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INFORMED DECISIONS

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Dysbiosis and Probiotics

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OVERVIEW

Dysbiosis is a serious condition that may be the underlying cause of some of our most prevalent diseases or clinical conditions. It has been overlooked by the medical community due to the previous misunderstanding of the critical role this condition plays in an individual's long-term overall health. Many experts and healthcare pioneers who have researched this subject believe that immune system function is directly related to the health of the gastrointestinal tract. As Dysbiosis becomes a problem in individuals, the immune system becomes impaired, resulting in a multitude of symptoms that can be unique in different people. Today **thousands of clinical studies validate and or indicate the seriousness of the condition**. In addition, laboratory tests can now be performed on patients to substantiate this condition, forcing even former nonbelievers to confront the realities of Dysbiosis.

In order to understand our complex Gastrointestinal (GI) System, let us review its components and functions.

GI TRACT

One of the functions of the digestive system is to simply **process food and waste**. However, the steps involved in the processing of food and waste are numerous and complex. The GI tract, an important component of the digestive system, consists of the stomach and intestines. If the GI tract is not healthy, the organism (the human body in this case) will not be healthy. **The key elements to good health and feeling good are eating nutrient rich foods and taking care of the GI tract**. This allows the digestive system to do the work that helps keep the body healthy. The GI tract constitutes the body's second largest surface area, with the respiratory tract being the first. This surface area could be described as comparable to the size of a tennis court.[1] This system's functioning is directly affected by the fuel used to run it and by general overall maintenance, which includes lifestyle factors such as exercise, stress and rest. **Changes in environmental factors or in lifestyle can alter the balance of the intestinal environment** and it may be a challenge to get all the parts to run together smoothly again.

The GI tract plays a crucial role in breaking down food and utilizing the nutrients present in the food. It is estimated that approximately 60 tons of food pass through the GI tract during a normal lifespan. While this is important to well being, **an impairment anywhere along this system will negatively impact the nutritional status and overall health of the individual**.[1] The process of digestion begins before food enters the mouth. Visual and olfactory stimuli cause the brain to alert the mouth to salivate and the stomach to secrete pepsin and hydrochloric acid. Thorough mastication (chewing) of food allows for adequate release of salivary enzymes, which begin the process of carbohydrate digestion. Food then travels to the stomach via the esophagus where gastric acids or "juices" help break the

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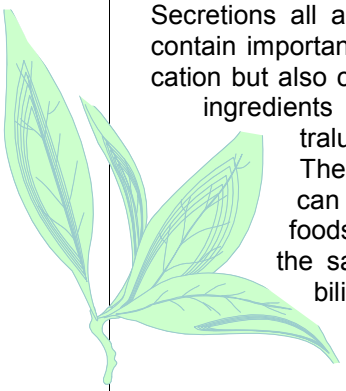
food down even more. These juices include pepsin, hydrochloric (HCl) acid and enzymes. Protein digestion begins here and will be incomplete at this stage if digestive juices are insufficient. By nature, to do its job the stomach should be highly acidic. The body's first line of defense against exogenous organisms such as bacteria, viruses and parasites is this gastric acidity. If the acid-producing beneficial bacteria are killed off, a shift towards a **more alkaline intestinal pH** occurs, creating an environment that is favorable for pathogenic organisms to proliferate and for parasites to take refuge and flourish.

Muscles and digestive juices in the stomach further macerate the food. It then passes through the pyloric valve into the small intestine, which has a more alkaline pH. Bile and pancreatic enzymes are released for fat digestion and for further digestion of protein and carbohydrates. The pancreas also secretes bicarbonates to neutralize the HCl acid from the stomach, alkalizing the food for the small intestine. Secretions all along the GI tract not only contain important factors for mucosal lubrication but also contain literally hundreds of ingredients that are important for intraluminal microbial defense.[1] The fluid milieu of the GI tract can be altered by the types of foods and fluids consumed, but the salivary, gastric, pancreatic, biliary and intestinal secretions account for 6 to 7 liters a day. [2]



Peristalsis occurs to move the food along the tract of the small intestine. Food is broken down into nutrients that are absorbed at different stages of digestion and along different areas of the GI tract and then used for energy. Once the work is done, the remains are passed on to the large intestine. The large intestine normally has a slightly acidic pH. Water is absorbed and the waste that is left is excreted. An alteration in the pH or in the intestinal mucosa will impair this absorption.

The average adult has approximately 26 feet of intestinal tract. Within that tract are microvilli and folds and creases. The villus surface is in perpetual motion and is another line of defense for the intestinal mucosa. Within the folds and creases are microflora, organisms that are extremely important not only to the health of the GI tract but to the entire body. More simply put, **the organisms in the intestines make up a complex environment of microorganisms that play a critical role in the whole health of an individual**. It is also important to note that the epithelial surface of the intestines is shed and renewed every day or so. If there is impairment in the balance of intestinal organisms, there may be nutrient or functional deficiencies in meeting the metabolic demands of that turnover. If these imbalances and deficiencies continue unchallenged for a period of time (which varies by individual), an unhealthy state called Dysbiosis can occur.

DYSBIOSIS

The intestinal ecology consists of all the bacteria (both health-promoting and potentially pathogenic) and other organisms that are present in the digestive tract. These organisms perform many important functions. It is estimated that **over 500 different species of identified organisms exist in the digestive tract with a total of more than 10 billion organisms altogether**.[2, 3] Dysbiosis occurs when there is an alteration in the normal balance of the microflora or organisms of the GI tract. This imbalance creates a pathogenic, disordered or dysfunctional microflora ecosystem that alters the metabolic or immunologic responses of the person. Symptoms can range from mild discomfort to outright disease. In fact, the balance of the organisms in the GI tract impacts all functions within the body, including **vitamin production, hormonal activities, immunity and detoxification processes. Dysbiosis can develop not only in the gastrointestinal tract, but also in the oral and vaginal cavities**.

CAUSES OF DYSBIOSIS

What contributes to the development of Dysbiosis? There are many factors, but following is a list and explanation of some of the most common.

ANTIBIOTICS

One of the primary causes of dysbiosis in the United States is the use of antibiotics. Every year, **hundreds of thousands of prescriptions for antibiotics are written and filled** in the U. S. That number continues to rise. The discovery of antibiotics has been a critical development in improving human survival rates when infectious diseases strike. However, wide-

spread and often indiscriminate antibiotic use has led to the development of other health problems and challenges.

One of the main problems associated with the use of antibiotics is that **they kill off the good bacteria along with the bad bacteria**. By destroying and creating a deficiency of beneficial bacteria, antibiotic use can create a state of dysbiosis. In addition to health problems that occur secondary to dysbiosis, we now have antibiotic-resistant strains of organisms developing. Some antibiotics, such as **mycin drugs, kill over 99 percent of the beneficial bacteria in the GI tract**.[3] It can take the intestinal tract months to rebuild this balance of beneficial bacteria. Sometimes the immune system is weakened so badly that the body may not be able to rebuild the correct balance.

HYPOCHLORHYDRIA AND ACHLORHYDRIA

As mentioned previously, gastric acidity is the first line of defense against exogenous organisms infecting or inhabiting the GI tract. A deficiency in this acidity, leading to conditions such as **hypochlorhydria and achlorhydria, will promote the development of dysbiosis**. While this deficiency is more prevalent in the elderly, it can occur in all ages. With age the cells in the lining of the stomach (parietal cells) that produce hydrochloric acid become less efficient. In fact, it is estimated that most people over 40 years of age have some level of hydrochloric acid deficiency and digestive enzyme deficiencies. This contributes to dysbiosis by:

1. Compromising the body's ability to properly digest protein. When this happens, the incompletely digested protein is dumped into the small intestine where it cannot be properly broken down, and putrefaction occurs. With proper digestion, meat normally remains in the stomach two to four hours. Putrefaction is the process whereby partially digested material sits in the gut, rotting and decaying rather than being properly digested. This leads to a production and buildup of toxins within the digestive tract that create local and systemic problems.
2. Compromising the body's first line of defense against exogenous pathological organisms. As previously mentioned, the acidity of the gastric juices provides a defensive barrier that kills most pathological organisms, thereby preventing their entry into the GI tract. When the acidity is altered, this defense mechanism is ineffective.

POPULAR MEDICATIONS

The use of **anti-ulcer medications and antacids** (H-2 blockers, proton ion pump inhibitors and OTC antacids) purposefully alter gastric pH, setting the stage for dysbiosis. Now that the FDA has classified these as over-the-counter drugs, the free access to many of these products can set off an alarming trend of more people with dysbiosis.

Other medications that can contribute to dysbiosis by altering the intestinal environment include female hormones (such as **birth control pills** and other forms of birth control), **steroids, muscle relaxants, chemotherapy and radiation**.

DIET

High consumption of sugar or fat, the typical American diet, is a factor that contributes to dysbiosis, and it deserves special attention. The typical Western diet consists of 100 pounds of refined sugar per individual annually. [1] In most cases, a diet high in sugar means the individual is taking in excessive calories with very few nutrients. In addition to **creating nutritional starvation of the beneficial bacteria and altering the body's pH**, sugar promotes the growth of **yeasts such as Candida albicans**. Thus, high sugar diets increase the likelihood of developing candidiasis, a systemic yeast-overgrowth. Metabolic byproducts of candida include **alcohol** and hydroxyl radicals, which create other health issues. Alcohol alters the intestinal ecology. Fermented alcohols also introduce yeast into the system while the alcohol itself contributes to altering the intestinal ecology. Foods containing yeast also contribute to the overgrowth of Candida.

