The Role of Commensal and Probiotic Bacteria in Human Health

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Introduction

History

Nearly half a millennium ago science took a great leap forward with the discovery of the microscope. Before its existence it was postulated that "little creatures," too small to be seen by the naked eye, existed; however, it was not until the discovery of the microscope that this could be demonstrated. Two men are credited today with the discovery of microorganisms using primitive microscopes: Robert Hooke who described the fruiting structures of molds in 1665 and Antoni van Leeuwenhoek who is credited with the discovery of bacteria in 1676. . The existence of microscopic organisms was discovered during the period 1665-83 by two Fellows of The Royal Socinty, Robert Hooke and Antoni van Leeuwenhoek. In Micrographia (1665), Hooke presented the first published depiction of a microganism, the micro fungus Mucor.

Later, Leeuwenhoek observed and described microscopic protozoa and bacteria. These important revelations were made possible by the ingenuity of Hooke and Leeuwenhoek in fabricating and using simple microscopes that magnified objects from about 25-fold to 250-fold. After a lapse of more than 150 years, microscopy became the backbone of our understanding of the roles of microbes in the causation of infectious diseases and the recycling of chemical elements in the biosphere (Aria Nouri, 2021, Gest, 2004).

classification bacteria

There are many different types of bacteria. One way of classifying them is by shape.

There are three basic shapes.

1. Spherical: Bacteria shaped like a ball are called cocci, and a single bacterium is a coccus. Examples include the streptococcus group
2. Rod-shaped: These are known as bacilli (singular bacillus). Some rod-shaped bacteria are curved.

These are known as vibrio. Examples is anthrax.

3. Spiral: These are known as spirilla (singular spirillus). If their coil is very tight, they are known as spirochetes. Leptospirosis, Lyme disease, and syphilis are caused by bacteria of this shape. (Mitsuoka, 1990) (Jill Seladi-Schulman and Brazier, 2019).

