on the surface is immediately reached, the micro-organisms send out a signal (via quorum sensing) in order to reduce their activity of production. After a few days, a large number of micro-organisms will have died in their natural cycle. Now, adding to that, the reduced activity, no new micro-organisms can produce. This state is maintained within the microbial community until their number is decreased again to below the threshold. Only then, will they revert to normal activity. However, as a new charge of good micro-organisms is added with each probiotic cleaning, despite the decreased activity of the microbial community, their numbers never fall below 100. In essence, the probiotic cleaning maintains the number of micro-organisms to the maximum space by inundating it with good micro-organisms.

By continuing to use probiotic cleaning, the original microbial community will thus be forced to continuously decreased activity, so that the original micro-organisms will disappear with age from the community. After several cleanings, the probiotic microbial community will change as demonstrated below:

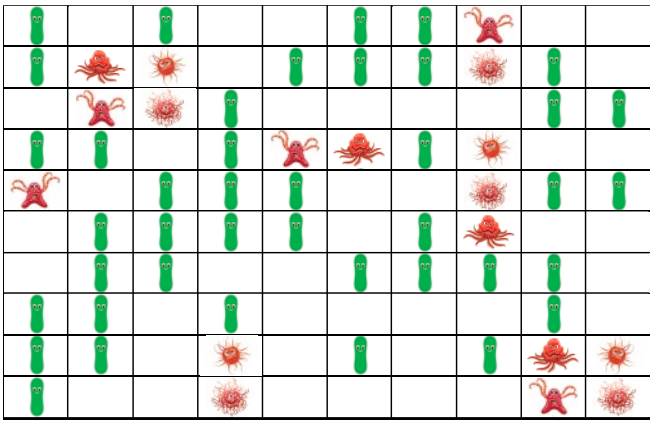
DIAGRAM 5 (Total 100: 96 good, 4 bad, 0 empty)



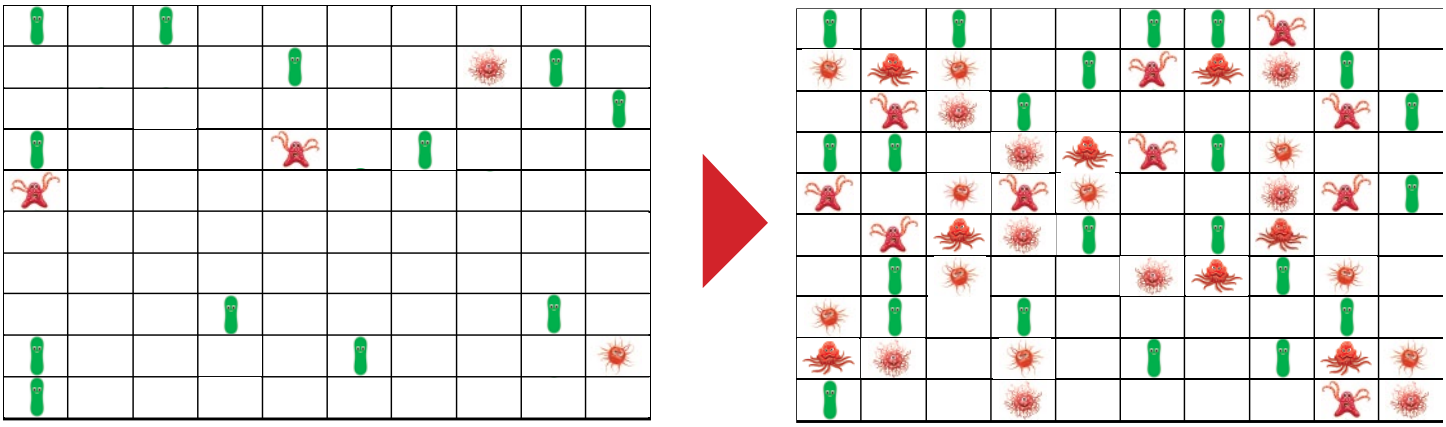
This surface becomes largely occupied with good micro-organisms and has been achieved without having to use biocidal chemistry. We rely on the self-regulating effect of nature to obtain healthy microflora with probiotics.

