Antibacterial Technology
Glossary of Terms

Bd. I

Silestone Institute

Glossary of Terms

Vol. I

This document contains simple definitions of key concepts used in communications related to the Discovery project. The terms are arranged alphabetically and divided into four main sections:

1. Basic concepts

Antibacterial | A chemical product or substance, natural or synthetic, used in antibiotic therapy. Given that it kills bacteria or prevents them from growing, an antibacterial agent controls, reduces, counteracts and/or eliminates bacterial infections. Antibacterial products are divided into bactericidal and bacteriostatic.

Antibiotic | From the biological point of view, an antibiotic is a chemical produced by a living being or synthetically derived that, at low concentrations, destroys or prevents the growth of sensitive micro-organisms, usually bacteria. In stricter terms, an antibiotic is a substance secreted by a micro-organism that has the ability to affect other organisms.

Antibiotics are bacteriostatic if they prevent the growth of germs, and bactericidal if they destroy them. They are used in human, animal and horticultural medicine to treat infections caused by germs.

Modern antibiotic therapy began in Germany, in 1909, thanks to Paul Ehrlich, who developed the short-spectrum antibiotic Salvarsan.

In 1928, British physician Alexander Fleming accidentally discovered that the mould of the genus Penicillium produces a natural substance with antibacterial effects: Penicillin.

French physician Ernest Duchesne had made the same discovery in 1897, but failed to report it to the scientific community. Finally, in 1938, chemists Ernst Chain and Howard W. Florey became interested in the work of Fleming and developed a method of purification of penicillin which permitted its synthe-

sis and commercial distribution. Fleming, Chain and Florey shared the Nobel Prize for Medicine in 1945.

Antibiotic resistance | A truly global public health problem, as its name suggests is the ability of a micro-organism to withstand the effects of an antibiotic.

Normally, resistance to antibiotics is naturally generated through mutations that arise by chance (in fact, it is a consequence of evolution via natural selection), but it can also be induced artificially. If we assume that antibiotic action is a form of environmental pressure, those bacteria that undergo a mutation and survive continue to reproduce. In turn, the resistant bacteria pass on that trait to their offspring which becomes a totally resistant generation.

Several studies have shown that the overuse of antibiotics significantly affects the number of resistant organisms which develop.

Other factors that contribute to resistance to antibiotics include misdiagnosis, unnecessary prescriptions, improper use of antibiotics by patients and the use of these drugs to speed up the fattening of cattle.

Antifungal | An antifungal or antimycotic agent is any substance with the ability to slow the growth of some types of fungi or even destroy them. The research and development of antifungal agents began in the middle of the last century; and since then a wide variety of antifungal substances have been discovered.

Most treatments are administered topically (clotrimazole, miconazole, econazole, etc.), but in recent decades the possibility has arisen of using injectable antifungal agents (flucytosine, ketoconazole, fluconazole, itraconazole), with positive results in the treatment of serious diseases.

Antimicrobial | A chemical that, at low concentrations, destroys or inhibits the growth of microbes such as bacteria, fungi, parasites or viruses, without involving the humoral or cellular defense responses of the host. Therefore, antibiotics agents have antimicrobial, antifungal, antiparasitic and antiviral properties. Other antimicrobial agents are biocides, which have the same effect on the micro-organisms considered harmful to humans.

Bacteria | Bacteria are single-cell micro-organisms essential for recycling elements. They are the most abundant and widespread organisms on the planet, and are found in all terrestrial habitats. Most bacteria in the human body are found in the skin and digestive tract. Although the protective effect of the immune system makes many of these bacteria harmless or even beneficial, some pathogenic bacteria can cause infectious diseases (cholera, syphilis, leprosy, typhus, diphtheria, Legionnaires' disease, scarlet fever, tetanus, etc.). The most common fatal bacterial diseases are respiratory infections (tuberculosis alone kills approximately two million people a year worldwide).

Bactericide | A bactericidal agent is a substance that kills bacteria. It can also be defined as the weakest concentration of a substance capable of causing the destruction of a microbe. Bactericidal substances are secreted by living organisms as a means of defence against bacteria.

Bacteriology | It is unanimously acknowledged that the field of bacteriology was founded in 1882 by the German botanist of Jewish origin Ferdinand Cohn, who in his work Die Pflanze (The plant) was the first researcher to formulate a scheme for the taxonomic classification of bacteria. Later, bacteriology would become a branch of microbiology. Louis Pasteur, the father of medical microbiology, and Robert Koch, who discovered the tuberculosis bacillus, were contemporaries of Cohn and emphasised the important role of microbiology.