Structure of Bacteria

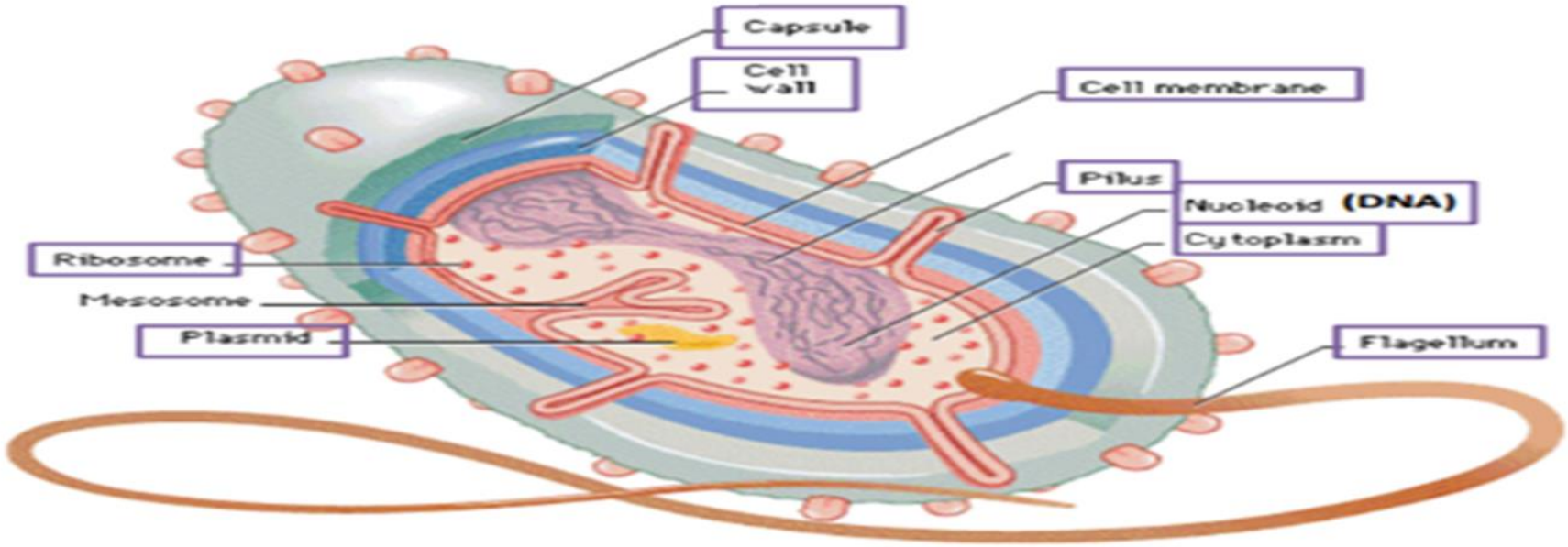


Figure 1

1.3.1 Cell Wall

1.3.2. Plasma Membrane

1.3.3. Cytoplasm

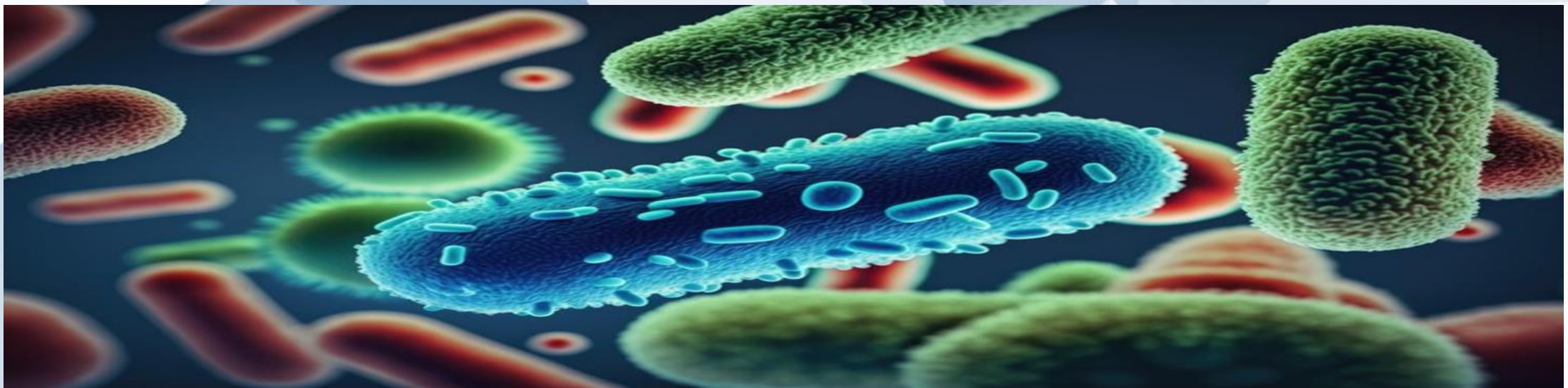
1.3.4. Ribosome

1.3.5. Flagella

1.3.6. Capsule

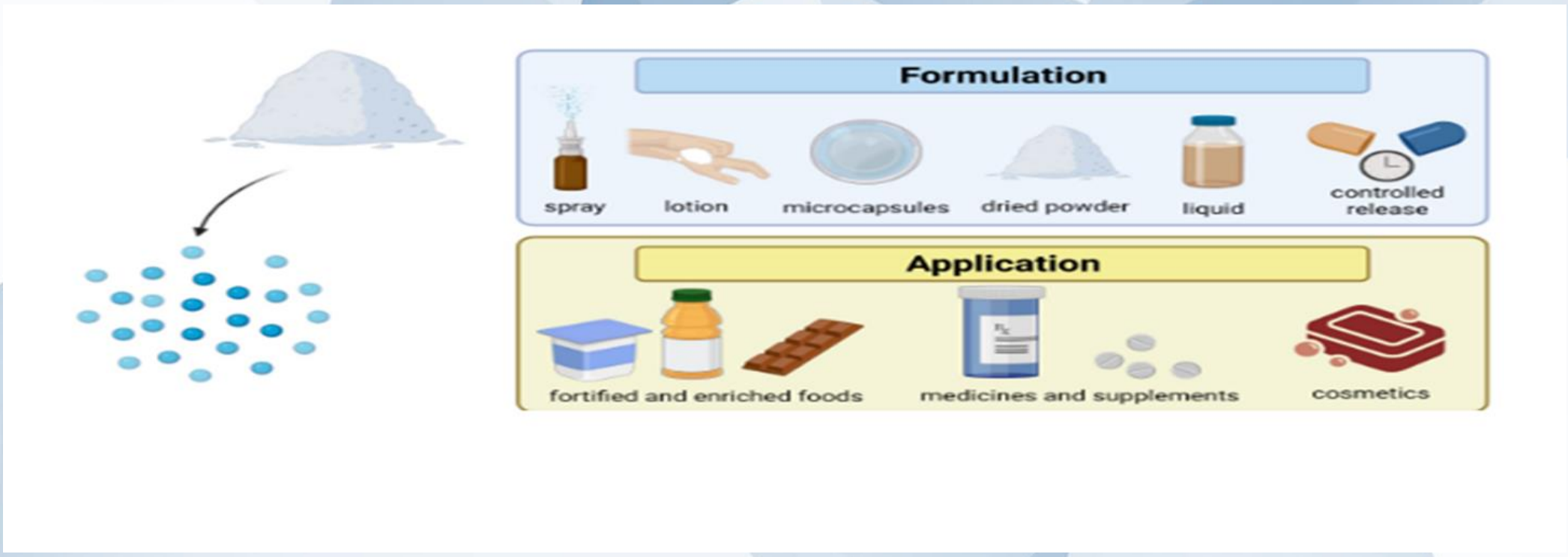
History of probiotic Bacteria

Louis Pasteur discovered fermentation by lactic acid bacteria which he described as Beneficial bacteria to protect foods from spoilage.Despite the traditional use of Fermentation in foods and beverages to impruve storage time, Safety, Functionability Organoleptic quality and nutritional properties it was Pasteur who demons started that The