In the last 100 years, the diet in Western countries has also doubled in cholesterol consumption, increased ten-fold in sodium consumption and quadrupled in saturated fat consumption. Other characteristics of the Western diet include insufficient consumption of vegetable fibers, minerals (such as potassium, magnesium, chromium and calcium), vitamins, antioxidants and omega 3 essential fatty acids. [1] Fats (the

appropriate type), are important in hormone synthesis and absorption of fat-soluble vitamins. However, the wrong type of fats (hydrogenated and transfatty acids) can actually promote inflammatory processes and interfere with absorption of some nutrients. These indigestible or partially digestible fats create an ideal breeding ground for pathogens.

FOOD-BORNE PATHOGENS

Food-borne pathogens can annihilate the balance of organisms in the GI tract. Many of these organisms even kill, with nationwide **estimates of food-borne pathogen associated deaths as high as 9,000 annually**. It is estimated that in the United States, more than **6.5 million cases of illness from food-borne microbial pathogens occur annually**. [5]

There are three classifications of food-borne illnesses:

1. **Infections** occur when pathogenic organisms invade and penetrate the intestinal mucosa.
2. **Toxicoinfections:** Some pathogenic bacteria in our system actively secrete toxins which may not make us acutely ill but place stresses on the system. This can weaken our immune response and our ability to neutralize such toxins in the liver or kidneys.
3. **Intoxications** occur when pathogenic organisms produce a toxin in food prior to its consumption. This is the most common cause or form of food-borne illness. Intoxications are also the quickest to manifest symptoms, occurring anywhere from 15 minutes to several hours later, depending on the organism ingested.

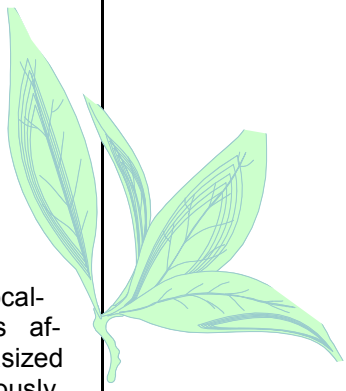
Examples of food-borne pathogens include Campylobacter sp., E. coli, Salmonella sp., Shigella sp., Botulinus and Staphylococcus aureus. If the intestinal microflora is intact and "good" organisms exist in healthy numbers, exposure to these pathogenic organisms is less likely to result in ill effects, or the effects may be minimized.

OTHER CAUSES

Other factors that can cause dysbiosis include **lifestyle changes, stress (psychological and/or physical), excessive alcohol use, eating habits (consumption of refined or processed foods), drinking fluoridated and/or chlorinated water, travel, viral infections, toxic metals** and other forms of environmental pollution. These all adversely alter the balance of the intestinal bacteria and enzymes, creating a dysbiotic situation in which "bad" bacteria flourish.

SYMPTOMS OF DYSBIOSIS

Metabolic byproducts of the "bad" bacteria are toxic and can create a wide variety of symptoms. Digestive complaints are the most common and include flatulence, bloating, intestinal pain and inflammation, cramping and constipation and/or diarrhea. Unfortunately, the cause of these symptoms is frequently misunderstood and misdiagnosed. When the symptoms are treated but the cause of the problem is not corrected (as is often the case) more serious systemic disorders can develop. In fact, intestinal dysbiosis should be considered as a possible cause, or at least a contributing factor in patients who have **asthma, bronchitis, allergies, autoimmune disorders, breast and colon cancer, unexplained fatigue or neuropsychiatric symptoms**.



The fact that much more than the localized gastrointestinal environment is affected by dysbiosis cannot be emphasized strongly enough. As mentioned previously, systemic effects can occur in all body systems and organs. **Halitosis, adrenal stress, diarrhea, candida, leaky gut syndrome, colon cancer and breast cancer** are just a few examples of some of the symptoms or consequences of dysbiosis. The following list shows that dysbiosis can contribute to a wide range of problems. It is a serious condition that must be addressed if optimum health is to be achieved. Symptoms can include:

- Acne
- ADD/Autism
- Aggressive Behavior
- Arrhythmia/Palpitations
- Arthritis
- Asthma/Allergies/Hayfever
- Belching/Bloating
- Blurred Vision
- Brain Fog/Memory Problems/Confusion
- Cardiovascular Symptoms/Disease
- Chronic Fatigue Syndrome
- Constipation/Diarrhea/Gas
- Cystitis/Urethritis

- Dental Caries
- Depression
- Diaper Rash
- Dry Eyes/Mouth
- Eczema
- Fibromyalgia
- Fungus (Finger/Toe)
- Inflammation
- Leaky Gut Syndrome
- Menopausal/PMS symptoms
- Periodontal Disease/Halitosis
- Poor Concentration/Learning
- Tinnitis
- Vertigo/Dizziness
- Weight Gain/Overweight
- Yeast Infections

Many of these conditions would indicate that the dysbiosis has evolved into leaky gut syndrome. Chronic Fatigue Syndrome (CFS), for example, is now recognized by many professionals as a health condition that is characterized by a toxic overload and a breakdown of the individual's immune system. Case studies indicate that a **high percentage of patients with chronic fatigue may have dysbiosis as a result of recurrent antibiotic treatment**. [3] Many medical authorities now concur with this theory.

In the end, correcting Dysbiosis may be as simple as fortifying the GI tract with "good" bacteria, known as Probiotics.

PROBIOTICS

Probiotics are considered functional foods and contain beneficial bacteria. They can **re-establish colonization and restore the microfloral balance of the intestinal tract**. Three of the most important species of beneficial intestinal organisms are Lactobacillus acidophilus, Bifidobacterium bifidum (Bifidus) and Saccharomyces Boulardii. Lactobacillus and Saccharomyces Boulardii primarily colonize the upper GI tract (small intestine), while bifidobacteria are anaerobic bacteria that predominate in the lower GI tract (large intestine). Many Soil-Based Organisms (SBO's) have very recently been found to benefit the human GI tract as well.

In a healthy intestinal environment, most of these organisms attach themselves to the surfaces of the intestinal tract, where they rapidly multiply and become an important part of the immune system. If the intestinal lining is coated with beneficial bacteria, there is no room for pathological organisms to attach. A detailed discussion of each type of beneficial intestinal bacteria follows.

LACTOBACILLUS

Lactobacilli are found primarily in the small intestine and play an important role in the initial stages of digestion and assimilation of food. Lactobacilli provide a number of important benefits that affect **the health of the intestinal mucosa as well as the general overall health of the individual**. Some of the important activities of lactobacilli, especially lactobacillus acidophilus, include **synthesis of various B vitamins**, **assistance in digestion and assimilation of food, antibiotic-like effects against certain pathogenic organisms, detoxification of toxic metabolites from other bacteria** and **helping with lactose intolerance**.

Antimicrobial

Lactobacilli function in several ways that help prevent pathological organisms from proliferating in the GI tract. They require amino acids, peptides, nucleotide bases, fatty acids, carbohydrates, vitamins and minerals as well as a pH of 5.5 to 5.8 for optimal growth. Metabolic byproducts include lactic acid and hydrogen peroxide. Although the exact mechanism is not clearly understood, **these metabolic byproducts exert an inhibitory effect on a number of pathogenic and nonpathogenic bacteria and fungi**. [6, 7] These include organisms such as Salmonella, E. coli, Clostridium, staphylococcus, and candida. [7]

Lactobacilli are also able to produce a number of **natural antibiotics such as bulgarican and acidophilin**. [7] Due to their anaerobic activity, these are difficult to isolate outside the GI tract. By ingesting the beneficial bacteria that are known to produce these agents in the GI tract as part of their metabolic processes, we can gain benefit from these natural antibiotics through their inhibitory mechanisms on undesirable organisms.

Lactose Intolerance

Lactobacilli also produce the lactose hydrolyzing enzyme *B*-galactosidase, which aids

in the digestion of lactose, or milk sugar. Many who are lactose intolerant can tolerate fermented dairy products as they induce intestinal lactase. [8] It is possible that probiotic supplementation can help lactose intolerant individuals.

Cholesterol Assimilation

Certain lactobacilli seem able to enzymatically modify the cholesterol molecule and may therefore be beneficial in lowering cholesterol levels.[9] The beneficial bacteria convert cholesterol into coprostanol, a less soluble substance, which is then excreted. **When lactobacilli levels are inadequate, more cholesterol is absorbed back into the body**, contributing to elevated blood levels of cholesterol and increasing the risk of cardiovascular disease. However, studies in man have shown mixed results and no clear hypocholesterolemic effects.

Vitamin Production

The lactobacilli synthesize **B vitamins such as B-2, B-3, B-6, B-12, folic acid and vitamin K in our intestinal tract** as metabolic byproducts. There is also some evidence that mineral uptake may be enhanced, particularly calcium and magnesium.

Identified Forms Of Lactobaccilli

- **L. Acidophilus** – May help reduce cholesterol and lactose intolerance, controls diarrhea and helps prevent colonization of unhealthy bacteria. Enhances the immune system.

- **L. Brevis** – Inhibits growth of certain pathogenic bacteria and may alleviate post antibiotic treatment syndromes.

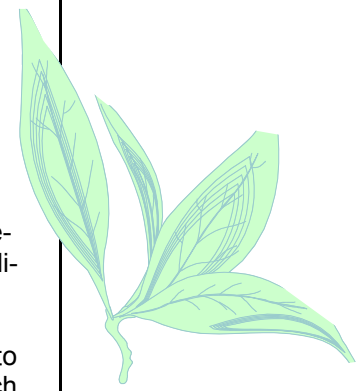
- **L. Bulgaricus** – Beneficial against intestinal infections and enhances the immune system through its production of antibiotics and lactic acid.