Bacteriostatic | A substance or drug is said to be bacteriostatic when, despite not causing the death of the bacteria, it prevents their reproduction, that is, the bacteria grow old and die "without descendants". Bacteriostatic substances are secreted by organisms as a means of defence against bacteria. Bacteriostatic agents are also known as antiseptics.

Fungus | The Latin fungi (mushrooms) encompasses a group of eukaryotes (organisms with a true nucleus cell) formed by moulds, yeasts and mushrooms. Biologically, fungi belong to a different realm than plants, animals and bacteria. Mush-

rooms can be edible, poisonous, hallucinogenic, medicinal, contaminants and even decorative.
Since the discovery that certain fungi (medicinal) have an antagonistic mechanism against other micro-organisms, a large industry has developed for the detection, isolation and marketing of new antibiotics. In turn, contaminating fungi are responsible for a number of pathologies in humans.

Germ | In principle, a germ is a micro-organism that can cause or spread disease. However, there are some beneficial micro-organisms that can be used in processing food to prolong its life or change its properties (a good example is the induced fermentation in the production of yoghurt, cheese, etc.). There are four main types of germs: bacteria, viruses, fungi and protozoa.

Pathogens | These are formed by bacteria, viruses, protozoa and larvae that coagulate or adhere to colloidal substances or suspended solids that are present in the water and in the atmosphere. When a person is infected, pathogens multiply in the host, carrying a risk of disease. People who become ill are contagious and spread the disease through secretions and direct contact with the mucous membranes of other individuals.
However, not all persons infected with pathogens fall ill.

Protozoa | Single-celled pathogens characterized by the complexity of their metabolism. Protozoa

feed on solid nutrients, algae and bacteria present in multi-cellular organisms, such as humans and animals. They are often present in the form of cysts or eggs. Protozoa as cysts are resistant to chlorine disinfection. They are eliminated by filtration and applying sodium hypochlorite.

Virus | An infectious microscopic element that can only multiply inside the cells of other living organisms. In fact, it is an organic entity composed solely of genetic material that has a protective shell. For this reason, viruses lack independent life, but they can replicate inside living cells, which in many cases results in harm to the host.

Hundreds of viruses are known, but researchers believe that there may be millions of them yet to be discovered. Viruses are the cause of many diseases in humans, animals and plants.

2. Chemical products and elements

Colloidal silver | Before the invention of refrigeration and preservation, milk was kept in a glass jar with a silver coin in it, since no bacteria, microbes or parasites can live in a liquid which has the smallest particle silver. Obviously, this practice involved toxic risks. Today, colloidal silver (in particles ranging in size from 1 to 100 nm) is very effective against a wide range of Gram-positive and Gram-negative bacteria, fungi and yeasts. It inhibits the enzymes involved in the respiratory redox process of cellular bacteria, which causes their death within minutes. For this reason, the micro-organism can not develop resistance mechanisms, as is the case with antibiotics. Furthermore, colloidal silver respects the rest of the enzymes involved, so it is completely safe for multi-cellular living organisms, including humans.

Nanosilver | The use of colloidal silver before its reduction to microscopic size was accompanied by the problem that, when ingested in high doses, there was a risk of poisoning. The solution was to create a silver solution with molecules so small that they passed through the cell without staying in vital organs: molecular silver or nano silver. U.S. researcher Robert C. Beck, one of the greatest proponents of electro-medicine found that molecular silver is 100% effective in penetrating membranes, while the ionic and colloidal silver only achieved a 5-6% success rate. In addition to its medical use, nano silver is applied, for example, to heating panels, since it eliminates bacteria, pollen, dust mites

or moulds before they have the opportunity to get into the lungs of human beings. It is also used to kill the germs that cause bad odours in clothes.

Silver | Silver is a white transition metal, shiny and soft (only gold is more ductile and malleable). It is found in nature as part of various minerals or alone.
Silver is very scarce in nature and most of its production is obtained from the treatment processes in copper, zinc, lead and gold mines. It has the highest electrical and thermal conductivity of all metals (even higher than that of copper), but its high price has prevented its massive use in electrical applications. In medicine and hygiene products, silver is highly valued for its wide spectrum antimicrobial properties. Specifically, silver ions kill bacteria, fungi, viruses and protozoa.

Silver ions | Antimicrobial elements that interfere with the gas permeability of the cell membrane. Once inside the cells, they alter their enzyme system and as a result, inhibit their metabolism and energy production, in addition to modifying their genetic material. Consequently, the organism quickly loses its ability to grow and reproduce.
With this action, the silver ions prevent the growth of pathogenic micro-organisms such as Legionella, Salmonella, Escherichia coli and Staphylococcus aureus, among others.