lactate produced during fermentation inhibited the growth of pathogens and Avoided Food spoilage.And some of the bacteria using to made vacciues and the scientific world Was shaken by the promise of modern microbiology which saw the rise of vaccines, the Isolation of beneficial bacteria and later in the century with the discovery in 1928 of Penicillin by Alexander Fleming, the development of antibiotics. Berg et al., 2020)



Production of probiotic bacteria

only a few compounds of the carbohydrate group, such as short and long chain _-fructans [FOS and inulin], lactulose, and GOS, can be classified as prebiotics. In 2008, the 6th Meeting of the International Scientific Association of Probiotics and Prebiotics (ISAPP) defined “dietary prebiotics” as “a selectively fermented ingredient that results in specific changes in the composition and/or activity of the gastrointestinal microbiota, thus conferring benefit(s) upon host health”. (Davani-Davari et al., 2019)

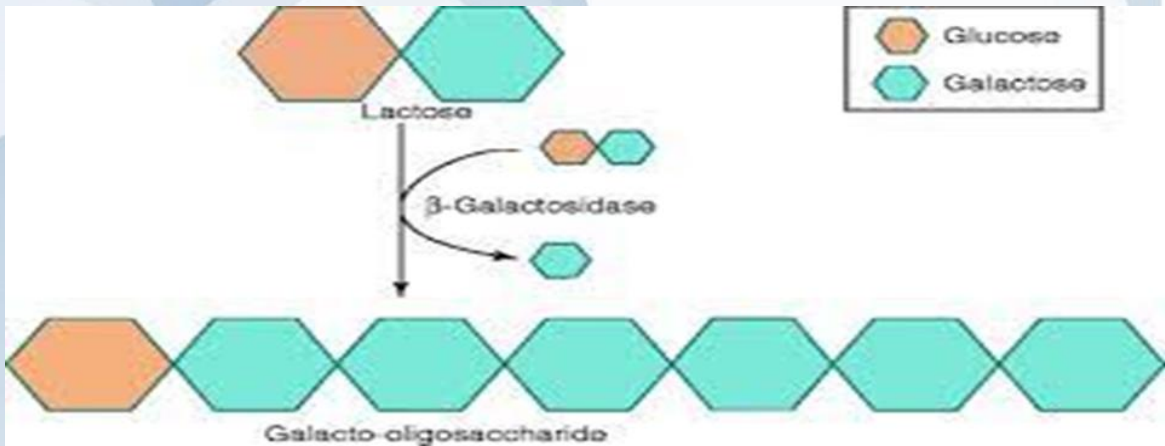


Types of Prebiotic

There are many types of prebiotics. The majority of them are a subset of carbohydrate groups and are mostly oligosaccharide carbohydrates (OSCs). but there are also some pieces of evidence proving that prebiotics are not only carbohydrates.