- **L. Casei** – Coats the intestinal mucosa and protects against invasion and activities of pathogenic organisms, thus aiding and supporting the immune system; contributes to intestinal peristalsis and helps eliminate the harmful amines from amino acids metabolism. Has been used in prevention of intestinal disturbances and treatment of rotavirus diarrhea. Also has shown positive effects in the treatment of bladder cancer and enhancing the immune system in early colon cancer. [10]

- **Lactobacillus GG** – Effective for prevention of antibiotic associated diarrhea, rotavirus diarrhea, Clostridium difficile diarrhea, and Crohn's disease. Has also shown antagonistic activity against carcinogenic bacteria. [10]

- **L. Plantarum** – There are many strains of L. Plantarum. They produce acetate and lactate, possess conversion pathways for malate, tartrate and citrate into lactate or acetate and are able to deaminate arginine into ornithine and serine into pyruvate. [1] One of the most important features of L. plantarum is that it has at least six different pathways to degrade arginine and all of those produce nitric oxide. Antibiotics depress or interrupt those functions. Nitric oxide produced by enzyme activities provides beneficial effects to the GI system. [1]

- **L. Rhamnosus** – Inhibitory effect on bacterial & fungal vaginal infections and helps prevent diseases from intestinal infection by sticking to the mucosal walls. Has been found to decrease *B*-glucuronidase, nitroreductase and hydrolase activities and may have cancer preventive effects for this reason. [1] Also effective in preventing and treating many forms of diarrhea.



- **L. Salivarius** – Has been shown to produce alpha-Galactosidase, which helps reduce flatulence. In addition, L-Salivarius is highly **resistant to tetracycline and other types of antibiotic therapy** thus reducing antibiotic induced diarrhea.

Other forms of beneficial bacilli

- **Streptococcus thermophilus** - Enhances digestion of milk sugars & exerts an inhibitory effect on pathogenic bacteria.

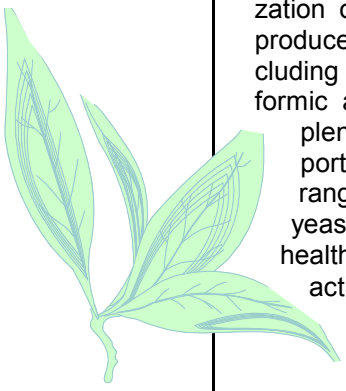
- **Enterococcus faecium** - Inhibits the growth of certain pathogens that cause diarrhea. Experimentally demonstrated inhibition of E. coli, Listeria, Salmonella, Shigella and Staphylococcus aureus. It has decreased the amount of S. typhimurium in the spleen of mice in animal studies. [11] E. faecium strain

SF68 has also been used to treat patients who have hepatic encephalopathy. [8]

- **Bacillus subtilis** - Effective against pathogenic bacteria & beneficial in some intestinal disorders.

BIFIDOBACTERIA

While lactobacilli protect the small intestine, bifidobacteria are abundant in the colon, the lower portions of the small intestine and the vaginal tract. The health of the large intestine is dependent upon adequate colonization of these organisms. Bifidobacteria produce short-chain fatty acids (SCFAs), including acetic, propionic, butyric, lactic and formic acids, with acetic acid being most plentifully produced.[15] Acetic acid is important because GI health exerts a wide range of antimicrobial activity against yeasts, molds, and bacteria. Thus, a healthy intestinal environment allows for active production of **organic acids and antibiotics, which function as an integral part of our immune system**.



Adequate colonization of these beneficial bacteria also protects us simply by occupying space. The presence of billions of beneficial bacteria within the intestinal tract literally **leaves no room for undesirable organisms or parasites to attach**. This is known by microbiologists as the principle of exclusion. Competition for nutrients is another factor. When adequate numbers of beneficial organisms are present, they consume most of the available bacterial nutrients, making it difficult for pathogenic organisms to proliferate.

Some of the bifidobacteria include:

- **B. Longum** - Potential toxicities from the nitrites in the diet may be prevented.

- **B. Bifidum** - Abundant in the lower portion of the small intestine and vaginal tract, helps manufacture B vitamins, inhibits colonization of Candida and detoxifies bile. Since estrogen is conjugated by the liver, estrogen recycling should be more efficient when bile is nontoxic.

- **B. Infantis** - Has been shown to be the main inhabitant of every healthy infant's gastrointestinal tract. It is also found in small amounts in the vaginal tract. B-Infantis functions synergistically with B. Bifidum.

SACCHAROMYCES BOULARDII

Bacteria are not the only types of organisms that have proven to benefit human health. Saccharomyces boulardii (SB) is a species of yeast similar to brewer's yeast that exerts a direct antagonistic effect against a number of pathological organisms including Candida albicans and C. pseudotropicalis. It may actually help prevent Candida from spreading.

Diarrhea

There are also studies that indicate SB **protects the gut from amoebas and cholera and alleviates diarrhea** resulting from C. difficile, Crohn's disease, traveler's diarrhea and diarrhea of unknown cause in people with AIDS. [12, 13] SB has been shown to be effective in preventing diarrhea in critically ill tube-fed patients as well. A study done in Europe on SB and Crohn's disease indicated a decrease in the frequency of bowel movements in the tenth week with no adverse effects. While S. boulardii does not prevent acquisition of the pathogen, it seems to reduce the incidence of diarrhea associated with the pathogen. It is thought that some of this activity occurs through enzymatic modification of toxin receptors. In a double blind controlled study using 180 patients, only 9.5% of those receiving S. boulardii experienced diarrhea compared to 22% who received placebo when C. difficile was introduced. [13]

Immune System

SB also **increases several immune system markers and enhances the activity of beneficial enzymes** in the intestinal mucosa. People who have a poor tolerance of wheat have elevated anti-gliadin levels, which increases allergenic response and putrefaction. Exactly how SB works isn't known, but people who take SB will, over time, have a lowered anti-gliadin level. This improves allergenicity as well as nutritional uptake in the GI system. Inflammatory issues in the gut have also been shown to diminish with the introduction of SB.

Although other forms of yeast such as Candida are normally absorbed through the system, SB yeast is not. In fact, animal studies indicate that **SB decreases proliferation of systemic Candida albicans,**

presumably through some type of immune stimulation. SB moves through the GI tract and is excreted through the stool in 3 to 5 days. It is not sensitive to many antibiotics, which is not the case with most of the other GI flora. For someone at risk for C.difficile overgrowth (which some antibiotics can contribute to the development of), taking SB may keep proliferation of the bacteria in check.

SOIL-BASED ORGANISMS

Even more recent than the discovery of the benefits of SB is the discovery of the beneficial bacteria known as soil-based organisms. As we are learning more about the role of microorganisms and biological balance in health, we are discovering that **only a small percentage of the millions of different types of bacteria on this earth are toxic to humans or animals**. Our fear of these organisms and perception of them as bad has led to overuse of pesticides in agriculture and antibiotics in humans. As a result, the natural biological balance of the microflora of the earth and of humans has been disrupted.

In earlier times, mankind ate a diet consisting of raw fermented foods and fresh, raw organic foods. In this way, people ingested a sufficient number of microorganisms that were beneficial to health. As industrialization has occurred, **modern agricultural and food processing techniques have virtually destroyed many of these organisms** and effectively eliminated them from the diet. Today we are discovering that these bacteria from the earth (soil-based organisms or SBO's) provide numerous benefits to overall health and wellness. These SBO's properly represent the living ecology of organic agriculture and food. Although there is little to no research on them, they are perfectly safe as we have been eating them in our food supply for thousands of years and, if we were eating live foods, we would be consuming them now. A full spectrum blend of friendly bacteria that includes SBO's is safe and effective for children, infants, pregnant women and pets of any age.[16] It is interesting to note that Americans experience far more bowel and digestive system problems than do people from non-industrialized countries. Those people have **diets significantly higher in intake of fresh raw plant life that includes soil-based organisms**.

Many benefits can be derived from consuming SBO's. The following is an explanation of those benefits as known to us today.

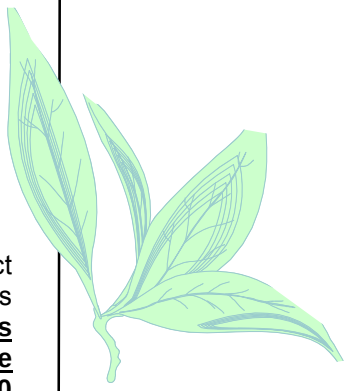
- **SBO's eliminate accumulated putrefaction**. These organisms actually consume and digest the putrefaction, dislodging it from the walls of the intestines and thereby allowing its elimination from the body. [17]

- **SBO's break food down into its most basic elements**, which allows for improved assimilation and absorption of nutrients. This process creates an improved nutritional state and enhances cellular growth and development. It also improves waste elimination. [17]

- **SBO's work symbiotically with certain cells, helping them to rid themselves of toxins**. This improves the body's functioning on a cellular level.

- **SBO's quickly engulf and ingest many pathological viruses, fungi, yeasts and molds**, allowing the immune system to rest. These microbes include candida, penicillium, mucor racemosus and aspergillus niger, among others. [17]

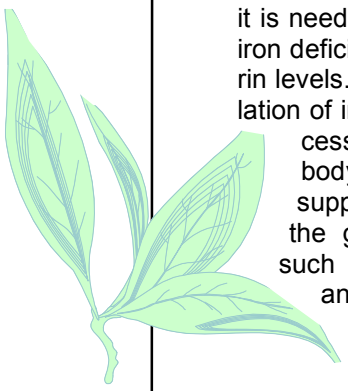
- **SBO's enhance the immune system in various ways**:



1. They stimulate the body's production of alpha-interferon, which is a key regulator of the immune response. Through scientific attempts to replicate the body's interferon, we now know that there are many sub-species of interferon that are required to protect the body's cells against various viruses and other antigens. In lab tests, **SBO's have also been shown to stimulate at least 16 out of approximately 20 sub-species of interferon** and to provide over 50 different immune modulating effects. [17] These effects hold promise for those suffering from chronic degenerative diseases such as hepatitis B and C, viral herpes, chronic fatigue syndrome and so on.
2. They stimulate β-lymphocytes which in **turn leads to the production of mass quantities of antibodies**. The interesting feature of these antibodies is that they are non-specific in that they have not identified or been programmed to attack any infectious or

pathogenic agent. [17] They wait in reserve until they are needed and at that time will imprint for the invading pathogen and work to destroy it. It has been noted that these extra antibodies remain present as long as SBO's are ingested, but once ingestion ceases, the reservoir of antibodies disappears.