Let’s examine the various situations in comparison:

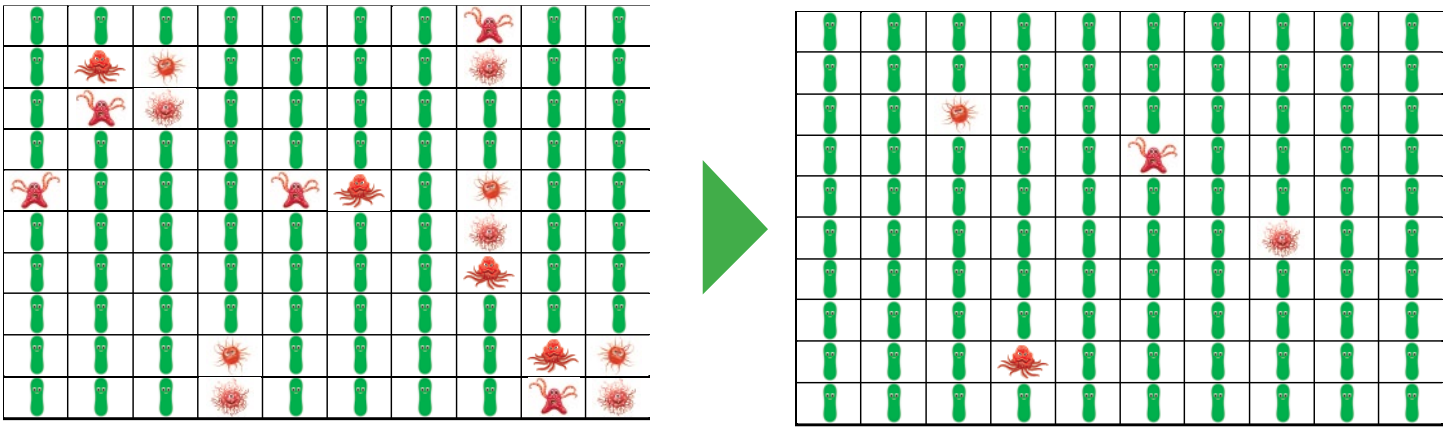
Natural Microflora



Chemical Cleaning and Disinfection (immediate effect on the left and final effect on the right)



Probiotic Cleaning (immediate effect on the left and final effect on the right)



In our theoretical surface of 100 available spots the end result is this:

DISINFECTED SURFACE: (22 good, 38 bad, 40 empty)
PROBIOTIC CLEANING: (96 good, 4 bad, 0 empty)

Thus, it is clear that through the use of probiotic cleaning, a healthier microflora is created, without killing (which causes resistance), or exposing ourselves, our pets and our environment to harmful chemicals.

3.2 What are the benefits?

The most important advantage of probiotic cleaning was made clear from the above explanations, namely, the installation of a healthy microflora which remains healthy as long as the probiotic cleaning is applied. We know from experience that some questions are always made, such as those below.

- **Don't the harmful germs become resistant to probiotics?** No, the micro-organisms do not become resistant to other micro-organisms. They only build resistance against chemicals that threaten them. There are no biocide chemicals in the probiotic cleaning solutions, so no resistance is built.
- **Are the probiotics safe for my family?** Yes, definitely. The probiotics used by Prōtëkt are internationally approved for use in food. Moreover, our lab performs additional tests to be absolutely sure before our products ever make it to production. Our formulas have been lab, hospital and university tested and are found to be 100% safe for families and animals.
- **Does probiotic cleaning require a lot of work?** No. It is no more difficult to clean with Prōtëkt products than with chemical cleaners or disinfectants. In fact, because the probiotics continue to work after initial application, over time, it requires less cleaning because the biofilm cannot build up. We recommend regular cleaning with a minimum of twice a week for the first few cleanings, for optimal effect. After that, a weekly cleaning will maintain your surface microflora.
- **What are some of the advantages to using Prōtëkt Probiotic Products?**
    - **Deep cleaning.** The probiotics remove dirt and biofilm deep into surfaces for cleaning down to the microscopic level.
    - **Odor control.** Odors are often formed by undesirable micro-organisms and their by-products. Replacing with probiotics eliminates those odors and probiotics do not produce odor.
    - **Safe for families and pets.** Unlike many of the chemical cleaners and disinfectants, probiotic products are safe on animals and for human use without gloves or masks.
    - **Environmental benefits.** Probiotics are not only 100% natural, but they actively collaborate in improving wastewater treatment. They are not only environmentally friendly, they are environmentally enhancing.

In conclusion…
Prōtëkt is proud to bring safe and beneficial probiotic cleaning to homes across the country and to be part of a revolution in cleaning and a sustainable solution to the growing problems of resistant micro-organisms. The excellent performance in terms of cleaning, coupled with safety, durability and environmental friendliness, ensures these products provide sustainable solutions.

Over the coming years this technology will be applied in more and more sectors. We couldn't be happier to be on the cutting edge of building a more sustainable future in personal hygiene, pet care and cleaning products!

Contact
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