1-Fructans:This category consists of inulin and fructo oligosaccharide or oligofructose.

2-Galacto-Oligosaccharides; Galacto-oligosaccharides (GOS), the product of lactose extension



Types of Prebiotic

3-Non-carbohtdrate oligosaccharides;

Although carbohydrates are more likely to meet the criteria of prebiotics definition, there are some compounds that are not classified as carbohydrates but are recommended to be classified as prebiotics, such as cocoa-derived flavanols. (Davani-Davari et al., 2019).

Function of Probiotic Bacteria

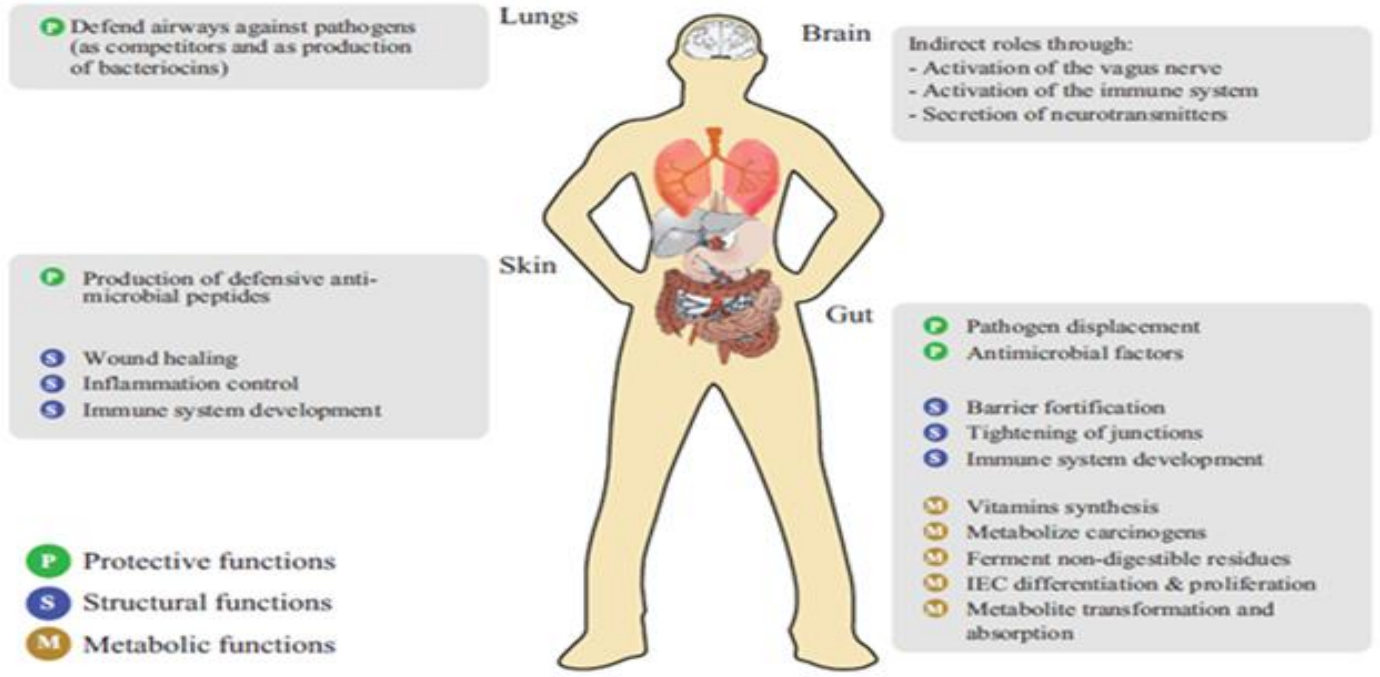
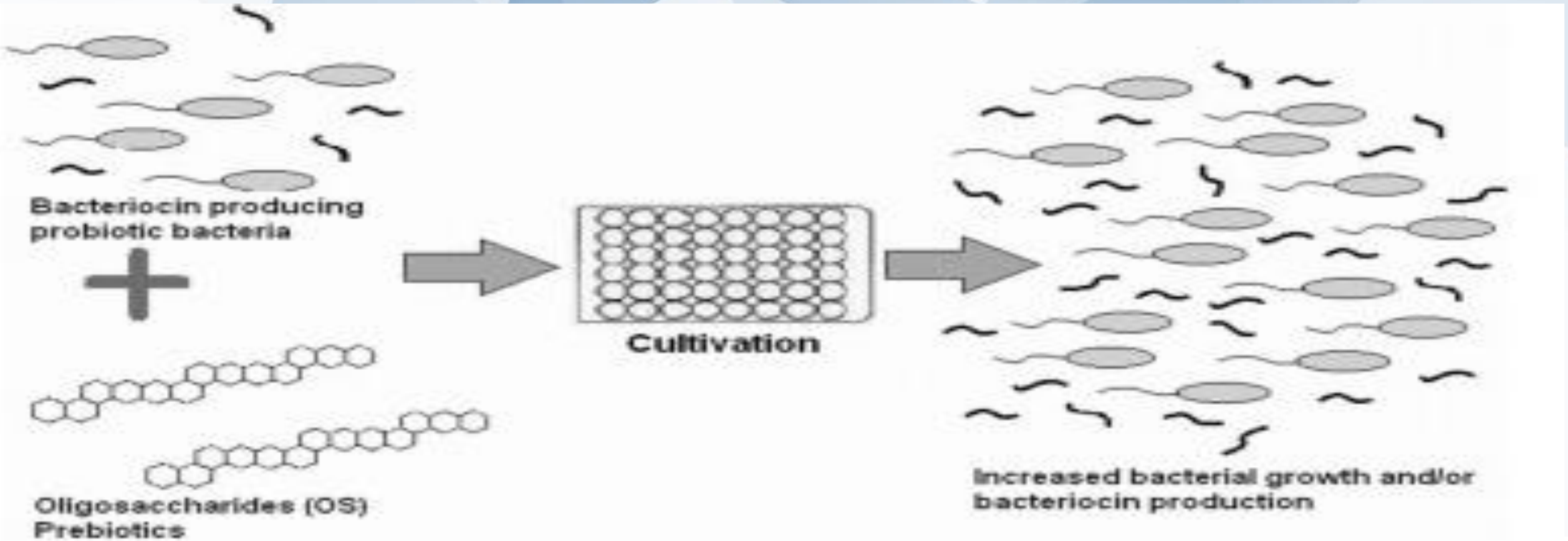