3. **They produce lactoferrin**, an iron binding protein, as a metabolic byproduct. Lactoferrin is necessary in order for the body to retrieve iron from the foods eaten and help deliver it to where it is needed. Many people who test as iron deficient actually have low lactoferrin levels. This prevents proper assimilation of iron. In addition, if there is excess iron floating around in the body (such as can occur with iron supplementation), it will support the growth of harmful organisms such as yeasts, viruses, parasites and pathogenic bacteria.[17] If there is adequate lactoferrin in the system, the iron is not available for those organisms to flourish and proliferate.



- **SBO's produce SOD, Super Oxide Dismutase**, as a metabolic byproduct. SOD is known to be a **powerful antioxidant and enzyme**. It is difficult to obtain from our food and a deficiency may be associated with certain forms of cancer. Studies done at Johns Hopkins University have shown positive results with the use of SOD in eliminating or **decreasing tissue damage in damaged hearts, kidneys, the intestines, the pancreas and the skin**. These results are thought to be due to the enzymatic activity of SOD in increasing energy production efficiency within the cells of organ tissues. This allows them to nourish and repair themselves more efficiently and effectively. [17]

- **SBO's produce a specific type of DNA/RNA that is desirable** to the body. In this way, SBO's help the body to activate and expedite cellular self-repair on wounds and injuries.

- **SBO's are able to correct deficiencies in nutrient absorption** by providing a unique level of micronutrient support. This allows the system to more adequately and appropriately assimilate the nutrients available through food intake.

SBO's offer a high quality and variety of microorganisms to affect human health in a positive manner. They are safe and non-toxic. It is significant to note that **many SBO's have a long shelf-life, are stable at room temperature** and are acid-resistant, which creates a much more reliable bacterial supplement.

Some of the soil based organisms that have been identified include Artherobacter agilis, A. citreus, A. gloviformis, A. leuteus and A simplex; Acinetobacter calcoaceticus; Azotobacter chroococcum, Az. Paspali; Azospirillum brasiliense; Aspergillus terrieus; Baccillus brevis, B subtilis; Bacteroids lipolyticum and Succinogenes; Brevibacterium lipolyticum; Kurtha zopfii; Myrothecium verrucaria; Psudomonas calcis, Ps. Dentrificans, Ps. Fluorescens; Phanerochaete chrysoporium; Rhizzopus oryzae; Strteptomyces fradiae, S. cellulosae; Trichoderma viridae. This is not an all-inclusive list and most of these names will be foreign to you. Again, there is little to date of specific information on individual SBO's, except for B. Subtilis.

B. Subtilis

Of all the soil-based organisms listed, the only one that has been well documented is B. subtilis. It has a fascinating history of discovery. In 1941 a group of Nazi Germans in North Africa were taken with dysentery. The Nazis began to observe the native Arabs and noticed that although they caught dysentery, they did not die and it did not last long. At the first sign of **diarrhea, they were observed to follow around a horse or camel until it would drop its dung**. At which point they would immediately pick up the droppings and consume them! This eliminated the dysentery almost overnight. When questioned about it, the Arabs explained that they had no idea why it worked but their ancestors had always practiced this habit because it always worked. The dung had to be fresh, however, or it would not work.

The Nazis began careful examination of the fresh camel and horse dung and were able to isolate the bacterial organism Bacillus subtilis. It turns out that it practically cannibalizes pathogenic organisms in the human body. Soon the **Nazis had produced gallons of active B. subtilis and administered them to the troops and eliminated dysentery**. [17] This bacteria has been used extensively worldwide for dysentery and

other intestinal problems but in the U.S. it began to lose favor after the pharmaceutical companies began promoting antibiotics as "wonder drugs" in the 1950's.

As you can see, we have much to learn and much to benefit from SBO's. By following a more ecologically balanced and sound formula, all individuals stand to benefit greatly.

OTHER FACTORS IN GI TRACT ECOLOGY

In addition to the microbes already mentioned, various other organisms and substances that contribute to the dynamics of the intestinal microecology.

Pseudomonas aeruginosa may be pathogenic or non-pathogenic. In excess or in compromised immune systems, it may be responsible for producing gut inflammation and diarrhea. It has been associated with infections of the urinary tract, burns, and various wounds.

Short chain fatty acids (SCFAs), produced during fermentation of soluble fibers by the colon, provide the largest percentage of energy requirements of the intestinal mucosa. The most prevalent ones were mentioned above and they make a major contribution to human metabolism. Butyric acid is not only the major fuel for the epithelium of the colon, it can also be therapeutic in such disease entities as **diverticulitis and an insufficiency has been associated with colon cancer**. In addition, acetic and propionic acids contribute to the stability of lipid and cholesterol metabolism. If fiber is deficient in the diet, it stands to reason that there will be a deficiency of short-chain fatty acids. We now know that short-chain fatty acids play a role in overall health and homeostasis, particularly of the human colonic physiology. [2]

SIgA is an immunoglobulin that plays a role in the first line of defense of the intestinal mucosa relative to permeability.

PREVENTING AND CORRECTING DYSBIOSIS

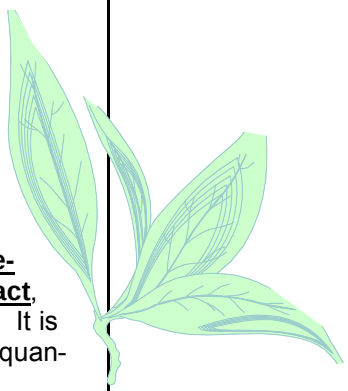
PREVENTION

The keys to preventing dysbiosis are related to diet and lifestyle. Consuming highly nutritious foods, keeping saturated fats and sugars to a minimum, consuming adequate fiber and eliminating processed and refined foods from the diet will go a long way toward optimizing intestinal health. Many lifestyle factors may be unalterable, but diet is one factor where control can be exercised.

Diet

Olive and rice oils should be used for cooking. Protein should be high quality and should primarily come from fish, chicken or soy. For some people, red meat is acceptable, with lamb being the most easily digested.

Milk and dairy are common allergens and increase mucus production in the body, which can be detrimental to the GI tract. They should therefore be avoided. Alcohol, caffeine and carbonated beverages should be avoided because they alter the pH of the gut, interfering with proper digestion and assimilation of nutrients. Carbonated beverages also contain phosphorus, which can create calcium imbalances in the body. **Diet sodas contain toxic substances**.



Fresh fruits and vegetables and whole grains help keep the GI tract balanced in pH as well as appropriate organisms. They are a good source of nutrients, particularly antioxidants and fiber. When possible, it is preferable for all foods to be organic. **Pesticides and food additives can place a burden on the detoxification processes of the GI tract**, particularly when dysbiosis is present. It is also imperative to always drink large quantities of high quality water.

Lifestyle

While diet is quite possibly the most important factor in preventing dysbiosis, various lifestyle patterns can greatly affect GI health. Positive lifestyle factors to consider include exercise and reducing stress. Exercise is important in burning calories and working the muscles and lungs. **Exercise supports the immune system** and helps the body deal more effectively with stress. It improves the body's ability to deliver blood and oxygen supplies to body tissues and can increase blood flow and oxygen content to tissues.

Stress alters the environment of the GI tract and can actually reduce the number of beneficial bacteria. Learning to appropriately deal with stress can go a long way in preventing an imbalance of organisms. Eliminating unnecessary stressors is important. Techniques and activities to help decrease negative responses to stress include yoga, meditation, hobbies, sports activities, relaxation techniques and deep breathing exercises.

Supplements and Herbals

To maintain overall good health, **a good multivitamin and mineral is always a wise investment**. Most people do not eat three well-balanced meals daily and given today's agricultural practices and the condition of our soils, many of the foods eaten today are not nutrient rich. A good high quality multivitamin is just good insurance.

Herbals should be selected according to overall health and lifestyle. Tonic herbs are good in health maintenance. Siberian ginseng, for instance, is a good overall tonic and supports the adrenal glands. The adrenal glands respond to stress with hormonal secretions that can alter the GI system. In addition, toxins within the GI system also affect the adrenal glands.

It is a good idea to take a probiotic on a regular basis as a preventive measure. People without dysbiosis can probably do fine with a probiotic once or twice a week. Anyone on antibiotics or other medications that alter the GI tract ecology should take probiotics daily during the course of treatment and continue for 7-14 days after treatment.

FOS, **fructooligosaccharides**, may also be beneficial. The meaning of this word is as follows: fructo = fruit; oligo = short; saccharides = sugars. Fructooligosaccharides are short-chain fruit sugars. These sugars are a preferred food source for the beneficial bacteria in the large intestine. Although our bodies do not possess the necessary enzymes to metabolize them, the bifidobacteria do have the enzymes necessary to metabolize FOS. FOS offers no benefit to the pathological organisms. **These sugars are non-digestible and contain zero calories for humans**.