Silver nanoparticles | These are microscopic particles with a dimension of less than 100 nm (na-

nometres). They have many potential applications in biomedicine, optics and electronics, but also in various other fields. For example, socks are already available that contain this type of nanoparticles to kill bacteria that cause bad odours or washing machines that disinfect clothes by generating these tiny particles. However, studies suggest that the use of silver nanoparticles may have a negative impact on the environment, as they may destroy benign bacteria used to remove ammonia in waste-water treatment systems.

Silver-based antibacterial products | The addition of silver ions to certain consumer products (food containers, knives, water filters), health products (oral hygiene, dressings, and hospital supplies) and materials for certain appliances inhibit the growth of bacteria and is an effective antiseptic measure.

These are natural or synthetic substances, organic or inorganic, which inhibit the growth of micro-organisms (bacteria, fungi, viruses, protozoa). Their effectiveness depends on several parameters: concentration, type of micro-organism and substrate, temperature, pH, moisture and oxygen levels

Triclosan | A powerful antibacterial and antifungal agent that has been used since 1972 as an antiseptic in hospital products (soap for washing patients, hand washing solutions for surgeons), personal care products (mouthwashes, deodorants, toothpaste, shaving cream) and other products such as

kitchen utensils, garbage bags and toys. Triclosan acts as a biocide in normal doses and has a bacteriostatic effect at lower doses. However, the safety of triclosan is currently under review by the FDA, since some studies have detected negative side effects. Specifically, it is suspected that triclosan can act as an endocrine disruptor and also increase calcium levels in neurons, with subsequent mental development impairment. These studies, however, are not yet conclusive. The use of triclosan as an additive for plastic production for use in food packages has not been approved by the EFSA.

3. Technologies

Nanomedicine | In the medical field, nanotechnology helps improve diagnosis methods, disease screening, drug delivery systems and tools for monitoring certain biological parameters. This discipline has been given the name of nanomedicine. Scores of laboratories around the world are currently pumping large sums of money into nanomedicine research.

Nanotechnology | The study, design, creation, synthesis, manipulation and application of materials, devices and functional systems via nanoscale control of matter, i.e., on a scale smaller than a micron (unit of length equal to one millionth of a meter). The matter manipulated is the same size as atoms and molecules. When matter is handled on such a tiny scale, entirely new phenomena and properties emerge. Nanotechnology promises cutting-edge and more efficient solutions in many fields, especially disinfection, environmental and medicine.

4. Regulatory bodies

AEMPS | The acronym for the Spanish Agency for Medication and Healthcare Products, under the Ministry of Health, Social Affairs and Equality. Founded in 1997, the AEMPS is an autonomous body that oversees the quality, safety, efficiency and correct labelling information of drugs and healthcare products, from research to use. Its main functions include assessing, recording, licensing, inspecting, monitoring and controlling medicines for human and veterinary uses in the Spanish market, as well as medical, cosmetics and personal care products. It also evaluates the drugs approved by the European Medicines Agency (EMEA), evaluates and approves clinical trials and products undergoing clinical investigation, authorises the activity of pharmaceutical drug labs, develops the Spanish pharmacovigilance system, controls drugs under government jurisdiction and manages the Royal Spanish Pharmacopoeia.

AESAN | Acronym for the Spanish Agency for Food Safety and Nutrition, an autonomous agency connected with the Ministry of Health, Social Affairs and Equality. It was created in 2001 to ensure food safety, promote citizens' trust in the food they eat and provide proper information about it. Another of its goals is the prevention of obesity, a role it took on in 2006. AESAN's actions are based on general and specific objectives, policy areas and functions, and it upholds independent and transparent management.

AFCA | Acronym for the Spanish Association of Food Additive Manufacturers and Distributors, a nonprofit organization which aims to take an active role in the discussion on new food legislation in Spain. AFCA is a member of the Federation of European Food Additives and Food Enzymes Industries (ELC), based in Brussels. The Federation is very active in all areas related to food additives (European government, Codex Alimentarius, universities, research centres, etc.).

ANSES | Acronym for the Agence Nationale de Sécurité Sanitaire, de l'Alimentation, de l'Environnement et du Travail, the French Agency for Food, Environmental and Occupational Health & Safety. It is involved in the areas of oversight, expert appraisal, research and investigation in a wide range of fields including human health, animal health and well-being, and plant health. The agency provides a cross-functional perspective on health issues and can pinpoint the overall risks to which people are exposed through their lifestyles and consumption patterns, as well as through environment factors, including in the workplace.