Figure.3

(Scotti et al., 2017).

Growth And Increase of Probiotic Bacteria

Bacteria differ dramatically with respect to the conditions that are necessary for their optimal growth. In terms of nutritional needs, all cells require sources of carbon, nitrogen, sulfur, phosphorus, numerous inorganic salts (e.g., potassium, magnesium, sodium, calcium, and iron), and a large number of other elements called micronutrients (e.g., zinc, copper, manganese, selenium, tungsten, and molybdenum). Carbon is the element required in the greatest amount by bacteria since hydrogen and oxygen can be obtained from water, which is a prerequisite for bacterial growth. (BRITANICA, 2020)

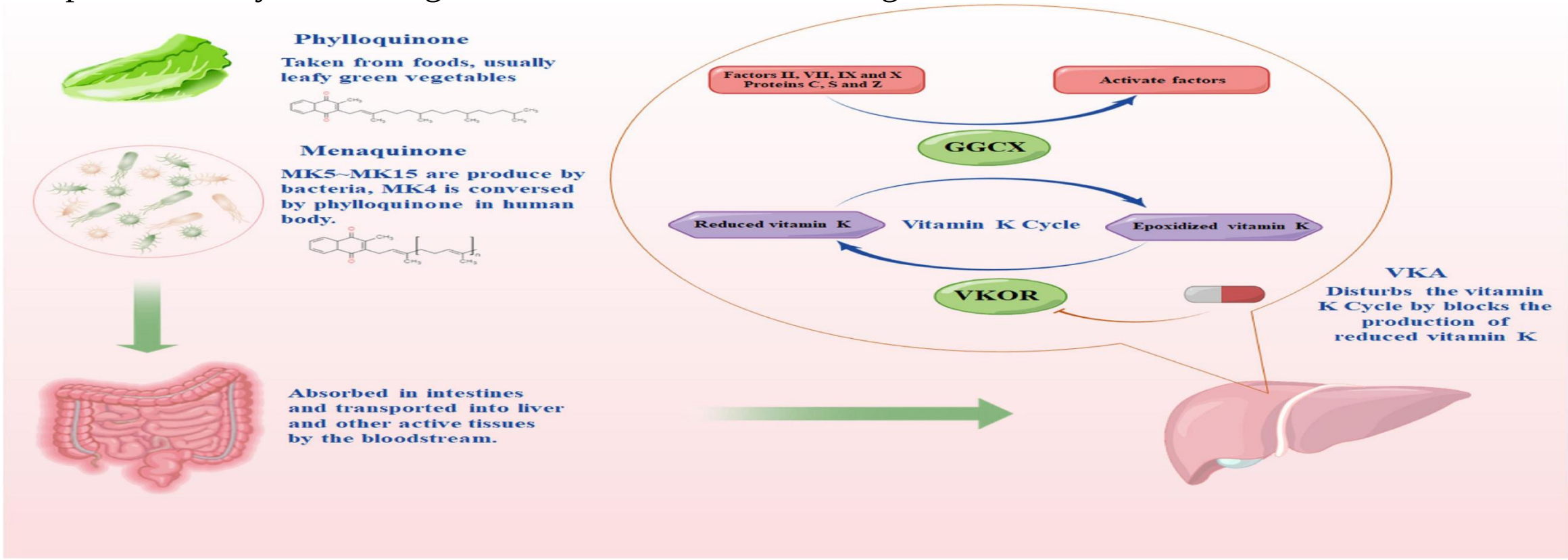


Sources of Probiotic Bacteria

the Danone Essential Dairy & Plant-Based division encompasses the traditional range of fermented dairy products and probiotics. The portfolio was recently broadened to include plant-based products, expanding the possibility to develop dairy and non-dairy ranges of healthy products that will contribute to nourish, enrich and protect the gut and its microbiome. Here we present the history of microbiology and Danone and reveal our research priorities for the coming years (Veiga

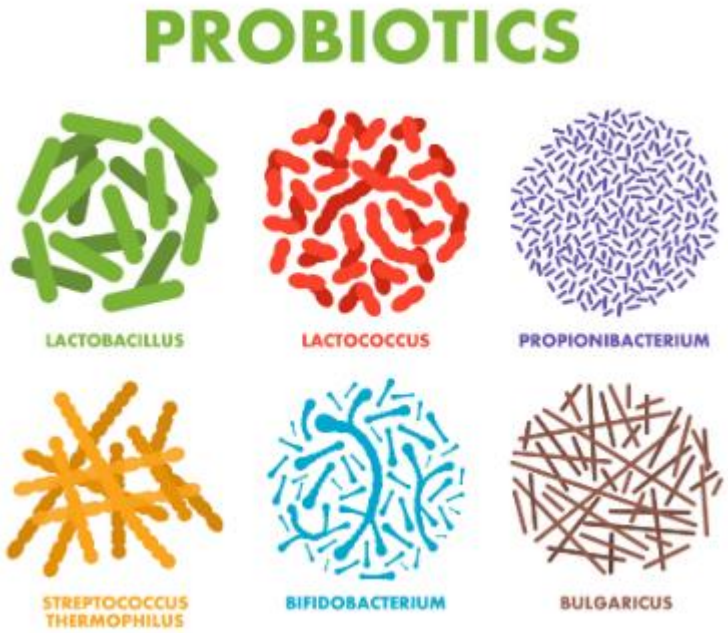
Relationship Between Probiotic Bacteria and Vitamin K

A lot of studies indicated the potential relationship between microbiome and the vitamin K antagonist. Vitamin K is absorbed by the gut, and the intestinal bacteria are a major source of vitamin K in human body. A combined use of the vitamin K antagonist and antibiotics may result in an increase in INR, thus elevating the risk of bleeding, while vitamin K supplementation can improve stability of anticoagulation for oral vitamin K antagonist treatment.



Relationship Between probiotic Bacteria and Immune System

Commensal bacteria and probiotics can promote the integrity of gut barriers. Commensal bacteria contribute to the host gut defence system mainly by resisting the invasion of pathogenic bacteria and helping the development of the host immune system. ”. The invasion of pathogenic bacteria is also prevented by commensal bacteria due to the reduction of intestinal pH by the production of lactate and short-chain fatty acids (SCFAs).