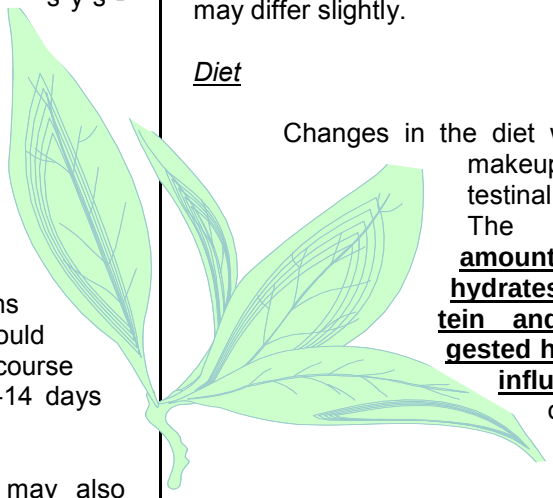
Controlled dietary studies in humans with FOS administration **have shown not only a ten-fold increase in fecal bifidobacteria but also a decrease in fecal clostridia and enterobacteria**.[13]

Bananas, beer, onions, rye, honey and oats naturally contain small amounts of FOS, although probably not in adequate enough amounts to make much difference. It is now produced commercially for the probiotics industry and can be purchased separately. It is often found as an added ingredient in probiotic products.

CORRECTING DYSBIOSIS

While prevention is critical for many people, dysbiosis is already a major problem in an astonishing number of Americans. Correcting this condition is relatively simple, but may take months to accomplish. Consultation with a professional and high doses of probiotics may be necessary, but **diet and lifestyle changes are not optional** if good GI health is to be achieved and maintained. Lifestyle recommendations for correcting Dysbiosis are the same as those listed in the Prevention section of this article. Diet requirements, however, may differ slightly.

Diet



Changes in the diet will alter the makeup of the intestinal microflora. The **type and amount of carbohydrates, fat, protein and fiber ingested have a major influence** on the organisms inhabiting our GI tracts.

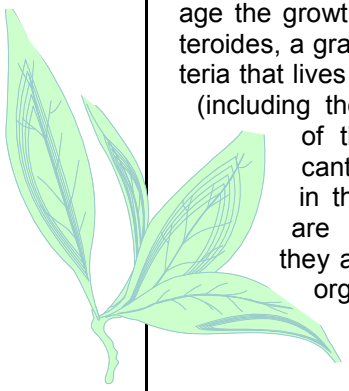
The same dietary rules apply in correction as in prevention. Healthy, nutritious foods with plenty of fresh fruits and vegetables and high quality protein are crucial. When cooking, avoid the use of saturated fats and oils and use olive and rice bran oils instead. Avoid refined and processed foods, white sugar and flour and artificial sweeteners. Pork, shellfish and dairy should be avoided. **Pork is the most difficult food for the body to digest and it is heavily**

viral and parasite laden. Shellfish are often high in bacteria and may be toxic with pollutants.

Drink at least one liter of high quality filtered water daily. **Water is essential in all the detoxification processes of the body**. Alcohol, caffeine, milk and carbonated beverages should be completely eliminated from the diet.

Fiber

One of the most important components of diet is fiber. Putrefaction (as defined earlier) is an aspect of dysbiosis usually caused by diets that are high in fat and meat products and low in fiber (the typical American diet). **Fiber is the preferred food and source of energy for the beneficial bacteria** residing in the large intestine. This microbial population is pathologically altered by high fat/low fiber diets. These unhealthy diets encourage the growth and proliferation of Bacteroides, a gram negative anaerobic bacteria that lives in many areas of the body (including the bowels). An overgrowth of these bacteria can significantly reduce the "good" flora in the GI tract. Bifidobacteria are particularly at risk since they are one of the predominant organisms in the gut. It seems logical to conclude that many of today's degenerative diseases, while due to long-term effects of dietary intake or deficiency, are directly related to changes in the microecology of the GI tract. [2]



As a supportive substance, dietary fiber will improve the balance of the intestinal microflora and exert a beneficial effect on the individual's overall health. In dysbiotic patients, fiber intake often should be increased. Lack of adequate fiber predisposes one to more health problems due to the alteration of gut microecology and metabolic processes that occur as a result of the affect on short-chain fatty acids.

There are primarily two types of fiber. **Soluble fiber** is mostly hemicellulose, the type found in a plant's sticky components (such as pectin, gum and mucilage). Fruits, vegetables, whole grains, legumes and psyllium are examples of foods containing soluble fiber.

While we still do not completely understand these fibers, it is clear they are poorly digested by human enzymes, if at all. However, in the gut, bacterial enzymes do digest soluble fibers, producing short-chain fatty acids in the process. [2] As these fibers pass through the digestive system, they are converted into gels.

There is an enormous amount of information available in various publications (books and magazines) about the benefits of fiber in many diseases. Although the mechanisms may not be completely understood, there are **reports of conditions such as elevated blood pressure, elevated cholesterol and triglycerides, atherosclerosis, diabetes, obesity and gallstones being positively affected by soluble fibers**. This is most likely due to improving transit times, absorption of endotoxins as well as improving the microecology of the GI tract.

Insoluble fiber is found in plant and animal skeletons and is primarily made up of lignins and cellulose. They are poorly digested and as they pass through the GI tract they perform functions that maintain certain physiochemical properties. They absorb and hold water, bind up chemicals and minerals and form gels. **This binding capacity allows them to absorb carcinogens**, which are then excreted in the stool. Fecal bulk is also increased by insoluble fibers through water absorption. The swelling of the fiber increases the urge to evacuate, speeding up transit times and decreasing the amount of time toxic substances are in contact with the intestinal epithelium.

The types of intestinal organisms that inhabit the GI tract are influenced by the type and quantity of fiber consumed. Diets low in fiber support the proliferation of organisms capable of transforming bile acids into metabolites that are carcinogenic. A fiber that "scrubs" the inside of the intestines is the preferred choice. **It will bind with mucus, waste and toxins and excrete them**. Green leafy vegetables, brown rice and cruciferous vegetables are good dietary sources of fiber. **Ground psyllium and ground flaxseed are the preferred supplemental fiber sources**.

Diabetics will find fiber to be especially beneficial. A diet high in fiber can help improve blood glucose control, regulate plasma insulin levels and normalize blood lipid levels.

Nutritional Supplements

Increasing fiber intake can set the stage for an all-out attack on dysbiosis. Supplementation is then necessary to give the body what it needs to continue the war. Following is a list that should be helpful although it is not all-inclusive.

- **Vitamin B Complex**: The family of B vitamins work together to ensure proper metabolic nutrition. Vitamin B Complex components are generally present in even a poor diet, but they require a proper environment in the gut to be activated and absorbed. A deficiency in any of the individual B vitamins can lead to **constipation, diarrhea, loss of appetite, abdominal cramps, elevated cholesterol or a myriad of other dietary illnesses**. A supplement that provides a high level of Vitamin B Complex should provide adequate protection against dietary deficiency.

- **Magnesium** is one of the most important minerals in proper gut function. Magnesium deficiency can cause gut spasms, constipation, increased blood lipids, sleep disorders and depression. Amino acid metabolism and GI fluid transport rely on an adequate supply of magnesium.

- **Digestive Enzymes** such as pancreatin, pepsin, bromelain, papain and oxbile help assist the body in breaking down complex long chain molecules into easily assimilated nutrients. A deficiency in any of the essential enzymes leads to improper stomach digestion which translates into intestinal gas, cramping and bloating from putrefaction of partially digested food that has entered the intestine.

- **Folic acid** is a good antidote for chronic diarrhea. Deficiency can cause GI symptoms, anorexia and chronic inflammatory bowel disease.

- **Vitamin E** aids in lipid absorption, collagen production, hormone production and provides antioxidant activity.

- **Copper** is important in the production of energy, the healing process and sensitivity to taste. Deficiency can cause diarrhea and osteoporosis.

- **Potassium**: Deficiency symptoms include acne, constipation, glucose intolerance and sodium retention. Potassium citrate helps to maintain stable blood pressure.

- **Chromium** aids in food metabolism, enzyme activation and regulation of cholesterol. Chromium is necessary for proper insulin transport ability.

- **Manganese**: Deficiency symptoms include glucose intolerance, hypercholesterolemia, pancreatic damage, nausea, weight loss and disturbed carbohydrate metabolism.

- **Glutamine** is an amino acid that serves as a source of fuel for cells lining the intestines and is important for immune function. Glutamine is absolutely essential for proper repair and maintenance of the gut lining.

- **Inositol** is required for proper formation of cell membranes. It affects nerve transmissions and helps in transporting fats within the body.

- **DGL Licorice** is used for conditions of the digestive tract, such as ulcers. It increases the production of mucin which acts as a protectant for the digestive tract. Licorice also inhibits the growth of helicobacter pylori.

Herbs

Many **herbs and spices** used for food preparation and preservation possess antimicrobial activity.

- **Garlic:** Numerous studies have documented the antimicrobial activity of garlic against a wide range of bacteria, viruses, fungi and parasites. About three small cloves per day (10 grams) must be used to be effective.

- **Onions** have also been shown to possess antimicrobial activity, but at a significantly lower potency than garlic. [1]

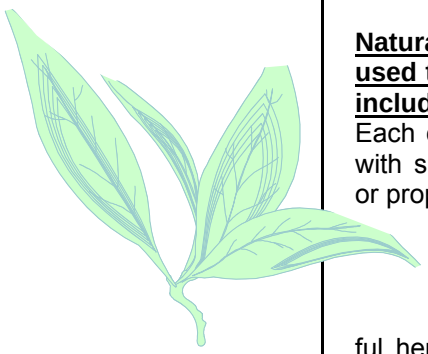
- **Ginger**, containing over 400 active ingredients, has been used to treat digestive complaints for centuries. Its constituents help protect the intestinal lining against ulceration and are active against a wide variety of intestinal

parasites.