Based on the principle of handling assessment and risk management separately, it provides information to the relevant authorities, responds to their requests for expert assessment and provides early warning in the event of a health crisis. The agency operates in close cooperation with its European counterparts.

BFR | Acronyms for the Federal Institute for Risk Assessment (Bundesinstitut für Risikobewertung) in Germany. The Federal Institute for Risk Assessment (BfR) was set up in November 2002 to bolster consumer health protection. Its guiding principle—"Identifying risks - Protecting health"—sums up its aim in the field of consumer health protection. It is the specialised agency of the Federal Republic of Germany responsible for preparing expert reports and opinions on food and feed safety as well as on the safety of substances and products. The Institute plays an important role in improving consumer protection and food safety. Although the BfR reports to the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV), it is completely independent when it comes to its scientific assessments and research.

EFSA | Acronyms for the European Food Safety Authority.
It was created in 2002 following a series of food crises that took place in Europe in the late 1990s.
Based in Parma (Italy), EFSA provides independent scientific advice on all matters directly or indirectly affecting food safety, including animal health and welfare and plant-health protection. It also provides advice on EC legislation related to human nutrition.

EMA | Acronym of the European Medicines Agency, an organization responsible for evaluating marketing authorisation applications and overseeing

medicines in the European Union. Established in 1995 and headquartered in London, this agency's main objective is to ensure safe, effective and high-quality drugs for human and veterinary use in the EU. The EMA operates as a network that brings together the scientific resources of the 25 Member States of the EU and over 40 national agencies involved. It is the European counterpart—in terms of functions and powers—to the FDA, but it not as centralized in its operations as the U.S. agency.

EPA | Acronym for the U.S. Environmental Protection Agency (EPA). It was created in December 1970 in response to the wave of protests over environmental pollution that hit the United States in the late 1960s. The idea was to centralise the various federal efforts focused on environmental research and protection in one government agency. It is headquartered in Washington, D.C. The EPA's mission is to protect human health and safeguard the natural environment on which life depends. Among the EPA's regulatory milestones, it's worth highlighting the ban on agricultural use of DDT, the regulations on automobile gases, toxic waste treatment programs, efforts to protect the ozone layer, recycling promotion and the recovery of deteriorated urban centres.

FDA | Acronym for the U.S. Food and Drug Administration. Part of the U.S. Department of Health & Human Services (the equivalent of the Spanish Ministry of Health, Social Affairs and Equality), it

was founded in 1930 as a spin-off of old agencies created in 1927 to address problems identified years earlier in product handling in the meat industry. Its headquarters are located in the town of Silver Spring (Maryland). The FDA is the U.S. agency responsible for regulating human and animal food, food supplements, medicines for human and veterinary use, cosmetics and dermopharmaceuticals, medical devices intended for human and animal use, biological products and blood products. Its influence in the field of drugs, cosmetics and food products reaches beyond the U.S. since many countries around the world tend to adapt their legislation in this area in light of resolutions adopted by the FDA.

FSA | Acronym for the Food Standards Agency (United Kingdom). The Food Standards Agency is an independent government department set up by an Act of Parliament in 2000 to protect the public's health and consumer interests in relation to food. The FSA provides advice and information to the public and government on food safety from farm to fork. It also protects consumers through effective food enforcement and monitoring.

ISO | Acronym for the International Organization for Standardization ISO has developed over 18,500 International Standards on a variety of subjects and some 1,100 new ISO standards are published every year. The full range of technical fields can be seen on the International Standards listing, which

users can browse to find bibliographic information on each standard in addition to a brief abstract, in many cases. The online ISO Standards listing features both the ISO Catalogue of published standards and the ISO Technical programme of standards under development.

SOFHT | AAcronym for the Society of Food Hygiene & Technology (United Kingdom).

The Society of Food Hygiene & Technology was established in 1979 as an independent body offering support through membership to anyone involved in food hygiene and technology issues. The Society—or SOFHT as it is commonly known—is steered by a high-profile voluntary board of directors committed to food hygiene and technology issues throughout the entire food chain. SOFHT boasts many major retailers as some of its Supporting Company Members, and it is constantly striving to improve and meet the needs of its members, whether they are food manufacturers, distributors, suppliers, retailers or wholesalers, to name just a few. Society members come from a cross-section of the food industry, from market leaders through to individuals, offering a platform for like-minded people to share ideas, viewpoints and concerns through topical events or the Society's communications.

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