The effect of antibiotic of bacteria

in Western countries, up to 35% of women are exposed to an antibiotic during pregnancy and delivery, and antibiotics comprise 80% of the drugs a woman is exposed to during pregnancy . Mothers are frequently prescribed intrapartum antibiotics prophylactically to prevent and treat infections . Clostridioides difficile (formerly known as Clostridium difficile) infection is an example of a disease brought about directly through antibiotic disruption of the gut microbiota . single (Patangia et al., 2022)

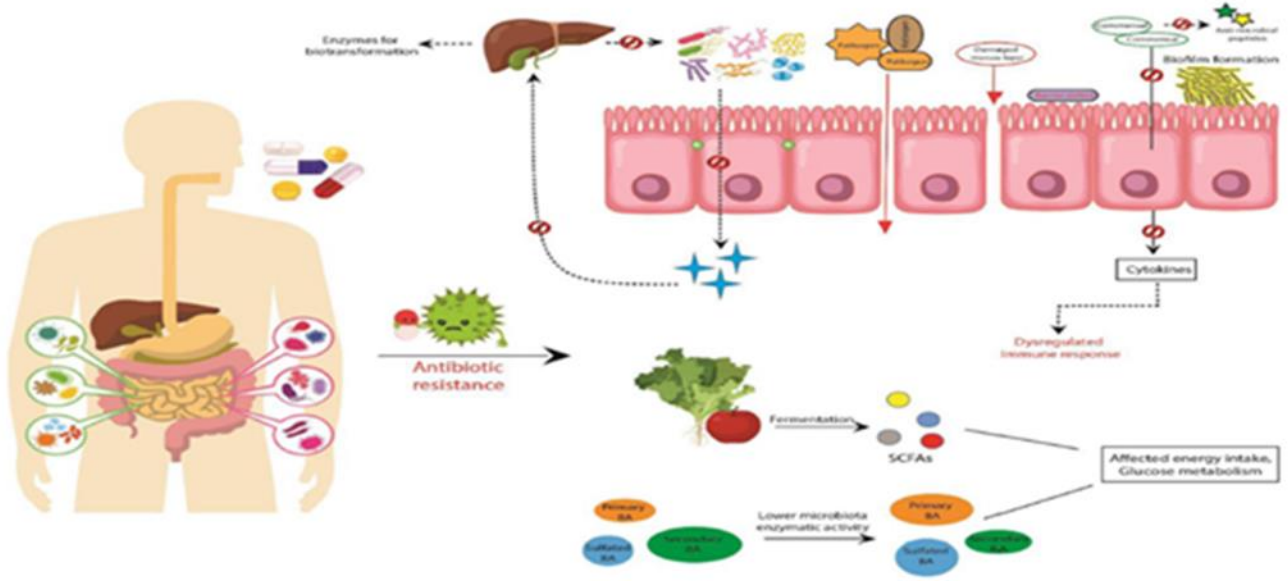


Figure.4 The negative impacts that can occure an host heaith due to overuse and misuse of antibiotics.

Discussion

We can conclude that current probiotic research encourages the search and characterization of gut bacteria as a model for finding new natural or engineered probiotic strains to be used to restore the normal balance of the human gut ecosystem. The fact that commensal and probiotic bacteria interact with the host immune system is now well accepted and illustrated by in vitro and in vivo experiments. However, the current knowledge of the molecular mechanisms involved in this cross-talk remain poorly understood. Although some mechanisms and active compounds have been identified in a few commensal or probiotic strains, and taking into account that the human GIT is composed of 1013-1014 microorganisms, it is necessary to explore profoundly this research area and in particular to elucidate the exact role of bacterial compounds in homeostasis and immune response. As for the use of genetically modified commensal and probiotic bacteria in humans, it is certain that most of the studies being done are Proof-of-Concept. However, although some researchers have claimed that genetically modified probiotics should be banned, the data obtained in the phase I clinical trial with the recombinant strain of L. lactis secreting IL10 (see above in the text) showed that the containment strategy (ie. release of such genetically modified organisms into nature) used to construct the strain, was not only safe and effective but also that mucosal delivery of IL-10 by a genetically modified LAB is feasible in humans.