- **Turmeric** can be used to relieve intestinal gas, but it also has antifungal activity. It specifically reduces the number of gas-forming bacteria. 500 mg twice daily is the usual dose.

- **Goldenseal**, or berberine, is often used to successfully treat inflammations of the GI tract as well as bronchitis and cystitis. It inhibits the growth of various bacteria, fungi and viruses. 250 mg. four times daily when needed is the suggested dose. It is not to be taken daily for an indefinite period. Long-term daily use will kill the beneficial bacteria as well as the pathogenic bacteria.

- **Oregano, rosemary, sage and thyme** all have microbe-fighting capabilities. The concentrated essential oils from these herbs are irritating and should only be used with qualified medical supervision, but the whole herbs are generally safe. Some practitioners have reported success using capsules containing standardized oregano extract to treat various parasitic and yeast conditions.



Natural therapies that are frequently used to treat intestinal yeast overgrowth include caprylic acid and citrus seed. Each can be used alone or in combination with short-chain fatty acids such as sorbic or propionic acid.

A combination of black walnut hulls, wormwood and common cloves is one of the most successful herbal therapies for the treatment of a wide range of intestinal parasites. All three herbs must be used together for this therapy to be effective. **Black walnut hulls and wormwood kill the adults and the developmental stages of about 100 different parasites. Cloves kill the eggs**. Thus the use of all three breaks the cycle by killing off the adults, while eggs and larvae are destroyed before they can reach adulthood.

Homeopathics

Many homeopathics support the activities of the body in normalizing and removing pathogenic organisms. Truly stubborn organisms may require the use of nosodes. **Nosodes** are homeopathic attenuations of organs or tissues (and their secretions) that have been affected by bacteria, fungi, ova, parasites, viruses and/or yeast. By homeopathically stimulating the body's immune response against these diseased tissues and their causative pathogens, many of the pathogens will be eliminated by the body's own defense system. Homeopathic practitioners report that combination nosode homeopathic products can be used to successfully treat dysbiosis.

Other homeopathic agents may be effective in stimulating the body's own defenses against candida infection, viral assault or parasitic infestation. Homeopathics offer an excellent addition to an integrated approach to optimal health.

DYSBIOSIS AND HEALTH CONDITIONS

Animal and human studies indicate **probiotics provide immune modulation**. They may act as adjuvants in antigen-specific immune responses or strengthen nonspecific defense mechanisms against tumors and infections. In these studies, ingestion of bifidobacteria and lactobaccilli **increased systemic immune response**, with significant increases in phagocytic activity that was directly related to increased fecal colonization. When fecal colonization decreased, phagocytic activity decreased. [19] This may be related to Peyer's patches in the gut, which are a part of the gut-associated lymphoid tissue (GALT). In addition, in vitro studies have shown probiotics to induce interferon production by human lymphocytes and peritoneal macrophages. In mice, they have induced endogenous tumor necrosis factor-*a* production as well as enhancing macrophage and neutrophil functions. In vivo human studies revealed a decrease in phagocytic activity six weeks after discontinuation of probiotics. However, this activity remained higher than it had been prior to probiotic ingestion. [19] While this indicates an overall improvement, it would also seem to indicate a need for continued probiotic supplementation for maximum immune system benefits.

Other animal studies have shown **positive epithelial alterations in the GI tract and changes in the IgA and SIgA levels with probiotic administration**. L. casei in particular was noted to increase the mucosal immune response, and much of this was relevant to stimulation of secretory IgA. As lactobaccilli dosage increased, so did the

number of IgA-producing cells. These effects were observed with L. casei alone, but not with L. acidophilus alone. [18, 20]

The Peyer's patches also play a role in immunoregulatory mechanisms in this area as well. Migration through the epithelium of certain cell types stimulates functions that increase T lymphocytes and macrophages. All of these factors improve mucosal immunity. The immune system does not function alone and ideally works in equilibrium with other body systems such as the nervous and endocrine systems.

When the intestinal microflora are in balance, this healthy ecosystem promotes the health of the host. On the other hand, the phrase "**death begins in the colon**" has often been used by health professionals. Following is a brief review of some of the health problems that develop when a high fat/low fiber diet alters the intestinal ecosystem. When the immune system is impaired and nutritional deficits and toxins are present, then the stage is set for the development of many diseases. Some **conditions which occur as a result of dysbiosis include halitosis, adrenal stress, diarrhea, candida, leaky gut syndrome, colon cancer and breast cancer**.

HEALTH PROBLEMS CAUSED BY DYSBIOSIS

Halitosis: Bad breath can occur due to gum disease, but is almost always related to dysbiosis. This is especially true in the elderly. Toxins present in the GI tract create odors as a result of their metabolic processes. **One of the organs of detoxification is the lung**. Thus, halitosis may be the result of the body's attempt to detoxify through the lung tissue. The air that is exhaled contains noxious fumes from the toxins being eliminated. Dysbiosis can also occur in the oral cavity (tongue and back of throat). Eliminating the dysbiosis will, in many cases, eliminate the halitosis.

Adrenal Stress: The body's two adrenal glands are about the size of a peas, and one sits atop each kidney. They are involved in many important functions in the body and interrelate with other glands. The toxins that are released due to **dysbiosis can place a strain on the adrenal glands and can alter their normal regulatory functions**. This can lead to irregular cortisol levels, which in turn leads to such conditions as fatigue, insomnia, further impaired immunity, heart disease, hypoglycemia, osteoporosis, mood swings and diabetes. Eliminating dysbiosis will reduce adrenal stress.

Diarrhea: Many dysbiotic individuals will have problems with diarrhea. This is the body's normal attempt to eliminate poisons, bacteria and viruses from the body. It may also be due to peristaltic stimulation from toxic metabolites. In the presence of dysbiosis, parasites can accumulate in greater numbers and can cause diarrhea. In addition, dysbiotic individuals may shift back and forth between diarrhea and constipation. Eliminating the dysbiosis will oftentimes eliminate the diarrhea.

Candida: Everyone has yeast. Candida albicans lives in the mouth, throat, genitourinary tract and the intestines of humans. All yeasts, including candida, are fungi. Candida is *supposed* to be in the human body. The problem occurs when **the immune system becomes weakened and Candida overgrowth occurs**.

Being an "opportunistic organism", candida will attempt to colonize all bodily tissues if given the chance, meaning it can spread to all parts of the body. This leads to systemic candida overgrowth, which in turn further weakens the immune system and eventually leads to many health problems. Once this occurs, **it is extremely difficult to eliminate**.

Many things can contribute to yeast overgrowth in the body, including antibiotics, birth control (pills or devices), tap water consumption, excessive stress (which elevates cortisol levels), drugs and alcohol, diets high in carbohydrates – especially simple carbohydrates, hormonal imbalances, hypothyroidism, diabetes, constipation, excessive bowel cleanses, parasites and/or intestinal worms, and immune deficiency. **Dysbiosis can allow Candida the opportunity not only to grow, but to thrive**.

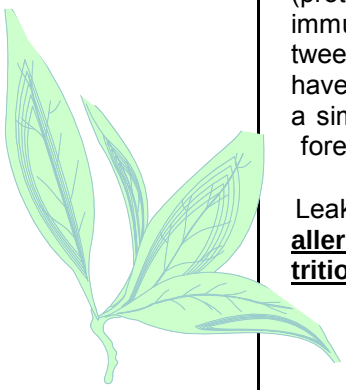
In a baby, for example, oral thrush is an overgrowth of Candida, indicating the immune system is weakened. If the body is unable to maintain the balance between Candida and other bacteria present in the body, the Candida will quickly grow unhindered.

Seventy-nine different toxins are known to be released by Candida. These in turn

place an even heavier burden on the immune system. One of the most detrimental metabolic by-products of Candida is **acetaldehyde**. It is similar to formaldehyde and **can affect the metabolic, neurological, endocrine and immune systems**.

Leaky Gut Syndrome: Simply defined, leaky gut syndrome occurs when **the membranous lining of the digestive tract has been compromised, allowing unwanted toxins and food molecules into the bloodstream.** Much as a car's tire will continue to go flat with a slow leak and hamper the vehicle's ability to move efficiently, the body will continue to be poisoned by a leaky gut. The consequences can be devastating. For example, protein molecules are large and, if allowed into the bloodstream before properly metabolized, will be **recognized by the immune system as a foreign body**. This sets off an immune response that can be just as powerful as a response to viruses or other foreign invaders.

It has also been theorized that leaky guy may be a **contributing factor to some autoimmune diseases**. This theory is based on the fact that genetic similarities exist between exogenous (proteins we take into our bodies) and endogenous proteins (proteins that make up our bodies). The immune system does not differentiate between these two proteins once antibodies have been developed. If an organ contains a similar molecule, it will be attacked as a foreign body.



Leaky gut commonly leads to **increased allergenicity, digestive problems and nutritional deficiencies**.

Colon Cancer: Bacteroides (previously mentioned) produce an enzyme, urease, which hydrolyzes the urea in animal protein to ammonia. This results in higher colonic pH. An elevated **colonic pH has been associated with a higher incidence of colon cancer**. This offers one scientific explanation of how a diet low in fiber and high in fat and animal protein increases cancer risk. In addition, the longer a toxin sits in the colon, the more time it has to do damage, not only locally but systemically.

An enzyme called beta-glucoronidase that hydrolyzes or deconjugates bile acids is also produced by pathogenic bacteria that proliferate in a high fat/low fiber diet. Bile acids are normally bound into an insoluble form (conjugated) for excretion. Deconjugation frees up bile acids, making them toxic to the epithelial cells that line the colon. Increased incidences of colon cancer are associated with deconjugated bile acids.

