Probiotics and prebiotics—the concept

Over a century ago, Elie Metchnikoff (a Russian scientist, Nobel laureate, and professor at the Pasteur Institute in Paris) postulated that lactic acid bacteria (LAB) offered health benefits capable of promoting longevity.

Probiotics are live microorganisms that confer a health benefit on the host when administered in adequate amounts (Table 1). Species of *Lactobacillus* and *Bifidobacterium* are most commonly used as probiotics, but the yeast *Saccharomyces boulardii* and some *E. coli* and *Bacillus* species are also used. Newcomers include also *Clostridium butyricum*, recently approved as a novel food in European Union.

Table 1 Definitions

Concept	Definition
Probiotics	Live microorganisms that, when administered in adequate amounts, confer a health benefit on the host
Prebiotic	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
Synbiotics	Products that contain both probiotics and prebiotics, with conferred health benefits
Lactic acid bacteria (LAB)	A functional classification of nonpathogenic, nontoxigenic, Gram-positive, fermentative bacteria that are associated with the production of lactic acid from carbohydrates, making them useful for food fermentation. Species of *Lactobacillus, Lactococcus,* and *Streptococcus thermophilus* are included in this group. Many probiotics are also LABs, but some probiotics (such as certain strains of *E. coli,* spore-formers, and yeasts used as probiotics) are not
Fermentation	A process by which a microorganism transforms food into other products, usually through the production of lactic acid, ethanol, and other metabolic end products

Prebiotics and synbiotics

The prebiotic concept is a more recent one than probiotics and was first proposed by Gibson and Roberfroid in 1995. The key aspects of a prebiotic are that it is not digestible by the host and that it leads to health benefits for the individual through a positive influence on native beneficial microbes. The administration or use of prebiotics or probiotics is intended to influence the gut environment, which is dominated by

trillions of commensal microbes, for the benefit of human health. Both probiotics and prebiotics have been shown to have beneficial effects that extend beyond the gut, but this guideline will focus on gut effects. Prebiotics are dietary substances (mostly consisting of nonstarch polysaccharides and oligosaccharides). Most prebiotics are used as food ingredients—in biscuits, cereals, chocolate, spreads, and dairy products, for example. Commonly known prebiotics are:

- Oligofructose
- Inulin
- Galacto-oligosaccharides
- Lactulose
- Breast milk oligosaccharides

The *lactobacilli* and *bifidobacteria* have been shown to stimulate immune maturation and minimize inflammation. Other health benefits attributed to the consumption of fermented milks involve minimizing lactose intolerance, lowering serum cholesterol, and possibly protecting against colon cancer. Several lactobacilli have antitumor compounds in their cell walls.