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## WHITE PAPER – *Bifidobacterium longum*

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### SUMMARY

*Bifidobacterium* is known as a “friendly” bacterium that begins immediately occupying the large intestine following birth.(1,2) Discovered in 1899, *Bifidobacterium* has been long known for its symbiotic relationship that benefits both bacteria and host.(3) *Bifidobacterium* is presently the focus of renewed attention because of recent studies that underscore its importance for human health.(1,4) *Bifidobacterium* provides countless essential nutrients, boosts immune function, protects against “unfriendly” bacteria, and supports a large network of cellular functions.(5) Renewed interest has also been driven by alarming knowledge that recent changes in western cultural and medical practices have caused detrimental effects to the predominance of *Bifidobacterium* and support of human health.(6) Recent studies reveal both a natural and therapeutic importance for *Bifidobacterium*.(4)

### BACKGROUND

The bacteria, *Bifidobacterium*, are part of the large intestine “microflora” which refers to a group of naturally occurring microorganisms that collectively form a healthy biomass in excess of 200gm. This biomass functions like a complex organ, roughly the size of the spleen or kidney, and contains more than 400 species of bacteria at any given time.(7) *Bifidobacterium*, together with another friendly bacterium, *Lactobacillus acidophilus*, should comprise a majority of the microorganisms of a healthy microflora. Today, however, most microfloras do not contain enough friendly bacteria. This is cause for concern, since colorectal cancer is the second largest cause of cancer death, and 60 to 70 million Americans suffer from digestive diseases.(4,8) Today, a majority of individuals have a compromised microflora that has been overgrown with unfriendly bacteria that tend to rob the body of nutrients, disrupt immune function, and cause disease.(9) Studies reflect an alarming absence of *Bifidobacterium* prevalence, beginning in 1971. At the same

time, a predominance of pathogenic microorganisms has developed.(6)

### HEALTH IMPACT

The bacterial composition of microflora can be negatively altered by stress, diet, age, environmental factors, antibiotics, disease, premature birth, cesarean section, and baby formula composition.(10-14) Some research is now focused on restoring health of the microflora through the use of probiotics (live microbial feed supplements) and prebiotics (non-digestible food ingredients that stimulate growth of friendly bacteria).(5,15) Research has also been focused on restoring the healthy composition of the microflora through encouraging cultural practices like breast-feeding, and by changing diet.(15) With renewed public interest in healthy foods, manufacturers have begun producing several new milk products containing *Bifidobacterium longum* and *Lactobacillus*. These healthy bacterial cultures are now being incorporated into yogurts, breakfast foods, cheese, drinks, and spreads to enhance market value of milk.(16) Over the last two decades, Russia has developed various pharmaceuticals based on *Bifidobacterium* to support cellular, gastrointestinal, and liver function.(17)

### DEVELOPMENT

Development of the infant microflora begins at birth as microorganisms are acquired from the birth canal, delivery environment, and hospital staff.(5, 11) Research suggests that changes in various cultural and medical practices adversely affect this development. In a 20-year retrospective study, Grutte found that predominance of *Bifidobacterium* in infant stools had continuously decreased until in 1971, the bacterium no longer predominated in fecal microflora.(6) Significant differences in neonate health have been attributed to differences in the composition of microflora. Infants tend to be healthier when they are breast-fed, when they have significant contact

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during natural birth, and when they are born full-term. These factors are all associated with predominant growth of *Bifidobacterium* immediately following birth.(5) Since breast-fed infants have fecal microflora consisting of nearly 100% *Bifidobacterium bifidum*, much attention has been focused on research to identify components of breast milk that are directly responsible for stimulating growth of *Bifidobacterium*.(18) Researchers hypothesize that the low buffering capacity of breast-milk is responsible for the acidic growth-stimulating environment.(3) Research is aimed at creating baby formula that duplicates the growth of *Bifidobacterium* in breast-fed newborns.(5,19)

#### ***Supports cellular function...***

Several studies have focused on restoring normal microflora and supporting cellular function through the use of prebiotics and probiotics containing viable *Bifidobacterium*.(7,20) Consumption of yogurt was shown to favor growth of *Bifidobacterium* in healthy volunteers, and *Bifidobacterium*-fortified formula stimulates *Bifidobacterium* growth in newborns.(20,21) Researchers observed less necrotizing enterocolitis after ingesting preparations of *acidophilus* and *Bifidobacterium infantis*.(22) A fiber-rich diet is also associated with a substantial increase in *Bifidobacterium*, and a reduction of nitrosamines, which have been implicated in a number of cancers.(23) Animal and human studies have also shown that dietary administration of lyophilized cultures of *Bifidobacterium*, or culture-fortified milk has been associated with decreased activity of carcinogen-generating bacterial enzymes, and lower incidence of some tumors and cancers.(4,24,25) Sekine *et al.* demonstrated that purified cell walls from *Bifidobacterium infantis* were responsible for decreasing activity of some progressive tumors.(4)

#### ***Facilitates metabolism...***

The primary activity of *Bifidobacterium* in the microflora is to digest proteins and carbohydrates, and produce short chain fatty acids, (SCFA) which are readily absorbed for energy generation and incorporation into tissues.

A high intensity substrate flow from the microflora to human host suggests that *Bifidobacterium* metabolism may be useful for supplying nutrients under periods of accelerated growth or low availability of dietary protein.(26) These metabolic processes generate vitamins B and K.(2) Without the host-microflora symbiosis, these nutrients would be lost as they are excreted from the digestive tract.(7) The bacteria comprising the microflora have several branched pathways of energy generation. *Bifidobacterium*, along with other symbiotic microorganisms in the microflora, assist host metabolism by continuously switching to pathways that facilitate optimum energy production.(3) *Bifidobacterium* supports metabolism by competing for nutrients that would otherwise be lost to harmful bacteria. Researchers hypothesize that the enormous amounts of *Bifidobacterium* found in the newborn colon provide nitrogen from protein digestion, similar to the manner in which ruminants obtain nitrogen for protein synthesis.(18)

#### ***Enhances immune function...***

*Bifidobacterium* protects human health by producing an acid environment that prevents growth of pathogens.(3) In addition, several important antibiotic substances are produced as a result of *Bifidobacterium* metabolism. These substances inhibit growth of harmful pathogens by antagonistic action, by blocking adherence to the intestine, and by competition for nutrients.(2,5) Research suggests that the higher acid content of infant feces is responsible for inhibiting growth of pathogens, as observed in breast-fed infants, found to be healthier than formula-fed infants in several epidemiological studies.(27,28) Iseki has postulated that low-buffering capacity of breast-milk is responsible for producing an acidic environment in the large intestine. According to his hypothesis, this environment favors *Bifidobacterium* and discourages growth of pathogens and enterobacteria, thus protecting against intestinal or systemic infection.(30) In addition, Sekine *et al.* observed that both *Bifidobacterium longum* and *Bifidobacterium animalis* promote the *in vitro* induction of immune response.(4)

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