Breast Cancer: An increased risk of breast cancer is associated with a dysbiotic colon. As mentioned previously, estrogens are normally conjugated in the liver for excretion in the bile via the colon. Dysbiosis can interfere with the normal metabolism of estrogen, particularly when the bile becomes toxic thus freeing up the estrogens to be reabsorbed back into the body. Higher lifetime exposure to estrogen can significantly increase the risk of breast cancer. In other words, an unhealthy diet causes the proliferation of **pathogenic organisms that produce enzymes which can deconjugate estrogens**. Instead of being excreted, female hormones are reabsorbed, increasing breast cancer risks.

HOW HEALTHCARE PROFESSIONALS CAN HELP

From this list of dysbiosis-induced health problems, it should be apparent that healthcare providers must address this situation. As one begins to comprehend the immune-enhancing properties of probiotics and the potential health problems associated with dysbiosis, it is staggering to consider the implications of the **millions of antibiotic prescriptions filled each year**. There are enormous numbers of people who are developing **compromised immune function** problems which are secondary to dysbiosis. The origin of these problems is not only rarely recognized, but is frequently misunderstood and often misdiagnosed. Sadly, **most physicians and most patients do not know that probiotics should follow a course of antibiotics**. Hence, those healthcare professionals who are aware of the significance of this problem have a professional responsibility to teach people how to avoid the complications that can occur when taking antibiotics.

This should be a regular part of any pharmacist's patient counseling services. Counseling customers about this topic should not take long or be difficult for the customer to understand. When a customer is picking up an antibiotic, ask them if they know about acidophilus or probiotics. The answer is usually "No" and you can then explain, "Probiotics are the beneficial bacteria,

or the good guys, in our gastrointestinal system. When you take an antibiotic, you not only kill off the bad bacteria or organisms; you also **kill off the good bacteria**. These organisms, called probiotics, have many important functions in our bodies and need to be replaced."

When counseling a woman, you can explain, "One of the main functions of the probiotic organisms is that **they keep yeast growth under control**. When you take an antibiotic you kill off the good bacteria, particularly the acidophilus and bifidus. The yeast that is normally present can go into a significant overgrowth and you could end up with a vaginal yeast infection. The best way to prevent a yeast infection is to take a well formulated probiotic daily during the course of antibiotic treatment. Then continue daily dosing for two weeks after finishing your course of antibiotics."

For the parent who is picking up an antibiotic for a child, also explain to them that the probiotic organisms **help with digestion and production of a number of B-vitamins** as well as some natural antibiotics in our bodies. **If these beneficial bacteria are killed off, a child is more likely to have problems with digestion and ear infections** and will also have a weaker immune system. Actually, this is a strong argument for probiotic replacement therapy in people of all ages. The dose for children ten and over is the same as the dose for adults. For children under 10, suggest cutting the dose in half and give daily for two weeks. For infants, cut the dose by one third to one fourth the adult dose.

LABORATORY TESTING

If a client is having a hard time believing the information you are sharing on dysbiosis, laboratory tests can be done to validate dysbiosis and the presence of pathogenic organisms. Tests to consider are:

Adrenal Stress Index – Measures 24-hour cortisol production at selected time frames that correspond to the body's natural biorhythm. Cortisol has a major affect on our energy maintenance, immune function, hormones and feedback to other organ systems. An ASI also measures DHEA levels (the building block for other hormones in the body), SIgA (a measure of proper gut function and determinate of leaky gut syndrome), and antigliadin (an indicator of gluten sensitivity). A person with a significant sensitivity to gluten proteins will never feel better until these proteins are removed from the diet.

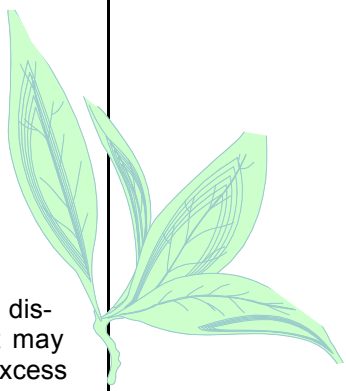
GI Health Panel – Includes pathogen screening for bacteria, fungi, yeast and various parasites; measures enzyme levels and immunochemical markers for intolerance to grains, protein, etc.; measures intestinal function markers to evaluate irritation and inflammation; measures markers that indicate overall status of gut immunity and integrity.

Dysbiosis Metabolic Markers – Detects byproducts of intestinal microbial growth that have been absorbed into the bloodstream, discriminating among microbial classes, yeast, clostridia, bacteria and protozoa.

Organic Acid – One of the most comprehensive nutritional testing programs. Measures markers in energy production, functional cofactors, detoxification, fatty acid oxidation, neurotransmitter metabolism and dysbiosis markers.

Yeast Screen – Detects all types of yeast overgrowth, not just Candida albicans.

Other labs that may be considered include **Digestive Efficiency Panel, Fatty Acids, Urine Metal Minerals (if heavy metals are suspected), amino acids, and IgG4**.

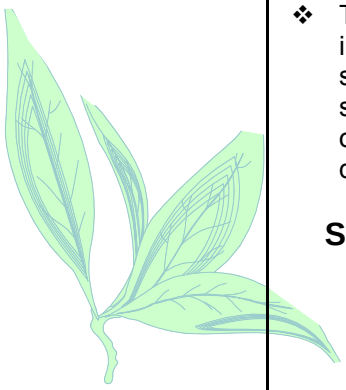


Significance of some of the test results

- Short-chain fatty acids have been discussed. If these are elevated, it may be an indication of bacterial excess within the gut and/or impaired absorption of nutrients (particularly of fats). This could indicate inflammation of the mucosa of the small intestine.
- A deficiency or low level of short-chain fatty acids is indicative of insufficient dietary fiber, malfunctions in metabolism or other conditions relative to dysbiosis.
- Low levels of the short-chain fatty acid N-butyrate have been associated with colon cancer.
- Elevations of the short-chain fatty acids valerate and iso-butyrate indicate insufficient protein digestion since they are produced during bacterial fermentation

of proteins.

- Low SIgA levels indicate increased susceptibility to allergies and infections.
- Elevation of *β*-glucuronidase indicates altered intestinal pH, overgrowth of pathogenic bacteria and reduced levels of beneficial bacteria, excessive dietary fat and increased carcinogens in the GI tract (increases risk for colon cancer).
- Visual and microscopic examination of fecal material (via a Digestive Efficiency laboratory test) can reveal several important factors. For example, stool colored yellow to green can occur with diarrhea and indicate a sterilized bowel – often seen with antibiotic use. Dark, tarry or red stool indicates intestinal bleeding. Tan or gray stool indicates problems with fat digestion, usually indicative of problems with the bile duct. The presence of occult blood can indicate hemorrhoids, cancer or high red meat consumption. The presence of mucus or pus indicates bowel disorders such as inflammation, IBS, diverticulitis and or polyps.
- The presence of cholesterol in the stool indicates impaired digestion, malabsorption or IBS. Decreased chymotrypsin indicates insufficient HCl acid and/ or pancreatic enzymes and thus, poor digestion.



SELECTION AND DOSING OF PROBIOTICS

After testing has validated the existence of a GI problem, the very first part of any support program must be Probiotics. During the past several decades, an enormous amount of research has been conducted on many of the different strains of L. acidophilus and bifidobacteria, and some on Saccharomyces boulardii and other forms of beneficial microorganisms.

Among the factors that affect the quality and effectiveness of probiotic products are the strains of bacteria, the culture method, packaging and handling and the concentration and viability of the organisms in the product.

Host specificity is another important factor. For example, strains of acidophilus that originate from the human intestinal tract have been determined to adhere to the lining of the gut mucosa much more effectively than strains of acidophilus that originate from cattle or other animals. However, even different human strains of acidophilus vary greatly in their ability to survive and grow in the hostile environment of the GI tract. Their survival and proliferation depends on their tolerance of stomach acid and intestinal bile, their production of natural antibiotics and their ability to adhere to the intestinal wall.

The method used to culture, package, ship and store probiotic products is also important. **These fragile organisms are heat, light and moisture sensitive** and these factors will ultimately affect the strength and viability of the product purchased by the consumer. For this reason, it is important that independent laboratories provide verification of the quantity and viability of the organisms. Not only should this be verified at the packaging date, but also at the expiration date of the product after a certain period of "shelf life" time.

Potency of probiotic products varies widely. While some labels claim to contain "millions of organisms," better quality products usually contain billions of CFUs (colony forming units) per dose. **For those formulas with a wide variety of organisms, such a high CFU may not be necessary due to the synergistic properties between the various organisms**.

In most cases, probiotics should be refrigerated for optimum potency. However, there is a relatively new "freeze drying" technique that enables probiotics to maintain their potency without being refrigerated. Refrigeration is always advisable after a bottle has been opened as a precaution for viability and longevity.

Individuals with dysbiosis should consider ingesting a probiotic containing 10 to 20 billion CFU's of a single or double-strain Probiotic or use a high-potency multi-strain synergistic probiotic every day for two weeks, especially after taking antibiotics. **Better outcomes will be obtained when probiotics are taken at bedtime or twice**

daily between meals on an empty stomach. The farther away from meals they are taken, the fewer good organisms are destroyed by stomach acids.

Products like yogurt and acidophilus containing milk do contain some of the live organisms, but the amount of beneficial bacteria in these products is not nearly enough to re-colonize the GI tract after taking a round of antibiotics.

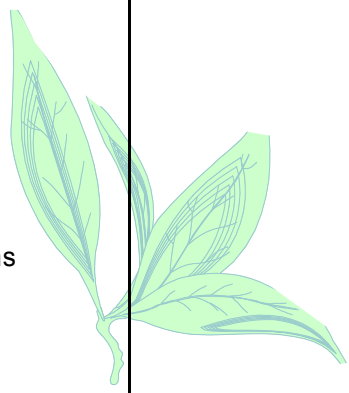
INFANTS

Colonization of the GI tract is a special consideration in infants. It cannot be emphasized enough how important it is for infants to start out life with a strong, fully functioning immune system. One important aspect of creating this foundation is the development of a healthy GI tract microecology. There are two situations or factors that play a critical role in determining whether or not an infant gets the opportunity to develop a healthy immune system after being born.

The first determining factor is a vaginal birth. **An infant is born with a sterile GI tract, or essentially without microorganisms in the gut**. However, as an infant passes through the vaginal canal during a vaginal delivery, the infant's head and body are coated with the slimy mucous secretions from the mother's vaginal lining. These vaginal mucosal secretions contain large numbers of beneficial bacteria, some of which get into the infant's mouth and down the throat into the stomach. The proliferation of these bacteria is the beginning of developing a healthy intestinal microflora and a healthy immune system, assuming that the mother has these organisms in her vaginal canal. If she is dysbiotic herself, she may not have these organisms and the dysbiosis can be passed on to the infant. **There is a high rate of cesarean births in the United States, approximately 23 percent annually**, which means there are many infants born every year whose immune systems are immediately compromised due to their unnatural birthing procedure. Consequently, the premature infant who is sent off to the neonatal unit suffers stress and is given antibiotics and other medications that prevent proliferation of these bacterial organisms even if born vaginally. All these infants could greatly benefit from probiotic supplementation.

The second important immune system development factor is **breastfeeding**. It is beyond the scope of this article to discuss the many benefits and the large number of immunoglobulins that are transferred from mother to infant during breastfeeding. However, it is applicable to comment that scientists have discovered **mother's milk (but not cow's milk) contains a disaccharide amino sugar that is a required growth factor for the beneficial bacteria**. Thus, there is a substance in mother's milk that specifically stimulates the growth and proliferation of bifidobacteria in infants. Studies show that the fecal flora of breastfed infants is **99 percent bifidobacteria, but the fecal flora in bottle fed infants is less than 20 percent bifidobacteria**. C-section, bottle-fed and premature babies have a much higher incidence of colic, diarrhea, gas, fungal diaper rash, ear infections, etc.

Healthcare professionals have an opportunity and a professional responsibility to educate pregnant women about the importance of helping their newborn babies develop a healthy intestinal microflora as soon as possible after birth. Encourage women to breastfeed and recommend probiotic supplementation when infants are born by C-section, born prematurely, or if the mother is unable or choosing not to breastfeed. Have the mother place a little on the nipple or the tip of the finger and let the baby suck it off. This will help colonize the infant's GI system and may prevent health problems later in life.

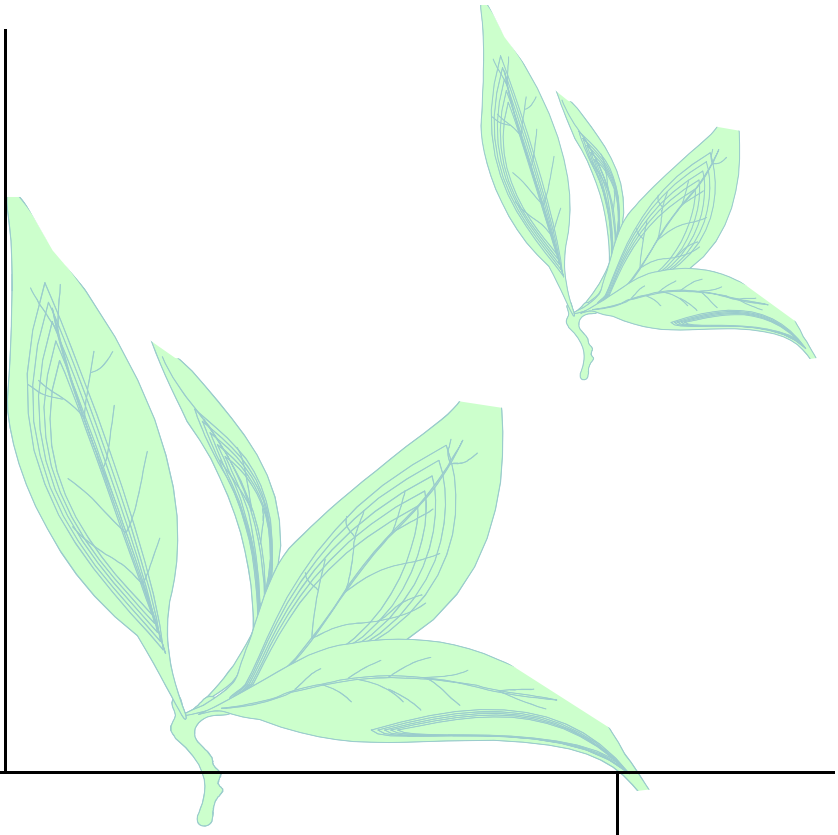


FINAL REMARKS

Health professionals are accepting the importance of good digestion, nutrient assimilation, waste elimination and general intestinal health as one of the primary keys to health and longevity. As highlighted in this article, a healthy intestinal ecology is absolutely essential to good health. **People in reasonably good health should take a good quality probiotic product several times per week, making it part of a regular supplementation program. Individuals in less than optimal health should take a daily dose. People on antibiotics should take probiotics daily throughout the medication cycle and for two weeks thereafter.**
For people who take antibiotics or other GI tract altering medications and for those who

may have developed dysbiosis for some other reason, counseling on how to implement high-dosage probiotic supplementation to rebuild the GI organisms and improve overall health is advised. **Treating but not correcting digestive complaints leads to more serious symptomatic systemic disorders**. Probiotics can possibly decrease cancer risks by eliminating the cancer-causing enzymes and strengthening the immune system by enhancing the growth of beneficial bacteria.

Promoting the use of probiotics is a simple, effective measure in generating more business and developing happy, healthy customers who view you as the professional.



REFERENCES

1. Bengmark, S. "Ecological Control Of The Gastrointestinal Tract. The Role Of Probiotic Flora." *Gut* 1998; 42:2-7.
2. Floch, Martin H., M.D. and Khalid Moussa, M.D. "Probiotics and Dietary Fiber, The Clinical Coming of Age of Intestinal Microecology." *J Clin Gastroenterol* 1998; 27(2): 99-100.
3. Gibson, G.R. and A.L. McCartney. "Modification Of The Gut Flora By Dietary Means." *Biochemical Society Transactions*, Vol. 26, p. 223
4. www.fightbac.org; web site for The Partnership for Food Safety Education.
5. Reid, Gregor, Andrew W. Bruce, Jacqueline A. McGroarty, K.J. Cheng and J. William Costerton. "Is There A Role For Lactobaccilli In Prevention Of Urogenital And Intestinal Infection?" *Clin Microbiol Reviews* Oct. 1990, pp. 335-344. Vol. 3, No. 4.
6. Shahani, Khem M., Ph.D. and Amadu D. Ayebo, Ph.D. "Role Of Dietary Lactobaccilli In Gastrointestinal Microecology." *Am Journal of Clin Nutr* 33: Nov. 1998, pp. 2448-2457.
7. Lewis, S.J. and A.R. Freedman. "Review Article: The Use Of Biotherapeutic Agents In Prevention And Treatment Of Gastrointestinal Diseases." *Ailment Pharmacol Ther* 1998: 12: 807-822.
8. Vanderhoof, Jon A. and Rosemary J. Young. "Use Of Probiotics In Childhood Gastrointestinal Disorders." *Jrnl of Ped Gastroenterol and Nutr* 27:323-332. September 1998.
9. Salminen, S., E. Isolauri and E. Salminen. "Clinical Uses Of Probiotics For Stabilizing The Gut Mucosal Barrier: Successful Strains And Future Challenges." *Antomie van Leeuwenhoek* 70:347-358. 1996.
10. Fuller, R. "Probiotics in Human Medicine." *Gut* 1991, 32, 434-442.
11. www.immunet.org
12. Scarpignato, Carmelo and Patrick Rampal. "Prevention and Treatment of Traveler's Diarrhea: A Clinical Pharmacological Approach." *Chemother* 1995;41 (suppl 1):48-81.
13. Macfarlane, George T. and John H. Cummings. "Probiotics And Prebiotics: Can Regulating The Activity Of Intestinal Bacteria Benefit Health?" *BMJ* Vol. 318, 10 Apr 1999. Pp. 999-1003.
14. Lankaputhra, W.E.V. and N.P. Shah. "Antimutagenic Properties Of Probiotic Bacteria And Of Organic Acids." Mutation Research 397 (1998) 169-182
15. Living Ecology, The Nutrition Foundation for a Living Body & Earth by Zane Baranowski, CN. Capstone Publishing, Co.
16. http://www.lifescienceproducts.com and http://users.penn.com
17. Perdigom, G.S. Alvarez, M. Rachid, G. Aguero and N. Gobbato. "Symposium: Probiotic Bacteria for Humans: Clinical Systems for Evaluation of Effectiveness. Immune System Stimulation by Probiotics." *J Dairy Sci* Vol. 78, No. 7; 1995 pp. 1597-1606.
18. Schiffrin, Eduardo J., Dominique Brassert, Alain L. Servin, Florene Rachat and Anne Donnet-Hughes. "Immune Modulation Of Blood Leukocytes In Humans By Lactic Acid Bacteria: Criteria For Strain Selection." *Am J Clin Nutr* 1997;66:515S-20S.
19. Brock, T., et al. Biology of Microorganisms Englewood Cliffs, N.J.; Prentice Hall 1994, p. 404